FINAL ROUND 10 DAM ASSESSMENT REPORT
NIPSCO MICHIGAN CITY GENERATING STATION
COAL ASH IMPOUNDMENTS

OCTOBER 19, 2012

PREPARED FOR:

U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

PREPARED BY:

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October 19, 2012
File No. 01.0170142.30

Mr. Stephen Hoffman
U. S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Round 10 Dam Assessment - Final Report
EPA Contract No. EP10W001313
NIPSCO – Michigan City Generating Station Coal Ash Impoundments
Michigan City, Indiana

Dear Mr. Hoffman:

In accordance with our proposal 01.P000177.11, dated March 28, 2011, and U.S. Environmental Protection Agency (EPA) Contract No. EP10W001313, Order No. EP-B11S-00049, GZA GeoEnvironmental, Inc. (GZA) has completed our inspection of the Northern Indiana Public Service Company (NIPSCO) Michigan City Generating Station Coal Ash Impoundments located in Michigan City, Indiana (Site). The Site visit was conducted on May 23, 2011 and a Draft Report submitted to EPA, dated March 29, 2012. The purpose of our efforts was to provide the EPA with a Site-specific evaluation of the impoundments to assist EPA in assessing the structural stability of the impoundments under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act Section 104(e). We are submitting one Final Report in portable document format (PDF) directly to the EPA.

Following submittal of the March 2012 Draft Report, NIPSCO completed a geotechnical investigation and embankment stability analyses for the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. (Golder) with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, our visual inspection and in accordance with EPA's criteria, it is GZA's opinion the Site's Coal Ash Impoundments are currently in **SATISFACTORY** condition. Further discussion of our evaluation and recommended actions are presented in the Round 10 Dam Assessment Report. The report includes: (a) completed Field Assessment Checklists; (b) figures of the impoundments; (c) selected photographs with captions; and (d) copies of the August 2012 Golder reports. Our services and report are subject to the Limitations found in **Appendix A** and the Terms and Conditions of our contract agreement.

We are happy to have been able to assist you with this assessment and appreciate the opportunity to continue to provide you with dam engineering consulting services. Please contact the undersigned if you have any questions or comments regarding the content of this Round 10 Dam Assessment Report.

Sincerely,

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FINAL REPORT

EXECUTIVE SUMMARY

This Dam Assessment Report presents the results of a visual inspection of the Northern Indiana Public Service Company (NIPSCO, Owner), Michigan City Generating Station (MCGS) located in Michigan City, Indiana (Site). The inspection was performed on May 23, 2011, by representatives of GZA GeoEnvironmental, Inc (GZA), accompanied by representatives of NIPSCO.

MCGS IMPOUNDMENTS

There are six separate impoundments located at the MCGS, consisting of: Primary Settling Pond No. 1 (Primary No. 1), Secondary Settling Pond No. 1 (Secondary No. 1), Primary Settling Pond No. 2 (Primary No. 2), Secondary Settling Pond No. 2 (Secondary No. 2), the Bottom Ash Area (BAA), and the Final Settling Pond (FSP).

In general, wastewater flows through the impoundments by gravity from southwest to northeast to the FSP where it is either pumped (recycled) back to the MCGS or discharged to Outfall 001 by gravity.

Primary No. 1, Primary No. 2, and Secondary No. 1 consist of an earthfill embankment with a crest length of approximately 3,050 feet and a maximum height (from the lowest elevation of Secondary No. 1 to the top of embankment) of approximately 29 feet. A gravel road along the top of the crest has a width of approximately 20 feet and an elevation of approximately 608.72 feet, National Geodetic Vertical Datum of 1929 (NGVD 29)[1]. The outer and inner slopes of the embankments are approximately 2.5 horizontal to 1 vertical (2.5H:1V). The perimeter of Secondary No. 1 is a sheet pile wall. Crushed stone up to 8-inch diameter was placed on the upper portion of the inner slope from the top of the sheet pile wall up to the crest.

Secondary No. 2 consists of an earthfill embankment with a crest length of approximately 450 feet. Secondary No. 2 shares its southwestern slope with Primary No. 2. The southwestern upstream slope of Secondary No. 2 is the northeastern downstream slope of Primary No. 2. As such, the maximum embankment height of Secondary No. 2 (from the top of the embankment between Secondary No. 2 and Primary No. 2 to the bottom of Primary No. 2) is approximately 29 feet.

The BAA consists of an area of compacted sand that was placed on top of the natural ground surface for the purpose of directing bottom ash sluice water and stormwater runoff to the FSP. It has one embankment that is shared with the FSP. This embankment has a maximum height of 2 feet. Since the BAA does not retain/impound water, it is GZA's opinion the BAA does not satisfy the criteria set forth by the EPA for units requiring further evaluation.

The FSP consists of an earthfill embankment with a crest length of approximately 2,500 feet and a maximum height (from the top of the embankment to the estimated elevation of Lake Michigan) of approximately 18 feet. A gravel road along the top of the crest has a width of approximately 20 feet and at its lowest elevation is approximately 587.72 feet. The inner slopes of the embankments are approximately 2.5 horizontal to 1 vertical (2.5H:1V). The northern perimeter of the FSP is a sheet pile wall.

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[1] Unless otherwise stated, elevations in this report are given in NGVD 29.

The impoundments do not meet the definition of a dam in the State of Indiana and are therefore not regulated by the IDNR, nor assigned a hazard potential rating. Under the EPA classification system, it is GZA's opinion that the Secondary No. 1, Secondary No. 2 and FSP would be considered as having a **Low** hazard potential. This hazard potential rating was assigned because failure or misoperation of these impoundments would result in no probable loss of human life and low economic or environmental losses. Any economic or environmental losses would be primarily limited to the MCGS property.

It is GZA's opinion that the Primary No. 1 and Primary No. 2 would be considered as having a **Significant** hazard potential. This hazard potential rating was assigned because, in the event of dike failure, the coal ash stored in these primary impoundments may discharge into Lake Michigan and could potentially cause environmental damage. Additionally, a dike failure would cause disruption of lifeline facilities as the MCGS depends upon the water within the impoundments. Note that MCGS alternates use of Primary No. 1 and Primary No. 2 such that only one primary impoundment is utilized at a time. Primary No. 1 is currently operational.

Following submittal of the March 2012 Draft Report, NIPSCO completed a geotechnical investigation and embankment stability analyses of the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. (Golder) with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, our visual inspection and in accordance with EPA's criteria, it is GZA's opinion the Site's Coal Ash Impoundments are currently in **SATISFACTORY** condition.

The impoundments were found to have the following deficiencies:

1. Piezometers of unknown depth or construction were located throughout the impoundments *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates the unused and undocumented piezometers were abandoned as recommended)*;
2. No formal operation and maintenance plan or inspection checklist in place to observe and document the structural condition of the impoundments *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates NIPSCO is developing an O&M plan for the Site)*;
3. The discharge pipes within the impoundments have not been inspected internally since they were installed *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates NIPSCO has completed a survey of the impoundment structures and video survey of the pipes was 90% complete)*;
4. There was an obstruction at the decant inlet and lack of a trash rack in Secondary No. 2;
5. The trash rack in Primary No. 2 was bent;
6. There was a pipe of unknown use observed near the overflow pipes at the FSP; and,
7. No design information available for the steel sheet piling used to support the northwestern sides/ends of the impoundments *(NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses included evaluation of the steel sheet piling).*

The following recommendations and remedial measures generally describe the recommended approach to address current deficiencies at the impoundments. Prior to undertaking recommended maintenance, repairs, or remedial measures, the applicability of environmental permits needs to be determined for activities that may occur within resource areas under the jurisdiction of the appropriate regulatory agencies.

Studies and Analyses

GZA recommends the following studies and analyses:

1. If an analysis of the structural capacity of the steel sheet piling has not been performed previously or is not available, this type of analysis should be performed to verify that the installed sheet piling has sufficient strength to support the loading applied by the impoundments *(NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses included evaluation of the steel sheet piling)*;
2. Perform a seepage and stability analysis to evaluate the embankment slopes *(As indicated above, NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses results indicated "acceptable factors of safety for all cases considered when evaluated with respect to U.S. Army Corps of Engineers criteria for the types of analyses and loading conditions evaluated")*; and,
3. Perform a hydrologic and hydraulic analyses of the individual impoundments to determine the adequacy of intake/discharge features and adequacy of current operating water levels *(NIPSCO provided EPA with a hydrologic and hydraulic evaluation of the impoundments that was completed by Golder. The evaluation results indicated that…"All impounds are shown to safely pass up to the 100-year return period event which is the minimum for a low hazard dam as specified by the State of Indiana DNR Division of Water. The Primary and Secondary Impoundments, the southwest Bottom Ash Area, and the Final Settling Pond safely pass up to 50% of the 6-hour, PMP rainfall depth without overtopping.")*

Operation & Maintenance Recommendations

GZA recommends the following operation and maintenance level activities:

1. If they are not necessary for the operation of the impoundments, abandon the piezometers that are located near the impoundments since their purpose, depth and construction are unknown;

2. Clear the obstruction from the decant inlet in Secondary No. 2 and install a trash rack;

3. Exercise stops logs and related water level control mechanisms at exiting decant structures;

4. Increase/adjust the frequency of vegetative maintenance activity such that overgrowth is minimized;

5. Perform a video camera survey of the intake and discharge pipe network within the Impoundments to verify that they are operating correctly and are in suitable condition; and,

6. Create a formal checklist for visual inspections of the impoundments and associated appurtenances and maintain the inspection records on file.

NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates the unused and undocumented piezometers were abandoned as recommended, a video survey of pipes within the impoundments was being completed, and an operation and maintenance (O&M) plan was being developed to address these O&M issues.

Minor Repair Recommendations

GZA recommends the following repairs which may improve the overall condition of the impoundments and water storage system, but do not alter the current design of the embankment. The recommendations may require design by a professional engineer and construction contractor experienced in embankment construction.

1. Repair the bent trash rack in Primary No. 2 before this impoundment is put back in service;

2. Repair sloughs and scarps on the embankments and provide future erosion protection as necessary and,

3. Evaluate the function and necessity of the unknown pipe found on the northeast side of the FSP and remove the pipe if it is not needed.

Remedial Measures Recommendations

1. In conjunction with the results of the seepage and stability analyses make provisions to address inadequate factors of safety as applicable; and,

2. In conjunction with the results of the hydrologic and hydraulic analyses, make provisions for an emergency overflow spillway, if necessary.

NIPSCO completed a geotechnical investigation and embankment stability analyses of the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, it is GZA's opinion that the remedial measure recommendations summarized above and provided in the Draft Report have been satisfied and no longer apply.

PREFACE

The assessment of the general condition of the embankment at the Northern Indiana Public Service Company, Michigan City Generating Station located in Michigan City, Indiana is based upon available data and visual inspections. Detailed investigations and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of this report.

In reviewing this report, it should be realized that the reported condition of the embankment is based on observations of field conditions at the time of inspection, along with data available to the inspection team. In cases where an impoundment is lowered or drained prior to inspection, such action, while improving the stability and safety of the embankment, removes the normal load on the structure and may obscure certain conditions, which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is critical to note that the condition of the embankment depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the embankment will continue to represent the condition of the embankment at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Prepared by:

GZA GeoEnvironmental, Inc.

Walter Kosinski

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No. 10201153

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COAL ASH IMPOUNDMENTS
NIPSCO – MICHIGAN CITY GENERATING STATION
MICHIGAN CITY, INDIANA

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1.0 DESCRIPTION OF PROJECT

1.1 General

1.1.1 Authority

The United States Environmental Protection Agency (EPA) has retained GZA GeoEnvironmental, Inc. (GZA) to perform a visual assessment and develop a report of conditions for the Northern Indiana Public Service Company (NIPSCO, Owner), a division of NiSource, Michigan City Generating Station (MCGS, Site) coal ash impoundments located in Michigan City, Indiana. This evaluation was authorized by the EPA under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e). This assessment and final report were performed in accordance with Round 10 of the Assessment of Dam Safety of Coal Combustion Surface Impoundments, RFQ-DC-16, dated March 16, 2011, and EPA Contract No. EP10W001313, Order No. EP-B11S-00049. The assessment generally conformed to the requirements of the Federal Guidelines for Dam Safety[1], and this report is subject to the limitations contained in **Appendix A** and the Terms and Conditions of our Contract Agreement.

1.1.2 Purpose of Work

The purpose of this assessment was to visually assess and evaluate the present condition of the impoundments and appurtenant structures to attempt to identify conditions that may adversely affect their structural stability and functionality, to note the extent of any deterioration that may be observed, review the status of maintenance and needed repairs, and to evaluate the conformity with current design and construction standards of care.

The assessment was divided into five parts: 1) obtain and review available reports, investigations, and data from the Owner pertaining to the impoundments and appurtenant structures; 2) perform an on-Site review with the Owner of available design, inspection, and maintenance data and procedures for the Impoundments; 3) perform a visual assessment of the Site; 4) prepare and submit a field assessment checklist; and, 5) prepare and submit a draft and a final report presenting the evaluation of the impoundments, including recommendations and proposed remedial actions.

1.1.3 Definitions

To provide the reader with a better understanding of the report, definitions of commonly used terms associated with dams are provided in **Appendix B**. Some of these terms may be included within this report. The terms are presented under common categories associated with dams which include: 1) orientation; 2) dam components; 3) size classification; 4) hazard classification; 5) general; and, 6) condition rating.

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[1] FEMA/ICODS, April 2004: http://www.ferc.gov/industries/hydropower/safety/guidelines/fema-93.pdf

1.2 Description of Project

1.2.1 Location

The MCGS is located on the shores of Lake Michigan about one mile northwest of Michigan City, Indiana, at the address 101 Wabash Street, Michigan City, Indiana 46360. The impoundments are located less than a mile southwest of the MCGS at latitude 41˚ 43' 07" North and longitude 86 ˚ 54' 48" West. A Site locus map of the MCGS, impoundments, and surrounding area is shown on **Figure 1**. An aerial photograph of the MCGS, impoundments, and surrounding area is provided as **Figure 2**.

1.2.2 Owner/Caretaker

The Impoundments are owned and operated by NIPSCO, a wholly owned division of NiSource.

	Dam Owner/Caretaker
Name	NIPSCO, Michigan City Generating Station
Mailing Address	101 Wabash Street
City, State, Zip	Michigan City, Indiana 46360
Contact	Greg Costakis
Title	Manager - Environmental Services
E-Mail	gcostakis@nisource.com
Phone Number	(219) 956-5125

1.2.3 Purpose of the Impoundments

The MCGS was originally constructed in 1929 and commercial operation began in 1931. Currently, the MCGS is a single-unit coal-fired power plant with a maximum generating capacity of approximately 515 megawatts. The impoundments were constructed in the early 1970's for the purpose of storing and disposing coal combustion byproducts and began operation in 1973. Prior to 1973, fly ash was used as structural fill to fill in the shoreline of Lake Michigan. In 1999, the MCGS switched to a dry fly ash handling system. The impoundments have been utilized from 1973 to date.

Wastewater discharged from the Site is regulated under one National Pollution Discharge Elimination System (NPDES) permit[2]. NIPSCO personnel indicated that the majority of the wastewater discharged to the impoundments is recycled back to the MCGS. Any wastewater discharged from the impoundments under the NPDES permit is discharged to Lake Michigan through Outfall 001 as shown on **Figure 2**.

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[2] National Pollutant Discharge Elimination System (NPDES) Permit No. IN0000116, NIPSCO – Michigan City Generating Station, Indiana Department of Environmental Management, March 15, 2011.

1.2.4 Description of the Impoundments and Appurtenances

The following description of the impoundments is based on the Owner interviews, design reports, as-built drawings, and field observations by GZA.

As shown on **Figures 2 and 3**, there are six separate impoundments: Primary Settling Pond No. 1 (Primary No. 1), Secondary Settling Pond No. 1 (Secondary No. 1), Primary Settling Pond No. 2 (Primary No. 2), Secondary Settling Pond No. 2 (Secondary No. 2), the Bottom Ash Area (BAA), and the Final Settling Pond (FSP).

In general, wastewater flows through the impoundments by gravity from southwest to northeast to the FSP where it is either pumped (recycled back) to the MCGS or discharged to Outfall 001 by gravity through two 24-inch-diameter overflow pipes. Each impoundment receives the following types of wastewater:

1. Primary No. 1 receives economizer ash sluice, precipitator ash sluice, air heater washwater, boiler blowdown water, boiler fireside wash water, filter backwash, reverse osmosis reject water, and miscellaneous low volume wastes;
2. Secondary No. 1 is the polishing pond for Primary No. 1 and as such only receives flow from Primary No. 1;
3. Primary No. 2 can receive the same wastewaters as Primary No. 1. Currently, no wastewater is discharged into Primary No. 2. No wastewater will be discharged into Primary No. 2 until Primary No. 1 is filled with ash;
4. Secondary No. 2 is the polishing pond for Primary No. 2 and as such, only receives wastewater from Primary No. 2;
5. The BAA receives boiler slag sluice, coal pile stormwater runoff, and coal handling area floor drain water; and,
6. The Final Settling Pond receives flow from Secondary No. 1, Secondary No. 2, and the BAA.

The impoundments were primarily constructed with compacted sands or silty sands on the natural ground surface. Several soil borings completed by Golder in 2012 indicated the presence bottom ash mixed within the sand fill at a low percentage. Additionally, a thin layer of bottom ash was observed in soil borings BH-5 and BH-6 between Primary No. 2 and Secondary No. 2 and Primary No. 2 and Lake Michigan. This condition was simulated in Golder's stability analyses and found to be satisfactory.

There is no lining beneath the impoundments. There are two rows of sheet piling that separate the impoundments from Lake Michigan. The northernmost row was reportedly installed between 1935 and 1950 and was primarily installed to protect the MCGS from wave erosion. The second row of sheet piling was installed in 1973 in conjunction with the Impoundments for the primary purpose of supporting the structural integrity of the Impoundments and further protection from Lake Michigan. Heavy rip rap was placed in between the two rows of sheet piling.

Primary No. 1, Primary No. 2, and Secondary No. 1 consist of an earthfill embankment with a crest length of approximately 3,050 feet and a maximum height (from the lowest elevation of Secondary No. 1 to the top of embankment) of approximately 29 feet. A gravel road along the top of the crest has a width of approximately 20 feet and an elevation of approximately 608.72 feet, National Geodetic Vertical Datum of 1929 (NGVD 29)[3]. The outer and inner slopes of the embankments are approximately 2.5 horizontal to 1 vertical (2.5H:1V). The interior perimeter of Secondary No. 1 is a sheet pile wall. Crushed stone up to 8-inch diameter was placed on the upper portion of the inner slope from the top of the sheet pile wall up to the crest of the embankment. Secondary No. 1 shares its southwest slope with the northeast embankment of Primary No. 1.

Secondary No. 2 consists of a sheet pile wall impounded area and is surrounded by an earthfill embankment with a crest length of approximately 450 feet similar to Secondary No. 1. Secondary No. 2 shares its southwestern slope with Primary No. 2. The southwestern upstream slope of Secondary No. 2 is the northeastern downstream slope of Primary No. 2 as shown in **Figure 2**. As such, the maximum embankment height of Secondary No. 2 (from the top of the embankment between Secondary No. 2 and Primary No. 2 to the bottom of Primary No. 2) is approximately 29 feet.

The BAA consists of an area of compacted sand that was placed on top of the natural ground surface or compacted sand fill for the purpose of directing bottom ash runoff to the FSP. It has one embankment that is shared with the FSP. This embankment has a maximum height of 2 feet and is solely used for controlling stormwater runoff from the BAA to the FSP.

The FSP consists of an earthfill embankment with a crest length of approximately 2,500 feet and a maximum height (from the top of the embankment to the estimated elevation of Lake Michigan) of approximately 18 feet. A gravel road along the top of the crest has a width of approximately 20 feet and at its lowest elevation is approximately 587.72 feet. The inner slopes of the embankments are approximately 2.5 horizontal to 1 vertical (2.5H:1V). The northern perimeter of the FSP is a sheet pile wall.

The impoundments have not been expanded since they were constructed in the 1970's.

The discharge structures in each impoundment are summarized in the following table.

Impoundment Name	Number of Decant Structures	Decant Structure Pipe Diameter and Type	Inlet Elevation of Decant Structures (Feet)	Purpose
Primary No. 1	1	24-inch Corrugated Metal	602.92	Transfer liquids to Secondary No. 1
Secondary No. 1	1	24-inch Corrugated Metal	588.82	Transfer liquids to FSP
Primary No. 2	1	24-inch Corrugated Metal	587.72	Transfer liquids to Secondary No. 2
Secondary No. 2	1	24-inch Corrugated Metal	588.12	Transfer liquids to FSP
BAA	5	12-inch PVC	587.72	Transfer liquids to FSP
FSP	None	N/A	N/A	Pump liquids to the MCGS

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[3] Unless otherwise stated, elevations in this report are given in NGVD 29.

Two of the impoundments have emergency overflow pipes. Primary No. 1 has a 24-inch diameter corrugated metal pipe set at a decant inlet elevation of approximately 606.72 feet that discharges to Secondary No. 1. The FSP has two 24-inch diameter welded steel pipes set at a decant inlet elevation of approximately 585.72 feet that discharge to Outfall 001.

Instrumentation at the impoundments includes several monitoring wells to conduct groundwater sampling and approximately eight piezometers. According to NIPSCO, since the time our GZA's Site visit, piezometers that were unused and undocumented have been abandoned.

Further discussion of the hydrology and hydraulics of the impoundments is provided in Section 2.5.

1.2.5 Operations and Maintenance of the Impoundments

NIPSCO personnel visually inspect the impoundments on an infrequent basis but generally not for structural purposes. There are limited formal operation and maintenance procedures. Vegetation is sprayed once or twice per year to prohibit growth. The impoundments do not meet the definition of a dam in the State of Indiana and are therefore not regulated by the Indiana Department of Natural Resources (IDNR). Note that MCGS alternates use of Primary No. 1 and Primary No. 2 such that only one primary impoundment is utilized at a time. Primary No. 1 is currently operational. Primary No. 2 was last utilized in 2003 and the settled fly ash has since been removed.

1.2.6 Size Classification

For the purposes of this EPA-mandated inspection, the size classifications will be based on United States Army Corps of Engineers (COE) criteria. According to guidelines established by the COE, dams with a storage volume less than 1,000 acre-feet and/or a height less than 40 feet are classified as Small sized structures. Based on their respective maximum heights and storage volumes (refer to Section 1.3), each of the impoundments is classified as a **Small** sized structure. As noted by NIPSCO in their July 31, 2012 letter to EPA following review of the Draft Report, none of the impoundments at MCGS meet the minimum criteria as regulated structures by the IDNR.

1.2.7 Hazard Potential Classification

Given that the impoundments do not meet the minimum criteria for a dam in the State of Indiana and are therefore not regulated by the IDNR, the IDNR has not assigned them a hazard potential rating. Under the EPA classification system, as presented in the Definitions section (**Appendix B**) and on page 2 of each EPA checklist (**Appendix C**), it is GZA's opinion that the Secondary No. 1, Secondary No. 2, BAA, and FSP would be considered as having a **Low** hazard potential. This hazard potential rating was assigned because failure or misoperation of these impoundments would result in no probable loss of human life and low economic or environmental losses. Any economic or environmental losses would be primarily limited to the MCGS property.

It is GZA's opinion that the Primary No. 1 and Primary No. 2 would be considered as having a **Significant** hazard potential. This hazard potential rating was assigned because, in the event of dike failure, the coal ash stored in these primary impoundments may discharge into Lake Michigan and could potentially cause environmental damage. Additionally, a dike failure would cause disruption of lifeline facilities served by MCGS as the MCGS depends upon the water within the impoundments in the production of electricity. Note that MCGS alternates use of Primary No. 1 and Primary No. 2 such that only one primary impoundment is utilized at a time. Primary No. 1 is currently operational.

1.3 Pertinent Engineering Data

The impoundments are located near Lake Michigan and are approximately bordered by the Indiana National Dunes Lakeshore to the southwest, by Lake Michigan to the north and west, Trail Creek to the east, and Michigan City to the south and east. The impoundments were reportedly constructed on the natural ground surface and primarily consist of medium dense to dense sand and silty sand. Small quantities of ash fill appears to be mixed with the compacted sand and silty sand based on soil boring data recently completed by Golder. Historical soil boring logs indicate that the impoundments were constructed on top of a layer of natural fine sand underlain by silty sand[4] and / or stiff clay. The construction specifications indicate that the sand fill used for construction was obtained from on-Site sources. The fill was specified to be placed in loose lifts of 6 to 8 inches and compacted to a minimum dry density of 98 pounds per cubic foot. According to the specification, prior to placing the fill, the area to be filled was to be cleared of all vegetation, topsoil, and organic material. The remaining soil underlying the filled area was specified to be turned to a depth of 6-inches prior to placing the fill[5].

The size, capacity, and current storage volume of each impoundment based on information provided by NIPSCO[6] are included in the following table.

Impoundment	Size (Acres)	Total Storage Capacity (Cubic Yards)	Current Material Storage Volume (Cubic Yards)
Primary No. 1	2.2	57,250	42,938
Secondary No. 1	0.2	4,440	120
Primary No. 2	2.6	70,260	3,513
Secondary No. 2	0.2	5,344	267
BAA	0.7	2,296	459
FSP	5.7	137,361	6,868

As mentioned previously, there are two rows of continuous sheet piling at the MCGS. The northernmost row was primarily installed to protect the MCGS from wave erosion and abuts Lake Michigan. The second row of sheet piling was installed primarily along/adjacent to the northwestern side/end of the impoundments for the primary purpose of supporting the structural integrity of the impoundments and further shoreline protection. Heavy rip rap was placed in between the two rows of sheet piling. The sheet pile walls are thick (3/8-inch) sheet steel and

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[4] Log of Soil Borings, Drawing No. B-252, Sargent & Lundy Engineers, February 4, 1970.

[5] Specification W-2539 for Ash Settling Basins Work, Michigan City Generating Station - Unit 12, Sargent & Lundy Engineers, August 11, 1972.

[6] NIPSCO Response to EPA Information Request for Information for the Michigan City Generating Station, October 4, 2010.

are constructed with interlocked Z-sections. The Z-shape of the sheet pile cross section is designed to help the wall resist bending and the interlock serves to make the wall act like one continuous wall.

NIPSCO did not have design information for the northern row of sheet piling. The second row was installed at the same time the Impoundments were constructed. According to the design drawings[7], the horizontal lengths, vertical lengths, sheet piling type, and construction method consisted of the following:

Location of Sheet Piling	Horizontal Length (feet)	Vertical Length (feet)	Type of Piling	Construction Method
Adjacent to Primary No. 1	420	42	280-PZ38	ASTM A-572-50
Adjacent to Primary No. 1 and Primary No. 2	1,084.5	42	724-PZ38	ASTM A-572-50
Adjacent to FSP	934.5	42	623-PZ27	ASTM A-328
Adjacent to northern embankment of FSP	54	42	36-PZ27	None specified

1.3.1 Drainage Area

The impoundments are enclosed embankments built up from the natural ground surface. As such, the contributory drainage area is the surface area of the impoundments, approximately 12 acres, plus the surface stormwater runoff from the on-Site coal pile, which is approximately 10 acres in size. As such, the total drainage area for the impoundments is approximately 22 acres. The coal pile was not evaluated by GZA during the impoundment assessment.

1.3.2 Discharges at the Site

Discharges at the Site are regulated under the previously noted NPDES Permit. During normal operating conditions, all of the wastewater discharged to the impoundments is recycled back to the MCGS by a pump house located on the east side of the FSP. If the water level in the FSP reached the emergency overflow discharge pipes, water would be discharged to Outfall 001 which empties into Lake Michigan and is permissible under the NPDES Permit.

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[7] Ash Settling Basins Tower Piling & Pond, Drawing No. B-473, Sargent & Lundy Engineers, December 19, 1972.

1.3.3 General Elevations

Impoundment elevations presented in this report are taken from design drawings and reports provided by NIPSCO personnel. Elevations are based upon the NGVD 29 vertical datum.

Impoundment Name	Lowest Dam Crest Elevation (feet)	Normal Operating Pool Elevation (feet)	Current Operating Pool Elevation (feet)	Emergency Overflow Elevation (feet)
Primary No. 1	608.72	602.92	602.92	606.72
Secondary No. 1	599.72	589.02	589.02	None
Primary No. 2	608.72	602.92	587.72	None
Secondary No. 2	594.72	588.12	586.12	None
BAA	589.92	N/A[1]	587.72[1]	None
FSP	587.72	584.22	584.22	585.72

Note:

1. The BAA does not have a normal operating pool elevation because it is typically empty. The current operating pool elevation provided is the decant inlet elevation.

1.3.4 Design and Construction Records and History of the Impoundments

According to the information provided by NIPSCO, the impoundments were designed by Sargent & Lundy Engineers. Construction of the impoundments and sheet piling associated therewith was completed in 1973. The structure of the impoundments has not been modified since they were constructed. In 1999, the MCGS switched to a dry fly ash handling system instead of the wet fly ash handling system that had been in use previously. The dry fly ash handling system decreased the volume of sluice water discharged to the impoundments.

1.3.5 Operating Records

Minimal operating records are recorded by MCGS personnel and were not available to GZA at the time of the assessment.

1.3.6 Previous Inspection Reports

According to NIPSCO personnel, previous inspection reports regarding the structural stability of the impoundments have not been completed.

2.0 INSPECTION

2.1 Visual Inspection

The Impoundments were evaluated on May 23, 2011 by Walter Kosinski, P.E., and Thomas Boom, P.E., of GZA. The weather was mostly cloudy with temperatures in the 60°s to 70°s Fahrenheit. Underwater areas were not inspected as this level of investigation was beyond GZA's scope of services. A copy of the EPA Checklist for each impoundment is included in **Appendix C**. Photographs to document the current conditions of the impoundments were taken during the inspection and are included in **Appendix D**. With respect to our visual evaluation, there was no evidence of prior releases, failures, or patchwork observed by GZA.

2.1.1 General Findings

Following submittal of the March 2012 Draft Report, NIPSCO completed a geotechnical investigation and embankment stability analyses of the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. (Golder) with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, our visual inspection and in accordance with EPA's criteria, it is GZA's opinion the Site's Coal Ash Impoundments are currently in **SATISFACTORY** condition.

Specific concerns are identified in more detail in the sections below.

An overall plan showing the pertinent features, including the location and orientation of photographs provided in **Appendix D**, is detailed on **Figure 3**.

2.1.2 Primary No. 1 (Photo Nos. 1 – 8, 50 and 51)

Primary No. 1 generally appeared to be in good condition. Wastewater was being discharged into it during GZA's assessment. The outer embankment slope generally appeared to be in good condition. A layer of rip rap was evident on the outer embankment slope. There was a minimal amount of vegetation on the outer slope. No unusual movement or sloughing was observed on the outer slope. The alignment of the sheet piling appeared straight with no lateral displacement (Photo Nos. 50 and 51).

The crest of Primary No. 1 also functions as a gravel road. The alignment of the top of the embankment appeared generally level, with no depressions or irregularities observed.

Most of the interior slope could not be observed due to the water elevation within Primary No. 1. The parts of the interior slope that could be observed appeared to be in good condition. Some minor erosion channels were observed (Photo 8) and some minor sloughing was noted near the emergency overflow pipe (Photo 7).

There are two discharge structures in Primary No. 1, the discharge structure and the emergency overflow pipe. The concrete discharge structure utilizes stop logs to control the elevation of the water within Primary No. 1. The concrete above the water level appeared intact. The interior of the discharge structure could not be observed. The transfer and discharge pipes could not be visually inspected during the assessment. MCGS reportedly has never had an issue with any of the discharge pipes since the Impoundment was originally constructed.

The exterior of the corrugated metal emergency overflow pipe (Photo No. 7) appeared to be in poor condition with significant corrosion observed in the exposed portion. GZA was not able to observe its interior portion beneath the embankment.

A piezometer of unknown depth or construction was observed on the northwest side of Primary No. 1 (Photo 3). Additionally, leakage from the wastewater pipes entering Primary No. 1 (Photo 4) was observed; NIPSCO personnel indicated that when this type of leakage was discovered, it is routinely repaired immediately upon discovery.

2.1.3 Secondary No. 1 (Photo Nos. 9-14)

Secondary No. 1 generally appeared to be in good condition. A continuous row of sheet piling encloses the pool area of Secondary No. 1 (Photo 9). The inner embankment slope appeared to be in good condition. A continuous layer of rip rap was evident on the inner embankment slope. There was a minimal amount of vegetation on the inner slope. No unusual movement was observed on the inner slope and some minor erosion channeling and sloughing was observed (Photos 12 and 14).

The alignment of the sheet piling appeared straight with no lateral displacement. It appeared that one section of the sheet piling in the southeastern corner was at a lower elevation than the rest of the sheet piling (Photos 10 and 14). The condition of the sheet piling could not be observed because it was underwater.

The crest of Secondary No. 1 also functions as a gravel road. The alignment of the top of the embankment appeared generally level, with no depressions or irregularities observed.

There is one discharge structure in Secondary No. 1. The inlet of the discharge structure was obstructed with debris and there did not appear to be a trashrack in place (Photo No. 11). The interior of the discharge structure and discharge pipe could not be observed during the assessment. MCGS reportedly has never had an issue with the discharge pipe since the impoundment was originally constructed.

Several piezometers of unknown depth or construction were observed on the southeast side of Secondary No. 1.

2.1.4 Primary No. 2 (Photo Nos. 15 - 23, 47, 48 and 49)

Primary No. 2 generally appeared to be in good condition. This impoundment was not in use during GZA's assessment and, according to NIPSCO personnel, it has not been used since 2003. The outer embankment slope generally appeared to be in good condition. A layer of rip rap was evident on the outer embankment slope (i.e. the slope along the Lake Michigan side). There was a minimal amount of vegetation on the outer slope. No unusual movement or sloughing was observed on the outer slope. The alignment of the sheet piling appeared straight with no lateral displacement (Photo Nos. 47, 48 and 49).

The crest of Primary No. 2 also functions as a gravel road. The alignment of the top of the embankment appeared generally level, with no depressions or irregularities observed.

The interior slope appeared to be in good condition. Some minor erosion channels were observed and some minor sloughing was noted near the emergency overflow pipe (Photos 16 and 22).

