

50-352
50-353

SUPPLEMENTAL DATA AND INFORMATION

ACCOMPANYING
PERMIT APPLICATION
FOR
BRADSHAW RESERVOIR

PHILADELPHIA ELECTRIC COMPANY

November, 1981

E. H. BOURQUARD ASSOCIATES, INC.
Consulting Engineers

Boos
g/i
Limited Dist

8209210.222A

SUPPLEMENTAL DATA AND INFORMATION
ACCOMPANYING
PERMIT APPLICATION
FOR
BRADSHAW RESERVOIR

Applicant. Philadelphia Electric Company
2301 Market Street, 2N-1
Philadelphia, Pa. 19101

Description.

1. Purpose - Bradshaw Reservoir and Pumping Station are component parts of the Philadelphia Electric Company and Neshaminy Water Resources Authority water supply systems (See Exhibit 1). The purpose of the reservoir and pumping station is to store and distribute water to the two systems. All reservoir inflow will be from the proposed Point Pleasant Pumping Station. There is no natural streamflow to the reservoir.
2. Location of Reservoir - The reservoir will be located in Bucks County, Plumstead Township, at latitude 40° 23" 48" N, longitude 75° 05' 53" W on USGS Lumberville Quad.
3. Type of Dam - The dam will be a modified homogenous earthen embankment with toe drain.
4. Length of Dam - The length of the dam embankment which encircles the reservoir will be 3317 feet.
5. Height/ss/width - The maximum height of the dam above existing ground will be 23 feet. The upstream and downstream side slopes will be 3 to 1 and 2½ to 1, respectively, except at the pumping station intake. At the intake the upstream side slope will be 2 to 1. The top width of the dam will be 14 feet.

6. Spillway - The spillway will be a standard overflow riser discharging in a 42" conduit to a Bureau of Reclamation Type VI impact basin. The spillway discharge will be uncontrolled. There are no gates, valves or other means to restrict its capacity. The spillway is designed to pass the maximum reservoir inflow (95 MGD) from the Point Pleasant Pumping Station.
7. Inlet Structure - The inlet structure consists of a weir type overflow structure equipped with three sluice gates. The purpose of the structure is to direct the pumped flow either into the reservoir or bypass the flow directly to Bradshaw Pumping Station. Under the first method of operation, the flow will enter the reservoir through two 48" x 48" sluice gates. Under the second method of operation, the flow will exit the structure through a 72-inch sluice gate and travel through the bypass main directly to the pumping station. The second method is provided to allow continued operation of the facilities when the reservoir would be drained for cleaning or maintenance.
8. Pumping Station - The pumping station will consist of an intake structure situated in the upstream embankment, sump located below the station floor and an above ground superstructure. The station will house four vertical pumping units with a combined capacity of 46 MGD and facilities for the gravity release of 49 MGD. Pumped discharge from the reservoir will be delivered to the East Branch of Perkiomen Creek via a proposed 48"/42" transmission main. Gravity releases will be to the North Branch Neshaminy Creek via a proposed 42" transmission main. A venturi will be provided on each transmission main to measure the discharges.

Storage and Surface Area. The storage and surface area of the reservoir are shown in Exhibits 2 and 3 attached. As shown, the maximum storage at

design overflow elevation 436.5 will be 78 MG. The storage over the normal operating range will vary from 52 MG to 70 MG. A reserve storage of 46 MG will be provided below the normal operating range.

Dam Instrumentation. No instrumentation is proposed due to the small size and storage of the dam.

Hydrology. There is no natural streamflow into the reservoir.

Construction Period. The construction period of the project will be from the Spring of 1982 to the Spring of 1983.

Method of Operation. The pumped flow from Point Pleasant Pumping Station will enter the reservoir through the inlet structure. The water level in the reservoir will be maintained within a selected range by controlling the operation of the Point Pleasant Pumping Station. Pumps at Point Pleasant will be automatically or manually turned on and off as necessary to maintain the water level in Bradshaw Reservoir as withdrawals are made. In the event there were a failure in the control system causing the pumps to continue to operate after the high water level was reached, alarms would be sounded at two remote locations and the pumps would be manually shut-down. If the pumps were not shut-down, the spillway would overflow thus protecting the dam from overtopping.

Erosion and Sediment Control. Provisions for erosion and sediment control will be provided. Erosion and Sediment Control Drawings have been submitted to and reviewed by the Bucks County Conservation District. The District has provided a letter approving the Erosion and Sediment Control Plan.

Flood Easements. The reservoir is totally enclosed by the dam. The dam and reservoir are within the property owned by the Applicant.

Subsurface Investigation. A subsurface investigation was performed at the site and is attached.

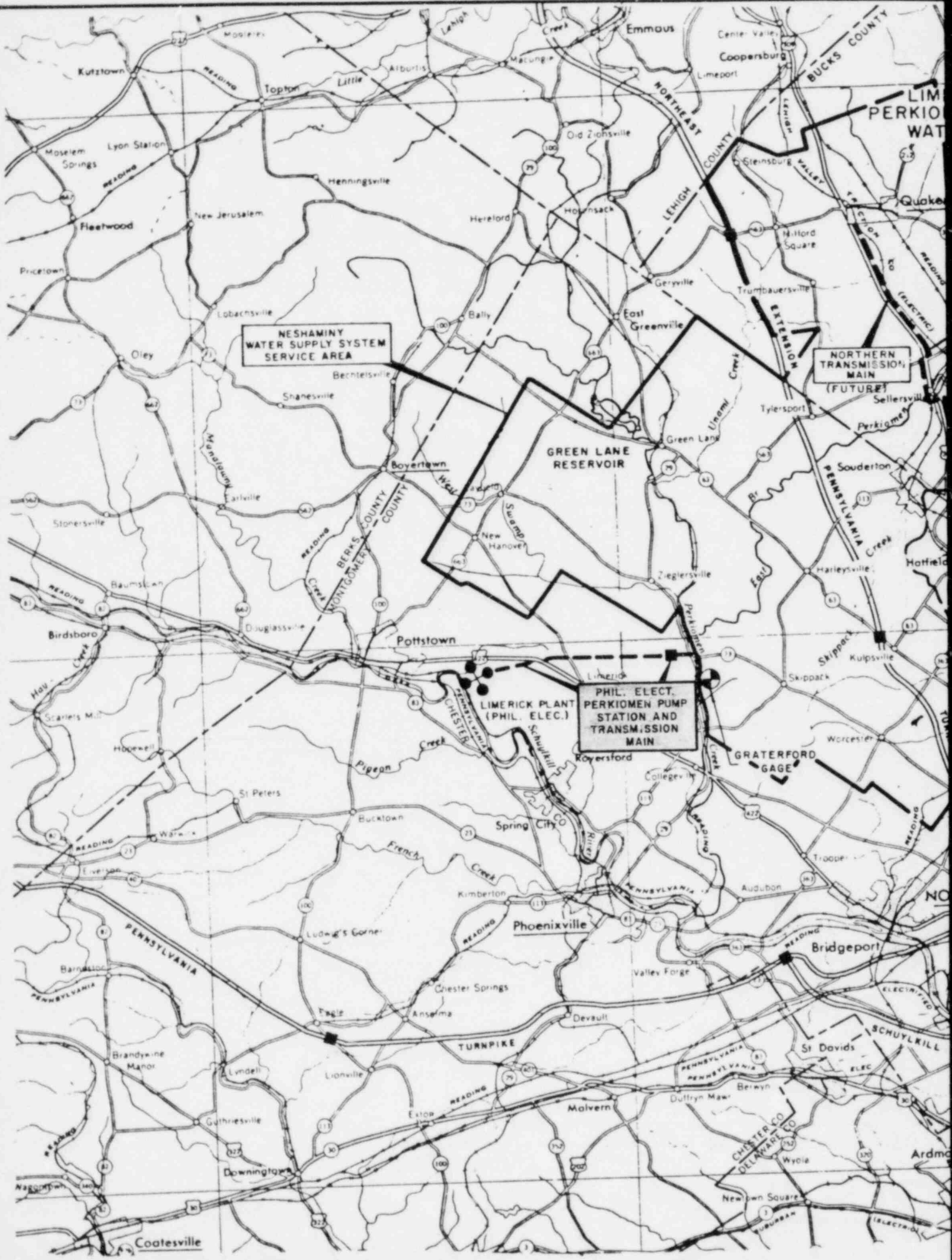
Slope Stability Evaluation. The stability of the upstream and downstream slopes at the maximum section were evaluated by computer simulation. Corps of Engineers Program 741-11-F5030, "Slip Circle Slope Stability with Side Forces" was utilized to evaluate steady state seepage and sudden draw-down conditions. The minimum factor of safety found under the steady state seepage condition was 1.54. The minimum factor of safety found under the sudden drawdown condition was 1.77. The minimum factors of safety recommended by the Corps of Engineers Manual, EM-1110-2-1902, "Stability of Earth and Rock-fill Dams" for steady state seepage and sudden drawdown are 1.5 and 1.2, respectively.

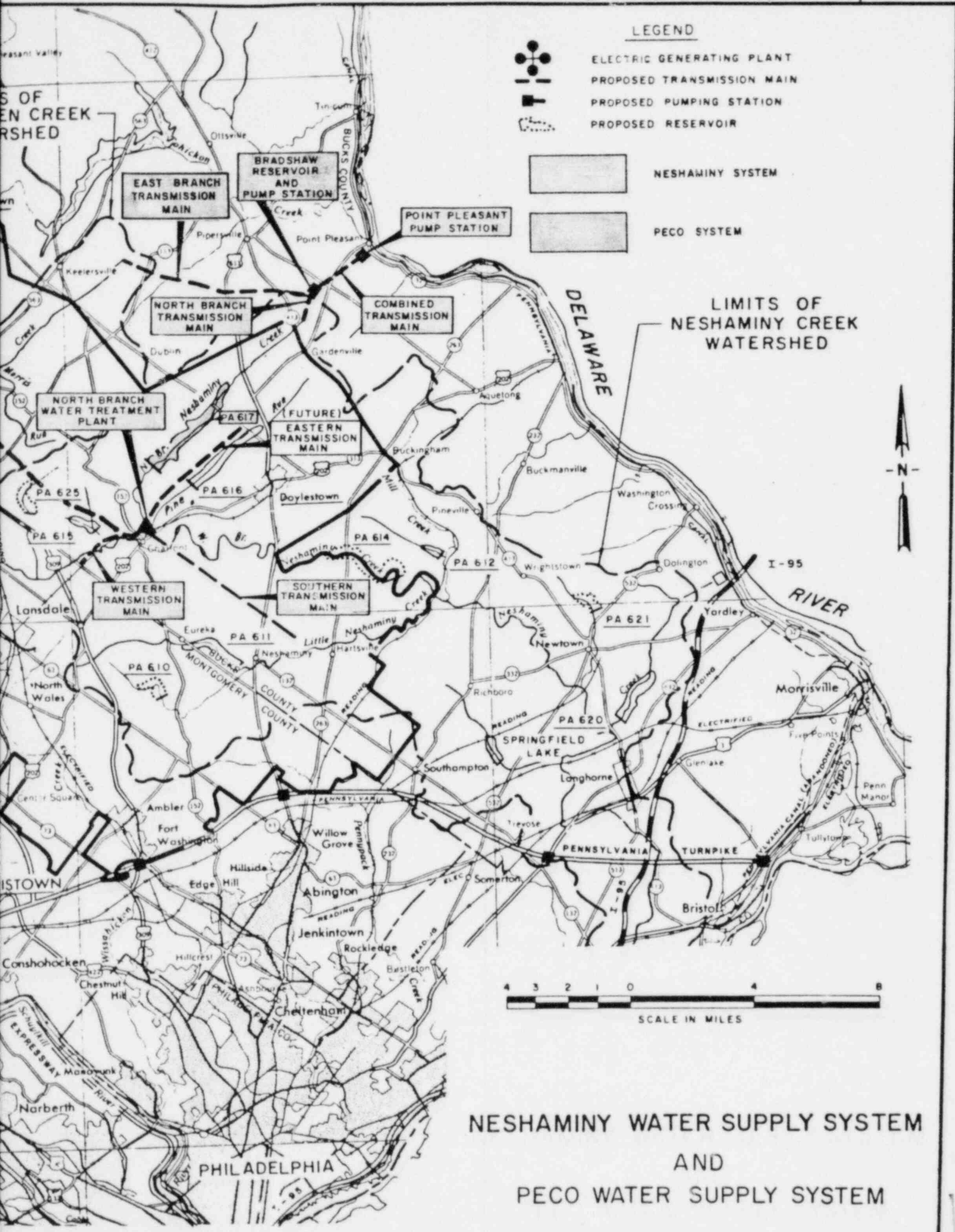
Size Classification. The maximum height of the dam is 23 feet and the storage at maximum water level is 78 MG (239 Acre-ft.). In accordance with the requirements of Chapter 105, Section 105.91, the dam is Class C.

Hazard Potential. The dam is not subject to failure by overtopping. The maximum inflow to the reservoir is equal to the capacity of the Point Pleasant Pumping Station (95 MGD). The spillway capacity is equal to the pumping station capacity. There is no natural inflow to the reservoir.






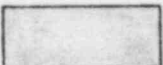
The dam is located in a rural/agricultural area. Failure of the dam by other than overtopping would result in the release of stored water in a northwesterly direction. The flow would cross over Bradshaw Road which is a non-paved minor road. After crossing the road, the flow would follow natural drainage swales through forested and uninhabited land for a distance of about 1000 feet where it would enter a tributary of Geddes Run (See Exhibits 4 and 5). Travel through the forested land would result in attenuation of the peak flow. After entering the tributary, the flow would travel a distance of about 2500 feet to Pipersville Road and then a distance of about 4500 feet to the junction with Geddes Run near Tollgate Road. ^{From} Front the junction the flow would travel a distance of about 6,000 feet where it would enter Tohickon Creek and then a distance of about 1600 feet to the Delaware River.

Since the dam is not subject to failure by overtopping, low height, small amount of storage and no natural flood inflow, there is no expected loss of life with only minimal economic loss and effect on public convenience in the event of a failure.

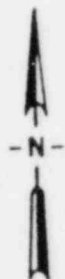




LEGEND

-  ELECTRIC GENERATING PLANT
-  PROPOSED TRANSMISSION MAIN
-  PROPOSED PUMPING STATION
-  PROPOSED RESERVOIR
-  NESHAMINY SYSTEM
-  PECO SYSTEM

LIMITS OF NESHAMINY CREEK WATERSHED



NESHAMINY WATER SUPPLY SYSTEM
AND
PECO WATER SUPPLY SYSTEM

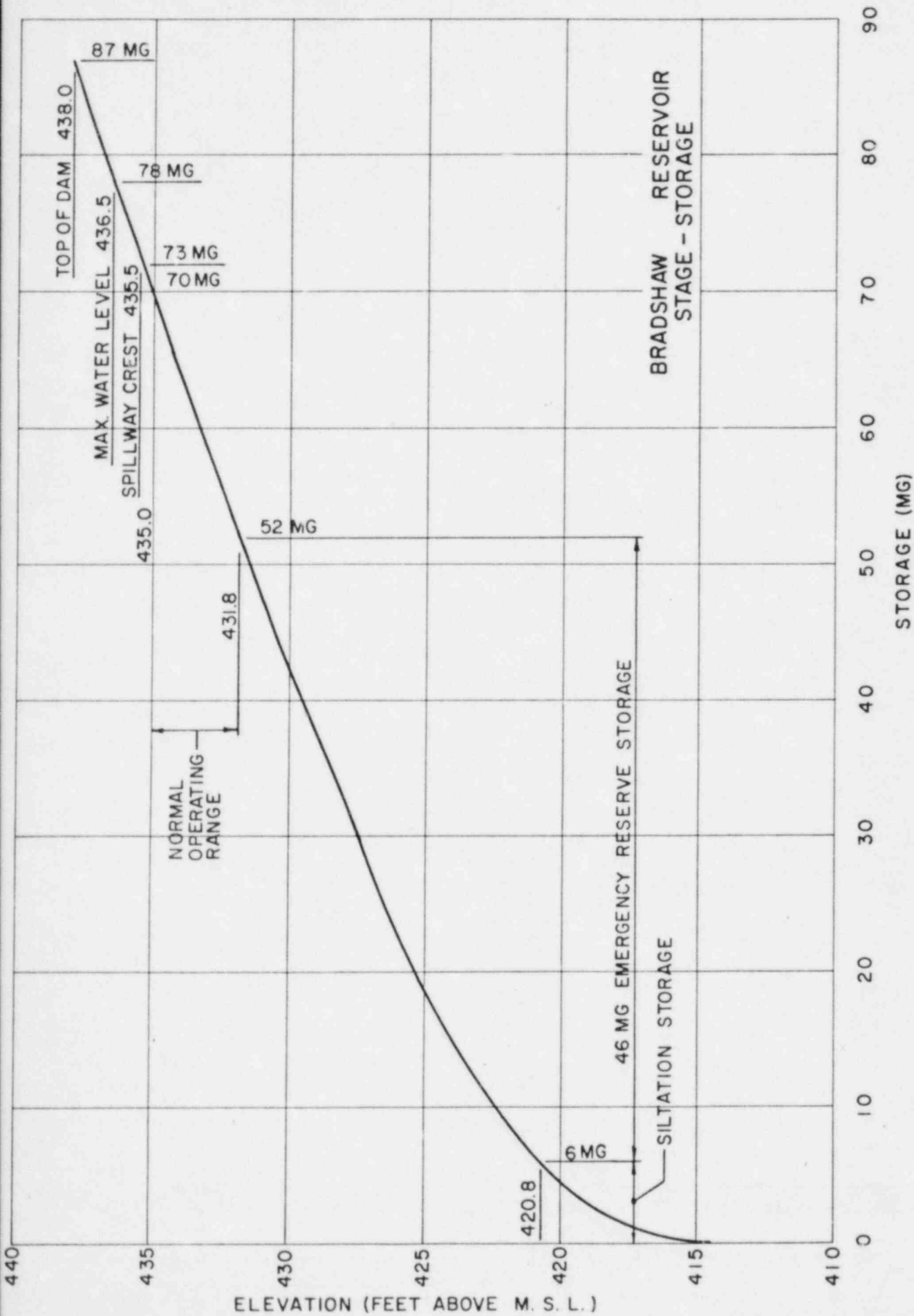


EXHIBIT 2

4-25-70

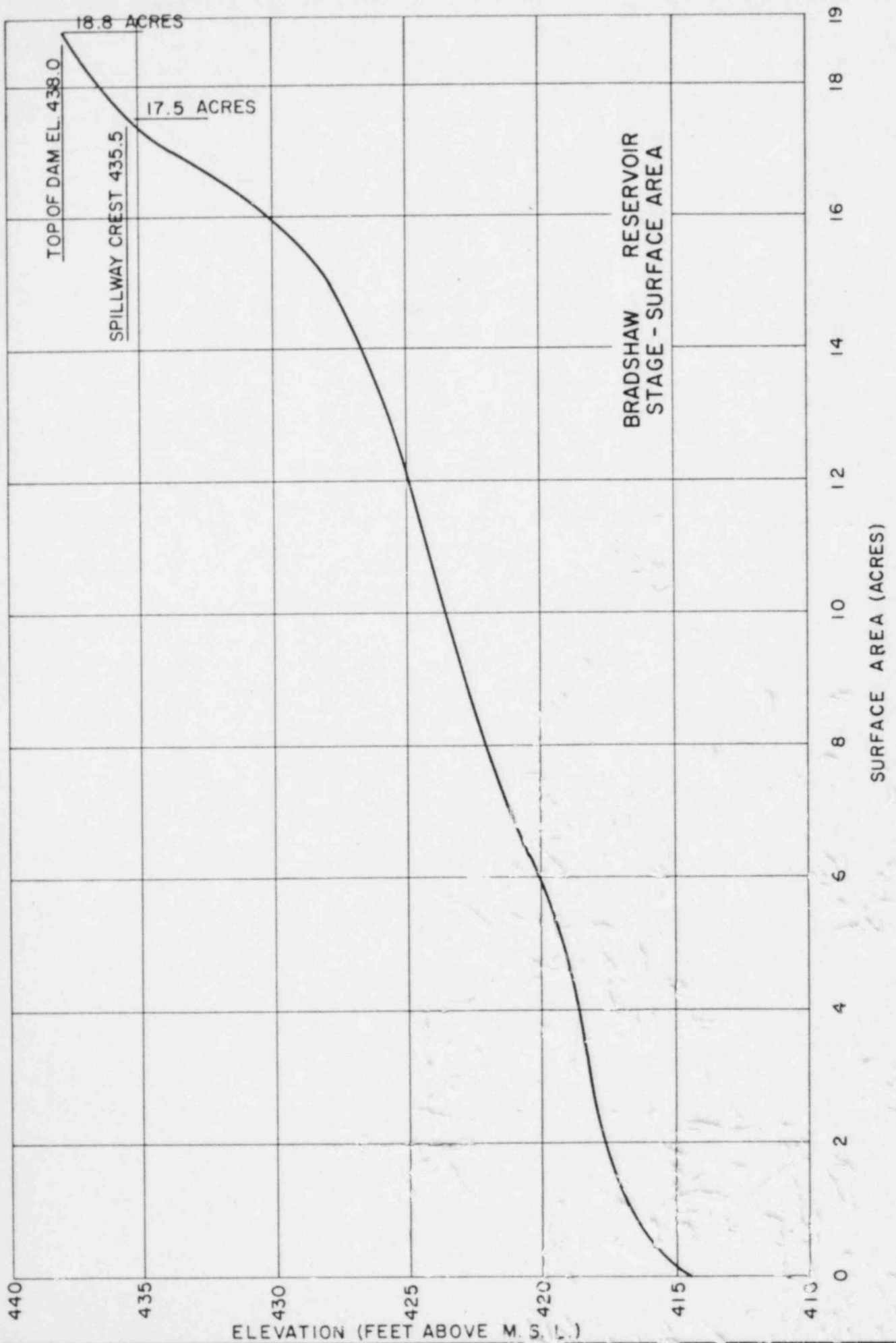
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BRADSHAW RESERVOIR

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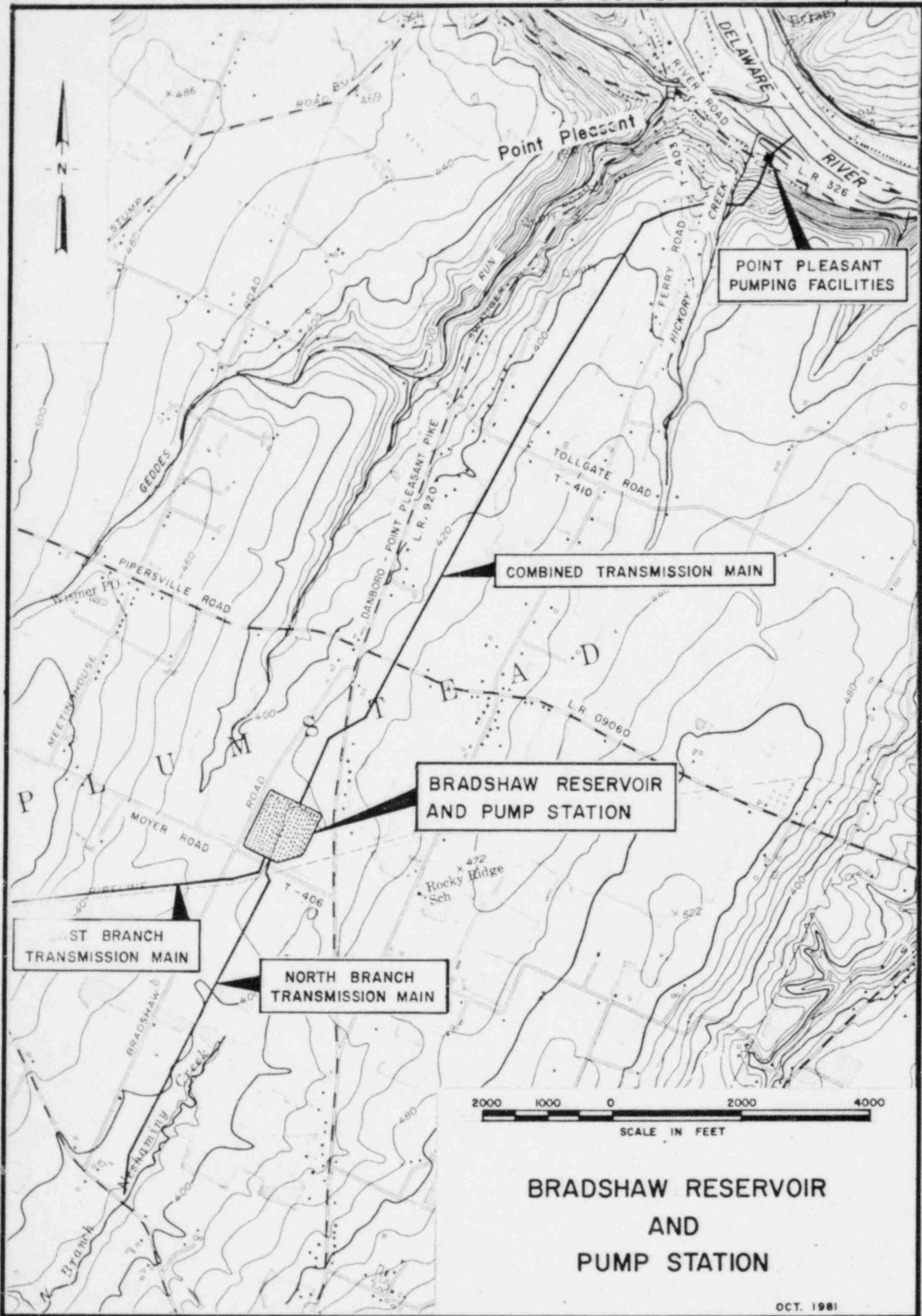
EXHIBIT NO. 4



BRADSHAW RESERVOIR
STAGE - SURFACE AREA

ELEVATION (FEET ABOVE M. S. L.)

SURFACE AREA (ACRES)



POINT PLEASANT PUMPING FACILITIES

COMBINED TRANSMISSION MAIN

BRADSHAW RESERVOIR AND PUMP STATION

WEST BRANCH TRANSMISSION MAIN

NORTH BRANCH TRANSMISSION MAIN

2000 1000 0 2000 4000
SCALE IN FEET

BRADSHAW RESERVOIR AND PUMP STATION

OCT. 1981

EXHIBIT NO. 5

REPORT ON
THE SUBSURFACE INVESTIGATION
ALONG THE SITES
OF THE PROPOSED
POINT PLEASANT PUMPING FACILITIES
UNDER
CONTRACT 24
OF THE
BUCKS COUNTY
NESHAMINY WATER RESOURCES AUTHORITY

Field work on Contract 24 began on October 17, 1972 and was stopped (with Hole F-1 held in abeyance under a Stop Order) on December 21st. There were 46 working days in this period. F-1 was later completed on January 11, 1973, the Delaware River having fallen meanwhile to a level permitting work. This brought the total number of work days to 48.

Tinney Drilling Company of Bridgeville, Pennsylvania was granted the contract. They sent in three drill rigs as follows:

1. A Central Mining Equipment, Model 45.
2. A Joy, Model 12.
3. A Tinney-built rig.

A fourth rig was present between November 6th and 16th as follows:

4. An Acker, Model AD II.

The final hole (F-1) was drilled by,

5. A Caterpillar mounted Joy, Model 12.

Harold Scott was in charge of the operation for Tinney Drilling Company and he was present in the field during the most difficult part of the investigation. John Bell, drilling foreman, was present for most of the time. Drillers on the three rigs were Ron Doyle, Joseph Eger, and E. W. Gardner. L. Spiker was the driller on the fourth rig and William Crane drilled hole F-1.

On October 25th and 26th eight test pits were dug, logged, sampled, and back-filled according to specifications. Michael Baker, Jr., Inc. of Beaver, Pennsylvania was charged with the work done in this connection. Their representative in the field was Mr. Carr.

The investigation dealt with an area in Point Pleasant, where a pumping station has been proposed along the western shore of the Delaware River, thence along a

surveyed line for a proposed transmission main to Bradshaw and Moyer Roads, where a storage reservoir has been proposed, and finally along a proposed transmission main from the reservoir area to a point near the intersection of Bradshaw Road with Highway #413 and at the headwaters of North Branch of Neshaminy Creek.

The purposes of the investigation were to test the soil and bedrock conditions apropos the different uses to which the various areas are to be put. Two kinds of test holes were used in obtaining this information. In an F-series 50 holes were drilled by drive sample boring through the soil and by core drilling into the bedrock underneath. In an AH-series 48 holes were augered to refusal. An additional nine holes were augered in connection with groundwater observations.

The following summarizes the footages resulting from the investigation:

| | | |
|--|--------------|-------------|
| I. <u>F-series Holes</u> | | |
| Drive Sample Boring | | 583.5 |
| Core Drilling | | |
| A. Boulders in overburden | 157.5 | |
| B. Bedrock | <u>495.6</u> | 653.1 |
| Footage disallowed in Hole F-13A | | <u>24.0</u> |
| | | 1,260.6 |
| Total Footage Drilled | | 1,260.6 |
| II. <u>AH-series Holes</u> | | |
| Soil Testing | | 277.6 |
| Groundwater Observation | | <u>51.2</u> |
| Total Footage Augered | | 328.8 |
| III. Standpipes, Total Footage Installed | | 188.4 |
| IV. Test Pits, Total Footage | | 48.2 |

SURFACE FEATURES

Three geomorphic features were encountered on this project. Each will offer difficulties of access to equipment, to its movement about, and to construction. The Valley Bottom is subject to flooding by the Delaware River. During a heavy rain in November, for example, the site of F-2 was submerged under 2.6 feet for a period of two or three days. Although this is a relatively short time, the ground remained soft and slippery for several more days and an incredible amount of debris, mostly dead trees and branches, was left behind. Also submergence under the rising river can be rapid while emergence from under the receding river can be tantalizingly slow.

On the Plateau the overburden is very impermeable and the ground becomes a virtual bog in wet weather. This is especially true in the vicinity of the proposed

reservoir and its borrow areas. Access to these areas together with excavating and filling may not be possible at such times without some method of drainage and protection. Study of the hydrology of these areas through wet and dry seasons should be pursued in order to select a better time for the work and to know if drainage and protection can be avoided. (The area between stations 35+00 and 57+00 also seems poorly drained.)

The Valley Side intervenes between the valley bottom and the plateau, and it will offer the most serious obstacles to access, to movement about, and to construction. For one thing it is strewn with boulders and with blocks of bedrock 12 to 15 feet thick. There is no soil here in the commonly accepted sense. It is virtually the C-zone with B-zone either washed away or dispersed down among the boulders, blocks, and other bedrock fragments.

For another thing the Valley Side is steep; as much as 30% where it starts its rise above the valley floor and for about 800 feet. Then the slope diminishes to about 12% at Ferry Road; it then falls off to 4% at station 21+00 and lessens beyond as the valley side merges with the plateau.

GEOLOGY

The Triassic Period in the earth's history began about 225 million years ago and continued for the next 45 million years. During the early Triassic, widening of the Atlantic Basin caused severe structural movements in what was to become eastern North America. Along with the westerly directed vector of compression had come uplift and the Appalachian Mountains resulted. During the late Triassic these forces ceased and with their cessation came relaxation and the development at various places between Nova Scotia and North Carolina of tensional fractures. Under these conditions blocks of the earth's crust, pulled by gravity, dropped forming basins.

Bucks County lies above one of these - the Newark Basin. With the Appalachian Mountains standing high nearby and with the substrate of the basin subsiding slowly throughout the late Triassic, large amounts of rock detritus were washed into the basin and deposited. A variety of environments developed in the Newark Basin and one of these is of interest because the bedrock encountered in this subsurface investigation was formed from sediment deposited in it.

A very large lake came into existence during the late Triassic. Rock formed by the induration of sediment deposited in it is found today from the Schuylkill River east of Phoenixville, Pennsylvania to the Palisades on the Hudson. That it was a lake is attested to by the fossilized skeletons of freshwater fish plus petrified remains and/or imprints of the freshwater clam, Unio, and of some freshwater crustaceans. Bones of amphibians, phytosaurs and other reptiles, the rare track of a dinosaur, and rare plant remains testify to shoreline conditions. The lake existed for an incredibly long time and cyclic deposition from detrital to chemical, back to detrital, etc., is believed traceable to the "expansion and waning of an extensive lake, controlled by the 21,000 year precession cycle". (1)

The formation that resulted from the hardening of this sediment is called the Lockatong argillite, and the bedrock in all the holes of this project except two (F-19 and F-61) is of this formation. The two exceptions drilled into diabase

which formed from magma intruded into the Locketong during the late Triassic and before its complete induration to argillite. The formation measures about 3,750 feet in thickness and the rock encountered in the test holes near Point Pleasant falls about 1,000 feet above the base of the formation. As one proceeds from this point along the surveyed line toward its western end, the bedrock encountered gets progressively lower stratigraphically until, at F-38, one is about 500 feet above the base of the formation.

The most distinctive characteristics of the Locketong formation are its color-dark gray when dry and black when wet, its fine texture - argillaceous (clayey), its toughness which has resulted from cementation by carbonates (calcite and dolomite) and analcime, and finally its bedded and fractured nature.

Given the subsiding nature of the crust under the basin, it is not surprising that at times molten material came up along fractures. Some of this material made its way into Triassic formations forming sills and some of it flowed out as lava over the ground of that particular time and was later buried as sedimentation continued with continued subsidence.

The material intruded as sills, being under a thick cover of overlying sediment, retained its heat much longer than did the material which flowed out as a lava. The result was that, in the case of a sill, the underlying and overlying sediment was baked and hardened by the heat and formed a hard rock called hornfels. As indicated above the rock cored in two test holes was from one such sill, the Byram diabase. Other test holes may have encountered the hornfels facies of the Locketong (F-20, F-18A, F-7, F-6, F-13 & 13A, F-15R).

The Bradshaw Reservoir and its Borrow Areas.

The Locketong argillite underneath these areas is typical of the rock found elsewhere on the project. Its top surface underneath overburden has its highest elevation in the borrow area which is southeast of the reservoir area and adjacent to Point Pleasant Pike. From here its elevations fall off to the north as well as along the surveyed line to the Delaware River, on the one hand, and to Highway #413, on the other. Quite evidently it is rising and falling with the surface topography, a fact indicating that the overburden has been derived by the weathering of the underlying argillite.

The overburden in these areas averages 6.67 feet in thickness. It is uniformly a silty clay and is impermeable.

The Locketong argillite, even where it has not been baked to hornfels, as it has not in the reservoir and adjacent area, is a tough rock and will have to be blasted if it is to be dug into. The zones of weathered shale frequently found on top of bedrock, the badly broken and the thin-bedded zones - all workable by a backhoe - are deceptive. The weathered zones are not included in bedrock, as they were generally augerable or penetrable by the driven spoon-sampler. The thin-bedded zones belong to the parts of detrital cycles which, although they recur frequently and persist laterally, are only 14 to 20 feet thick and the strike and dip (averaging E-W and 15-deg. N) are such that one cannot count on staying within this interval as one moves about over the area of the reservoir, the borrow areas, or along the projected transmission main. The badly broken parts are associated

with fractures. They will, therefore, be linear and narrow and separated by wider areas of tough, massive rock. Although solid argillite is impermeable, where fractured it is permeable. If, therefore, bedrock is to be dug into in making room for the reservoir, the floor will have to be covered with an impermeable material.

The Valley Side (Ferry Road to River Road)

This area (about 1,200 feet wide) presents problems to anyone having to do with it. It was difficult, for example, moving the drill rig across it, and once the rig was set up, getting the hole down presented problems. As has already been indicated these difficulties arose from the steep slope and from the boulder strewn nature of the surface.

Three factors are involved in the situation. One is that the Delaware River has been downcutting faster than any other bodies of flowing water on either side of it. This factor is, however, in no way distinctive for it applies all along the course of the river. A second and important factor is that a rock type not encountered elsewhere on this project, is found on this slope. The geologic map accompanying Bulletin C-9 (2) shows this rock, a diabase, to crop out along Ferry Road near its juncture with Point Pleasant Pike and to extend from there to the valley side. The details of the trend of this rock on the valley side are not clearly exposed. Since diabase was cored in test holes F-19 and F-61 and argillite was cored in F-18A and F-20, the diabase crosses the surveyed lines between 18A and 20. It then probably passed, I believe, where Hickory Run goes under River Road and courses down to the canal. From there it crossed over to New Jersey where there is an excellent outcrop of the rock in a roadcut along highway #29. This diabase, being more resistant to erosion than the argillite, causes the steepness of the valley side between River Road and the site of F-18.

The third factor gives rise to the valley side being strewn with blocks and boulders of bedrock. These blocks and boulders show two interesting things. Firstly, there are abundant growths of moss and especially of fungi on them; and secondly, they show patterns of cracking which I had thought were tension cracks resulting from some heat effect as the diabase intruded nearby. Literature (1), however, indicates them to be syneresis* cracks which develop in the chemical phases of the cyclic deposition mentioned earlier in this report. Because of these cracks, as soon as rock is exposed it begins to fall apart. In addition, exfoliation starts as soon as more than one side becomes exposed and the angular corners and edges become rounded. So whatever the cause of the network of cracks, it is to its presence that the boulder field is ultimately traceable.

The entire valley side, where the surveyed line crosses, is strewn with boulders. Since the chemical cycles, within which the pattern of cracks occur average only 8 to 13 feet thick (1), there has to be some explanation for the size of the boulder field. An obvious possibility is that there are several recurring layers with the syneresis cracks in the rock section of the valley side. It is my opinion, however, that there is but one such layer. It is high up on the valley side and adjacent to the diabase. The argillite erodes faster than

* Syneresis- A spontaneous throwing off of water by a gel during aging. In the hardened or set gel the shrinkage resulting from loss of water causes cracking.

the diabase, so that once the Delaware river had cut below the diabase, it began to undercut and to widen thereby the valley. Meanwhile, the layer with the network of cracks was falling apart to boulders and blocks and these, too heavy to be moved by flowing water, were simply "let down" and eventually came to cover the slope.

Have the boulders and blocks moved down slope under the pull of gravity? There must have been such movement but there is evidence suggesting that this has been very little. Many trees grown on the valley side. Most of them are erect and straight and some of these have large circumferenced trunks at their bases suggesting a considerable age. There are some trees, however, that curve from the ground becoming erect upward, suggesting a slip of their substrate during their lifetime. At still other places on the valley side one comes across a large, dead tree lying flat, suggesting such a movement as to have knocked it over (or at least to have so weakened the root system that a strong wind knocked it over). On the whole, however, a look at the overall forest-picture suggests stability to the ground underneath.

Whether or not the abundant growth of mosses and fungi had any significance in the breakup of the rock is problematic. Their presence is probably due to an abundance of analcime in the cement of the rock. This mineral is a zeolite, a family of minerals whose molecular structure is open resulting in wide channelways in which water may be housed. It may be such water picked up from groundwater that the plants are after. Analcime has a hardness of 5-5 1/2 and gives toughness to a rock containing it.

The Valley Bottom (River Road to the Delaware River)

Seventeen test holes were drilled in this area and they encountered an average of 24.0 feet of overburden above the bedrock. The overburden contains considerable sand and gravel. No permeability tests were possible in these sand-gravel intervals because they were below the water table. November, it was learned during an inquiry made to the Trenton office of the Coast & Geodetic Survey which is charged with conditions along the river, was the wettest since 1897. December, too, proved to be a wet month. The ground, therefore, was thoroughly soaked during the drilling. Although not as abundant as on the valley side, large boulders were encountered in drilling the overburden. Frequently drive-sample boring had to be abandoned because of refusal. Coreing or drilling with a tri-cone roller bit was required to make progress. There were cases, too, where the driven sampler angled past boulders. Large boulders and perhaps even blocks (to 10 feet or more?) may be expected during any excavation in this area.

In general the top of the bedrock surface rises in elevation from 55 feet under F-1 to 90 feet under F-6. The rock itself is typical of the Lockatong argillite. It may prove to be harder than the argillite encountered on the plateau because of the possible baking action of the sill which was intruded stratigraphically above it. A diamond core bit has no difficulty coreing this rock where it is massive. Near fractures, however, difficulty was encountered, but not because the rock could not be cut. Rather pieces of broken rock would twist in the barrel or in the core lifter blocking downward progress. Hole F-13, for example, must have fallen directly above a fracture plane which the core bit

encountered and followed down. Fifteen feet of bedrock was cored (27'-42') in an attempt to get broken rock. F-13A relocated (at the driller's request) about 10 feet away encountered good rock immediately under the overburden.

Bedrock conditions are well illustrated in the face of the quarry along Point Pleasant Pike where the latter ascends the valley side. The argillite and the diabase are also well illustrated in road cuts along highway #29 directly across the river near Byram, New Jersey.

- (1) Subitzky, Seymour (editor), Geology of Selected Areas in New Jersey and Eastern Pennsylvania, 1969, Rutgers University Press.
- (2) Bulletin C-9, Bureau of Topographic & Geologic Surveys, Harrisburg, Pa.

SUMMARY OF

| <u>Location</u> | <u>Sample Depth</u> | <u>Soil Type</u> | <u>% Gravel</u> | <u>% Sand</u> | <u>% Silt</u> | <u>% Clay</u> |
|-----------------|---------------------|------------------|-----------------|---------------|---------------|---------------|
| TP1 | .9-2' | ML | 8 | 5 | 66 | 21 |
| TP2 | - | ML-CL | 1 | 2 | 72 | 25 |
| TP3A | 1'-2' | MC-CL | 12 | 8 | 54 | 26 |
| TP7A | 1.5'-2.5' | ML | 0 | 2 | 68 | 30 |
| TP8A | - | CL | 1 | 1 | 64 | 34 |
| AH17 | .5'-5' | CL | 19 | 16 | 33 | 32 |
| AH21 | 2'-3.5' | CL | 4 | 17 | 43 | 36 |
| AH24 | 0-3' | CL | 10 | 7 | 51 | 32 |
| AH28 | .5'-5' | CL | 13 | 17 | 33 | 37 |
| TP4 | 0-2' | CL | 9 | 5 | 59 | 27 |
| TP5 | 0-6.5' | CL | 0 | 1 | 64 | 35 |
| TP6 | 4'-7' | ML | 8 | 20 | 54 | 18 |
| AH38 | - | CL | 14 | 11 | 43 | 32 |

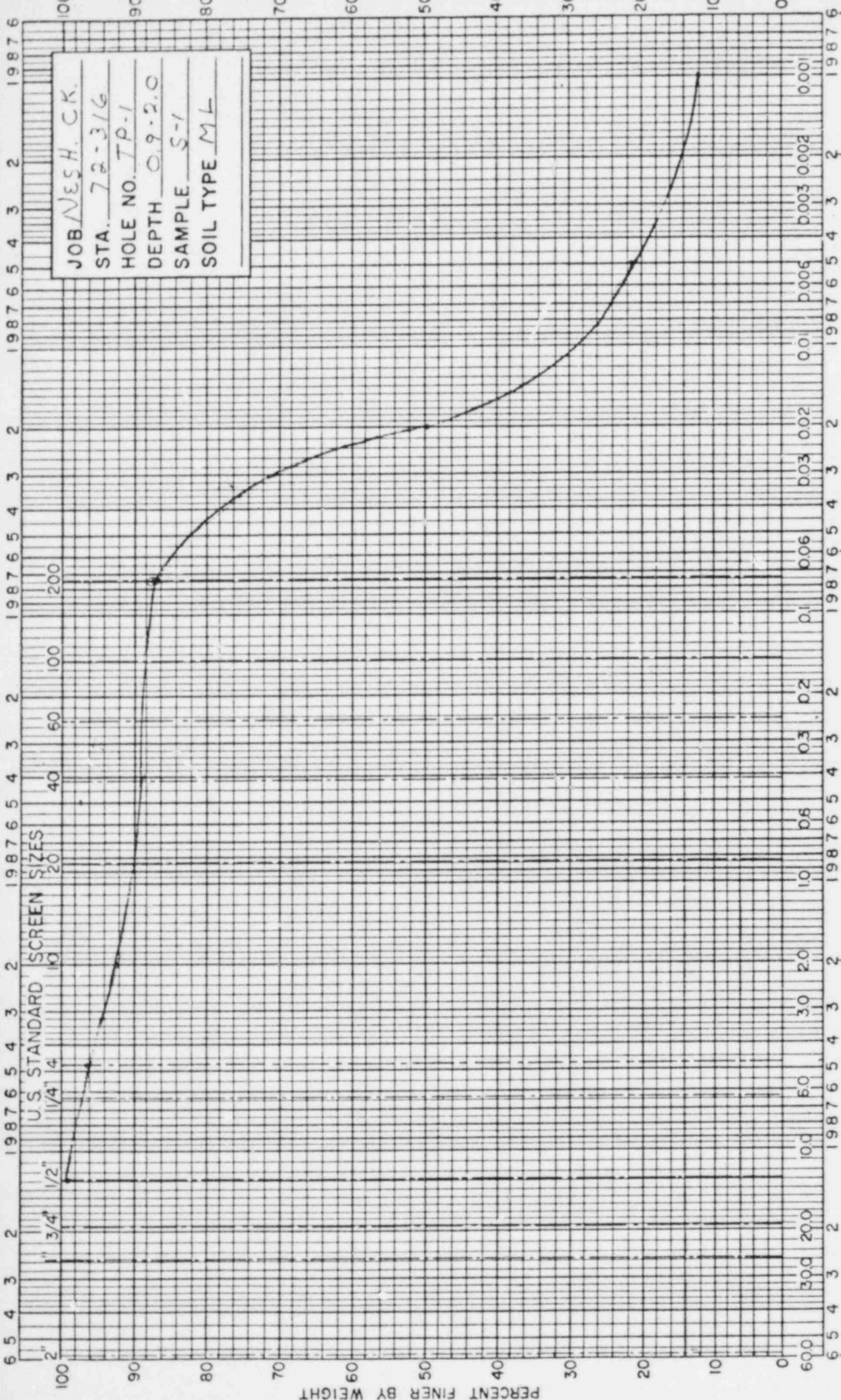
| <u>Location</u> | <u>Optimum Moisture %</u> | <u>Dry Density pcf</u> | <u>Wet Density pcf</u> |
|-----------------|---------------------------|------------------------|------------------------|
| TP4 | 17 | 108.6 | 128 |
| TP5 | 16.5 | 107.7 | 125.4 |
| TP6 | 17.9 | 109.7 | 129.3 |

CHARACTERISTICS

| <u>I</u> | <u>PHI</u> | <u>Tangent</u> | <u>Cohesion psi</u> | <u>Stress Type</u> | <u>Lab Per- meability cm/sec.</u> | <u>Samples</u> |
|----------|------------|----------------|-------------------------|------------------------|---|----------------|
| 27°-30' | 0.5206 | | 2.0 | Effective | .00005 | Undisturbed |
| 24°-30' | 0.4557 | | 2.5 | Total | | |
| - | - | | - | - | - | Undisturbed |
| 29°-0' | 0.5543 | | 6.1 | Effective | .00004 | Undisturbed |
| 29°-1' | 0.5547 | | 5.5 | Total | | |
| - | - | | - | - | .00245 | Undisturbed |
| 31°-0' | 0.6009 | | 8.8 | Effective | .000085 | Undisturbed |
| 29°-30' | 0.5658 | | 9.0 | Total | | |
| | | | | | | Disturbed |
| | | | | | | Disturbed |
| | | | | | | Disturbed |
| | | | | | | Disturbed |
| 28°-0' | 0.5317 | | 7.0 | Total | | Disturbed |
| 25°-30' | 0.4770 | | 14.0 | Effective | | Disturbed |
| 28°-30' | 0.5430 | | 14.0 | Effective | | Disturbed |
| - | - | | - | - | | |

BRADSHAW RESERVOIR

TEST PIT 1



JOB NE5H. CK.
 STA. 72-316
 HOLE NO. TP-1
 DEPTH 0.9-2.0
 SAMPLE S-1
 SOIL TYPE ML

GRAIN SIZE IN MILLIMETERS

| GRAVEL | | SAND | | | SILT | | | CLAY | |
|--------------------------|--------|-----------------------|--------|--------|------------------------|--------|--------|-----------------------|--|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>60</u> | | % SAND SIZES <u>5</u> | | | % SILT SIZES <u>60</u> | | | % CLAY SIZES <u>2</u> | |

MICHAEL BAKER, JR., INC.

Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT



MICHAEL BAKER, JR., INC.

ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG

LIMITS OF SOILS

Project No. NESHAMINY CK.
 Laboratory No. 72-316
 Test Bore 7P-1 Station S-1 Offset 0.9-2.0'
 Date Received 12-15-72 Date Tested 12-19-72
 Tested By R. Dorothy
 Checked By _____

SPECIFIC GRAVITY = 2.704 @ 20°C NMC = 11.5%

Wt. of Dry Soil and Flask $W_1 =$ g.
 Wt. of Flask No. $W_2 =$ g.
 Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
 % Passing 02 = 49.7
 Frost Group = F4

Aggr. = 8
 CS = 4
 FS = 1
 S = 66
 C = 21
 Volume of Soil $V_s =$ c.c.
 Apparent Sp. Gr. $\frac{W_0}{V_s} =$

LIQUID LIMIT

Wt. of Wet Soil and Dish A B
 Wt. of Dry Soil and Dish 29.18
 Wt. of Dry Soil and Dish 25.15
 Wt. of Water 4.03
 Percent of Moisture 26.6 26

N = 18

Wt. of Dry Soil and Dish 25.15 A B
 Wt. of Dish 3.8 9.99
 Wt. of Dry Soil 15.16

PLASTIC LIMIT

Wt. of Wet Soil and Dish A B
 Wt. of Dry Soil and Dish 24.91 25.14
 Wt. of Dry Soil and Dish 22.39 22.60
 Wt. of Water 2.52 2.54
 Percent of Moisture 23.4 23.5

Wt. of Dry Soil and Dish 22.39 A B
 Wt. of Dish 3.9 11.61 11.80 E-10
 Wt. of Dry Soil 10.78 10.80

PLASTICITY INDEX (LL.-P.L.) = 26 - 23 = 3 ML

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|--------------------------|---------------------------|---------------|------------|--------|---|---------------|----------|---------------------------|-------------|------------|------------|
| Sieve Number | Retained | | | Cumulative | | Sieve Number | Particle Size | Retained | | | Cumulative | |
| | Weight (W ₁) | Percent (W ₁) | Per. Ret. (W) | % Ret. | % Pass | | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | g | % | % | % | % | | mm. | g | % | % | % | % |
| 1" | --- | | | | | 10 | 1.98 | | | | | |
| 3/4" | | | | | | 20 | 0.833 | | | | | |
| 1/2" | 10.9 | 0.8 | | 0.8 | 99.2 | 40 | 0.417 | 2.0 | 4.0 | | 4.0 | 96.0 |
| 3/8" | | | | | | 60 | 0.246 | | | | | |
| No. 4 | 44.5 | 3.1 | | 3.9 | 96.1 | 140 | 0.104 | | | | | |
| No. 10 | 55.9 | 3.9 | | 7.8 | 92.2 | 200 | 0.074 | 0.7 | 1.4 | | 5.4 | 94.6 |
| No. 40 | | | | | 88.5 | Pass | No. 200 | | | | | |
| No. 200 | | | | | 87.2 | Total | | 50 | 100 | | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | | |
| Total | 145.7 | | | | | Partial Sample W ₁ = g. % | | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)
 Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|------|-----------|-----------|--------------------|-----|------|-----------------------------------|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Kn | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 8:55 | 5 | 23.0 | 33.0 | 6.0 | 27.0 | 54.0 | | | | .035 | .02 | 49.7 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 0:00 | 60 | 23.5 | 17.5 | 5.9 | 11.6 | 23.2 | | | | .010 | .005 | 21.4 |
| | 90 | | | | | | | | | .008 | | |
| 8:55 | 1440 | 23.5 | 12.5 | 5.9 | 6.6 | 13.2 | | | | .002 | .001 | 12.2 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.