There is one discharge structure in Primary No. 2. The concrete discharge structure utilizes stop logs to control the elevation of the water within Primary No. 2. The concrete appeared intact but the trash rack appeared bent (Photo 17). The discharge pipe could not be visually inspected during the assessment. MCGS reportedly has never had an issue with the discharge pipe since the impoundment was originally constructed.

2.1.5 Secondary No. 2 (Photo Nos. 24, 25, and 26)

Secondary No. 2 generally appeared to be in good condition but was not in use at the time of GZA's assessment. A continuous row of sheet piling encloses the pool area of Secondary No. 2. The alignment of the sheet piling generally appeared straight but its condition could not generally be observed because it was underwater. There is no inner embankment slope.

There is one discharge structure in Secondary No. 2 that could not be observed because of vegetation within the impoundment. MCGS reportedly has never had an issue with the discharge pipe since the impoundment was originally constructed.

2.1.6 Bottom Ash Area (Photo Nos. 27 through 30)

Bottom ash sluice water is discharged to the BAA which acts as a temporary holding area for bottom ash before it is sold for commercial use. The discharged water immediately drains to the FSP through one of five discharge pipes. The BAA ground surface slopes toward the FSP with a small embankment/road along the northwest side, located between the BAA and FSP. The embankment is relatively small, approximately two feet in height, and appeared to be in good condition. The discharge pipes were in fair condition. The BAA controls the sluice water and stormwater from this area prior to discharging to the FSP. Since the BAA does not retain / impound water, it is GZA's opinion the BAA does not satisfy the criteria set forth by the U.S. EPA for units requiring further evaluation, therefore the photos provided herein are for reference only and the previously submitted Checklist has been removed from the Final Report.

2.1.7 Final Settling Pond (Photo Nos. 31 through 46)

The FSP generally appeared to be in good condition. The alignment of the sheet piling on the northwest side of the FSP generally appeared straight (Photo Nos. 45 and 46). The crest of the FSP also functions as a gravel road. The alignment of the top of the embankment appeared generally level, with no depressions or irregularities observed. Most of the interior slope could not be observed due to the water elevation within the FSP. The parts of the interior slope that could be observed appeared to be in good condition.

The primary method to remove water from the FSP is by pumping. The pumphouse contains pumps that transfer water from the FSP to the MCGS and controls the level of water within the FSP. Additionally, there are two overflow pipes (Photo No. 31) that discharge to Outfall 001. If water is discharged to Outfall 001, totalizers located on the overflow pipes (Photo No. 33) will measure the volume of wastewater discharged. According to NIPSCO personnel, the totalizers were operational. The concrete manholes housing the totalizers (Photo Nos. 32 and 33) appeared to be in good condition. The interior of the overflow pipes could not be visually inspected during the assessment. MCGS reportedly has never had an issue with the discharge pipes since the Impoundment was originally constructed.

The pumphouse was not assessed during GZA's site visit as this was outside of our scope of work (Photo 44). An unknown pipe was observed penetrating through the embankment with an outfall end above the current waterline on the northeast side of the FSP (Photo 31).

2.1.8 Steel Sheet Piling

The steel sheet piling generally appeared to be in good condition with no indications of lateral wall movement and little corrosion. GZA did not evaluate the sheet piling as part of the inspection but has provided some general comments. As mentioned previously, there are two rows of continuous sheet piling at the MCGS. Heavy rip rap was placed in between the two rows of sheet piling. The sheet pile walls are thick (3/8-inch) sheet steel and are constructed with interlocked Z-sections. The Z-shape of the sheet pile cross section is designed to help the wall resist bending and the interlock serves to make the wall act like one continuous wall. Design information regarding the sheet pile wall structural integrity was not available at the time of the inspection.

2.2 Caretaker Interview

Maintenance of the dam is the responsibility of MCGS personnel. GZA met with MCGS personnel and discussed the current operations and maintenance procedures, regulatory requirements, and the history of the impoundments since they were constructed. The observations, descriptions and findings presented in this Final Report reference these discussions.

2.3 Operation and Maintenance Procedures

As discussed in Section 1.2.5, MCGS personnel are responsible for the regular operation and maintenance of the impoundments but there are no formal operation and maintenance procedures in place. The impoundments are typically observed at least once per day for anything unusual. NIPSCO indicated in their July 31, 2012 letter to EPA following review of the Draft Report that an operation and maintenance (O&M) plan was in the process of being completed.

2.4 Emergency Action Plan

There is no Emergency Action Plan (EAP) developed for the impoundments. An EAP is not required under Indiana regulations. However, NIPSCO indicated in their July 31, 2012 letter to EPA that an O&M plan was being prepared that would include operating procedures, inspections and vegetative maintenance.

2.5 Hydrologic/Hydraulic Data

GZA did not perform an independent assessment of the hydraulics and hydrology for the impoundments as this was beyond our scope of services. During normal operating conditions, there is approximately six feet of freeboard in Primary No.1 and Primary No. 2, approximately 10.5 feet in Secondary No. 1, approximately 6.5 feet in Secondary No. 2, and approximately 3.5 feet in the FSP. The BAA is generally empty. NIPSCO provided EPA with an August 27, 2012 final report prepared by Golder regarding the hydrologic and hydraulic performance of the impoundments. The evaluation results indicated that "…All impounds are shown to safely pass up to the 100-year return period event which is the minimum for a low hazard dam as specified by the State of Indiana DNR Division of Water. The Primary and Secondary Impoundments, the southwest Bottom Ash Area, and the Final Settling Pond safely pass up to 50% of the

6-hour, PMP rainfall depth without overtopping." A copy of the August 27, 2012 final report is included in Appendix E.

2.6 Structural and Seepage Stability

The original structural and seepage stability analyses, if any, were not available to GZA at the time of inspection. Slope stability analyses, seepage analyses, foundation liquefaction analyses, and settlement analyses reports were not available. NIPSCO provided EPA with an August 27, 2012 geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses results indicated "…acceptable factors of safety for all cases considered when evaluated with respect to U.S. Army Corps of Engineers criteria for the types of analyses and loading conditions evaluated." A copy of the August 27, 2012 geotechnical investigation and embankment stability analyses is included in Appendix F.

3.0 ASSESSMENTS AND RECOMMENDATIONS

3.1 Assessments

Following submittal of the March 2012 Draft Report, NIPSCO completed a geotechnical investigation and embankment stability analyses of the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. (Golder) with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, our visual inspection and in accordance with EPA's criteria, it is GZA's opinion the Site's Coal Ash Impoundments are currently in **SATISFACTORY** condition.

The impoundments were found to have the following deficiencies:

1. Piezometers of unknown depth or construction were located throughout the impoundments *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates the unused and undocumented piezometers were abandoned as recommended)*;
2. No formal operation and maintenance plan or inspection checklist in place to observe and document the structural condition of the impoundments *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates NIPSCO is developing an O&M plan for the Site as discussed in Section 2.3)*;
3. The discharge pipes within the impoundments have not been inspected internally since they were installed *(NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates NIPSCO has completed a survey of the impoundment structures and video survey of the pipes was 90% complete)*;
4. There was an obstruction at the decant inlet and lack of a trash rack in Secondary No. 2;
5. The trash rack in Primary No. 2 was bent;
6. There was a pipe of unknown use observed near the overflow pipes at the FSP; and,

7. No design information available for the steel sheet piling used to support the northwestern sides/ends of the impoundments *(NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses included evaluation of the steel sheet piling and found to be satisfactory).*

The following recommendations and remedial measures generally describe the recommended approach to address current deficiencies at the impoundments. Prior to undertaking recommended maintenance, repairs, or remedial measures, the applicability of environmental permits needs to be determined for activities that may occur within resource areas under the jurisdiction of the appropriate regulatory agencies.

3.2 Studies and Analyses

GZA recommends the following studies and analyses:

1. If an analysis of the structural capacity of the steel sheet piling has not been performed previously or is not available, this type of analysis should be performed to verify that the installed sheet piling has sufficient strength to support the loading applied by the impoundments *(NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses included evaluation of the steel sheet piling)*;

2. Perform a seepage and stability analysis to evaluate the embankment slopes *(As indicated above, NIPSCO provided EPA with a geotechnical investigation and embankment stability analyses of the Site impoundments that was completed by Golder. The embankment stability analyses results indicated "acceptable factors of safety for all cases considered when evaluated with respect to U.S. Army Corps of Engineers criteria for the types of analyses and loading conditions evaluated")*; and,

3. Perform a hydrologic and hydraulic analyses of the individual impoundments to determine the adequacy of intake/discharge features and adequacy of current operating water levels *(NIPSCO provided EPA with a hydrologic and hydraulic evaluation of the impoundments that was completed by Golder. The evaluation results indicated that "All impounds are shown to safely pass up to the 100-year return period event which is the minimum for a low hazard dam as specified by the State of Indiana DNR Division of Water. The Primary and Secondary Impoundments, the southwest Bottom Ash Area, and the Final Settling Pond safely pass up to 50% of the 6-hour, PMP rainfall depth without overtopping.")*

3.3 Recurrent Operation & Maintenance Recommendations

GZA recommends the following operation and maintenance level activities:

1. If they are not necessary for the operation of the impoundments, abandon the piezometers that are located near the impoundments since their purpose, depth and construction are unknown;

2. Clear the obstruction from the decant inlet in Secondary No. 2 and install a trash rack;

3. Exercise stops logs and related water level control mechanisms at exiting decant structures;

4. Increase/adjust the frequency of vegetative maintenance activity such that overgrowth is minimized;
5. Perform a video camera survey of the intake and discharge pipe network within the Impoundments to verify that they are operating correctly and are in suitable condition; and,

6. Create a formal checklist for visual inspections of the impoundments and associated appurtenances and maintain the inspection records on file.

NIPSCO provided comments to EPA regarding the Draft Report in a letter dated July 31, 2012. The letter indicates the unused and undocumented piezometers were abandoned as recommended, a video survey of pipes within the impoundments was being completed, and an operation and maintenance (O&M) plan was being developed to address these O&M issues.

3.4 Minor Repair Recommendations

GZA recommends the following repairs which may improve the overall condition of the impoundments and water storage system, but do not alter the current design of the embankment. The recommendations may require design by a professional engineer and construction contractor experienced in embankment construction.

1. Repair the bent trash rack in Primary No. 2 before this impoundment is put back in service;

2. Repair sloughs and scarps on the embankments and provide future erosion protection as necessary and,

3. Evaluate the function and necessity of the unknown pipe found on the northeast side of the FSP and remove the pipe if it is not needed.

3.5 Remedial Measures Recommendations

1. In conjunction with the results of the seepage and stability analyses make provisions to address inadequate factors of safety as applicable; and,
2. In conjunction with the results of the hydrologic and hydraulic analyses, make provisions for an emergency overflow spillway, if necessary.

NIPSCO completed a geotechnical investigation and embankment stability analyses of the Site impoundments, as well as a hydrologic and hydraulic evaluation. These analyses were completed by Golder Associates, Inc. with reports provided to EPA dated August 27, 2012. Based on the results of these analyses, it is GZA's opinion that the remedial measure recommendations summarized above and provided in the Draft Report have been satisfied and no longer apply.

3.6 Alternatives

There are no practical alternatives to the repairs itemized above.

4.0 ENGINEER'S CERTIFICATION

I acknowledge that the management units referenced herein, the Michigan City Generating Station Impoundments, have been assessed to be in **SATISFACTORY** condition based on our May 23, 2011 Site inspection and the results of recent geotechnical investigations and stability analyses, as well as the hydrologic and hydraulic evaluation completed by Golder for NIPSCO.

Walter Kosinski

Walter Kosinski, P.E.
Principal

WALTER KOSINSKI
REGISTERED
No.
10201153
STATE OF
INDIANA
PROFESSIONAL ENGINEER

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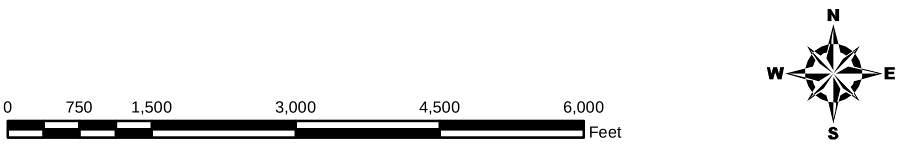
Figures

SOURCE : This map contains the ESRI ArcGIS Online World Topographic Map service, published February 2011 by ESRI ARCIMS Services. The service was compiled to uniform cartography using a variety of best available sources from several data providers.

Data Supplied by : esri



GZA

PROJ. MGR.: TRB
DESIGNED BY: TRB
REVIEWED BY: PHB
OPERATOR: GAS/EMD

DATE: 08-28-2011

LOCUS PLAN
(USGS TOPOGRAPHIC QUAD)

NIPSCO MICHIGAN CITY GENERATING STATION
101 WABASH STREET
MICHIGAN CITY, INDIANA

JOB NO.
01.0170142.30

FIGURE NO.
1

SOURCE : This map contains the ESRI ArcGIS Online World Imagery Map service, published February 2011 by ESRI ARCIMS Services. The service was compiled to uniform cartography using a variety of best available sources from several data providers.

Data Supplied by : esri

GZA

PROJ. MGR.: TRB
DESIGNED BY: TRB
REVIEWED BY: PHB
OPERATOR: GAS/EMD

DATE: 08-28-2011

LOCUS PLAN
(DIGITAL ORTHOPHOTO/AERIAL IMAGERY)

NIPSCO MICHIGAN CITY GENERATING STATION
101 WABASH STREET
MICHIGAN CITY, INDIANA

JOB NO.
01.0170142.30

FIGURE NO.
2

LEGEND

◄(27) PHOTO LOCATION / DIRECTION

SOURCE: This map contains the ESRI ArcGIS Online World Imagery Map service, published February 2011 by ESRI ARCIMS Services. The service was compiled to uniform cartography using a variety of best available sources from several data providers.

Data Supplied by : esri

0 150 300 600
SCALE IN FEET

NIPSCO MICHIGAN CITY GENERATING STATION
101 WABASH STREET
MICHIGAN CITY, INDIANA

PHOTOLOG

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
www.gza.com

PREPARED FOR:

PROJ MGR: TRB	REVIEWED BY: PHB	CHECKED BY: TRB	FIGURE 3
DESIGNED BY: TRB	DRAWN BY: GAS	SCALE: 1 in = 300 ft	
DATE: 09/06/2011	PROJECT NO. 01.0170142.30	REVISION NO.	

Appendix A

Limitations

DAM ENGINEERING & VISUAL INSPECTION LIMITATIONS

1. The observations described in this report were made under the conditions stated herein. The conclusions presented in the report were based solely on the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the United States Environmental Protection Agency (EPA).

2. In preparing this report, GZA GeoEnvironmental, Inc. (GZA) has relied on certain information provided by the Northern Indiana Public Service Company (NIPSCO) as well as Federal, state, and local officials and other parties referenced therein. GZA has also relied on certain information contained on the State of Indiana's website as well as Federal, state, and local officials and other parties which were available to GZA at the time of the inspection. Although there may have been some degree of overlap in the information provided by these various sources, GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this work.

3. In reviewing this Report, it should be noted that the reported condition of the Ash Pond is based on observations of field conditions during the course of this study along with data made available to GZA. The observations of conditions at the Ash Pond reflect only the situation present at the specific moment in time the observations were made, under the specific conditions present. It may be necessary to reevaluate the recommendations of this report when subsequent phases of evaluation or repair and improvement provide more data.

4. It is important to note that the condition of a dam or embankment depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam or embankment will continue to represent the condition of the dam or embankment at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions may be detected.

5. Water level readings have been reviewed and interpretations have been made in the text of this report. Fluctuations in the level of the groundwater and surface water may occur due to variations in rainfall, temperature, and other factors different than at the time measurements were made.

6. GZA's comments on the history, hydrology, hydraulics, and embankment stability for the Impoundments are based on a limited review of available design documentation for the NIPSCO facility. Calculations and computer modeling used in these analyses were not available and were not independently reviewed by GZA.

7. This report has been prepared for the exclusive use of EPA for specific application to the existing dam facilities, in accordance with generally accepted dam engineering practices. No other warranty, express or implied, is made.

8. This dam inspection verification report has been prepared for this project by GZA. This report is for broad evaluation and management purposes only and is not sufficient, in and of itself, to prepare construction documents or an accurate bid.

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Appendix B

Definitions

COMMON DAM SAFETY DEFINITIONS

For a comprehensive list of dam engineering terminology and definitions refer to references published by the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, the Department of the Interior Bureau of Reclamation, or the Federal Emergency Management Agency.

Orientation

Upstream – Shall mean the side of the dam that borders the impoundment.

Downstream – Shall mean the high side of the dam, the side opposite the upstream side.

Right – Shall mean the area to the right when looking in the downstream direction.

Left – Shall mean the area to the left when looking in the downstream direction.

Dam Components

Dam – Shall mean any artificial barrier, including appurtenant works, which impounds or diverts water.

Embankment – Shall mean the fill material, usually earth or rock, placed with sloping sides, such that it forms a permanent barrier that impounds water.

Crest – Shall mean the top of the dam, usually provides a road or path across the dam.

Abutment – Shall mean that part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed as a concrete gravity section, to take the thrust of an arch dam where there is no suitable natural abutment.

Appurtenant Works – Shall mean structures, either in dams or separate there from, including but not be limited to, spillways; reservoirs and their rims; low level outlet works; and water conduits including tunnels, pipelines, or penstocks, either through the dams or their abutments.

Spillway – Shall mean a structure over or through which water flows are discharged. If the flow is controlled by gates or boards, it is a controlled spillway; if the fixed elevation of the spillway crest controls the level of the impoundment, it is an uncontrolled spillway.

General

EAP – Emergency Action Plan - Shall mean a predetermined plan of action to be taken to reduce the potential for property damage and/or loss of life in an area affected by an impending dam break.

O&M Manual – Operations and Maintenance Manual; Document identifying routine maintenance and operational procedures under normal and storm conditions.

Normal Pool – Shall mean the elevation of the impoundment during normal operating conditions.

Acre-foot – Shall mean a unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet. One million U.S. gallons = 3.068 acre feet.

Height of Dam – Shall mean the vertical distance from the lowest portion of the natural ground, including any stream channel, along the downstream toe of the dam to the crest of the dam.

Spillway Design Flood (SDF) – Shall mean the flood used in the design of a dam and its appurtenant works particularly for sizing the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

Condition Rating

SATISFACTORY - No existing or potential management unit safety deficiencies are recognized. Acceptable performance is expected under all applicable loading conditions (static, hydrologic, seismic) in accordance with the applicable criteria. Minor maintenance items may be required.

FAIR - Acceptable performance is expected under all required loading conditions (static, hydrologic, seismic) in accordance with the applicable safety regulatory criteria. Minor deficiencies may exist that require remedial action and/or secondary studies or investigations.

POOR - A management unit safety deficiency is recognized for any required loading condition (static, hydrologic, seismic) in accordance with the applicable dam safety regulatory criteria. Remedial action is necessary. POOR also applies when further critical studies or investigations are needed to identify any potential dam safety deficiencies.

UNSATISFACTORY - Considered unsafe. A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution. Reservoir restrictions may be necessary.

Hazard Potential

(In the event the impoundment should fail, the following would occur):

LESS THAN LOW HAZARD POTENTIAL: Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

LOW HAZARD POTENTIAL: Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

SIGNIFICANT HAZARD POTENTIAL: Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

HIGH HAZARD POTENTIAL: Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Appendix C

Inspection Checklists

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Michigan City Generating Station

Date: May 24, 2011

Unit Name: Primary Settling Basin No. 1

Operator's Name: NIPSCO

Unit I.D.: N/A

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Walter Kosinski, P.E. & Thomas Boom, P.E.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✔
2. Pool elevation (operator records)?	602.92 ft		19. Major erosion or slope deterioration?		✔
3. Decant inlet elevation (operator records)?	602.92 ft		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✔
5. Lowest dam crest elevation (operator records)?	608.72 ft		Is water exiting outlet, but not entering inlet?		✔
6. If instrumentation is present, are readings recorded (operator records)?		✔	Is water exiting outlet flowing clear?	✔	
7. Is the embankment currently under construction?		✔	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✔		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✔	At isolated points on embankment slopes?		✔
10. Cracks or scarps on crest?		✔	At natural hillside in the embankment area?		✔
11. Is there significant settlement along the crest?		✔	Over widespread areas?		✔
12. Are decant trashracks clear and in place?	✔		From downstream foundation area?		✔
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✔	"Boils" beneath stream or ponded water?		✔
14. Clogged spillways, groin or diversion ditches?		✔	Around the outside of the decant pipe?		✔
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?		✔	23. Water against downstream toe?	✔	
17. Cracks or scarps on slopes?		✔	24. Were Photos taken during the dam inspection?	✔	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1) Impoundment is not regulated by Indiana Department of Natural Resources (DNR) but daily routine maintenance is conducted for security and operations although not specifically for the impoundment structure.

3) Stoplogs and a concrete structure control the pool elevation. The invert evaluation of the outlet pipe within the concrete structure is 588.72 feet. Water discharges to the Secondary Settling Basin No. 1.

6) Monitoring wells are present but not monitored.

8) According to plans and specifications, the foundation was prepared.

12) Decant pipe uses stoplogs which were clear of any materials.

20) Appeared to be clear based on our observations.

21) Unable to observe the outside of the decant pipe.

23) Water was against the northeast side toe adjacent to Secondary Settling Basin No. 1. Water (Lake Michigan) was also against the northern most sheet pile wall. There is also a second sheet pile wall at the northern edge of Primary Settling Basin No. 1.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0000116   INSPECTOR Walter Kosinski, P.E. & Thomas Boom, P.E.

Date May 24, 2011

Impoundment Name Michigan City Generating Station
Impoundment Company NIPSCO
EPA Region 5
State Agency (Field Office) Addresss Not regulated by Indiana DNR

Name of Impoundment Primary Settling Basin No. 1
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling of coal combustion ash.

Nearest Downstream Town : Name N/A - Lake Michigan
Distance from the impoundment 100 feet
Impoundment
Location: Longitude 86 Degrees 54 Minutes 56 Seconds
Latitude 41 Degrees 42 Minutes 59 Seconds
State IN County LaPorte County

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

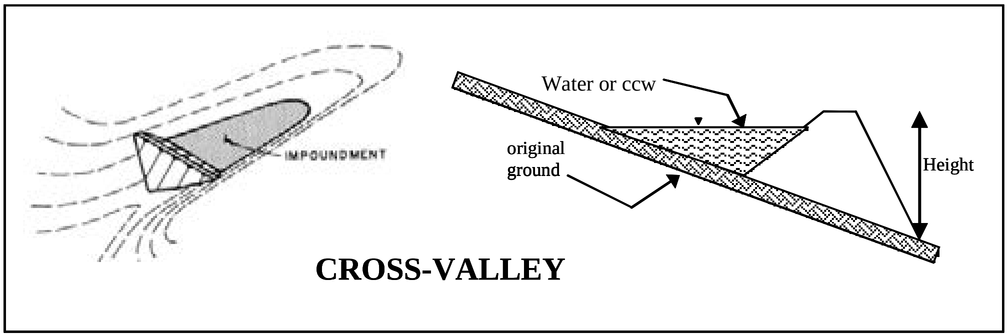
__X__ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

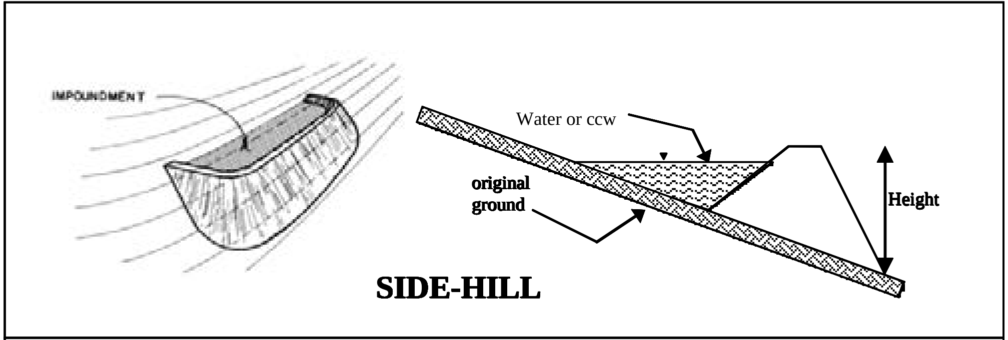
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

A significant hazard rating was selected because in the unlikely event of dike failure, the coal ash stored in the impoundment may discharge into Lake Michigan and cause environmental damage. Although this condition is unlikely due to the presence of two protective sheet pile walls separating Lake Michigan from the impoundment, by definition, the potential for environmental impact is possible. Additionally, a dike failure would cause disruption of lifeline facilities as the generating station depends upon the water within the impoundments. Failure of the dike would not likely result in loss of human life. Note that the generating station alternates use of Primary Settling Basin No. 1 with Primary Settling Basin No. 2 such that only one primary basin is utilized at a time.

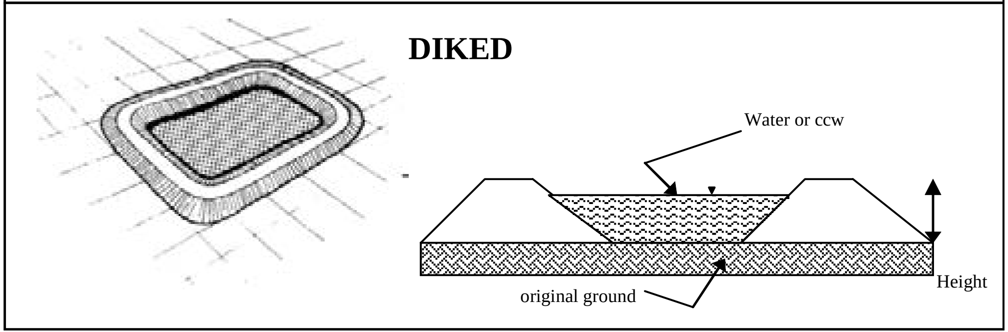
CONFIGURATION:



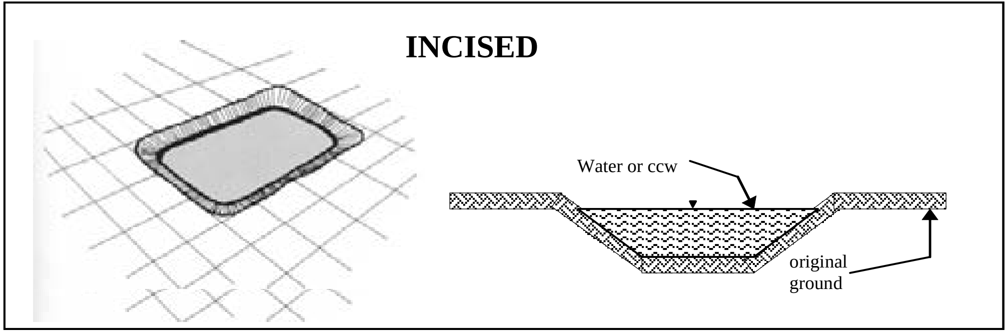
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

______ Cross-Valley
______ Side-Hill
______ Diked
______ Incised (form completion optional)
__x__ Combination Incised/Diked

Embankment Height 28* feet Embankment Material Compacted sand and sheet pile wall
Pool Area 2.2 acres Liner None
Current Freeboard ____________ feet Liner Permeability N/A

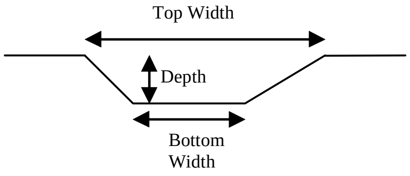
*Maximum height from top of embankment to Lake Michigan.

TYPE OF OUTLET (Mark all that apply)

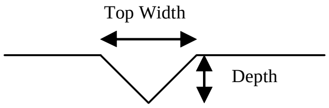
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

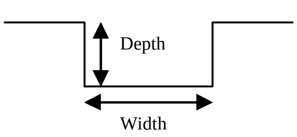
TRAPEZOIDAL



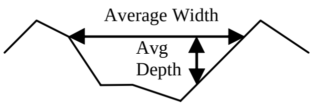
TRIANGULAR



RECTANGULAR

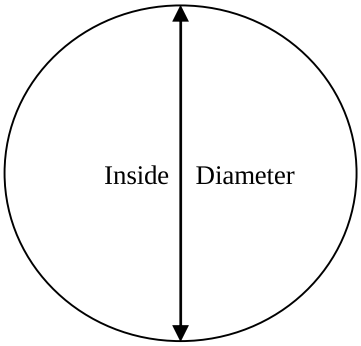


IRREGULAR



X **Outlet** *

24 in. inside diameter
*Inside concrete structure with stoplogs



Material
X corrugated metal
______ welded steel
______ concrete
______ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

Is water flowing through the outlet? YES X NO _______

______ **No Outlet**

X **Other Type of Outlet** (specify) Emergency Overflow - 24-inch corrugated metal

The Impoundment was Designed By Sargent & Lundy Engineers

Has there ever been a failure at this site? YES ___________ NO ___X___

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO ___X____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Michigan City Generating Station **Date:** May 24, 2011

Unit Name: Secondary Settling Basin No. 1 **Operator's Name:** NIPSCO

Unit I.D.: N/A **Hazard Potential Classification:** High Significant [✓ Low]

Inspector's Name: Walter Kosinski, P.E. & Thomas Boom, P.E.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	589.02 ft +/-		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	588.82 ft		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		✓
5. Lowest dam crest elevation (operator records)?	599.72 ft		Is water exiting outlet, but not entering inlet?		✓
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?	✓	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?		✓	From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?		✓
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?		✓	23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1) Impoundment is not regulated by Indiana Department of Natural Resources (DNR) but daily routine maintenance is conducted for security and operations although not specifically for the impoundment structure.
6) Monitoring wells are present but not monitored.
8) According to plans and specifications, the foundation was prepared.
12) No trashrack but there was debris in the pipe inlet.
19) Some minor erosion noted on the interior slope.
20) Appeared to be clear based on our observations.
23) Water against the downstream toe to the west is from the Primary Settling Basin No. 1 and against the downstream toe to the north is Lake Michigan however the northern portion of the impoundment is bound by two protective sheet pile walls separating Lake Michigan from the impoundment.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0000116 INSPECTOR Walter Kosinski, P.E. & Thomas Boom, P.E.

Date May 24, 2011

Impoundment Name Michigan City Generating Station
Impoundment Company NIPSCO
EPA Region 5
State Agency (Field Office) Addresss Not regulated by Indiana DNR

Name of Impoundment Secondary Settling Basin No. 1
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling of coal combustion ash.

Nearest Downstream Town : Name N/A - Lake Michigan
Distance from the impoundment 100 feet
Impoundment
Location: Longitude 86 Degrees 54 Minutes 54 Seconds
Latitude 41 Degrees 43 Minutes 03 Seconds
State IN County LaPorte County

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

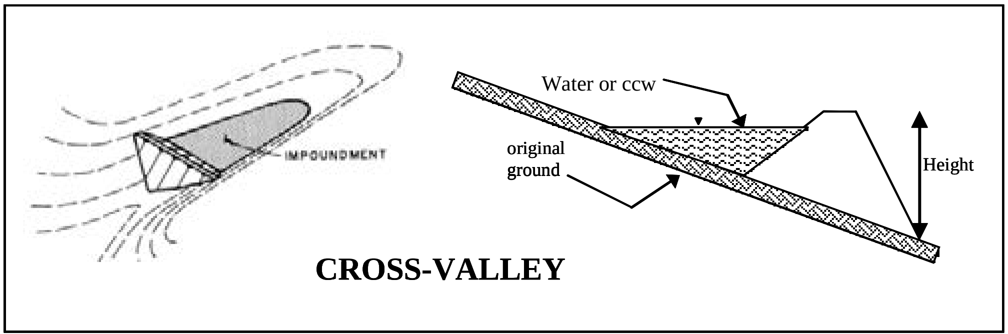
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

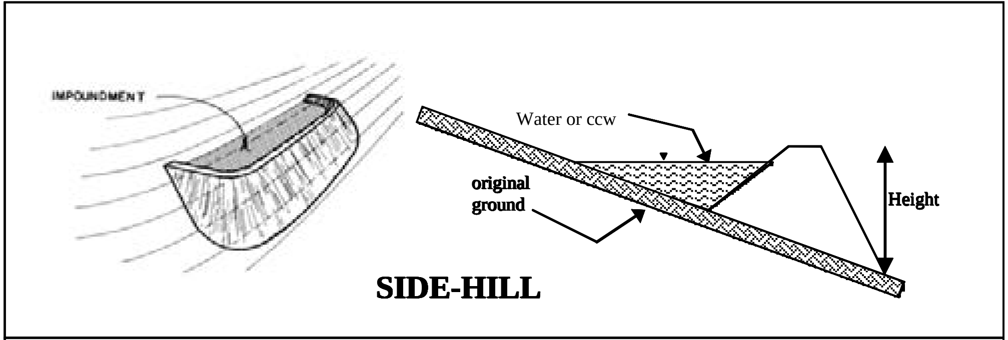
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

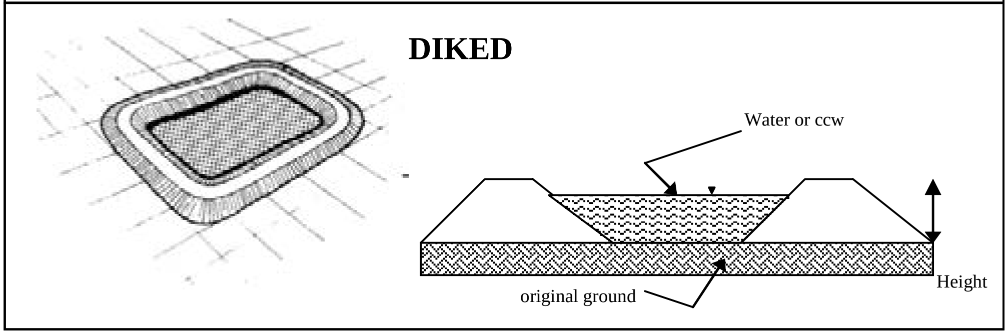
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

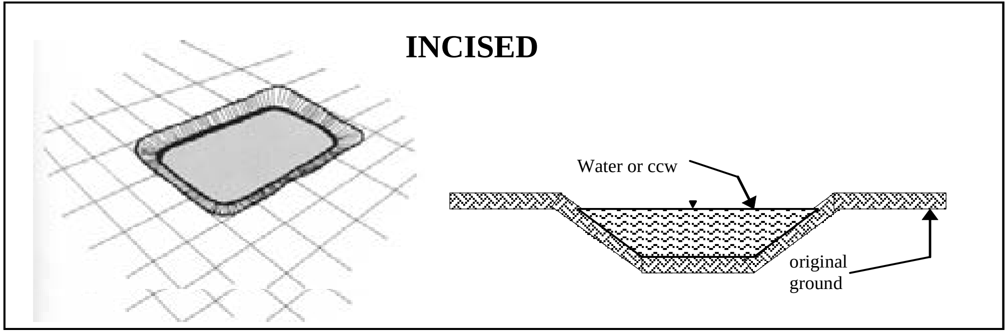
Low hazard potential was selected because in the event of dike failure the losses would be minimal due to the relatively small volume of water and potential ash in the impoundment, the losses would be principally limited to the owner's property, and there are two rows of protective sheet piling between the dike and Lake Michigan.

CONFIGURATION:









______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

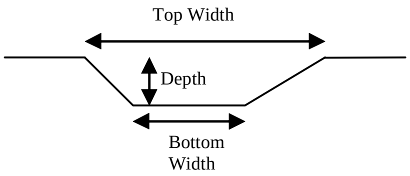
Embankment Height __28*__ feet   Embankment Material __Compacted sand and sheet pile wall__
Pool Area __0.2__ acres   Liner __None__
Current Freeboard __11__ feet   Liner Permeability __N/A__
*Maximum height from top of embankment to Lake Michigan.

TYPE OF OUTLET (Mark all that apply)

_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

TRAPEZOIDAL



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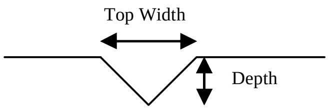
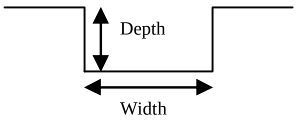
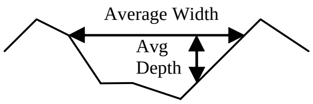


RECTANGULAR

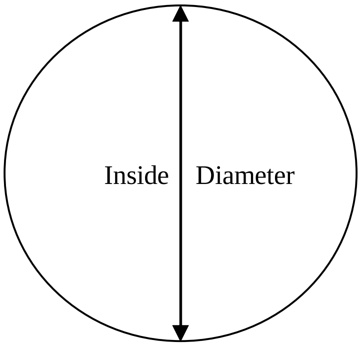


IRREGULAR



__X__ **Outlet**

24 in. inside diameter



Material
__X__ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES __X__ NO _______

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By Sargent & Lundy Engineers
____

Has there ever been a failure at this site? YES ___________ NO ___X_______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower
Phreatic water table levels based on past seepages or breaches
at this site? YES ________NO ___X_____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Michigan City Generating Station

Date: May 24, 2011

Unit Name: Primary Settling Basin No. 2

Operator's Name: NIPSCO

Unit I.D.: N/A

Hazard Potential Classification: High [✓ Significant] Low

Inspector's Name: Walter Kosinski, P.E. & Thomas Boom, P.E.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✔
2. Pool elevation (operator records)?	See Note		19. Major erosion or slope deterioration?		✔
3. Decant inlet elevation (operator records)?	587.72 ft		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	608.72 ft		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?		✔	Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		✔	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✔		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✔	At isolated points on embankment slopes?	N/A	
10. Cracks or scarps on crest?		✔	At natural hillside in the embankment area?	N/A	
11. Is there significant settlement along the crest?		✔	Over widespread areas?	N/A	
12. Are decant trashracks clear and in place?	✔		From downstream foundation area?	N/A	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✔	"Boils" beneath stream or ponded water?	N/A	
14. Clogged spillways, groin or diversion ditches?		✔	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?		✔	23. Water against downstream toe?	✔	
17. Cracks or scarps on slopes?		✔	24. Were Photos taken during the dam inspection?	✔	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1) Impoundment is not regulated by Indiana Department of Natural Resources (DNR) but daily routine maintenance is conducted for security and operations although not specifically for the impoundment structure.
2) The impoundment is not currently in use but there was standing rain water in it during the assessment that is allowed to evaporate.
6) Monitoring wells are present but not monitored.
8) According to plans and specifications, the foundation was prepared.
12) In place and clear but not in use. Appeared to be bent.
13, 14, 16, 20, 21) The impoundment is not currently in use.
19) Some erosion channels on interior slope.
23) Water (Lake Michigan) was against the north toe against the northern most sheet pile wall, against the west toe in the Secondary Settling Basin No. 1, and against the northeast toe in the Secondary Settling Basin No. 2.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0000116

INSPECTOR Walter Kosinski, P.E. & Thomas Boom, P.E.

Date May 24, 2011

Impoundment Name Michigan City Generating Station

Impoundment Company NIPSCO

EPA Region 5

State Agency (Field Office) Addresss Not regulated by Indiana DNR

Name of Impoundment Primary Settling Basin No. 2

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?		X

IMPOUNDMENT FUNCTION: Settling of coal combustion ash.

Nearest Downstream Town : Name N/A - Lake Michigan

Distance from the impoundment 100 feet

Impoundment

Location: Longitude 86 Degrees 54 Minutes 52 Seconds

Latitude 41 Degrees 43 Minutes 05 Seconds

State IN County LaPorte County

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

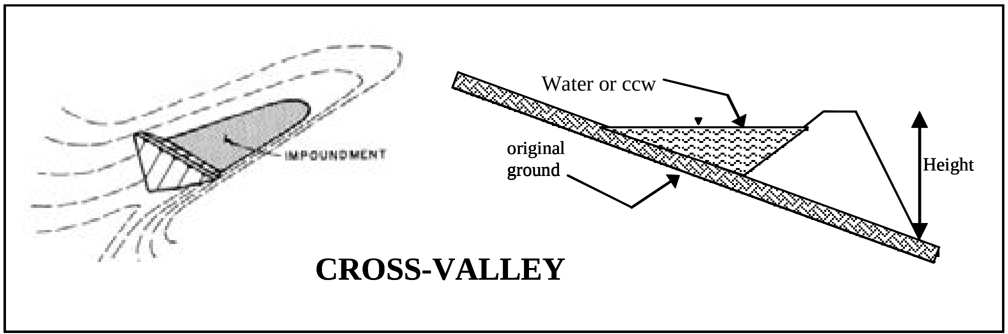
__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

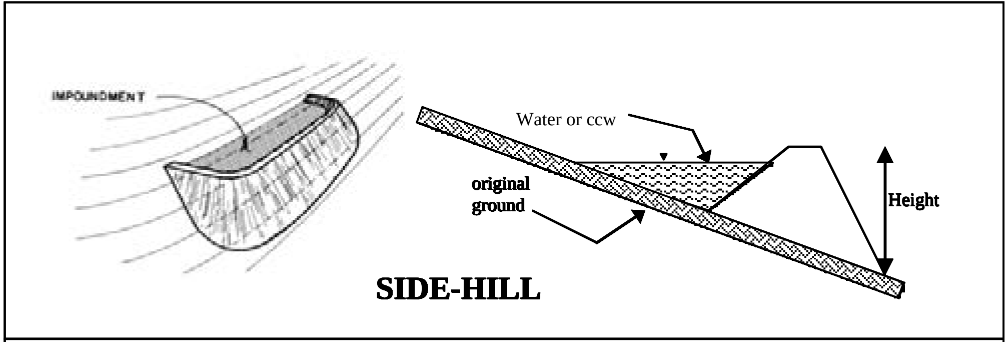
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Although this impoundment was not in use at the time of the inspection, a significant hazard rating was selected based on the maximum volume of coal ash storage capacity. In the unlikely event of dike failure, the coal ash stored in the impoundment may discharge into Lake Michigan and cause environmental damage. Although this condition is unlikely due to the presence of two protective sheet pile walls separating Lake Michigan from the impoundment, by definition, the potential for environmental impact is possible. Additionally, a dike failure would cause disruption of lifeline facilities as the generating station depends upon the water within the impoundments. Failure of the dike would not likely result in loss of human life. Currently the impoundment has little to no coal ash stored in it and is not being used for impounding coal ash slurry. The generating station alternates use of Primary Settling Basin No. 2 with Primary Settling Basin No. 1 such that only one primary basin is utilized at a time.

CONFIGURATION:

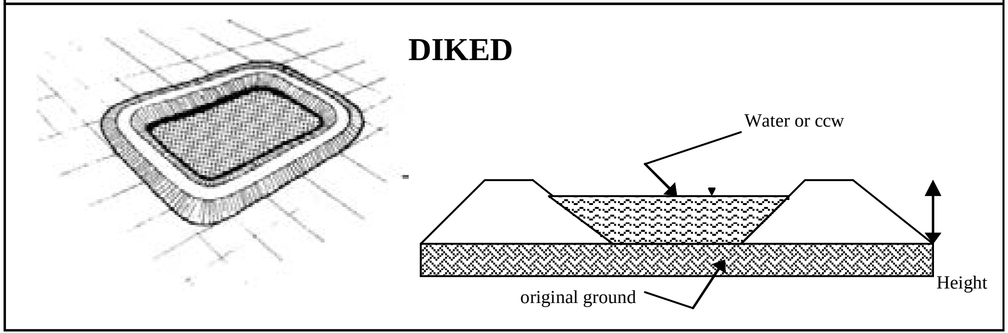


CROSS-VALLEY

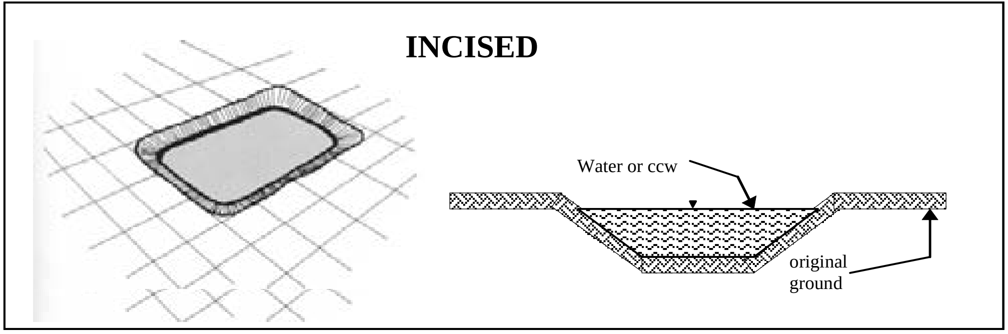


SIDE-HILL

DIKED



INCISED



______ Cross-Valley
______ Side-Hill
X Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height 29* feet
Embankment Material Compacted sand and sheet piling
Pool Area 2.6 acres
Liner None
Current Freeboard 20 feet
Liner Permeability N/A

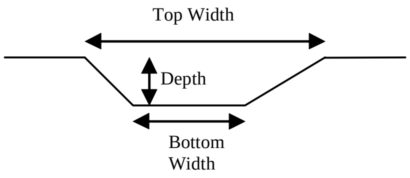
*Maximum height from top of embankment to Lake Michigan.

TYPE OF OUTLET (Mark all that apply)

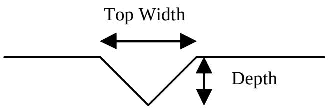
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width

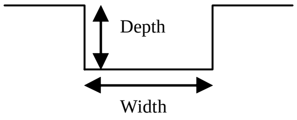
TRAPEZOIDAL



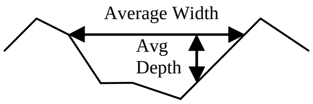
TRIANGULAR



RECTANGULAR

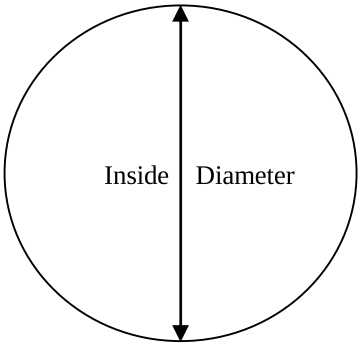


IRREGULAR



__X__ **Outlet**

24 in. inside diameter



Material
__X__ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO __X (impoundment is fundamentally empty)

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By __Sargent & Lundy Engineers________
____

Has there ever been a failure at this site? YES ___________ NO ___X_______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO ___X____

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name: Michigan City Generating Station

Date: May 24, 2011

Unit Name: Secondary Settling Basin No. 2

Operator's Name: NIPSCO

Unit I.D.: N/A

Hazard Potential Classification: High Significant [✓ Low]

Inspector's Name: Walter Kosinski, P.E. & Thomas Boom, P.E.

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✔
2. Pool elevation (operator records)?	See Note		19. Major erosion or slope deterioration?		✔
3. Decant inlet elevation (operator records)?	588.12 ft		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	594.72 ft		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?		✔	Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		✔	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✔		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✔	At isolated points on embankment slopes?	N/A	
10. Cracks or scarps on crest?		✔	At natural hillside in the embankment area?	N/A	
11. Is there significant settlement along the crest?		✔	Over widespread areas?	N/A	
12. Are decant trashracks clear and in place?	✔		From downstream foundation area?	N/A	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✔	"Boils" beneath stream or ponded water?	N/A	
14. Clogged spillways, groin or diversion ditches?	N/A		Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?	N/A		23. Water against downstream toe?	✔	
17. Cracks or scarps on slopes?		✔	24. Were Photos taken during the dam inspection?	✔	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1) Impoundment is not regulated by Indiana Department of Natural Resources (DNR) but daily routine maintenance is conducted for security and operations although not specifically for the impoundment structure.
2) The impoundment is not currently in use but there was standing rain water in it during the assessment.
6) Monitoring wells are present but not monitored.
12) Not able to observe during the assessment.
13, 14, 16, 20, 21) The impoundment is not currently active and was virtually empty during the assessment.
23) Currently none, but there would be if Primary Settling Basin No. 2 was active.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0000116 INSPECTOR Walter Kosinski, P.E. & Thomas Boom, P.E.

Date May 24, 2011

Impoundment Name Michigan City Generating Station

Impoundment Company NIPSCO

EPA Region 5

State Agency (Field Office) Addresss Not regulated by Indiana DNR

Name of Impoundment Secondary Settling Basin No. 2

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?		X

IMPOUNDMENT FUNCTION: Secondary settling of coal combustion ash.

Nearest Downstream Town : Name N/A - Lake Michigan

Distance from the impoundment 100 feet

Impoundment

Location:

Longitude 86 Degrees 54 Minutes 50 Seconds

Latitude 41 Degrees 43 Minutes 08 Seconds

State IN County LaPorte County

Does a state agency regulate this impoundment? YES NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

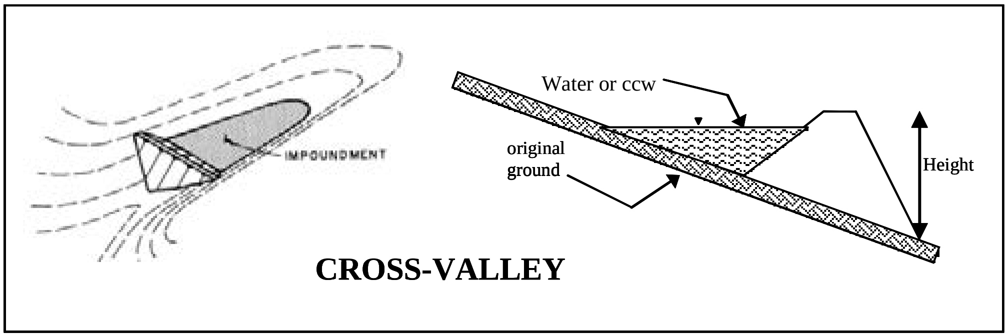
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

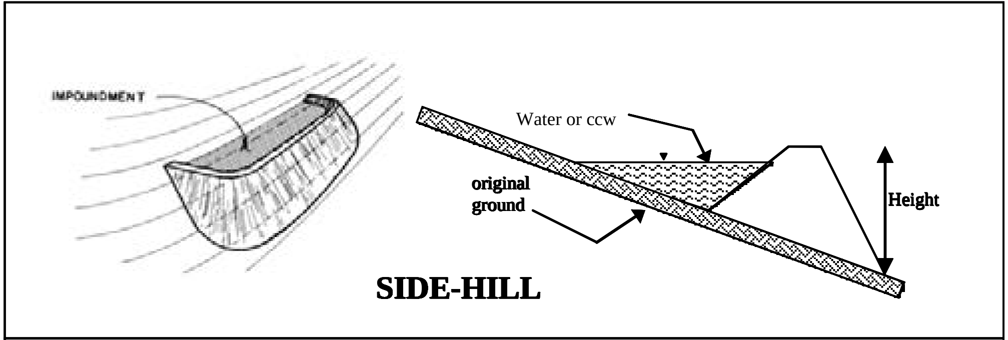
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

Low hazard potential was selected because in the event of dike failure the losses would be minimal, the losses would be principally limited to the owner's property, and there are two rows of protective sheet piling between the dike and Lake Michigan.

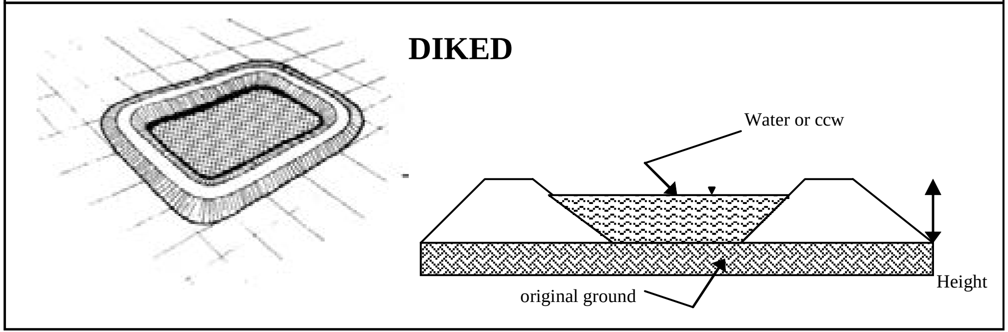
CONFIGURATION:



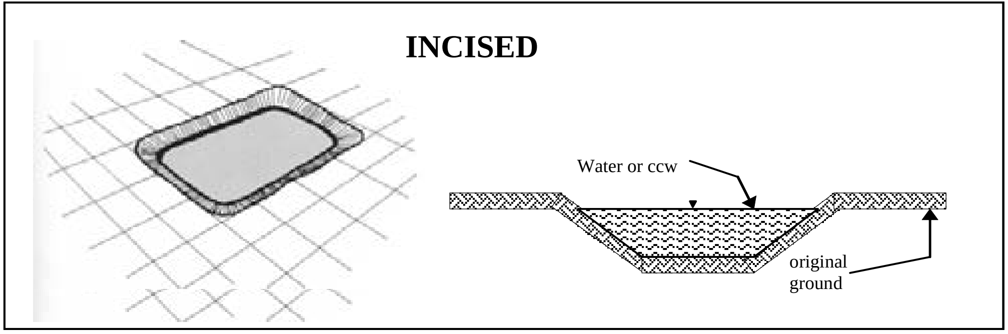
CROSS-VALLEY



SIDE-HILL



DIKED



INCISED

______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

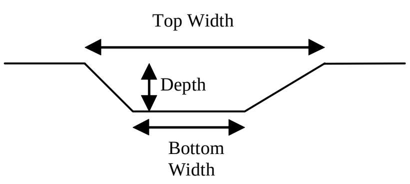
Embankment Height 29* feet
Embankment Material Compacted sand and sheet pile wall
Pool Area 0.2 acres
Liner None
Current Freeboard 6 feet
Liner Permeability N/A

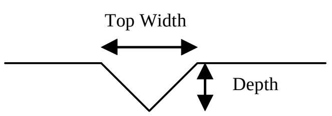
*Maximum height from top of embankment to Lake Michigan.

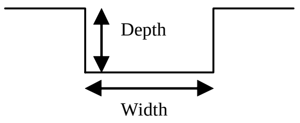
TYPE OF OUTLET (Mark all that apply)

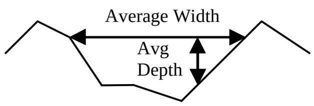
_____ **Open Channel Spillway**
_____ Trapezoidal
_____ Triangular
_____ Rectangular
_____ Irregular

_____ depth
_____ bottom (or average) width
_____ top width


TRAPEZOIDAL

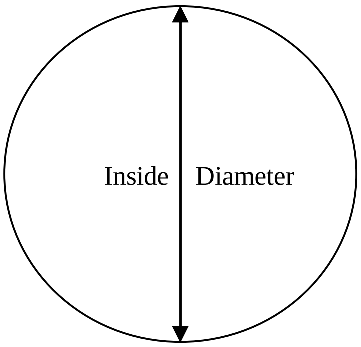

TRIANGULAR


RECTANGULAR


IRREGULAR

__X__ **Outlet**

24 in. inside diameter



Material
__X__ corrugated metal
_____ welded steel
_____ concrete
_____ plastic (hdpe, pvc, etc.)
_____ other (specify) ____________________

Is water flowing through the outlet? YES _______ NO __X__ (not currently in use)

_____ **No Outlet**

_____ **Other Type of Outlet** (specify) ______________________________

The Impoundment was Designed By Sargent & Lundy Engineers
____

Has there ever been a failure at this site? YES ___________ NO ___X___________

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ________________________________

Coal Combustion Dam Inspection Checklist Form

US Environmental
Protection Agency

Site Name:	Michigan City Generating Station	Date:	May 24, 2011
Unit Name:	Final Settling Pond	Operator's Name:	NIPSCO
Unit I.D.:	N/A	Hazard Potential Classification:	High Significant [✓ Low]
Inspector's Name:	Walter Kosinski, P.E. & Thomas Boom, P.E.		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	Daily		18. Sloughing or bulging on slopes?		✓
2. Pool elevation (operator records)?	584.22 ft		19. Major erosion or slope deterioration?		✓
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	587.72 ft		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?		✓	Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?		✓	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓		From underdrain?	N/A	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓	At isolated points on embankment slopes?		✓
10. Cracks or scarps on crest?		✓	At natural hillside in the embankment area?		✓
11. Is there significant settlement along the crest?		✓	Over widespread areas?		✓
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		✓
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓	"Boils" beneath stream or ponded water?		✓
14. Clogged spillways, groin or diversion ditches?		✓	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?	N/A		22. Surface movements in valley bottom or on hillside?	N/A	
16. Are outlets of decant or underdrains blocked?	N/A		23. Water against downstream toe?	✓	
17. Cracks or scarps on slopes?		✓	24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1) Impoundment is not regulated by Indiana Department of Natural Resources (DNR) but daily routine maintenance is conducted for security and operations although not specifically for the impoundment structure.
3, 16, 20) There are no decant pipes because the water in the Final Settling Pond is pumped back to the Michigan City Generating Station for recycling. There are two emergency overflow pipes at elevation 585.72 feet.
6) Monitoring wells are present but not monitored.
8) According to plans and specifications the foundation was prepared.
23) Lake Michigan was against the toe to the north behind two walls of sheet piles.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # IN0000116 INSPECTOR Walter Kosinski, P.E. & Thomas Boom, P.E.
Date May 24, 2011

Impoundment Name Michigan City Generating Station
Impoundment Company NIPSCO
EPA Region 5
State Agency (Field Office) Addresss Not regulated by Indiana DNR

Name of Impoundment Final Settling Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New X Update ______

	Yes	No
Is impoundment currently under construction?		X
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Final settling basin prior to recycling water

Nearest Downstream Town : Name N/A - Lake Michigan
Distance from the impoundment 100 feet
Impoundment
Location: Longitude 86 Degrees 54 Minutes 48 Seconds
Latitude 41 Degrees 43 Minutes 15 Seconds
State IN County LaPorte County

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency? N/A

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

__X___ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

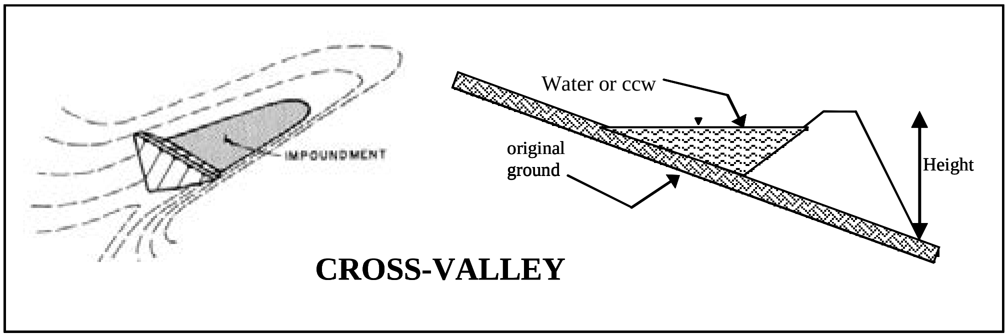
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

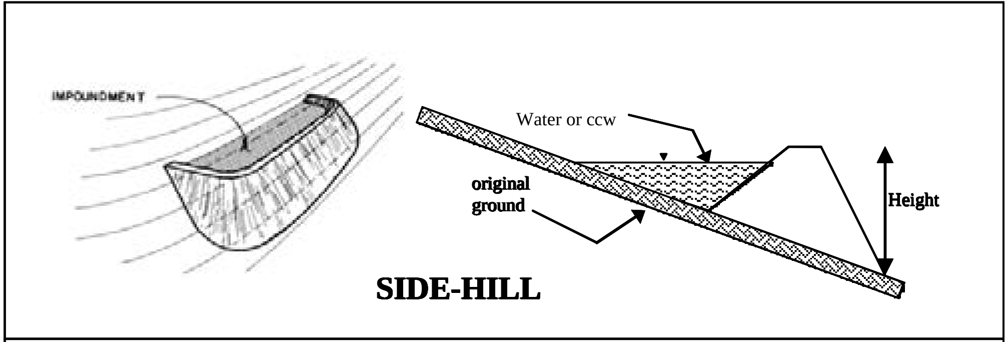
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

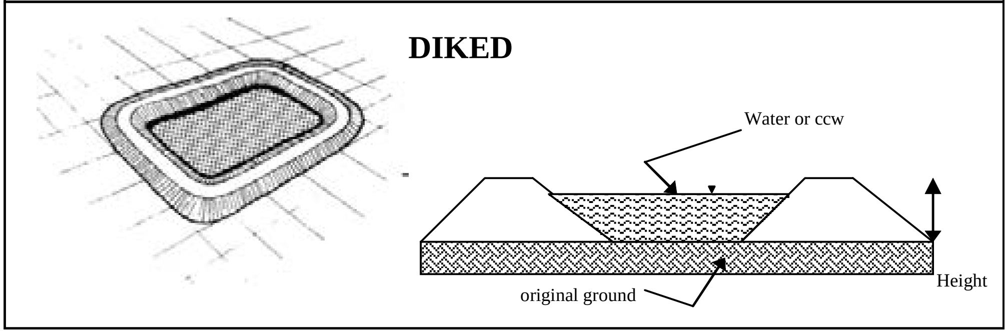
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

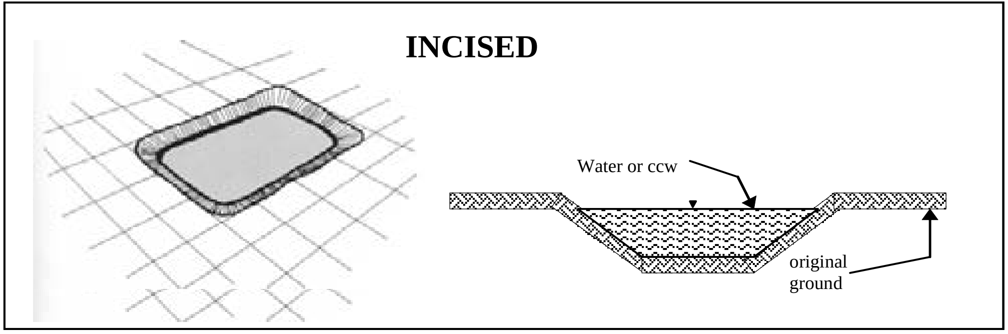
Low hazard potential was selected because in the event of dike failure the losses would be minimal, the environmental impact would be minimal since the impoundment contains little (if any) ash, the losses would be principally limited to the owner's property, and there are two rows of protective sheet piling between the dike and Lake Michigan.

CONFIGURATION:


CROSS-VALLEY


SIDE-HILL


DIKED


INCISED

______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height 18* feet Embankment Material Compacted sand and sheet piling
Pool Area 5.7 acres Liner None
Current Freeboard 3.5 feet Liner Permeability N/A

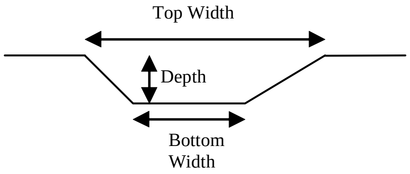
*Maximum height from top of embankment to Lake Michigan.

TYPE OF OUTLET (Mark all that apply)

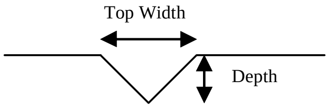
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

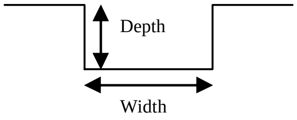
TRAPEZOIDAL



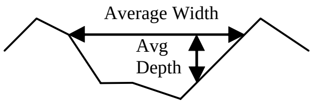
TRIANGULAR



RECTANGULAR

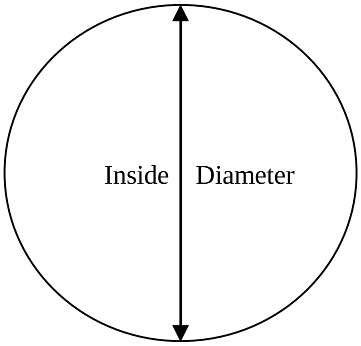


IRREGULAR



______ **Outlet**

______ inside diameter



Material
______ corrugated metal
______ welded steel
______ concrete
______ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

Is water flowing through the outlet? YES _______ NO _______

__X*__ **No Outlet** *Except for emergency overflow. Pumps are used to recirculate water to the generating station.

__X__ **Other Type of Outlet** (specify) Emergency overflow pipe - 24 in. All water is recycled.

The Impoundment was Designed By Sargent & Lundy Engineers
____

Has there ever been a failure at this site? YES ___________ NO ___X_______

If So When? ______________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES ________ NO ___X___

If So When? ______________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________ NO __X__

If so, which method (e.g., piezometers, gw pumping,...)? ____________________

If so Please Describe : ____________________

Appendix D

Photographs

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **1**

Date: 05/23/11

Direction Photo Taken:
North

Description:
Primary Settling Basin No. 1 influent discharge area.

Photo No. **2**

Date: 05/23/11

Direction Photo Taken:
Northeast

Description:
Primary Settling Basin No. 1 settling area.

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 3

Date: 05/23/11

Direction Photo Taken:
Northeast

Description:
Piezometer near the crest of the Primary Settling Basin No. 1.

Photo No. 4

Date: 05/23/11

Direction Photo Taken:
South

Description:
Discharge pipes leaking waste water into the Primary Settling Basin No. 1.

Client Name: U.S. Environmental Protection Agency	Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana	Project No. 01.0170142.30

Photo No. 5 **Date:** 05/23/11

Direction Photo Taken:
East

Description:
Inner slope of crest of Primary Settling Basin No. 1.

Photo No. 6 **Date:** 05/23/11

Direction Photo Taken:
Northwest

Description:
Monitoring well at the crest of Primary Settling Basin No. 1. The Indiana Dunes National Lakeshore national park property is visible beyond the chain link fence.

Client Name: **U.S. Environmental Protection Agency**

Site Location: **NIPSCO**
Michigan City Generating Station
Michigan City, Indiana

Project No. **01.0170142.30**

Photo No. **7**

Date: 05/23/11

Direction Photo Taken:
Northeast

Description:
The overflow pipe in the Primary Settling Basin No. 1 that discharges into the Secondary Settling Basin No. 1.

Photo No. **8**

Date: 05/23/11

Direction Photo Taken:
East

Description:
Inner slope of the Primary Settling Basin No. 1 embankment and discharge structure. Note minor erosion channeling.

Client Name: U.S. Environmental Protection Agency	**Site Location:** NIPSCO Michigan City Generating Station Michigan City, Indiana	**Project No.** 01.0170142.30

Photo No. 9

Date: 05/23/11

Direction Photo Taken:
North

Description:
Secondary Settling Pond No. 1. Note the continuous sheet piling at the toe of the embankment.

Photo No. 10

Date: 05/23/11

Direction Photo Taken:
Southeast

Description:
Decant structure in Secondary Settling Pond No. 1. The sheet piling to the right of the photograph appears to be at a lower elevation than the rest of the sheet piling in Secondary Settling Pond No. 1.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 11

Date: 05/23/11

Direction Photo Taken:
North

Description:
Debris in the Secondary Settling Pond No. 1 outlet structure.

Photo No. 12

Date: 05/23/11

Direction Photo Taken:
West

Description:
Overflow structure outlet from Primary Settling Pond No. 1 into Secondary Settling Pond No. 1. Note the minor erosion channels and minor sloughing on the slope.

Photo No. 13	**Date:** 05/23/11
Direction Photo Taken: Northwest	
Description: Discharge structure from Primary Settling Pond No. 1 into Secondary Settling Pond No. 1.	


05/23/2011

Photo No. 14	**Date:** 05/23/11
Direction Photo Taken: South	
Description: West embankment in Secondary Settling Pond No. 1	


05 23 2011

Client Name: U.S. Environmental Protection Agency

Site Location: NIPSCO
Michigan City Generating Station
Michigan City, Indiana

Project No.
01.0170142.30

Photo No. 15

Date: 05/23/11

Direction Photo Taken:
North

Description:
Overview of Primary Settling Pond No. 2.

Photo No. 16

Date: 05/23/11

Direction Photo Taken:
West

Description:
Erosion channels and sloughing in Primary Settling Pond No. 2.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. **17**	**Date:** 05/23/11

Direction Photo Taken:
Northwest

Description:
Decant structure in Primary Settling Pond No. 2. Note the decant trashrack is bent.

Photo No. **18**	**Date:** 05/23/11

Direction Photo Taken:
South

Description:
Exterior slope of Primary Settling Pond No. 2.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 19

Date: 05/23/11

Direction Photo Taken:
Southeast

Description:
Embankment between the Primary Settling Pond No. 2 and the Secondary Settling Pond No. 1.