FIELD DENSITY TEST - SAND CONE METHOD

Date of Test 10-25-72 Test No. 2
 Test Location POINT PLEASANT HARBOR FAC.
 Area Represented TEST PIT No 1

Sand Cone Apparatus Number 1 Material 67 Classy Silt
 Mode of Compaction _____ Layer Designation 1.0'-1.6'
 Type of Compactor NONE Thickness _____
 Number of Passes NONE

| | | | |
|-------------------------------|---|--------------|-------|
| <u>CALIBRATION</u> | (1) Weight of Container filled to valve with water | <u>5654</u> | gm |
| | (2) Deduct weight of empty container | <u>1664</u> | gm |
| | (3) Net weight of water in gm = Volume in cc | <u>3990</u> | cc |
| | (4) Weight of container plus funnel, filled with sand | <u>7810</u> | gm |
| | (5) Close valve, empty funnel and reweigh; deduct | <u>6001</u> | gm |
| | (6) Weight of sand in funnel | <u>1809</u> | gm |
| <u>VOLUME OF HOLE</u> | (7) Weight of sand plus apparatus before test | <u>7855</u> | gm |
| | (8) Deduct weight of sand plus apparatus after test | <u>3573</u> | gm |
| | (9) Weight of sand emptied from container | <u>4282</u> | gm |
| | Deduct (6) Weight of sand in funnel | <u>1809</u> | gm |
| | (10) Weight of sand remaining in hole | <u>2473</u> | gm |
| | (11) Bulk Density of Sand: | | |
| | (11a) Enter (7) Sand plus apparatus before test | <u>7855</u> | gm |
| | (11b) Deduct (2) Weight of Appartus | <u>1664</u> | gm |
| | (11c) Weight of sand in container | <u>6215</u> | gm |
| | (11d) Enter (3) Container Volume | <u>3990</u> | cc |
| | (11e) Divide (11c) by (11d) = Bulk Density | <u>1.558</u> | gm/cc |
| | (12) Divide (10) by (11e) = Volume of hole | <u>1587</u> | cc |
| <u>SAMPLE TAKEN FROM HOLE</u> | (13) Weight of total sample taken from hole plus can | <u>3239</u> | gm |
| | (14) Deduct tare weight of can | <u>384</u> | gm |
| | (15) Net weight of sample as taken | <u>2855</u> | gm |

| | | | |
|---|----------|----------------|------------------|
| <u>MOISTURE CONTENT</u> | | When Compacted | When Tested |
| (16) Weight of wet sample plus can | _____ gm | _____ gm | <u>112.4</u> gm |
| (17) Deduct weight of dry sample plus can | _____ gm | _____ gm | <u>1674.1</u> gm |
| (18) Weight of water contained in sample | _____ gm | _____ gm | <u>357.3</u> gm |
| (19) Tare Number and Weight # _____ | _____ gm | # _____ | <u>111.5</u> gm |
| (20) Net Weight of dry sample, (17) - (19) | _____ gm | _____ gm | <u>1562.6</u> gm |
| (21) Moisture content, (18) divided by (20) | _____ % | _____ % | <u>21.7</u> % |

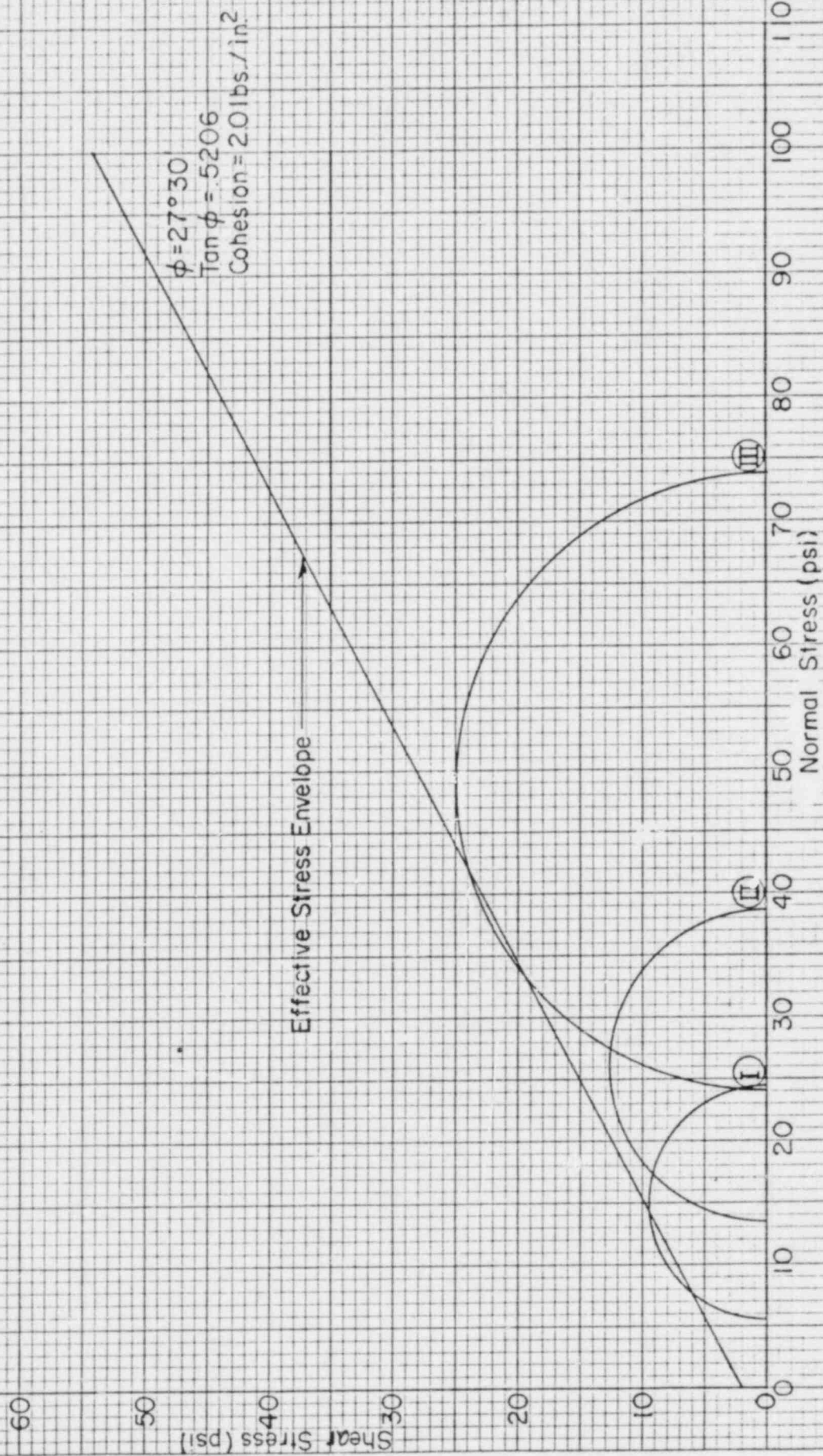
| | | | |
|--|--|-------------------|---------------------------|
| <u>DENSITY COMPUTATION</u> | | (For correlation) | (For density Computation) |
| (22) Wet density | $\frac{\text{Item (15)}}{\text{Item (12)}} \times 62.4$ | _____ | <u>113.4</u> lb./cu. ft. |
| (23) Dry Density | $\frac{\text{Item (22)}}{1.00 \text{ plus Item (21) "when tested"}}$ | _____ | <u>93.2</u> lb./cu. ft. |
| (24) Optimum dry density from compaction tests | _____ | _____ | _____ lb./cu. ft. |
| (25) Percent of optimum dry density obtained in field | _____ % | _____ % | _____ % |
| (26) Specified minimum allowable percentage of optimum dry density | _____ % | _____ % | _____ % |

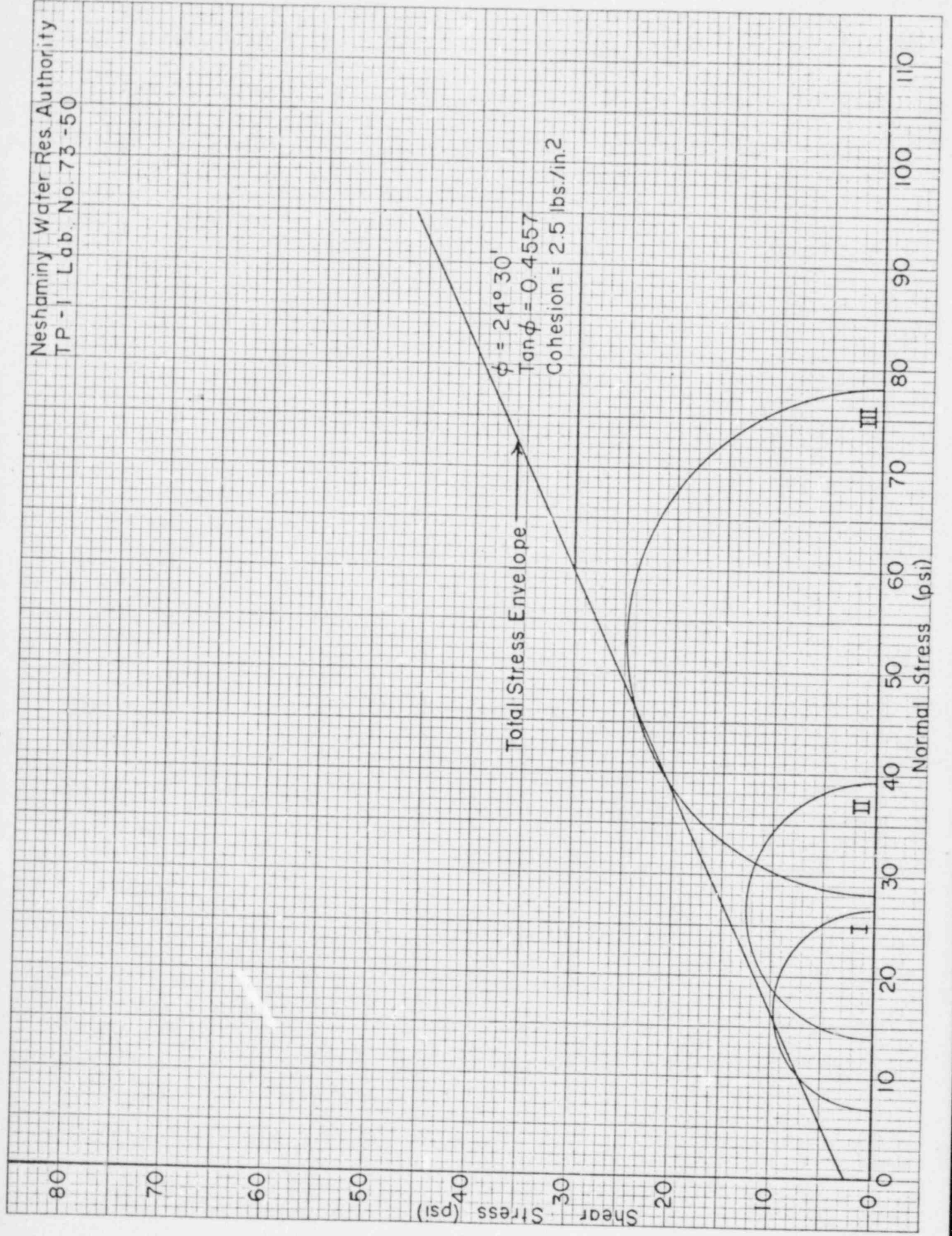
(27) THE ABOVE TEST INDICATES SOIL IN AREA REPRESENTED (HAS, HAS NOT) BEEN COMPACTED TO THE DENSITY REQUIRED BY THE GOVERNING SPECIFICATIONS. Remarks: _____

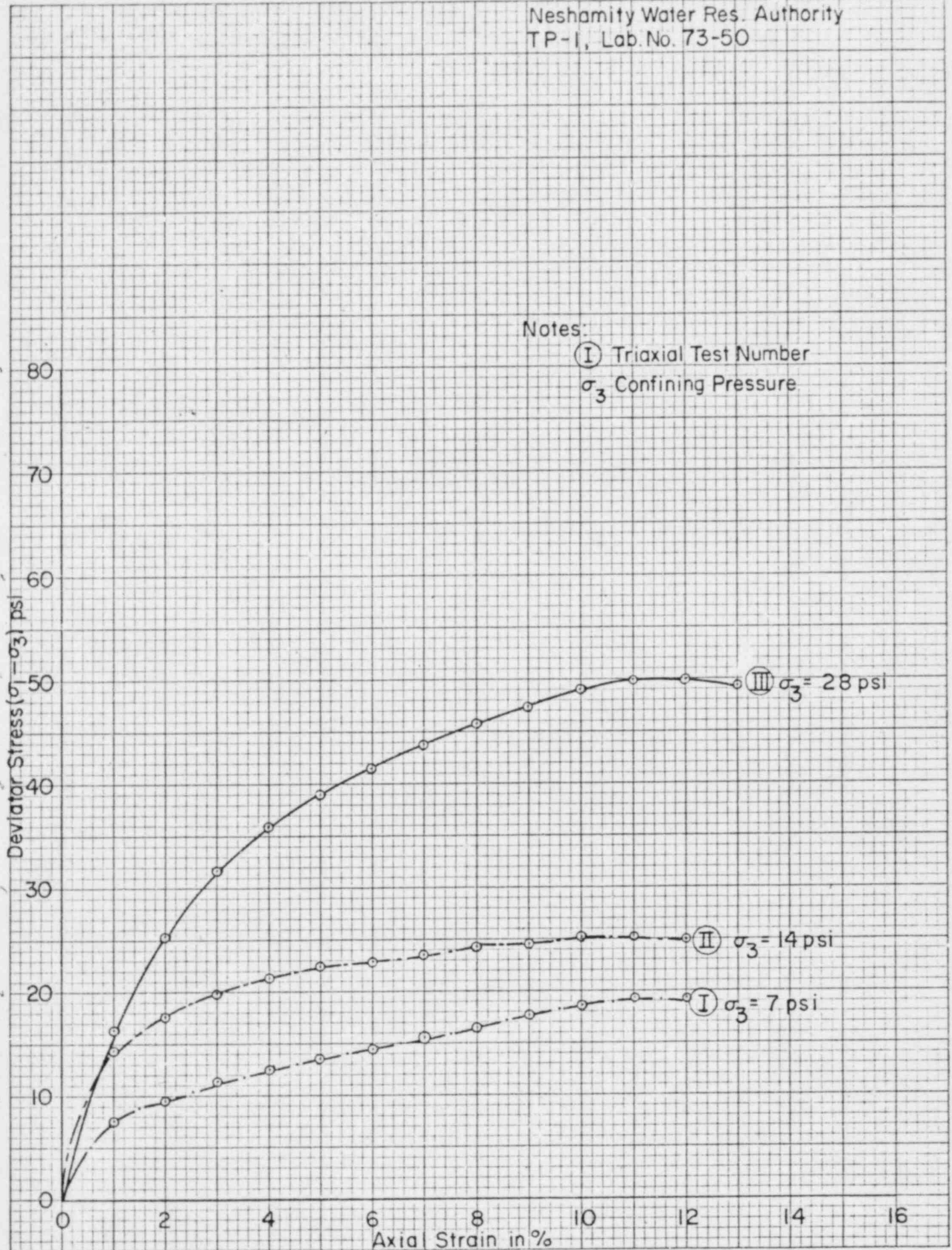
Signed _____

CU
Neshdminy Water Res. Authority
TP-1, Lab. No. 73-50
Depth 1.0' to 2.0'

GEOSCIENCES MICHAEL BAKER, JR. INC.







Notes:

- Ⓘ Triaxial Test Number
- σ_3 Confining Pressure.

Ⓙ $\sigma_3 = 28$ psi

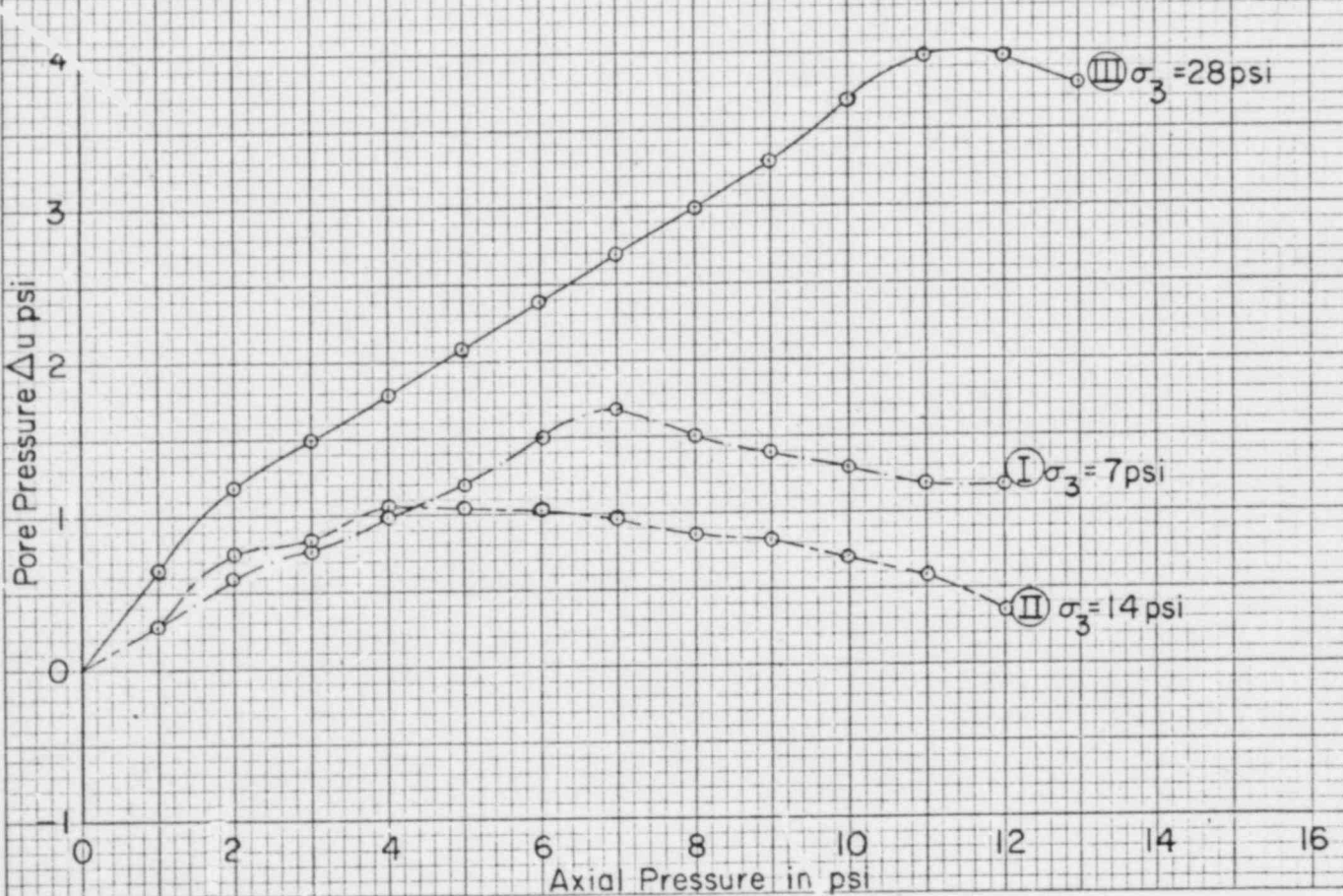
Ⓛ $\sigma_3 = 14$ psi

Ⓚ $\sigma_3 = 7$ psi

Neshamity Water Res. Authority
TP-1, Lab. No. 73-50
Depth 1.0' to 2.0'

Notes:

I Triaxial Test Number
 σ_3 Confining Pressure



MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Date 4-11-73
 Lab. No. 73-50

Sample Source TP-1

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|----------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (~~cm~~) (inches) 9.25 x 9.50 x 11.0

Specimen Volume (~~cm³~~) (feet³)559

Weight of Container + Wet Specimen, (~~g~~) (pounds) 70.61

Weight of Container, (~~g~~) (pounds) 7.21

Wet weight of Specimen, (~~g~~) (pounds) 63.40

Wet Density, (g/cc) _____

Wet Density, (pcf) 113.4 ✓

Dry Density, (pcf) 93.2



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

Location Neshaminy Creek Specimen Measurements Test No. 73-50
 Boring No. TP-1 Depth 0.9-2.0' Diameter 6.1 cm Date 4-13/73
 Sample No. TP-1 Circumference _____ Tested By Frank
 Specific Gravity, G_s 2.704 Area, A 29.22 cm
 Wet Wt. of Sample 368.50 Length, L 6.25 cm
 Dry Wt. of Sample W_s 301.05 Volume of Sample 182.63 cc³
 Volume of Solid Material = $V_s = W_s/G_s = \frac{301.05}{2.704} = 111.50$ cc
 Void Ratio of Sample = $e = \frac{V - V_s}{V_s} = \frac{182.63 - 111.50}{111.50} = \frac{71.13}{111.50} = .6379$

Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h_0 | h_1 | $\log_{10} h_0/h_1$ | k cm/sec. |
|---------|--------------------------|------------------|--|-------|-------|---------------------|----------------|
| 1:15:00 | | | | 60.0 | | | |
| 2:04:00 | | | | | 38.0 | | |
| | 2940 | 36.5 | 1.66 | | | .19838 | .000054 |
| 2:10:00 | | | | 60.0 | | | |
| 3:15:00 | | | | | 36.0 | | |
| | 3900 | 40 | 1.67 | | | .22183 | .000047 |
| 3:20:00 | | | | 65.0 | | | |
| 4:10:00 | | | | | 44.0 | | |
| | 3000 | 35 | 1.67 | | | .16959 | .000047 |
| 4:15:00 | | | | 55.0 | | | |
| 4:40:00 | | | | | 44.0 | | |
| | 1500 | 18.5 | 1.68 | | | .09691 | .000053 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |

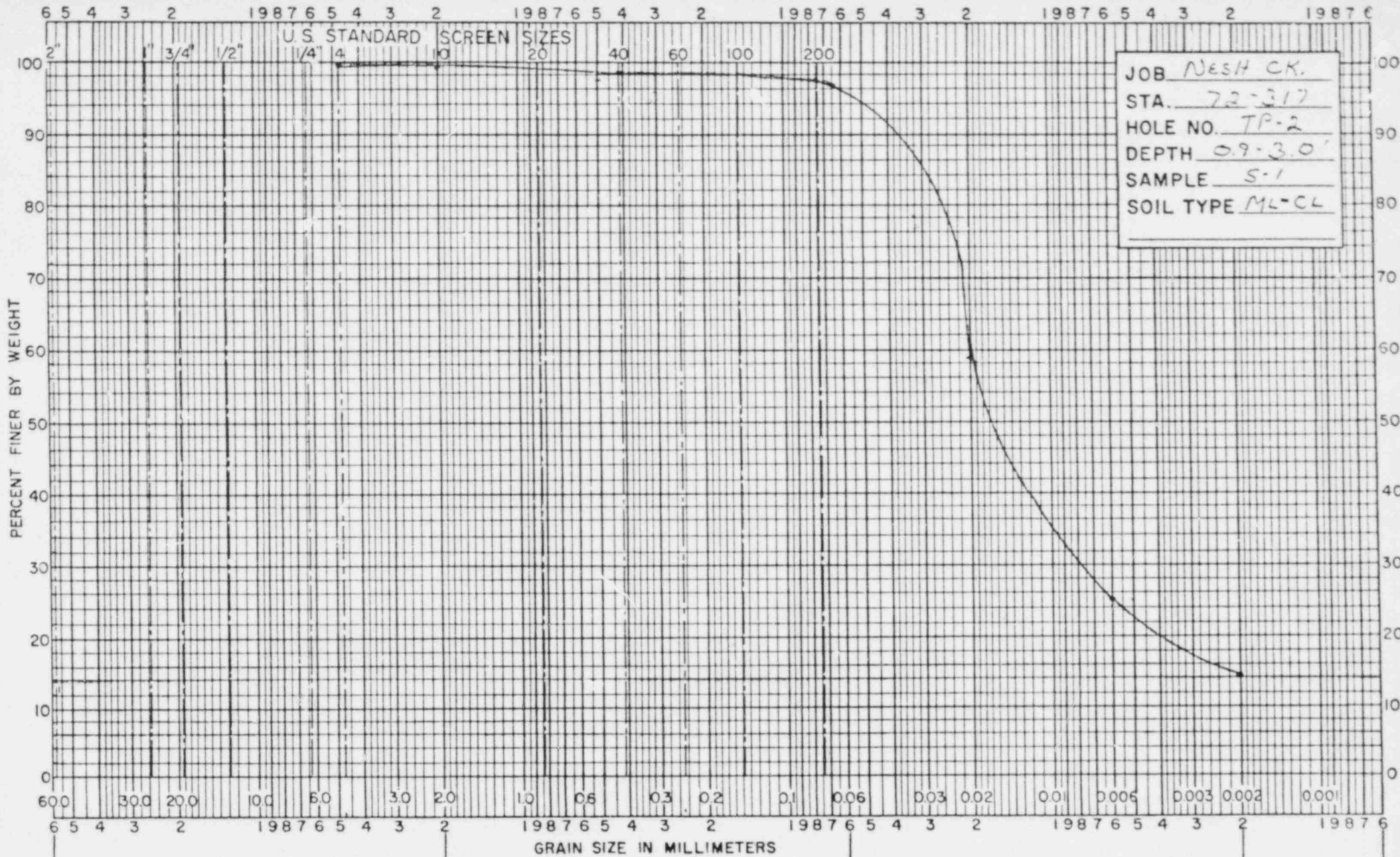
$$K = 2.3 \frac{aL}{At} \cdot \log_{10} \frac{h_0}{h_1}$$

$$a = \frac{Q}{h_1 - h_2}$$

Remarks Avg. K = 0.000050

BRADSHAW RESERVOIR

TEST PIT 2



JOB NESH CK.
 STA. 72-317
 HOLE NO. TP-2
 DEPTH 0.9-3.0'
 SAMPLE S-1
 SOIL TYPE ML-CL

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|----------------|--------|------|--------------|--------|------|--------------|--------|------|--------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| 100 | | | 100 | | | 72 | | | 25 |
| % GRAVEL SIZES | | | % SAND SIZES | | | % SILT SIZES | | | % CLAY SIZES |



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Project No. NESHAMINY CK.
Laboratory No. 72-317
Test Bore TP-2 Station S-1 Offset 0.9.30'
Date Received 12-15-72 Date Tested 12-19-72
Tested By R. DOROTHY
Checked By _____

SPECIFIC GRAVITY = 2.733 @ 20°C

NMC = 20.6%

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
% Passing $D_2 =$ 58.6%
Frost Group = F4

Aggr = 1
CS = 1
FS = 1
S = 72
C = 25

Volume of Soil $V_s =$ c.c.
Apparent Sp. Gr. $\frac{W_0}{V_s} =$

LIQUID LIMIT

Wt. of Wet Soil and Dish --- 28.27 g. ^A _B
Wt. of Dry Soil and Dish --- 24.71 g.
Wt. of Water --- 3.56 g.
Percent of Moisture --- 25.5 26

N = 22

Wt. of Dry Soil and Dish 24.71 g. ^A _B
Wt. of Dish --- 5.3 10.76 g.
Wt. of Dry Soil --- 13.95 g.

PLASTIC LIMIT

Wt. of Wet Soil and Dish --- 21.40 22.19 g. ^A _B
Wt. of Dry Soil and Dish --- 19.78 20.41 g.
Wt. of Water --- 1.62 1.78 g.
Percent of Moisture --- 20.6 20.4

Wt. of Dry Soil and Dish 19.78 20.41 g. ^A _B
Wt. of Dish --- 7.7 11.92 11.71 11.2 g.
Wt. of Dry Soil --- 7.86 8.72 g.

PLASTICITY INDEX (LL.-P.L.) = 25 - 21 = 4

ML-CL

SIEVE ANALYSIS RETAINED ON No. (W₁)

SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W₃)

| Sieve Number | Retained | | | Cumulative | | Sieve Number | Particle Size mm. | Retained | | | Cumulative | |
|--------------|--------------------------|---------------------------|---------------|------------|--------|--|----------------------|----------|---------------------------|-------------|------------|------------|
| | Weight (W ₁) | Percent (W ₁) | Per. Ret. (W) | % Ret. | % Pass | | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | g | % | % | % | % | | | g | % | % | % | % |
| 1" | — | | | | | 10 | 1.98 | | | | | |
| 3/4" | | | | | | 20 | 0.833 | | | | | |
| 1/2" | — | | | | | 40 | 0.417 | 0.6 | 1.2 | | 1.2 | 98.8 |
| 3/8" | | | | | | 60 | 0.246 | | | | | |
| No. 4 | 1.0 | 0.1 | | 0.1 | 99.9 | 140 | 0.104 | | | | | |
| No. 10 | 2.0 | 0.5 | | 0.6 | 99.4 | 200 | 0.074 | 0.5 | 1.0 | | 2.2 | 97.8 |
| No. 40 | | | | | 98.2 | Pass | No. 200 | | | | | |
| No. 200 | | | | | 97.2 | Total | | 50 | 100 | | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | | |
| Total | 1327.5 | | | | | Partial Sample W ₁ = g. % | | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)

Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|-------|-----------|-----------|--------------------|-----|------|-----------------------------------|--------------|----|----|-----------------|-----------------------|-----------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Ku | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 9:05 | 5 | 22.0 | 35.5 | 6.0 | 29.5 | 59.0 | | | | .035 | .02 | 58.6 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 10:15 | 60 | 23.0 | 18.5 | 6.0 | 12.5 | 25.0 | | | | .010 | .005 | 24.9 |
| | 90 | | | | | | | | | .008 | | |
| 9:05 | 1440 | 23.5 | 13.0 | 5.9 | 7.1 | 14.2 | | | | .002 | .001 | 14.1 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.

FIELD DENSITY TEST - SAND CONE METHOD

Date of Test 10-25-73 Test No. 4
 Test Location 1-100 Pleasant Avenue Facility
 Area Represented Test Pit No. 2

Sand Cone Apparatus Number #1
 Mode of Compaction _____
 Type of Compactor None
 Number of Passes None

Material Reddish Gray Silty Clay
 Layer Designation 20-2.5'
 Thickness _____

| | | |
|-------------------------------|---|--------------------|
| <u>CALIBRATION</u> | (1) Weight of Container filled to valve with water | <u>5654</u> gm |
| | (2) Deduct weight of empty container | <u>1664</u> gm |
| | (3) Net weight of water in gm - Volume in cc | <u>3990</u> cc |
| | (4) Weight of container plus funnel, filled with sand | <u>7810</u> gm |
| | (5) Close valve, empty funnel and reweigh; deduct | <u>6001</u> gm |
| | (6) Weight of sand in funnel | <u>1809</u> gm |
| <u>VOLUME OF HOLE</u> | (7) Weight of sand plus apparatus before test | <u>7777</u> gm |
| | (8) Deduct weight of sand plus apparatus after test | <u>3005</u> gm |
| | (9) Weight of sand emptied from container | <u>4552</u> gm |
| | Deduct (6) Weight of sand in funnel | <u>1809</u> gm |
| | (10) Weight of sand remaining in hole | <u>2743</u> gm |
| | (11) Bulk Density of Sand: | |
| | (11a) Enter (7) Sand plus apparatus before test | <u>7777</u> gm |
| | (11b) Deduct (2) Weight of Apparatus | <u>1664</u> gm |
| | (11c) Weight of sand in container | <u>6113</u> gm |
| | (11d) Enter (3) Container Volume | <u>3990</u> cc |
| | (11e) Divide (11c) by (11d) = Bulk Density | <u>1.532</u> gm/cc |
| | (12) Divide (10) by (11e) = Volume of hole | <u>1790</u> cc |
| <u>SAMPLE TAKEN FROM HOLE</u> | (13) Weight of total sample taken from hole plus can | <u>4057</u> gm |
| | (14) Deduct tare weight of can | <u>361</u> gm |
| | (15) Net weight of sample as taken | <u>3696</u> gm |

| | | | |
|---|---------|-----------------------|---------------------------|
| <u>MOISTURE CONTENT</u> | | <u>When Compacted</u> | <u>When Tested</u> |
| (16) Weight of wet sample plus can | | _____ gm | <u>2565.2</u> gm |
| (17) Deduct weight of dry sample plus can | | _____ gm | <u>2178.6</u> gm |
| (18) Weight of water contained in sample | | _____ gm | <u>392.4</u> gm |
| (19) Tare Number and Weight | # _____ | _____ gm | <u>177.2</u> gm |
| (20) Net Weight of dry sample, (17) - (19) | | _____ gm | <u>1994.0</u> gm |
| (21) Moisture content, (18) divided by (20) | | _____ % | <u>19.6</u> % |
| | | (For correlation) | (For density computation) |

| | | |
|--|--|--------------------------|
| <u>DENSITY COMPUTATION</u> | | <u>128.2</u> lb./cu. ft. |
| (22) Wet density | $\frac{\text{Item (15)}}{\text{Item (12)}} \times 62.4$ | |
| (23) Dry Density | $\frac{\text{Item (22)}}{1.00 \text{ plus Item (21) "when tested"}}$ | <u>107.7</u> lb./cu. ft. |
| (24) Optimum dry density from compaction tests | | _____ lb./cu. ft. |
| (25) Percent of optimum dry density obtained in field | Item (23) expressed as a percent of Item (24) | _____ % |
| (26) Specified minimum allowable percentage of optimum dry density | | _____ % |

(27) THE ABOVE TEST INDICATES SOIL IN AREA REPRESENTED (HAS, HAS NOT) BEEN COMPACTED TO THE _____ TY REQUIRED BY THE GOVERNING SPECIFICATIONS. Remarks: _____

Signed _____

MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Date 5-11-72

Sample Source TP-2

Lab. No. _____

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|-------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (cm) (inches) 9.86 x 9.86 x 11.75

Specimen Volume (cm³) (feet³)661

Weight of Container + Wet Specimen, (g) (pounds) 90.00

Weight of Container, (g) (pounds) 7.26

Wet weight of Specimen, (g) (pounds), 82.74

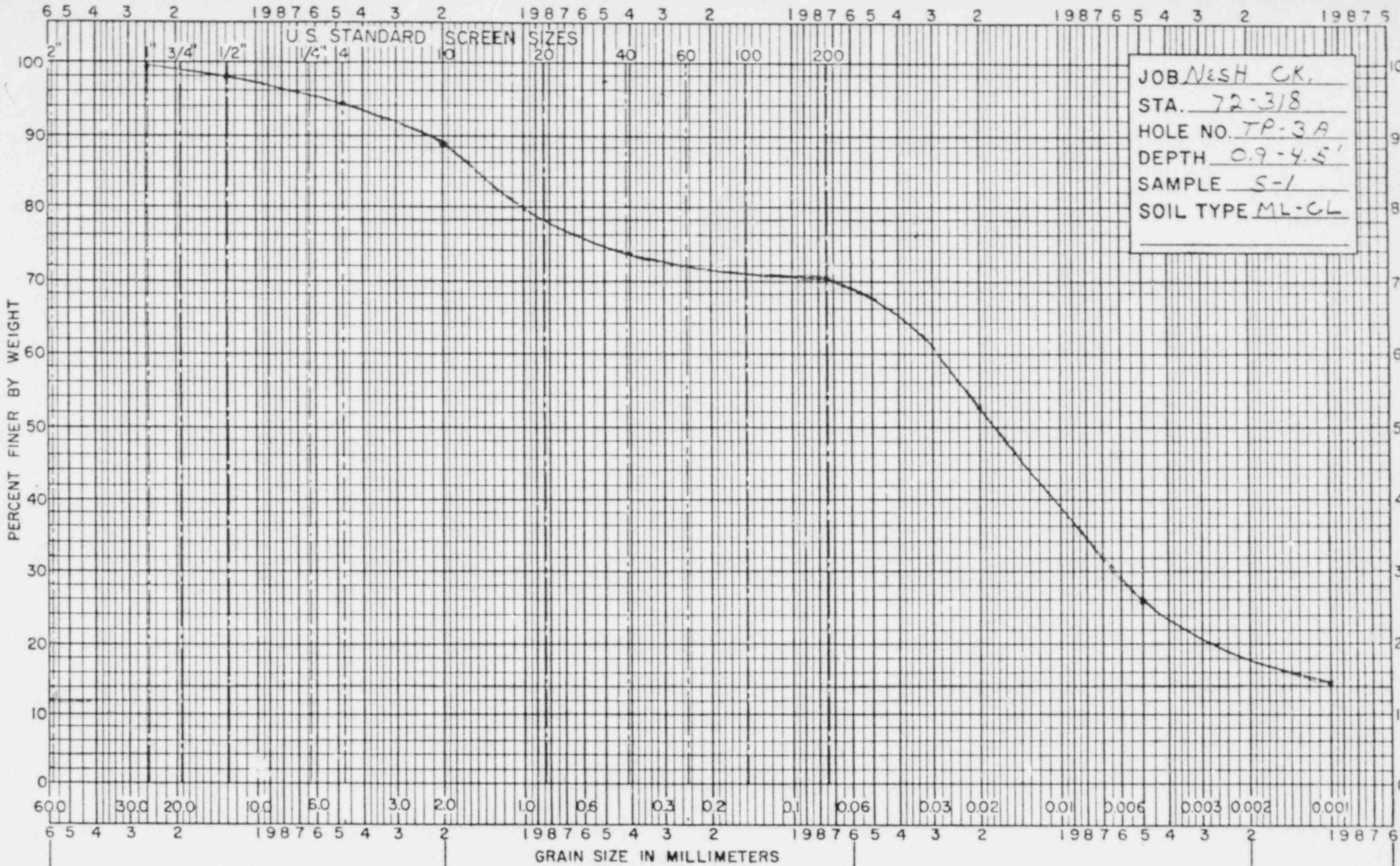
Wet Density, (g/cc) _____

Wet Density, (pcf) 125.2

Dry Density, (pcf) 104.7

BRADSHAW RESERVOIR

TEST PIT 3-A



JOB NESH CK,
 STA. 72-318
 HOLE NO. TP-3A
 DEPTH 0.9-4.5'
 SAMPLE S-1
 SOIL TYPE ML-CL

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|--------------------------|--------|------|-----------------------|--------|------|------------------------|--------|------|------------------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>12</u> | | | % SAND SIZES <u>8</u> | | | % SILT SIZES <u>54</u> | | | % CLAY SIZES <u>26</u> |

MICHAEL BAKER, JR., INC.

Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT

12

18

44

26



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Project No. NESHAMINY CR.
Laboratory No. 72-318
Test Bore TP-3A Station S-1 Offset 0.9-4.5
Date Received 12-15-72 Date Tested 12-20-72
Tested By R. Dorothy
Checked By _____

SPECIFIC GRAVITY = 2.721 @ 20°C NMC = 13.4%

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
% Passing 02 = 52.2
Frost Group = F4

Aggr = 12
CS = 5
FS = 5
S = 34
C = 26
Volume of Soil $V_s =$ c.c.
Apparent Sp. Gr. $\frac{W_0}{V_s} =$

LIQUID LIMIT

Wt. of Wet Soil and Dish g.
Wt. of Dry Soil and Dish g.
Wt. of Water g.
Percent of Moisture %

N = 21

Wt. of Dry Soil and Dish g.
Wt. of Dish g.
Wt. of Dry Soil g.

PLASTIC LIMIT

Wt. of Wet Soil and Dish g.
Wt. of Dry Soil and Dish g.
Wt. of Water g.
Percent of Moisture %

Wt. of Dry Soil and Dish g.
Wt. of Dish g.
Wt. of Dry Soil g.

PLASTICITY INDEX (LL.-P.L.) = 28 - 22 = 6

ML-CL

SIEVE ANALYSIS RETAINED ON No. (W₁)

SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W₃)

| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | |
|--------------|--------------------------|---------------------------|---------------|------------|--------|
| | Weight (W ₁) | Percent (W ₁) | | % Ret. | % Pass |
| | g | % | % | % | % |
| 1" | 8.2 | 0.5 | 0.5 | 99.5 | |
| 3/4" | | | | | |
| 1/2" | 23.7 | 1.4 | 1.9 | 98.1 | |
| 3/8" | | | | | |
| No. 4 | 62.2 | 3.8 | 5.7 | 94.3 | |
| No. 10 | 94.6 | 5.8 | 11.5 | 88.5 | |
| No. 40 | | | | 83.5 | |
| No. 200 | | | | 80.5 | |
| Pass | | | | | |
| Total | 1627.1 | | | | |

| Sieve Number | Particle Size | Retained | | | Cumulative | |
|--------------|---------------|----------|---------------------------|-------------|------------|------------|
| | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | mm. | g | % | % | % | % |
| 10 | 1.98 | | | | | |
| 20 | 0.833 | | | | | |
| 40 | 0.417 | 2.8 | 5.6 | | 5.6 | 94.4 |
| 60 | 0.246 | | | | | |
| 140 | 0.104 | | | | | |
| 200 | 0.074 | 1.7 | 3.4 | | 9.0 | 91.0 |
| Pass | No. 200 | | | | | |
| | Total | 50 | 100 | | | |

Original Sample W = g. 100%
Partial Sample W₁ = g. %
Partial Sample W₃ = g. %

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)

Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra + W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|-------|-----------|-----------|--------------------|-----|------|--------------------------------|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Kd | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 9:15 | 5 | 23.0 | 35.5 | 6.0 | 29.5 | 59.0 | | | | .035 | .02 | 52.2 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 10:25 | 60 | 23.0 | 20.5 | 6.0 | 14.5 | 29.0 | | | | .010 | .005 | 25.7 |
| | 90 | | | | | | | | | .008 | | |
| 9:15 | 1440 | 23.5 | 14.0 | 5.9 | 8.1 | 16.2 | | | | .002 | .001 | 14.3 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra + W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.

FIELD DENSITY TEST - SAND CONE METHOD

Date of Test 10-25-77 Test No. 3
 Test Location Point of Interest Burial
 Area Represented Test Pit No. B-A
 Sand Cone Apparatus Number #1 Material Quartzite
 Mode of Compaction _____ Layer Designation 1.5'-2.0'
 Type of Compactor None Thickness _____

Number of Passes None

CALIBRATION

| | | |
|---|-------------|----|
| (1) Weight of Container filled to valve with water | <u>5654</u> | gm |
| (2) Deduct weight of empty container | <u>1664</u> | gm |
| (3) Net weight of water in gm - Volume in cc | <u>3990</u> | cc |
| (4) Weight of container plus funnel, filled with sand | <u>7910</u> | gm |
| (5) Close valve, empty funnel and reweigh; deduct | <u>6001</u> | gm |
| (6) Weight of sand in funnel | <u>1909</u> | gm |

VOLUME OF HOLE

| | | |
|---|--------------|-------|
| (7) Weight of sand plus apparatus before test | <u>7770</u> | gm |
| (8) Deduct weight of sand plus apparatus after test | <u>3543</u> | gm |
| (9) Weight of sand emptied from container | <u>4227</u> | gm |
| Deduct (6) Weight of sand in funnel | <u>1809</u> | gm |
| (10) Weight of sand remaining in hole | <u>2418</u> | gm |
| (11) Bulk Density of Sand: | | |
| (11a) Enter (7) Sand plus apparatus before test | <u>7770</u> | gm |
| (11b) Deduct (2) Weight of Apparatus | <u>1664</u> | gm |
| (11c) Weight of sand in container | <u>6106</u> | gm |
| (11d) Enter (3) Container Volume | <u>3990</u> | cc |
| (11e) Divide (11c) by (11d) = Bulk Density | <u>1.530</u> | gm/cc |
| (12) Divide (10) by (11e) = Volume of hole | <u>1777</u> | cc |

SAMPLE TAKEN FROM HOLE

| | | |
|--|-------------|----|
| (13) Weight of total sample taken from hole plus can | <u>3126</u> | gm |
| (14) Deduct tare weight of can | <u>264</u> | gm |
| (15) Net weight of sample as taken | <u>2862</u> | gm |

MOISTURE CONTENT

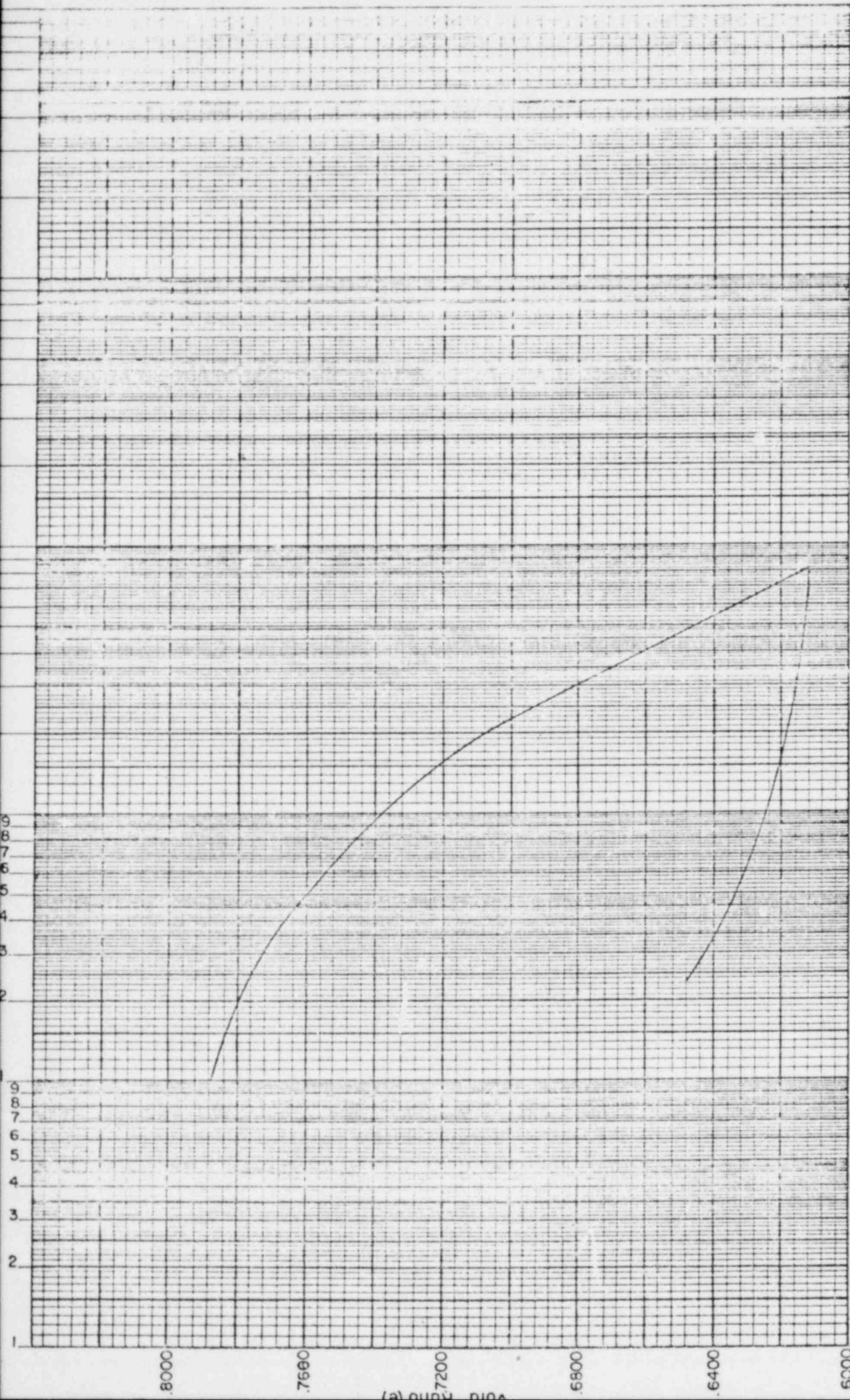
| | When Compacted | When Tested |
|---|----------------|------------------|
| (16) Weight of wet sample plus can | _____ gm | <u>2796.2</u> gm |
| (17) Deduct weight of dry sample plus can | _____ gm | <u>1975.6</u> gm |
| (18) Weight of water contained in sample | _____ gm | <u>820.6</u> gm |
| (19) Tare Number and Weight # _____ | _____ gm | <u>176.2</u> gm |
| (20) Net Weight of dry sample, (17) - (19) | _____ gm | <u>1799.4</u> gm |
| (21) Moisture content, (18) divided by (20) | _____ % | <u>12.3</u> % |

DENSITY COMPUTATION

| | | |
|--|--|-------------------------|
| (22) Wet density | Item (15) Item (12) X 62.4 | <u>99.1</u> lb./cu. ft. |
| (23) Dry Density | Item (22) 1.00 plus Item (21) "when tested" | <u>88.2</u> lb./cu. ft. |
| (24) Optimum dry density from compaction tests | | _____ lb./cu. ft. |
| (25) Percent of optimum dry density obtained in field | Item (23) expressed as a percent of Item (24) | _____ % |
| (26) Specified minimum allowable percentage of optimum dry density | | _____ % |

(27) THE ABOVE TEST INDICATES SOIL IN AREA REPRESENTED (HAS, HAS NOT) BEEN COMPACTED TO THE DENSITY REQUIRED BY THE GOVERNING SPECIFICATIONS. Remarks: _____

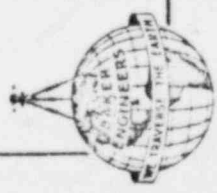
Signed _____



Class ML-CL
 Depth 10' to 20'
 Sheet 1 of 7

Project No. Cont 24 Subs. Inv. Lab. No. 73-47
 Test For Neshaminy Water Res. Auf. Point Pleasant Pumping Fac.
 Test Bore T.P.-3A Station Offset
 Date Received Date Tested 4-(11to19)-73

MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION



CONSOLIDATION TEST

SOIL SAMPLE 73-47
Neshaminy Creek
 PROJECT NO. _____
 BORING NO. TP-3A SAMPLE DEPTH 1'-2'
 SAMPLE NO. _____
 SPECIFIC GRAVITY, G_s , 2.75

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 , 2.55 cm. 1.0039 in.
 CONTAINER DIAMETER 6.35 cm. 2.5 in.
 CONTAINER AREA, A , IN sq. cm. 31.67
 STONE + COVER
 THICKNESS, Z_2 , _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 1 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. 73-47
 DATE 4-(11 to 19)-73
 TESTED BY T. O'Connell