Photo No. 20

Date: 05/23/11

Direction Photo Taken:
Southeast

Description:
Embankment between Primary Settling Pond No. 2 and Secondary Settling Pond No. 2.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. **21**	**Date:** 05/23/11
Direction Photo Taken:	
Description: Discharge pipes into Primary Settling Pond No. 2.	


05/23/2011

Photo No. **22**	**Date:** 05/23/11
Direction Photo Taken: West	
Description: Inner slope of Primary Settling Pond No. 2.	


05 23 2011

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **23**

Date: 05/23/11

Direction Photo Taken:
Northeast

Description:
Inner slope and discharge pipes in Primary Settling Pond No. 2.

Photo No. **24**

Date: 05/23/11

Direction Photo Taken:
Southeast

Description:
Secondary Settling Pond No. 2.

Photo No. 25	**Date:** 05/23/11
Direction Photo Taken: Northeast	
Description: Secondary Settling Pond No. 2 with the Bottom Ash Storage Area in the background.	

Photo No. 26	**Date:** 05/23/11
Direction Photo Taken: North	
Description: Secondary Settling Pond No. 2 with the Final Settling Pond and Lake Michigan in the background.	

Client Name: U.S. Environmental Protection Agency	**Site Location:** NIPSCO Michigan City Generating Station Michigan City, Indiana	**Project No.** 01.0170142.30

Photo No. 27

Date: 05/23/11

Direction Photo Taken:
Northwest

Description:
Bottom Ash Storage Area.

Photo No. 28

Date: 05/23/11

Direction Photo Taken:
North

Description:
Bottom Ash Storage Area discharge pipes.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **29** **Date:** 05/23/11

Direction Photo Taken:
Northwest

Description:
Runoff from the Bottom Ash Storage Area that flows into the Final Settling Pond.

Photo No. **30** **Date:** 05/23/11

Direction Photo Taken:
Northwest

Description:
One of the discharge locations from the Bottom Ash Storage Area to the Final Settling Pond.

Photo No. 31 **Date:** 05/23/11

Direction Photo Taken:
North

Description:
Final Settling Pond interior slope. The purpose of the black pipe in the foreground in unknown. The two pipes with 90 degree bends shown in the background are overflow pipes.

Photo No. 32 **Date:** 05/23/11

Direction Photo Taken:
South

Description:
Manholes to monitor overflow.

Client Name: U.S. Environmental Protection Agency	**Site Location:**	**NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. **33**	**Date:** 05/23/11

Direction Photo Taken:
Northeast

Description:
Interior of manhole to monitor overflow.

Photo No. **34**	**Date:** 05/23/11

Direction Photo Taken:
South

Description:
Crest of embankment and interior slope of Final Settling Pond.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 35

Date: 05/23/11

Direction Photo Taken:
Southwest

Description:
Crest of embankment and interior slope of Final Settling Pond.

Photo No. 36

Date: 05/23/11

Direction Photo Taken:
South

Description:
Monitoring wells at the crest of the Final Settling Pond.

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 37

Date: 05/23/11

Direction Photo Taken:
Northeast

Description:
Crest of embankment and interior slope of Final Settling Pond.

Photo No. 38

Date: 05/23/11

Direction Photo Taken:
South

Description:
Interior slope of the Final Settling Pond. The white pipe to the right of the photograph is the effluent for road drainage.

Photo No. 39

Date: 05/23/11

Direction Photo Taken:
East

Description:
Crest and interior slope of the Final Settling Pond.

Photo No. 40

Date: 05/23/11

Direction Photo Taken:
East

Description:
Interior slope of the Final Settling Pond. The black pipe in the photograph is a drain pipe from the Bottom Ash Area. The concrete structure in the water is the drainage structure from the Secondary Settling Pond Numbers 1 and 2.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 41 **Date:** 05/23/11

Direction Photo Taken:
Northwest

Description:
Concrete drainage structure in the Final Settling Pond drains from the Secondary Settling Pond Numbers 1 and 2.

Photo No. 42 **Date:** 05/23/11

Direction Photo Taken:
West

Description:
Crest and interior slope of the Final Settling Pond.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 43

Date: 05/23/11

Direction Photo Taken:
North

Description:
Partitioning dike in the Final Settling Pond.

Photo No. 44

Date: 05/23/11

Direction Photo Taken:
Northwest

Description:
Pump house at the Final Settling Pond.

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **45**

Date: 05/23/11

Direction Photo Taken:
North

Description:
Two rows of sheet piling along the Final Settling Pond. Note the heavy rip rap between the rows of sheet piling.

Photo No. **46**

Date: 05/23/11

Direction Photo Taken:
North

Description:
Two rows of sheet piling along the Final Settling Pond. Note the heavy rip rap between the rows of sheet piling.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **47**	**Date:** 05/23/11

Direction Photo Taken:
Southwest

Description:
Two rows of sheet piling between the impoundments and Lake Michigan. Note the heavy rip rap between the rows of sheet piling.

Photo No. **48**	**Date:** 05/23/11

Direction Photo Taken:
Southwest

Description:
Exterior slope of Primary Settling Pond No. 2. Note the two rows of sheet piling and rip rap.

Client Name: U.S. Environmental Protection Agency	**Site Location:** **NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** **01.0170142.30**

Photo No. **49**	**Date:** 05/23/11

Direction Photo Taken:
Southwest

Description:
Exterior slope of Primary Settling Pond No. 2. Note the two rows of sheet piling and rip rap.

Photo No. **50**	**Date:** 05/23/11

Direction Photo Taken:
Southwest

Description:
Exterior slope of Primary Settling Pond No. 1.

Client Name: U.S. Environmental Protection Agency	**Site Location: NIPSCO Michigan City Generating Station Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. 51	**Date:** 05/23/11
Direction Photo Taken:	
Description: Exterior slope of the Primary Settling Pond No. 1.	

Photo No. 52	**Date:** 05/23/11
Direction Photo Taken: Northwest	
Description: NPDES outfall location into Lake Michigan.	

Client Name: **U.S. Environmental Protection Agency**	**Site Location:** **NIPSCO** **Michigan City Generating Station** **Michigan City, Indiana**	**Project No.** 01.0170142.30

Photo No. **53**	**Date:** 05/23/11
Direction Photo Taken:	
Description:	

Photo No. **54**	**Date:** 05/23/11
Direction Photo Taken:	
Description:	

Appendix E

Summary of Hydraulic Evaluation of Impoundments
(Golder Associates)

Golder Associates

TECHNICAL MEMORANDUM

Date: August 27, 2012 **Project No.:** 12388898

To: Mr. Greg Costakis **Company:** NIPSCO

From: J. Bobby Reese, P.E., Mark Funkhouser, P.E.

cc: **Email:** gcostakis@nisource.com

RE: FINAL REPORT – SUMMARY OF HYDRAULIC EVALUATION OF IMPOUNDMENTS

Introduction

Golder evaluated the hydrologic and hydraulic performance of the on-site impoundments at Northern Indiana Public Service Company (NIPSCO) Michigan City Generating Station (MCGS), located in Figure 1. While these structures are not regulated by the State of Indiana, this evaluation was done in conformance to the Indiana Department of Natural Resources (DNR), Division of Water's *General Guidelines for New Dams and Improvements to Existing Dams in Indiana* (2001 Edition) for low hazard dams. Generally speaking, the DNR guidelines dictate that "a spillway system must be capable of safely passing the runoff from the design storm event, without the embankment overtopping and failing." This memorandum summarizes the structures evaluated and routing results. Refer to the attached calculation for greater detail regarding the methods used. The following impoundments were evaluated:

- Primary 1 (P1)
- Secondary 1 (S1)
- Primary 2 (P2)
- Secondary 2 (S2)
- Bottom Ash Area
  - Northeast section (BAA-NE)
  - Southwest section (BAA-SW)
- Final Settling Pond (FSP)

A median berm, higher in elevation than the berm separating the Bottom Ash Area from the Final Settling Pond, effectively divides the Bottom Ash Area into two unconnected impoundments, the Northeast Section and the Southwest Section.

References

Golder used the impoundment configuration and spillway details shown in the following sources:.

- GZA GeoEnvironmental, Inc., Draft Round 10 Dam Assessment Report, NIPSCO Michigan City Generating Station Coal Ash Impoundments, March 29, 2012.
- Site survey completed by Golder in June 2012.
- Indiana State, 2005 Digital Surface Model of Indiana. Downloaded from http://www.Indianamap.org on July 10, 2012.
- Sargent & Lundy, Design Drawings of the Site Impoundments, dated 1972.

- NIPSCO, NPDES Renewal Application Package for NIPSCO Michigan City Generating Station, NPDES IN0000116.

Design Storm Event

Per the DNR Guidelines, low hazard dams are to safely pass a storm event between the 100-year return period (1% annual probability of occurrence) and 50% of the Probable Maximum Precipitation (50%-PMP). Golder evaluated a range of storm depths between the 1-year and 50%-PMP storm events. All storm events evaluated were temporally distributed according to the Natural Resource Conservation Service's (NRCS) TR-60 distribution (identical to the Type B distribution referred to in the DNR Guidelines).

Waste Inflows and Pump Outflows

The regulated operational waste inflows and pump outflows are shown in the NPDES permit application to be on average about 9 million gallons per day (about 0.5 cfs) into and out of the Final Settling Pond. This flow rate is insignificant to the expected peak storm inflow rate to the Final Settling Pond from the 100-year return period event at 120 cfs, and was therefore not included in the model. Golder assumed that regulated waste inflow rate will equal outflow pump rate during the duration of the modeled storm events for a zero net inflow.

Watershed Areas

Figure 2 depicts the watershed delineation used in the analysis. The watershed areas for the Primary and Secondary impoundments (1 and 2) are assumed to be only the reservoir surface (storm inflow is from direct rainfall only). A portion of the plant area is assumed to discharge to the Final Settling Basin by way of the discharge pipe trench. The northeast Bottom Ash Area was modeled with contributing storm runoff from the coal storage area. The NPDES permit application specifies a 15,000-square-foot (about 0.34 acres) watershed discharging into Outfall 002 located at the adjacent river east of the plant site. The remaining 35 acres of plant site appear generally flat with many low-lying surface storage areas that limit discharge to infiltration and evaporation during typical rainfall events without discharge offsite. .

Impoundment Connectivity

Figure 2 depicts the location of the impoundments evaluated and the connecting culverts. The Primary impoundments (which receive waste inflows) discharge to the Secondary impoundments by way of flash-board risers. Golder assumed sediment would have accumulated against the risers in the Primary impoundments up to the overflow elevation. The Secondary impoundments discharge by way of a horizontal culvert spillway into the Final Settling Pond. The Bottom Ash Area receives waste inflow and rainfall runoff from the operational areas of the site, and discharges to the Final Settling Pond by way of two horizontal culverts (one in each the northeast and southwest sections). The Final Settling Pond receives inflows from all impoundments via the Secondary Ponds and the Bottom Ash Area, and is the sole point of discharge off site by way of two horizontal culverts discharging into the flume and ultimately to Lake Michigan through the NDPES permitted outfall 001.

Several culverts between the Bottom Ash Area and the Final Settling Pond identified in the Sargent & Lundy design package from 1972 are believed to be either removed or non-functional. The culverts assumed non-functional (i.e., inactive) are identified in Figure 2.

Hydrologic/Hydraulic Model

Golder performed watershed and reservoir routing using the US Environmental Protection Agency's (EPA) Stormwater Management Model (SWMM) Version 5.0. Because some of the impoundments are expected to be hydraulically connected (the peak stage elevation of both the upstream and downstream reservoirs are above the inlet and outlet, respectively, of a connecting culvert) a dynamic routing model (one that allows for both upstream and downstream flow directions) such as the EPA SWMM model is needed.

Results of Routing

Table 1 below illustrates the resultant freeboard remaining at the peak stage in each reservoir. Freeboard is the height of the top of the dam above the peak stage, where a negative value denotes overtopping. All impounds are shown to safely pass up to the 100-year return period event which is the minimum for a low hazard dam as specified by the State of Indiana DNR Division of Water. The Primary and Secondary Impoundments, the southwest Bottom Ash Area, and the Final Settling Pond safely pass up to 50% of the 6-hour, PMP rainfall depth without overtopping.

None of these impoundments are considered to be regulated by the State of Indiana, DNR, Division of Water.

Table 1: Resultant Freeboard at the Peak Stage

Impoundment	6-Hour Rainfall Event				
	1-year 1.66 inches	10-year 3.10 inches	100-year 5.07 inches	1,000-year 7.69 inches	50%-PMP 12.9 inches
	Freeboard At Peak Stage (feet)*				
Primary 1	6.1	5.9	5.7	5.4	4.9
Secondary 1	15.0	14.7	14.3	12.3	6.5
Primary 2	6.3	6.2	6.0	5.9	5.6
Secondary 2	6.7	6.6	6.4	6.2	4.7
Bottom Ash Area SW	4.8	4.1	3.1	2.0	0.5
Bottom Ash Area NE	2.1	1.8	0.4	-1.1	**
Final Settling Pond	4.6	4.2	3.3	2.5	0.9

* Freeboard is the height between the top of the dam and the peak stage during the storm event; Negative denotes overtopping.
** Peak stage is above the modeled stage-area rating curve established for the impoundment.

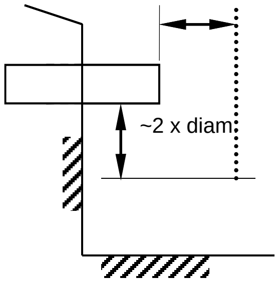
While the Bottom Ash Area is shown to have only a small freeboard remaining at the peak 100-year stage, the risk of an overtopping failure is low. Risk is a consideration of both the probability of failure, which is low because the expected head difference between the Bottom Ash Area and the Final Settling Basin is small, and the consequence of failure, which is also low because a breach of the Bottom Ash Area would be fully contained within the Final Settling Pond.

Wave height/ Wave run-up

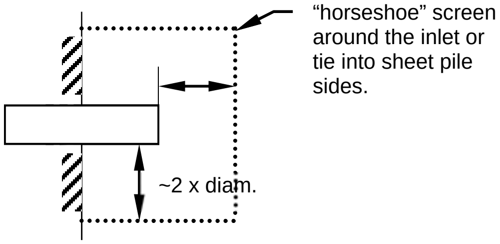
The effective wave height and wave run-up was not considered in this evaluation because the risk of wave-action overtopping to the stability of the dams is considered low. The resultant freeboards for all ponds, except the northeast Bottom Ash Area, are sufficient to contain the expected wave run-up (about 1 foot). The low point at the crest of the Final Settling Pond is at the sheet pile wall separating it from the adjacent flume. Assuming the sheet pile wall is founded on stable ground, wave-action overtopping would occur over a non-erodible surface.

Inlet Trash Racks

If debris blockage at the spillway inlets is a concern, NIPSCO may consider installing trash racks at the inlets. NIPSCO should avoid a flush-mounted screen and consider a screen structure similar to one detailed below. Flow is allowed to pass uninhibited under the screen, while floatables will be captured in the screen. Install the screen a minimum distance of two times the diameter (2 x diameter) away from the inlet.



Side View



Plan View

Attachments: Figure 1 – Site Location
Figure 2 – Site Layout and Watershed Delineation
Calculation Details

MTC/

X:\Clients\NIPSCO\12388898 Geo Invest Michigan City\200_Reports\Final\MCGS Tech Memo Final.docx

Golder Associates

CALCULATIONS

Date:	07/23/2012	**Made By:**	MTC
Project No.:	12388898	**Checked By:**	JCD
Subject	Introduction and Rainfall	**Reviewed By:**	MF
Project Short Title:	NIPSCO/Geo Invest/Michigan City/IN		

1.0 INTRODUCTION

Golder evaluated the hydraulic performance of six structures at the NIPSCO Michigan City Generating Station. The dams evaluated are listed below. While these structures do not meet the definition of a dam per the Indiana State DNR, they were evaluated for compliance to the Indiana State DNR (2010) *General Guidelines for New Dams and Improvements to Existing Dams in Indiana,* referred to throughout this report as the DNR Guidelines, for a low hazard structure. The DNR Guidelines specify a range of the 100-year to the 50% PMP rainfall for a low hazard dam.

- Primary 1 (P1)
- Secondary 1 (S1)
- Primary 2 (P2)
- Secondary 2 (S2)
- Bottom Ash Area
    - Northeast (BAA-NE)
    - Southwest (BAA-SW)
- Final Settling Pond (FSP)

The Bottom Ash Area is subdivided by a median berm higher in elevation than the dividing berm between it and the Final Settling Pond. The southwest section receives plant waste inflows, and the northeast section receives stormwater inflows from a portion of the plant and coal pile areas. No exchange of water occurs between the two sections of the Bottom Ash Area. Both sections discharge separately to the Final Settling Pond, and were treated as separate reservoirs.

List of Attachments:

- Figure 1 Site Location
- Figure 2 Site Layout and Watersheds
- All Season 6-Hour PMP for 10 Square Miles (as presented in the DNR Guidelines)
- Soil Conservation Service Type B Storm Distribution (as presented in the DNR Guidelines)

2.0 METEOROLOGICAL MODELS

2.1 Rainfall Depths

Probable Maximum Precipitation (PMP) rainfall depths are from Appendix D of the DNR Guidelines (attached), reproduced from NOAA (1978) Hydrometerological Report No. 51 (HMR-51). The frequency rainfall depths are taken from the NOAA (2004) Atlas 14, Volume 2.

6-Hour Frequency Storm Events

Return Period (years)	Precipitation Depth (inches)
1	1.66
10	3.10
100	5.07
1,000	7.69

6-Hour PMP Storm Events

PMP Fraction (%)	Est. Frequency (years)	Precipitation Depth (inches)
25	400	6.45
50	20,000	12.9
100	1,100,000	25.8

Golder Associates

CALCULATIONS

Date: 07/23/2012
Made By: MTC
Project No.: 12388898
Checked By: JCD
Subject Introduction and Rainfall
Reviewed By: MF
Project Short Title: NIPSCO/Geo Invest/Michigan City/IN

2.2 Temporal Distribution

The NRCS storm distribution, as shown in NRCS (2005) Technical Report No. 60 (TR-60) *Earth Dams and Reservoirs,* (reproduced in the DNR Guidelines as a Type B Rainfall distribution) was used for evaluation.

The 7.2 minute time step used for the Type B Hyetograph shown in the DNR Guidelines was resampled for 10 minutes. The distribution applied to the hydrologic model is as follows:

T/T_t	P/P_t
0.00	0.000
0.03	0.011
0.06	0.022
0.08	0.036
0.11	0.047
0.14	0.064
0.17	0.081
0.19	0.097
0.22	0.114
0.25	0.138
0.28	0.168
0.31	0.198
0.33	0.237
0.36	0.359
0.39	0.476
0.42	0.593
0.44	0.638
0.47	0.672
0.50	0.704
0.53	0.727
0.56	0.754
0.58	0.775
0.61	0.795
0.64	0.816
0.67	0.831
0.69	0.849
0.72	0.867
0.75	0.883
0.78	0.899
0.81	0.911
0.83	0.925
0.86	0.937
0.89	0.948
0.92	0.962
0.94	0.974
0.97	0.988
1.00	1.000

Time (T)	Precipitation (P) (inches)					
(min)	1-Yr	10-Yr	100-Yr	1000-Yr	25%-PMP	50%-PMP
0	0.00	0.00	0.00	0.00	0.00	0.00
10	0.02	0.03	0.05	0.08	0.07	0.14
20	0.04	0.07	0.11	0.17	0.14	0.28
30	0.06	0.11	0.18	0.28	0.23	0.46
40	0.08	0.15	0.24	0.36	0.30	0.60
50	0.11	0.20	0.32	0.49	0.41	0.83
60	0.13	0.25	0.41	0.62	0.52	1.04
70	0.16	0.30	0.49	0.74	0.62	1.25
80	0.19	0.35	0.58	0.88	0.73	1.47
90	0.23	0.43	0.70	1.06	0.89	1.78
100	0.28	0.52	0.85	1.29	1.08	2.17
110	0.33	0.61	1.00	1.52	1.28	2.55
120	0.39	0.74	1.20	1.83	1.53	3.06
130	0.60	1.11	1.82	2.76	2.31	4.63
140	0.79	1.47	2.41	3.66	3.07	6.13
150	0.98	1.84	3.01	4.56	3.83	7.65
160	1.06	1.98	3.24	4.91	4.12	8.23
170	1.12	2.08	3.41	5.17	4.34	8.67
180	1.17	2.18	3.57	5.41	4.54	9.08
190	1.21	2.25	3.69	5.59	4.69	9.38
200	1.25	2.34	3.82	5.80	4.86	9.72
210	1.29	2.40	3.93	5.96	5.00	9.99
220	1.32	2.46	4.03	6.11	5.13	10.25
230	1.35	2.53	4.14	6.28	5.26	10.53
240	1.38	2.58	4.21	6.39	5.36	10.72
250	1.41	2.63	4.30	6.53	5.47	10.95
260	1.44	2.69	4.40	6.67	5.59	11.19
270	1.46	2.74	4.47	6.79	5.69	11.38
280	1.49	2.79	4.56	6.91	5.80	11.59
290	1.51	2.82	4.62	7.00	5.87	11.75
300	1.53	2.87	4.69	7.11	5.96	11.93
310	1.55	2.90	4.75	7.20	6.04	12.08
320	1.57	2.94	4.81	7.29	6.12	12.23
330	1.60	2.98	4.88	7.40	6.20	12.41
340	1.62	3.02	4.94	7.49	6.28	12.57
350	1.64	3.06	5.01	7.60	6.37	12.75
360	1.66	3.10	5.07	7.69	6.45	12.90

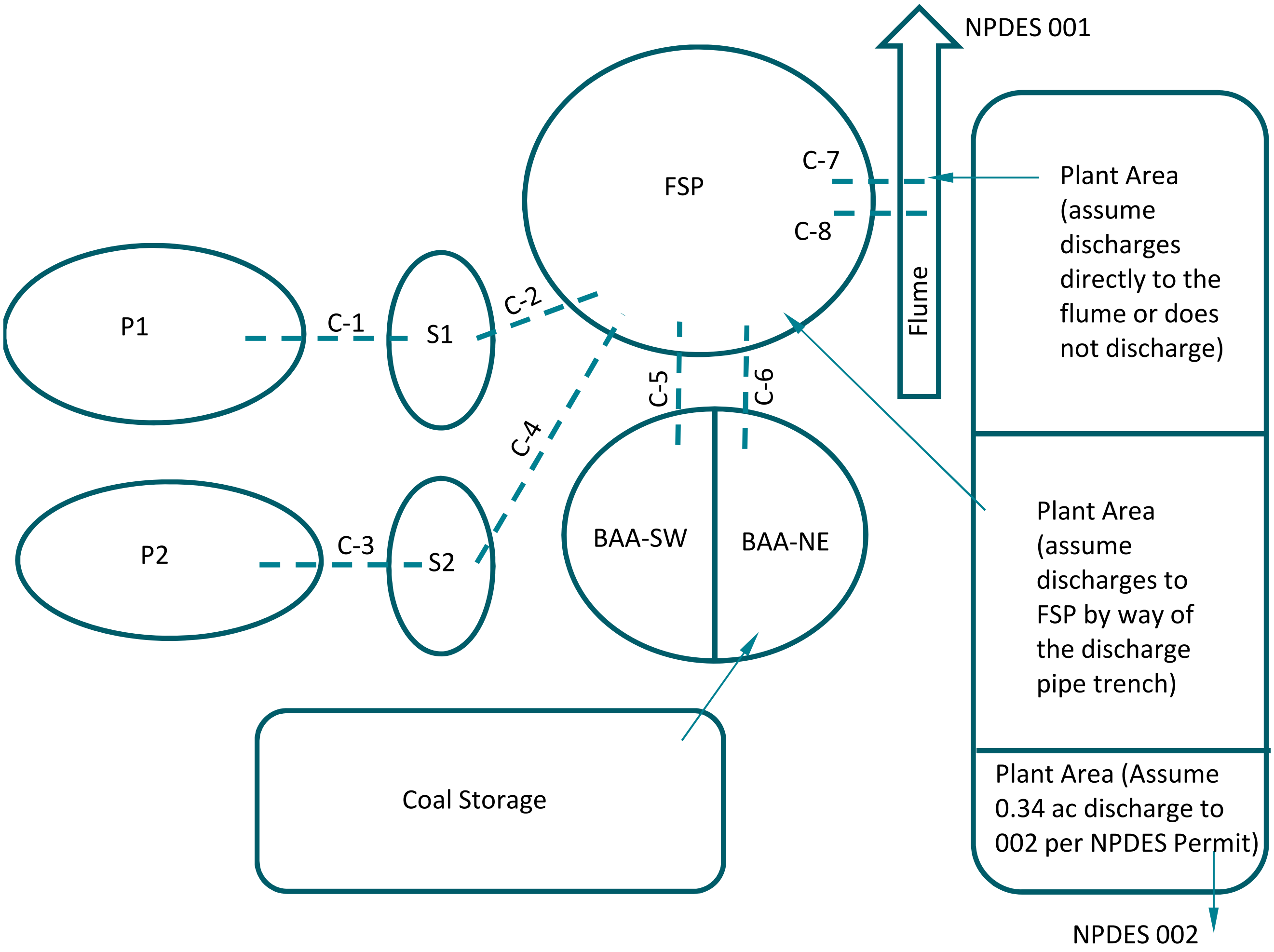
Date:	07/23/2012	**Made By:**	MTC
Project No.:	12388898	**Checked By:**	JCD
Subject	US EPA SWMM Model and Results	**Reviewed By:**	MF
Project Short Title:	NIPSCO/Geo Invest/Michigan City/IN		

3.0 US EPA SWMM MODEL

The impoundments are all expected to be hydraulically connected during periods of increased reservoir stage (2-way flow is possible through the connecting culverts); therefore, a dynamic routing technique is required for adequate modeling. Dynamic routing allows for the flow through the connecting culvert to be dependent on changing tailwater conditions. The typical kinematic routing technique (used in most hydrologic models such as HEC-HMS) is independent of tailwater and does not allow for this possibility. Therefore, the US EPA Stormwater Management Model (SWMM) was used for watershed runoff and reservoir routing computations.

The schematic below illustrates the connectivity of the impoundment system. Plant waste inflows occur at Primary 1 (P1), Primary 2 (P2), and the Bottom Ash Area (BAA-SW). Stormwater runoff inflows from the plant site (other than direct rainfall) are assumed to be distributed between NPDES permit outfall 002, directly to the flume an then to NPDES permit outfall 001, or into the Final Settling Pond (FSP) impoundment.

No information is available regarding the distribution of the plant watershed other than the NPDES permit identifies a 15,000-square-foot (0.34-acre) watershed contributing runoff to NPDES outfall 002. Therefore, Golder assumes the remaining area ultimately discharges at the only other identified external NPDES outfall, 001.



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Impoundment and culvert dimensions and elevations were collected from the following sources:

- GZA GeoEnvironmental, Inc., Draft Round 10 Dam Assessment Report NIPSCO Michigan City Generating Station Coal Ash Impoundments, March 29, 2012.
- Site survey completed by Golder in June 2012.
- State of Indiana, 2005 Digital Surface Model of Indiana. Downloaded from <http://www.Indianamap.org>
- Sargent & Lundy, design drawings of the site impoundments, dated 1972.
- NIPSCO, NPDES Renewal Application Package for NIPSCO Michigan City Generating Station, NPDES IN0000116.

Based on the available information, the following assumptions were made regarding the pond connectivity:

- The GZA report identifies a 24-inch CMP emergency overflow pipe" from Primary 1 to Secondary 1. This spillway is shown to be above the peak water surface elevation and not used in the evaluation.

- Available aerial photographs suggest runoff from the coal storage area, and plant site discharge into the NE Bottom Ash Area. The NPDES permit identifies the NPDES discharge point 002 as receiving runoff from 15,000 square feet (about 0.34 acres) of the plant site. Golder assumes the remaining plant area (about 35 acres not including the coal storage area) discharge through the only other designated external NPDES point 001. Discharge from the remaining watershed area is divided, based on physical location, between the Final Settling Pond and the flume.

- The NPDES application specifies a typical waste flow through the system of about 9 million gallons per day (about 0.5 cfs). This value is insignificant to the expected peak storm inflow rate to the Final Settling Pond of about 120 cfs. Golder assumes waste inflows will equal pump discharge throughout the duration of any storm event and thus has ignored both waste inflow and pump discharge.

3.1 Watershed Areas and Curve Numbers (CN)

An area-weighted curve number was estimated for watersheds containing multiple land uses. Water surface was assumed to have a curve number of 100 indicating no initial abstraction, depression storage, or infiltration losses.

The EPA SWMM model uses a kinematic wave approach for watershed routing and runoff computations that is based on the watershed width. For watersheds containing only reservoir surface, a width (W) = (area x 43560) was used to simulate a travel length of about 1 foot resulting in near instantaneous runoff as is expected for direct rainfall.

The coal pile is assumed to be equivilant to a newly graded surface and hydrologic soil group (HSG) A with high infiltration potential as defined in the NRCS TR-55 report.

The impervious areas of the plant site are assume to be equivilant to a gravel surface and HSG A.

Two inches of surface storage is assumed for both the coal pile and plant area that collects in low-lying areas with out discharge.

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CALCULATIONS

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WATERSHED PARAMETERS

Watersheds	Pervious CN	Area (acres)	Water/Imp. CN	Area (acres)	Total		Width (feet)
					Area	CN	
Primary 1 (P1)			100	5.85	5.85	100	254,800
Secondary 1 (S1)	80	1.33	100	0.2	1.53	83	700
Primary 2 (P2)			100	3.45	3.45	100	150,200
Secondary 2 (S2)	80	0.55	100	0.2	0.75	85	500
BAA-SW	90	3.46	100	1.41	4.87	93	300
BAA-NE			100	1.79	1.79	100	77,900
Coal Pile	77	22.7			22.7	77	600
Plant	76	7	98	8	15.0	88	700
Final Settling (FSP)			100	10.32	10.32	100	449,500

3.2 Reservoir Stage-Areas

Reservoir stage-areas were approximated from the available information. Areas below existing solids/water surfaces were extrapolated based on the design surface slopes identified in the 1972 design drawings.

Primary 1 Pond (P1)

Elevation (feet-msl)	Stage (feet)	Area	
		(acres)	(sq.feet)
590	0	1.11	48,400
595	5	1.44	62,700
600	10	1.80	78,400
605	15	2.18	95,000
608	18	2.42	105,400
609	19	2.77	120,700

Secondary 1 Pond (S1)

Elevation (feet-msl)	Stage (feet)	Area		
		(acres)	(sq.feet)	
587	0	0.20	8,710	
593.6	6.6	0.20	8,710	Piles
597	10	0.34	14,800	
600	13	0.49	21,300	
605	18	0.80	34,800	
609	22	1.11	48,400	

Primary 2 Pond (P2)

Elevation (feet-msl)	Stage (feet)	Area	
		(acres)	(sq.feet)
590	0	1.51	65,800
595	5	1.84	80,200
600	10	2.20	95,800
604	14	2.50	109,000
606	16	2.71	118,000
608	18	2.92	127,000
609	19	3.07	134,000

Secondary 2 Pond (S2)

Elevation (feet-msl)	Stage (feet)	Area		
		(acres)	(sq.feet)	
586	0	0.2	8710	
596.7	10.7	0.2	8710	Piles

Golder Associates

CALCULATIONS

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Bottom Ash Area (BAA-SW)

Elevation (feet-msl)	Stage (feet)	Area (acres)	(sq.feet)
587	0	0	0
589	2	0.22	9580
590	3	0.41	17900
591	4	0.68	29600
592	5	0.94	40900
593	6	1.24	54000
594	7	1.41	61400

Bottom Ash Area (BAA-NE)

Elevation (feet-msl)	Stage (feet)	Area (acres)	(sq.feet)
588	0	0	0
589	1	0.39	17000
590	2	0.66	28700
591	3	0.91	39600
592	4	0.94	40900
593	5	2.10	91500
595	7	2.50	108900

Final Settling Pond (FSP)

Elevation (feet-msl)	Stage (feet)	Area (acres)	(sq.feet)	
580	0	6.65	289,700	
585	5	7.48	325,800	
588	8	7.99	348,000	
590	10	9.54	415,600	
590.7	10.7	9.97	434,300	Piles

3.3 Reservoir Elevation Data

POND ELEVATION (feet-msl)

	P1	S1	P2	S2	BAA-SW	BAA-NE	FSP
Bottom of Pond (feet-msl) =	590.0	587.0	590.0	586.0	587.0	588.0	580.0
Decant Elevation (feet-msl) =	602.9	588.8	602.9	588.1	587.7	588.5	585.7
Top of Dam (feet-msl) =	609.2	604.3	609.3	595.00	593.3	591.0	590.7

POND STAGE (feet)

Initial Depth (feet) =	12.9	1.8	12.9	2.1	0.7	0.5	5.7
Maximum Depth (feet) =	19.2	17.3	19.3	9.0	6.3	3.0	10.7

3.4 Spillway Weirs

	P1	P2	BAA-NE
Type =	Riser	Riser	Overtopping
Weir Elevation =	602.9	602.9	591.0
Weir Height (feet) =	6.3	6.4	0.0
Inlet Offset (feet) =	12.9	12.9	3.0
Weir Length (feet) =	3.33	3.33	70
Side Slope (h:1v) =	0	0	45
Discharge Coefficient =	3.1	3.1	3.1

Because the northeast Bottom Ash Area was found to have significant overtopping potential, overtopping flow was considered to gage the full impact on the receiving reservoir, the Final Settling Pond.

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3.5 Culvert Data

CULVERT/SPILLWAY DATA

	C-1*	C-2	C-3	C-4	C-5	C-6	C-7	C-8
Inlet Pond =	P1	S1	P2	S2	BAA-SW	BAA-NE	FSP	FSP
Inlet Inv. (feet-msl) =	591.0	588.8	590.0	588.1	587.7	588.5	586.9	586.9
Inlet Depth (feet) =	1.0	1.8	0.0	2.1	0.7	0.5	6.9	6.9
Outlet Pond =	S1	FSP	S2	FSP	FSP	FSP	Discharge	Discharge
Outlet Inv. (feet-msl) =	590.0	582.0	589.0	582.0	587.0	588.4	586.1	586.1
Outlet Depth (feet) =	3.0	2.0	3.0	2.0	7.0	8.4	NA	NA
Length (feet) =	180	1010	120	200	70	40	90	90
Diameter (feet) =	2	2	2	2	1	1	2	2
Manning's (n) =	0.024	0.024	0.024	0.024	0.012	0.012	0.012	0.012
Additional Loss Coef =	0.2	0.8					0.2	0.2
	1-bend	4-bends					1-bend	1-bend

* The inlet of the second spillway from P1 is located above the expected peak stage and not included here.

4.0 RESULTS OF ROUTING

POND ELEVATION (feet-msl)

	P1	S1	P2	S2	BAA-SW	BAA-NE	FSP*
Top of Dam	609.20	604.30	609.30	595.00	593.00	591.00	590.70
Initial Stage	602.90	588.80	602.90	588.10	587.70	588.50	585.70

PEAK FLOOD ELEVATION (feet-msl)

	Rainfall (inches)	P1	S1	P2	S2	BAA-SW	BAA-NE	FSP*
1-Year	1.66	603.13	589.28	603.03	588.32	588.20	588.93	586.09
10-Year	3.10	603.31	589.58	603.13	588.44	588.88	589.18	586.51
100-Year	5.07	603.54	589.98	603.25	588.61	589.93	590.57	587.37
1,000-Yr	7.69	603.82	592.05	603.42	588.81	590.95	592.11	588.19
50%-PMP	12.90	604.35	597.84	603.72	590.27	592.54	592.36	589.84

FREEBOARD (feet)

1-Year	1.66	6.07	15.02	6.27	6.68	4.80	2.07	4.61
10-Year	3.10	5.89	14.72	6.17	6.56	4.12	1.82	4.19
100-Year	5.07	5.66	14.32	6.05	6.39	3.07	0.43	3.33
1,000-Yr	7.69	5.38	12.25	5.88	6.19	2.05	-1.11	2.51
50%-PMP	12.90	4.85	6.46	5.58	4.73	0.46	**	0.86

* Containment from the FSP would be lost after overtopping the sheet pile wall located on the northeast side between the pond and the flume located at a crest elevation of 590.7 feet-msl. However, overtopping of the perimeter road (thereby limiting access around the pond) would occur at about elevation 588.6 feet-msl).
** Not evaluated because peak stage is above the specified stage-area rating curve.

Appendix F

2012 Geotechnical Investigation and Embankment Stability Analyses
(Golder Associates)

REPORT

2012 GEOTECHNICAL INVESTIGATION AND EMBANKMENT STABILITY ANALYSES

NIPSCO Michigan City Generating Station

Michigan City, Indiana

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Distribution: 1 Copy Michigan City Generating Station
1 Copy Golder Associates Inc.

August 27, 2012

Project No. 123-88898

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EXECUTIVE SUMMARY

This report provides a summary of the recent geotechnical engineering assessments at the Northern Indiana Public Service Company (NIPSCO) Michigan City Generating Station (MCGS) located in Michigan City, Indiana. The engineering analyses were completed in part due to questions contained in a recent draft Environmental Protection Agency (EPA) funded site inspection report dated 29 March 2012. Specifically, this report describes the analyses that were performed to assess slope stability of several embankments and steel sheet piling around multiple hydraulic structures.

A geotechnical investigation was performed prior to completing the analyses to provide current geologic information for the various structures in question. A conventional hollow stem auger (HSA) drilling program was completed in late June and early July, 2012, at six of the hydraulic structures. A total of 12 HSA borings were advanced in and around several of the embankments at the MCGS, (the site).

The subsurface conditions encountered during this investigation are generally consistent with information available from previous historic geotechnical information at the site. Subsurface conditions consist of dense Sand and Silty Sand underlain by a medium stiff to stiff Silty Clay with alternating layers of Sand and Silty Clay to the depth of the exploration. Embankment fill is consistently loose to medium dense Sand overlying medium dense Ash fill. Several borings indicate less dense zones, and some of the borings encountered fine grained material in localized zones typically at depths below the base of the constructed embankments.

Geotechnical models of the embankments and embankment foundations were developed based on the conditions inferred from the geotechnical investigation. Slope stability analyses were performed on the modeled slopes using Slide software. The analyses were performed in general accordance with Indiana Department of Natural Resources, Division of Water guidelines. The analyses results indicate acceptable factors of safety for all cases considered when evaluated with respect to US Army Corps of Engineers criteria for the types of analyses and loading conditions evaluated.

The geotechnical models of the embankments were also used to analyze the existing sheet pile walls along the western boundary of the hydraulic structures and the sheet pile walls of the secondary settling basins. Specifically the structural capacity of the walls was assessed and compared to the anticipated existing applied forces to determine if adequate wall sections/depths exist. Based on the exposed sheeting heights and sheet pile section properties obtained from the construction drawings available, the existing walls have adequate capacity to resist the anticipated loads. Additionally, as analyzed, the walls are stable from a global rotational perspective. Both the wall structural capacity and overall stability are based on the assumption that no additional forces are applied to the walls and that the site conditions don’t vary from what was provided on the construction drawings and assumptions outlined within this report.

The embankments and walls should be routinely inspected as a part of an overall operation and maintenance plan.

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1.0 INTRODUCTION

The Michigan City Generating Station (MCGS) is located in Northern Indiana along Lake Michigan in LaPorte County as shown on Figure 1. Golder Associates Inc. (Golder) and subcontractor, Earth Exploration Inc. of Niles, Michigan (Earth Explorations) performed a geotechnical investigation at the site from June 26, 2011 through July 3, 2011. Earth Explorations performed hollow stem auger (HSA) borings at 12 locations and installed Casagrande type standpipe piezometers at 6 of these locations. The work was performed to obtain geotechnical and hydrogeologic data for assessing the stability of the embankments and steel sheet pile walls. Borehole locations were surveyed by Golder personnel.

The HSA borings were advanced around the Final Settling Pond (FSP), Primary Settling Basin No. 1 (Primary No. 1), Primary Settling Basin No. 2 (Primary No. 2), Secondary Settling Basin No. 1 (Secondary No. 1), Secondary Settling Basin No. 2 (Secondary No. 2), and the Bottom Ash Area (BAA).

Figure 2 shows the current geotechnical exploratory borehole locations on an overall plan view of the site.

The geotechnical investigation, slope stability analyses and sheet pile wall analyses described in this report have been performed to assess the stability of the hydraulic structures and the steel sheet pile walls.

2.0 SOURCES OF INFORMATION

2.1 Historical Geotechnical Borings

NIPSCO provided Golder geotechnical data from historic hydrogeologic and geotechnical investigation reports completed at the site by others. Numerous boring logs were available from the reports including results from the initial 1970s facility design/construction efforts in areas that are near the current investigation. The available boring logs are included in Appendix A. Not all information on the boring logs, or boring log locations are clearly legible on these historic logs. Note also that the borings from the 1970s were all advanced from the original ground surface elevations at some locations where there are now embankments or where other earthwork has been performed. The collar elevations indicated on the historic logs may not correspond to the existing ground elevation at those historic boring locations.

2.2 Historical Drawings

NIPSCO provided Golder with various applicable Sargent & Lundy construction drawings from the initial facility design/construction in the 1970s. These drawings were utilized in the planning of the geotechnical investigation, slope stability analyses and sheet pile wall analyses. Applicable, available drawings are included for reference in Appendix B.

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3.0 SITE GEOLOGY

The Michigan City Generating Station is underlain by more than 200 feet of unconsolidated glacial and lacustrine sediments. Borings have been drilled on the site by Sargent and Lundy prior to 1970 and by Golder in June and July 2012. The twelve borings drilled by Golder have a median depth of 50 feet below grade, with three borings drilled to a maximum of 75 feet below grade. The Sargent and Lundy borings were generally deeper, with a median depth of around 150 feet below grade, and one boring to 256 feet below grade (13 feet into limestone bedrock). Boring logs from these investigations are provided in Appendix A.

The MCGS site is located near the eastern end of the physiographic region of Indiana known as the Calumet Lacustrine Plain. The plain is topographically-low region bordering Lake Michigan, and is a remnant of the Lake Chicago stage of the Wisconsinan glaciations. The geology of the plain is characterized by complex clay, sand, and silt deposits, ranging from ground moraines to aeolian sand and silt, as the shoreline of glacial Lake Chicago moved with its rising and falling stage.

The set of borings drilled at the MCGS property are consistent with regional geology. The soil sequence is dominated by massive, very stiff silt and clay, but contains numerous lenses of fine and/or silty sand particularly in the uppermost 50 feet. Additionally, the presence of thin lenses of ash, and trace amounts of ash mixed with sand in the uppermost 20 to 40 feet suggests some excavation and re-grading of shallow soils has occurred. The groundwater table is between 5 and 25 feet below grade.

The United States Department of Agriculture (USDA) soil survey of the site and surrounding areas identified the major surficial soil components as the Oakville fine sand (elevation 570-950 feet) and Morocco loamy sand (elevation 600-800 feet). The Oakville unit is described as having a fine sand layer from the surface to 60 inches in depth. The Morocco unit is described as having a loamy sand layer from the surface to a depth of 9 inches, with a bottom layer of sand. For each of the soil units, the confining layer is listed at a depth greater than 80 inches. The most limiting saturated hydraulic conductivity for the soils ranges from high to very high. (*USDA Web Soil Survey* and *National Cooperative Soil Survey*, Version 11, September 22, 2010).

The area around the site is suburban and industrial, and the near surface is known to have been reworked. Significant areas of the site have fill indicated in the borings.

4.0 FIELD EXPLORATION

Golder completed a field investigation program including drilling and surveying at the site. Drilling operations were completed by Earth Exploration using a track mounted CME 55 and a truck mounted CME 75 drill rigs equipped with automatic drop hammers. Golder provided onsite geotechnical engineering oversight during drilling. Soil samples were obtained using Standard Penetration Test (SPT) split spoon samplers as well as thin walled Shelby Tubes. Soil samples collected were taken to Golder's Lansing Laboratory for testing. Samples will be retained for 90 days after issuance of the final report at which time they will be discarded unless NIPSCO directs otherwise.

A site survey was also completed by Golder in late June early July of 2012. The purpose of the survey was to obtain actual site elevations at the locations in question for use in the analyses. A Nikon Total Station DTM-322 was used for these elevation checks. Existing monitoring well locations and elevations were used as benchmarks for this work. Elevation and coordinate data is included in Appendix C.

4.1 Hollow Stem Auger Borings

The HSA borings were advanced at twelve locations around the hydraulic structures as shown on Figure 2. Borings were drilled vertically with standard penetration testing (SPT) within the HSA's at regular intervals. The hollow stem auger borings were used for retrieval of soil samples for visual and manual assessment. Select samples were also tested in Golder's Lansing, MI laboratory for more thorough classification. The HSA holes were ultimately used to install shallow standpipe piezometers for measuring groundwater levels.

The elevation of the collar of each probe was surveyed for location and elevation by Golder personnel. Elevations of strata and relative depths of changes in interpreted strata as described herein are approximate. The boring logs generated from the borings are included in Appendix A. A summary of the HSA borings performed at the site is included in Table 1 below.

Table 1: Summary of HSA Borings

Boring Number	Date Performed	Boring Depth (feet)	Boring Collar Elevation (feet above msl)	Angle	Comments/ Locations
BH-1	6.26.2012	50	609.40	Vertical	Secondary No. 1 Embankment Crest
BH-2	6.26.2012	50	601.38	Vertical	Secondary No. 1 Embankment
BH-3	6.27.2012	75	609.73	Vertical	Primary No. 1 Embankment Crest
BH-4	6.26.2012	40	609.35	Vertical	Primary No. 1 Embankment Crest, Screen Tip 22' bgs
BH-5	6.27.2012	50	609.40	Vertical	Embankment between Primary No. 2 and Secondary No. 2, Screen Tip 25' bgs
BH-6	6.28.2012	50	609.61	Vertical	Primary No. 2 Embankment Crest, Screen Tip 25' bgs
BH-7	6.27.2012	40	609.39	Vertical	Primary No. 2 Embankment Crest
BH-8	7.2-3.2012	75	588.66	Vertical	FSP Embankment, Screen Tip 15' bgs
BH-9	7.2.2012	50	589.62	Vertical	FSP Embankment
BH-10	6.29/7.2.2012	75	592.71	Vertical	FSP Embankment, Screen Tip 15' bgs
BH-11	6.28.2012	30	594.86	Vertical	Embankment between FSP and BAA
BH-12	6.28.2012	40	595.41	Vertical	Adjacent to Secondary No. 2, Screen Tip 12' bgs

For discussion purposes in this report, the subsurface conditions indicated by the HSA borings are grouped by hydraulic facility, and interpreted subsurface conditions at each of these facilities are described in the following sections. The interpreted conditions are based on the combined results of the current investigation and the historic geotechnical borings in descending order of precedence.

4.2 Primary Settling Basin No. 1 (Primary No. 1)

Primary No. 1 is formed by an above grade embankment that is approximately 14 feet high on the outside (Lake Michigan side, from top of existing sheet pile) and approximately 19 feet high on the inside. Both upstream and downstream slopes are approximately 2.5 horizontal to 1 vertical (2.5H:1V). The crest is at approximately elevation 609.5 ft mean sea level (msl). Normal water level is not shown on the historic construction drawings. Along the south/southwest perimeter, the impoundment is incised and the surrounding ground is the impoundment crest. The embankment increases in height towards the north along the east perimeter. The surrounding ground varies from approximately elevation 605.9 ft msl to

603.8 ft msl. The northwest embankment slopes toward Lake Michigan and the northeast embankment is shared with Secondary No. 1. A typical embankment cross section of Primary No. 1 is shown on Sargent & Lundy Construction Drawing B-478 in Appendix B.

HSA boreholes, BH-3 and BH-4 were advanced from the center of the crest of the south and west embankments of Primary No. 1. Boreholes BH-1 and BH-2 were located just downstream of the north embankment that is shared with Secondary No.1. The collar elevation of these holes range from approximately 601.4 ft msl to 609.8 ft msl based on recent survey data, which is included in Appendix C.

These boreholes indicate the subsurface material consists of dense to very dense Slag and Sand from ground surface to approximately 1 foot below ground surface (bgs). Beneath the Slag is a loose to medium dense Sand to approximately 22 feet bgs. In BH-4 along the south perimeter, a 5 ft to 6ft thick layer of soft fine Sandy Silt to Silty Clay (possible fill material) is indicated. A dense to very dense layer of fine to medium Sand was encountered in BH-1 and BH-2 to 40 ft bgs (approximate elevation of 570 ft msl) where a 5 to 10 ft thick layer of stiff Silty Clay was encountered. Immediately below the Silty Clay a dense layer of medium Sand as indicated by BH-3 to a depth of 73 ft bgs where another layer of stiff Silty Clay was encountered.

During drilling groundwater levels along the east and south embankment crests are approximately 18 feet bgs in both BH-1 and 4. In BH-3, located on the west embankment, groundwater was noted at 28 feet bgs.

4.3 Primary Settling Basin No. 2 (Primary No. 2)

Primary No. 2 is formed by an above grade embankment that is approximately 14 feet high on the outside and approximately 20 feet high on the inside. Both upstream and downstream slopes are approximately 2.5H:1V.The crest is at approximate elevation 609 ft msl, normal high water level is not evident on the construction drawings. The surrounding ground varies from approximately 596 ft to 602 ft msl. A typical embankment cross section of Primary No. 2 is shown on Sargent & Lundy Construction Drawing B-478 in Appendix B. The typical section for Primary No. 2 is similar to the typical section for Primary No. 1.

HSA boreholes BH-5, BH-6 and BH-7 were advanced 50 feet, 50 feet, and 40 feet, respectively from near the center of the crest of the west, north and east embankments of Primary No. 2. The collar elevations of these probes are 609.4 ft above msl at BH-5, 609.6 ft above msl at BH-6 and 609.4 ft above msl at BH-7 based on recent survey data. BH-10, BH-11 and BH-12 were also advanced downstream of the north embankment. The collar elevations of these borings are 592.7, 594.9 and 595.4 ft above msl, respectively.

These boreholes indicate the subsurface material consists of dense to very dense Slag and Sand from ground surface to approximately 1 ft bgs. Immediately below this upper layer there is an approximate 35 ft thick layer of loose to medium dense Sand. Borings BH-5, BH-6, BH-7 indicate that below the upper sand layer is a 2.5 ft to 5 ft thick layer of dense to very dense black Ash. Below this ash layer, is a layer of dense to very dense Sand as indicated in BH-5, BH-7 and BH-11. BH-6 indicates a medium stiff Clay layer to the end of the boring at 50 ft bgs or approximately elevation 560 ft above msl. BH-10 indicates that the Clay later extends to approximately elevation 535 ft above msl 75 feet below the embankment crest.

During drilling groundwater levels along the north embankment were 8.5 ft bgs in BH-5. Along the west embankment, groundwater levels were 18 ft bgs in BH-6 and along the east embankment, groundwater levels were 11.5 ft bgs.

4.4 Secondary Settling Basin No. 1 (Secondary No. 1)

Secondary No. 1 is formed by a 4-sided, steel sheet pile wall that reportedly is 30 feet in depth. A soil embankment extends upward from 1 foot below the top of the sheet pile to approximately 16 feet above the sheet pile at a 2.5H:1V slope. The top of the sheet pile is at approximately elevation 594 ft msl. The embankment crest is at elevation 609 ft msl. Normal high water level is not evident on historic construction drawings. The surrounding ground is at approximately elevation 604 ft msl around the south and west sides. Primary No 1 exists adjacent to the south and Primary No. 2 is adjacent to the north. A typical embankment cross section of the north and south sides of Secondary No. 2 is shown on Sargent & Lundy Construction Drawing B-478 in Appendix B.

Boreholes BH-1 and BH-2 were advanced 50 feet from the centers of the west and east embankments of Secondary No. 1. The collar elevations of these probes are 609.4 and 601.4 ft msl respectively based on recent survey data. These probes indicate the subsurface material consists of dense to very dense Slag and Sand from ground surface to 1 ft bgs which is underlain by a loose to medium dense Sand to approximately 33 ft bgs. Below the Sand is a thin layer of fine Sandy Silt. A medium dense Sand continues below the thin Sandy Silt to approximately 40 ft bgs. Beneath the medium dense Sand is medium stiff to stiff Silty Clay to the end of the advancements.

From the embankment crest, the groundwater level was observed at 18 feet bgs in borehole BH-1 and at 19 feet bgs at BH-2.

4.5 Secondary Settling Basin No. 2 (Secondary No. 2)

Secondary No. 2 is formed by a 4-sided, steel sheet pile wall that reportedly is 36 feet in depth. Along the southwest side of the basin, a soil embankment extends upward from approximately 1 foot below the top of the sheet pile to approximately 13 feet above the sheet pile at a 2.5H:1V slope. On the remaining sides, the sheet pile wall extends approximately 1.5 ft to 2 ft above the surrounding grade. The normal high water level is not evident on historic construction drawings. The top of the sheet pile wall is at approximately elevation 596.7 ft. above msl. The surrounding ground is at approximately elevation 595 ft msl around the north, west and east sides. Primary No. 2 exists adjacent to the southwest and the BAA is adjacent to the northeast. A typical embankment cross section of Secondary No. 2 is shown on Sargent & Lundy Construction Drawing B-479 in Appendix B.

Borehole BH-12 was advanced to 40 feet and located adjacent to the sheet pile wall on the east side of the basin. BH-5 was advanced 50 feet from the top of the embankment crest along the southwest side of the basin and BH-11 was advanced 30 feet from the adjacent crest of the FSP. The collar elevations of these borings are 595.4 ft, 609.4 ft and 594.9 ft msl respectively based on recent survey data. These boreholes indicate the subsurface material consists of dense to very dense Slag and Sand to from ground surface to approximately 1 ft bgs. Immediately below this upper layer there is an approximate 18 ft thick layer of loose to medium dense Sand. Borings BH-5 and BH-11 indicate that below the upper sand layer is a 1.5 ft to 5 ft thick layer of dense to very dense black Ash. Below this ash layer, is a layer of dense to very dense Sand as indicated in BH-5 and BH-11. A medium stiff to stiff Silty Clay is encountered at approximately 30 ft bgs as indicated in BH-11.

During drilling groundwater was encountered at approximately 5.5 feet bgs and 3.5 feet bgs at boreholes BH-11 and BH-12 respectively.

4.6 Final Settling Pond (FSP)

The FSP is formed by an embankment that extends below grade and is approximately 25 ft in depth. The top of the embankment is the access roadway at approximate elevation 591 ft above msl. Along the northwest side of the crest is a steel sheet pile wall that is reportedly 42 feet in depth, based on historical drawings. Along the southeast side of the basin is a common embankment with the Bottom Ash Area. The normal high water level is not evident on historic record drawings. The top of the sheet pile wall is at approximately elevation 596 ft. above msl. A typical embankment cross section of the FSP is shown on Sargent & Lundy Construction Drawing B-479 in Appendix B.

Boreholes BH-8, BH-9 and BH-10 were advanced 75 feet, 50 feet and 75 feet, respectively, in the center of the west embankment crest. BH-11 was advanced 30 feet from the FSP/BAA common embankment crest. The collar elevations of these borings are 588.7 ft, 589.6 ft and 592.7 ft msl respectively based on recent survey data. These boreholes indicate the subsurface material consists of dense to very dense Slag and Sand to from ground surface to approximately 1 ft bgs. Immediately below this upper layer there is an approximate 28 ft to 33 ft thick layer of loose to medium dense Sand. Below the sand layer, is a layer of stiff Clay with alternating layers of silt and sand to the bottom of the advancements.

During drilling groundwater levels were observed at 3 ft bgs at BH-8 and BH-9 and 5 ft bgs at BH-10.

4.7 Bottom Ash Area (BAA)

The BAA slopes toward the FSP from ground surface to a common embankment that is shared with the FSP along the northwest side. This embankment has a maximum height of 2 feet. Secondary No. 2 is adjacent to the south. A typical embankment cross section of the BAA is shown on Sargent & Lundy Construction Drawing B-479 in Appendix B.

BH-11 was advanced 30 feet bgs from the center of the embankment and BH-12 was advanced 40 feet bgs in the roadway to the south of the BAA. These boreholes indicate the subsurface material consists of dense to very dense Slag and Sand from ground surface to approximately 1 ft bgs. Immediately below this upper layer there is an approximate 18 ft thick layer of loose to medium dense Sand. Boring BH-11 indicates that below the upper sand layer is a 1.5 ft thick layer of dense to very dense black Ash. Below this ash layer, is a layer of dense to very dense Sand. A medium stiff to stiff Silty Clay is encountered at approximately 30 ft bgs as indicated in BH-11.

During drilling, groundwater levels were observed at 5.5 ft bgs as observed in BH-11.

5.0 LABORATORY TESTING

During HSA drilling, which included standard penetration testing, samples were retrieved from the split spoon sampler for subsequent laboratory testing. The samples were stored in jars and transported to Golder’s Lansing, Michigan geotechnical laboratory for testing. Samples were selected for testing based on their visual character, location along the borehole, and distribution around the facility. Additionally, undisturbed soil samples of fine grained material were collected with thin walled Shelby Tube samplers. One Shelby Tube sample was sent to Golder’s Atlanta, Georgia geotechnical laboratory for triaxial testing.

Moisture content, grain size analyses, Unified Soil Classification System (USCS) classifications, Atterberg limits testing, and triaxial testing were performed in the laboratory. In total, 75 samples were tested for at least one of these parameters. A summary of the laboratory test data, laboratory test data sheets, including the plotted grain size curves are included in Appendix D. A summary of the test data, grouped by relative geologic model layer is presented in Table 2 below.

Table 2: Laboratory Test Data Summary

Material	Moisture Content (%)	USCS Classification	Cohesion (c′), (psf)	Internal Friction Angle (ϕ′), (degrees)
Loose to Compact Poorly Graded Sand Fill	2 - 9 (above water table)# 19 - 39 (below water table)	SP, SM#	NA#	NA#
Medium Dense Bottom Ash Fill	17#	SW#	NA#	NA#
Dense to Very Dense, Fine to Medium Sand	16 - 23#	SP-SC, SP, SW#	NA#	NA#
Native Clay	13 to 20#	CL#	70#	30#

The test results indicate a relatively uniform deposit of poorly graded, medium Sand with typically less than 10 percent fines. The material is variously classified as a Poorly Graded Sand with little or no fines (SP); a “SP-SC” or “SP-SM” which are borderline classifications used for materials with between 5 percent and 12 percent fines. Test results also indicate a deposit of fine grained soils classified as Silty Clay (CL). The frequency of particular material types indicated on the attached laboratory data sheets is not necessarily indicative of the relative frequency or amount of material types encountered in the field. Individual samples were specifically selected for testing based on visual and manual assessment, and samples exhibiting non-typical and apparent borderline characteristics are preferentially selected for laboratory testing.

The measured water contents in the granular soil ranged from approximately 2 percent to 38 percent. In the fine grained soils, the measured water contents ranged from approximately 13 percent to 20 percent. The distribution of water content with depth indicates with reasonable certainty where the water table is in the field. Laboratory samples consistently show lower water contents in samples from the upper portions of holes, and higher water contents in samples from the lower portions.

6.0 INTERPRETED CONDITIONS AND GEOTECHNCIAL MODELS

Based on the current and historic subsurface information, generalized geologic cross sections were developed for each area planned for analysis. This information was utilized along with insitu and laboratory testing to develop geotechnical models for the slope stability and sheet pile wall analyses.

6.1 Primary Settling Basin No. 1

The HSA borings located around Primary No. 1 indicate the embankment consists of compacted fine sand fill, with a thin layer of Sandy Silt immediately below the embankment. Below the Sandy Silt is a medium dense to dense layer of Sand underlain with a 5 ft to 6 ft thick layer of stiff Silty Clay. Another Sand layer is below the Silty Clay with a second layer of Silty Clay to the bottom of the advancements.

Low blow counts in the borings suggest the presence of a looser layer of sand at or just below groundwater levels. It is possible that these lower blow counts do not represent the true density of the soil as there is some possibility that “quick” conditions developed at the bottom of the drill holes during drilling and sampling. However, lower strength values have been assessed in this area to account for any possible variability. Figure 3 below shows the interpreted geotechnical model for Primary No. 1.

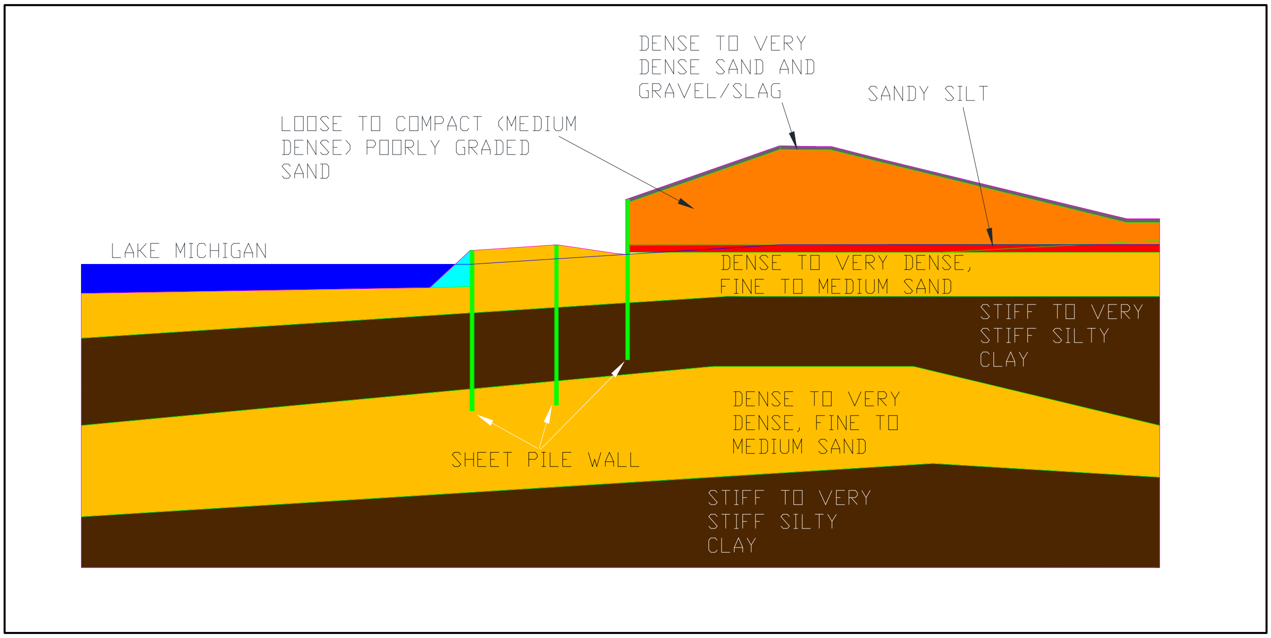

Figure 3 – Geotechnical Model of Primary No. 1 Embankment

Material properties of each of the modeled layers are included in Table 3 below. These properties are based on the geotechnical investigation, associated laboratory testing and empirical correlations to published data sources.

Table 3: Geotechnical Model Material Properties

Material	Internal Friction Angle (deg.)	Peak Cohesion (psf)	Dry Unit Weight (pcf)	Saturated Unit Weight (pcf)	Undrained Shear Strength (psf)	Layer Thick-ness (ft)	Hydraulic Conductivity (cm/s)
Loose to Medium Dense Fill (SP)	33	0	100	110	NA	Varies	$1x10^{-3}$
Large Limestone Riprap	45	0	140	145	NA	Varies	100
8-inch Riprap	45	0	140	145	NA	1	100
Crushed Blast Furnace Slag	40	0	120	130	NA	Varies	1
Medium Dense Bottom Ash Fill	35	0	100	110	NA	Varies	$1x10^{-3}$
Loose Silty Sand	30	0	100	120	NA	Varies	$1x10^{-3}$
Medium to Very Stiff Clay	30	70	116	136	750 – 2500	Varies	$1x10^{-6}$
Native Sand (SW)	40	0	110	120	NA	Varies	$1x10^{-3}$

6.2 Primary Settling Basin No. 2

The HSA holes around Primary No. 2 indicate variable conditions from both the standpoint of material variability with depth at a given location and differences in materials from location to location. To develop the geotechnical model, in general, lower strength materials were inferred where variations were noted in the exploration. The probes at Primary No. 2 indicate loose to medium dense sand in the embankment. A layer of dense to very dense Ash is shown below the sand and below that a dense to very dense sand. A medium stiff clay layer underlies the sand. Figure 4 below shows the Primary No. 2 geotechnical model.

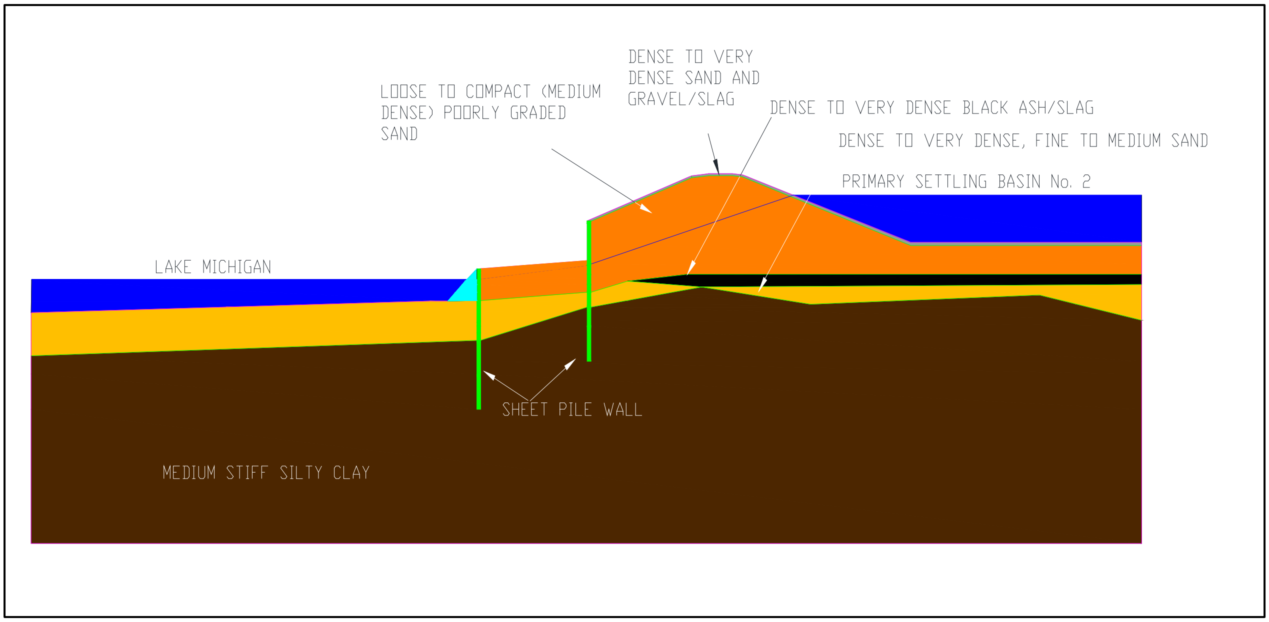

Figure 4: Geotechnical Model at Primary No. 2

Material properties for these modeled layers are included in Table 2.

6.3 Secondary Settling Basin No. 1

The boreholes in the Secondary No. 1 embankment indicate relatively uniform and loose to medium dense granular material to approximately 40 feet bgs where medium stiff to stiff silty clay is encountered.

Figure 5 shows the geotechnical model for Secondary No. 1.