SOLIDS HEIGHT, $2H_o = \frac{W_s}{G_s \gamma_w A} = 1.4266$ cm. .5616 in.
 DEGREE OF SATURATION IN %
 TEST START 79.5%
 TEST END 100.7%

WATER CONTENT

| SPECIMEN LOCATION | | | | | | REMARKS |
|-------------------------------|-------|-------|--|--|--|---------|
| CONTAINER NO. | | | | | | |
| WT. CONTAINER + WET SOIL IN g | 443.8 | 445.0 | | | | |
| WT. CONTAINER + DRY SOIL IN g | 415.4 | 415.4 | | | | |
| WT. WATER, W_w IN g | 28.4 | 29.6 | | | | |
| WT. CONTAINER IN g | 291.6 | 291.6 | | | | |
| WT. DRY SOIL W_s IN g | 123.8 | 123.8 | | | | |
| WATER CONTENT, w , IN % | 22.9 | 23.9 | | | | |

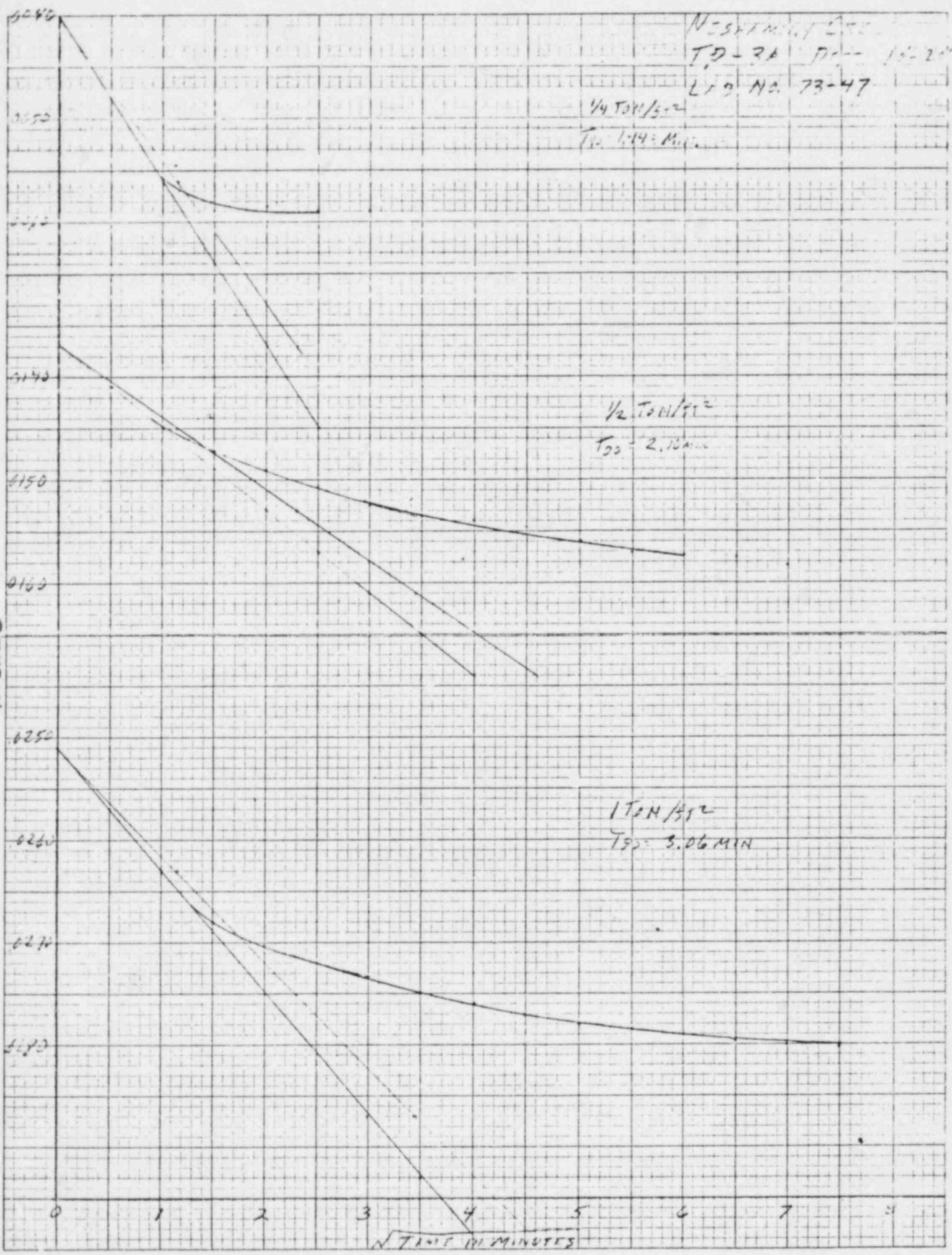
| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 - Z_2 + Z_3$ IN in. | $2H$ FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_o$ IN in. | VOID RATIO $e = \frac{2H - 2H_o}{2H_o}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_v IN sq. cm./sec. | |
|---------------------------------|--------------------|-------------------|--------------------|--------------|---|------------------------------|--------------------------------|---|----------------------|-----|--|---------------|
| | | | | | | | | | 190 | 150 | $.848H^2/190$ | $.197H^2/150$ |
| 0 | | .0000 | | | | 1.0039 | .4423 | .7876 | | | | |
| | | | .0059 | | | | | | 1.44 | | .14751 | |
| 1/4 | | .0059 | | | | .9980 | .4364 | .7771 | | | | |
| | | | .0106 | | | | | | 2.10 | | .09948 | |
| 1/2 | | .0165 | | | | .9874 | .4258 | .7582 | | | | |
| | | | .0126 | | | | | | 3.06 | | .06669 | |
| 1 | | .0291 | | | | .9748 | .4132 | .7358 | | | | |
| | | | .0179 | | | | | | 1.69 | | .11702 | |
| 2 | | .0470 | | | | .9569 | .3953 | .7039 | | | | |
| | | | .0250 | | | | | | 1.69 | | .11188 | |
| 4 | | .0720 | | | | .9319 | .3703 | .6594 | | | | |
| | | | .0261 | | | | | | 1.77 | | .10112 | |
| 8 | | .0981 | | | | .9058 | .3442 | .6129 | | | | |
| | | | + .0014 | | | | | | | | | |
| 4 | | .0967 | | | | .9072 | .3456 | .6154 | | | | |
| | | | + .1025 | | | | | | | | | |
| 2 | | .0942 | | | | .9097 | .3481 | .6198 | | | | |
| | | | + .0033 | | | | | | | | | |

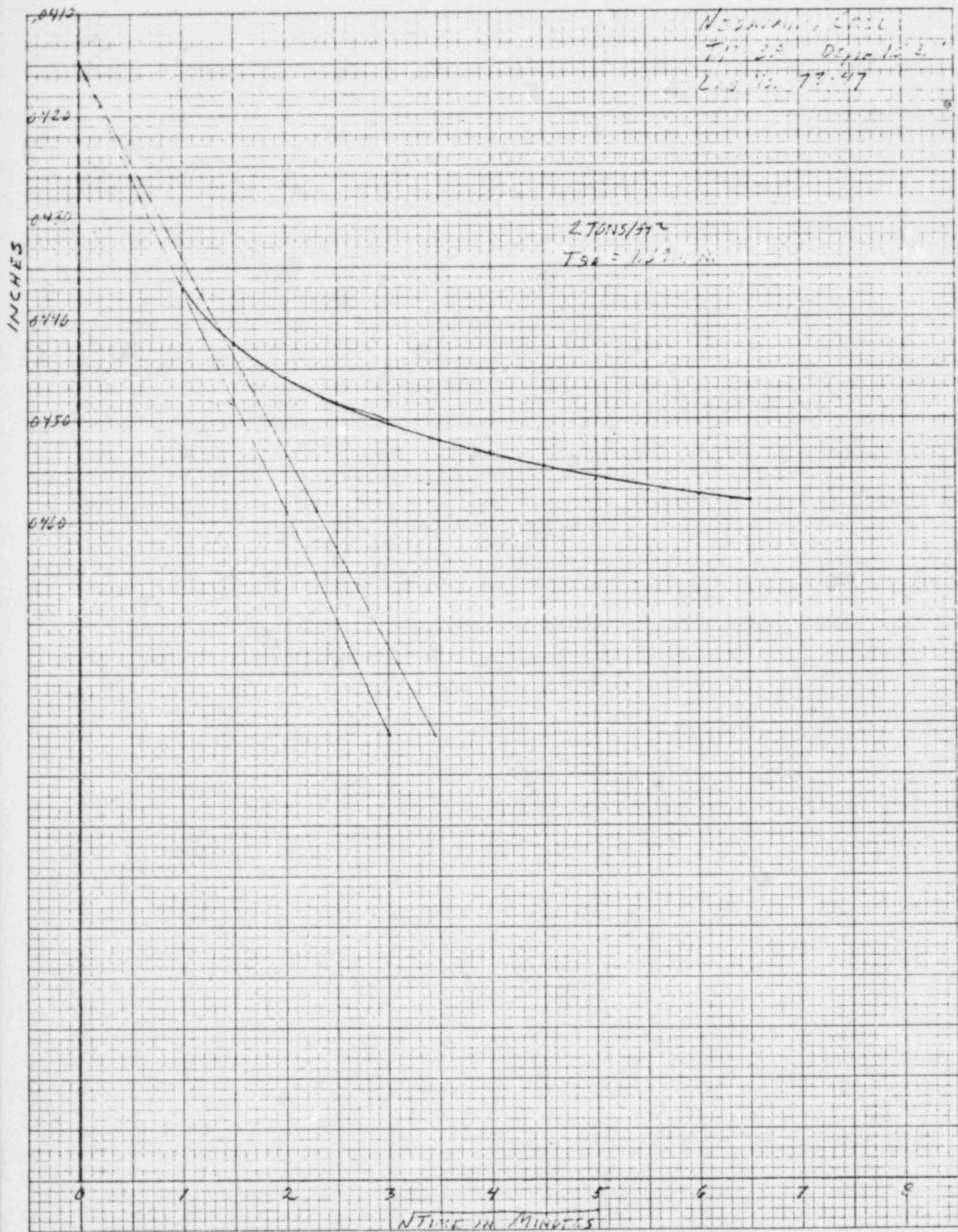
CONSOLIDATION TEST

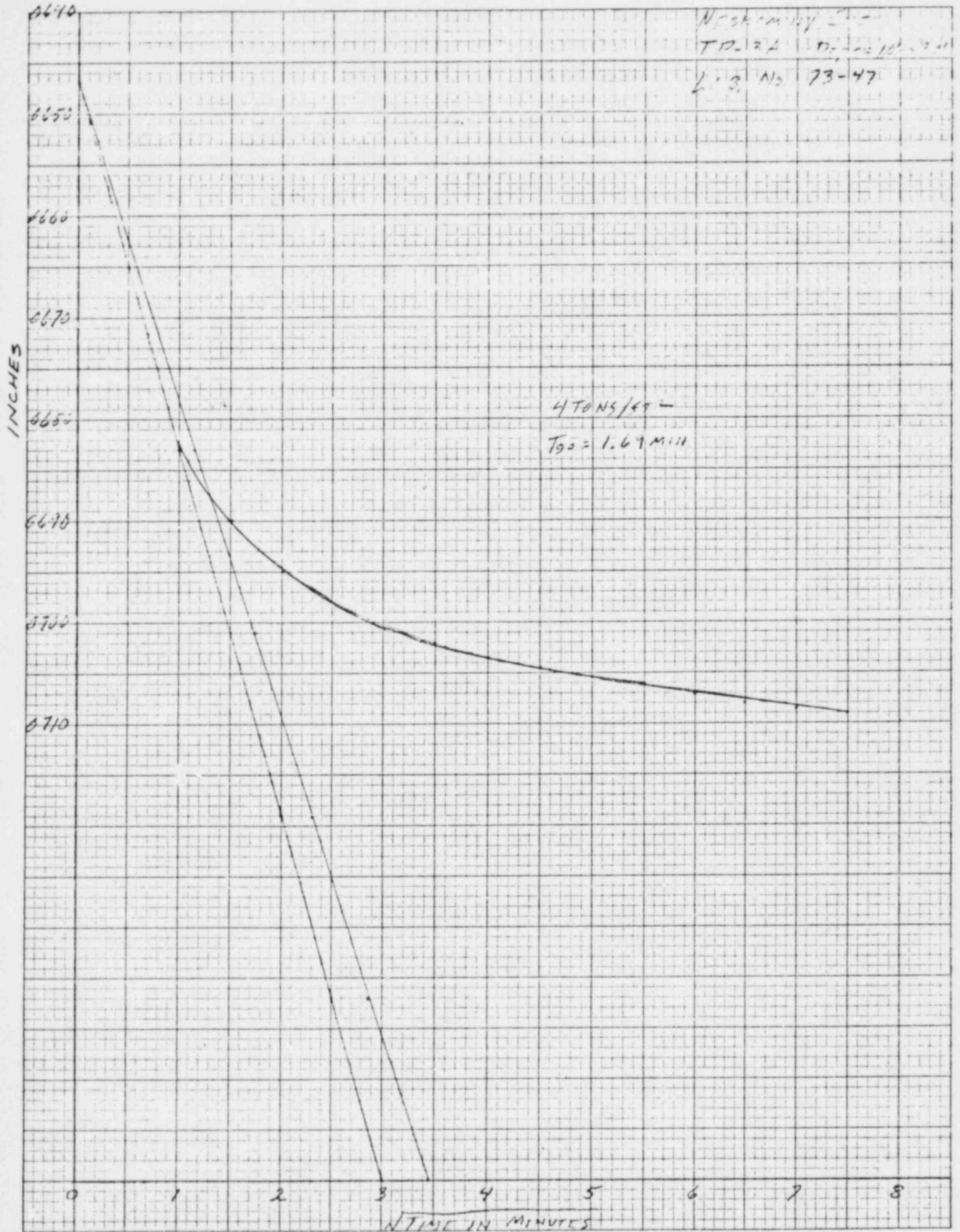
SOIL SAMPLE 73-47 LAB. NO. _____
 PROJECT NO. 1 P-3A L A T E _____
 BORING NO. 1 P-3A TESTED BY _____
 SAMPLE NO. _____ APPLIED LOADS _____
 SPECIFIC GRAVITY, G_s _____ SIDE FRICTION ALLOWANCE IN % _____
1 kg./sq. cm. = _____ lbs. SCALE LOAD
TARE IN lbs. _____
W_s _____
 THICKNESS, Z₂ _____ cm. _____ in. DEGREE OF SATURATION IN % _____
SOLIDS HEIGHT, 2H₀ = $\frac{W_s}{G_s \gamma_w}$ _____ in.
TEST START _____
TEST END _____

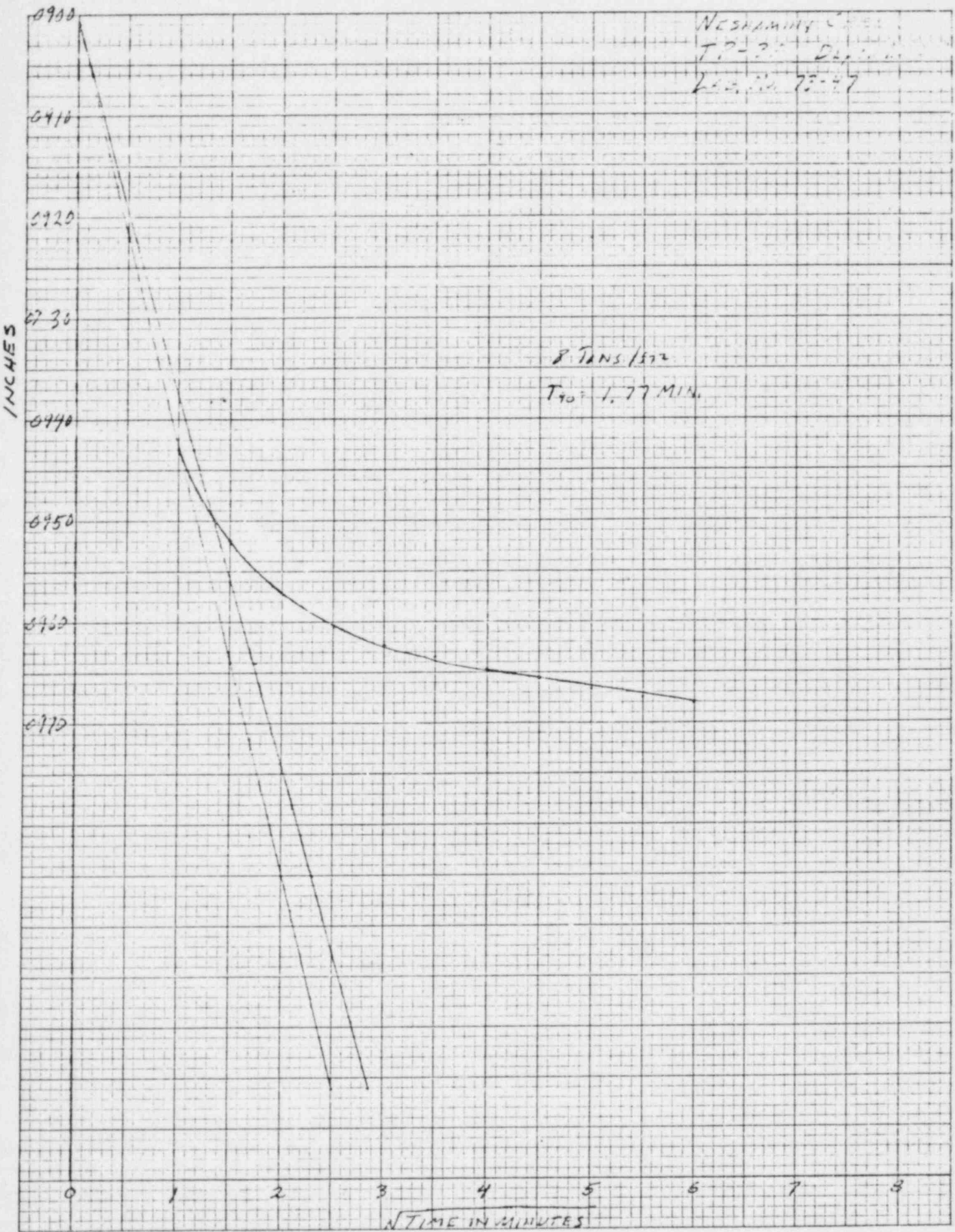
| SPECIMEN LOCATION | WATER CONTENT | REMARKS | |
|--|---------------|---------|-------|
| CONTAINER NO. _____ | _____ | _____ | _____ |
| WT. CONTAINER + WET SOIL IN g _____ | _____ | _____ | _____ |
| WT. CONTAINER + DRY SOIL IN g _____ | _____ | _____ | _____ |
| WT. WATER, W _w IN g _____ | _____ | _____ | _____ |
| WT. CONTAINER IN g _____ | _____ | _____ | _____ |
| WT. DRY SOIL W _s IN g _____ | _____ | _____ | _____ |
| WATER CONTENT, w _w IN % _____ | _____ | _____ | _____ |

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z ₃ IN in. | SAMPLE HEIGHT 2H = Z ₁ - Z ₂ + Z ₃ IN in. | DIAL CHANGE IN in. | VOID HEIGHT 2H - 2H ₀ IN in. | VOID RATIO $e = \frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | | COEF. OF CONSOL. C _u IN %/cm/sec. |
|---------------------------------|--------------------|-------------------|--------------------|-----------------------|--|--------------------|---|---|----------------------|-----|-------------------------|--|
| | | | | | | | | | 190 | 150 | .197H ² / 50 | |
| 1 | | .0909 | | | | | | | | | | |
| 1/2 | | .0865 | ±.0044 | | | .9130 | .3514 | .6257 | | | | |
| 1/4 | | .0787 | ±.0078 | | | .9174 | .3558 | .6335 | | | | |
| | | | | | | .9252 | .3636 | .6474 | | | | |
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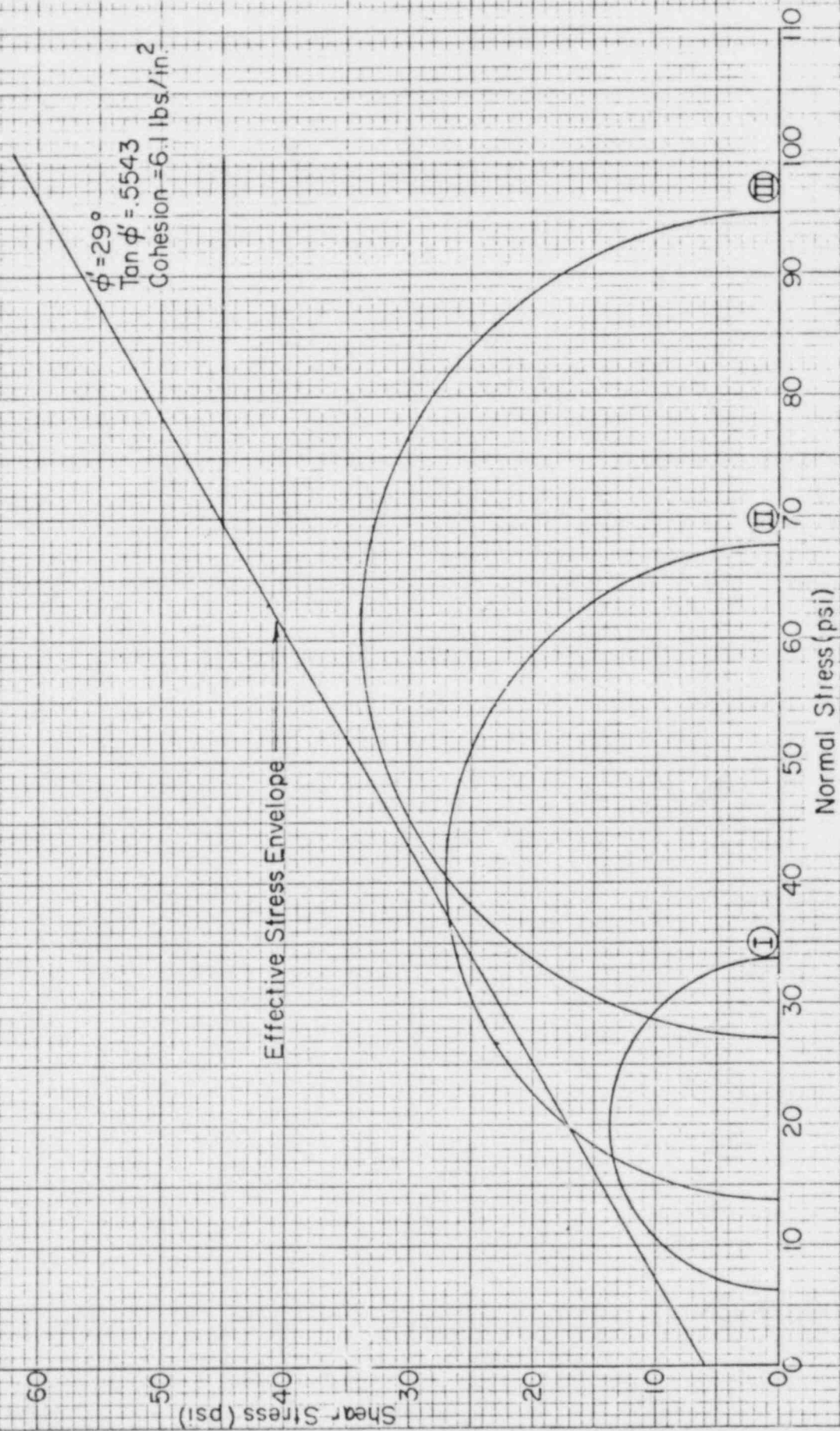
CU

Neshaminy Water Res. Authority
TP-3A
Depth 1.0' to 2.0'
Consolidated, Undrained

GEOSCIENCES MICHAEL BAKER, JR. INC.

$\phi' = 29^\circ$
 $\tan \phi' = .5543$
Cohesion = 6.1 lbs./in.²

Effective Stress Envelope

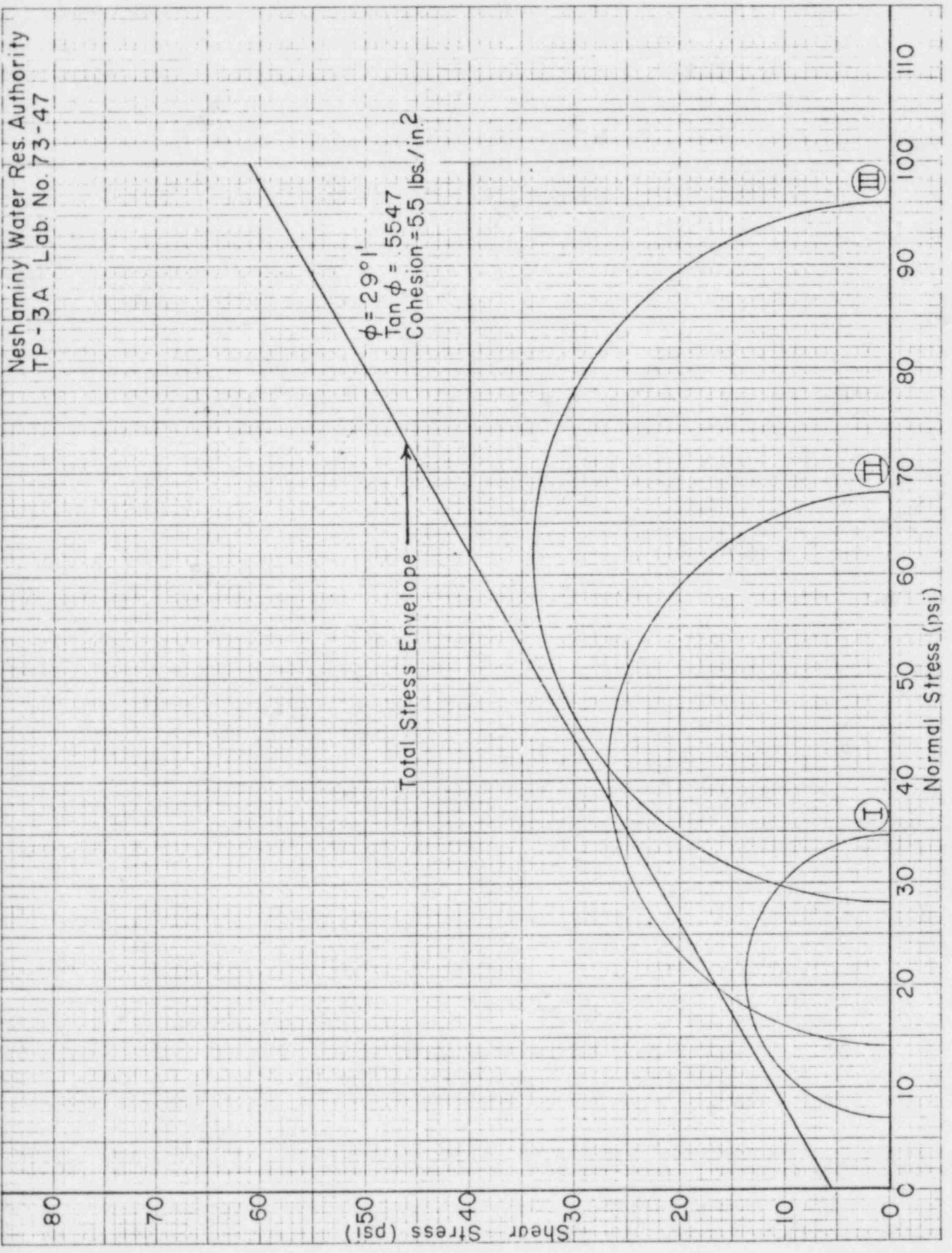


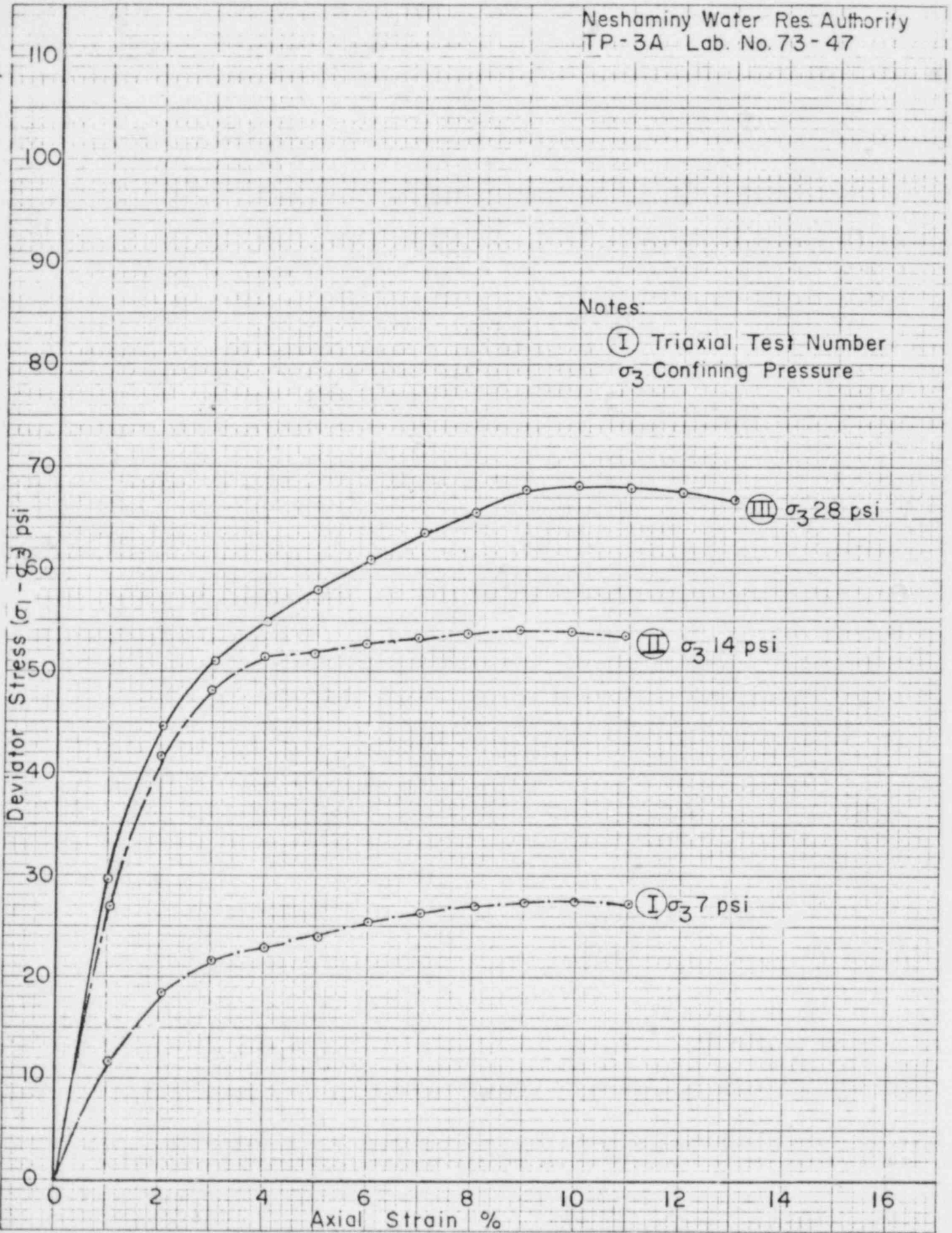
Normal Stress (psi)

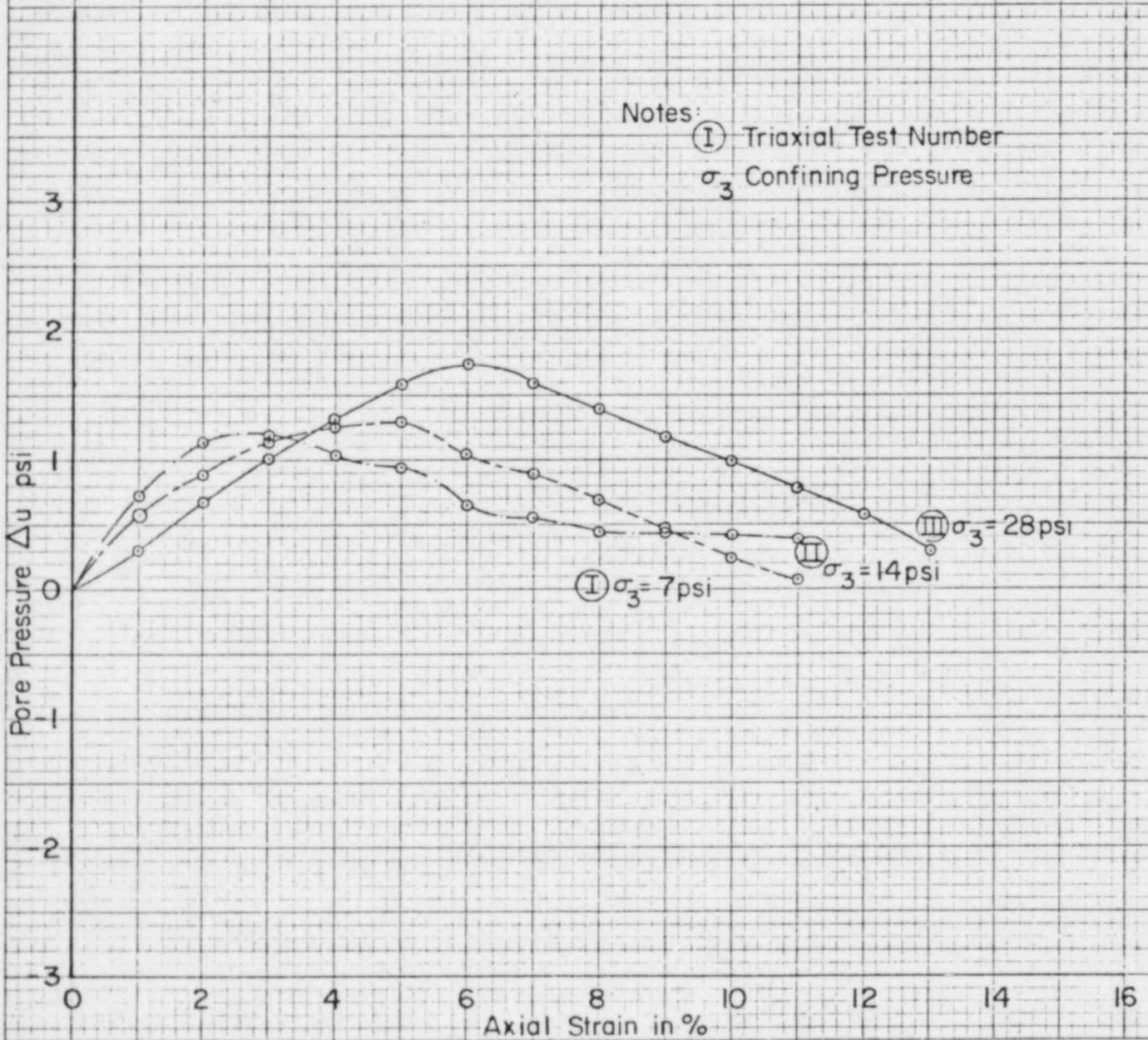
Shear Stress (psi)

$\phi = 29^{\circ}1'$
 $\tan \phi = .5547$
Cohesion = 55 lbs./in²

Total Stress Envelope







MICHAEL BAKER, JR., INC.
 BEAVER, PENNSYLVANIA
 Geotechnical Engineering
 Department

Project No. _____ Job No. 73-47
 Project Neshaminy Creek
 Hole No. TP-3A Station _____ Offset _____
 Depth 1' - 2' Date Tested 5-1-73
 Tested by Frank

TEST FOR SPECIFIC GRAVITY

1 = Weight of Sample
 2 = Weight of Flask + H₂O
 3 = Weight of Flask + H₂O + Soil

$$V_1 = W_1 - (W_3 - W_2)$$

$$V_1 = W_1 - W_4$$

$$SG = \frac{W_1}{V_1}$$

| Sample No. <u>1</u> | |
|--|----------------|
| Weight of Flask | <u>16.830</u> |
| Weight of Flask + Soil | <u>34.029</u> |
| Weight of Sample W ₁ | <u>17.199</u> |
| Weight of Flask + H ₂ O = W ₂ | <u>139.422</u> |
| Temperature | <u>25°</u> |
| Weight of Flask + H ₂ O + Soil = W ₃ | <u>150.366</u> |
| | <u>139.422</u> |
| W ₃ - W ₂ = W ₄ | <u>10.944</u> |
| | <u>17.199</u> |
| | <u>10.944</u> |
| W ₄ = V ₁ | <u>6.255</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| G. = $\frac{17.199}{6.255}$ | = <u>2.74</u> |

| Sample No. <u>2</u> | |
|---|----------------|
| 1. Weight of Flask | <u>16.801</u> |
| 2. Weight of Flask + Soil | <u>42.351</u> |
| 3. 2 - 1 Weight of Sample W ₁ | <u>25.550</u> |
| 4. Weight of Flask + H ₂ O W ₂ | <u>139.447</u> |
| 5. Temperature | <u>24°</u> |
| 6. Weight of Flask + H ₂ O + Soil = W ₃ | <u>155.700</u> |
| 7. W ₂ | <u>139.447</u> |
| 8. W ₃ - W ₂ = W ₄ | <u>15.253</u> |
| 9. W ₁ | <u>25.550</u> |
| 10. W ₄ | <u>16.253</u> |
| 11. W ₁ - W ₄ = V | <u>9.297</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| SP. G. = $\frac{25.550}{9.297}$ | = <u>2.75</u> |



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

| | | |
|---|---|------------------------|
| Location <u>Neshaminy Creek</u> | Specimen Measurements | Test No. <u>73-47</u> |
| Boring No. <u>TP-3A</u> Depth <u>1.0-2.0'</u> | Diameter <u>6.05 cm</u> | Date <u>4-27-73</u> |
| Sample No. <u>3-A</u> | Circumference _____ | Tested By <u>Frank</u> |
| Specific Gravity, G_s <u>2.74</u> | Area, A <u>28.56 cm²</u> | |
| Wet Wt. of Sample <u>366.79</u> | Length, L <u>6.27 cm</u> | |
| Dry Wt. of Sample W_s <u>299.89</u> | Volume of Sample <u>179.07</u> | |
| | Volume of Solid Material = $V_s = W_s / G_s =$ <u>109.42</u> cc | |
| | Void Ratio of Sample = $e = \frac{V - V_s}{V_s} = \frac{179.07 - 109.42}{109.42} = \frac{69.65}{109.42} =$ <u>.6365</u> | |

Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h_0 | h_1 | $\text{Log}_{10} h_0/h_1$ | k cm/sec. |
|---------|--------------------------|------------------|--------------------------------------|-------|-------|---------------------------|--------------|
| 1:27:00 | | | | 70.0 | | | |
| 2:15:00 | | | | | 49.0 | | |
| | 2880 | 35.5 | 1.69 | | | .15488 | .000046 |
| 2:25:00 | | | | 70.0 | | | |
| 3:33:00 | | | | | 45.0 | | |
| | 4080 | 42.0 | 1.68 | | | .19187 | .000040 |
| 3:35:00 | | | | 70.0 | | | |
| 4:21:00 | | | | | 53.2 | | |
| | 2760 | 27.2 | 1.65 | | | .11926 | .000036 |
| 4:26:00 | | | | 70.6 | | | |
| 4:42:00 | | | | | 63.6 | | |
| | 960 | 11.0 | 1.72 | | | .04163 | .000038 |
| | | | | | | | |
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$$K = 2.3 \frac{aL}{At} \cdot \text{Log}_{10} \frac{h_0}{h_1}$$

$$a = \frac{Q}{h_1 - h_2}$$

Remarks Avg. K = .000040 cm/sec.

MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Date 4-4-79
 Lab. No. 72-17

Sample Source TP-3A

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|----------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (~~cm~~) (inches) 9.25 x 9.40 x 11.25

Specimen Volume (~~cm³~~) (feet³)566

Weight of Container + Wet Specimen, (g) (pounds) 64.40

Weight of Container, (g) (pounds) 7.09

Wet weight of Specimen, (g) (pounds) 57.31

Wet Density, (g/cc) _____

Wet Density, (pcf) 101.2

Dry Density, (pcf) 90.1

BRADSHAW RESERVOIR

TEST PIT 4



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

Location Neshaminy Creek Specimen Measurements Test No. 73-48
 Boring No. TP-4 Depth 9/10'-2' Diameter 4" Date 5-16-73
 Sample No. 73-48 Circumference _____ Tested By Frank
 Specific Gravity, G_s _____ Area, A _____
 Wet Wt. of Sample _____ Length, L _____
 Dry Wt. of Sample W_s _____ Volume of Sample _____
 Volume of Solid Material = $V_s = W_s / G_s =$ _____ cc
 Void Ratio of Sample = $e = \frac{V - V_s}{V_s} =$ _____ = _____ = _____

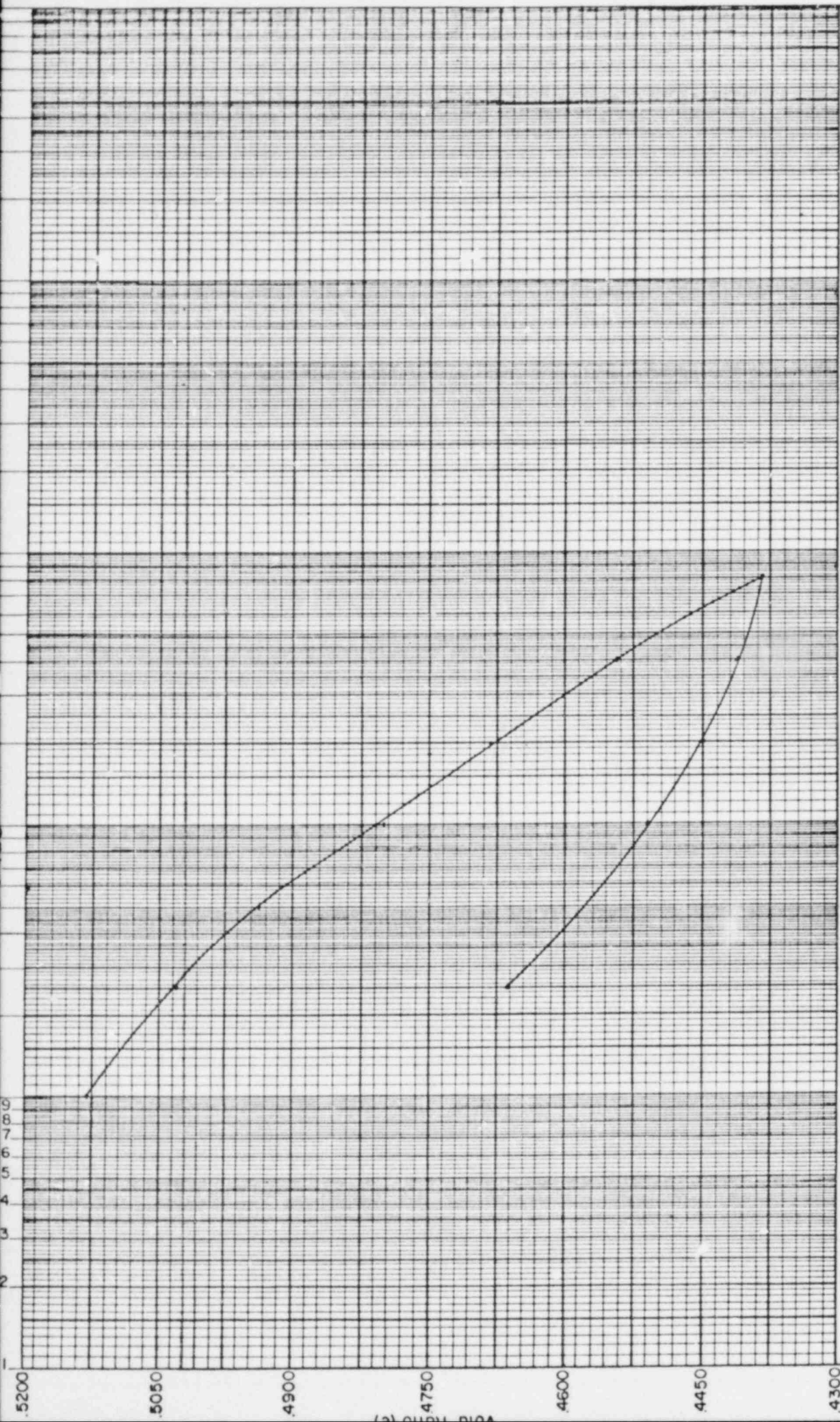
Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h ₀ | h ₁ | Log ₁₀ h ₀ /h ₁ | k cm/sec. |
|------|-----------------------|---------------|-----------------------------------|----------------|----------------|--|-----------|
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$$K = 2.3 \frac{aL}{At} \cdot \text{Log}_{10} \frac{h_0}{h_1}$$

$$a = \frac{Q}{h_1 - h_2}$$

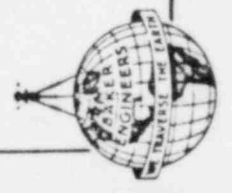
Remarks Compacted to Max. Density at Opt. Moist. - Non-Permeable



Class CL
 Depth 0.9' to 2.0'
 Sheet 1 of 5

Project No. Cont 24 Subs. Inv. Lab. No. 73-48
 Test For Meshominy Water Res. Auth. Point Pleasant Pumping Fac.
 Test Bore TP-4 Station Offset
 Date Received Date Tested 4-10-18-73

MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION



CONSOLIDATION TEST

SOIL SAMPLE 73-48
Neshaminy Creek
 PROJECT NO. _____
 BORING NO. TP-4 SAMPLE DEPTH. _____
 SAMPLE NO. _____
 SPECIFIC GRAVITY, G_s , 2.68

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 , 2.54 cm. 10000 in.
 CONTAINER DIAMETER 6.35 cm. 2.5 in.
 CONTAINER AREA, A , IN sq. cm. 31.67
 STONE + COVER
 THICKNESS, Z_2 _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 1 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. 73-48
 DATE 4-(10 to 18)-73
 TESTED BY T. O'Connor

SOLIDS HEIGHT, $2H_s = \frac{W_s}{G_s \cdot W} \cdot A = \frac{1.6788}{2.68 \cdot 31.67} \cdot 10000 = 66.09$ cm. 66.09 in.
 DEGREE OF SATURATION IN %
 TEST START 89.8%
 TEST END 113.6%

WATER CONTENT

Compacted at O. M. - M. D.

| SPECIMEN LOCATION | | | | | |
|-------------------------------|-------|-------|--|--|--|
| CONTAINER NO. | | | | | |
| WT. CONTAINER + WET SOIL IN g | 475.4 | 479.9 | | | |
| WT. CONTAINER + DRY SOIL IN g | 451.8 | 451.8 | | | |
| WT. WATER, W_w IN g | 23.6 | 28.1 | | | |
| WT. CONTAINER IN g | 309.3 | 309.3 | | | |
| WT. DRY SOIL W_s IN g | 142.5 | 142.5 | | | |
| WATER CONTENT, w , IN % | 16.6 | 19.7 | | | |

REMARKS

| APPLIED PRESSURE IN kg./sq. cm. IN lbs. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 - Z_2 + Z_3$ IN in. | 2H FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_0$ IN in. | VOID RATIO $e = \frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_v IN sq. cm./sec. | |
|---|-----------------------|----------------------|-----------------------|-----------------|---|----------------------------------|--------------------------------------|--|----------------------|------|--|----------------|
| | | | | | | | | | ± 90 | ± 50 | $.848H^2 / 90$ | $.197H^2 / 50$ |
| 0 | | .0000 | | | | 1.0000 | .3391 | .5131 | | | | |
| | | | .0065 | | | | | | ---- | | ---- | |
| 1/4 | | .0065 | | | | .2935 | .3326 | .5032 | | | | |
| | | | .0062 | | | | | | | | | |
| 1/2 | | .0127 | | | | .9873 | .3264 | .4939 | 1.69 | | .12305 | |
| | | | .0092 | | | | | | | | | |
| 1 | | .0219 | | | | .9781 | .3172 | .4800 | 2.99 | | .06847 | |
| | | | .0087 | | | | | | | | | |
| 2 | | .0306 | | | | .9694 | .3085 | .4668 | 2.10 | | .09572 | |
| | | | .0081 | | | | | | | | | |
| 4 | | .0387 | | | | .9613 | .3004 | .4545 | 1.96 | | .10080 | |
| | | | .0105 | | | | | | | | | |
| 8 | | .0492 | | | | .9508 | .2899 | .4386 | 2.56 | | .07570 | |
| | | | + .0016 | | | | | | | | | |
| 4 | | .0476 | | | | .9524 | .2915 | .4411 | | | | |
| | | | + .0028 | | | | | | | | | |
| 2 | | .0448 | | | | .9552 | .2943 | .4453 | | | | |
| | | | + .0039 | | | | | | | | | |

CONSOLIDATION TEST

SOIL SAMPLE 73-48
 PROJECT NO. _____
 BORING NO. IP-4 SAMPLE DEPTH _____
 SAMPLE NO. _____
 SPECIFIC GRAVITY, G_s _____

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 _____ cm. _____ in.
 CONTAINER DIAMETER _____ cm. _____ in.
 CONTAINER AREA, A , IN sq. cm. _____
 STONE + COVER
 THICKNESS, Z_2 _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 1 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. _____
 DATE _____
 TESTED BY _____

SOLIDS HEIGHT, $2H_0 = \frac{W_s}{G_s \gamma_w A} =$ _____ cm. _____ in. DEGREE OF SATURATION IN %
 TEST START _____
 TEST END _____

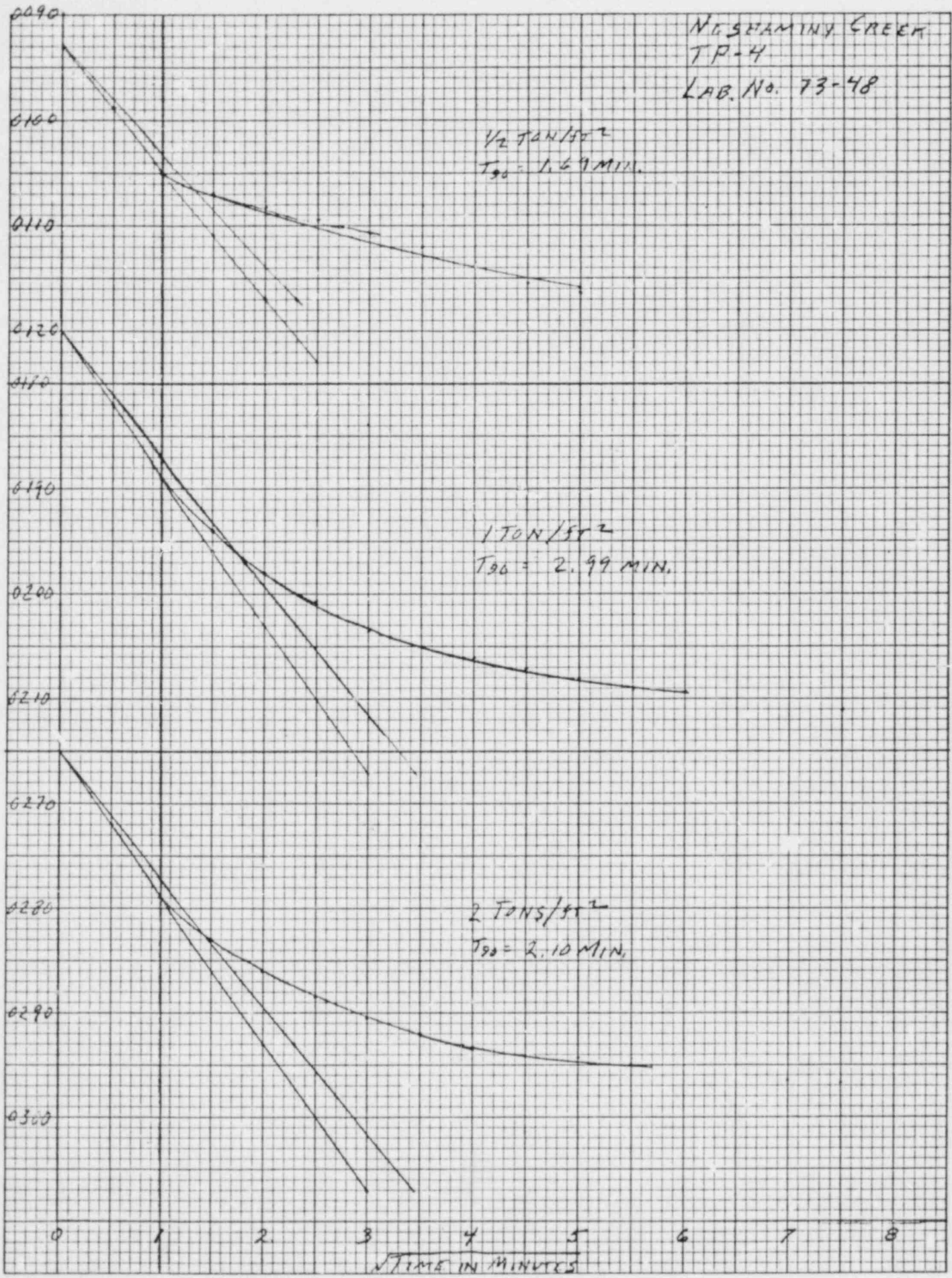
WATER CONTENT

| SPECIMEN LOCATION | | | | | |
|-------------------------------|--|--|--|--|--|
| CONTAINER NO. | | | | | |
| WT. CONTAINER + WET SOIL IN g | | | | | |
| WT. CONTAINER + DRY SOIL IN g | | | | | |
| WT. WATER, W_w IN g | | | | | |
| WT. CONTAINER IN g | | | | | |
| WT. DRY SOIL W_s IN g | | | | | |
| WATER CONTENT, w , IN % | | | | | |

REMARKS

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 - Z_2 + Z_3$ IN in. | 2H FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_0$ IN in. | VOID RATIO $e = \frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | COEF. OF CONSOL C_v IN sq. cm./sec. | |
|------------------------------------|-----------------------|----------------------|-----------------------|-----------------|---|-------------------------------|--------------------------------------|--|----------------------|-----|---------------------------------------|-------------------------------------|
| | | | | | | | | | +90 | +50 | .848H ² / ₊₉₀ | .197H ² / ₊₅₀ |
| 1 | | .0409 | | | | .9591 | .2982 | .4512 | | | | |
| 1/4 | | .0307 | + .0102 | | | .9693 | .3084 | .4666 | | | | |
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NE SHAMING GREEN
 TP-4
 LAB. No. 73-48



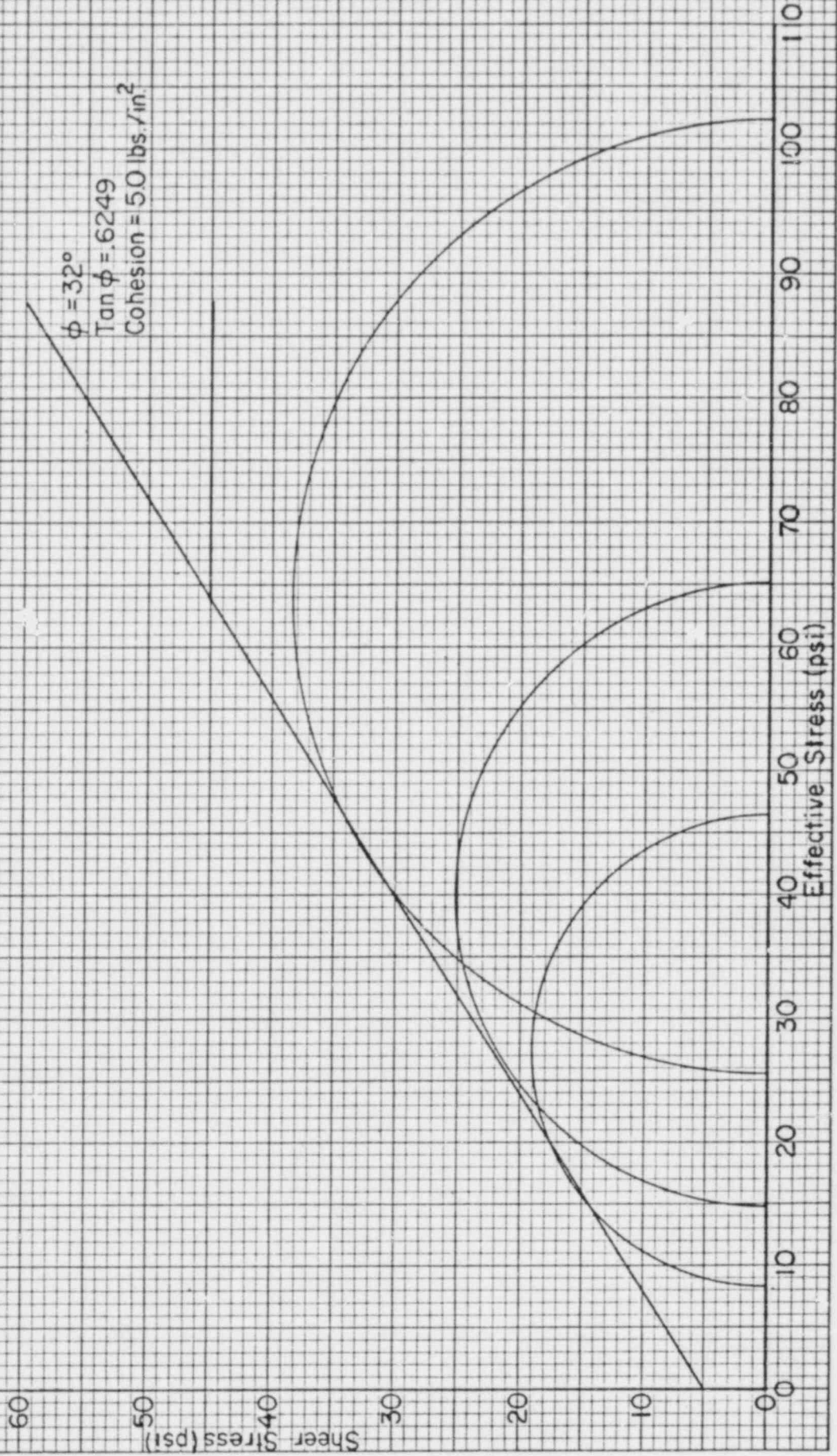


Neshaminy Water Res. Authority

TP- No. 4

Remolded Sample, Compacted at Maximum
Density and Optimum Moisture

GEOSCIENCES MICHAEL BAKER, JR., INC.





MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Proctor

Project No. NESHAMINY Creek
 Laboratory No. 72-283 0-2"
 Test Bore TP-4 (1) Station _____ Offset _____
 Date Received 11-8-72 Date Tested 11-15-72
 Tested By R. Dorothy
 Checked By _____

SPECIFIC GRAVITY = 2.680 @ 20°C

NMC = 21.7%

Wt. of Dry Soil and Flask $W_1 =$ g.
 Wt. of Flask No. $W_2 =$ g.
 Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
 % Passing 0.2 = 53.9%

Aggr = 9
 CS = 3
 FS = 2
 S = 59
 C = 27

Volume of Soil $V_s =$ c.c.
~~Apparent Sp. Gr. $\frac{W_0}{V_s} =$~~

LIQUID LIMIT

Frost Group = F-4
 Wt. of Wet Soil and Dish 24.26
 Wt. of Dry Soil and Dish 21.08
 Wt. of Water 3.18
 Percent of Moisture 30.0 = 31

$N = 30$

Wt. of Dry Soil and Dish 10.58
 Wt. of Dish 10.50
 Wt. of Dry Soil 10.58

PLASTIC LIMIT

Wt. of Wet Soil and Dish 22.07
 Wt. of Dry Soil and Dish 20.27
 Wt. of Water 1.80
 Percent of Moisture 21.0 = 22.9

Wt. of Dry Soil and Dish 19.49
 Wt. of Dish 11.71
 Wt. of Dry Soil 8.56 = 7.80 *H-1*

PLASTICITY INDEX (LL.-P.L.) = 31 - 22 = 9

CL

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | |
|--|--------------------------|---------------------------|---------------|------------|--------|
| Sieve Number | Retained | | | Cumulative | |
| | Weight (W ₁) | Percent (W ₁) | Per. Ret. (W) | % Ret. | % Pass |
| | g | % | % | % | % |
| 1" | — | | | | |
| 3/4" | | | | | |
| 1/2" | 1.5 | 0.2 | | 0.2 | 99.8 |
| 3/8" | | | | | |
| No. 4 | 29.6 | 3.0 | | 3.2 | 96.8 |
| No. 10 | 55.2 | 5.4 | | 8.6 | 91.4 |
| No. 40 | | | | | 88 |
| No. 200 | | | | | 86 |
| Pass | | | | | |
| Total | 97.6 | | | | |

| SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|---------------|--|---------------------------|-------------|------------|------------|
| Sieve Number | Particle Size | Retained | | | Cumulative | |
| | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | mm. | g | % | % | % | % |
| 10 | 1.98 | | | | | |
| 20 | 0.833 | | | | | |
| 40 | 0.417 | 1.8 | 3.6 | | 3.6 | 96.4 |
| 60 | 0.246 | | | | | |
| 140 | 0.104 | | | | | |
| 200 | 0.074 | 1.3 | 2.6 | | 6.2 | 93.8 |
| Pass | No. 200 | | | | | |
| | Total | 50 | 100 | | | |
| | | Original Sample W = g. 100% | | | | |
| | | Partial Sample W ₁ = g. % | | | | |
| | | Partial Sample W ₃ = g. % | | | | |

843 HYDROMETER ANALYSIS OF MATERIAL PASSING No. SIEVE (W₂)
 Hydrometer No. Sp. Gr. Corr a Wt. of Sample W₃ Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 R _a ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|--------------|-----------|-------------|--------------------|------------|-------------|---|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Kn | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| <i>9:06</i> | 5 | <i>23.0</i> | <i>35.5</i> | <i>6.0</i> | <i>29.5</i> | <i>59.0</i> | | | | .035 | <i>.02</i> | <i>53.9</i> |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| <i>10:16</i> | 60 | <i>23.0</i> | <i>21.0</i> | <i>6.0</i> | <i>15.0</i> | <i>30.0</i> | | | | .010 | <i>.005</i> | <i>27</i> |
| | 90 | | | | | | | | | .008 | | |
| <i>9:106</i> | 1440 | <i>22.0</i> | <i>15.0</i> | <i>6.0</i> | <i>9.0</i> | <i>18.0</i> | | | | .002 | <i>.001</i> | <i>16</i> |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 R_a ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS DIVISION

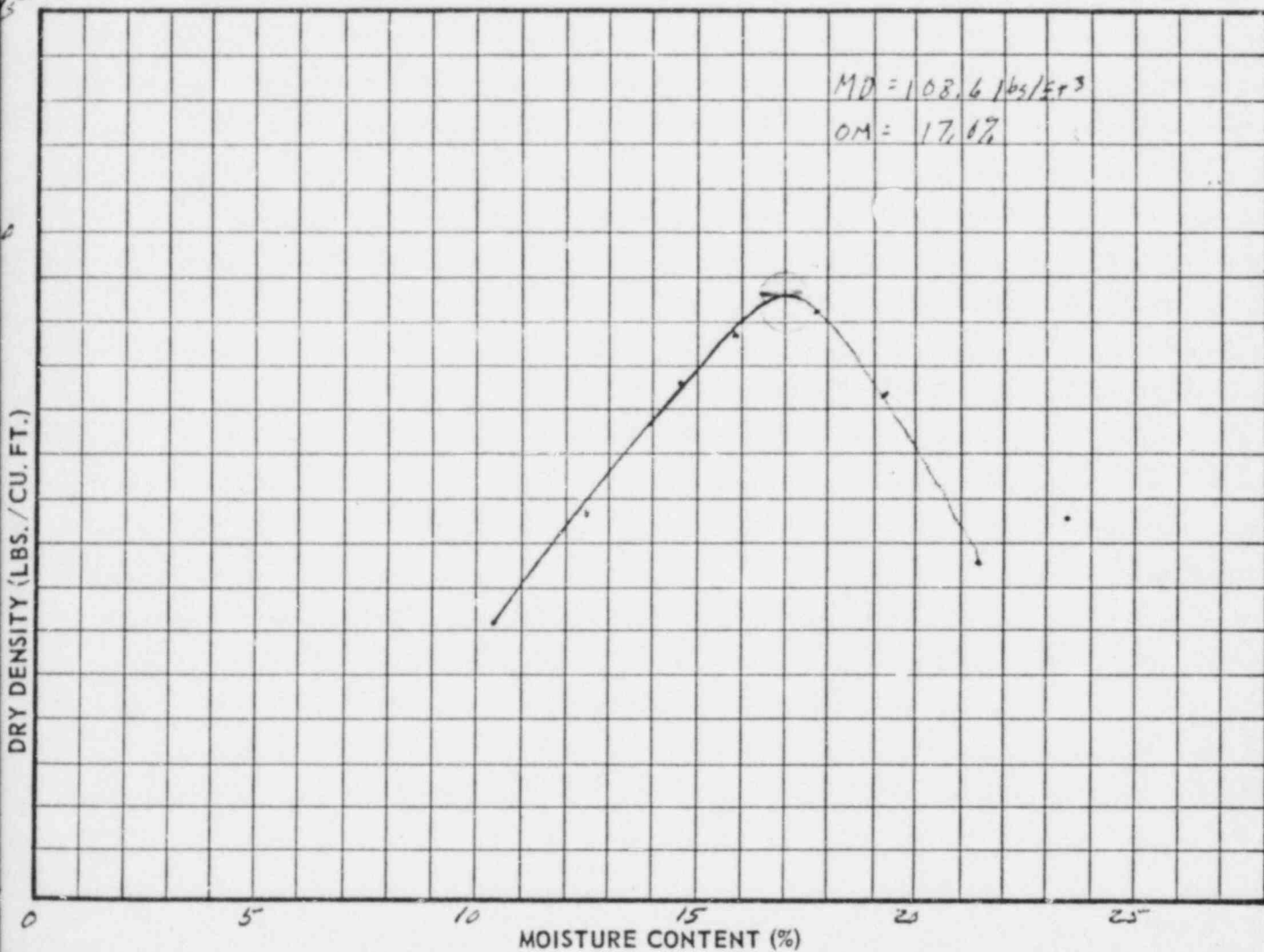
MOISTURE DENSITY TEST

Project No. Nesh. CK Lab. No. 72-283
 Test For Proc.
 Test Bore TP-4 Station _____ Offset 0-2'
 Date Received 11-8-72 Date Tested 11-15-72
 Tested By B. Dorothy
 Checked By _____

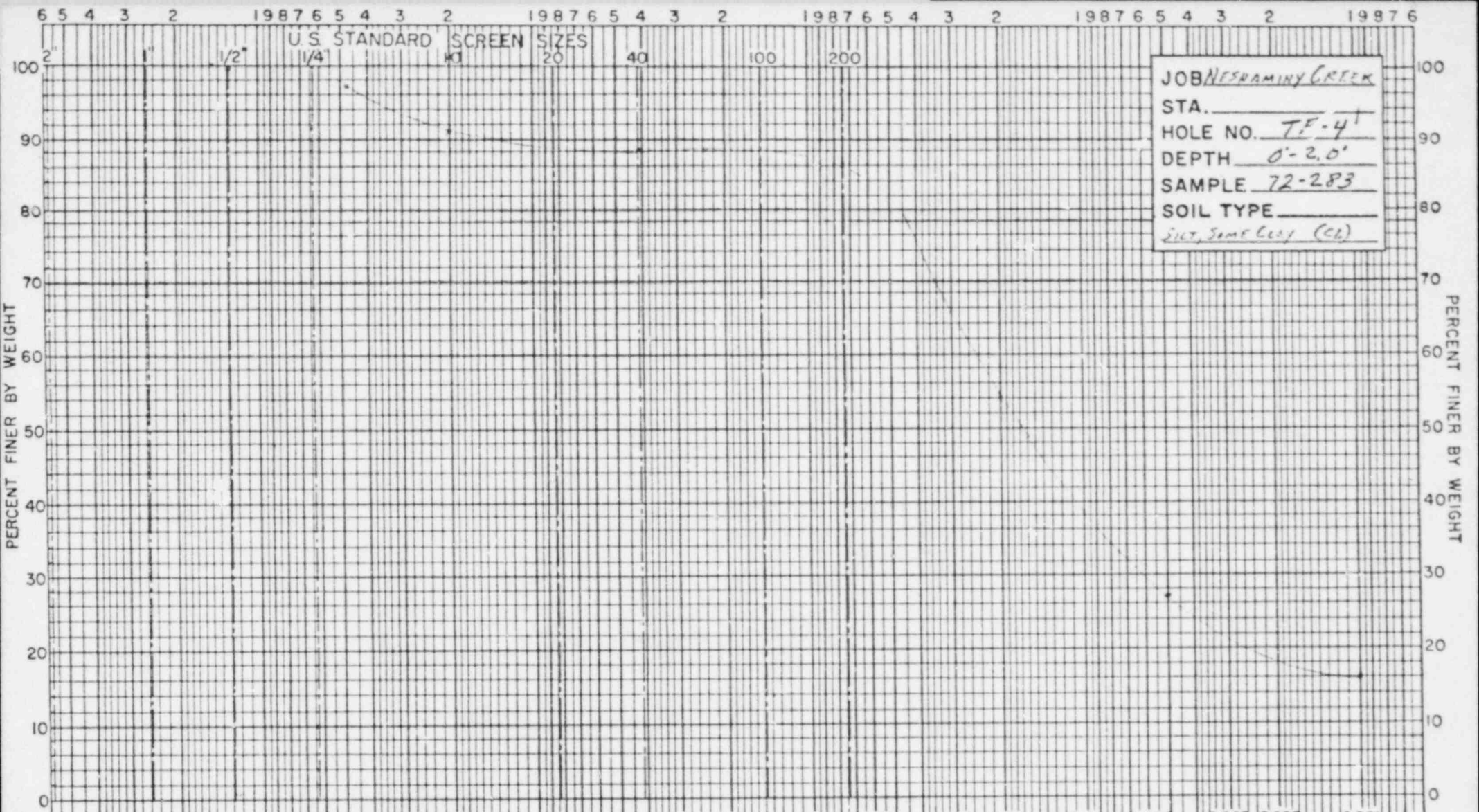
MATERIAL _____

STANDARD

MODIFIED



| MOLD VOL. <u>1/30</u> (FT. ³) | | MOLD WT. <u>9.32</u> LBS. | | OPERATOR <u>DICK</u> | | | | |
|---|---|---------------------------|-------|----------------------|-------|-------|-------|---|
| Trial No. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tare No. | | F-4 | Y-8 | Y-25 | Y-16 | Y-38 | Y-17 | |
| Wt. Wet Sample + Tare | | 179.6 | 178.2 | 175.5 | 172.6 | 200.5 | 202.5 | |
| Wt. Dry Sample + Tare | | 165.0 | 161.1 | 156.1 | 151.1 | 174.0 | 173.8 | |
| Wt. Water | | 14.6 | 17.1 | 19.4 | 21.5 | 26.5 | 28.7 | |
| Tare Wt. | | 24.6 | 24.4 | 24.3 | 24.2 | 25.1 | 24.5 | |
| Wt. Dry Soil | | 140.4 | 136.7 | 131.8 | 126.9 | 148.9 | 149.3 | |
| MC = | $\frac{\text{Wt. Water}}{\text{Wt. Dry Soil}} \times 100$ | 10.4 | 12.5 | 14.7 | 16.9 | 17.8 | 19.2 | |
| Wt. Sample + Mold | | 13.04 | 13.21 | 13.40 | 13.52 | 13.57 | 13.54 | |
| Wt. Wet Sample in Mold | | 3.72 | 3.89 | 4.08 | 4.20 | 4.25 | 4.22 | |
| Wet Density (lbs./cu. ft.) | | 111.6 | 116.7 | 122.4 | 126.0 | 127.5 | 126.6 | |
| Dry Density (lbs./cu. ft.) | | 101.1 | 103.7 | 106.7 | 107.8 | 108.2 | 106.2 | |



JOB NESRAMINY CREEK
 STA. _____
 HOLE NO. TF-4¹
 DEPTH 0'-2.0'
 SAMPLE 72-283
 SOIL TYPE _____
SILT, SAND CLAY (CL)

| | | | | | | | | | |
|-------------------------|--------|-----------------------|--------|--------|------------------------|--------|--------|------------------------|--|
| GRAVEL | | SAND | | | SILT | | | CLAY | |
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>9</u> | | % SAND SIZES <u>5</u> | | | % SILT SIZES <u>59</u> | | | % CLAY SIZES <u>27</u> | |

BRADSHAW RESERVOIR

TEST PIT 5



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

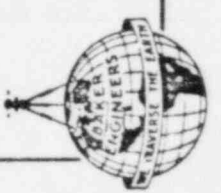
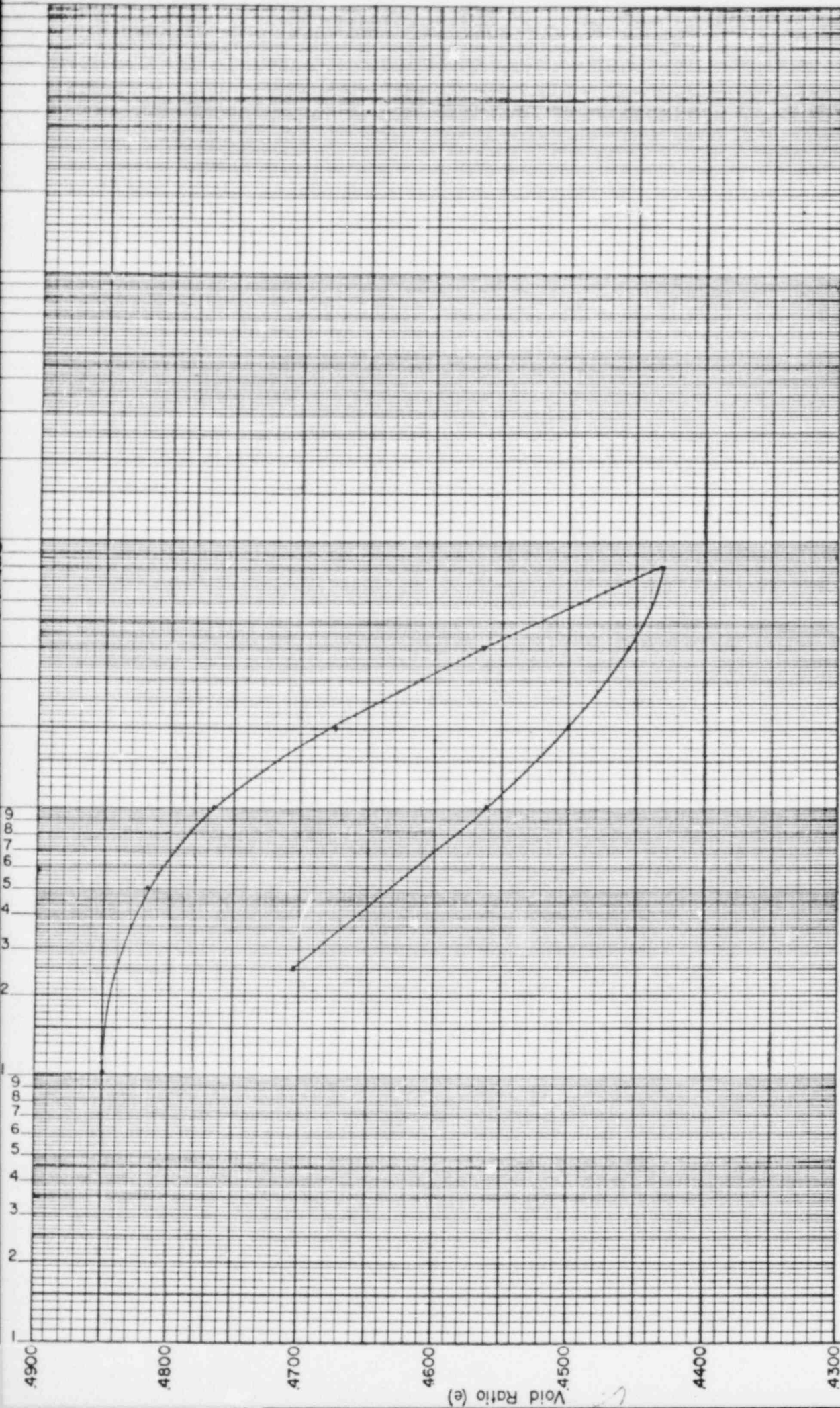
Location Neshaminy Creek Specimen Measurements Test No. 73-49
 Boring No. TP-5 Depth Diameter 4" Date 5-4-73
 Sample No. 73-49 Circumference Tested By Frank
 Specific Gravity, G_s Area, A
 Wet Wt. of Sample Length, L
 Dry Wt. of Sample W_s Volume of Sample
 Volume of Solid Material = $V_s = W_s/G_s =$ cc
 Void Ratio of Sample = $c = \frac{V - V_s}{V_s} =$ = =

Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h_o | h_l | $\log_{10} h_o/h_l$ | k cm/sec. |
|------|--------------------------|---------------------|---|-------|-------|---------------------|----------------|
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$K = 2.3 \frac{aL}{At} \cdot \log_{10} \frac{h_o}{h_l}$ $a = \frac{Q}{h_1 - h_2}$

Remarks Compacted to Max. Density at Opt. Moist. - Non-Permeable



MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION

Project No. Cont. 24 Subs. Inv. Lab. No. 73-49
 Test For Methomyl Water Res. Auf. Point Pleasant Pumping Fac.
 Test Bore TP-5 Station Offset
 Date Received Date Tested 4-(10 to 18) 73

Class CL
 Depth 0.0' to 65'
 Sheet 1 of 3

CONSOLIDATION TEST

SOIL SAMPLE TP-5
Neshaminy Creek
 PROJECT NO. _____
 BORING NO. TP-5 SAMPLE DEPTH _____
 SAMPLE NO. 73-49
 SPECIFIC GRAVITY, G_s 2.71

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z₁ 2.56 cm. 1.0079 in.
 CONTAINER DIAMETER 6.35 cm. 2.50 in.
 CONTAINER AREA, A, IN sq. cm. 31.67
 STONE + COVER
 THICKNESS, Z₂ _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. 73-49
 DATE _____
 TESTED BY _____

SOLIDS HEIGHT, 2H₀ = $\frac{W_s}{G_s \gamma_w A}$ = 1.7232 cm. .6784 in. DEGREE OF SATURATION IN %
 TEST START 88.3%
 TEST END 109.2%

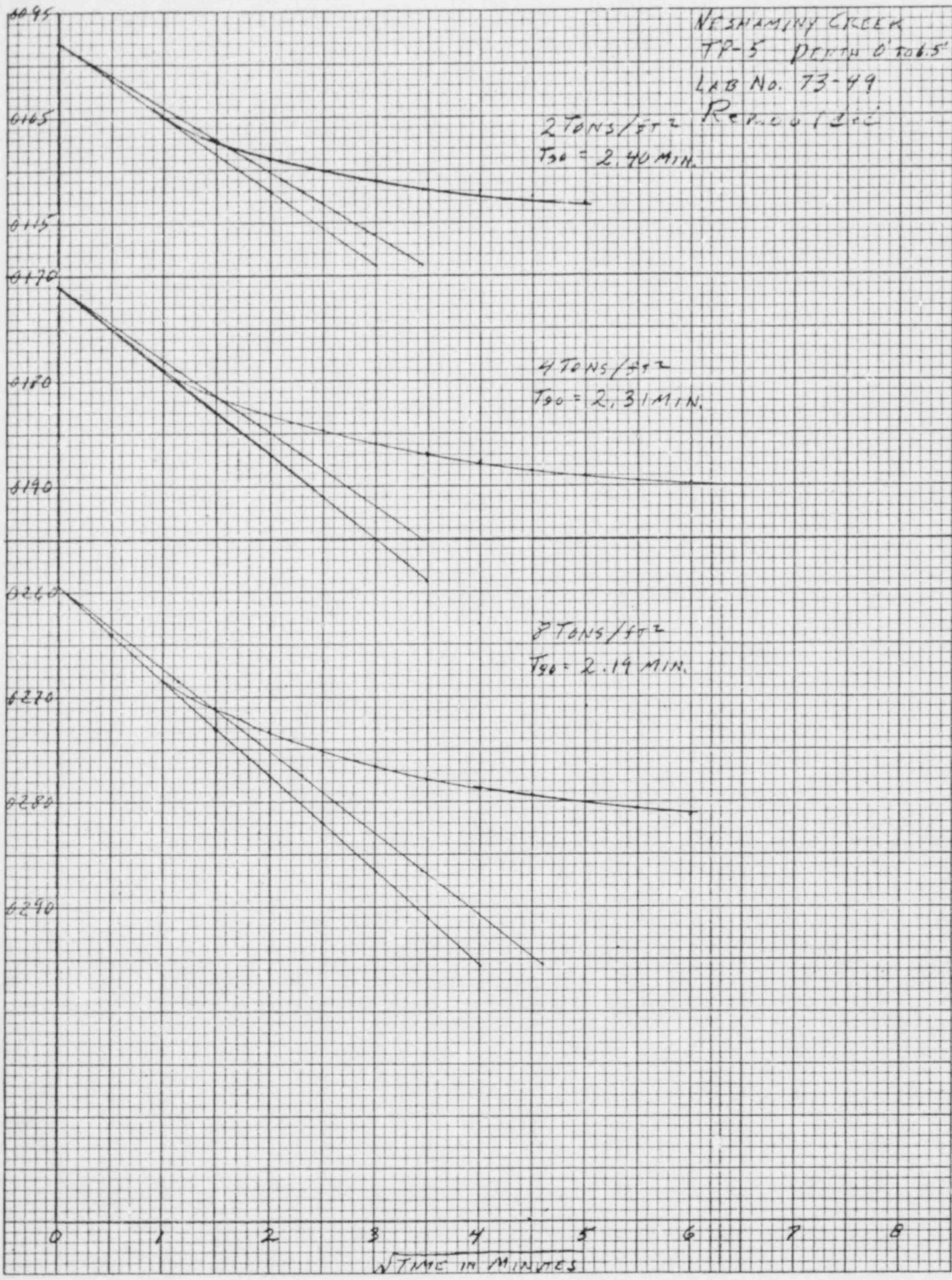
WATER CONTENT

Remolded Sample

| SPECIMEN LOCATION | | | | | |
|----------------------------------|-------|-------|--|--|--|
| CONTAINER NO. | | | | | |
| WT. CONTAINER + WET SOIL IN g | 476.5 | 481.7 | | | |
| WT. CONTAINER + DRY SOIL IN g | 453.1 | 453.1 | | | |
| WT. WATER, W _w IN g | 23.4 | 28.6 | | | |
| WT. CONTAINER IN g | 305.2 | 305.2 | | | |
| WT. DRY SOIL W _s IN g | 147.9 | 147.9 | | | |
| WATER CONTENT, w, IN % | 15.8 | 19.3 | | | |

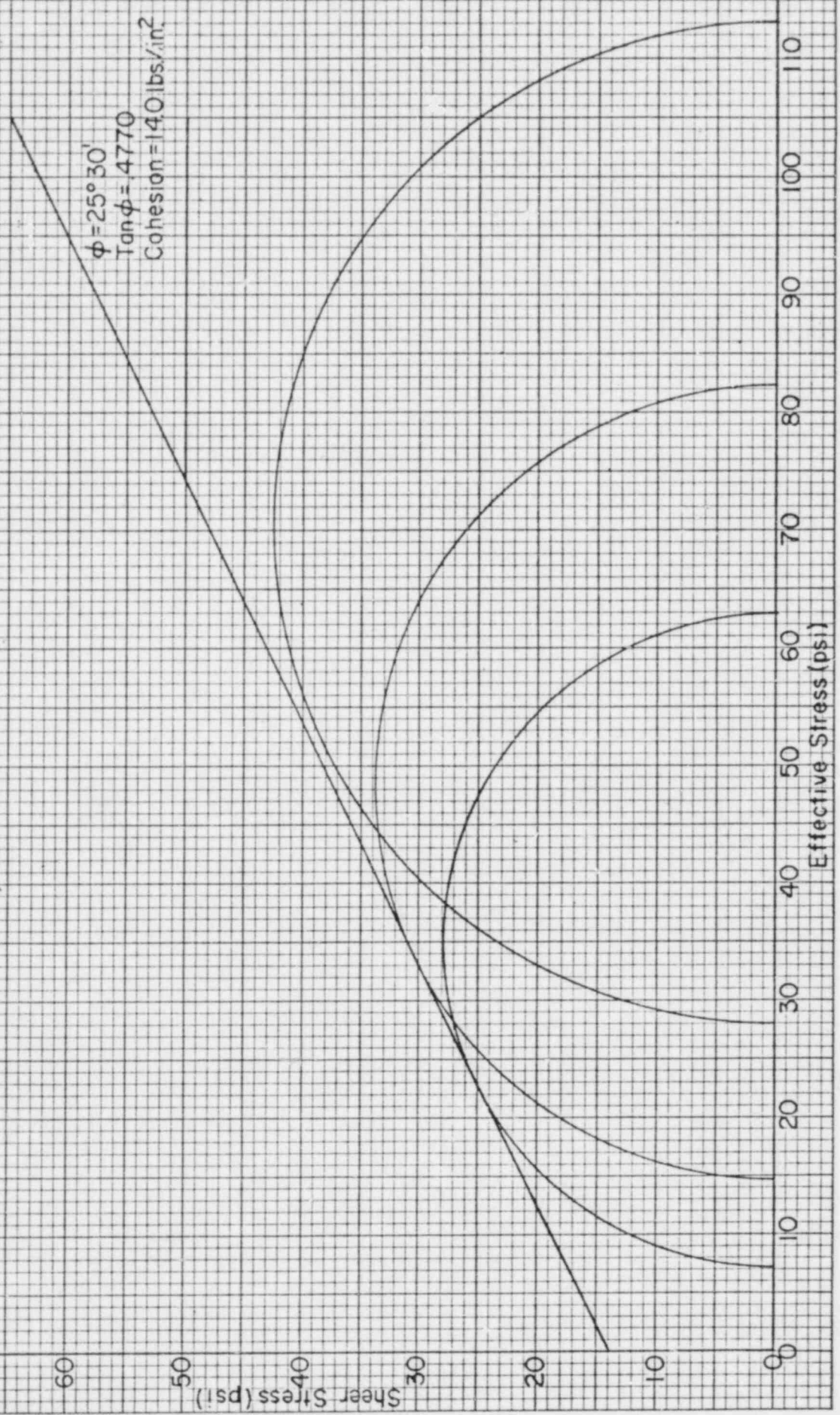
REMARKS

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z ₃ IN in. | SAMPLE HEIGHT 2H = Z ₁ - Z ₂ + Z ₃ IN in. | 2H FROM DIAL CHANGE IN in. | VOID HEIGHT 2H - 2H ₀ IN in. | VOID RATIO e = $\frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C _v IN sq. cm./sec. | |
|------------------------------------|-----------------------|----------------------|-----------------------|--------------------------|--|----------------------------------|---|--|----------------------|------|---|-------------------------------------|
| | | | | | | | | | + 90 | + 50 | .848H ² / ₊₉₀ | .197H ² / ₊₅₀ |
| 0 | | .0000 | | | | 1.0079 | .3295 | .4857 | | | | |
| | | | .0026 | | | | | | ---- | | | |
| 1/2 | | .0026 | | | | 1.0053 | .3269 | .4819 | | | | |
| | | | .0035 | | | | | | ---- | | | |
| 1 | | .0061 | | | | 1.0018 | .3234 | .4767 | | | | |
| | | | .0063 | | | | | | | | | |
| 2 | | .0124 | | | | .9955 | .3171 | .4674 | 2.40 | | .08809 | |
| | | | .0073 | | | | | | | | | |
| 4 | | .0197 | | | | .9882 | .3098 | .4567 | 2.31 | | .09028 | |
| | | | .0092 | | | | | | | | | |
| 8 | | .0289 | | | | .9790 | .3006 | .4431 | 2.19 | | .09365 | |
| | | | + .0018 | | | | | | | | | |
| 4 | | .0271 | | | | .9868 | .3024 | .4458 | | | | |
| | | | + .0029 | | | | | | | | | |
| 2 | | .0242 | | | | .9837 | .3653 | .4500 | | | | |
| | | | + .0041 | | | | | | | | | |
| 1 | | .0201 | | | | .9878 | .3094 | .4561 | | | | |
| | | | + .0099 | | | | | | | | | |
| 1/4 | | .0102 | | | | .9977 | .3193 | .4707 | | | | |



Neshaminy Water Res. Authority
TP-5, Lab No. 73-49
Depth: 0.0 to 6.5
Remolded Sample, Compacted at Maximum
Density and Optimum Moisture

GEOSCIENCES MICHAEL BAKER, JR. INC.



MICHAEL BAKER, JR., INC.
 GEOLOGICAL SCIENCES DEPARTMENT
 TRIAXIAL COMPRESSION TEST

Sample TP-5
 Haminy Water Res.
 Location
 Sampling No. Depth 0-6.5
 Sample No.
 Specific Gravity, G_s 2.71

Soil Specimen Measurements
 Diameter 2.404 6.106 cm
 Circumference
 Initial Area, A_0 4.54 in² 29.28 cm²
 Initial Length, L 4.94 in. 12.55 cm

Test No. 73-49
 Date 5-4-73
 Tested By Dick

WATER CONTENT

After Test

| Specimen Location | Total | Total | Entire Specimen Start of Test | Entire Specimen End of Test |
|--------------------------|-------|-------|----------------------------------|--------------------------------|
| Container No. | | | Membrane + Covers | Membrane + Covers |
| Container + Soil in G | 752.2 | 757.3 | | |
| Container + Soil in G | 654.6 | 654.6 | | |
| Water, W_w | 98.6 | 102.7 | | |
| Container | | | | |
| Dry Soil in G | 654.6 | 654.6 | | |
| Water Content, W | 15.1 | 15.7% | | |

| Vertical Pressure psi/in ² | Length Change ΔL in in. | Strain ϵ in % | Area, A , in Sq. in. | Axial Load, P , in lbs. | Axial Pressure P/A , in lbs/in ² | Pore Pressure pp in lbs/in ² | $\bar{\sigma}_3$ lbs/in ² $\sigma_3 - pp$ | $\bar{\sigma}_1$ lbs/in ² $P/A + \sigma_3$ | $\frac{\bar{\sigma}_1}{\bar{\sigma}_3}$ | T_{cr} in lbs/in ² |
|---|--|------------------------------|---------------------------|---------------------------------|--|--|--|---|---|------------------------------------|
| psi | 0.0 | 0.00 | 4.54 | 0 | 0.00 | 0.00 | 7.00 | 7.00 | | |
| | .05 | 1.01 | 4.59 | 90 | 19.61 | 0.15 | 6.85 | 26.46 | | |
| | .10 | 2.02 | 4.63 | 167 | 36.07 | 0.30 | 6.70 | 42.77 | | |
| | .15 | 3.04 | 4.68 | 210 | 44.87 | 0.33 | 6.67 | 51.54 | | |
| | .20 | 4.05 | 4.73 | 235 | 49.68 | 0.24 | 6.76 | 56.44 | | |
| | .25 | 5.06 | 4.78 | 250 | 52.30 | 0.15 | 6.85 | 59.15 | | |
| | .30 | 6.07 | 4.83 | 260 | 53.83 | 0.00 | 7.00 | 60.83 | | |
| | .35 | 7.08 | 4.88 | 270 | 55.33 | -0.18 | 7.18 | 62.51 | | |
| | .40 | 8.10 | 4.94 | 275 | 55.67 | -0.36 | 7.36 | 63.03 | | |
| | .45 | 9.11 | 4.99 | 275 | 55.11 | -0.60 | 7.60 | 62.71 | | |
| | .50 | 10.12 | 5.05 | 270 | 53.46 | -0.99 | 7.99 | 61.45 | | |



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Proctor

Project No. NESHAMINY Creek
Laboratory No. 72-284 0-6.5'
Test Bore TP-5 Station _____ Offset _____
Date Received 11-8-72 Date Tested 11-15-72
Tested By FRANK
Checked By _____

SPECIFIC GRAVITY = 2.713 @ 20°C

NMC = 13.8%

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.

Agg = 0
CS = 0
FS = 1
S = 64
C = 35

Volume of Soil $V_s =$ c.c.
~~Apparent Sp. Gr. $\frac{W_0}{V_s}$~~

% Passing $O_2 = 64.0$

Frost Group = F-4

LIQUID LIMIT

Wt. of Wet Soil and Dish 27.79 g. ^A _B
Wt. of Dry Soil and Dish 23.54 g.
Wt. of Water 4.25 g.
Percent of Moisture 31.9 % ₃₂

$n = 23$

Wt. of Dry Soil and Dish 23.54 g. ^A _B
Wt. of Dish 10.23 g.
Wt. of Dry Soil 13.31 g.

PLASTIC LIMIT

Wt. of Wet Soil and Dish 21.16 g. ^A _B
Wt. of Dry Soil and Dish 19.35 g.
Wt. of Water 1.81 g.
Percent of Moisture 22.3 % _{21.6}

Wt. of Dry Soil and Dish 19.35 g. ^A _B
Wt. of Dish 11.22 g. _{11.53}
Wt. of Dry Soil 8.13 g. _{8.27}

PLASTICITY INDEX (LL.-P.L.) = 32-22=10

CL

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|-----------------------------|-----------------------------|---------------|------------|---|--|-------------------|-----------------------------|---------------|---------------|--------------|
| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | | Sieve Number | Particle Size mm. | Retained | | Cumulative | |
| | Weight (W ₁) g. | Percent (W ₁) % | | % Ret. | % Pass | | | Weight (W ₃) g. | Percent (W) % | Percent (W) % | % Ret. (W) % |
| 1" | | | | | | 10 | 1.98 | | | | |
| 3/4" | <u>0</u> | | | | | 20 | 0.833 | | | | |
| 1/2" | | <u>0</u> | | <u>0</u> | <u>100</u> | 40 | 0.417 | <u>.1</u> | <u>0.2</u> | <u>0.2</u> | <u>99.8</u> |
| 3/8" | | | | | | 60 | 0.246 | | | | |
| No. 4 | <u>0</u> | | | <u>0</u> | <u>100</u> | 140 | 0.104 | | | | |
| No. 10 | <u>0</u> | | | <u>0</u> | <u>100</u> | 200 | 0.074 | <u>.5</u> | <u>1.0</u> | <u>1.2</u> | <u>98.8</u> |
| No. 40 | | | | <u>100</u> | | Pass | No. 200 | | | | |
| No. 200 | | | | <u>99</u> | | Total | | <u>50</u> | <u>100</u> | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | |
| Total | <u>364.1</u> | | | | | Partial Sample W ₁ = g. % | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. SIEVE (W₂)

Hydrometer No. Sp. Gr. Corr a Wt. of Sample W₃ Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr. Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|-------------|-----------|-------------|--------------------|------------|-------------|--------------------------------|----------------|----------------|----------------|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K ₁ | K _R | K _n | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| <u>7/10</u> | 5 | <u>79</u> | <u>38.0</u> | <u>6.0</u> | <u>32.0</u> | <u>64.0</u> | | | | .035 | <u>.02</u> | <u>64.0</u> |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| <u>0/20</u> | 60 | <u>73.0</u> | <u>39.5</u> | <u>6.0</u> | <u>17.5</u> | <u>35.0</u> | | | | .010 | <u>.005</u> | <u>35.0</u> |
| | 90 | | | | | | | | | .008 | | |
| <u>9/10</u> | 1440 | <u>73.0</u> | <u>17</u> | <u>6.0</u> | <u>11.0</u> | <u>22.0</u> | | | | .002 | <u>.001</u> | <u>22.0</u> |

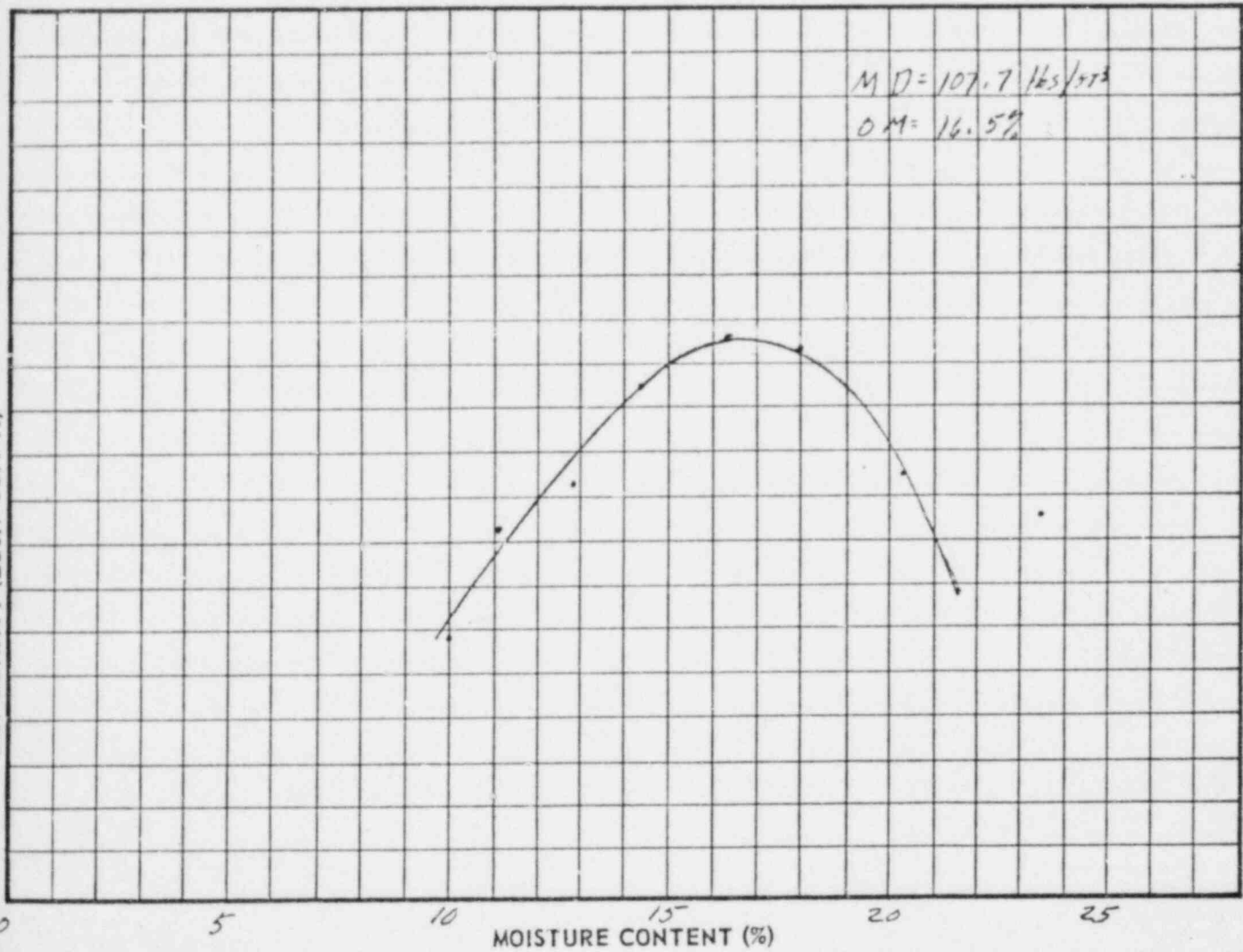
NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION
 MOISTURE DENSITY TEST

Project No. WESHAMING Lab. No. 284
 Test For PROC. 0-6.5'
 Test Bore TP 5 Station _____ Offset _____
 Date Received _____ Date Tested _____
 Tested By FRANK
 Checked By _____

MATERIAL _____ STANDARD MODIFIED



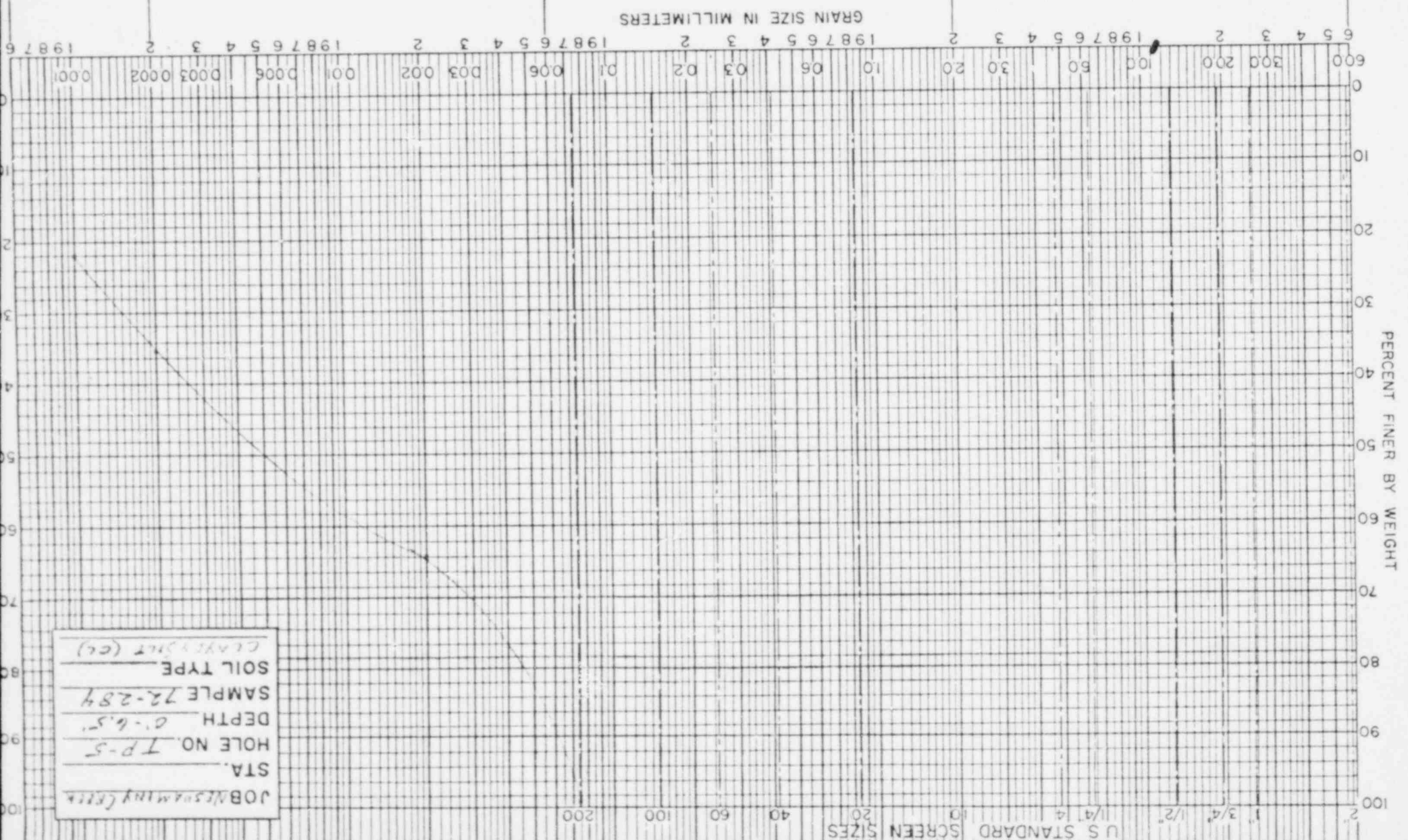
| MOLD VOL. (FT. ³) | MOLD WT. <u>9.32</u> LBS. | | | | | | | | OPERATOR <u>FRANK</u> |
|--|---------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------------------|
| Trial No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| Tare No. | <u>Y-42</u> | <u>F-4</u> | <u>Y-7</u> | <u>Y-29</u> | <u>F-9</u> | <u>Y-47</u> | <u>Y-33</u> | <u>Y-34</u> | |
| Wt. Wet Sample + Tare | <u>156.0</u> | <u>180.5</u> | <u>173.1</u> | <u>192.8</u> | <u>179.6</u> | <u>151.0</u> | <u>175.1</u> | <u>189.0</u> | |
| Wt. Dry Sample + Tare | <u>144.1</u> | <u>164.9</u> | <u>156.2</u> | <u>171.6</u> | <u>157.8</u> | <u>140.2</u> | <u>149.7</u> | <u>157.9</u> | |
| Wt. Water | <u>11.9</u> | <u>15.6</u> | <u>16.9</u> | <u>21.2</u> | <u>21.8</u> | <u>20.8</u> | <u>25.4</u> | <u>29.1</u> | |
| Tare Wt. | <u>24.8</u> | <u>24.6</u> | <u>24.9</u> | <u>24.6</u> | <u>25.1</u> | <u>24.8</u> | <u>24.8</u> | <u>24.9</u> | |
| Wt. Dry Soil | <u>119.3</u> | <u>140.3</u> | <u>131.3</u> | <u>147.0</u> | <u>132.7</u> | <u>115.4</u> | <u>124.9</u> | <u>135.0</u> | |
| MC = $\frac{\text{Wt. Water}}{\text{Wt. Dry Soil}} \times 100$ | <u>10.0</u> | <u>11.1</u> | <u>12.9</u> | <u>14.4</u> | <u>16.4</u> | <u>18.0</u> | <u>20.3</u> | <u>21.6</u> | |
| Wt. Sample + Mold | <u>13.02</u> | <u>13.14</u> | <u>13.24</u> | <u>13.38</u> | <u>13.50</u> | <u>13.54</u> | <u>13.51</u> | <u>13.45</u> | |
| Wt. Wet Sample in Mold | <u>3.70</u> | <u>3.82</u> | <u>3.92</u> | <u>4.06</u> | <u>4.18</u> | <u>4.22</u> | <u>4.19</u> | <u>4.13</u> | |
| Wet Density (lbs./cu. ft.) | <u>111.0</u> | <u>114.6</u> | <u>117.6</u> | <u>121.8</u> | <u>125.4</u> | <u>126.6</u> | <u>125.7</u> | <u>123.4</u> | |
| Dry Density (lbs./cu. ft.) | <u>100.9</u> | <u>103.2</u> | <u>104.2</u> | <u>106.5</u> | <u>107.7</u> | <u>107.3</u> | <u>104.5</u> | <u>101.9</u> | |

MICHAEL BAKER, JR., INC.

Rochester, Pa.

DEPARTMENT OF GEOLOGICAL SCIENCES

| | | | | | | | | | | | | | |
|------------------------------|--|--|--|----------------------------|--|--|--|----------------------------|--|--|--|--------------|--|
| GRAVEL COARSE MEDIUM FINE | | | | SAND COARSE MEDIUM FINE | | | | SILT COARSE MEDIUM FINE | | | | CLAY | |
| % GRAVEL SIZES | | | | % SAND SIZES | | | | % SILT SIZES | | | | % CLAY SIZES | |



| | |
|-----------|-----------|
| JOB NO | MA2013 |
| STA. | TP-5 |
| HOLE NO. | TP-5 |
| DEPTH | 0'-6.5" |
| SAMPLE | 72-284 |
| SOIL TYPE | CLAY (CL) |

BRADSHAW RESERVOIR

TEST PIT 6



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

Location Neshaminy Creek Specimen Measurements Test No. 73-62
 Boring No. TP-6 Depth 4-7' Diameter 4" Date 5-22-73
 Sample No. 73-62 Circumference _____ Tested By Frank
 Specific Gravity, G_s _____ Area, A _____
 Wet Wt. of Sample _____ Length, L _____
 Dry Wt. of Sample W_s _____ Volume of Sample _____
 Volume of Solid Material = $V_s = W_s / G_s =$ _____ cc
 Void Ratio of Sample = $e = \frac{V - V_s}{V_s} =$ _____ = _____ = _____

Test Data

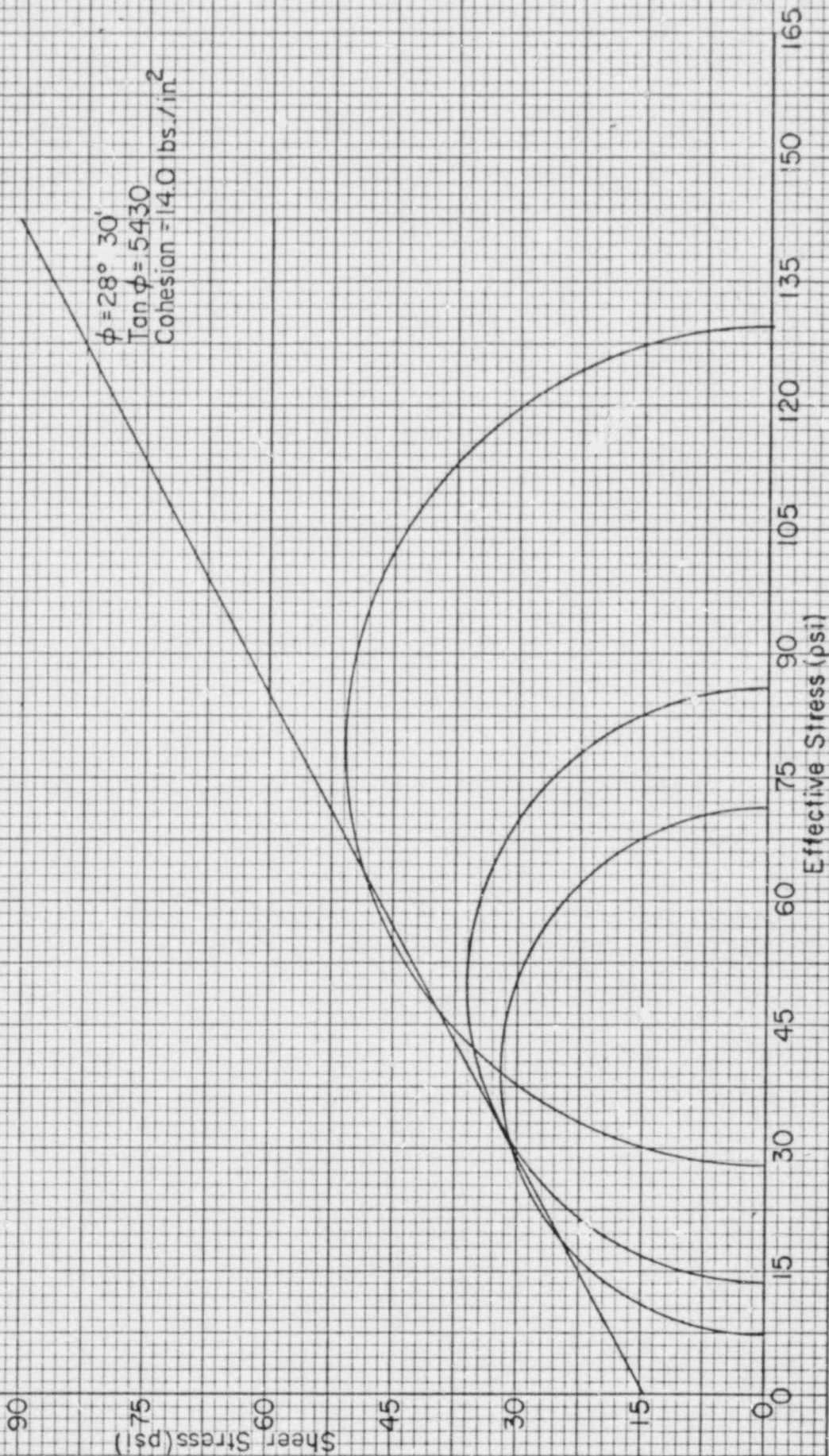
| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h_0 | h_1 | $\text{Log}_{10} h_0/h_1$ | k cm/sec. |
|------|-----------------------|---------------|-----------------------------------|-------|-------|---------------------------|-----------|
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$K = 2.3 \frac{aL}{At} \cdot \text{Log}_{10} \frac{h_0}{h_1}$ $a = \frac{Q}{h_1 - h_2}$

Remarks Compacted to Max. Density at Opt. Moist. - Non-Permeable

Neshaminy Water Res. Authority
TP-6, Lab. No. 73-62
Depth 4.0 to 7.0
Remolded Sample, Compacted at Maximum
Density and Optimum Moisture

**GEOSCIENCES
MICHAEL BAKER, JR. INC.**



MICHAEL BAKER, JR., INC.
GEOLOGICAL SCIENCES DEPARTMENT
TRIAxIAL COMPRESSION TEST

Sample TP-6
Shaminy Water Res.
Authority

Location
Dig No. Depth 4'-7'
Sample No.
Specific Gravity, G_s 2.77

Soil Specimen Measurements
Diameter 1.48" 3.75 cm
Circumference
Initial Area, A₀ 1.72 in² 11.04 cm²
Initial Length, L 2.96 in. 7.53 cm

Test No. 73-62
Date 5-23-73
Tested By Dick

WATER CONTENT

| Specimen Location | Total | Total | Entire Specimen Start of Test Membrane + Covers | Entire Specimen End of Test Membrane + Covers |
|--------------------------|-------|-------|--|--|
| Container No. | | | | |
| Container + Soil in G | 169.4 | 169.7 | | |
| Container + Soil in G | 145.5 | 145.5 | | |
| Water, W _w | 23.9 | 24.2 | | |
| Container | | | | |
| Dry Soil in G | 145.5 | 145.5 | | |
| Water Content, W | 16.4 | 16.6 | | |

| Vertical Pressure p _v in lbs/in ² | Length Change ΔL in in. | Strain ε in % | Area, A, in Sq. in. | Axial Load, P, in lbs. | Axial Pressure P/A, in lbs/in ² | Pore Pressure pp in lbs/in ² | $\bar{\sigma}_3$ in lbs/in ² $\frac{\sigma_3}{\sigma_3 - pp}$ | $\bar{\sigma}_1$ in lbs/in ² $\frac{\sigma_1}{P/A + \sigma_3}$ | $\frac{\bar{\sigma}_1}{\bar{\sigma}_3}$ | Ter in lbs/in ² |
|---|----------------------------------|---------------------|------------------------|------------------------------|---|--|--|---|---|-------------------------------|
| 0 | .00 | 0.00 | 1.72 | 0 | 0 | 0 | 7.0 | 7.00 | | |
| 0 | .03 | 1.01 | 1.74 | 23 | 13.2 | .15 | 6.85 | 20.0 | | |
| 0 | .06 | 2.03 | 1.76 | 54 | 30.7 | .39 | 6.61 | 37.3 | | |
| 0 | .09 | 3.04 | 1.77 | 76 | 42.9 | .51 | 6.49 | 49.4 | | |
| 0 | .12 | 4.05 | 1.79 | 99 | 55.3 | .48 | 6.52 | 61.8 | | |
| 0 | .15 | 5.07 | 1.81 | 109 | 60.2 | .36 | 6.64 | 66.8 | | |
| 0 | .18 | 6.08 | 1.83 | 115 | 62.8 | .18 | 6.82 | 69.6 | | |
| 0 | .21 | 7.09 | 1.85 | 118 | 63.8 | .00 | 7.00 | 70.8 | | |
| 0 | .24 | 8.11 | 1.83 | 120 | 64.2 | -.27 | 7.27 | 71.5 | | |
| 0 | .27 | 9.12 | 1.89 | 120 | 63.5 | -.45 | 7.45 | 71.0 | | |
| 0 | .30 | 10.14 | 1.91 | 120 | 62.8 | -.75 | 7.75 | 70.6 | | |



MICHAEL BAKER, JR., INC.

ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG

LIMITS of SOILS

Project No. NESHAMINY CREEK

Laboratory No. 72-285 4-2

Test Bore TP-6 Station _____ Offset _____

Date Received 11-8-72 Date Tested 11-15-72

Tested By R. Dorothy

Checked By _____

SPECIFIC GRAVITY = 2.771 @ 20°C

NMC = 22.2%

Aggr = 8
 CS = 13
 FS = 7
 S = 54
 C = 18

Volume of Soil $V_s =$ _____ c.c.
 Apparent Sp. Gr. $\frac{W_s}{V_s} =$ _____

LIQUID LIMIT

Wt. of Dry Soil and Flask $W_1 =$ _____ g.
 Wt. of Flask No. $W_2 =$ _____ g.
 Wt. of Dry Soil $W_1 - W_2 = W_0 =$ _____ g.
 % Passing O2 = 41.5%
 Frost Group = F-4

Wt. of Wet Soil and Dish 28.55 ^A _____ g.
 Wt. of Dry Soil and Dish 25.00 _____ g.
 Wt. of Water 3.55 _____ g.
 Percent of Moisture 24.6 = 24

Wt. of Dry Soil and Dish 23.00 ^B _____ g.
 Wt. of Dish 10.57 _____ g.
 Wt. of Dry Soil 14.43 _____ g.

N = 20

PLASTIC LIMIT

Wt. of Wet Soil and Dish 23.35 ^A 23.62 ^B _____ g.
 Wt. of Dry Soil and Dish 21.19 ^A 21.45 ^B _____ g.
 Wt. of Water 2.16 ^A 2.17 ^B _____ g.
 Percent of Moisture 22.3 ^A 21.9 ^B

Wt. of Dry Soil and Dish 21.19 ^A 21.45 ^B _____ g.
 Wt. of Dish 6.10 ^A 11.52 ^B _____ g. A-2
 Wt. of Dry Soil 9.67 ^A 9.93 ^B

PLASTICITY INDEX (LL.-P.L.) = 24 - 22 = 2

ML

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | |
|---|--------------------------|---------------------------|---------------|------------|--------|
| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | |
| | Weight (W ₁) | Percent (W ₁) | | % Ret. | % Pass |
| | g | % | % | % | % |
| 1" | — | | | | |
| 3/4" | — | | | | |
| 1/2" | — | 0 | | 0 | 100 |
| 3/8" | — | | | | |
| No. 4 | 0.8 | 0.2 | | 0.2 | 99.8 |
| No. 10 | 7.6 | 7.6 | | 7.8 | 92.2 |
| No. 40 | | | | 79 | |
| No. 200 | | | | 72 | |
| Pass | | | | | |
| Total | 362.1 | | | | |

| SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | | |
|---|---------------|--|---------------------------|-------------|------------|------------|--|
| Sieve Number | Particle Size | Retained | | | Cumulative | | |
| | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) | |
| | mm. | g | % | % | % | % | |
| 10 | 1.98 | | | | | | |
| 20 | 0.833 | | | | | | |
| 40 | 0.417 | 7.4 | 14.8 | | 14.8 | 85.2 | |
| 60 | 0.246 | | | | | | |
| 140 | 0.104 | | | | | | |
| 200 | 0.074 | 3.7 | 7.4 | | 22.2 | 77.8 | |
| Pass | No. 200 | | | | | | |
| | Total | 50 | 100 | | | | |
| | | Original Sample W = _____ g. 100% | | | | | |
| | | Partial Sample W ₁ = _____ g. % | | | | | |
| | | Partial Sample W ₃ = _____ g. % | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. SIEVE (W₂)
 Hydrometer No. Sp. Gr. Corr a Wt. of Sample W₃ Gm.

| Time | Time Min. | Temp. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|-------|-----------|-------|--------------------|-----|------|-----------------------------------|--------------|----|----|-----------------|-----------------------|-----------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Kn | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 9:13 | 5 | 23.0 | 28.5 | 6.0 | 22.5 | 45.0 | | | | .035 | .02 | 41.5 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 10:23 | 60 | 23.0 | 16.0 | 6.0 | 10.0 | 20.0 | | | | .010 | .005 | 18 |
| | 90 | | | | | | | | | .008 | | |
| 9:13 | 1440 | 23.0 | 11.0 | 6.0 | 5.0 | 10.0 | | | | .002 | .001 | 9 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



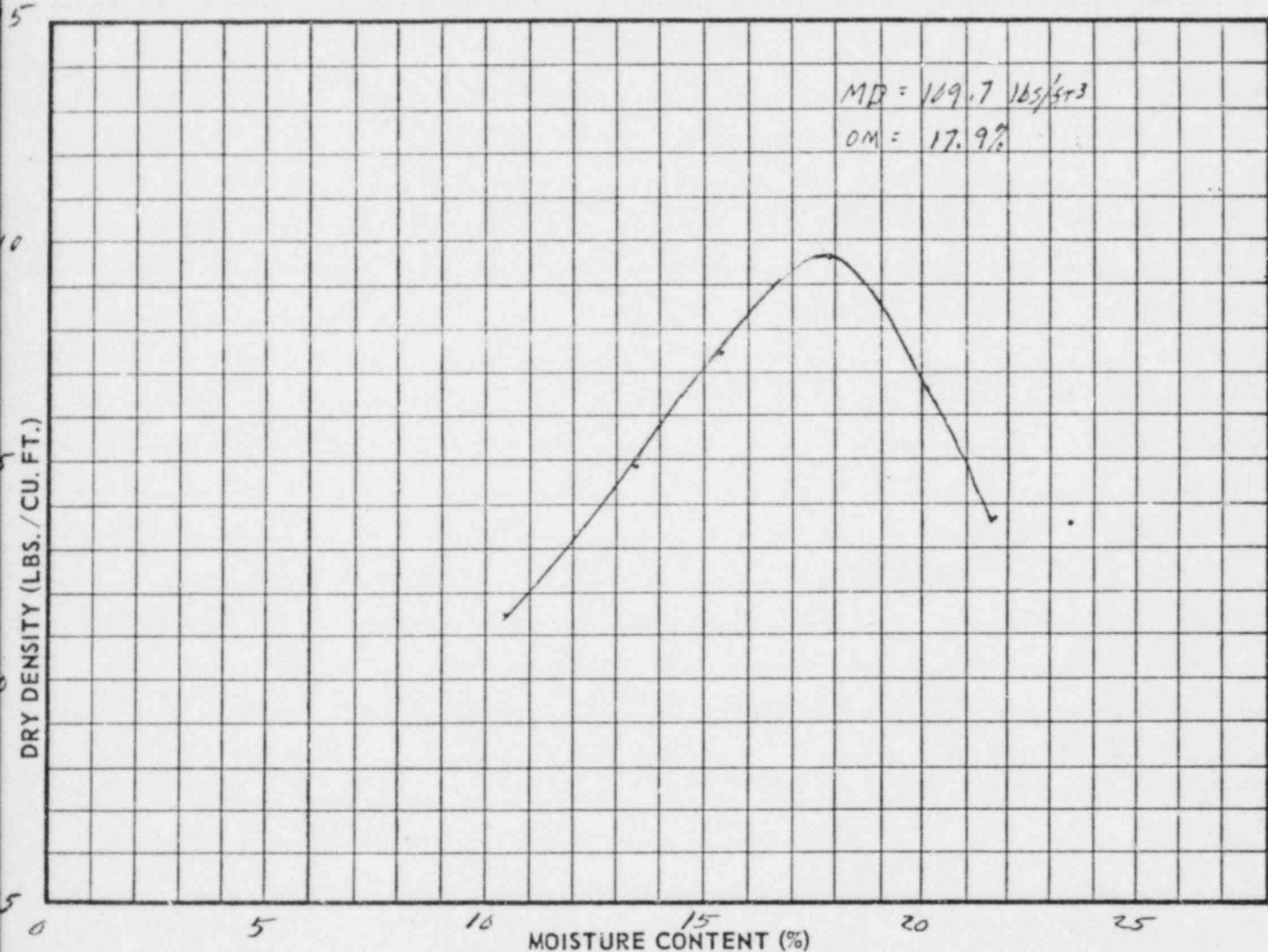
MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION
 MOISTURE DENSITY TEST

Project No. Nesh. CK Lab. No. 72-285
 Test For PROC ONLY
 Test Bore TP-6 Station B-2 Offset 4'-2"
 Date Received 11-8-72 Date Tested 11-14-72
 Tested By R. Dorothy
 Checked By _____

MATERIAL _____

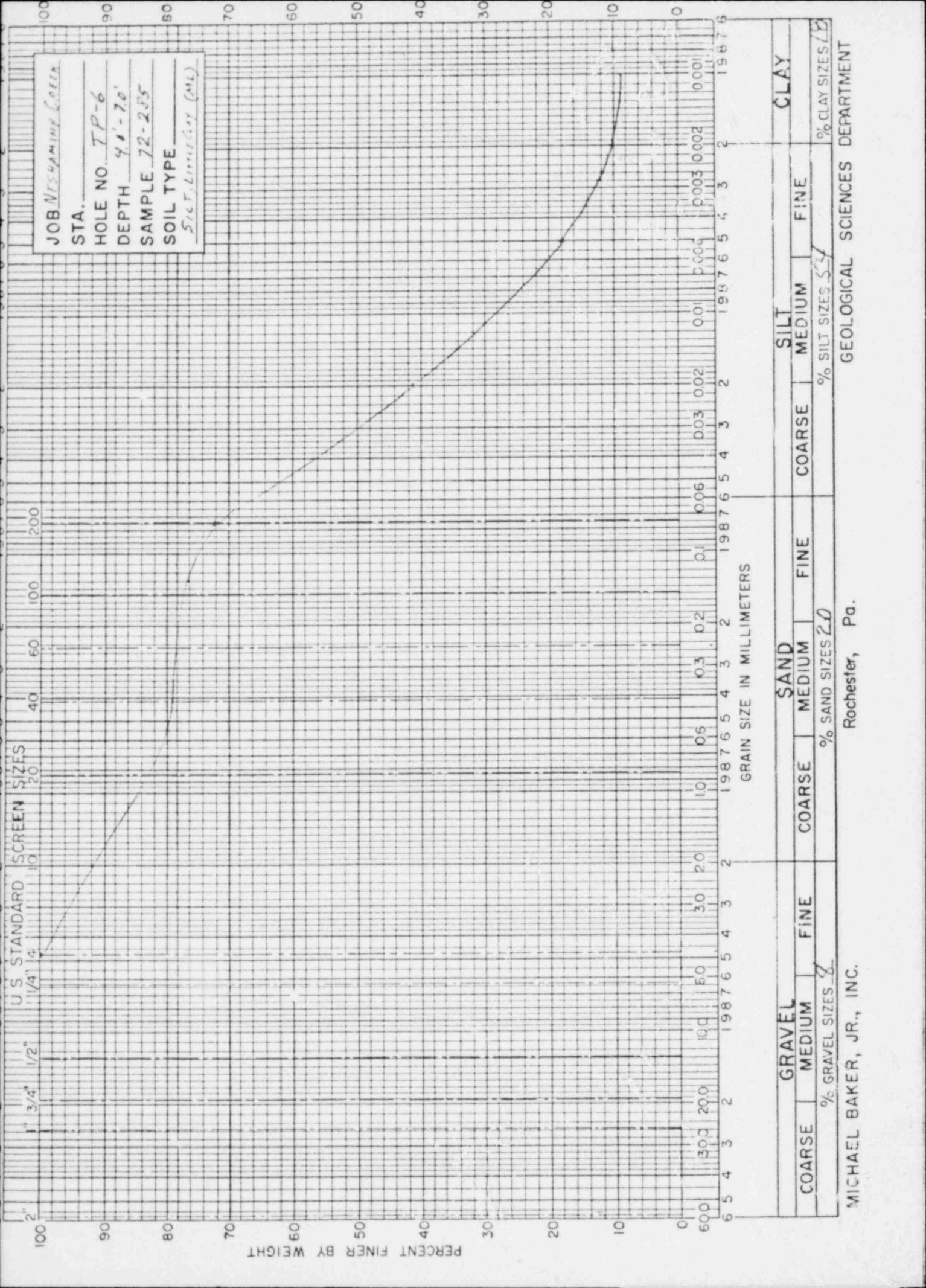
STANDARD A

MODIFIED



| MOLD VOL. <u>1/30</u> (FT. ³) | | MOLD WT. <u>9.32</u> LBS. | | OPERATOR <u>DICK</u> | | | |
|--|--------------|---------------------------|--------------|----------------------|--------------|--------------|---|
| Trial No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Tare No. | <u>Y-47</u> | <u>Y-42</u> | <u>Y-33</u> | <u>Y-29</u> | <u>Y-36</u> | <u>F-9</u> | |
| Wt. Wet Sample + Tare | <u>195.2</u> | <u>194.4</u> | <u>187.8</u> | <u>204.7</u> | <u>212.0</u> | <u>220.3</u> | |
| Wt. Dry Sample + Tare | <u>179.0</u> | <u>174.2</u> | <u>166.1</u> | <u>177.4</u> | <u>180.7</u> | <u>185.4</u> | |
| Wt. Water | <u>16.2</u> | <u>20.2</u> | <u>21.7</u> | <u>27.3</u> | <u>31.3</u> | <u>34.9</u> | |
| Tare Wt. | <u>24.8</u> | <u>24.8</u> | <u>24.8</u> | <u>24.6</u> | <u>25.0</u> | <u>25.1</u> | |
| Wt. Dry Soil | <u>154.2</u> | <u>149.4</u> | <u>141.3</u> | <u>152.8</u> | <u>155.7</u> | <u>160.3</u> | |
| MC = $\frac{\text{Wt. Water}}{\text{Wt. Dry Soil}} \times 100$ | <u>10.5</u> | <u>13.5</u> | <u>15.4</u> | <u>17.9</u> | <u>20.1</u> | <u>21.8</u> | |
| Wt. Sample + Mold | <u>13.06</u> | <u>13.29</u> | <u>13.45</u> | <u>13.63</u> | <u>13.54</u> | <u>13.53</u> | |
| Wt. Wet Sample in Mold | <u>3.74</u> | <u>3.97</u> | <u>4.13</u> | <u>4.31</u> | <u>4.27</u> | <u>4.21</u> | |
| Wet Density (lbs./cu. ft.) | <u>112.2</u> | <u>119.1</u> | <u>123.9</u> | <u>129.3</u> | <u>128.1</u> | <u>126.3</u> | |
| Dry Density (lbs./cu. ft.) | <u>101.5</u> | <u>104.9</u> | <u>107.4</u> | <u>109.7</u> | <u>106.7</u> | <u>103.7</u> | |

JOB NESHAMINY CREEK
 STA. _____
 HOLE NO. TP-6
 DEPTH 4'-7.0"
 SAMPLE 72-285
 SOIL TYPE _____
Silt, limy clay (ML)



| GRAVEL | | | SAND | | | SILT | | | CLAY | | |
|----------------|--------|------|--------------|--------|------|--------------|--------|------|--------------|--------|------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE |
| % GRAVEL SIZES | | | % SAND SIZES | | | % SILT SIZES | | | % CLAY SIZES | | |
| | | 2 | | | 2.0 | | | 55 | | | 15 |

MICHAEL BAKER, JR., INC.

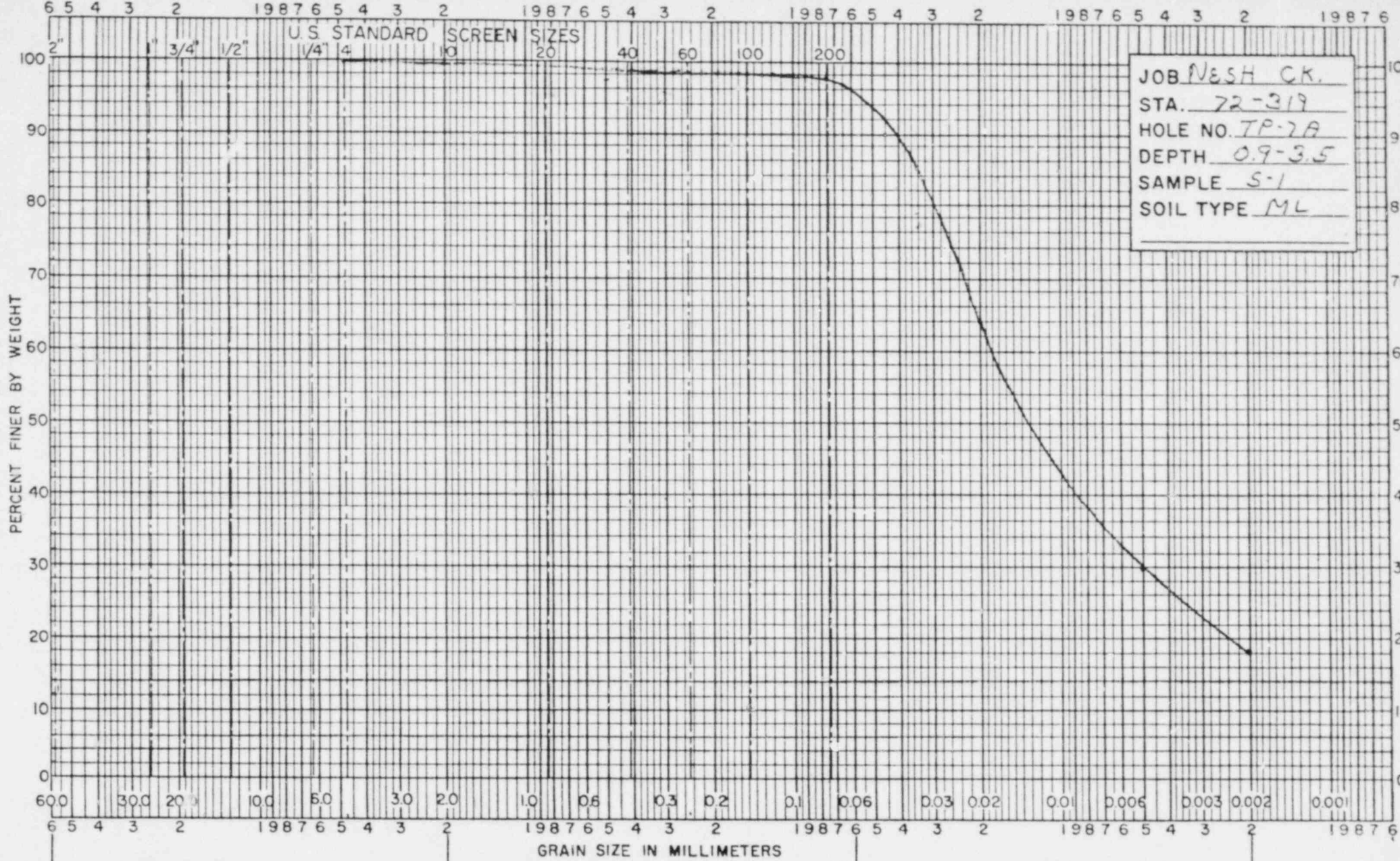
Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT

BRADSHAW RESERVOIR

TEST PIT 7-A

GRADATION CURVE



JOB NESH CK.
 STA. 72-319
 HOLE NO. TP-7A
 DEPTH 0.9-3.5
 SAMPLE S-1
 SOIL TYPE ML

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|-------------------------|--------|------|-----------------------|--------|------|------------------------|--------|------|------------------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>0</u> | | | % SAND SIZES <u>2</u> | | | % SILT SIZES <u>68</u> | | | % CLAY SIZES <u>30</u> |

MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS of SOILS

Project No. NEESHAMINY CK.
Laboratory No. 72-219
Test Bore TP-7A Station S-1 Offset 0.9-2.5
Date Received 12-15-72 Date Tested 12-20-72
Tested By RWD
Checked By _____

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
% Passing .02 = 63.7%
Frost Group = F4

SPECIFIC GRAVITY = 2.707 @ 20°C. NMC = 24.8%
Aggr = 0 Volume of Soil $V_s =$ c.c.
CS = 1 Apparent Sp. Gr. = $\frac{W_0}{V_s}$
FS = 1
S = 68
C = 30

LIQUID LIMIT
Wt. of Wet Soil and Dish 28.56 A B
Wt. of Dry Soil and Dish 24.46
Wt. of Water 4.10
Percent of Moisture 28.3 27
N = 19

Wt. of Dry Soil and Dish 24.46 A B
Wt. of Dish 8.999
Wt. of Dry Soil 14.47
F-9

PLASTIC LIMIT
Wt. of Wet Soil and Dish 21.16 A B
Wt. of Dry Soil and Dish 19.50
Wt. of Water 1.66
Percent of Moisture 22.0 22.1
F-9

Wt. of Dry Soil and Dish 19.50 A B
Wt. of Dish 11.92
Wt. of Dry Soil 7.58
F-9

PLASTICITY INDEX (I.L. - P.L.) = 27 - 22 = 5 ML

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|--------------------------|---------------------------|---------------|--------|--------|---|---------------|----------|---------------------------|-------------|------------|------------|
| Sieve Number | Retained | | Cumulative | | | Sieve Number | Particle Size | Retained | | Cumulative | | |
| | Weight (W ₁) | Percent (W ₁) | Per. Ret. (W) | % Ret. | % Pass | | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | g | % | % | % | % | | mm. | g | % | % | % | % |
| 1" | — | | | | | 10 | 1.98 | | | | | |
| 3/4" | — | | | | | 20 | 0.833 | | | | | |
| 1/2" | — | | | | | 40 | 0.417 | 0.6 | 1.2 | | 1.2 | 98.8 |
| 3/8" | — | | | | | 60 | 0.246 | | | | | |
| No. 4 | 1.6 | 0.1 | | 0.1 | 99.9 | 140 | 0.104 | | | | | |
| No. 10 | 4.7 | 0.3 | | 0.4 | 99.6 | 200 | 0.074 | 0.4 | 0.8 | | 2.0 | 98.0 |
| No. 40 | | | | | 98.4 | Pass | No. 200 | | | | | |
| No. 200 | | | | | 97.6 | Total | | 50 | 100 | | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | | |
| Total | 139.23 | | | | | Partial Sample W ₁ = g. % | | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)
Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 R _a ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|-------|-----------|-----------|--------------------|-----|------|---|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Ku | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 9:25 | 5 | 23.0 | 38.0 | 6.0 | 32.0 | 64.0 | | | | .035 | .02 | 63.7 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 10:35 | 60 | 23.0 | 21.0 | 6.0 | 15.0 | 30.0 | | | | .010 | .005 | 29.9 |
| | 90 | | | | | | | | | .008 | | |
| 9:25 | 1440 | 23.5 | 15.0 | 3.9 | 9.1 | 18.2 | | | | .002 | .001 | 18.1 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 R_a ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.

FIELD DENSITY TEST - SAND CONE METHOD

Date of Test 10-25-72 Test No. 5
 Test Location Point Pleasant Municipal Facility
 Area Represented Test Pit #10 7-A

Sand Cone Apparatus Number 1 Material Comp. Clay - SILT
 Mode of Compaction _____ Layer Designation 1.5-2.0
 Type of Compactor None Thickness _____
 Number of Passes None

CALIBRATION

| | | |
|---|-------------|----|
| (1) Weight of Container filled to valve with water | <u>5654</u> | gm |
| (2) Deduct weight of empty container | <u>1664</u> | gm |
| (3) Net weight of water in gm - Volume in cc | <u>3990</u> | cc |
| (4) Weight of container plus funnel, filled with sand | <u>7810</u> | gm |
| (5) Close valve, empty funnel and reweigh; deduct | <u>1001</u> | gm |
| (6) Weight of sand in funnel | <u>1809</u> | gm |

VOLUME OF HOLE

| | | |
|---|--------------|-------|
| (7) Weight of sand plus apparatus before test | <u>7755</u> | gm |
| (8) Deduct weight of sand plus apparatus after test | <u>3077</u> | gm |
| (9) Weight of sand emptied from container | <u>4678</u> | gm |
| Deduct (6) Weight of sand in funnel | <u>1809</u> | gm |
| (10) Weight of sand remaining in hole | <u>2869</u> | gm |
| (11) Bulk Density of Sand: | <u>7755</u> | gm |
| (11a) Enter (7) Sand plus apparatus before test | <u>1664</u> | gm |
| (11b) Deduct (2) Weight of Appartus | <u>6091</u> | gm |
| (11c) Weight of sand in container | <u>3990</u> | cc |
| (11d) Enter (3) Container Volume | <u>1.527</u> | gm/cc |
| (11e) Divide (11c) by (11d) = Bulk Density | <u>1748</u> | cc |
| (12) Divide (10) by (11e) = Volume of hole | | |

SAMPLE TAKEN FROM HOLE

| | | |
|--|-------------|----|
| (13) Weight of total sample taken from hole plus can | <u>3628</u> | gm |
| (14) Deduct tare weight of can | <u>361</u> | gm |
| (15) Net weight of sample as taken | <u>3267</u> | gm |

MOISTURE CONTENT

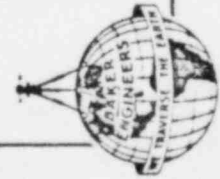
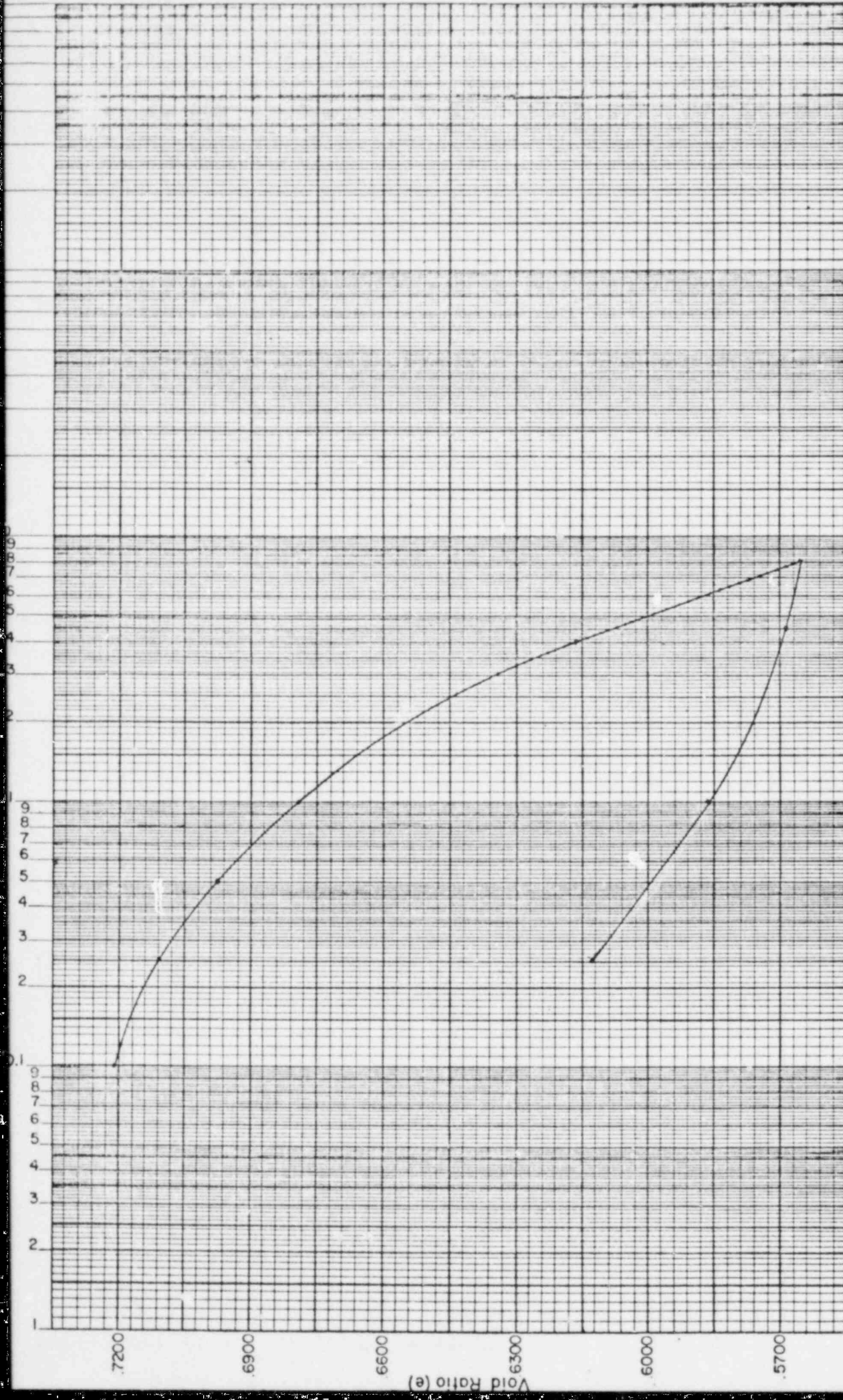
| | When Compacted | When Tested |
|---|--------------------|------------------|
| (16) Weight of wet sample plus can | <u> </u> gm | <u>1981.0</u> gm |
| (17) Deduct weight of dry sample plus can | <u> </u> gm | <u>1603.4</u> gm |
| (18) Weight of water contained in sample | <u> </u> gm | <u>377.6</u> gm |
| (19) Tare Number and Weight # _____ | <u> </u> gm | <u>109.1</u> gm |
| (20) Net Weight of dry sample, (17) - (19) | <u> </u> gm | <u>1493.5</u> gm |
| (21) Moisture content, (18) divided by (20) | <u> </u> % | <u>26.0</u> % |

DENSITY COMPUTATION

| | | |
|--|--|-----------------------------|
| (22) Wet density | $\frac{\text{Item (15)}}{\text{Item (12)}} \times 62.4$ | <u>116.6</u> lb./cu. ft. |
| (23) Dry Density | $\frac{\text{Item (22)}}{1.00 \text{ plus Item (21) "when tested"}}$ | <u>92.5</u> lb./cu. ft. |
| (24) Optimum dry density from compaction tests | | <u> </u> lb./cu. ft. |
| (25) Percent of optimum dry density obtained in field | Item (23) expressed as a percent of Item (24) | <u> </u> % |
| (26) Specified minimum allowable percentage of optimum dry density | | <u> </u> % |

(27) THE ABOVE TEST INDICATES SOIL IN AREA REPRESENTED (HAS, HAS NOT) BEEN COMPACTED TO THE DENSITY REQUIRED BY THE GOVERNING SPECIFICATIONS. Remarks: _____

Signed _____



MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION

Project No. Cont. 24 Subs. Inv. Lab. No. 73-61
 Test For Neshaminy Water Res. Auf. Point Pleasant Pumping Fac.
 Test Bore TP-7A Station Offset
 Date Received Date Tested 5-(3to 11)-73.

Class ML
 Depth 15' to 25'
 Sheet 1 of 7

CONSOLIDATION TEST

SOIL SAMPLE TP-7A LAB. NO. 73-61
Neshaminy Creek
 PROJECT NO. TP-7A SAMPLE DEPTH 2.74
 BORING NO. 73-61
 SAMPLE NO. 73-61
 SPECIFIC GRAVITY, G_s 2.74

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 2.55 cm, 1.0039 in.
 CONTAINER DIAMETER, D 3.35 cm, 2.50 in.
 CONTAINER AREA, A , IN SQ. CM, 31.67
 STONE + COVER THICKNESS, Z_2 cm, in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN %
 1 kg./sq. cm. = lbs. SCALE LOAD
 TARE IN lbs. Frank

TESTED BY Frank
 DEGREE OF SATURATION IN %
 TEST START 89.0⁰⁰
 TEST END 114.8⁰⁰

$$W_s = \frac{W_2 - W_1}{G_s \gamma_w A} = \frac{1.4819}{1.4819} = 1.4819$$
 cm. .5834 in.