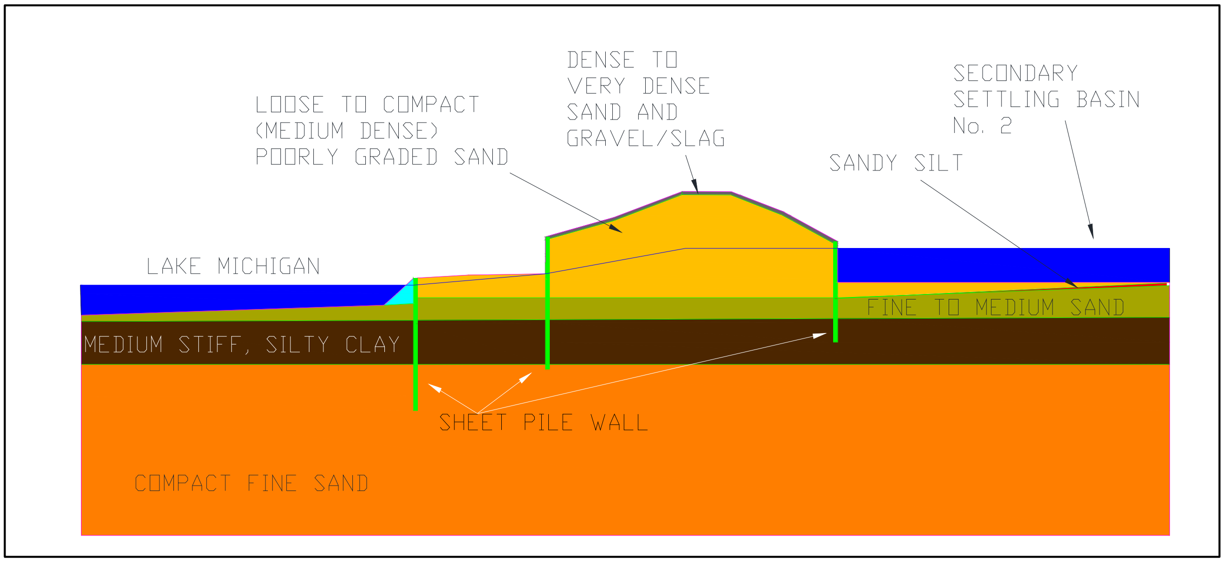

Figure 5: Geotechnical Model at Secondary No. 1

6.4 Secondary Settling Basin No. 2

The boreholes advanced around Secondary No. 2 suggest relatively uniform and loose to medium dense granular materials underlain by a layer of dense ash followed by a dense to very dense sand and finally stiff silty clay, in a similar manner to the conditions found at the adjacent Primary No. 2. Figure 6 below illustrates the model.

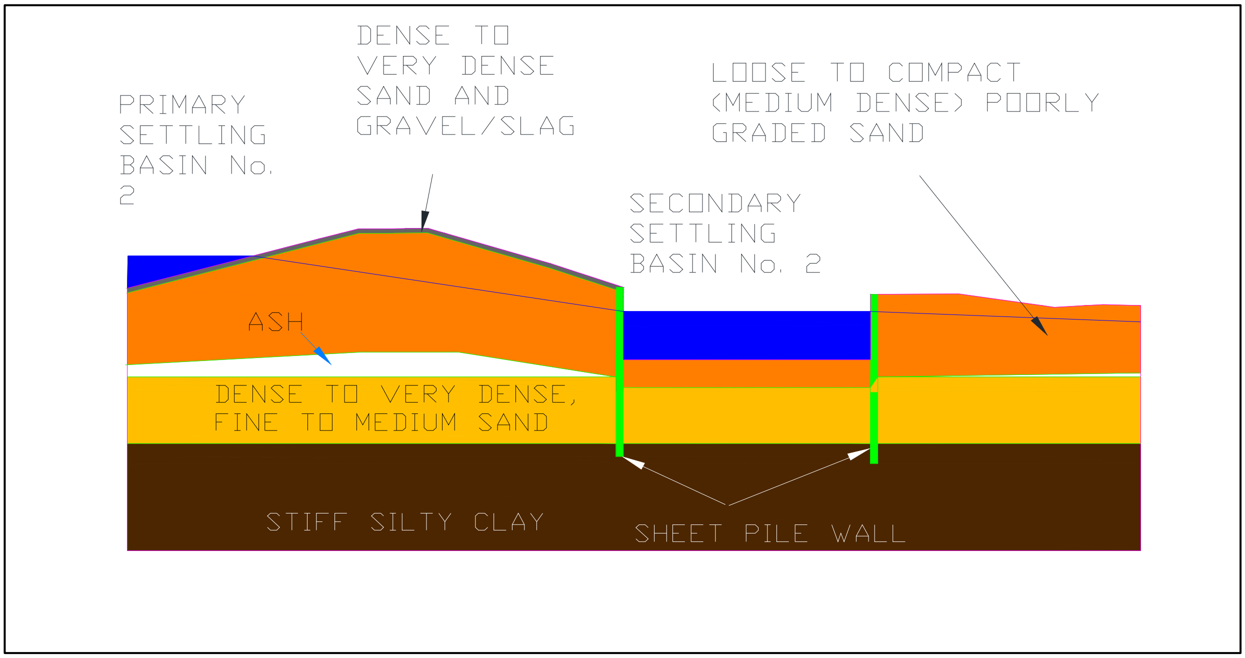

Figure 6: Geotechnical Model at Secondary No. 2

6.5 Final Settling Pond

The boreholes advanced around the FSP suggest relatively uniform and loose to medium dense granular materials underlain by a layer of stiff silty clay. Figure 7 below illustrates the model.

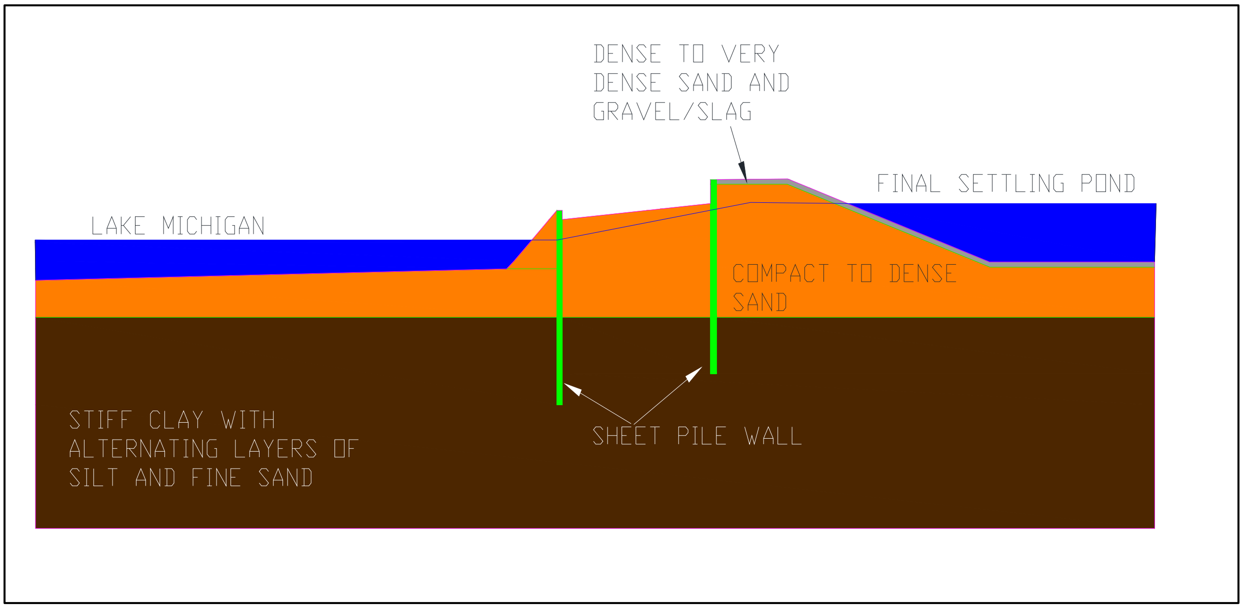

Figure 7: Geotechnical Model at the FSP

6.6 Bottom Ash Area

The BAA is generally formed with a bottom that slopes down from ground surface at its east side towards the FSP where a 2 foot high embankment is shared along its north/northwest side with the FSP. The BAA is primarily an incised structure. Depending on interpretation of survey data for surrounding ground, the BAA is less than 5 ft deep at its deepest; therefore, no stability analyses were performed at the BAA.

7.0 SLOPE STABILITY ANALYSES

Slope stability analyses were performed using ‘SLIDE’Version 6.018, a Rocscience software program designed for analysis of slopes such as the embankment slopes at the RMSGS facility. SLIDE is a two-dimensional slope stability program for evaluating the safety factor or probability of failure, of circular or non-circular failure surfaces in soil or rock slopes. SLIDE analyzes the stability of multiple slip surfaces using vertical slice limit equilibrium methods (e.g. Bishop, Janbu, Spencer, etc). Individual slip surfaces can be analyzed, or search methods can be applied to locate the critical slip surface for a given slope. The program also has the capacity to perform pseudo static seismic analyses with prescribed ground acceleration. The search method was used for the analyses described in this report, and the reported factors of safety (FoS) are the low FoS found from all individual analysis runs for each case.

Slope stability analyses were performed on the geotechnical model cross sections at five of the six hydraulic structures under evaluation. While these structures are not regulated by the State of Indiana, the specific analysis types are based on those described in the Indiana DNR, Division of Water *General Guidelines for New Dams and Improvements to Existing Dams in Indiana, 2001 Edition.* For existing dams, the specific analysis types are:

- Steady state seepage, full pool, downstream slope
- Steady state seepage, maximum pool, downstream slope
- Rapid drawdown, upstream slope; and
- Seismic (pseudo-static) with normal pool, steady state seepage, downstream slope

In addition to the specified analyses, a global analysis was performed for each structure. Full pool elevations were not evident on historic drawings; therefore, existing water levels were used for analyses. The steady state analyses were performed with the fully developed phreatic surface as indicated by the site geotechnical investigation and as extrapolated based on inferred subsurface conditions. This phreatic surface begins at the upstream water level, extends horizontally to the upstream side of the embankment, then extends downward to near the elevation where the groundwater level was encountered in exploratory holes in the downstream side of the embankment and then to the water level of Lake Michigan. The inferred piezometric levels in each model are illustrated in Appendix E. Drained shear strength parameters were used in the slope stability analyses for the material types.

In the rapid draw down analysis, the initial water level condition was assumed to be at normal pool elevation, and the final water level condition was assumed to be at the toe of the embankment, i.e., the pool is completely empty. This is a relatively severe loading condition as compared to that described in the Indiana guidelines where the final level is assumed to be the invert of a drawdown pipe.

A pseudo static seismic analysis was performed on the downstream slope of each section. The analyses were performed with the same steady state, fully developed phreatic surface in the embankments as was used in the initial three cases analyzed. The ground acceleration used in the seismic analysis was 0.1319g, which is the Maximum Considered Earthquake (MCE) ground motion of 0.2 second spectral response, or the 2 percent exceedance in 50 years. The value of the acceleration was obtained from the United States Geologic Survey (USGS) online seismic hazard tool, which provides such information for any location in the United States. The zip code for the MCGS was used as the location of the site. Contour intervals of this same seismic acceleration are included in Appendix D of the US Army Corps of Engineers (USCOE) publication number: ER 1110-2-1806 titled *Engineering and Design – Earthquake Design and Evaluation for Civil Works Projects*. This contour map, which illustrates the seismic acceleration contours for the 0.2 sec spectral response and 2 percent probability of exceedance in 50 years is also included in Appendix D of this report. This map shows how the area of northwest Indiana is a relatively low hazard area from the view point of seismic risk. The MCGS is in Risk Zone 1 in the ASCE seismic risk categorization which is also illustrated in the USACOE publication referenced above. This is the second lowest category in a five category system. This ASCE seismic risk map is also included in Appendix E.

As previously indicated, analyses were performed for the four loading cases on representative cross sections of each of the five embankments under consideration. Analyses were performed with circular analyses. Planar analyses were also performed in the case of the FSP and Primary No. 1. The search method of analysis was used, and several thousand trial surfaces for each case and each model were run.

The results of the analyses indicate the embankments have adequate FoS given the strength parameters used and the conditions analyzed.

A summary of the lowest calculated FoS for each case analyzed at the five structures is included in Table 4 below.

Table 4: Slope Stability Analysis Results Summary

<table>
<tr><th colspan="2">Primary No. 1</th></tr>
<tr><th>Case</th><th>Factor of Safety</th></tr>
<tr><td>Steady Sate, Global (01A)</td><td>2.4</td></tr>
<tr><td>Steady State, Existing Pool (01B)</td><td>2.2</td></tr>
<tr><td>Rapid Drawdown Upstream Slope (01C)</td><td>1.8</td></tr>
<tr><td>Seismic, Existing Pool (01D)</td><td>1.5</td></tr>
<tr><th colspan="2">Primary No. 2</th></tr>
<tr><th>Case</th><th>Factor of Safety</th></tr>
<tr><td>Steady Sate, Global (02A)</td><td>1.9</td></tr>
<tr><td>Steady State, Existing Pool (02B)</td><td>2.2</td></tr>
<tr><td>Rapid Drawdown Upstream Slope (02C)</td><td>1.6</td></tr>
<tr><td>Seismic, Existing Pool (02D)</td><td>1.5</td></tr>
<tr><th colspan="2">Secondary No. 1</th></tr>
<tr><th>Case</th><th>Factor of Safety</th></tr>
<tr><td>Steady Sate, Global (03A)</td><td>2.6</td></tr>
<tr><td>Steady State, Existing Pool (03B)</td><td>2.1</td></tr>
<tr><td>Rapid Drawdown Upstream Slope (03C)</td><td>1.6</td></tr>
<tr><td>Seismic, Existing Pool (03D)</td><td>1.5</td></tr>
<tr><th colspan="2">Secondary No. 2</th></tr>
<tr><th>Case</th><th>Factor of Safety</th></tr>
<tr><td>Steady Sate, Global (04A)</td><td>1.8</td></tr>
<tr><td>Steady State, Existing Pool (04B)</td><td>2.1</td></tr>
<tr><td>Rapid Drawdown Upstream Slope (04C)</td><td>2.1</td></tr>
<tr><td>Seismic, Existing Pool (04D)</td><td>1.4</td></tr>
<tr><th colspan="2">Final Settling Pond</th></tr>
<tr><th>Case</th><th>Factor of Safety</th></tr>
<tr><td>Steady Sate, Global (05A)</td><td>3.1</td></tr>
<tr><td>Steady State, Existing Pool Upstream (05B)</td><td>1.8</td></tr>
<tr><td>Rapid Drawdown Upstream Slope (05C)</td><td>1.4</td></tr>
<tr><td>Seismic, Existing Pool Upstream (05D)</td><td>1.0</td></tr>
</table>

Models, input and output from the slope stability analyses are included in Appendix E. In the front of the appendix, a summary of the analyses performed is presented. In the following subsections of the appendix, analysis results are presented for each of the five structures analyzed.

8.0 SHEET PILE WALL ANALYSES

The existing steel sheet pile walls were modeled with Shoring Suite V 8.12 using the subsurface conditions and material properties previously described. Specifically, three different wall sections and geometric configurations were analyzed including: Secondary No. 1 and 2 as well as Primary No. 2. The secondary pond walls are rectangular structures that provide storage for some ash and process water. The Primary No. 2 wall consists of two independent linear steel sheet pile structures spaced about 45 feet apart. The intent of the walls is to provide shoreline protection from Lake Michigan (lower wall) and stabilize the entire hydraulic structure area (upper wall). Where applicable a 375 lb/ft^2 vehicular live load was applied at the top of wall. The maximum exposed wall heights, obtained from the Sargent & Lundy construction drawings, ranged from 8 to 16 feet for Primary No. 2 and Secondary No. 2 respectively. Steel sheeting sections consisted of PZ 27 and 38 depending on location and varied in length from 30 to 42 feet. Sheeting sections were also gleaned from the Sargent & Lundy construction drawings. Sheeting lengths were not field verified as part of our investigation. The lengths provided on the Sargent and Lundy drawings were assumed to be as constructed. The following assumptions were made for the calculations:

1. No impact loads were analyzed on the wall – only live load from vehicle traffic
2. Adequate drainage is provided behind the existing wall
    a. Differential hydrostatic pressures were not applied above the groundwater depth noted during drilling. The exception being the lower/upper walls along Lake Michigan.
3. All sheeting is cantilevered with no tie backs or whalers present
4. Steel sheeting has a yield stress of 50 ksi.
5. Sargent and Lundy drawing information accurately reflects existing conditions.

Table 5 provides a summary of the calculations.

Table 5: Summary of Sheet Pile Wall Analysis

Wall location	Steel Sheet Pile Type	Maximum Exposed Wall Height (ft)	Length of Sheeting (ft)	Maximum Applied Moment (kip-ft) and Depth (ft)	Estimated Minimum Required Section Modulus (in^3/ft)(1)	Actual Section Modulus (in^3/ft)
Secondary Pond No. 1	PZ 27	13	30	32.8 at 19.2	11.9	30.2
Secondary Pond No. 2	PZ 27	16	36	67.7 at 24	24.6	30.2
Primary Pond No. 2 – lower wall	PZ 38	8	42	24.2 at 17.6	8.8	46.8
Primary Pond No. 2 – upper wall	PZ 38	12	42	35.7 at 20.5	13	46.8

Notes: (1) Estimated minimum section modulus based on Shoring Suite Model output

As shown in the above table the installed sheeting has adequate section capacity to resist the applied moments. In addition to the internal structural analysis a stability check was also completed for the walls to assess the potential for wall rotation and subsequent top of wall deflection. The analysis indicates the walls are stable under static loading conditions. Sheet pile wall analysis results are included in Appendix F.

9.0 CONCLUSIONS AND RECOMMENDATIONS

The slope stability analyses indicate shallow potential failure surfaces have the lowest calculated FoS, which is consistent with the sandy conditions encountered in the field investigation and as used in the geotechnical models. However, the analyses indicate acceptable FoS for the conditions analyzed. Most of the estimated FoS are relatively high which is expected given the material types, relative density of the embankment material and the presence of several steel sheet pile walls at the MCGS site. The calculated factors of safety for the rapid drawdown and seismic loading conditions are generally high with the exception of the seismic upstream condition for the FSP which is relatively low at 1.0, but is still acceptable based on US Army Corps of Engineers criteria.

Several analyses were completed for the existing steel sheet pile walls including a verification of the structural capacity and overall stability. Our analysis indicates the walls are stable from a structural and global perspective based on the conditions documented during our investigation and wall properties outlined in this report.

In general, the results of the current subsurface investigation are consistent with subsurface conditions indicated in the boring logs available from historic geotechnical investigations performed at the site. The embankments appear to have been constructed with compacted Sand borrowed from site or nearby areas. Locally ash appears to have been incorporated in the fill. The embankment foundations typically consist of loose to dense sand. There are some areas or layers of less dense or looser material. Some areas indicate the presence of dense bottom ash fill beneath the embankments.

The subsurface conditions indicated in the field investigations were summarized and condensed into geotechnical models and used in slope stability analyses. Slope stability and sheet pile wall analyses were performed on select cross sections from various locations around the facility.

It is recommended that operations and maintenance include regular periodic observations and documentation of the embankments and sheet pile walls at the site.

GOLDER ASSOCIATES INC.

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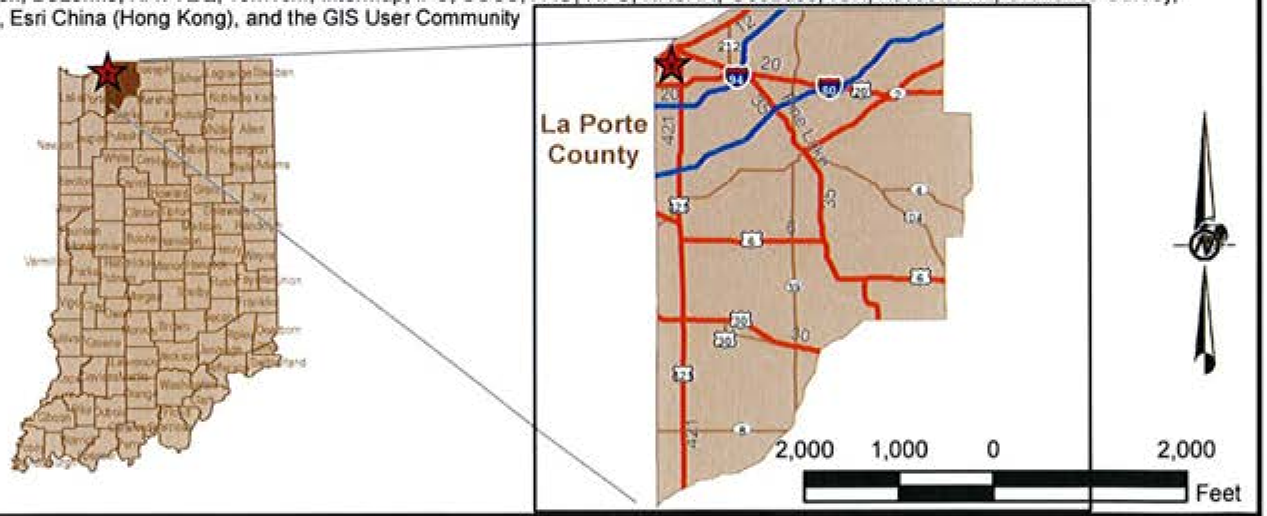
Project Engineer

Matt J. Wachholz, P.E.
Senior Engineer

Mark R. Funkhouser, P.E.
Principal

JRR/MJW/MRF

REFERENCE: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community



Golder Associates
Michigan

FILE No. 12388898A000-GIS

PROJECT No. 123-88898

REV. 0

SCALE AS SHOWN

DATE 7/26/12

DESIGN JRR

GIS MGG

CHECK JRR

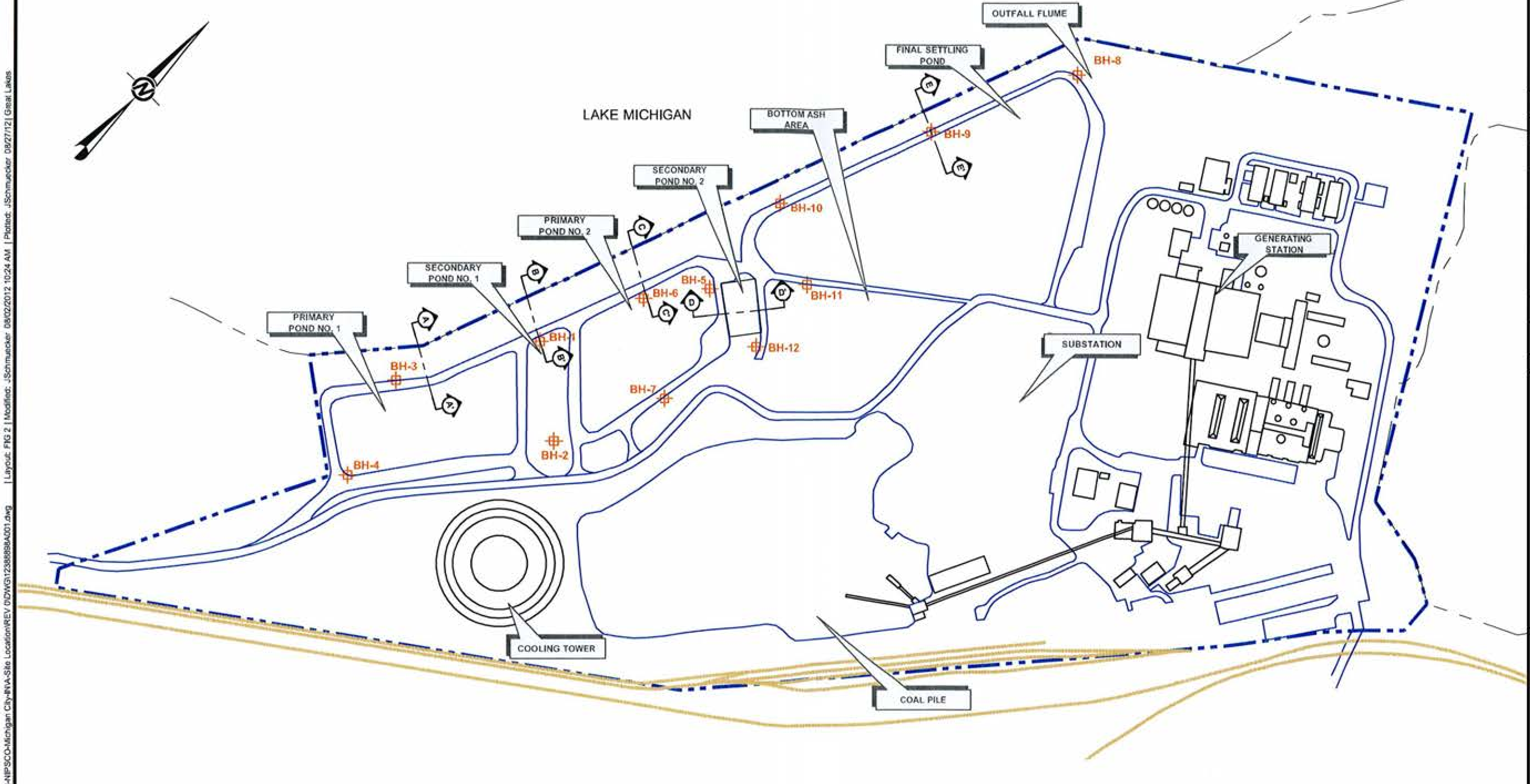
REVIEW MRF

SITE LOCATION MAP
NIPSCO MICHIGAN CITY
GENERATING STATION
101 WABASH STREET
MICHIGAN CITY, INDIANA

BORING LOCATIONS

FIGURE 1

SITE LOCATION EXAMPLE.mxd



REFERENCES

AERIAL PHOTOGRAPH FROM GOOGLE EARTH PRO;
IMAGERY DATE: 4/28/2011.

LEGEND

⌖ BH-11	2012 BORING LOCATIONS
— - —	APPROXIMATE PROPERTY BOUNDARY
A — — A'	CROSS-SECTION LOCATION FOR STABILITY ANALYSIS

300 0 300
SCALE FEET

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
NIPSCO MICHIGAN CITY
GENERATING STATION
101 WABASH STREET
MICHIGAN CITY, INDIANA

TITLE
SITE PLAN

PROJECT No.		123-88898
FILE No.		12388898A001
SCALE		AS SHOWN
DESIGN	JRR	07/16/12
CADD	MGG	07/16/12
CHECK	JRR	08/27/12
REVIEW	MRF	08/27/12

2

APPENDIX A

Hollow Stem Auger Boring Logs and Historic Boring Information

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-1

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5493.965 E: 4989.3142

DATUM: Geodetic

DRILLING DATE: JUNE 26, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

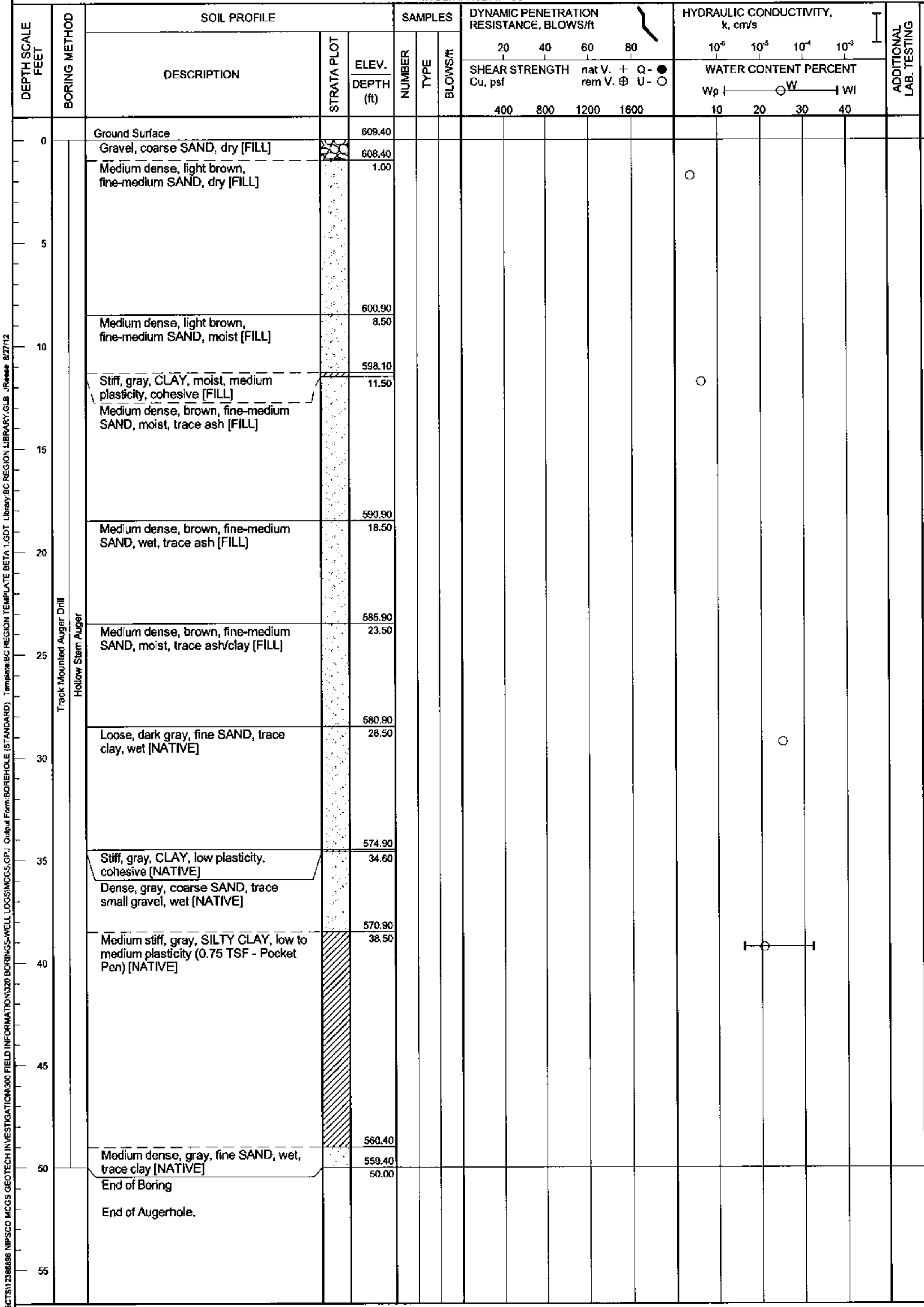
BORING METHOD: Track Mounted Auger Drill / Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	ELEV.	DEPTH (ft)
0	Ground Surface	609.40	
	Gravel, coarse SAND, dry [FILL]	608.40	1.00
	Medium dense, light brown, fine-medium SAND, dry [FILL]	600.90	8.50
	Medium dense, light brown, fine-medium SAND, moist [FILL]	598.10	11.50
	Stiff, gray, CLAY, moist, medium plasticity, cohesive [FILL]		
	Medium dense, brown, fine-medium SAND, moist, trace ash [FILL]	590.90	18.50
	Medium dense, brown, fine-medium SAND, wet, trace ash [FILL]	585.90	23.50
	Medium dense, brown, fine-medium SAND, moist, trace ash/clay [FILL]	580.90	28.50
	Loose, dark gray, fine SAND, trace clay, wet [NATIVE]	574.90	34.60
	Stiff, gray, CLAY, low plasticity, cohesive [NATIVE]		
	Dense, gray, coarse SAND, trace small gravel, wet [NATIVE]	570.90	38.50
	Medium stiff, gray, SILTY CLAY, low to medium plasticity (0.75 TSF - Pocket Pen) [NATIVE]	560.40	
	Medium dense, gray, fine SAND, wet, trace clay [NATIVE]	559.40	50.00
50	End of Boring		
	End of Augerhole.		

SAMPLES: NUMBER | TYPE | BLOWS/ft

ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION



DEPTH SCALE
1 in to 7 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

File:P:\12X-PROJECTS\12388898 NIPSCO MCGS GEOTECH INVESTIGATION\300 FIELD INFORMATION\320 BORINGS-WELL LOGS\MCGS.GPJ Output Form:BOREHOLE (STANDARD) Template:BC REGION TEMPLATE BETA 1.GDT Library:BC REGION LIBRARY.GLB JReese 8/27/12

PROJECT No.: 123-88898
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 6221.52 E: 5244.6484

RECORD OF AUGERHOLE: BH-10

SHEET 1 OF 2

DATUM: Geodetic

DRILLING DATE: JUNE 29-JULY 2, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

BORING METHOD: Truck Mounted Auger Drill, Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	ELEV. (ft)	DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft
0	Ground Surface	592.71				
	Gravel, sand, hard, dry [FILL]		0.00			
	Hard, gray, SAND and GRAVEL, dry [FILL]	590.71	2.00			
	Loose, brown/gray, fine to medium SAND, moist, trace gravel and ash [FILL]	589.21	3.50			
5	Very loose, brown/black, fune to medium SAND, wet, some ash [FILL]	586.71	6.00			
10	Loose to medium dense, gray, fine to medium SAND, wet, trace to little ash [FILL]	581.71	11.00			
15						
20						
	Medium dense, brown/gray, fine to medium SAND, trace ash/wood/brick [FILL]	569.21	23.50			
25						
	Very stiff, gray, SILT, wet, cohesive, non plastic [NATIVE]	564.21	28.50			
30						
	Stiff, gray, CLAY, low to medium plasticity, moist [NATIVE]	559.21	33.50			
35						
40						

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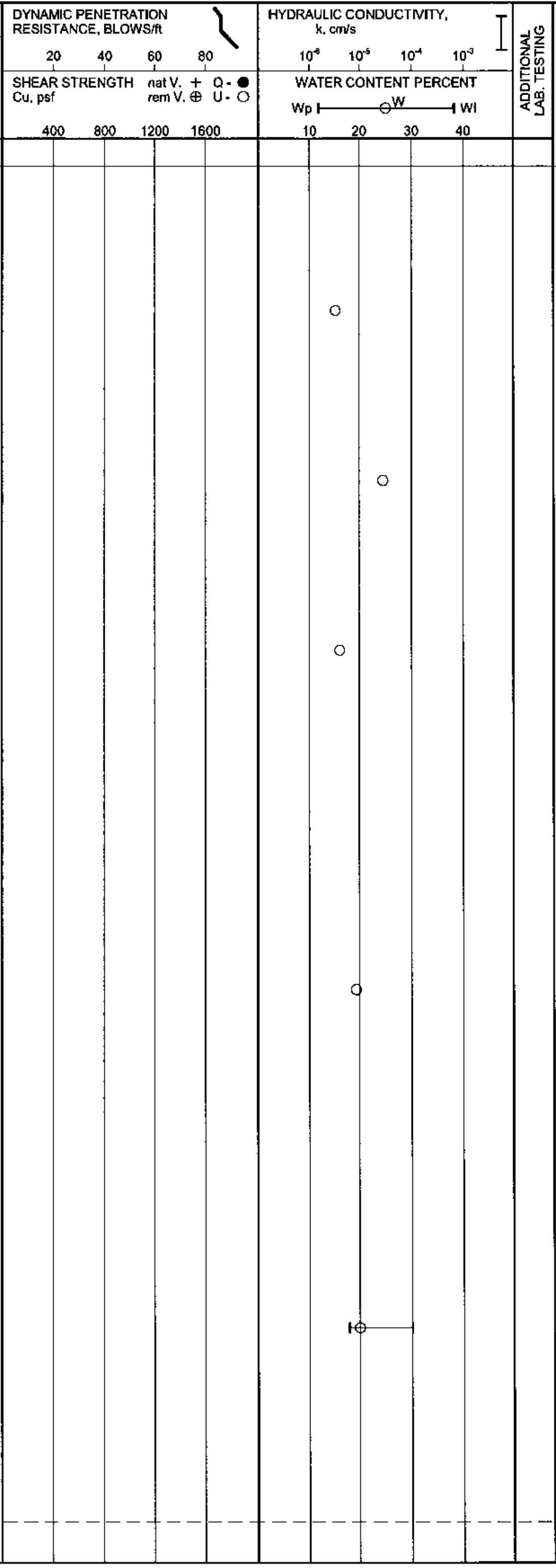
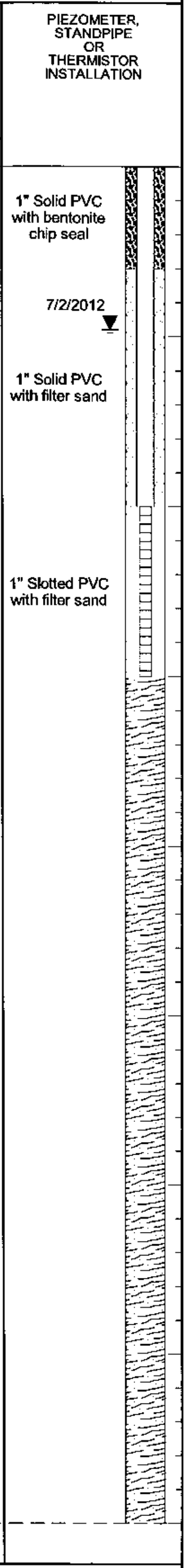




DEPTH SCALE
1 in to 5 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

PROJECT No.: 123-88898
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 6221.52 E: 5244.6484

RECORD OF AUGERHOLE: BH-10

SHEET 2 OF 2

DATUM: Geodetic

DRILLING DATE: JUNE 29-JULY 2, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

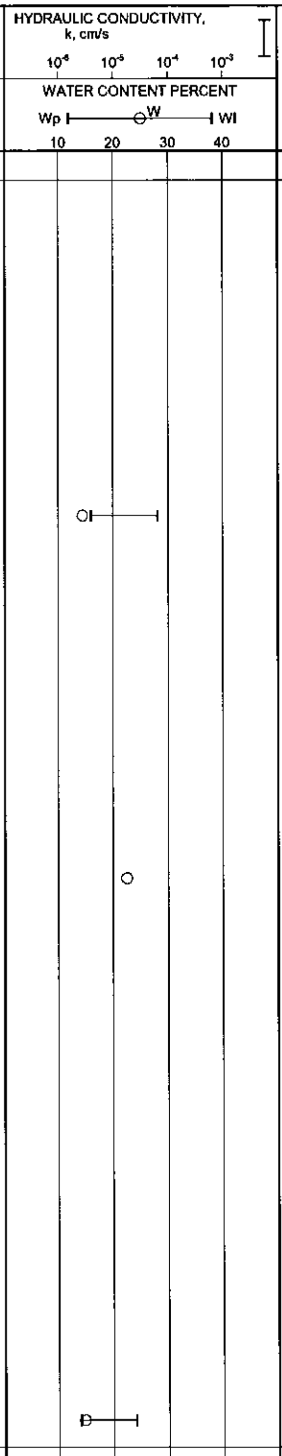
BORING METHOD: Truck Mounted Auger Drill, Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (ft)
40	Stiff, gray, CLAY, low to medium plasticity, moist [NATIVE] *(continued)*	
	Very hard, gray, fine SILTY CLAY AND SANDY SILT, some silt/clay, wet [NATIVE]	533.51 59.20
	Stiff to hard, gray, CLAY, low to medium plasticity, moist [NATIVE]	529.21 63.50
	Very dense, gray, fine SAND, some silt, wet [NATIVE]	523.31 69.40
	Very stiff, gray, CLAY, medium plasticity, moist [NATIVE]	519.21 73.50
75	End of Boring End of Augerhole.	517.71 75.00

SAMPLES: NUMBER | TYPE | BLOWS/ft

DYNAMIC PENETRATION RESISTANCE, BLOWS/ft: 20 40 60 80

SHEAR STRENGTH Cu, psf: nat V. + Q - ● rem V. ⊕ U - ○ 400 800 1200 1600



ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION

DEPTH SCALE
1 in to 5 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-11

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 6128.82 E: 5407.4322

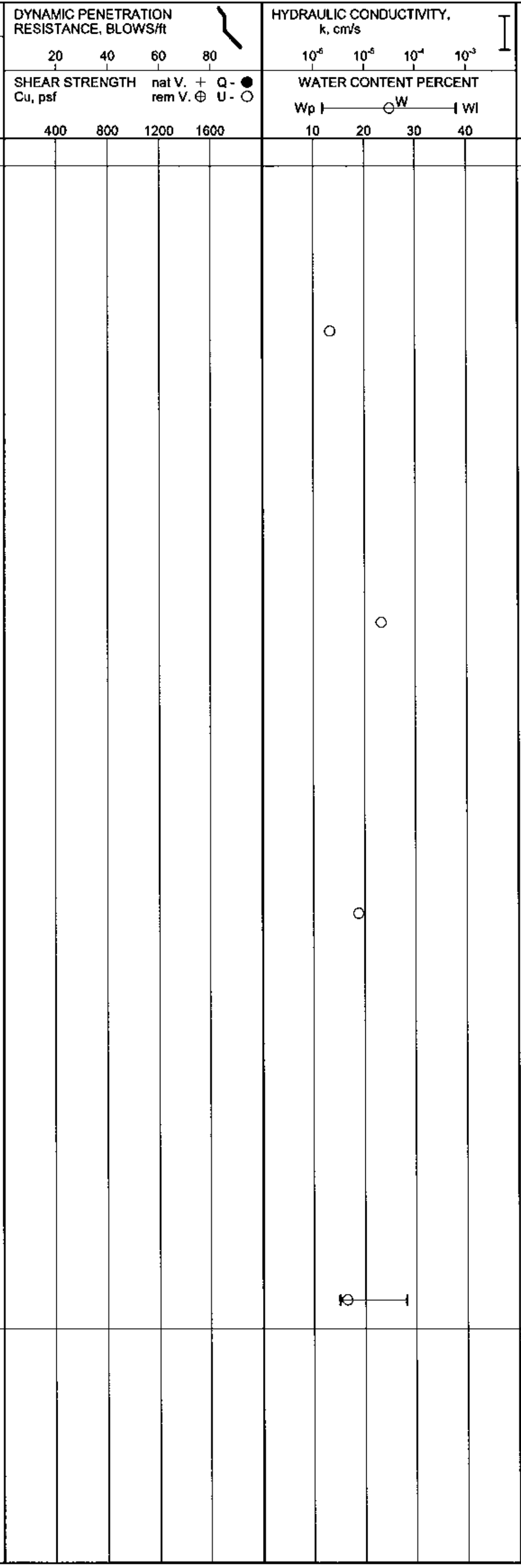
DRILLING DATE: JUNE 28, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

DATUM: Geodetic

INCLINATION: -90°

BORING METHOD: Track Mounted Auger Drill, Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV.	DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
0	Ground Surface		594.86						
	Gravel, coarse sand, gray, hard, dry [FILL]	▩		0.00					
	Hard, gray, coarse SAND and GRAVEL, dry [FILL]		593.86	1.00					
5									
	Very loose, brown, fine SAND, wet, trace ash [FILL]		588.86	6.00					
10									
	Medium dense, gray, fine SAND, wet [FILL]		581.36	13.50					
15									
	Loose, black ASH, wet [FILL]		576.36						
	Very loose, gray, fine SAND, wet, trace ash [possible FILL]		575.86	19.00					
20									
	Loose, gray, fine to coarse SAND, wet, little small gravel [NATIVE]		571.36	23.50					
25									
	Medium stiff, gray, CLAY, trace small gravel, moist [NATIVE]	▨	565.86	29.00					
30	End of Boring		564.86	30.00					
	End of Augerhole.								
35									



DEPTH SCALE
1 in to 4 ft

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-12

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5936.5143 E: 5504.8938

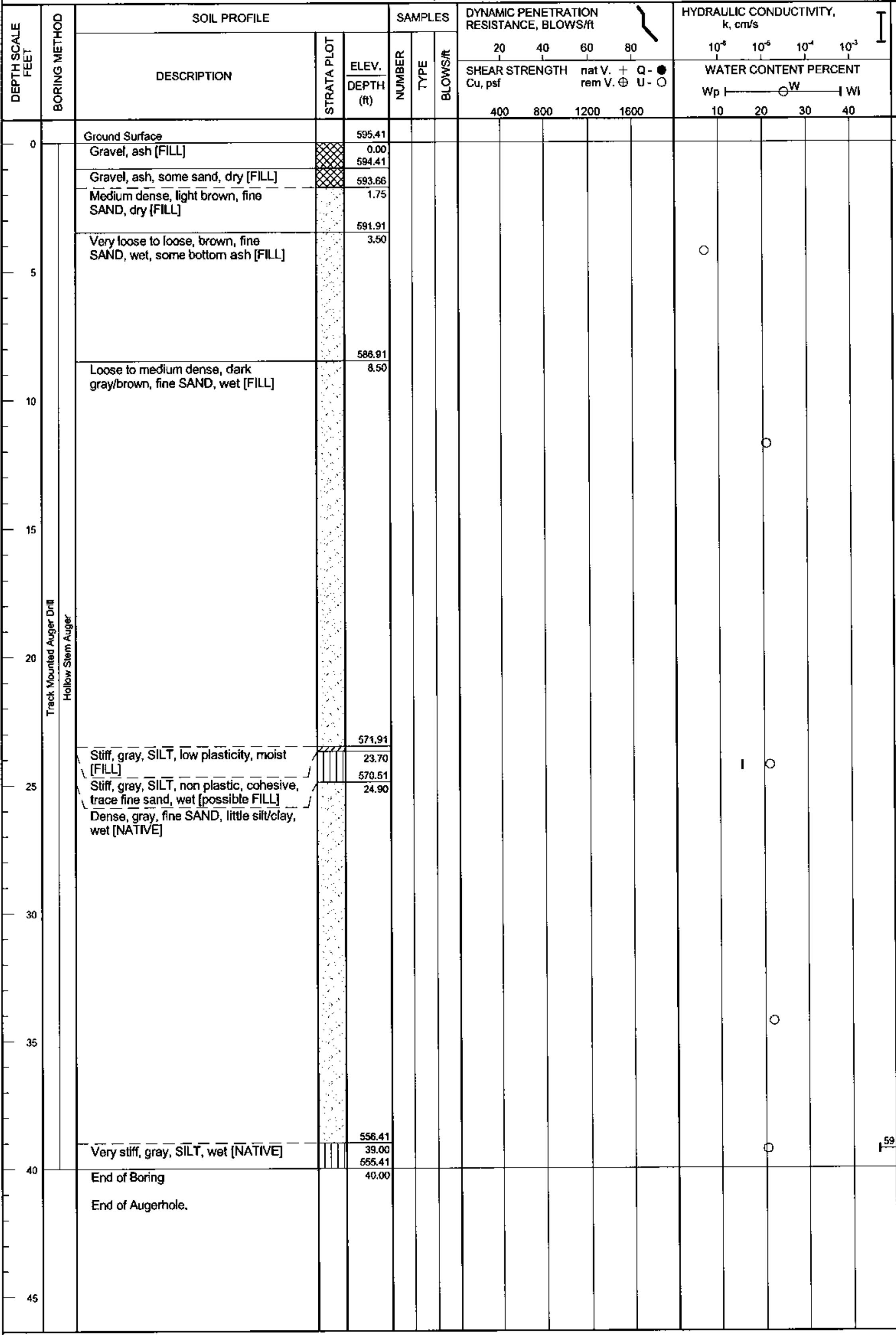
DATUM: Geodetic

DRILLING DATE: JUNE 28, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

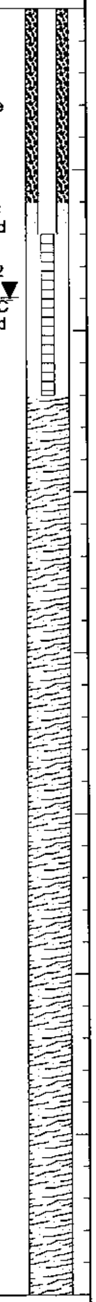
INCLINATION: -90°

BORING METHOD: Track Mounted Auger Drill
Hollow Stem Auger

SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (ft)
Ground Surface	595.41
Gravel, ash [FILL]	0.00 594.41
Gravel, ash, some sand, dry [FILL]	593.66
Medium dense, light brown, fine SAND, dry [FILL]	1.75 591.91
Very loose to loose, brown, fine SAND, wet, some bottom ash [FILL]	3.50 586.91
Loose to medium dense, dark gray/brown, fine SAND, wet [FILL]	8.50 571.91
Stiff, gray, SILT, low plasticity, moist [FILL]	23.70 570.51
Stiff, gray, SILT, non plastic, cohesive, trace fine sand, wet [possible FILL]	24.90
Dense, gray, fine SAND, little silt/clay, wet [NATIVE]	556.41
Very stiff, gray, SILT, wet [NATIVE]	39.00 555.41
End of Boring End of Augerhole.	40.00



PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION



1" Solid PVC with bentonite chip seal

1" Solid PVC with filter sand

7/2/2012

1" Slotted PVC with filter sand

DEPTH SCALE
1 in to 6 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5329.3386 E: 5263.828

RECORD OF AUGERHOLE: BH-2

SHEET 1 OF 1

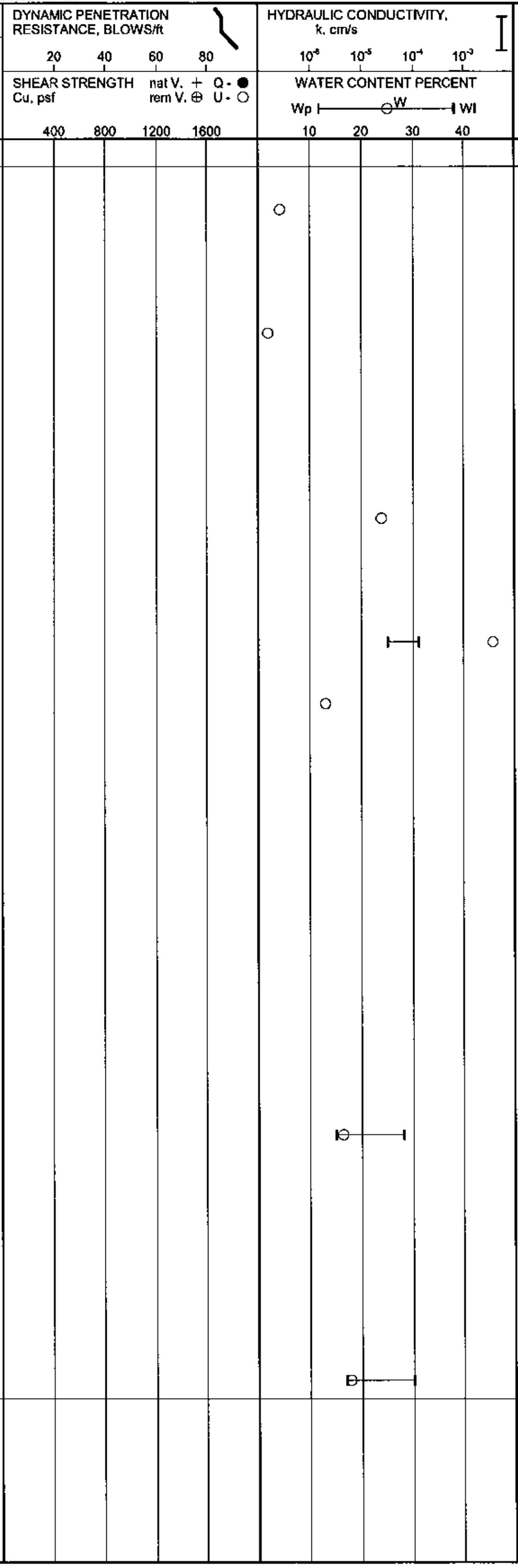
DATUM: Geodetic

DRILLING DATE: JUNE 26, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

BORING METHOD: Track Mounted Auger Drill — Hollow Stem Auger (0 to 50 ft)

DESCRIPTION	ELEV. DEPTH (ft)
Ground Surface	601.38
Dark brown, Sand/slag, trace gravel and ash [FILL]	600.38 1.00
Light brown, Fine SAND, dry, trace gravel/ash [FILL]	594.48
Loose, Ash, black, coarse, dry [FILL]	7.20
Loose, light brown, fine SAND, dry [FILL]	584.08
Loose, fine,gray SAND with Marl [possible FILL]	17.30 582.88
Loose, gray, fine SANDY SILT, wet, some fine gray sand [possible FILL]	18.50 581.58
Medium dense, gray, Fine SAND, wet, trace marl [possible FILL]	19.80 579.63
Medium dense, gray, medium to coarse SAND, wet, little small gravel [NATIVE]	21.75 572.38
Dense, gray, fine to fedium SAND, wet, trace gravel [NATIVE]	29.00 567.38
Medium, gray, SILTY CLAY, trace sand, moist, low to medium plasticity [NATIVE]	34.00 556.88
Medium dense, Gray, Fine SAND, wet, trace silt [NATIVE]	44.75
Medium stiff, gray, SILTY CLAY, trace sand, moist [NATIVE]	552.13
Medium dense, gray, fine SAND, wet [NATIVE]	
Stiff, gray, SILTY CLAY, medium plasticity, moist [NATIVE]	50.00
End of Boring	
End of Augerhole.	



SAMPLES: NUMBER | TYPE | BLOWS/ft

ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION

DEPTH SCALE FEET: 0 5 10 15 20 25 30 35 40 45 50 55

DEPTH SCALE
1 in to 7 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-3

SHEET 1 OF 2

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5132.6034 E: 4778.414

DATUM: Geodetic

DRILLING DATE: JUNE 27, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft	DYNAMIC PENETRATION RESISTANCE, BLOWS/ft (20 40 60 80); SHEAR STRENGTH Cu, psf nat V. + Q - ● rem V. ⊕ U - ○ (400 800 1200 1600)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		Ground Surface		609.73							
0	Track Mounted Auger Drill Hollow Stem Auger	Gravel and gray sand, dry [FILL]		0.00							
		Medium dense, light brown, fine SAND, dry, trace clay and small gravel [FILL]		608.73 1.00					○		
5		Very loose to loose, light brown, fine SAND, dry, trace clay [FILL]		603.73 6.00							
10		Very loose to loose, light brown, fine SAND, dry [FILL]		598.73 11.00					○		
15											
20											
		Dense, light brown, fine SAND, dry [FILL]		586.23 23.50					○		
25											
		Loose, light brown, fine SAND, wet [FILL]		581.23 28.50							
30											
		Dense, brown, fine to medium SAND, some small gravel, wet [possible FILL]		576.23 33.50							
35											
		Very dense, gray, fine to medium SAND, wet [NATIVE]		571.23 38.50					○		
40											

CONTINUED NEXT PAGE

DEPTH SCALE
1 in to 5 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

PROJECT No.: 123-88898
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5132.6034 E: 4778.414

RECORD OF AUGERHOLE: BH-3

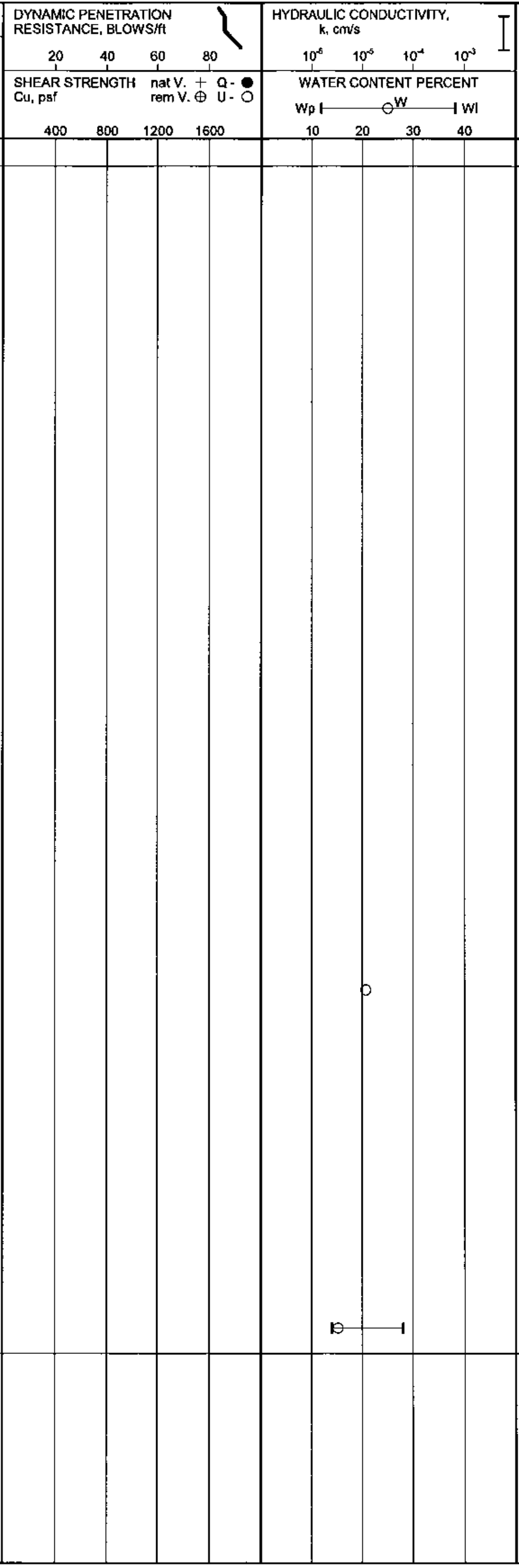
SHEET 2 OF 2

DATUM: Geodetic

DRILLING DATE: JUNE 27, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
40	Track Mounted Auger Drill Hollow Stem Auger	Very dense, gray, fine to medium SAND, wet [NATIVE] *(continued)*							
45									
50									
55									
60									
65									
		Very dense, gray, fine SAND with SILT, trace clay, non plastic, wet [NATIVE]		540.73 69.00					
70									
		Very stiff, gray, SILTY CLAY, low to medium plasticity, moist, 2.5 TSF pocket pen [NATIVE]	▨	538.23 73.50					
75		End of Boring End of Augerhole.		534.73 75.00					
80									



DEPTH SCALE
1 in to 5 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-4

SHEET 1 OF 1

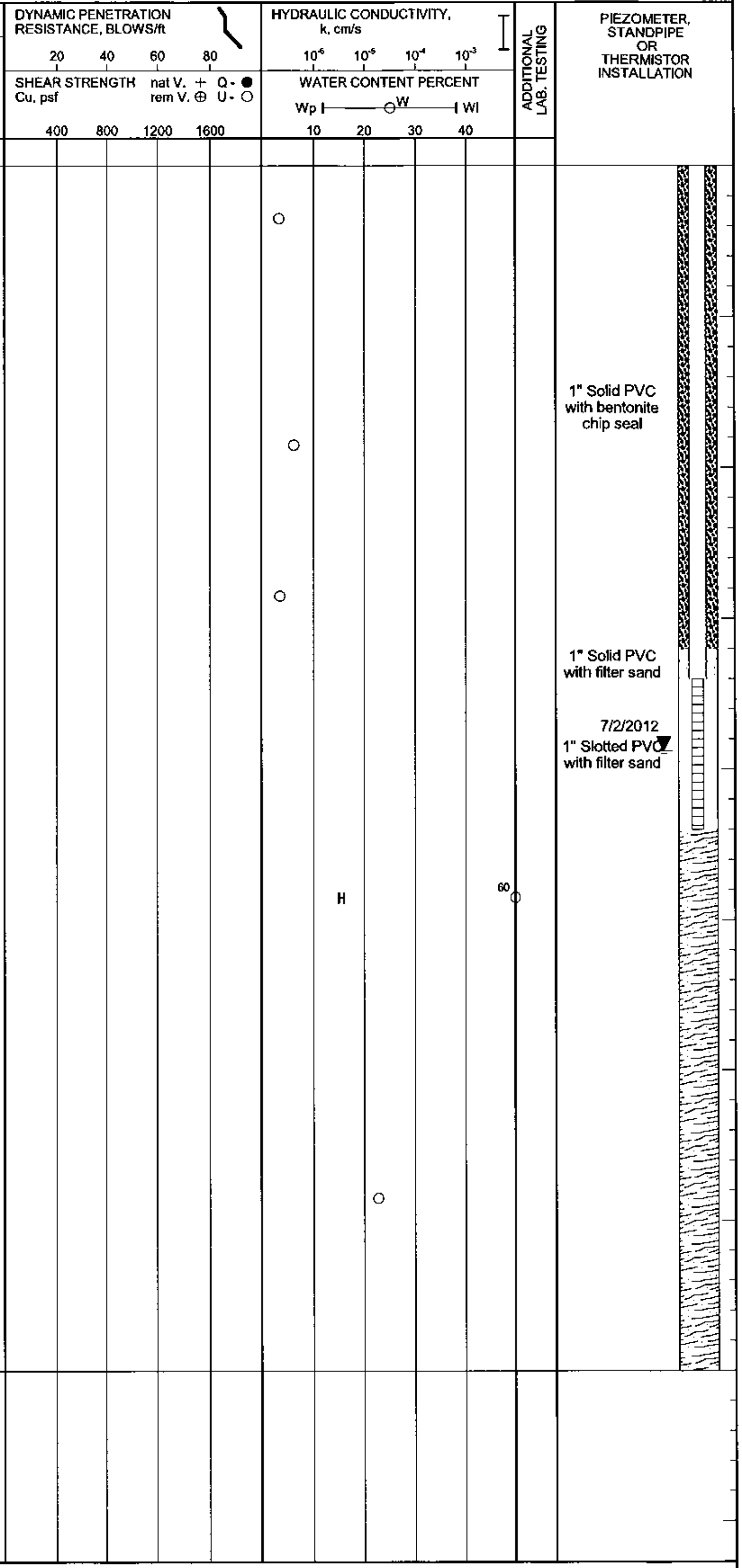
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 4828.3032 E: 4833.2054

DATUM: Geodetic

DRILLING DATE: JUNE 26, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/ft
		Ground Surface		609.35			
0	Track Mounted Auger Drill Hollow Stem Auger	Slag, gray ash [FILL]		0.00			
		Medium dense, light brown, fine SAND, dry, some silt/clay seams from 3.5' to 6' [FILL]		608.35 1.00			
5							
10		Medium dense, light brown, fine SAND, moist, trace ash [FILL]		598.35 11.00			
15		Medium dense, light brown, fine SAND, wet, trace ash [FILL]		590.85 18.50			
20		Soft, gray, fine SANDY SILT, wet, trace clay [NATIVE]		588.35 21.00			
25		Loose, dark gray, fine to coarse SAND, wet, trace clay [NATIVE]		582.35 27.00			
30		Medium dense, brown, medium SAND to small gravel, wet, trace clay [NATIVE]		575.85 33.50			
35							
40		End of Boring End of Augerhole.		569.35 40.00			
45							



1" Solid PVC with bentonite chip seal

1" Solid PVC with filter sand

7/2/2012

1" Slotted PVC with filter sand

DEPTH SCALE
1 in to 6 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-5

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 6000.1833 E: 5296.855

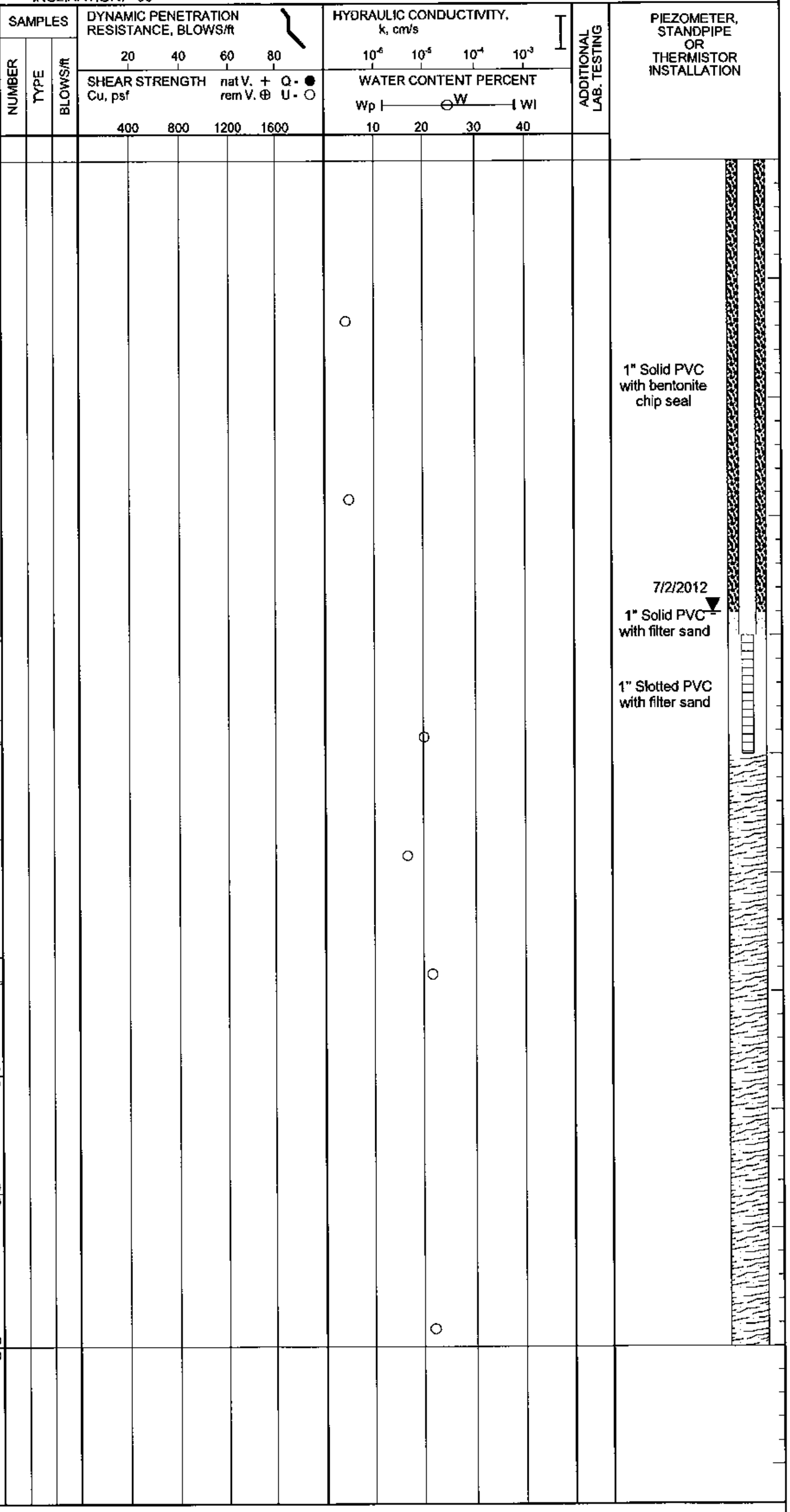
DATUM: Geodetic

DRILLING DATE: JUNE 27, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

BORING METHOD: Track Mounted Auger Drill
Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (ft)
	Ground Surface	609.40
0	Gravel, small, dry, some sand/slag [FILL]	0.00
	Very loose to loose, brown, fine SAND, dry [FILL]	607.90 1.50
	Very loose to loose, brown, fine SAND, wet [FILL]	600.90 8.50
	Dense, brown, fine to medium SAND, wet, trace ash [FILL]	585.90
	Very dense, gray, GRAVEL/SLAG, wet, trace sand [FILL]	585.00 24.50
	Very dense, brown, fine to medium sand, wet, trace ash [FILL]	
	Medium dense, black ASH, wet [FILL]	580.90 28.50
	Very loose, brown fine SAND, wet, trace ash [FILL]	575.90
	Loose, black ASH, wet [FILL]	574.90 34.60
	Very loose, brown fine to medium SAND, wet, some ash [FILL]	
	Hard, fine to coarse SAND, brown/gray, wet [NATIVE]	570.90 38.50
	Medium dense, gray, fine to medium sand, wet [NATIVE]	565.90 43.50
50	End of Boring End of Augerhole.	559.40 50.00



DEPTH SCALE
1 in to 7 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-6

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5833.1477 E: 5130.5199

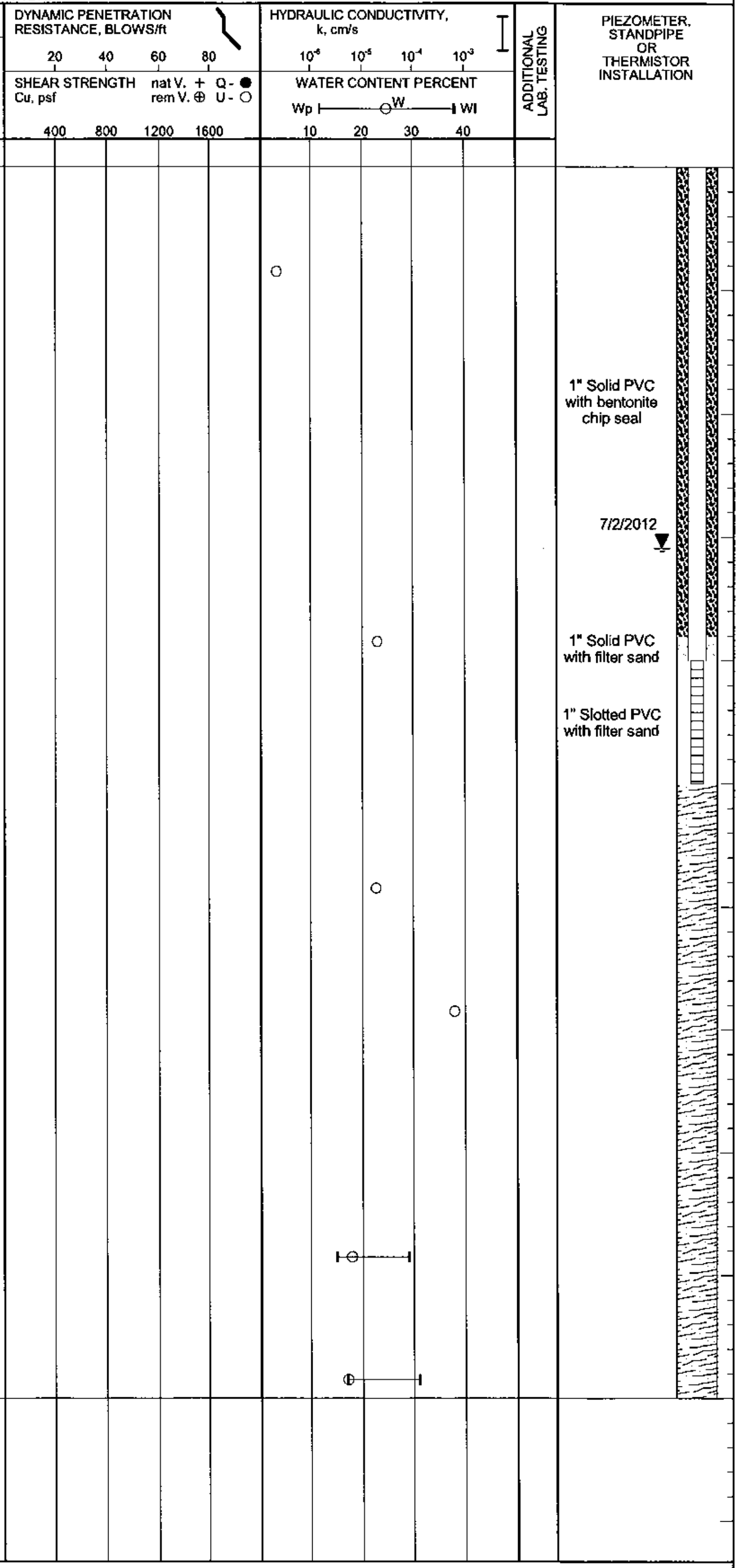
DATUM: Geodetic

DRILLING DATE: JUNE 28, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

BORING METHOD: Track Mounted Auger Drill; Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE DESCRIPTION	ELEV.	DEPTH (ft)
0	Ground Surface	609.61	
	Sand/Gravel, gray, coarse, dry [FILL]		
	Dense, gray, coarse SAND and GRAVEL, dry [FILL]	608.61	
	Very loose to loose, light brown, fine to medium SAND, dry to moist [FILL]		1.50
	Medium dense to dense, light brown, fine to medium SAND, moist [FILL]	598.61	11.00
	Very loose, brown, fine to medium SAND, wet [FILL]	591.11	18.50
	Very loose to medium dense, gray, fine to medium SAND, wet [FILL]	586.11	23.50
	Very loose, black/dark gray, bottom ASH and fine to medium SAND, wet [FILL]	576.11	33.50
	Medium stiff to stiff, gray, SILTY CLAY, moist, trace sand/gravel, medium plasticity, 2.5 TSF pocket pen [NATIVE]	569.86	39.75
50	End of Boring	559.61	50.00
	End of Augerhole.		