WATER CONTENT

| SPECIMEN LOCATION | CONTAINER NO. | WT. CONTAINER + WET SOIL IN g | WT. CONTAINER + DRY SOIL IN g | WT. WATER, w_w IN g | WT. CONTAINER IN g | WT. DRY SOIL w_s IN g | WATER CONTENT, w , IN % |
|-------------------|---------------|-------------------------------|-------------------------------|-----------------------|--------------------|-------------------------|---------------------------|
| | | 467.9 | 437.8 | 30.1 | 309.2 | 128.6 | 23.4 |
| | | 471.2 | 437.8 | 33.4 | 309.2 | 128.6 | 26.0 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

REMARKS

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z ₃ IN in. | SAMPLE HEIGHT $Z_1 - Z_2 + Z_3$ IN in. | Z _H FROM DIAL CHANGE IN in. | VOID HEIGHT $Z_1 - Z_H$ IN in. | VOID RATIO $e = \frac{Z_1 - Z_H}{Z_H}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_v IN $\frac{cm^2}{sec}$ |
|---------------------------------|--------------------|-------------------|--------------------|-----------------------|--|--|--------------------------------|--|----------------------|-----|--|
| | | | | | | | | | 190 | 150 | |
| 0 | | .0000 | | | | 1.0039 | .4205 | .7208 | | | .8481 ² / 90 |
| 1/4 | | .0055 | .0055 | | | .9984 | .4150 | .7113 | 1.56 | | .13621 |
| 1/2 | | .0138 | .0083 | | | .9901 | .4067 | .6971 | 1.82 | | .11515 |
| 1 | | .0240 | .0102 | | | .9799 | .3965 | .6976 | 2.25 | | .09142 |
| 2 | | .0382 | .0142 | | | .9657 | .3823 | .6553 | 2.43 | | .08099 |
| 4 | | .0609 | .0227 | | | .9430 | .3596 | .6164 | 1.96 | | .09852 |
| 8 | | .0906 | .0297 | | | .9133 | .3299 | .5655 | 2.25 | | .08116 |
| 4 | | .0884 | +.0022 | | | .9155 | .3221 | .5693 | | | |
| 2 | | .0842 | +.0042 | | | .9197 | .3363 | .5764 | | | |
| | | | +.0056 | | | | | | | | |

CONSOLIDATION TEST

SOIL SAMPLE TP-7A

PROJECT NO. _____

BORING NO. _____ SAMPLE DEPTH _____

SAMPLE NO. _____

SPECIFIC GRAVITY, G_s _____

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 _____ cm. _____ in.
 CONTAINER DIAMETER _____ cm. _____ in.
 CONTAINER AREA, A , IN SQ. CM. _____
 THICKNESS, Z_2 _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 $\frac{1 \text{ kg.}}{\text{sq. cm.}} =$ _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. _____
 DATE _____
 TESTED BY _____

SOLIDS HEIGHT, $2H_0 = \frac{W_s}{G \gamma_w} A$ _____ cm. _____ in.
 DEGREE OF SATURATION IN %
 TEST START _____
 TEST END _____

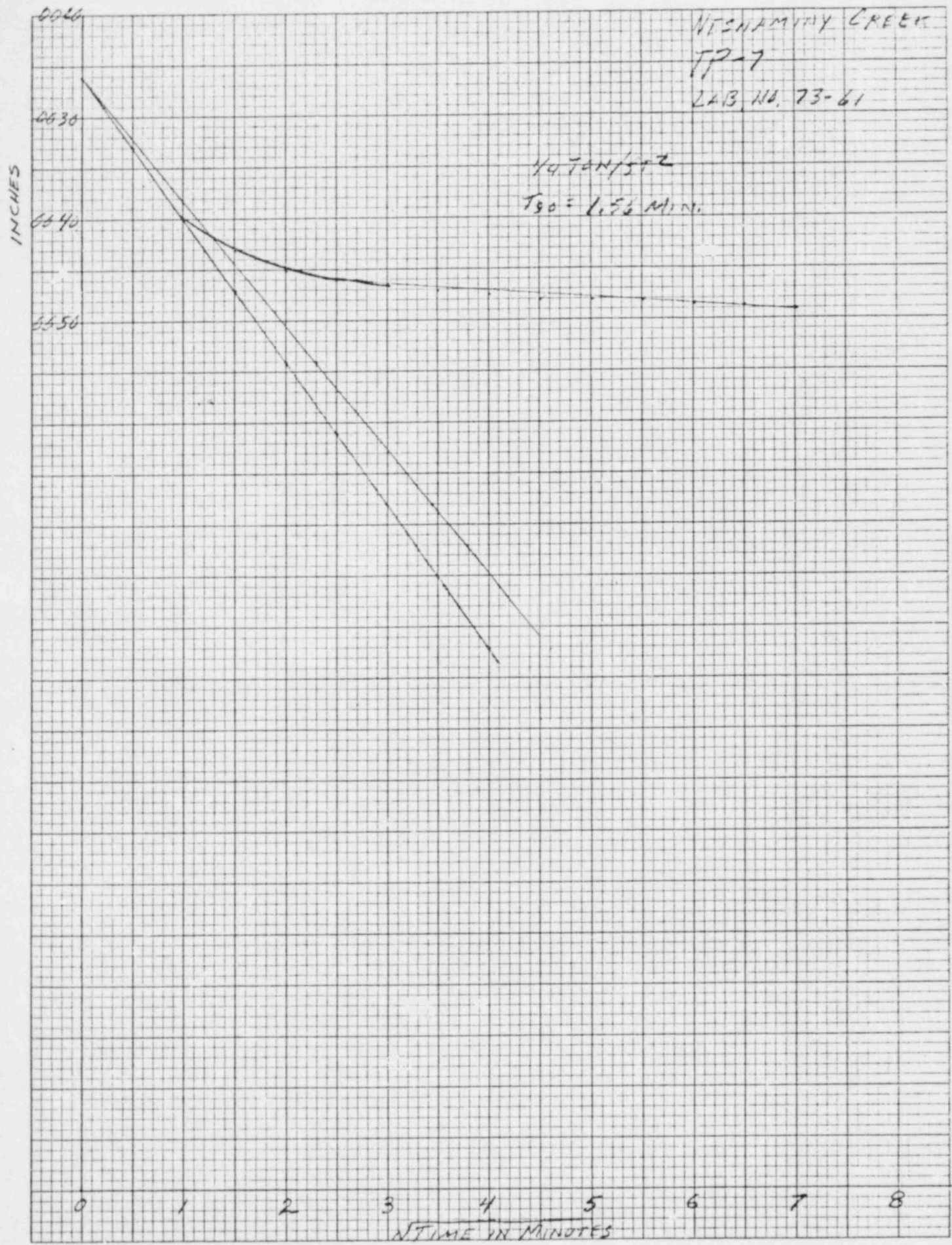
| WATER CONTENT | | SPECIMEN LOCATION | | | REMARKS |
|-------------------------------|--|-------------------|--|--|---------|
| | | | | | |
| CONTAINER NO. | | | | | |
| WT. CONTAINER + WET SOIL IN g | | | | | |
| WT. CONTAINER + DRY SOIL IN g | | | | | |
| WT. WATER, W_w IN g | | | | | |
| WT. CONTAINER IN g | | | | | |
| WT. DRY SOIL W_s IN g | | | | | |
| WATER CONTENT, w , IN % | | | | | |

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 + Z_2 + Z_3$ IN in. | $2H$ FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_0$ IN in. | VOID RATIO $e = \frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_v IN sq. cm. sec. |
|---------------------------------|--------------------|-------------------|--------------------|--------------|---|------------------------------|--------------------------------|---|----------------------|-----|--|
| | | | | | | | | | +90 | +50 | |
| 1 | | .0786 | | | | .9253 | .3419 | .5860 | | +50 | .848H ² / 90 |
| 1/4 | | .0625 | + .0161 | | | .9414 | .3580 | .6136 | | | |
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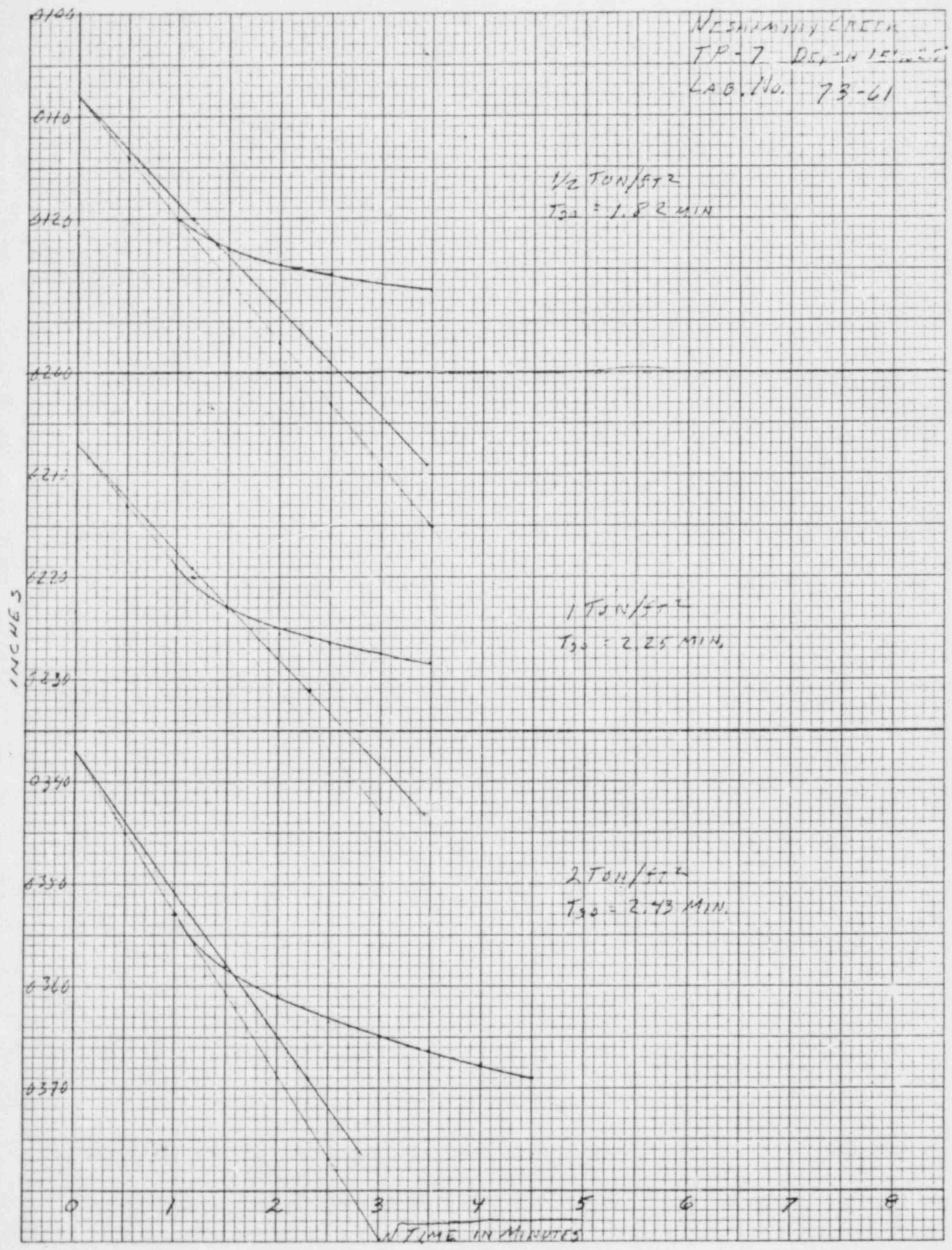
NICHAMINY CREEK

TP-7

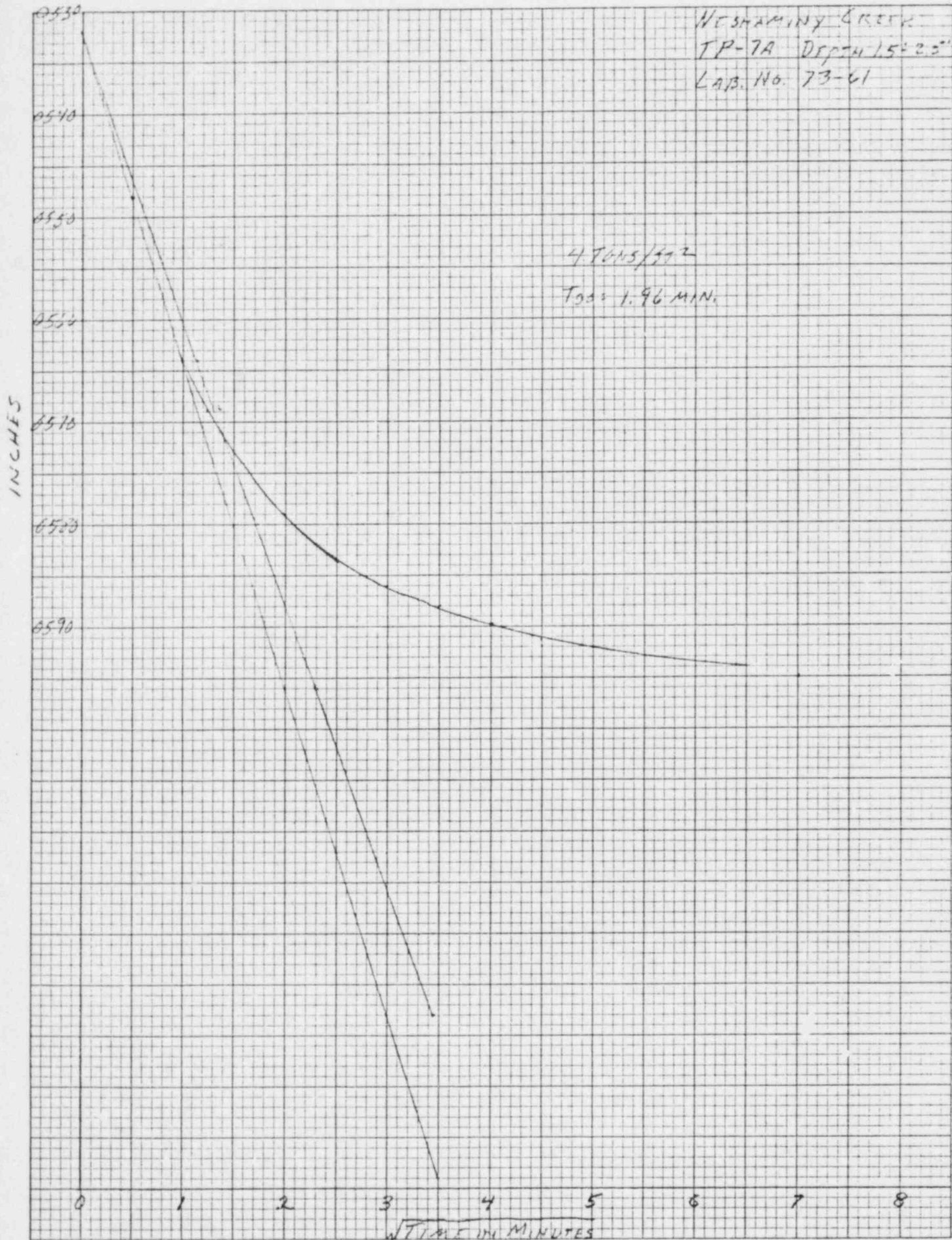
LAB. NO. 73-61



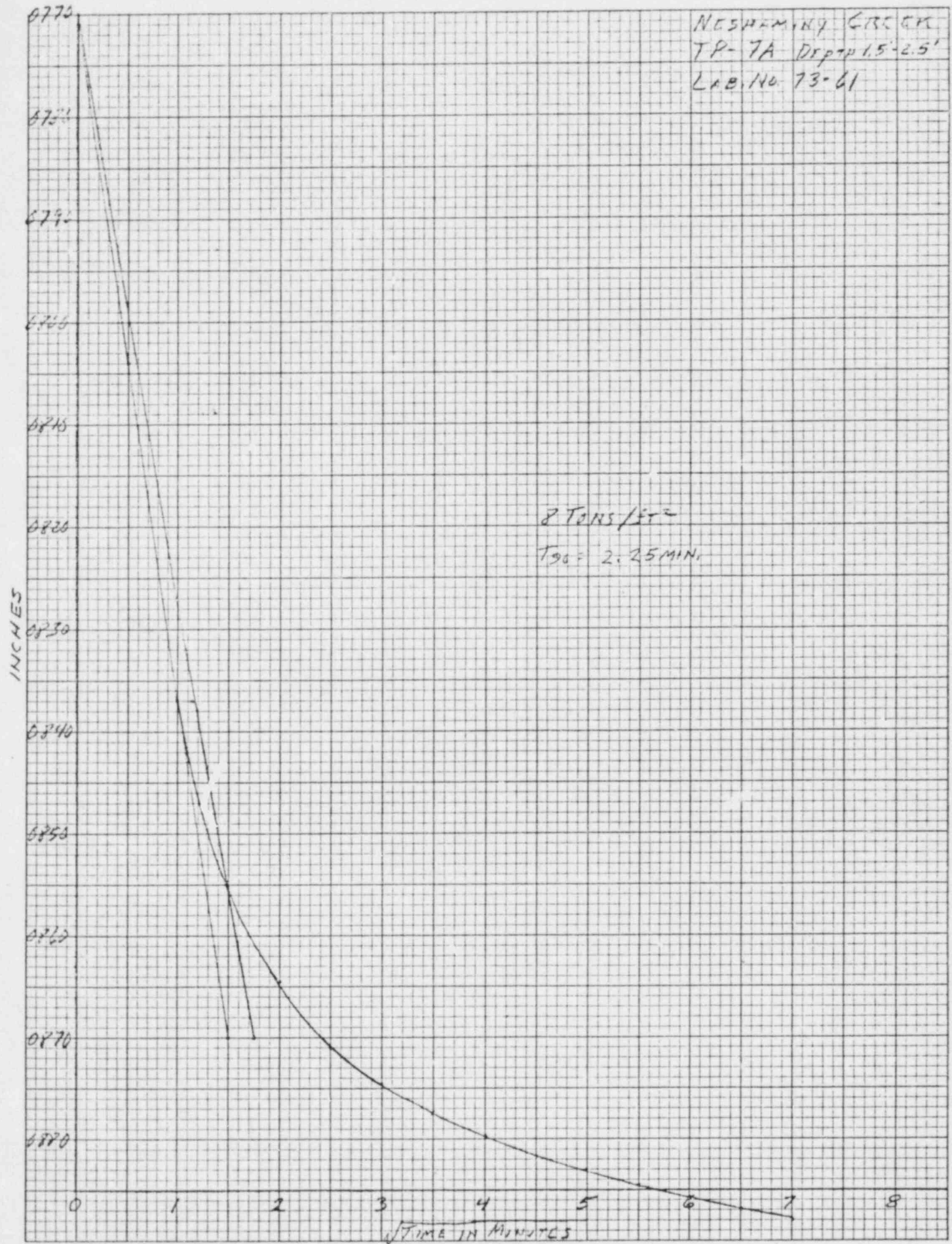
NESHAMINY CREEK
 TP-7 DEPTH 15 INCHES
 LAB. NO. 73-61



WESHAMINY CREEK
TP-7A DEPTH 15'-2.5"
LAB. NO. 73-61



NESHAMINY CREEK
TP-7A Depth 1.5-2.5'
LAB. NO. 73-61



MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Date 5-3-73
 Lab. No. 73-61

Sample Source TP-7A

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|----------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (~~cm~~) (inches) 9.75 x 9.5 x 11.25

Specimen Volume (~~cm³~~) (feet³)603

Weight of Container + Wet Specimen, (g) (pounds) 76.73

Weight of Container, (g) (pounds) 7.16

Wet weight of Specimen, (g) (pounds) 69.57

Wet Density, (g/cc) _____

Wet Density, (pcf) 115.4

Dry Density, (pcf) 91.6



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

Location Neshaminy Creek Specimen Measurements Test No. 73-61
 Boring No. TP-7A Depth 1.5'-2.5' Diameter 6.15 cc Date 5-5-73
 Sample No. TP-7-A Circumference _____ Tested By Frank
 Specific Gravity, G_s 2.74 Area, A 29.71^2
 Wet Wt. of Sample _____ Length, L 6.35
 Dry Wt. of Sample W_s 308.0 Volume of Sample 188.66 cm^3
 Volume of Solid Material = $V_s = W_s / G_s = \frac{308.0}{2.74} = 112.41 \text{ cc}$
 Void Ratio of Sample = $c = \frac{V - V_s}{V_s} = \frac{188.66 - 112.41}{112.41} = \frac{76.25}{112.41} = .6783$

Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm^2 | h_0 | h_1 | $\text{Log}_{10} h_0/h_1$ | k cm/sec. |
|---------|-----------------------|---------------|---------------------------------|-------|-------|---------------------------|-----------|
| 1:09:44 | | | | 70.0 | | | |
| 1:11:01 | | | | | 40.0 | | |
| | 77 | 50 | 1.67 | | | .24304 | .00259 |
| 1:15:08 | | | | 70.0 | | | |
| 1:15:59 | | | | | 50.0 | | |
| | 51 | 33 | 1.65 | | | .14613 | .00232 |
| 1:18:25 | | | | 70.0 | | | |
| 1:19:30 | | | | | 45.0 | | |
| | 65 | 42 | 1.68 | | | .19187 | .00247 |
| 1:21:45 | | | | 70.0 | | | |
| 1:23:03 | | | | | 40.0 | | |
| | 78 | 50 | 1.67 | | | .24304 | .00255 |
| 1:25:47 | | | | 70.0 | | | |
| 1:26:36 | | | | | 50.0 | | |
| | 49 | 33 | 1.65 | | | .14613 | .00242 |
| 1:27:12 | | | | 70.0 | | | |
| 1:28:17 | | | | | 45.0 | | |
| | 65 | 42 | 1.68 | | | .19187 | .00242 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

$$K = 2.3 \frac{aL}{At} \cdot \text{Log}_{10} \frac{h_0}{h_1}$$

$$a = \frac{Q}{h_1 - h_2}$$

Remarks Avg. K = .00245 cm/sec.

MICHAEL BAKER, JR., INC.
 BEAVER, PENNSYLVANIA
 Geotechnical Engineering
 Department

Project No. _____ Job No. 73-61
 Project Neshaminy Creek
 Hole No. 7-A Station _____ Offset _____
 Depth 1.5' - 2.5' Date Tested 5-16-73
 Tested by Frank

TEST FOR SPECIFIC GRAVITY

W_1 = Weight of Sample
 W_2 = Weight of Flask + H_2O
 W_3 = Weight of Flask + H_2O + Soil

$$V_1 = W_1 - (W_3 - W_2)$$

$$V_1 = W_1 - W_4$$

$$SG = \frac{W_1}{V_1}$$

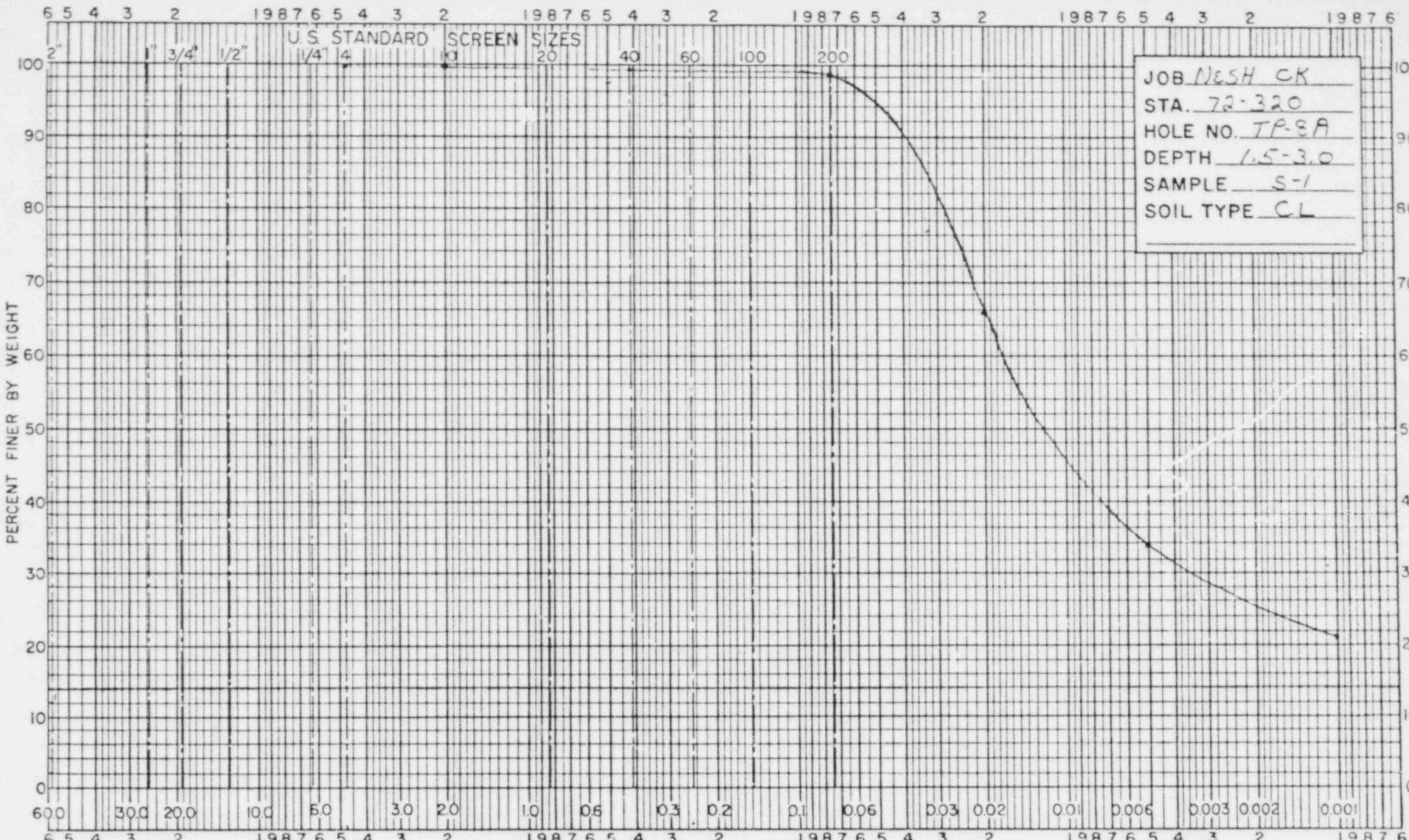
| Sample No. <u>A</u> | |
|---|---------------|
| Weight of Flask | <u>16.820</u> |
| Weight of Flask + Soil | <u>25.639</u> |
| Weight of Sample W_1 | <u>8.819</u> |
| Weight of Flask + H_2O = W_2 | <u>68.876</u> |
| Temperature | <u>24°</u> |
| Weight of Flask + H_2O + Soil = W_3 | <u>74.476</u> |
| | <u>68.876</u> |
| $W_3 - W_2 = W_4$ | <u>5.600</u> |
| | <u>8.819</u> |
| | <u>5.600</u> |
| $W_4 = V_1$ | <u>3.219</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| G. = $\frac{8.819}{3.219}$ | = <u>2.74</u> |

| Sample No. <u>B</u> | |
|--|----------------|
| 1. Weight of Flask | <u>47.404</u> |
| 2. Weight of Flask + Soil | <u>34.380</u> |
| 3. $W_3 - W_2 = W_4$ | <u>13.024</u> |
| 4. Weight of Flask + H_2O = W_2 | <u>129.448</u> |
| 5. Temperature | <u>24°</u> |
| 6. Weight of Flask + H_2O + Soil = W_3 | <u>74.476</u> |
| 7. W_2 | <u>139.448</u> |
| 8. $W_3 - W_2 = W_4$ | <u>8.270</u> |
| 9. W_1 | <u>13.024</u> |
| 10. W_4 | <u>8.270</u> |
| 11. $W_1 - W_4 = V$ | <u>4.754</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| SP. G. = $\frac{13.024}{4.754}$ | = <u>2.74</u> |

BRADSHAW RESERVOIR

TEST PIT 8-A

GRADATION CURVE



JOB NESH CK
 STA. 72-320
 HOLE NO. TP-8A
 DEPTH 1.5-3.0
 SAMPLE S-1
 SOIL TYPE CL

GRAIN SIZE IN MILLIMETERS

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|-------------------------|--------|------|-----------------------|--------|------|------------------------|--------|------|------------------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>L</u> | | | % SAND SIZES <u>L</u> | | | % SILT SIZES <u>64</u> | | | % CLAY SIZES <u>34</u> |



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS of SOILS

Project No. NESHAMINY CK
Laboratory No. 72-320
Test Bore TP8A Station S-1 Offset 15.30
Date Received 12-15-72 Date Tested 12-20-72
Tested By R.W.O.
Checked By _____

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.
% Passing #2 = 65.6
Frost Group = F4
Wt. of Wet Soil and Dish 27.44 B
Wt. of Dry Soil and Dish 23.65
Wt. of Water 3.79
Percent of Moisture 29.7 30.

SPECIFIC GRAVITY = 2.705 @ 20°C. NMC = 20.3%
Aggr = 1 Volume of Soil $V_s =$ c.c.
CS = 0 Apparent Sp. Gr. $\frac{W_s}{V_s} =$
FS = 1
S = 64
C = 34
LIQUID LIMIT

Wt. of Wet Soil and Dish 21.22 A B
Wt. of Dry Soil and Dish 19.50 21.42
Wt. of Water 1.72 1.70
Percent of Moisture 21.3 21.3

N = 25

Wt. of Dry Soil and Dish 23.65 A B
Wt. of Dish 6.3 18.89
Wt. of Dry Soil 12.76

PLASTIC LIMIT

Wt. of Wet Soil and Dish 21.22 A B
Wt. of Dry Soil and Dish 19.50 21.42
Wt. of Water 1.72 1.70
Percent of Moisture 21.3 21.3

Wt. of Dry Soil and Dish 19.50 A B
Wt. of Dish 11.42 11.45 H-10
Wt. of Dry Soil 8.08 8.25

PLASTICITY INDEX (LL.-P.L.) = 30 - 21 = 9 CL

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | |
|---|-------------------------------|--------------------------------|--------------------|------------|--------|
| Sieve Number | Retained | | | Cumulative | |
| | Weight (W ₁) g | Percent (W ₁) % | Per. Ret. (W) % | % Ret. | % Pass |
| 1" | — | | | | |
| 3/4" | | | | | |
| 1/2" | — | | | | |
| 3/8" | | | | | |
| No. 4 | 2.4 | 0.2 | | 0.2 | 99.8 |
| No. 10 | 5.1 | 0.3 | | 0.5 | 99.5 |
| No. 40 | | | | | 99.1 |
| No. 200 | | | | | 98.5 |
| Pass | | | | | |
| Total | 1589.9 | | | | |

| SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|----------------------|-------------|--------------------------------|------------------|-----------------|-----------------|
| Sieve Number | Particle Size mm. | Retained | | | Cumulative | |
| | | Weight g | Percent (W ₃) % | Percent (W) % | % Ret. (W) % | % Pass (W) % |
| 10 | 1.98 | | | | | |
| 20 | 0.833 | | | | | |
| 40 | 0.417 | 0.2 | 0.4 | | 0.4 | 99.6 |
| 60 | 0.246 | | | | | |
| 140 | 0.104 | | | | | |
| 200 | 0.074 | 0.3 | 0.6 | | 1.0 | 99.0 |
| Pass | No. 200 | | | | | |
| Total | | 50 | 100 | | | |

Original Sample W = g. 100%
Partial Sample W₁ = g. %
Partial Sample W₃ = g. %

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)
Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|------|-----------|-----------|--------------------|-----|------|-----------------------------------|----------------|----------------|----------------|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K ₁ | K _R | K _n | | | |
| | 1 | | | | | | | | .078 | | | |
| | 2 | | | | | | | | .055 | | | |
| 1:30 | 5 | 23.0 | 39.0 | 6.0 | 33.0 | 66.0 | | | .035 | .02 | 65.6 | |
| | 10 | | | | | | | | .025 | | | |
| | 15 | | | | | | | | .020 | | | |
| | 30 | | | | | | | | .014 | | | |
| 0:40 | 60 | 23.0 | 23.0 | 6.0 | 17.0 | 34.0 | | | .010 | .005 | 33.8 | |
| | 90 | | | | | | | | .008 | | | |
| 9:30 | 1440 | 23.5 | 16.5 | 5.9 | 10.6 | 21.2 | | | .002 | .001 | 21.1 | |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 RA ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the ratio of the Partial Sample, W₂, to the Total Sample, W.

FIELD DENSITY TEST - SAND CONE METHOD

Date of Test 10-25-72 Test No. #1
 Test Location POINT PLEASANT Highway Entrance
 Area Represented PAVING AREA
Test PIT 8-A
 Material Brown Clay-Lime Silty
 Layer Designation 1.5' - 2.0'
 Thickness _____

Sand Cone Apparatus Number #1
 Mode of Compaction _____
 Type of Compactor NONE
 Number of Passes NONE

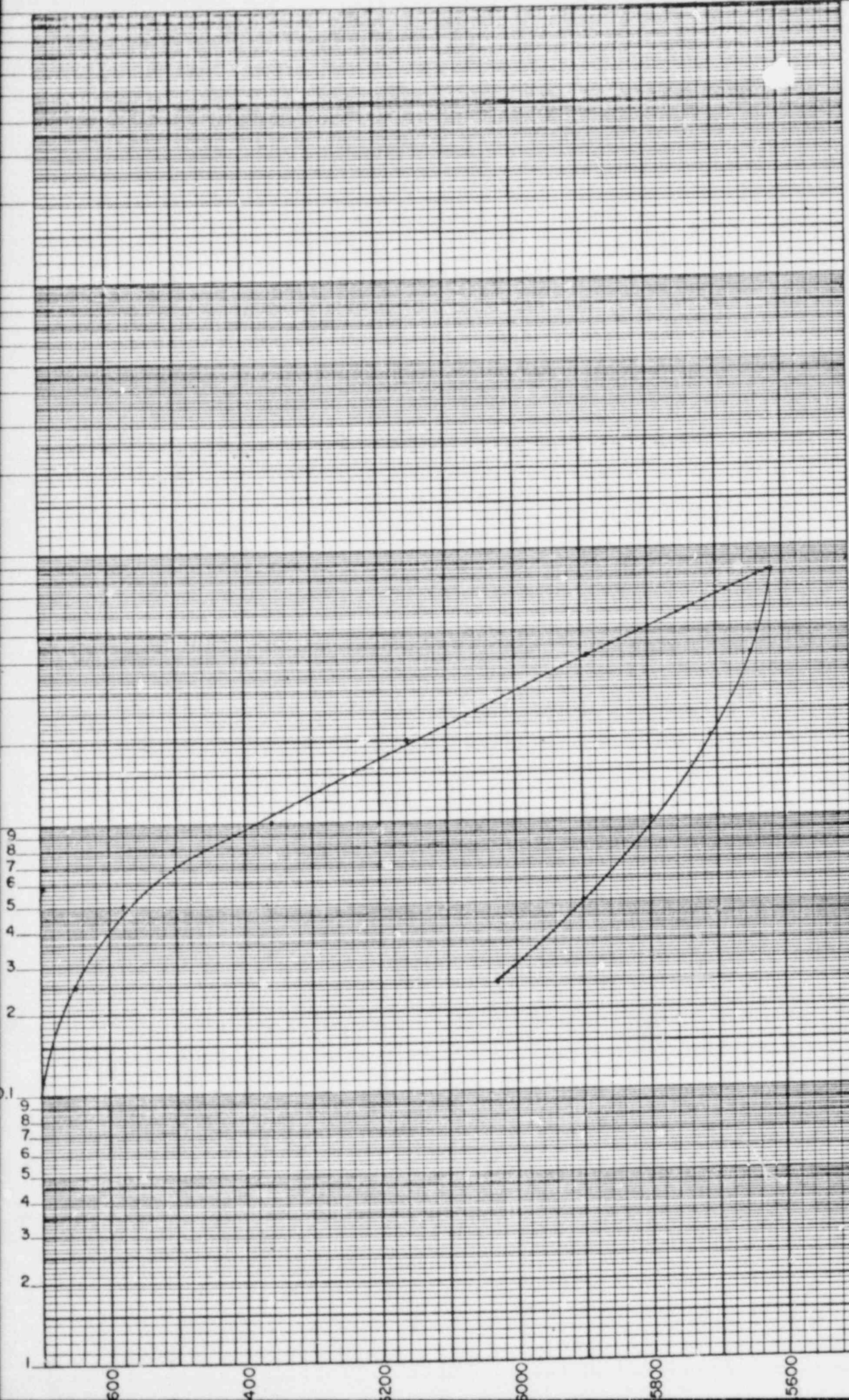
| | | | |
|-------------------------------|---|--------------|-------|
| <u>CALIBRATION</u> | (1) Weight of Container filled to valve with water | <u>5654</u> | gm |
| | (2) Deduct weight of empty container | <u>1664</u> | gm |
| | (3) Net weight of water in gm - Volume in cc | <u>3990</u> | cc |
| | (4) Weight of container plus funnel, filled with sand | <u>7810</u> | gm |
| | (5) Close valve, empty funnel and reweigh; deduct | <u>6001</u> | gm |
| | (6) Weight of sand in funnel | <u>1809</u> | gm |
| <u>VOLUME OF HOLE</u> | (7) Weight of sand plus apparatus before test | <u>7792</u> | gm |
| | (8) Deduct weight of sand plus apparatus after test | <u>3283</u> | gm |
| | (9) Weight of sand emptied from container | <u>4506</u> | gm |
| | Deduct (6) Weight of sand in funnel | <u>1809</u> | gm |
| | (10) Weight of sand remaining in hole | <u>2697</u> | gm |
| | (11) Bulk Density of Sand: | | |
| | (11a) Enter (7) Sand plus apparatus before test | <u>7792</u> | gm |
| | (11b) Deduct (2) Weight of Apparatus | <u>1664</u> | gm |
| | (11c) Weight of sand in container | <u>6128</u> | gm |
| | (11d) Enter (3) Container Volume | <u>3990</u> | cc |
| | (11e) Divide (11c) by (11d) = Bulk Density | <u>1.536</u> | gm/cc |
| | (12) Divide (10) by (11e) = Volume of hole | <u>1686</u> | cc |
| <u>SAMPLE TAKEN FROM HOLE</u> | (13) Weight of total sample taken from hole plus can | <u>3254</u> | gm |
| | (14) Deduct tare weight of can | <u>377</u> | gm |
| | (15) Net weight of sample as taken | <u>2877</u> | gm |

| | | | |
|---|--|----------------|-------------------------|
| <u>MOISTURE CONTENT</u> | | When Compacted | When Tested |
| (16) Weight of wet sample plus can | | <u>3254</u> gm | <u>1967.6</u> gm |
| (17) Deduct weight of dry sample plus can | | _____ gm | <u>1609.5</u> gm |
| (18) Weight of water contained in sample | | _____ gm | <u>358.1</u> gm |
| (19) Tare Number and Weight # _____ | | _____ gm | # _____ <u>110.1</u> gm |
| (20) Net Weight of dry sample, (17) - (19) | | _____ gm | <u>1499.4</u> gm |
| (21) Moisture content, (18) divided by (20) | | _____ % | <u>23.9</u> % |

| | | | |
|--|--|-------------------|---------------------------|
| <u>DENSITY COMPUTATION</u> | | (For correlation) | (For density Computation) |
| (22) Wet density | $\frac{\text{Item (15)}}{\text{Item (12)}} \times 62.4$ | | <u>110.4</u> lb./cu. ft. |
| (23) Dry Density | $\frac{\text{Item (22)}}{1.00 \text{ plus Item (21) "when tested"}}$ | | <u>89.1</u> lb./cu. ft. |
| (24) Optimum dry density from compaction tests | | | _____ lb./cu. ft. |
| (25) Percent of optimum dry density obtained in field | Item (23) expressed as a percent of Item (24) | | _____ % |
| (26) Specified minimum allowable percentage of optimum dry density | | | _____ % |

(27) THE ABOVE TEST INDICATES SOIL IN AREA REPRESENTED (HAS, HAS NOT) BEEN COMPACTED TO THE DENSITY REQUIRED BY THE GOVERNING SPECIFICATIONS. Remarks: _____

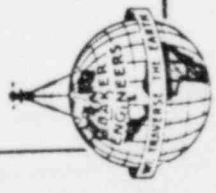
Signed _____



Class CL
 Depth 1.5' to 2.5'
 Sheet 1 of 6

Project No. Cont. 24 Subs. Inv. Lab. No. 73-64
 Test For Neshaminy Water Res. Auth. Point Pleasant Pumping Fac.
 Test Bore TP-8A Station Offset
 Date Received Date Tested 5-17-73

MICHAEL BAKER, JR., INC.
 ROCHESTER, PENNSYLVANIA
 SOILS DIVISION



CONSOLIDATION TEST

SOIL SAMPLE Neshaminy Creek
 PROJECT NO. TP-8A SAMPLE DEPTH _____
 BORING NO. _____
 SAMPLE NO. 2.72
 SPECIFIC GRAVITY, G_s , 2.72

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 , 2.55 cm, 10.020 in.
 CONTAINER DIAMETER, D , 2.5 in.
 CONTAINER AREA, A , IN SQ. CM, 31.57
 STONE + COVER
 THICKNESS, Z_2 _____ cm, _____ in.

LAB. NO. 73-64
 DATE 5-17-73
 TESTED BY Frank

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____
 SOLIDS HEIGHT, $2H_0 = \frac{W_s}{G_s \gamma_w A} = \frac{1.5209}{1.4 \times 1.0} = 1.5209$ cm, .5988 in.
 DEGREE OF SATURATION IN %
 TEST START 71.4
 TEST END 104.2

WATER CONTENT

| SPECIMEN LOCATION | CONTAINER NO. | WT. CONTAINER + WET SOIL IN g | WT. CONTAINER + DRY SOIL IN g | WT. WATER, w_w IN g | WT. CONTAINER IN g | WT. DRY SOIL w_s IN g | WATER CONTENT, w , IN % |
|-------------------|---------------|-------------------------------|-------------------------------|-----------------------|--------------------|-------------------------|---------------------------|
| | | 463.0 | 439.9 | 23.1 | 309.3 | 130.6 | 17.7 |
| | | 469.8 | 439.9 | 29.9 | 309.3 | 130.6 | 22.9 |
| | | | | | | | |
| | | | | | | | |
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REMARKS

| APPLIED PRESSURE IN kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 - Z_2 + Z_3$ IN in. | 2H FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_0$ IN in. | VOID RATIO $e = \frac{2H - 2H_0}{2H_0}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_c IN sq. cm./sec. |
|---------------------------------|--------------------|-------------------|--------------------|--------------|---|----------------------------|--------------------------------|---|----------------------|-----|--|
| | | | | | | | | | 190 | 150 | |
| 0 | | .0000 | | | | 1.0020 | .4032 | .6733 | | | .8481 / 190 |
| 1/4 | | .0037 | .0037 | | | .9983 | .3995 | .6672 | 1.69 | | .12547 |
| 1/2 | | .0092 | .0055 | | | .9928 | .3940 | .6580 | 2.16 | | .09727 |
| 1 | | .0224 | .0132 | | | .9796 | .3808 | .6359 | 2.56 | | .08054 |
| 2 | | .0344 | .0120 | | | .9676 | .3688 | .6159 | 2.25 | | .09125 |
| 4 | | .0505 | .0161 | | | .9515 | .3527 | .5890 | 3.13 | | .06236 |
| 8 | | .0726 | .0221 | | | .9294 | .3306 | .5521 | 2.40 | | .07812 |
| 4 | | .0708 | +.0018 | | | .9312 | .3324 | .5551 | | | |
| 2 | | .0672 | +.0036 | | | .9348 | .3360 | .5611 | | | |
| | | | +.0050 | | | | | | | | |

CONSOLIDATION TEST

SOIL SAMPLE _____

 PROJECT NO. _____
 BORING NO. TP-8A SAMPLE DEPTH _____
 SAMPLE NO. _____
 SPECIFIC GRAVITY, G_s _____

APPARATUS MEASUREMENTS
 CONTAINER HEIGHT, Z_1 _____ cm. _____ in.
 CONTAINER DIAMETER _____ cm. _____ in.
 CONTAINER AREA, A , IN sq. cm. _____
 STONE + COVER
 THICKNESS, Z_2 _____ cm. _____ in.

APPLIED LOADS
 SIDE FRICTION ALLOWANCE IN % _____
 1 kg./sq. cm. = _____ lbs. SCALE LOAD
 TARE IN lbs. _____

LAB. NO. _____
 DATE _____
 TESTED BY _____

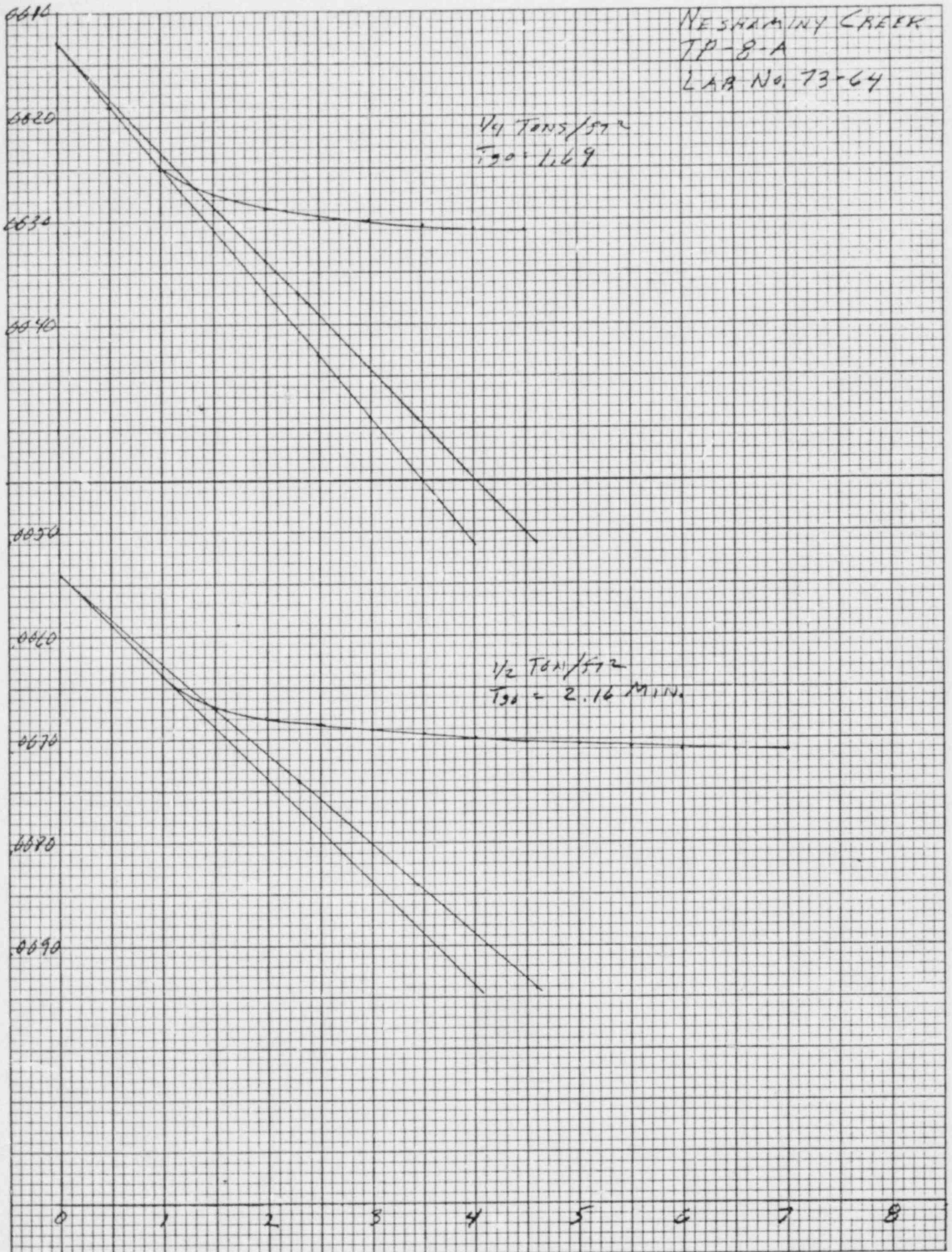
SOLIDS HEIGHT, $2H_o = \frac{W_s}{G_s \gamma_w A} =$ _____ cm. _____ in.
 DEGREE OF SATURATION IN %
 TEST START _____
 TEST END _____

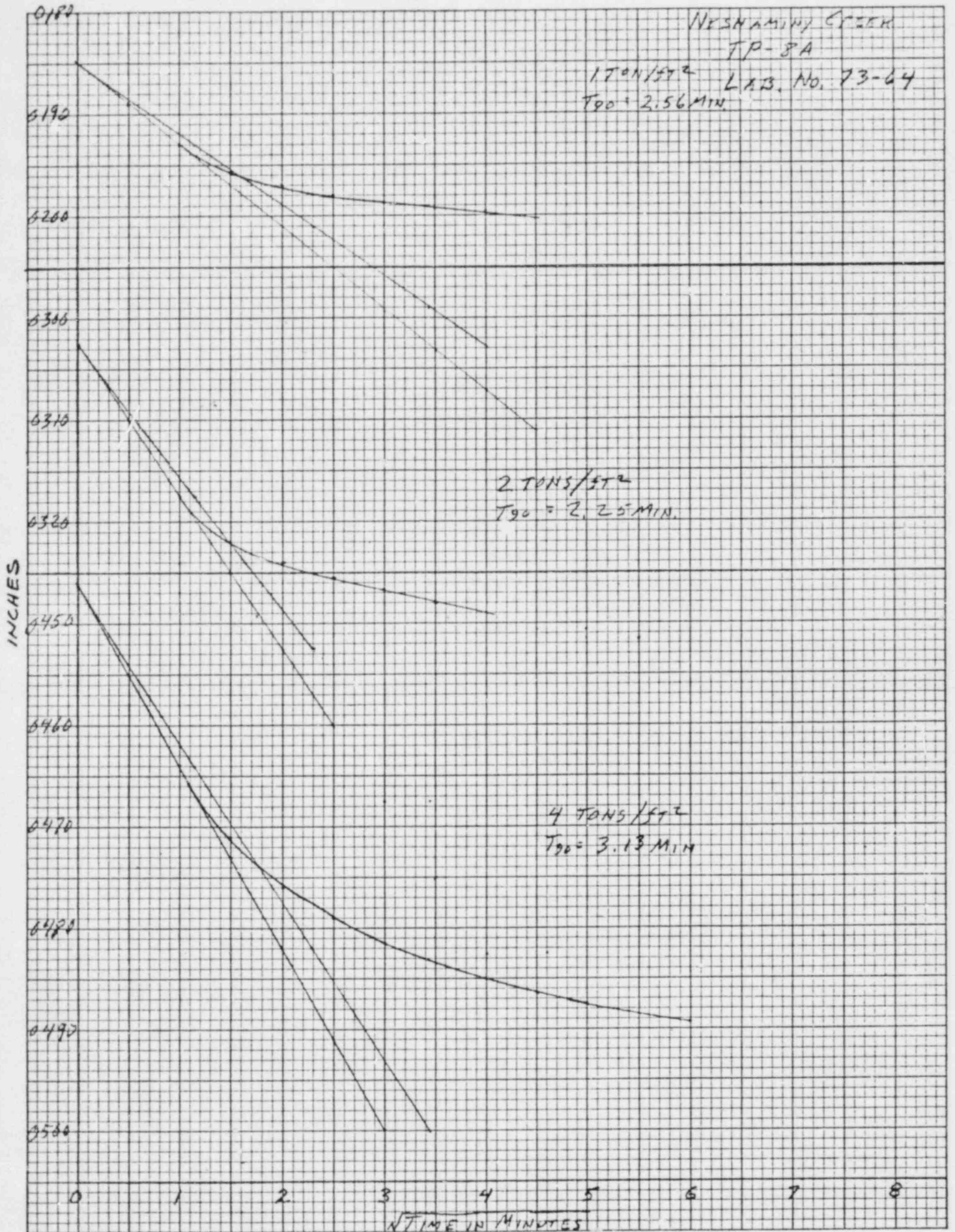
WATER CONTENT

| SPECIMEN LOCATION | | | | | | | | | | REMARKS |
|-------------------------------|--|--|--|--|--|--|--|--|--|---------|
| CONTAINER NO. | | | | | | | | | | |
| WT. CONTAINER + WET SOIL IN g | | | | | | | | | | |
| WT. CONTAINER + DRY SOIL IN g | | | | | | | | | | |
| WT. WATER, W_w IN g | | | | | | | | | | |
| WT. CONTAINER IN g | | | | | | | | | | |
| WT. DRY SOIL W_s IN g | | | | | | | | | | |
| WATER CONTENT, w , IN % | | | | | | | | | | |

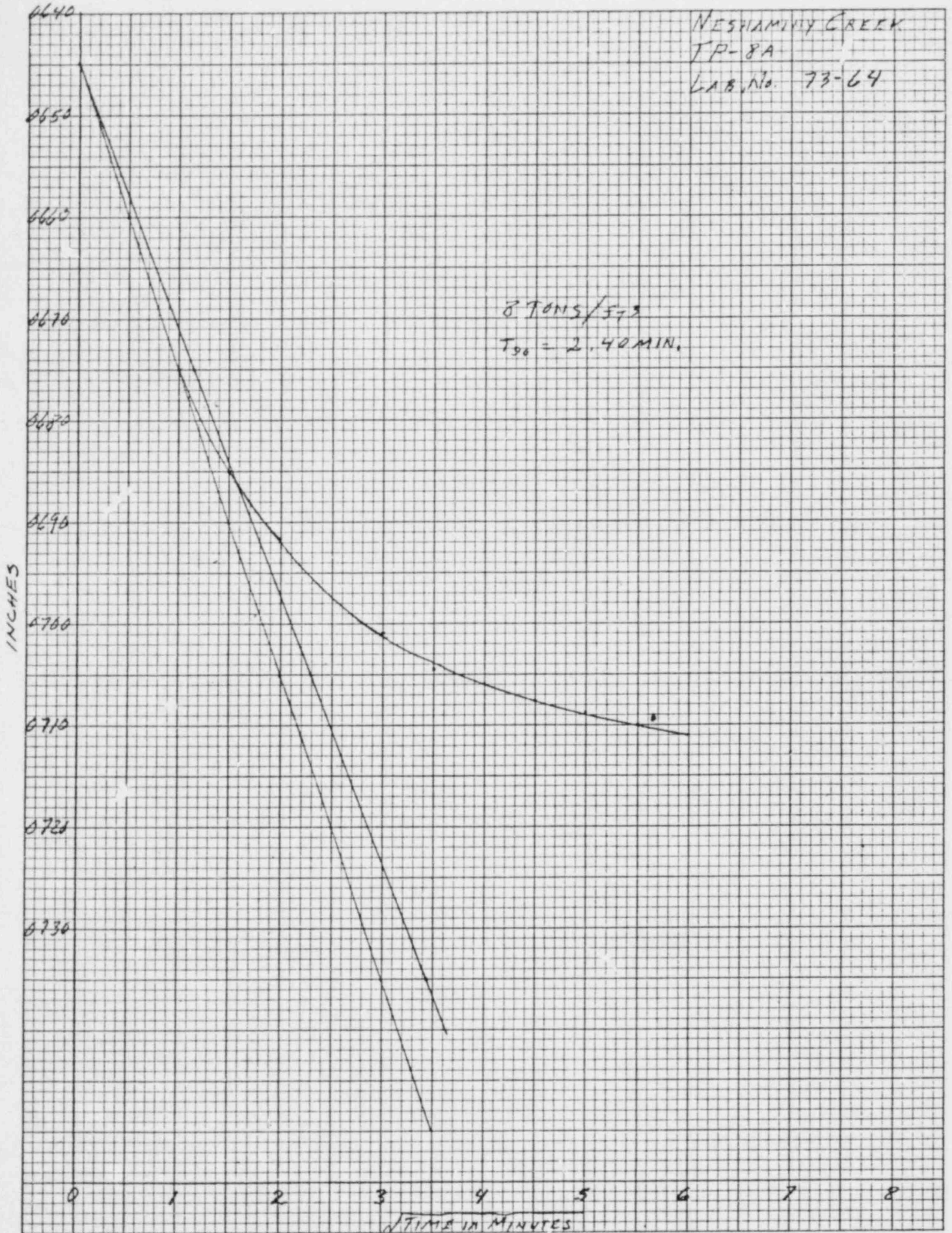
| APPLIED PRESSURE 1/4 kg./sq. cm. | SCALE LOAD IN lbs. | FINAL DIAL IN in. | DIAL CHANGE IN in. | Z_3 IN in. | SAMPLE HEIGHT $2H = Z_1 - Z_2 + Z_3$ IN in. | 2H FROM DIAL CHANGE IN in. | VOID HEIGHT $2H - 2H_o$ IN in. | VOID RATIO $e = \frac{2H - 2H_o}{2H_o}$ | FITTING TIME IN sec. | | COEF. OF CONSOL. C_v IN sq. cm./sec. | |
|-------------------------------------|-----------------------|----------------------|-----------------------|-----------------|---|-------------------------------|--------------------------------------|--|----------------------|------|--|--------------------------------------|
| | | | | | | | | | + 90 | + 50 | .848H ² / _{+ 90} | .197H ² / _{+ 50} |
| 1 | | .0622 | | | | .9398 | .3410 | .5695 | | | | |
| | | | + .0063 | | | | | | | | | |
| 1/2 | | .0559 | | | | .9461 | .3473 | .5800 | | | | |
| | | | + .0077 | | | | | | | | | |
| 1/4 | | .0482 | | | | .9538 | .3550 | .5928 | | | | |
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NESHAMINY CREEK
TP-8-A
LAB No. 73-64





NESHAMINY CREEK
TP-8A
LAB. No. 73-64



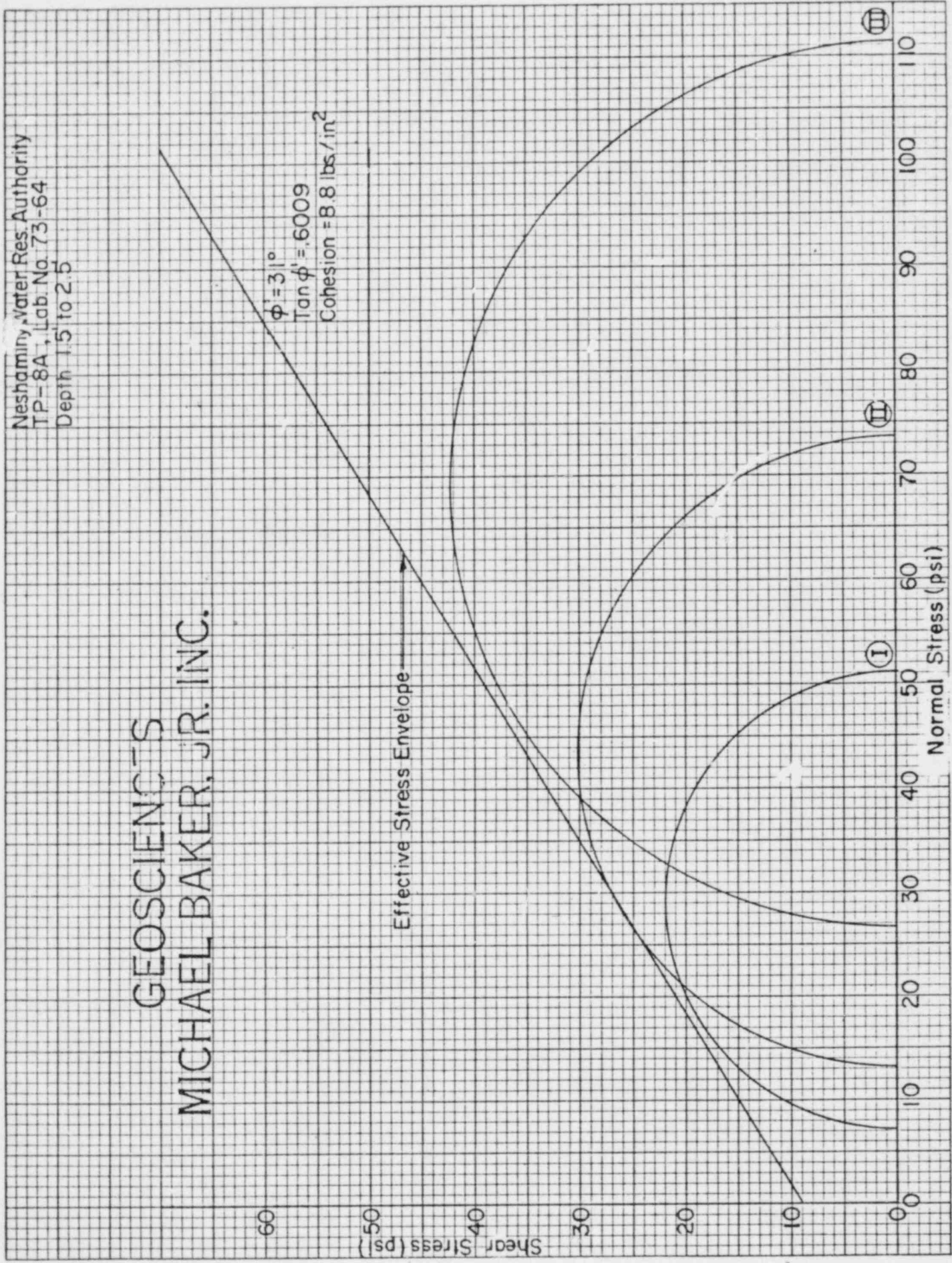
cu

Neshaminy Water Res. Authority
TP-8A, Lab. No. 73-64
Depth 1.5' to 2.5'

GEOSCIENCES MICHAEL BAKER, JR. INC.

$\phi' = 31^\circ$
 $\tan \phi' = .6009$
Cohesion = 8.8 lbs./in²

Effective Stress Envelope



Normal Stress (psi)

Shear Stress (psi)

Neshaminy Water Res. Authority
TP-8A, Lab. No. 73-64
Depth 1.5' to 2.5'

$\phi = 29^{\circ}30'$
 $\tan \phi = .5658$
Cohesion = 9.0 lbs./in.²

Total Stress Envelope

70
60
50
40
30
20
10
0

Shear Stress (psi)

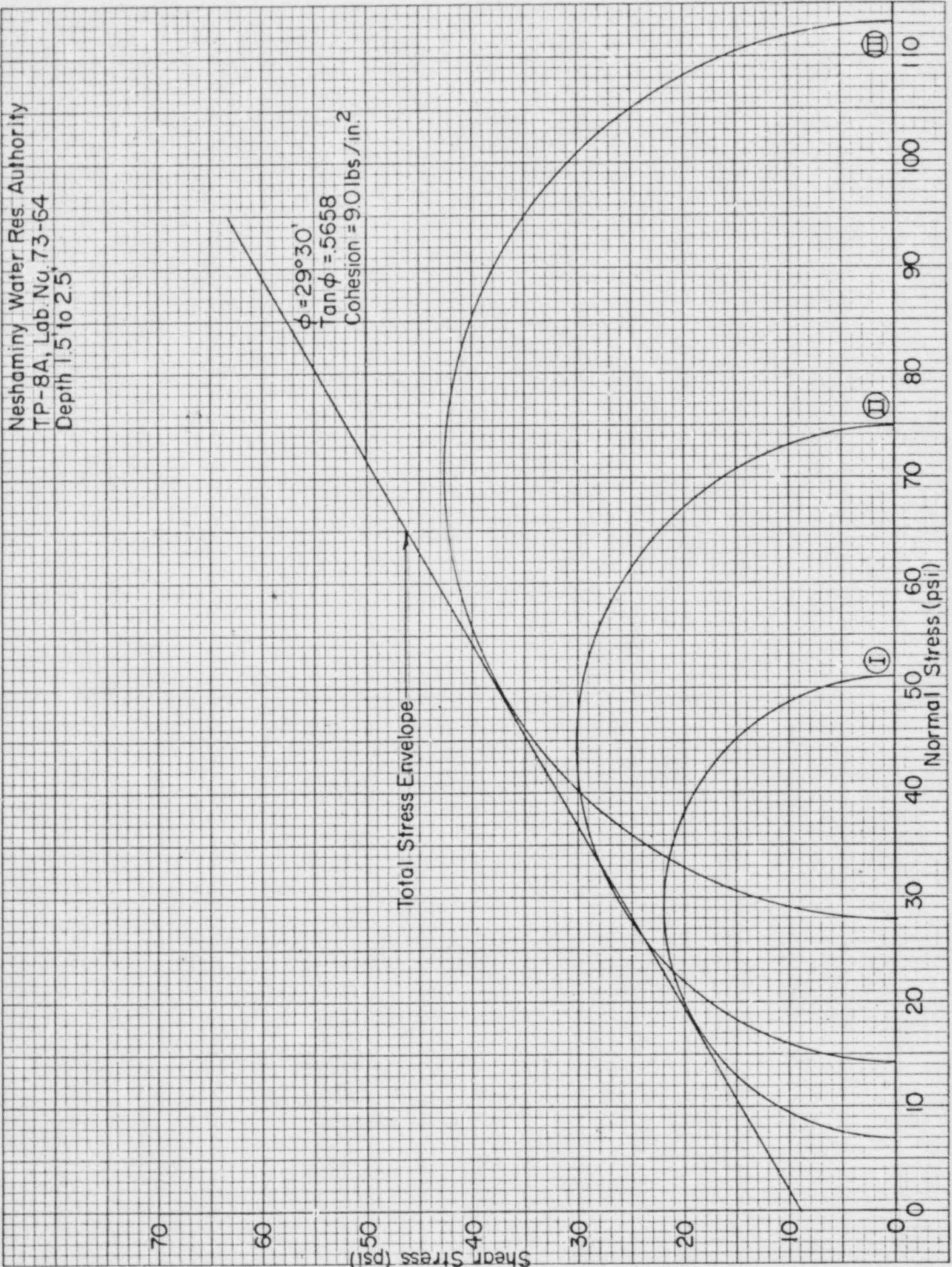
Normal Stress (psi)

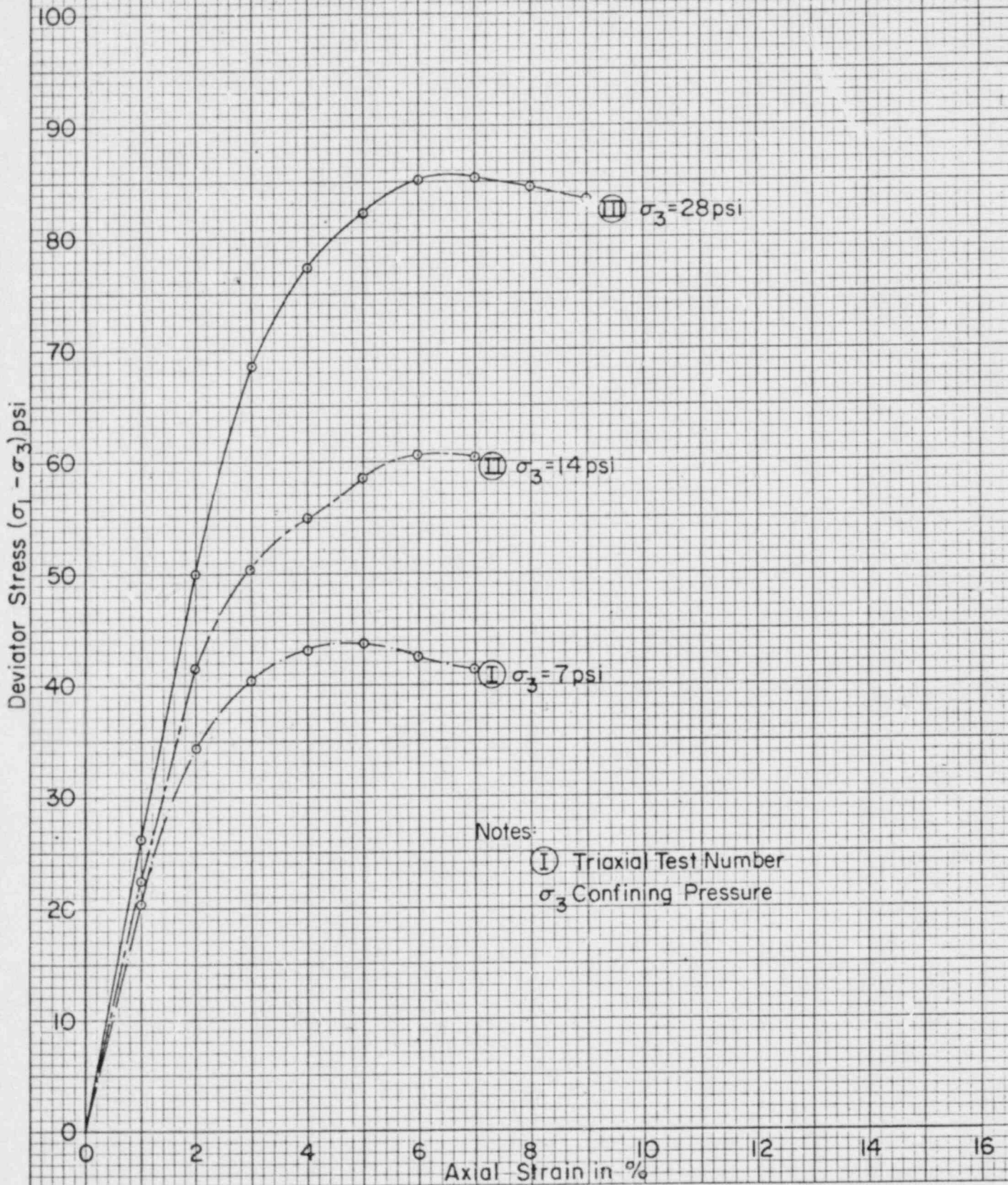
110
100
90
80
70
60
50
40
30
20
10
0

III

II

I

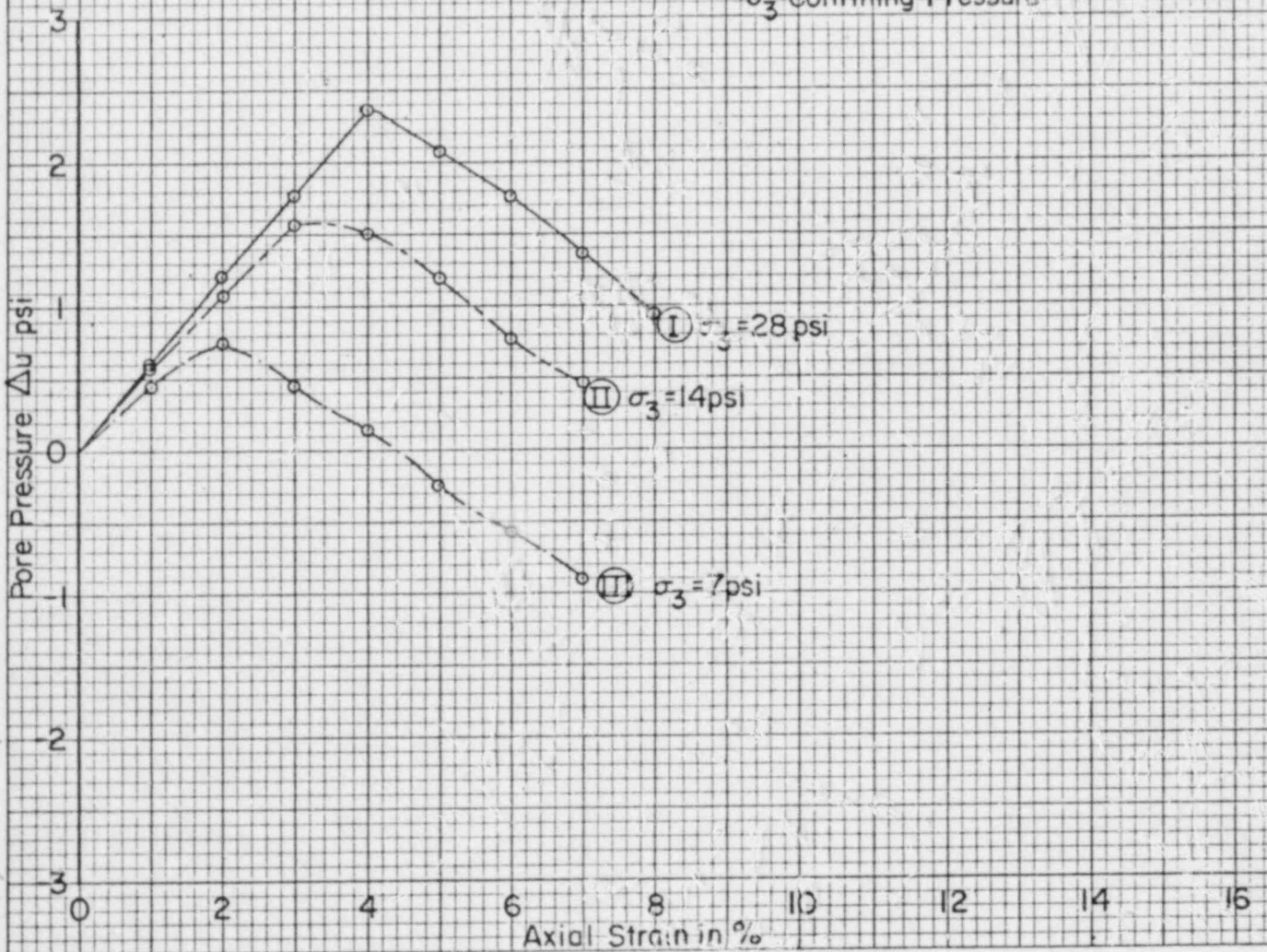




Notes:

- ① Triaxial Test Number
- σ_3 Confining Pressure

Notes: ① Triaxial Test Number
 σ_3 Confining Pressure



MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Sample Source TP-8A

Date 5-4-73
 Lab. No. 73-64

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|----------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (cm) (inches) 9.12 x 9.50 x 11.25

Specimen Volume (cm³) (feet³)564

Weight of Container + Wet Specimen, (g) (pounds) 69.65

Weight of Container, (g) (pounds) 7.17

Wet weight of Specimen, (g) (pounds) 62.48

Wet Density, (g/cc) _____

Wet Density, (pcf) 110.8

Dry Density, (pcf) 92.1

MICHAEL BAKER, JR., INC.
 GEOTECHNICAL ENGINEERING DEPARTMENT
 BEAVER, PENNSYLVANIA

Date 5-4-73
 Lab. No. 73-64

Sample Source TP-8A

WATER CONTENT & UNIT DENSITY DETERMINATION

WATER CONTENT DETERMINATION

| | | |
|----------------------------------|--|--|
| Specimen Location | | |
| Container No. | | |
| Wt. Container + Wet Soil in G | | |
| Wt. Container + Dry Soil in G | | |
| Wt. Water, W_w in G | | |
| Wt. Container in G | | |
| Wt. Dry Soil W_s in G | | |
| Water Content, W in % | | |

DENSITY DETERMINATION

Specimen Dimension (cm) (inches)912 x 9.50 x 11.25

Specimen Volume (cm³) (feet³)564

Weight of Container + Wet Specimen, (g) (pounds) 69.65

Weight of Container, (g) (pounds) 7.17

Wet weight of Specimen, (g) (pounds) 62.48

Wet Density, (g/cc) _____

Wet Density, (pcf) 110.8

Dry Density, (pcf) 92.1



MICHAEL BAKER, JR., INC.
Beaver, Pennsylvania

Geotechnical Engineering Department
Falling Head Permeability Test

Location Neshaminy Creek Specimen Measurements Test No. 73-64
 Boring No. TP-8A Depth _____ Diameter 6.17 cm Date 5-25-73
 Sample No. TP-8-A Circumference _____ Tested By _____
 Specific Gravity, G_s 2.72 Area, A 29.90 cm²
 Wet Wt. of Sample _____ Length, L 6.23 cm
 Dry Wt. of Sample W_s 303.4 Volume of Sample 186.28
 Volume of Solid Material = $V_s = W_s / G_s = \underline{111.54}$ cc
 Void Ratio of Sample = $c = \frac{V - V_s}{V_s} = \frac{186.28 - 111.54}{111.54} = \frac{74.74}{111.54} = \underline{.67007}$

Test Data

| Time | Elapsed Time (t) Sec. | Quantity Q cc | Area of Burette a cm ² | h_0 | h_1 | $\text{Log}_{10} h_0/h_1$ | k cm/sec. |
|----------|-----------------------|---------------|-----------------------------------|-------|-------|---------------------------|-----------|
| 3:45:00 | | | | 79.3 | | | |
| 4:00:00 | | | | | 61.0 | | |
| | 900 | 30.5 | 1.67 | | | .11394 | .000101 |
| 4:05:00 | | | | 78.0 | | | |
| 4:20:00 | | | | | 61.2 | | |
| | 900 | 28 | 1.67 | | | .10534 | .000094 |
| 4:25:00 | | | | 78.1 | | | |
| 4:45:00 | | | | | 55.7 | | |
| | 1200 | 37.5 | 1.67 | | | .14675 | .000099 |
| 8:50:00 | | | | 85.0 | | | |
| 9:10:00 | | | | | 66.5 | | |
| | 1200 | 31 | 1.68 | | | .10653 | .000072 |
| 9:15:00 | | | | 79.8 | | | |
| 9:45:00 | | | | | 55.1 | | |
| | 1800 | 42 | 1.70 | | | .16077 | .000073 |
| 9:50:00 | | | | 79.2 | | | |
| 10:15:00 | | | | | 58.5 | | |
| | 1500 | 35.0 | 1.69 | | | .13156 | .000071 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

$$K = 2.3 \frac{aL}{At} \cdot \text{Log}_{10} \frac{h_0}{h_1}$$

$$a = \frac{Q}{h_1 - h_2}$$

Remarks Avg. K = .000085 cm/sec.

MICHAEL BAKER, JR., INC.
 BEAVER, PENNSYLVANIA
 Geotechnical Engineering
 Department

Project No. _____ Job No. 73-64
 Project Neshaminy Creek
 Hole No. TP-8A Station _____ Offset _____
 Depth _____ Date Tested 5-18-73
 Tested by Frank

TEST FOR SPECIFIC GRAVITY

V_1 = Weight of Sample
 W_2 = Weight of Flask + H_2O
 W_3 = Weight of Flask + H_2O + Soil

$$V_1 = W_1 - (W_3 - W_2)$$

$$V_1 = W_1 - W_4$$

$$SG = \frac{W_1}{V_1}$$

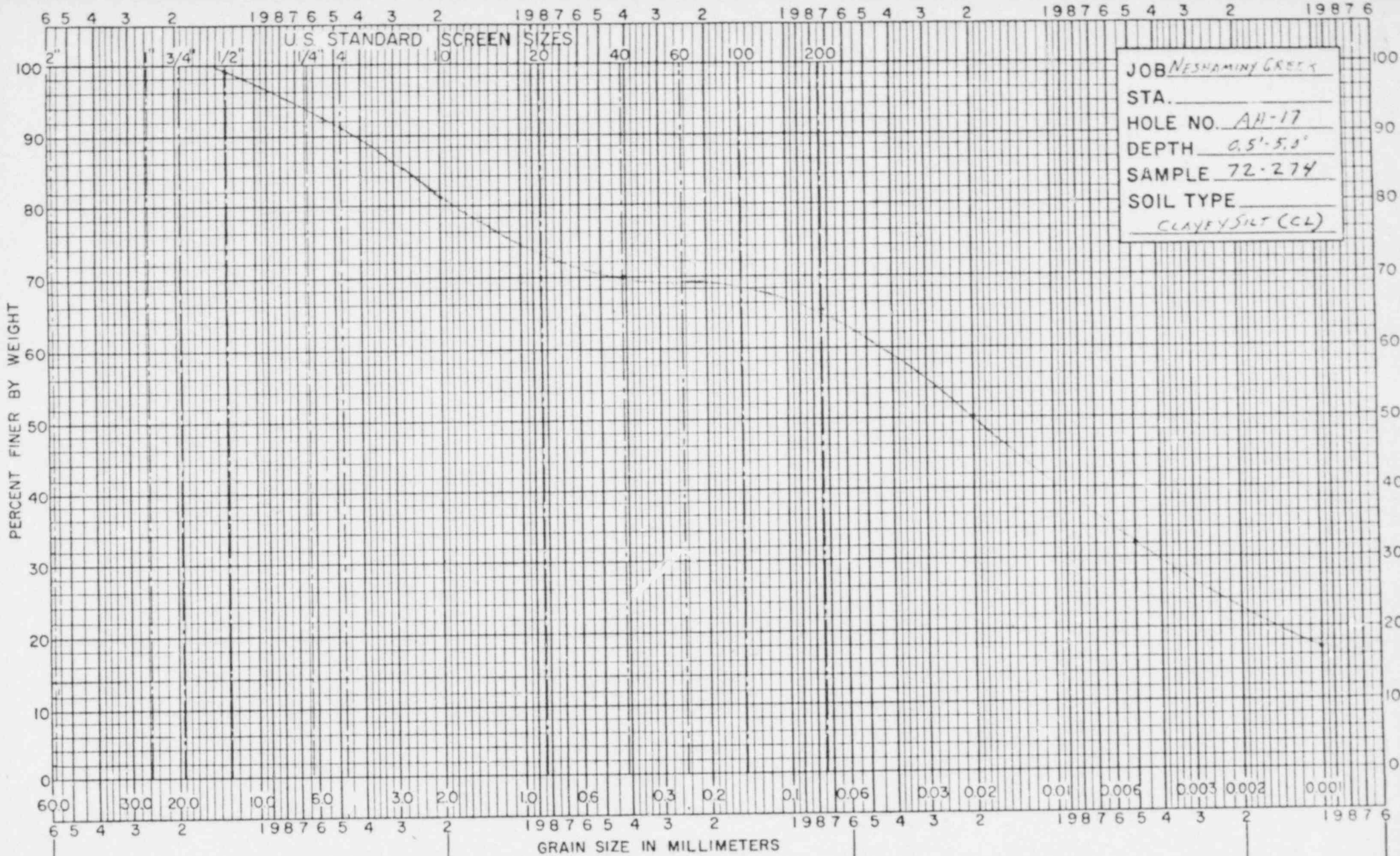
| Sample No. <u>1</u> | |
|---|---------------|
| Weight of Flask | <u>16.811</u> |
| Weight of Flask + Soil | <u>28.688</u> |
| Weight of Sample W_1 | <u>11.877</u> |
| Weight of Flask + H_2O = W_2 | <u>68.888</u> |
| Temperature | <u>23° C</u> |
| Weight of Flask + H_2O + Soil = W_3 | <u>764.11</u> |
| | <u>68.888</u> |
| $W_3 - W_2 = W_4$ | <u>7.523</u> |
| | <u>11.877</u> |
| | <u>7.523</u> |
| $W_4 = V_1$ | <u>4.354</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| G. = $\frac{11.877}{4.354}$ | = <u>2.72</u> |

| Sample No. <u>2</u> | |
|--|----------------|
| 1. Weight of Flask | <u>16.831</u> |
| 2. Weight of Flask + Soil | <u>26.377</u> |
| 3. $2 - 1$ Weight of Sample W_1 | <u>9.546</u> |
| 4. Weight of Flask + H_2O W_2 | <u>68.911</u> |
| 5. Temperature | <u>21° C</u> |
| 6. Weight of Flask + H_2O + Soil = W_3 | <u>74.944</u> |
| 7. W_2 | <u>68.911</u> |
| 8. $W_3 - W_2 = W_4$ | <u>6.033</u> |
| 9. W_1 | <u>9.546</u> |
| 10. W_4 | <u>6.033</u> |
| 11. $W_1 - W_4 = V$ | <u>3.513</u> |
| Specific Gravity = $\frac{W_1}{V_1}$ | |
| SP. G. = $\frac{9.546}{3.513}$ | = <u>2.717</u> |

BRADSHAW RESERVOIR

AUGER HOLES

17, 21, 24 & 28



JOB NESHAMINY CREEK
 STA. _____
 HOLE NO. AH-17
 DEPTH 0.5'-5.0'
 SAMPLE 72-274
 SOIL TYPE _____
CLAYEY SILT (CL)

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|--------------------------|--------|------|------------------------|--------|------|------------------------|--------|------|------------------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>19</u> | | | % SAND SIZES <u>16</u> | | | % SILT SIZES <u>33</u> | | | % CLAY SIZES <u>32</u> |



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Project No. NESHAMINY CREEK
Laboratory No. 72-274 5451
Test Bore AH-17 Station _____ Offset _____
Date Received 11-8-72 Date Tested 11-9-72
Tested By FRANK
Checked By _____

SPECIFIC GRAVITY

NMC = 15.4%

Wt. of Dry Soil and Flask $W_1 =$ _____ g.
Wt. of Flask No. $W_2 =$ _____ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ _____ g.
% Passing $C_2 =$ 50.1%

Aggr = 19
CS = 11
FS = 5
S = 33
C = 32

Volume of Soil $V_s =$ _____ c.c.
Apparent Sp. Gr. $= \frac{W_0}{V_s} =$ _____

LIQUID LIMIT

Frost Group = F-4

| | A | B |
|--------------------------|--------------|-----------|
| Wt. of Wet Soil and Dish | <u>27.93</u> | |
| Wt. of Dry Soil and Dish | <u>23.73</u> | |
| Wt. of Water | <u>4.00</u> | |
| Percent of Moisture | <u>29.8</u> | <u>30</u> |

$N =$ 28

| | A | B |
|--------------------------|--------------|---|
| Wt. of Dry Soil and Dish | <u>25.93</u> | |
| Wt. of Dish | <u>10.50</u> | |
| Wt. of Dry Soil | <u>13.43</u> | |

PLASTIC LIMIT

| | A | B |
|--------------------------|--------------|--------------|
| Wt. of Wet Soil and Dish | <u>21.31</u> | <u>21.57</u> |
| Wt. of Dry Soil and Dish | <u>19.63</u> | <u>19.79</u> |
| Wt. of Water | <u>1.68</u> | <u>1.78</u> |
| Percent of Moisture | <u>21.1</u> | <u>22.0</u> |

| | A | B |
|--------------------------|--------------|--------------|
| Wt. of Dry Soil and Dish | <u>19.63</u> | <u>19.79</u> |
| Wt. of Dish | <u>11.69</u> | <u>11.71</u> |
| Wt. of Dry Soil | <u>7.95</u> | <u>8.08</u> |

PLASTICITY INDEX (LL.-P.L.) = 30 - 21 = 9

CL

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | | | |
|--|----------------------------|-----------------------------|---------------|-------------|-------------|---|-------------------|------------|-----------------------------|---------------|--------------|--------------|-------------|--|
| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | | Sieve Number | Particle Size mm. | Retained | | | Cumulative | | | |
| | Weight (W ₁) g | Percent (W ₁) % | | % Ret. (%) | % Pass (%) | | | Weight g | Percent (W ₃) % | Percent (W) % | % Ret. (W) % | % Pass (W) % | | |
| 1" | — | | | | | 10 | 1.93 | | | | | | | |
| 3/4" | | | | | | 20 | 0.833 | | | | | | | |
| 1/2" | <u>8.9</u> | <u>1.0</u> | | <u>1.0</u> | <u>99.0</u> | 40 | 0.417 | <u>6.6</u> | <u>13.2</u> | | | <u>13.2</u> | <u>86.8</u> | |
| 3/8" | | | | | | 60 | 0.246 | | | | | | | |
| No. 4 | <u>65.0</u> | <u>7.7</u> | | <u>8.7</u> | <u>91.3</u> | 140 | 0.104 | | | | | | | |
| No. 10 | <u>29.6</u> | <u>10.5</u> | | <u>19.2</u> | <u>80.8</u> | 200 | 0.074 | <u>3.2</u> | <u>6.4</u> | | | <u>19.6</u> | <u>80.4</u> | |
| No. 40 | | | | <u>70</u> | | Pass | No. 200 | | | | | | | |
| No. 200 | | | | <u>65</u> | | | Total | <u>50</u> | <u>100</u> | | | | | |
| Pass | | | | | | | | | | | | | | |
| Total | <u>849.1</u> | | | | | | | | | | | | | |

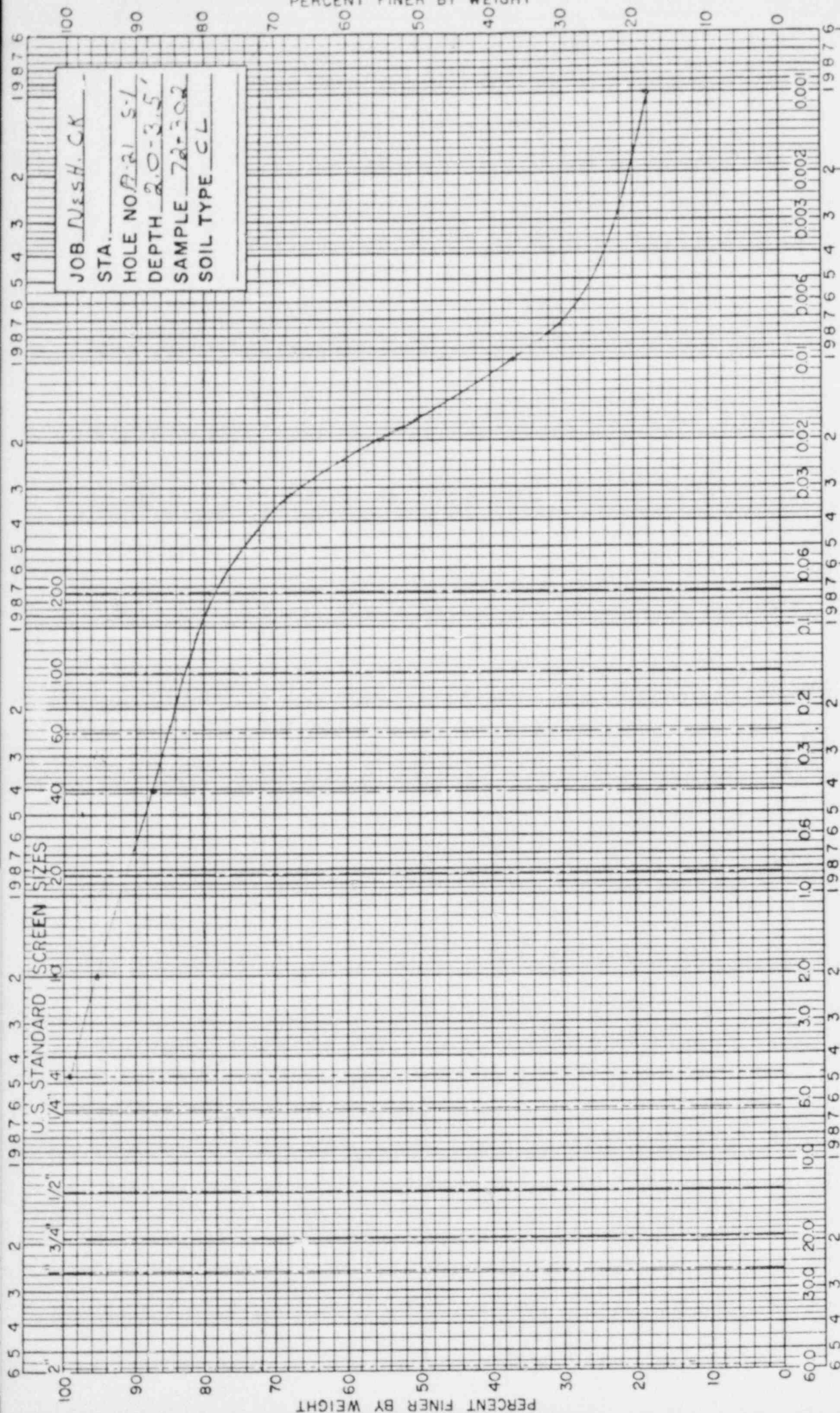
Original Sample W = _____ g. 100%
Partial Sample W₁ = _____ g. %
Partial Sample W₃ = _____ g. %

HYDROMETER ANALYSIS OF MATERIAL PASSING No. _____ SIEVE (W₂)

Hydrometer No. _____ Sp. Gr. Corr a _____ Wt. of Sample W₃ _____ Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|--------------|-----------|-------------|--------------------|------------|-------------|--------------------------------|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ΔR | R | | K1 | Kg | KD | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| <u>8:55</u> | 5 | <u>24.5</u> | <u>36.5</u> | <u>5.5</u> | <u>31.0</u> | <u>62.0</u> | | | | .035 | <u>.02</u> | <u>50.1</u> |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| <u>10:05</u> | 60 | <u>24.5</u> | <u>25.0</u> | <u>5.5</u> | <u>19.5</u> | <u>39.0</u> | | | | .010 | <u>.005</u> | <u>32</u> |
| | 90 | | | | | | | | | .008 | | |
| <u>2:40</u> | 1440 | <u>25.0</u> | <u>16.0</u> | <u>5.4</u> | <u>10.6</u> | <u>21.2</u> | | | | .002 | <u>.001</u> | <u>17</u> |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 RA ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



JOB NESH. CK
 STA. _____
 HOLE NO. A-21 S-1
 DEPTH 2.0-3.5'
 SAMPLE 72-302
 SOIL TYPE CL

GRAIN SIZE IN MILLIMETERS

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|-------------------------|--------|------|------------------------|--------|------|------------------------|--------|------|--------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | % CLAY SIZES |
| | | | | | | | | | <u>36</u> |
| % GRAVEL SIZES <u>4</u> | | | % SAND SIZES <u>17</u> | | | % SILT SIZES <u>43</u> | | | |

Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT

MICHAEL BAKER, JR., INC.



MICHAEL BAKER, JR., INC.

ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG

LIMITS of SOILS

Project No. NESHAMINY CK.
 Laboratory No. 72-302
 Test Date A-21 Station S-1 Offset 2.0-3.5
 Date Received 12-8-72 Date Tested 12-11-72
 Tested By R. D. ROOTH
 Checked By _____

Wt. of Dry Soil and Flask $W_1 =$
 Wt. of Flask No. $W_2 =$
 Wt. of Dry Soil $W_1 - W_2 = W_0 =$
 % Passing 02 = 56.4
 Frost Group = F4

SPECIFIC GRAVITY

NMC = 18.0%

Aggr. = 4
 CS = 9
 FS = 8
 S = 43
 C = 26

Volume of Soil $V_s =$ c.c.
 Apparent Sp. Gr. = $\frac{W_0}{V_s} =$

LIQUID LIMIT

Wt. of Wet Soil and Dish
 Wt. of Dry Soil and Dish
 Wt. of Water
 Percent of Moisture
28.22 24.09 4.13 32.1 30

$N = 16$

Wt. of Dry Soil and Dish
 Wt. of Dish
 Wt. of Dry Soil
24.09 11.22 12.87

PLASTIC LIMIT

Wt. of Wet Soil and Dish
 Wt. of Dry Soil and Dish
 Wt. of Water
 Percent of Moisture
21.23 23.78 1.55 21.68 1.68 2.10 22.0 21.9

Wt. of Dry Soil and Dish
 Wt. of Dish
 Wt. of Dry Soil
19.55 21.68 11.92 12.08 7.63 9.60

PLASTICITY INDEX (LL.-P.L.) = 30 - 22 = 8

CL

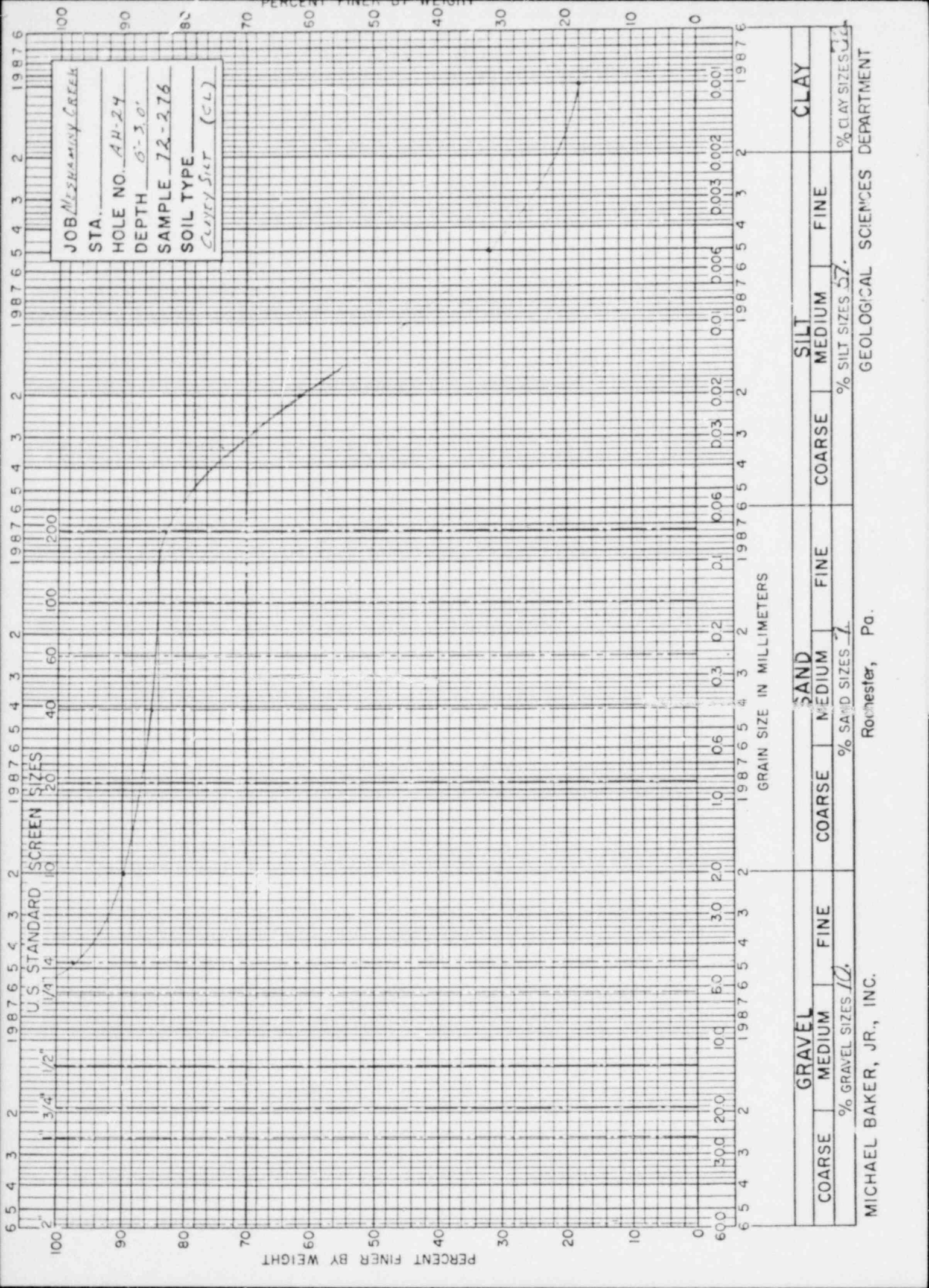
| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|----------------------------|-----------------------------|---------------|------------|--------|---|-------------------|----------|-----------------------------|---------------|--------------|--------------|
| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | | Sieve Number | Particle Size mm. | Retained | | | Cumulative | |
| | Weight (W ₁) g | Percent (W ₁) % | | % Ret. | % Pass | | | Weight g | Percent (W ₃) % | Percent (W) % | % Ret. (W) % | % Pass (W) % |
| 1" | | | | | | 10 | 1.98 | | | | | |
| 3/4" | | | | | | 20 | 0.833 | | | | | |
| 1/2" | | | | | | 40 | 0.417 | 4.6 | 9.2 | | 9.2 | 90.8 |
| 3/8" | | | | | | 60 | 0.246 | | | | | |
| No. 4 | 3.2 | 0.9 | | 0.9 | 99.1 | 140 | 0.104 | | | | | |
| No. 10 | 12.4 | 3.5 | | 4.4 | 95.6 | 200 | 0.074 | 4.1 | 8.2 | | 17.4 | 82.6 |
| No. 40 | | | | | 86.8 | Pass | No. 200 | | | | | |
| No. 200 | | | | | 79.0 | Total | | 50 | 100 | | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | | |
| Total | 354.5 | | | | | Partial Sample W ₁ = g. % | | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. 10 SIEVE (W₂)

Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ 50 Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|------|-----------|-----------|--------------------|----|------|--------------------------------|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲H | R | | K1 | Kg | Kn | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 8:30 | 5 | 23.0 | 35.5 | 60 | 29.5 | 59.0 | | | | .035 | .02 | 56.4 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 9:40 | 60 | 23.0 | 25.0 | 60 | 19.0 | 38.0 | | | | .010 | .005 | 26.2 |
| | 90 | | | | | | | | | .008 | | |
| 8:30 | 1440 | 23.0 | 16.0 | 60 | 10.0 | 20.0 | | | | .002 | .001 | 19.1 |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



JOB NEZHAMINY CREEK
 STA. _____
 HOLE NO. AH-24
 DEPTH 6'-3.0'
 SAMPLE 72-276
 SOIL TYPE _____
CLAYEY SILT (CL)

| GRAVEL | | SAND | | SILT | | CLAY | |
|--------------------|--------|-----------------|--------|------------------|--------|------------------|------|
| COARSE | MEDIUM | COARSE | MEDIUM | COARSE | MEDIUM | FINE | FINE |
| % GRAVEL SIZES 10. | | % SAND SIZES 7. | | % SILT SIZES 57. | | % CLAY SIZES 60. | |
| | | | | | | | |

MICHAEL BAKER, JR., INC.

Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT



MICHAEL BAKER, JR., INC.
ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG
LIMITS OF SOILS

Project No. NESHAMINY Creek
Laboratory No. 72-276 0-3'
Test Bore AH-24 Station..... Offset.....
Date Received 11-22-72 Date Tested 11-23-72
Tested By R. Dorothy
Checked By.....

SPECIFIC GRAVITY

NMC = 22.2%

Wt. of Dry Soil and Flask $W_1 =$ g.
Wt. of Flask No. $W_2 =$ g.
Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.

Aggr = 10
CS = 5
FS = 2
S = 51
C = 32

Volume of Soil $V_s =$ c.c.
Apparent Sp. Gr. = $\frac{W_0}{V_s} =$

% Passing 0.2 = 55.1

Frost Group = F-4

LIQUID LIMIT

Wt. of Wet Soil and Dish A 27.91
Wt. of Dry Soil and Dish B 23.95
Wt. of Water 3.96
Percent of Moisture 30.5 = 30

$N = 22$

Wt. of Dry Soil and Dish A 23.95
Wt. of Dish B 10.95
Wt. of Dry Soil 13.00

PLASTIC LIMIT

Wt. of Wet Soil and Dish A 21.30 B 22.59
Wt. of Dry Soil and Dish 19.51 20.62
Wt. of Water 1.79 1.97
Percent of Moisture 21.6 21.0

Wt. of Dry Soil and Dish A 19.51 B 20.62
Wt. of Dish F-2 11.22 11.22 E-1
Wt. of Dry Soil 8.29 9.40

PLASTICITY INDEX (LL - P.L.) = 30 - 21 = 9

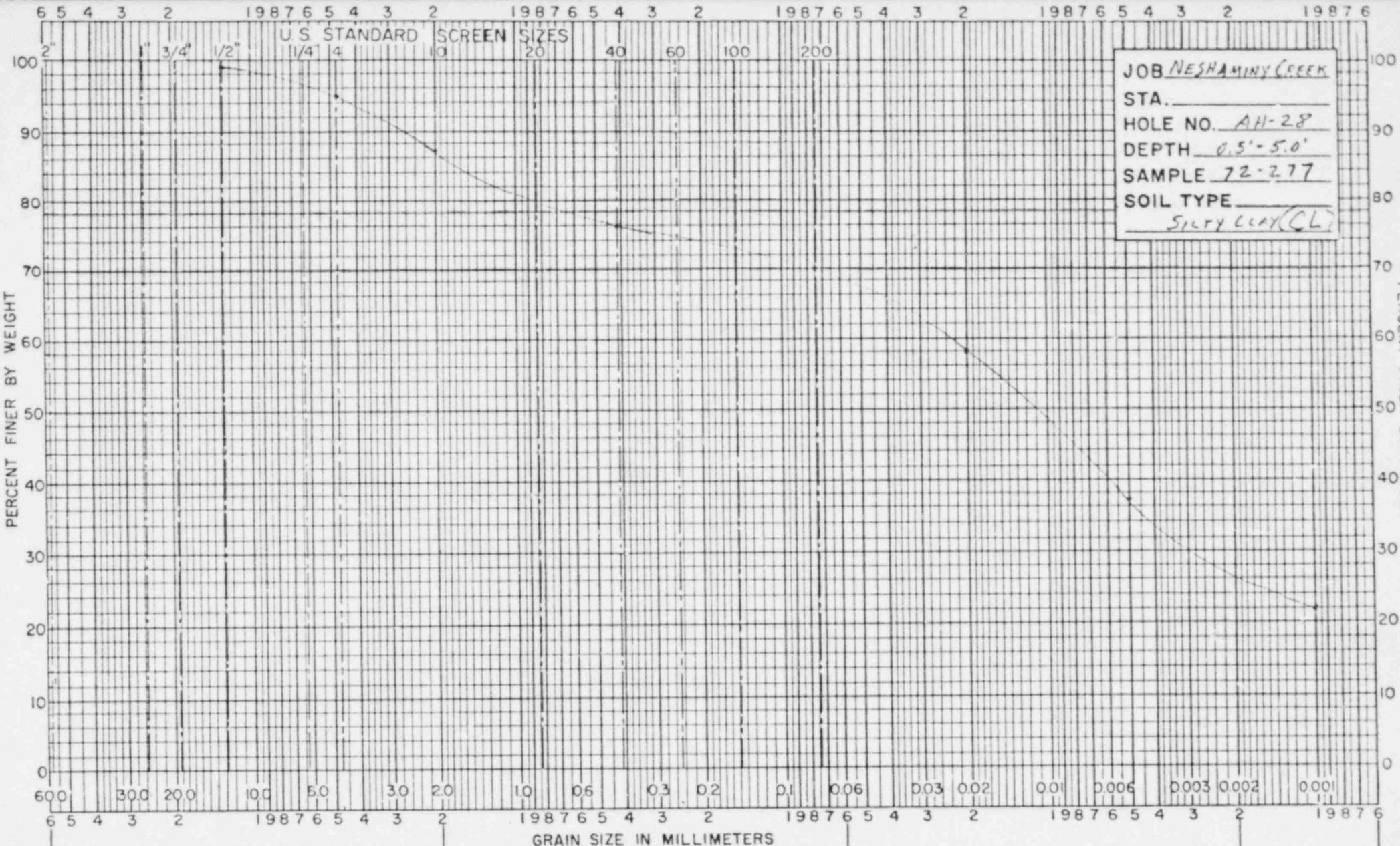
CL

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|--|----------------------------|-----------------------------|---------------|------------|---|--|-------------------|----------------------------|-----------------------------|-----------------------------|----------------------------|
| Sieve Number | Retained | | Per. Ret. (W) | Cumulative | | Sieve Number | Particle Size mm. | Retained | | Cumulative | |
| | Weight (W ₁) g | Percent (W ₁) % | | % Ret. | % Pass | | | Weight (W ₃) g | Percent (W ₃) % | Percent (W ₃) % | % Ret. (W ₃) % |
| 1" | — | | | | | 10 | 1.98 | | | | |
| 3/4" | — | | | | | 20 | 0.833 | | | | |
| 1/2" | — | 0 | | 0 | 100 | 40 | 0.417 | 2.1 | 5.4 | 5.4 | 14.6 |
| 3/8" | — | | | | | 60 | 0.246 | | | | |
| No. 4 | 27.2 | 2.6 | — | 2.6 | 97.4 | 140 | 0.104 | | | | |
| No. 10 | 87.6 | 7.7 | — | 10.3 | 89.7 | 200 | 0.074 | 1.2 | 2.4 | 7.8 | 92.2 |
| No. 40 | | | | | 85 | Pass | No. 200 | | | | |
| No. 200 | | | | | 83 | Total | 50 | 100 | | | |
| Pass | | | | | | Original Sample W = g. 100% | | | | | |
| Total | 113.1 | | | | | Partial Sample W ₁ = g. % | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. SIEVE (W₂)
Hydrometer No. 552 Sp. Gr. Corr a Wt. of Sample W₃ Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra ÷ W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|--------------|-----------|-------------|--------------------|------------|-------------|--------------------------------|--------------|----|------|--------------|--------------------|--------------|
| | | | ORIG | ▲it | R | | Kl | Kg | Kn | | | |
| | 1 | | | | | | | | .078 | | | |
| | 2 | | | | | | | | .055 | | | |
| <u>9:16</u> | 5 | <u>22.0</u> | <u>37.0</u> | <u>6.3</u> | <u>30.7</u> | <u>61.4</u> | | | .035 | <u>.02</u> | <u>55.1</u> | |
| | 10 | | | | | | | | .025 | | | |
| | 15 | | | | | | | | .020 | | | |
| | 30 | | | | | | | | .014 | | | |
| <u>10:26</u> | 60 | <u>23.0</u> | <u>24.0</u> | <u>6.0</u> | <u>18.0</u> | <u>36.0</u> | | | .010 | <u>.015</u> | <u>32</u> | |
| | 90 | | | | | | | | .008 | | | |
| <u>9:16</u> | 1440 | <u>23.0</u> | <u>16.0</u> | <u>6.0</u> | <u>13.0</u> | <u>20.0</u> | | | .002 | <u>.01</u> | <u>18</u> | |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra ÷ W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.



JOB NESHAMINY CREEK
 STA. _____
 HOLE NO. AH-28
 DEPTH 0.5'-5.0'
 SAMPLE 72-277
 SOIL TYPE _____
SILTY CLAY (CL)

| GRAVEL | | | SAND | | | SILT | | | CLAY |
|--------------------------|--------|------|------------------------|--------|------|------------------------|--------|------|------------------------|
| COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | COARSE | MEDIUM | FINE | |
| % GRAVEL SIZES <u>13</u> | | | % SAND SIZES <u>17</u> | | | % SILT SIZES <u>33</u> | | | % CLAY SIZES <u>33</u> |

MICHAEL BAKER, JR., INC.

Rochester, Pa.

GEOLOGICAL SCIENCES DEPARTMENT



MICHAEL BAKER, JR., INC.

ROCHESTER, PENNSYLVANIA

SOILS LABORATORY

MECHANICAL ANALYSIS & ATTERBERG

LIMITS OF SOILS

Project No. NES Hamliny Creek
 Laboratory No. 72-277
 Test Bore AH28 Station _____ Offset _____
 Date Received 11-8-72 Date Tested 11-10-72
 Tested By FRANK
 Checked By _____

SPECIFIC GRAVITY

NMC = 22.7%

Wt. of Dry Soil and Flask $W_1 =$ g.
 Wt. of Flask No. $W_2 =$ g.
 Wt. of Dry Soil $W_1 - W_2 = W_0 =$ g.

Aggr. = 13
 CS = 11
 FS = 6
 S = 33
 C = 37

Volume of Soil $V_s =$ c.c.
 Apparent Sp. Gr. $= \frac{W_0}{V_s} =$

% Passing $O_2 = 57.8\%$

LIQUID LIMIT

Frost Group =

Wt. of Wet Soil and Dish ^A 26.11 ^B
 Wt. of Dry Soil and Dish 22.45
 Wt. of Water 3.66
 Percent of Moisture 30.6 = 31

N = 25

Wt. of Dry Soil and Dish ^A 22.45 ^B
 Wt. of Dish 10.50
 Wt. of Dry Soil 11.95

PLASTIC LIMIT

Wt. of Wet Soil and Dish ^A 21.28 ^B 21.35
 Wt. of Dry Soil and Dish 19.52 19.55
 Wt. of Water 1.76 1.80
 Percent of Moisture 22.5 23.0

Wt. of Dry Soil and Dish ^A 19.52 ^B 19.55
 Wt. of Dish 11.69 11.71 K-2
 Wt. of Dry Soil 7.83 7.84

PLASTICITY INDEX (LL.-P.L.) = 31 - 23 = 8

(ML K₂ K₂)
 -CK

| SIEVE ANALYSIS RETAINED ON No. (W ₁) | | | | | | SIEVE ANALYSIS FROM HYDROMETER ANALYSIS (W ₃) | | | | | | |
|---|--------------------------|---------------------------|---------------|------------|--------|---|---------------|----------|---------------------------|-------------|------------|------------|
| Sieve Number | Retained | | | Cumulative | | Sieve Number | Particle Size | Retained | | | Cumulative | |
| | Weight (W ₁) | Percent (W ₁) | Per. Ret. (W) | % Ret. | % Pass | | | Weight | Percent (W ₃) | Percent (W) | % Ret. (W) | % Pass (W) |
| | g | % | % | % | % | | mm. | g | % | % | % | % |
| 1" | - | | | | | 10 | 1.98 | | | | | |
| 3/4" | | | | | | 20 | 0.833 | | | | | |
| 1/2" | 6.5 | 0.9 | | 0.9 | 99.1 | 40 | 0.417 | 6.1 | 12.2 | | 12.2 | 97.8 |
| 3/8" | | | | | | 60 | 0.246 | | | | | |
| No. 4 | 21.7 | 4.2 | | 5.1 | 94.9 | 140 | 0.104 | | | | | |
| No. 10 | 60.6 | 8.1 | | 13.2 | 86.8 | 200 | 0.074 | 3.5 | 7.0 | | 19.2 | 80.8 |
| No. 40 | | | | | 76 | Pass | No. 200 | | | | | |
| No. 200 | | | | | 70 | Total | | 100 | 100 | | | |
| PLSS | | | | | | Original Sample W = g. 100% | | | | | | |
| Total | 7498 | | | | | Partial Sample W ₁ = g. % | | | | | | |
| | | | | | | Partial Sample W ₃ = g. % | | | | | | |

HYDROMETER ANALYSIS OF MATERIAL PASSING No. SIEVE (W₂)

Hydrometer No. Sp. Gr. Corr a Wt. of Sample W₃ Gm.

| Time | Time Min. | Temp. °C. | Hydrometer Reading | | | % Pass 100 Ra = W ₂ | Corr: Coeff. | | | Diameter MM. | Corrected Diameter | % Pass of W. |
|------|-----------|-----------|--------------------|-----|------|-----------------------------------|--------------|----|----|--------------|--------------------|--------------|
| | | | ORIG | ▲R | R | | K1 | Kg | Kn | | | |
| | 1 | | | | | | | | | .078 | | |
| | 2 | | | | | | | | | .055 | | |
| 7:03 | 5 | 24.0 | 370 | 5.7 | 33.3 | 66.6 | | | | .035 | .02 | 57.8 |
| | 10 | | | | | | | | | .025 | | |
| | 15 | | | | | | | | | .020 | | |
| | 30 | | | | | | | | | .014 | | |
| 8:13 | 60 | 24.5 | 27.0 | 5.5 | 21.5 | 43.0 | | | | .010 | .005 | 37 |
| | 90 | | | | | | | | | .008 | | |
| 4:44 | | 25.0 | 18.0 | 5.4 | 12.6 | 25.2 | | | | .002 | .001 | 22 |
| | 1440 | | | | | | | | | .002 | | |

NOTE - Percentages of W₃ also apply directly to W₂, the material passing the lowest sieve. These percentages, as well as those recorded in Column 7 (100 Ra = W₃) of the Hydrometer Analysis, are converted to Percentages of the Total Sample, W, by multiplying the Ratio of the Partial Sample, W₂, to the Total Sample, W.

BRADSHAW RESERVOIR

TEST BORING RECORDS

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

By E. W. Gardner
 Per David Noble
 Surface Elevation 417.18 (From Field 10-27-72)
 Test Depth 24 hrs.
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Bit Size in. Sam. Size in.

Hole No. A-17 Sheet 1 of 1
 Station
 For E. H. BOUQUARD ASSOC. INC.
SURFACE INVESTIGATION
 Location Point Pleasant, Pa.
 Started 10-12-72 Completed 10-18-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|------------------------|---------------------------|--|------------------|------------------|---------------------|
| | | | <u>11.5-11.5 TOP SOIL</u> | | | |
| | | | <u>Light Brown Silty Clay</u> | | | |
| | | | <u>11.5-5.0</u> | <u>11.5-11.5</u> | | |
| | | | <u>DARK GRAY WEATHERED SLATE SOME CLAY</u> | | | |
| | | | <u>5.0-11.5</u> | <u>11.5-11.5</u> | | |
| | | | <u>11.5 REFUSAL</u> | | | |

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

[Handwritten scribbles]
 Elevation *417.97*
 Depth *2.2* 24 hrs.
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Sampler Size in. Sam. Size in.

Hole No. *18* Sheet *1* of *1*
 Station
 For *SOIL INVESTIGATION*
 Location *Full Tract*
 Started *10-19-72* Completed *10-19-72*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy |
|-------|---------------------|---------------------|---|-----------|---------------|-------------------|
| 2.0 | | | <i>0.5-5.0 GRAY SILTY CLAY</i> | BEST ↓ | | |
| 3.5 | <i>5-11-18</i> | | | | | |
| 5.0 | | | | | | |
| 6.5 | <i>11-41-28</i> | | <i>50-10.7 GRAY SILTY CLAY w/ DECOMPOSED SHALE LAYERS</i> | | | |
| 10.4 | | <i>4</i> | <i>REFUSAL 10.4 PERM TEST 20 min</i> | | | |

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator W. J. CONNER
 Date 11-17-72
 Face Elevation 200.00
 Bore Depth 24 hrs. —
 Hammer Weight Sa. — lbs. Drop — in.
 Hammer Weight Ca. — lbs. Drop — in.
 Bit Size — in. Sam. Size — in.

Hole No. 4-17 Sheet 1 of 1
 Station —
 For FOUNDATION
 Location POINT PLEASANT
 Started 11-17-72 Completed 11-19-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|--|-----------|---------------|------------------|
| 0.0 | | | 00-50 BR SILTY CLAY | — | | |
| → | | | 50-77 GRAY TO BLACK SILTY CLAY / FRAGMENTS | | | |
| 77 | | | REFUSAL 77 | | | |

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller TIM GARDNER
 Address 14112 N. HILL
 Phone 42068
 Drilling Date DRY 24 hrs.
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Bit Size in. Sam. Size in.

Hole No. A 21 Sheet 1 of 1
 Station
 For SOIL BORING SURFACE INVESTIGATION
 Location MOUNT PLEASANT
 Started 10-17-72 Completed 10-19-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|---|-----------|---------------|------------------|
| 0 0 | | | 0-0.5701 SOIL | | | |
| | | | 0.5-72 SILT & DRY CLAY SILT w/ SHALE LAYERS | | | |
| 72 | | 8 | REFILL 72 | | | |

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator JOSEPH EGER
R. COSTA
Face Elevation
Drill Depth WISPERED DRY 24 hrs.
Hammer Weight Sa. lbs. Drop — in.
Hammer Weight Ca. lbs. Drop — in.
Auger Size 1 1/2 in. Sam. Size — in.

Hole No. AH-20-A Sheet 1 of 1
Station
For E.H. BOURQUARD, ASSO.
Location POINT PLEASANT, PA
Started NOV-29-72 Completed NOV-29-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy. |
|----------------|---------------------|---------------------|--|---------------------|---------------|--------------------|
| <u>0-0.7</u> | | | 0-10-0.7. BROWN TOP SOIL | SOFT | | |
| 0.7 | | | <u>0.7-TO-4.0 BROWN SILT IR CLAY</u> | <u>MED DIRY</u> | | |
| <u>7.2</u> | | | <u>PUT IN 8.2 STAND PIPE</u> | <u>"</u> | | |
| | | | <u>REF. 7.2</u> <u>J. EGER</u> | | | |
| | | | <p>NOTE - HOLE AH-20 was found open to 4.0 and 5 feet of pipe was placed to make a permanent observation well. Later reference to the log for AH-20 revealed that refusal had been encountered at 7.2 ft. Since the hole had filled to 4.0 withavings, it was opened to 7.2 with a hand-held, motor-driven auger (Dec. 19, 1972) and 8.2 ft of pipe was placed.</p> <p style="text-align: right;"><u>Fritz H. Pruthy</u></p> | | | |

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

1510 BARBARA
1210 WOODRIDGE
Elevation 558.43
Depth 24 hrs.
Weight Sa. lbs. Drop in.
Weight Ca. lbs. Drop in.
Size in. Sam Size in.

Hole No. A 21 Sheet 1 of 1
Station
For SCOURGUARD
SUBSOIL INVESTIGATION
Location POINT PLEASANT
Started 10-19-72 Completed 11-17-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|--------------------------|-----------|---------------|------------------|
| 2.0 | | | TOP SOIL | REFUSE | | |
| 3.5 | | | DRY OR SATY CLAY | ↓ | | |
| 3.6 | | | CLAY UNCOMPRESSED SAMPLE | | | |
| | | | BOT OF HOLE 3.6 REFUSAL | | | |
| | | | PERM TEST 20 mm | | | |

WINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
per R COSTA
Surface Elevation 420-43
Water Depth NI 24 hrs.
Hammer Weight Sa. 140 lbs. Drop 30 in.
Hammer Weight Ca. 300 lbs. Drop 50 in.
Pipe Size 4 in. Sam. Size - in.

Hole No. A-21-A Sheet 1 of 1
Station
For E.H. BOURQUARD ASSO.
Location POINT PLEASANT, PA.
Started 11-2-72 Completed 11-2-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|------------|---------------------|---------------------|---|-----------------|---------------|------------------|
| <u>0.5</u> | | | <u>0 TO .5 BROWN TOP SOIL</u> | <u>SOFT</u> | | |
| <u>3.5</u> | | | <u>0.5 TO 3.5 BROWN RED. SILTY CLAY</u> | <u>HARD DRY</u> | | |
| <u>3.6</u> | | | <u>3.5 TO 3.6 GRAY SHALE</u> | <u>TOUGH</u> | <u>GR</u> | <u>SAMPLES</u> |
| | | | <u>BOTTOM OF BORING 3.6</u> | | | |
| | | | <u>(NOTE)</u> | | | |
| | | | <u>PUT 30 - 1" PIPE IN.</u> | | | |

ANNEX DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller *W. J. ...*
 Station *...*
 Face Elevation *222.0*
 Drilling Depth *24* hrs.
 Hammer Weight Sa. *...* lbs. Drop *...* in.
 Hammer Weight Ca. *...* lbs. Drop *...* in.
 Bit Size *...* in. Sam. Size *...* in.

Hole No. *122* Sheet *1* of *1*
 Station *...*
 For *...*
 Location *...*
 Started *10.18.72* Completed *10.19.72*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|------------|---------------------|---------------------|--|--------------|---------------|-------------------|
| <i>2.0</i> | | | <i>0-2.0 OR SATY CLAY</i> | <i>MOIST</i> | | |
| <i>2.6</i> | | | <i>2.0-2.6 OR SATY CLAY w/ FINE LAYERS</i> | | | |
| <i>3.4</i> | | | <i>REFUSAL 3.4</i> | | | |

NEEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Surface Elevation *93*
Drill Depth *24* hrs.
Hammer Weight Sa. lbs. Drop in.
Hammer Weight Ca. lbs. Drop in.
Sampling Size in. Sam. Size in.

Hole No. *123* Sheet *1* of *1*
Station
For *Geotechnical*
Subsidence Investigation
Location *Point Pleasant*
Started *10-22-72* Completed *10-29-72*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|------------|---------------------|---------------------|---|------------|---------------|------------------|
| <i>2.0</i> | | | <i>SS-6.1</i> | <i>W/S</i> | | |
| <i>3.0</i> | <i>7-11-22</i> | | <i>SS-6.1</i> | <i>W/S</i> | | |
| <i>5.0</i> | | | <i>SS-6.1</i> | <i>W/S</i> | | |
| <i>6.1</i> | <i>26.36 %</i> | | <i>SS-6.1</i> | <i>W/S</i> | | |
| | | | <i>REFUSAL 6.1</i> <i>PERM TEST 20 min</i> | | | |

WINEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

FW GASOLINE
RIGID NUTS
Ice Elevation 422.54
Depth 24 hrs.
Hammer Weight Sa. lbs. Drop in.
Hammer Weight Ca. lbs. Drop in.
Log Size in. Sam. Size in.

Hole No. A34 Sheet 1 of 1
Station
For BOUNDARY
SUBSOIL INVESTIGATION
Location POINT PLEASANT
Started 1-19-72 Completed 1-19-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy. |
|-------|---------------------|---------------------|---------------------------------------|-----------|---------------|------------------|
| 2.0 | | | 0.0-3.0 BR SILTY CLAY | mist | | |
| 3.5 | | | 3.0-5.0 BR SILTY CLAY w/ SHALE LAYERS | ✓ | | |
| 5.0 | | | REFUSAL 50 PERM TEST 20 MIN | | | |

KEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

15' W. GARNER
12' 17' 0" N. 1/2 E
Elevation 420.72
Depth 121' 24 hrs. —
er Weight Sa. lbs. Drop. in.
er Weight Ca. lbs. Drop. in.
Size in. Sam. Size in.

Hole No. A 25 Sheet 1 of 1
Station
For F. H. BOURBONNARD ASSOCIATES
Location POINT PLEASANT PA
Started 10-18-72 Completed 10-18-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Rec'y |
|-------|---------------------|---------------------|---|-----------|---------------|--------------------|
| 0 | | | 0.0-0.5 TOP SOIL | MIST | | |
| | | | 0.5-40 GRAYISH BR SIXTY CLAY | | | |
| 5 | | | 40-5.5 SIXTY CLAY IN DECOMPOSED SAND LAYERS | | | |
| | | | REFUSAL 5.5 | | | |

WINEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

BY FR JATONER
DATE NOV 10 1972
Elevation 453.83
Drill Depth 24 hrs.
Rod Weight Sa. lbs. Drop in.
Rod Weight Ca. lbs. Drop in.
Rod Size in. Sam. Size in.

Hole No. A 26 Sheet 1 of 1
Station
For BOUGUARD
SUBSOIL INVESTIGATION
Location POINT PLEASANT
Started 11-20-72 Completed 10-20-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|--|---------------------|---------------------|--|-----------|---------------|------------------|
| 2.0 | | | 0.0-0.5 TOP SOIL | MIST ↓ | | |
| 3.5 | | | 0.5-3.0 BR SILTY CLAY | | | |
| 4.1 | 5-9-14 | | → 3.0-4.1 SANDY BR CLAY SET TO HARD SILT | | | |
| <p>REFUSAL 4.1 PEN TEST 20 min</p> | | | | | | |

ANNEX DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator *E. L. Gardner*
 Station *DAVID ROBL*
 Surface Elevation *426.65* (FROM FIELD 10-27-72)
 Drilling Depth *24* hrs.
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Sampling Size in. Sam. Size in.

Hole No. *A-27* Sheet *1* of *1*
 Station *E. H. BOURQUARD ASSOC.*
 For *SURFACE INVESTIGATION*
 Location *PINE PLASANT PA*
 Started *10-12-72* Completed *10-16-72*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|-------|---------------------|---------------------|-------------------------------------|--------------|---------------|-------------------|
| | | | <i>2.0-2.5 TOP SOIL</i> | | | |
| | | | <i>Brown silty CLAY</i> | | | |
| | | | <i>0.5-5.0</i> | <i>moist</i> | | |
| | | | <i>5.0-5.5 Gray weathered shale</i> | <i>moist</i> | | |
| | | | <i>5.5' REF.</i> | | | |

WANEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

E. U. Gardner
DAVID NOBLE
Elevation 422.37
Depth Dry 24 hrs.
Sinker Weight Sa. lbs. Drop in.
Sinker Weight Ca. lbs. Drop in.
Sinker Size in. Sam Size in.

Hole No. A-28 Sheet 1 of 1
Station
For E. H. Ben Guard, Assoc. Inc.
SURFACE INVESTIGATION
Location Point Pleasant, Pa.
Started 10-12-72. Completed 10-18-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy. |
|-------|---------------------|---------------------|------------------------|-----------|---------------|------------------|
| | | | 01-015 TOP SOIL | | | |
| | | | Brown silty clay | | | |
| | | | 01-5.0 | moist | | |
| | | | DRY GY WENTHERED SHALE | | | |
| | | | 01-7.0 Same clay | moist | | |
| | | | 7.0 | | | |
| | | | REFUSAL | | | |

WATKINS DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Drilled by E. L. Gardner
 by David Noble
 Surface Elevation 431.16 (FROM FIELD 10-27-72)
 Drilling Depth dry 24 hrs.
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Core Size in. Sam. Size in.

Hole No. A-50 Sheet 1 of 1
 Station
 For E. H. BOURQUARD ASSOC. INC
SURFACE INVESTIGATION
 Location Point Pleasant, Pa.
 Started 10-18-72 Completed 10-18-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|-------|---------------------|---------------------|--------------------------------------|--------------|---------------|-------------------|
| | | | <u>1.1-1.5 TRAIL</u> | | | |
| | | | <u>grayish Brown CLAY & silt</u> | | | |
| | | | <u>0.5-5.0</u> | <u>DRY</u> | | |
| | | | <u>gray silty clay to</u> | | | |
| | | | <u>5.0-6.5 weathered shale</u> | <u>moist</u> | | |
| | | | <u>6.5</u> | | | |
| | | | <u>Ref.</u> | | | |

WATKINS DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
R. COSTA
Face Elevation
Bore Depth HUGER DRY 24 hrs.
Blow Weight Sa. --- lbs. Drop --- in.
Blow Weight Ca. --- lbs. Drop --- in.
Auger Size HUGERED in. Sam. Size --- in.

Hole No. AH 50-A Sheet 1 of 1
Station
For E.H. BOURQUARD ASSO.
Location POINT PLEASANT, PA.
Started 11-2-72 Completed 11-2-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|-------|---------------------|---------------------|--|---------------|-----------------|-------------------|
| 0-0.5 | | | 0-10-0.5 BROWN TOP SOIL | SOFT | | |
| 5.0 | | | 05-10-50 BROWN GRAY SILT TR CLAY | HARD DENSE | 6 FT SAMPLES | |
| 6.5 | | | 20-10-6.5 GRAY DECOMPOSED ROCK TR SILT | DENSE DRY | | |
| | | | BOTTOM OF BORING 6.5 (NOTE) PUT IN 6.1" PIPE | | | |

ANNEX DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator LEW J. HADJIK
 Date DAVID LITTLE
 Surface Elevation 435.06
 Drilling Depth DRY 24 hrs. —
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Rodding Size in. Sam. Size in.

Hole No. A 51 Sheet 1 of 1
 Station
 For E.H. BEEBEQUARD
SUBSURFACE INVESTIGATION
 Location POINT PLEASANT
 Started 11-11-72 Completed 11-17-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Rec'y. |
|-------|---------------------|---------------------|---|-----------|---------------|---------------------|
| 00 | | | 00-05 TOP SOIL | REFUSE | | |
| | | | 05-50 BRY GRAY SILTY CLAY | ↓ | | |
| 60 | | | 50-60 SALTY GRAY SILTY CLAY w/ DECOMPOSED SHALE LAYERS | | | |
| | | | REFUSAL 60 | | | |

INNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator EDWARD GARDNER
 Per DAVID MURPHY
 Surface Elevation 254.54
 Borehole Depth 114.5 24 hrs. —
 Hammer Weight Sa. lbs. Drop. in.
 Hammer Weight Ca. lbs. Drop. in.
 Bit Size in. Sam. Size in.

Hole No. A 52 Sheet 1 of 1
 Station
 For EN BOURBONNE
SUBSTANCE INVESTIGATION
 Location POINT PLEASANT
 Started 10-18-72 Completed 10-18-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. |
|-------|------------------------|---------------------------|--|-----------|------------------|------------|
| | | | | | | Rec'y |
| 0.0 | | | 0.0 - 0.5 TOP SOIL | MOIST | | |
| | | | 0.5 - 1.0 OR SILTY CLAY | | | |
| 5.5 | | | → 1.0 - 5.5 GRAY OR SILTY CLAY w/ SHALE LAYERS | | | |
| | | | REFUSAL 5.5 | | | |

WINEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

1500 2450 11-17-72
2450 11-17-72
Elevation 441.0
Depth 24 hrs.
Hammer Weight Sa. lbs. Drop in.
Hammer Weight Ca. lbs. Drop in.
Log Size in. Sam Size in.

Hole No. A 53 Sheet 1 of 1
Station
For E. L. POLI GUARD
SUBSURFACE INVESTIGATION
Location POINT PLEASANT
Started 11-17-72 Completed 11-17-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|---|-----------|---------------|------------------|
| | | | 2.5-3.5 70% SOLID 0.5-3.5 BK SAND CLAY | Med | | |
| 4.5 | | | 3.5-4.5 BK SAND CLAY w/ SHALY SAND LAYERS | | | |
| | | | REUSAR 4.5 | | | |

MINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
Operator R. COSTA
Face Elevation
Drilled Depth DRX 24 hrs.
Hammer Weight Sa. lbs. Drop — in.
Hammer Weight Ca. lbs. Drop — in.
Auger Size AUGERED in. Sam. Size — in.

Hole No. F.H. 53-A Sheet 1 of 1
Station
For E.H. BOURQUARD 17550
Location POINT PLEASANT, PA.
Started NOV. 2:72 Completed NOV. 2:72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|----------------------------------|--------------|---------------|------------------|
| 2.5 | | | 0.5-0.5 BROWN TOP SOIL | SOFT | | |
| 5.0 | | | 0.5 TO 5.0 BROWN SILT TR CLAY | DENSE DRX | JAR SAMPLE | |
| | | | PUT 4.5 OF 1" PIPE | | | |

ANNEX DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller: *W. J. ...*
 Station: *...*
 Surface Elevation: *427.50*
 Depth: *24* hrs. *—*
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Core Size in. Sam Size in.

Hole No. *A 54* Sheet *1* of *1*
 Station: *...*
 For: *EM FOUR GUARD*
SUBSURFACE INVESTIGATION
 Location: *PINE BLECKHINT*
 Started: *1-11-77* Completed: *1-19-77*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|---|-------------|---------------|------------------|
| 0 | | | <i>0.5 - 5' GRAY BS SILTY CLAY</i> | <i>M115</i> | | |
| 0 | | | <i>5.0 - 7.0 GRAY SILTY CLAY w/ DECOMPOSED SHALE LAYERS</i> | | | |
| | | | <i>REFUSAL 21</i> | | | |

TEST BORING RECORD

P. B. Dylli
T. Szwedke
Elevation 422.44
Depth 4.0 24 hrs. 3.6
er Weight Sa 140 lbs. Drop 30 in.
er Weight Ca 300 lbs. Drop 18 in.
Size 4 in. Sam Size 2 in.

Hole No. F-27 Sheet 1 of 1
Station 127+30
For E. H. Bourguard Assoc. Inc.
Surface Investigation
Location Paint Pleasant Pa
Started 10-19-72 Completed 10-19-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------------------|---------------------|--|-----------|---------------|------------------|
| 1.5 | 1-2 4 | | 0.0-0.5 TOP SOIL | | | |
| 3.0 | 2-9-13 | | Light Brown silty CLAY | | | |
| 4.5 | 9-13 13 | | 0.5-3.5 | DAMP | | |
| 6.0 | 11-14-15 | | 3.5-6.0 Brown CLAY WITH SLATE | MOIST | | |
| 6.5 | 70/5 | | NX CORE | | | |
| | D R I L L E D | | Med Hard GRAY SLATE VARY Badly Broken + trace CLAY SAND. | | | |
| 11.5 | | | 6.0-12.0 | | 5.0 | 3.0 |
| 6.0 | | | VARY HARD GRAY SLATE Broken + STAINED. | | | |
| 16.0 | | | 12.0-16.0 | | 4.5 | 4.5 |
| | | | 16.0 | | | |

NEEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

A. B. DOYLE
T. S. WEDKO
Elevation *420.84*
Depth *3.3* 24 hrs.
Hammer Weight *140* lbs. Drop *30* in.
Hammer Weight *300* lbs. Drop *18* in.
Hammer Size *4* in. Sam. Size *2* in.

Hole No. *1-58* Sheet *1* of *1*
Station
For *E. H. BOURGUARD ASSOC. INC.*
SURFACE INVESTIGATION
Location *Point Pleasant, Pa.*
Started *10-18-72* Completed *10-18-72*

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy |
|-------------|---------------------|---------------------|---------------------------------|--------------|---------------|-----------------|
| <i>1.7</i> | <i>2-6</i> | | <i>0.5-1.0 TOP SOIL</i> | | | |
| <i>3.0</i> | <i>21-30-53</i> | | <i>1.5-3.0 LIGHT BROWN SILT</i> | <i>DRY</i> | | |
| <i>4.5</i> | | | <i>BROWN HARD SILTY CLAY</i> | | | |
| <i>6.0</i> | | | <i>with</i> | | | |
| <i>6.5</i> | | <i>→</i> | <i>3.0-6.5</i> | <i>moist</i> | | |
| <i>9.5</i> | | | <i>VERY HARD DARK GRAY</i> | | <i>3.0</i> | <i>3.0</i> |
| | | | <i>SHALE STAINED + BROWN</i> | | | |
| <i>12.0</i> | | | <i>1.5-12.0</i> | | <i>2.5</i> | <i>2.3</i> |
| | | | <i>12.0</i> | | | |

ANNEX DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller Joseph EGER
Driller R COSTA
Face Elevation 421.70 From Field 11-1-72
Drift Depth 2 HR AFTER 2.8 24 hrs.
Hammer Weight Sa. 140 lbs. Drop 30 in.
Hammer Weight Ca. 300 lbs. Drop 30 in.
Rodding Size 4 in. Sam Size 2 in.

Hole No F-29 Sheet 1 of 1
Station
For EH BOURQUARD ASSO.
Location POINT PLEASANT, PA.
Started 10-24-72 Completed 10-24-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Rec'y |
|---------|---------------------|---------------------|---|-----------------|---------------|--------------------|
| 0-1.5 | 3-3 | | 0-1.5-0.0 BROWN TOP SOIL | SOFT | | |
| 1.5-3.0 | 12-19-25 | | 0.6 to 1.5 BROWN SILT, TR CLAY | SOFT | | |
| 3-4.5 | 28-38 | | 1.5-10-5.0 | HARD | | |
| 4.5-5.0 | 75 | | GRAY SILTY WITH WEATHERED SHALE | DRY | | CORED FROM 5.0 |
| 10.0 | | | 50-10-10.0 GRAY SHALE | HARD | 5.0 | 5.0 |

WATKINS DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
ROOSTER
 Surface Elevation
 Drilling Depth WUGERED DRY 24 hrs.
 Rod Weight Sa. lbs. Drop - in.
 Rod Weight Ca. lbs. Drop - in.
 Rod Size WUGERED in. Sam Size - in.

Hole No. F-29-A Sheet 1 of 1
 Station
 For EH BOURQUARD, ASSO.
 Location POINT PLEASANT, PA.
 Started NOV. 29.72 Completed NOV-29-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy. |
|-------|---------------------|---------------------|---|------------|---------------|------------------|
| 0-0.7 | | | 0.7-0.7 BROWN TOP SOIL | SOFT | | |
| 0.7 | | | 0.7-4.7 BROWN SILT TR. CLAY REF - FT 4.7 | MED DRY | | |
| | | | PUT IN 5.7- STAND PIPE IN <u>PER.</u> | | | |

WANEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller: Joseph EGER
 Cost: 12 COSTN
 Elevation: 425.23
 Depth: 5.5 24 hrs.
 Hammer Weight Sa: 40 lbs. Drop: 30 in.
 Hammer Weight Co: 300 lbs. Drop: 30 in.
 Ring Size: 4 in. Sam. Size: 2 in.

Hole No. F-30 Sheet 1 of 1
 Station:
 For: E.H. BOURQUARD ASSOC.
 Location: POINT PLEASANT, PA.
 Started: 10-23-72 Completed: 10-24-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy. |
|---------|---------------------|---------------------|------------------------------------|-----------------|---------------|------------------|
| 0-1.5 | 3-4 | | 0-TO-1.5 BROWN TOP SOIL | SOFT | | |
| 1.5-3.0 | 10-14 | | | | | |
| 3-4.5 | 15-17 | | 08-TO-75 | | | |
| 4.5-6.0 | 18-21 | | BROWN AND GRAY SILT WITH | HARD & DRY | | |
| 6-7.5 | 20-25 | | SHALE FBAG | | | CORED FROM 7.5 |
| 12.5 | | | 7.5-TO-12.5 | | | |
| | | | DARK GRAY SHALE BROKEN | HARD | 5.0 | 5.0 |

INNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

MUST
STRAIGHTEN
IN - JUST
ONE DAY

Driller Joseph EGER
Supervisor R. COSTA
Face Elevation 422.82
Time per Depth 2 hr AFTER 104 hrs.
Hammer Weight Sa 140 lbs. Drop 30 in.
Hammer Weight Ca 300 lbs. Drop 30 in.
Rodding Size 4 in. Sam Size 2 in.

Hole No F-31 Sheet 1 of 1
Station
For E.H. BOURQUARD ASSO.
Location POINT PLEASANT, PA.
Started 10-23-72 Completed 10-23-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|---------|---------------------|---------------------|---|-----------|---------------|------------------|
| 0-1.5 | 2-3 | | 0-TO-1.0 BROWN TOP SOIL | SOFT | | |
| 1.5-3.0 | 11-18 | | 10-TO-35 BROWN SILTY CLAY | HARD DRY | | |
| 3.0-4.5 | 16-21 | | | | | |
| 4.5-6.0 | 16-24 | | 3.5-TO-7.0 GRAY SAT. CLAY WITH SOFT SHALE | HARD DRY | | CORED FROM 7.0 |
| 6-7.0 | 10-15 | | NX CORE | | | |
| | | | 7.0-TO-12.0 GRAY SHALE | | | |
| 12.0 | | | | HARD | 5.0 | 5.0 |

NEEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Joseph EGER
R COSTA

WHAT DO WE
HAVE UP
OR DOWN

Hole No. **F-32** Sheet **1** of **1**
Station
For **E.H. BOURQUARD, P.S.S.O.**
Location **POINT PLEASANT, PA.**
Started **10-23-72** Completed **10-23-72**

Ice Elevation **422.10**
Depth **12** 24 hrs.
Weight Sa. **140** lbs. Drop **30** in.
Weight Ca. **300** lbs. Drop **30** in.
Gauge Size **4** in. Sam Size **2** in.

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Recy. |
|----------|---------------------|---------------------|--|---------------------------|---------------|---------------------------|
| 0-1.5 | 3 4-9 | | 0-TO-0.8 BROWN TOP SOIL | SOFT | | |
| 1.5-3.0 | 15 25-40 | | 0.8-TO-2.5 BROWN SILT TR CLAY | DENSE | | |
| 3-4.5 | 24 28-32 | | 2.5-TO-6.0 | HARD & DRY | | |
| 4.5-6.0 | 19 33-78 | | GREY WEATHERED SHALE TR. CLAY NX CORE | | | CORED FROM 6.0 |
| 6.0-11.0 | | | 6.0-TO-11.0 GREY SHALE | HARD | 5.0 | 4.8 |

JNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

.....

 ce Elevation 1124.55
 Depth 4.5 24 hrs. 4.5
 er Weight Sa. 140 lbs. Drop 30 in.
 er Weight Ca. lbs. Drop in.
 g Size in. Sam Size 2 in.

Hole No. F 50 Sheet 1 of 1
 Station
 For EN RANGUARD
SOIL SURFACE INVESTIGATION
 Location PUNIT PENICULT
 Started 11-17-72 Completed 11-17-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. |
|-------|---------------------|---------------------|---------------------------------------|-----------|---------------|------------|
| | | | | | | Rec'y |
| 1.5 | 1-2-6 | | 00-30 BR SILTY CLAY | 11157 | | |
| 3.0 | 6-16-24 | | | | | |
| 4.0 | 56-60 | | 30-40 BR SILTY CLAY TO DARK GRAY SILT | | | |
| 6.5 | | | 4.0-7.0 <u>DRY DARK GRAY SILT</u> | | 2.5 | 2.5 |
| 9.0 | | | <u>CRACKY BROKEN & FRACTURED</u> | | 2.5 | 2.5 |
| | | | <u>W/ WEATHERED SEAMS</u> | | | |
| | | | <u>END OF HOLE 90</u> | | | |

6.14

WINEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Dr. R. B. DOYLE
Dr. T. Swedko
Surface Elevation 418.24
Dr. Depth SURFACE 24 hrs. 3.4
Dr. Weight Sa. 140 lbs. Drop 30 in.
Dr. Weight Ca. 300 lbs. Drop 18 in.
Dr. Size 4 in. Sam. Size 2 in.

Hole No. F-57 Sheet 1 of 1
Station
For E. H. BOURQUARD ASSOC. INC.
SURFACE INVESTIGATION
Location Point Pleasant Pa.
Started 10-17-72 Completed 10-17-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy |
|-------|---------------------|---------------------|---|-----------|---------------|-------------------|
| 1.5 | 1-4 4 | | 0.0-0.5 TOP SOIL | | | |
| 3.0 | 9-10-13 40-31 | | Light Brown + Gray CLAYEY SILT | | | |
| 4.5 | 10 | | | | | |
| 6.0 | 9-13-21 | | 0.5-5.9 Hit water 5.5 | DRIP | | |
| 6.2 | 7 1/2 N.C. X.C. | | 5-9-6.5 Gray weathered shale | wet | 0.8 | 0.5 |
| 7.0 | | | | | | |
| 10.0 | | | DARK gray VERY HARD SHALE STAINED + BICKEN | | 3.0 | 3.0 |
| 12.0 | | | 6.5-12.0 | | 2.0 | 2.0 |
| | | | 12.0 | | | |

WINEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator R B Doyle
 Date 7-5-72
 Surface Elevation 416.63
 Core Depth 3.0 24 hrs.
 Hammer Weight 340 lbs. Drop 30 in.
 Anvil Weight 300 lbs. Drop 18 in.
 Core Size 4 in. Sam Size 2 in.

Hole No F-52 Sheet 1 of 1
 Station
 For E H BURQUARD ASSOC. INC.
SURFACE INVESTIGATION
 Location Point Pleasant Pa
 Started 7-17-72 Completed 7-12-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|---------------------------------------|-----------|---------------|------------------|
| 1.5 | 2-9 | | 0.0-0.5 TOP SOIL | dry | | |
| 3.0 | 11-17-16 | | light brown silt | | | |
| 4.5 | 14-10 | | 0.5-7.0 | DAMP | | |
| 6.0 | 16-17-24 | | gray silty clay stone frag | moist | | |
| 7.5 | 13-12 | | 7.0-8.0 | | | |
| 9.0 | 9-10-13 | | brown clay with shale | moist | | |
| 9.1 | 15/1 | | 6.0-8.5 | wet | | |
| | | | 2.5-9.1 very gray weathered shale | | | |
| 14.1 | | | Dark gray very hard shale broken some | | 5.0 | 4.8 |
| | | | 9.1-14.1 stain | | | |
| | | | 14.1 | | | |

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Borehole No. 12
 Elevation 430.00
 Depth 1.5 24 hrs.
 Hammer Weight 300 lbs. Drop 20 in.
 Hammer Weight 300 lbs. Drop 18 in.
 Hammer Size 4 in. Sam Size 2 in.

Hole No. F-53 Sheet 1 of 1
 Station For E.A. Downward Assoc. Inc.
SUBSURFACE INVESTIGATION
 Location Point Pleasant, PA.
 Started 10-24-72 Completed 10-27-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|-----------|---------------------|---------------------|---|-----------|---------------|-------------------|
| 0.0 - 1.5 | 1-1 | | 0.0 - 0.5 = TOP SOIL | | | |
| | ? | | 0.5 - 1.5 = Light brown silt | | | |
| 3.0 | 4-7-5 | | Brown silt & clay trace | | | |
| 4.5 | 5-13 | | SHALE | | | |
| 6.0 | 2-20-50 | | 1.5 - 5.5 | | | |
| 7.0 | 41-70 | | Brown to gray weathered shale some clay | | | |
| | | | * 5.5 - 7.5 shale med hard to HARD | | | |
| | | | stained & broken | | | |
| 12.0 | | | 7.5 - 12.0 | | 5 in | 4-3 |
| | | | 12.0 | | | |

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

PI. 54
 T. 30
 ce Elevation 479.05
 Depth 55 24 hrs.
 er Weight Sa. 140 lbs. Drop 30 in.
 er Weight Ca. 300 lbs. Drop 18 in.
 g Size 4 in. Sam Size 2 in.

Hole No. F 54 Sheet 1 of 1
 Station
 Fore H. S. F. G. R. D. ASSOC.
 SURFACE INVESTIGATION
 Location Point Pleasant Pa.
 Started 10-23-77 Completed

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy. |
|-------|---------------------|---------------------|---|-----------|---------------|--------------------|
| 1.5 | 1-1 | | 0.5-1.5 Brown soft silt | moist | | |
| 3.0 | 5-5-5 | | Brown silty clay | damp | | |
| 4.5 | 5-2 | | 1.5-4.5 | | | |
| 6.5 | 11-22-23 | | Brown Hard CLAY with | damp | | |
| 6.5 | 65/5 | | 4.5-7.0 shale + stone frag. gray shale very badly broken with weathered seams | | | |
| 11.5 | | | 7.0-10.7 | | 5.0 | 3.5 |
| | | | DARK gray shale med. Hard + badly broken | | | |
| 16.5 | | | 10.7-16.5 | | 5.0 | 5.0 |
| | | | 16.5 | | | |

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

R.P. Doyle
T. Szedko
ce Elevation 426.32
Depth 4.6 24 hrs. 4.0
er Weight Sa. 140 lbs. Drop 30 in.
er Weight Ca. 300 lbs. Drop 18 in.
g Size 4 in. Sam. Size 2 in.

Hole No. F-55 Sheet 1 of 1
Station
For E.H. BURQUARD, ASSOC., INC.
SUBSURFACE INVESTIGATION
Location Point Pleasant, Pa.
Started 11-23-72 Completed 11-23-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy. |
|-------|---------------------|---------------------|---|-------------|---------------|--------------------|
| 1.5 | 1-1 2 | | 0.0-0.5 Brown TOP soil | | | |
| 3.0 | 3-2-8 | | 0.5-3.0 Brown silty (clay) thin shale | DAMP | | |
| 4.5 | 8-12 16 | | 3.0-5.5 light Brown silt | DAMP | | |
| 6.0 | 11-12-55 | | 5.5-6.0 Brown clay with shale | DAMP | | |
| 7.5 | 8-5 14 | | Brown + Gray Decomposed shale (High water G.O.) | DAMP TO WET | | |
| 8.8 | 5-12-47/3 | | HARD Gray shale Badly stained & Broken | | | |
| 11.5 | | | 2.7-11.5 HARD Gray shale slightly Broken | | 2.7 | 2.5 |
| 14.0 | | | 11.5-14.0 Broken | | 2.5 | 2.5 |
| | | | 14.0 | | | |

WINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
 Per R. COSIA
 Surface Elevation 426.32
 Water Depth Augered Dry 24 hrs.
 Hammer Weight Sa. lbs. Drop - in.
 Hammer Weight Ca. ED lbs. Drop - in.
 Auger Size AUGERED in. Sam. Size - in.

Hole No. F55-A Sheet 1 of 1
 Station
 For E.H. BOURQUARD, ASSO.
 Location POINT PLEASANT, PA
 Started NOV-29-72 Completed NOV-29-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|--------------|---------------------|---------------------|--|----------------|---------------|---------------------|
| <u>0-1.0</u> | | | <u>0-101.0 BROWN TOP Soil</u> | <u>SOFT</u> | | <u>1 jar SAMPLE</u> |
| <u>6.0</u> | | | <u>1.0-6.0 BROWN SILT, TR CLAY REF AT. 6.0</u> | <u>MED DRY</u> | | |
| | | | <u>PUT IN 7.0- STAND PIPE IN PER</u> | | | |

TEST BORING RECORD

R. B. D. Y. I. F.
T. S. B. C. D. K. C.
Elevation 432.24
Depth 3.9 24 hrs. 3.5
er Weight Sa 140 lbs. Drop 30 in.
er Weight Ca 300 lbs. Drop 18 in.
g Size 4 in. Sam Size 2 in.

Hole No. F-56 Sheet 1 of 1
Station
For E. H. Soudry and Assoc. Inc.
Subsurface Investigation
Location Point Pleasant, Pa.
Started 10-23-72 Completed 10-25-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Rec'y |
|-------|---------------------|---------------------|---|-----------|---------------|--------------------|
| 1.5 | 1-2 3 | | 0.0-0.5 Brown Top Soil | | | |
| 3.0 | 5-8-17 | | Brown stiff silty clay + trace shale frag. | | | |
| 4.5 | 13-20 28 | | 4.5-4.6 Hard Brown clay with decomposed shale | Hard | | |
| 6.0 | 29-29.54 | | 4.6-6.5 | | | |
| 7.5 | 4-46 70 | * | 6.5-7.5 Brownish gray weathered shale | | | |
| 12.5 | DRILLED | | 7.5-12.5 Vary Hard Dark gray shale stained + broken | | 5.0 | 4.6 |
| | | | 12.5 | | | |

INNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator Joseph EGER
 per SR COSTA
 Surface Elevation
 Drilling Depth Augered DRY 24 hrs.
 Hammer Weight Sa. lbs. Drop - in.
 Hammer Weight Ca. lbs. Drop - in.
 Auger Size AUGERED in. Sam. Size - in.

Hole No. F-56-A Sheet 1 of 1
 Station
 For EH BOURQUARD ASSO.
 Location POINT PLEASANT, PA.
 Started NOV. 29 72 Completed NOV. 29 72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|--------------|---------------------|---------------------|--|----------------------|---------------|---|
| <u>0-0.8</u> | | | <u>2-TO-8. BROWN TOP SOIL</u> | <u>SOFT</u> | | |
| <u>8.5</u> | | | <u>BROWN SILT TR CLAY</u> <u>REF. AT 8.5</u> <u>BOTTOM OF BORING 8.5</u> <u>PUT IN 9.0. STAND PIPE</u> <u>PER.</u> | <u>MED & DRY</u> | | <u>1 JAR SAMPLE</u> <u>20-TO-8.0</u> |

TINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
 339 FAWCETT CHURCH ROAD
 BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller ED JARDNER
 Helper DAVID NOBLE
 Surface Elevation 418.78
 Water Depth BACKED BACKED HOLE
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Sampling Size in. Sam. Size in.

Hole No. TP-1 Sheet 1 of 1
 Station
 For 1300 GUARD
 Location SUBSOIL INVESTIGATION
PUNY PLEASANT
 Started 10-25-72 Completed 11-25-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|--|---------------------|---------------------|--|------------|---------------|-------------------|
| 0.0 | | | 0.0-0.9 BR TOP SOIL | MOIST | | |
| | | | 0.9-2.0 GRAY SILTY CLAY | | | |
| | | | 2.0-5.0 GRAY BR SILTY CLAY | | | |
| 6.0 | | | 5.0-6.0 GRAY SILTY CLAY & SHALE LAYERS | DRY TO WET | | |
| BOTTOM OF TEST PIT 60 WATER AT 5.0 & RISING | | | | | | |

WNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

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.....
ce Elevation 426.58
Depth DRY 24 hrs. BACK-FILLED HOLE
er Weight Sa. lbs. Drop in.
er Weight Ca. lbs. Drop in.
g Size in. Sam. Size in.

Hole No. TIP-2 Sheet 1 of 1
Station
For BOUQUARD
Location SUBSOIL INVESTIGATION
POINT PLEASANT
Started 10-25-72 Completed 11-25-72

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y. |
|-------|------------------------|------------------------|---|--------------|------------------|----------------------|
| 0.0 | | | 0.0-0.9 <u>1st TOP SOIL</u> | REFUSAL ↓ | | |
| | | | 0.9-3.0 <u>LIGHT BR. SATY CLAY</u> | | | |
| 4.3 | | | 3.0-4.3 <u>GRAY BR CLAY TO NO SCALE</u> | | | |
| | | | <u>BOTTOM OF TEST PIT 4.3</u> <u>REFUSAL</u> | | | |

TINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator EDWARD GARDNER
 Per DAVID NICOLE
 Surface Elevation 421.39
 Water Depth dry 24 hrs. BACK FILED HOLE
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Sampling Size in. Sam. Size in.

Hole No. TP 3-A Sheet 1 of 1
 Station BLUWARD
 For SUBSOIL INVESTIGATION
 Location POINT PLEASANT
 Started 11-25-22 Completed 11-25-22

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|--|-----------|---------------|------------------|
| 00 | | | 00-07 <u>DRY TOP SOIL</u> | ↓ WET | | |
| | | | 07-20 <u>LIGHT BR SILTY CLAY</u> | | | |
| | | | 20-75 <u>GRAYISH BR SILTY CLAY w/ ROCK FRAGMENTS</u> | | | |
| 5.5 | | | 75-55 <u>GRAY CLAY TO DECOMPOSED SHALE</u> | | | |
| | | | <u>BOTTOM OF TEST PIT 55</u> | | | |

TINNEY DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Driller THU J. JOHNSON
 Operator WILLIAM MOORE
 Surface Elevation 428.53
 Water Depth DNV 24 hrs. DISCONTINUED
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Casing Size in. Sam. Size in.

Hole No. TP 7-A Sheet 1 of 1
 Station
 For BOUGUARD
SUBSOIL INVESTIGATION
 Location POINT PLEASANT
 Started 4-25-77 Completed 11-5-77

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. / Recy. |
|-------|---------------------|---------------------|---|-----------|---------------|--------------------|
| 0.0 | | | 0.0-0.9 TOP SOIL TOP | MOIST | | |
| | | | 0.9-3.5 LIGHT BR SILTY CLAY | ↓ | | |
| 5.5 | | * | 3.5-5.5 GRAY BR SILTY CLAY TO HD WEATHERED SHALE | | | |
| | | | BOTTOM OF TEST PIT 5.5 REFUSAL 5.5 RUNNING WATER AT 4.5 | | | |

WATKINS DRILLING COMPANY, INC.

DIAMOND CORE DRILLING
339 FAWCETT CHURCH ROAD
BRIDGEVILLE, PA. 15017

TEST BORING RECORD

Operator FRANK GARDNER
 Supervisor DAVID WIBLE
 Face Elevation 423.21
 Test Depth DRY 24 hrs. BACK FILL
 Hammer Weight Sa. lbs. Drop in.
 Hammer Weight Ca. lbs. Drop in.
 Sampling Size in. Sam Size in.

Hole No. TP 8-A Sheet 1 of 1
 Station _____
 For BOUGUARD
SUBSOIL INVESTIGATION
 Location POINT PLEASANT
 Started 11-25-74 Completed 11-25-74

| DEPTH | Hammer Blows Sample | Hammer Blows Casing | LOG OF HOLE | CONDITION | Depth Drilled | Sample No. Rec'y |
|-------|---------------------|---------------------|---------------------------------------|-----------|---------------|------------------|
| 0.0 | | | 0.0-0.9 BT TOP SOIL | MOIST | | |
| | | | 0.9-2.0 BR SILTY CLAY | ↓ | | |
| | | | 2.0-6.3 GRAY BR SILTY CLAY | | | |
| 6.3 | | ⊕ | REFUSAL 6.3 BOTTOM OF TEST PIT 6.3 | | | |