DEPTH SCALE
1 in to 7 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

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PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-7

SHEET 1 OF 1

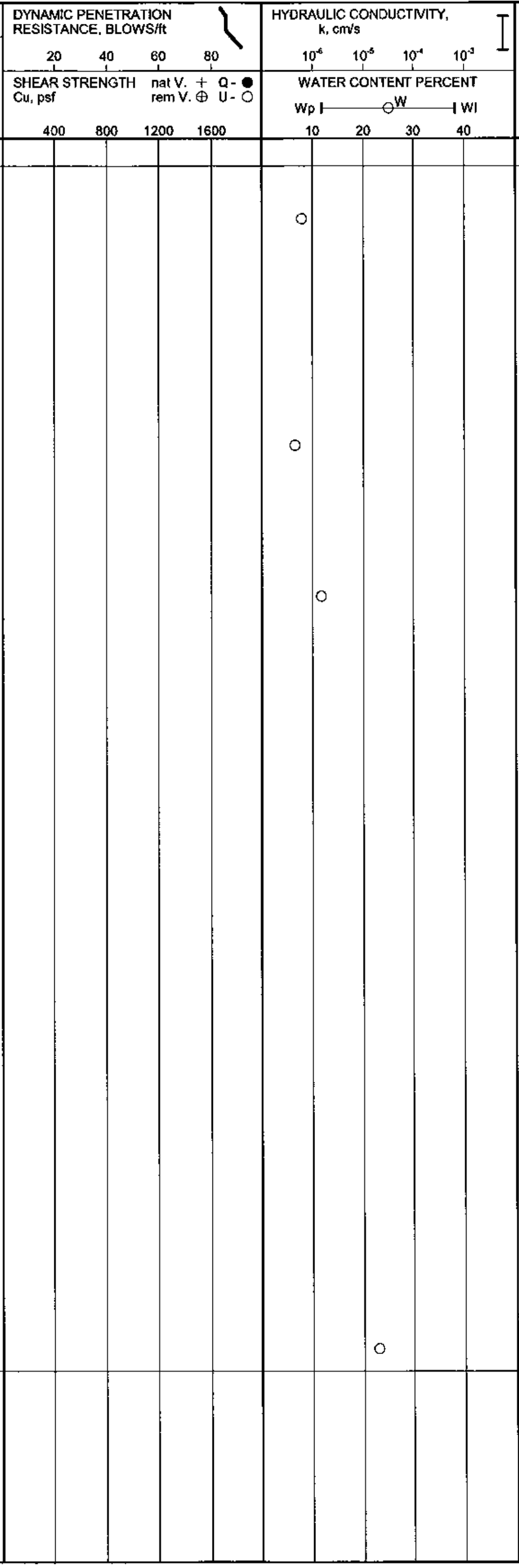
CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 5699.0208 E: 5395.0681

DATUM: Geodetic

DRILLING DATE: JUNE 27, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft	ADDITIONAL LAB. TESTING	PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION
		Ground Surface		609.39					
0	Track Mounted Auger Drill Hollow Stem Auger	Gravel, gray coarse sand [FILL]	▨	0.00					
		Medium dense, light brown, fine to medium SAND, dry, trave gravel, possible textile at 5' [FILL]		608.39 1.00					
5									
10		Very dense, gray/black, SLAG/ASH, wet [FILL]		597.89 11.50					
15		Medium dense to dense, brown, fine to medium SAND, trace black ash/slag, wet, wood at 19.25' [FILL]		595.39 14.00					
20									
25									
30		Medium dense to dense, gray, fine to medium SAND, trace ash and gravel, wet [FILL]		580.89 28.50					
35									
40		End of Boring End of Augerhole.		569.39 40.00					
45									



DEPTH SCALE
1 in to 6 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

File:P:\12X-PROJECTS\12388898 NIPSCO MCGS GEOTECH INVESTIGATION\300 FIELD INFORMATION\320 BORINGS-WELL LOGS\MCGS.GPJ Output Form:BOREHOLE (STANDARD) Template:BC REGION TEMPLATE BETA 1.GDT Library:BC REGION LIBRARY.GLB JReese 8/27/12

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-8

SHEET 1 OF 2

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 7131.9406 E: 5644.1865

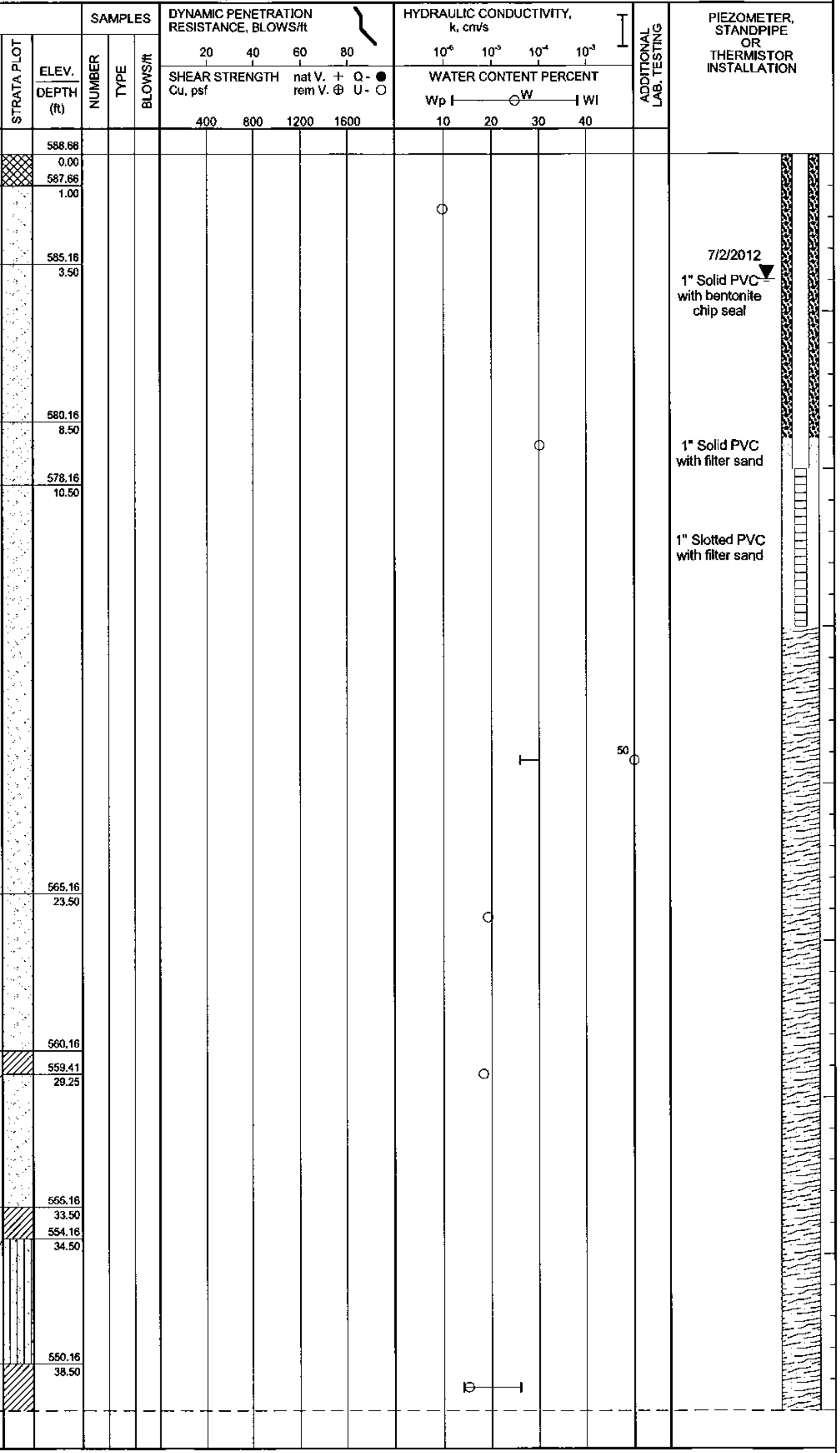
DRILLING DATE: JULY 2, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

DATUM: Geodetic

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (ft)
0	Truck Mounted Auger Drill Hollow Stem Auger	Ground Surface	588.66
		Gravel/sand, dry [FILL]	0.00
		Medium dense, brown, fine to medium SAND WITH GRAVEL, some ash, moist [FILL]	587.66 1.00
5		Loose, brown/gray, fine to medium SAND, trace ash, wet [FILL]	585.16 3.50
10		Very loose, black/dark gray, fine SAND, trace organics, trace ash, wet [FILL]	580.16 8.50
15 20		Very loose, black, fine SILTY SAND, some ash, wet, cohesive, non plastic [FILL]	578.16 10.50
25		Dense, gray, fine SAND, wet trace silt/ash [FILL]	565.16 23.50
		Stiff, gray, SILTY CLAY, moist, trace sand [possible FILL]	560.16
30		Dense, gray, fine SAND, wet, trace clay [possible FILL]	559.41 29.25
		Stiff, gray, SILTY CLAY, trace sand, low to medium plasticity, moist [possible FILL]	555.16 33.50
35		Dense, gray, fine SILTY SAND, wet, trace clay [possible FILL]	554.16 34.50
40		Stiff, gray, CLAY, medium plasticity, trace small gravel, moist [NATIVE]	550.16 38.50

CONTINUED NEXT PAGE



DEPTH SCALE
1 in to 5 ft

LOGGED: JRR
CHECKED: MRF

File:P:\12X-PROJECTS\12388898 NIPSCO MCGS GEOTECH INVESTIGATION\300 FIELD INFORMATION\320 BORINGS-WELL LOGS\MCGS.GPJ Output Form:BOREHOLE (STANDARD) Template:BC REGION TEMPLATE BETA 1.GDT Library:BC REGION LIBRARY.GLB JReese 8/27/12

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-8

SHEET 2 OF 2

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 7131.9406 E: 5644.1865

DATUM: Geodetic

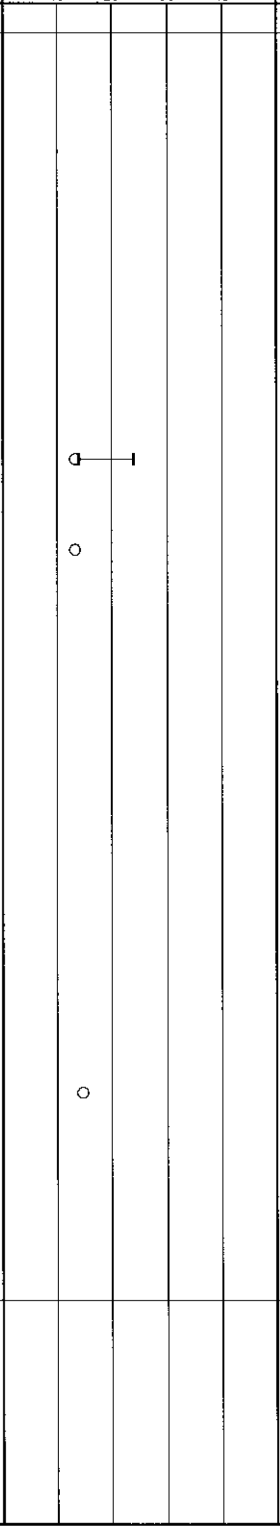
DRILLING DATE: JULY 2, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS/ft
40	Truck Mounted Auger Drill Hollow Stem Auger	Stiff, gray, CLAY, medium plasticity, trace small gravel, moist [NATIVE] *(continued)*	▨				
		Stiff, gray, CLAY, medium plasticity, trace small gravel, moist, some silt/fine sand at 59' [NATIVE]	▨	535.16 53.50			
		Stiff to very stiff, gray, CLAY/SILT, moist, trace fine sand, cohesive, low plasticity [NATIVE]	▨	529.16 59.50			
		Very dense, gray, SILT, moist, cohesive, non plastic [NATIVE]		518.91 69.75			
75		End of Boring End of Augerhole.		513.66 75.00			

DYNAMIC PENETRATION RESISTANCE, BLOWS/ft: 20 40 60 80
SHEAR STRENGTH Cu, psf: 400 800 1200 1600 — nat V. + Q - ● rem V. ⊕ U - ○

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}



ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION

DEPTH SCALE
1 in to 5 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

File:P:\12X-PROJECTS\12388898 NIPSCO MCGS GEOTECH INVESTIGATION\300 FIELD INFORMATION\320 BORINGS-WELL LOGS\MCGS.GPJ Output Form:BOREHOLE (STANDARD) Template:BC REGION TEMPLATE BETA 1.GDT Library:BC REGION LIBRARY.GLB JReese 8/27/12

PROJECT No.: 123-88898

RECORD OF AUGERHOLE: BH-9

SHEET 1 OF 1

CLIENT: NIPSCO
PROJECT: MCGS Geotechnical Investigation
LOCATION:
N: 6830.3718 E: 5498.3365

DATUM: Geodetic

DRILLING DATE: JULY 2, 2012
DRILLING CONTRACTOR: EARTH EXPLORATION

INCLINATION: -90°

BORING METHOD: Truck Mounted Auger Drill, Hollow Stem Auger

SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV.	DEPTH (ft)
Ground Surface		589.62	
Gravel, sand, dry, very dense [FILL]	▩	588.62	1.00
Medium dense, gray/brown, fine to medium SAND, moist, trace gravel [FILL]		586.12	3.50
Loose, gray/brown, fine to medium SAND, wet, trace gravel [FILL]		583.62	6.00
Medium dense, gray/brown, fine to medium SAND, wet, trace gravel [FILL]		576.12	13.50
Medium dense, gray/brown, fine to medium SAND, wet, trace gravel little ash, trace wood [FILL]		565.12	24.50
Medium dense, gray, fine to medium SAND, wet [FILL]		556.12	33.50
Stiff, gray, CLAY, moist, trace small gravel, medium plasticity [NATIVE]	▨	550.62	
Medium stiff, gray, fine SAND, wet [NATIVE]		549.87	39.75
Stiff, gray, SILTY CLAY, moist [NATIVE]	▨	540.62	
Medium dense to dense, gray, fine SAND, wet [NATIVE]		539.62	50.00
End of Boring End of Augerhole.			

SAMPLES: NUMBER | TYPE | BLOWS/ft

DYNAMIC PENETRATION RESISTANCE, BLOWS/ft: 20 40 60 80

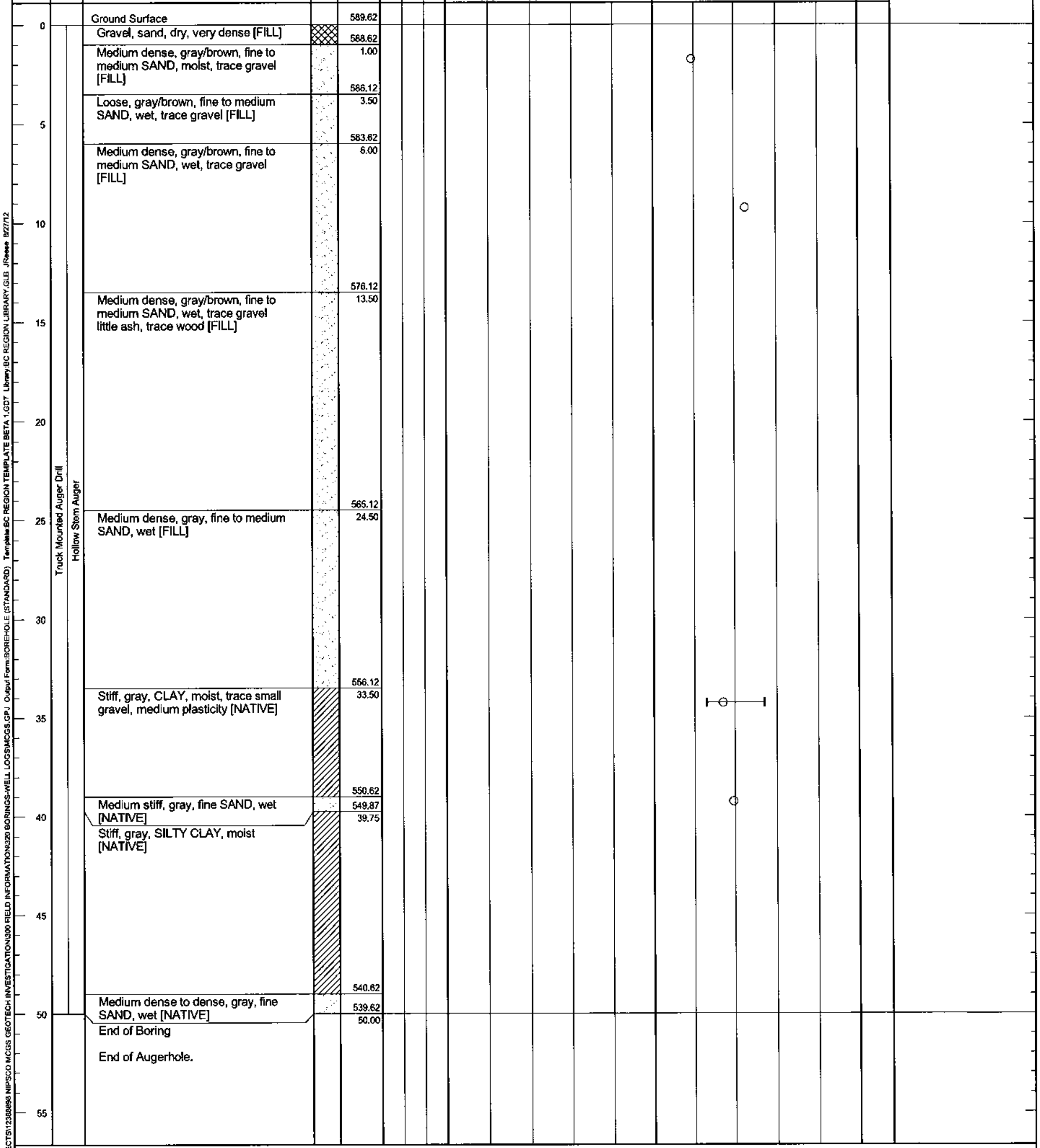
SHEAR STRENGTH Cu, psf: nat V. + Q - ● rem V. ⊕ U - ○ 400 800 1200 1600

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER, STANDPIPE OR THERMISTOR INSTALLATION

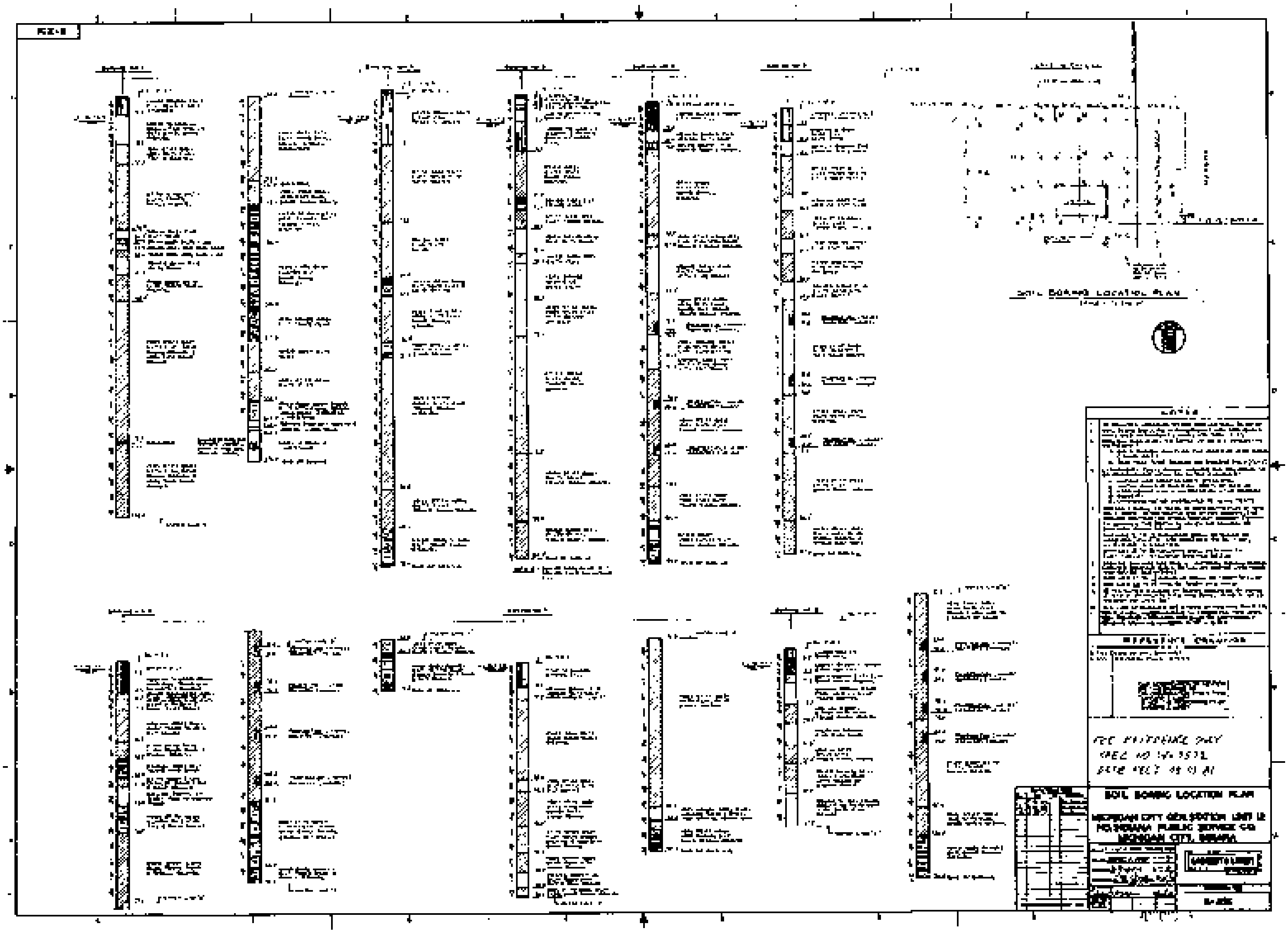


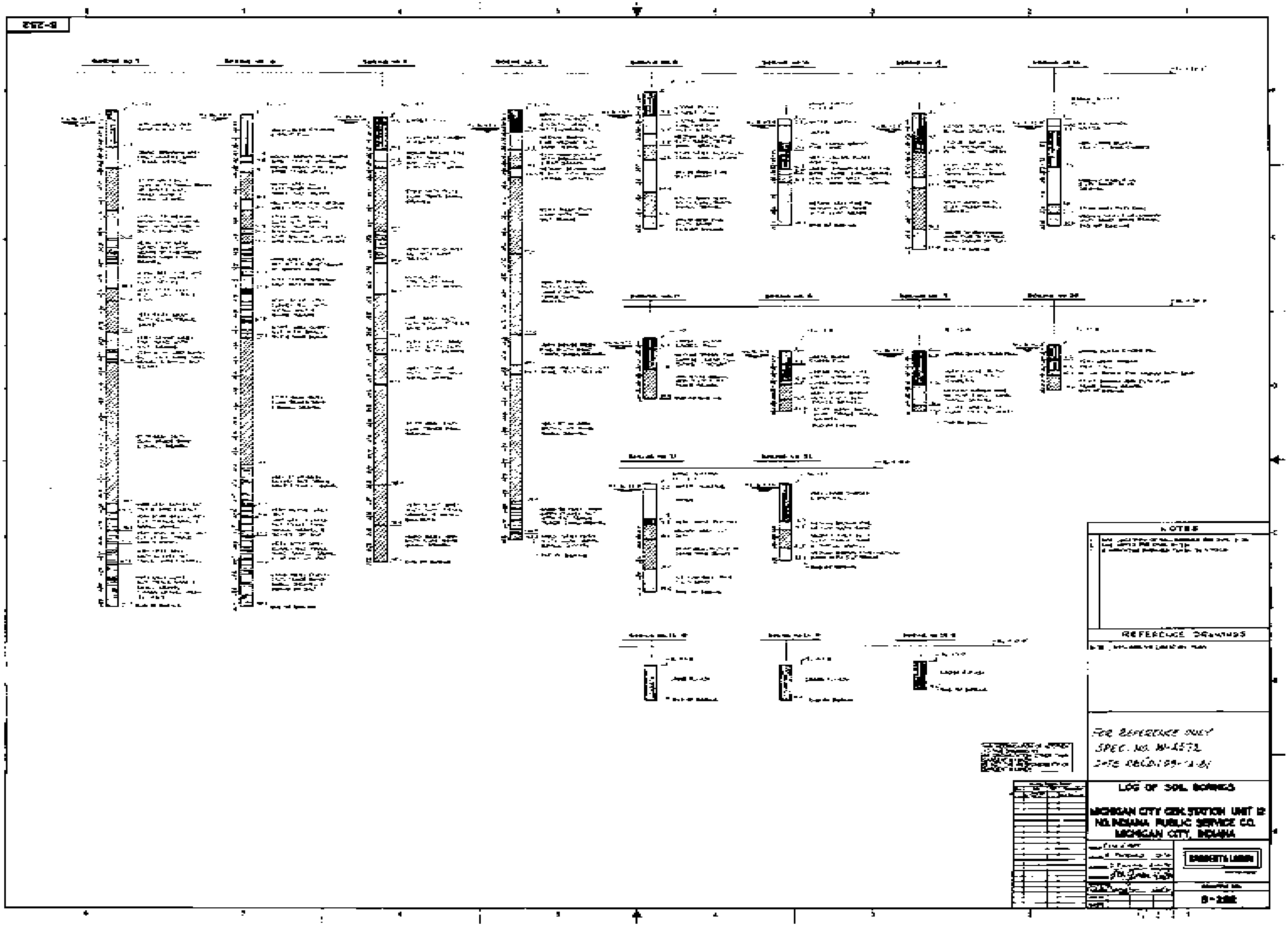
DEPTH SCALE
1 in to 7 ft

Golder Associates

LOGGED: JRR
CHECKED: MRF

File:P:\12X-PROJECTS\123-88898 NIPSCO MCGS GEOTECH INVESTIGATION\300 FIELD INFORMATION\320 BORINGS-WELL LOGS\MCGS.GPJ Output Form:BOREHOLE (STANDARD) Template:BC REGION TEMPLATE BETA 1.GDT Library:BC REGION LIBRARY.GLB JReese 8/27/12


SOIL BORING LOCATION PLAN
SEE REFERENCE DWG
SPEC NO [illegible]
DATE REC'D [illegible]
SOIL BORING LOCATION PLAN
MICHIGAN CITY GEN. STATION UNIT 12
NORTHERN INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA



FOR REFERENCE ONLY
SPEC. NO. M-4572
DATE REC'D: 99-12-8

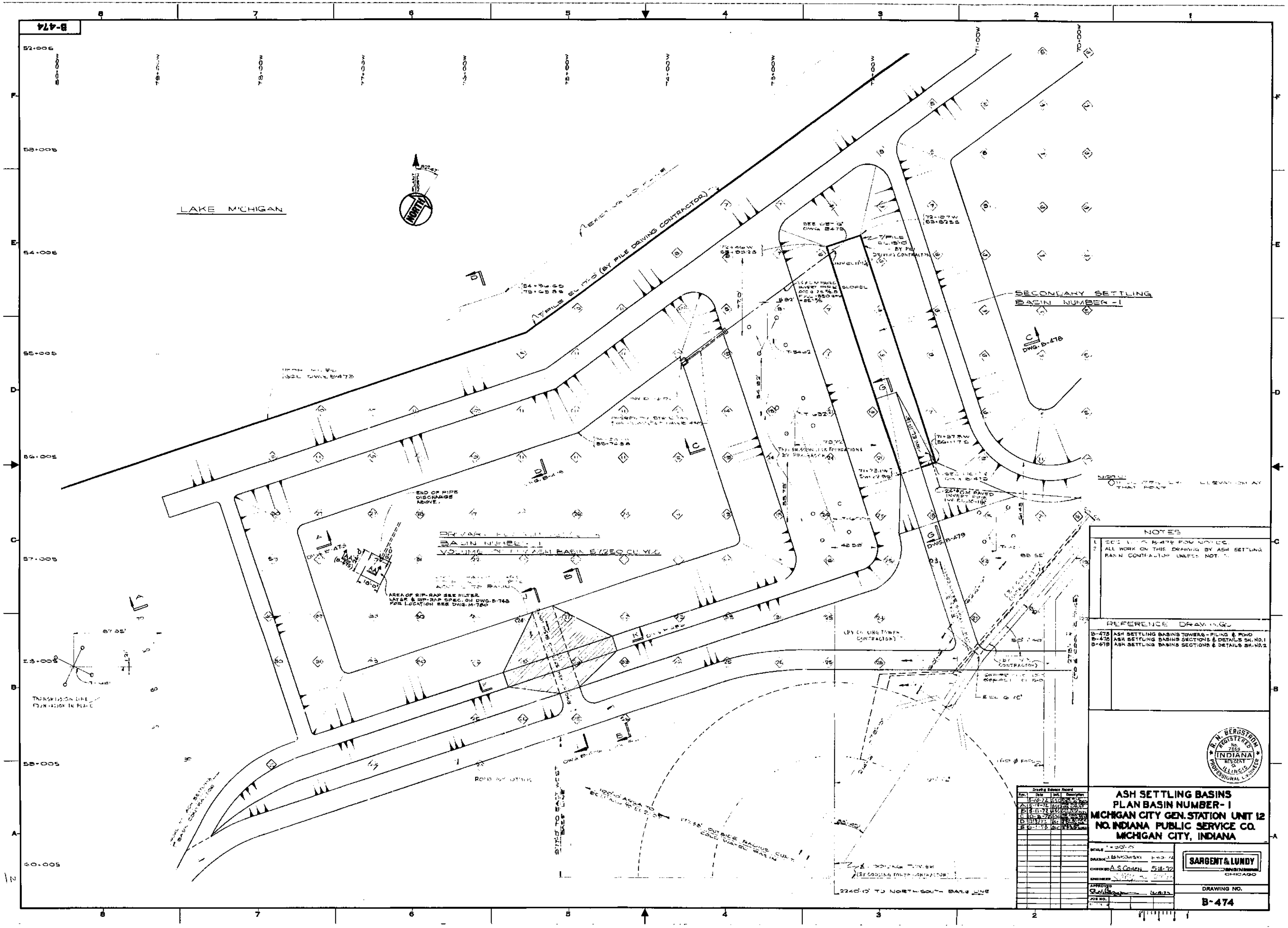
LOG OF SOIL BORINGS

MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

APPENDIX B

Sargent & Lundy Drawings

\Drawings\NIPSCO Drawing\B\B-0400\B-0450\B-0474.tif



NOTES

1. SEE DWG. B-475 FOR NOTES.
2. ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR UNLESS NOTED.

REFERENCE DRAWINGS

B-475	ASH SETTLING BASINS TOWERS - PILING & POND
B-476	ASH SETTLING BASINS SECTIONS & DETAILS SH. NO. 1
B-479	ASH SETTLING BASINS SECTIONS & DETAILS SH. NO. 2

R. N. BERGSTROM REGISTERED No. 7868 INDIANA RESIDENT OF ILLINOIS PROFESSIONAL ENGINEER

Drawing Release Record

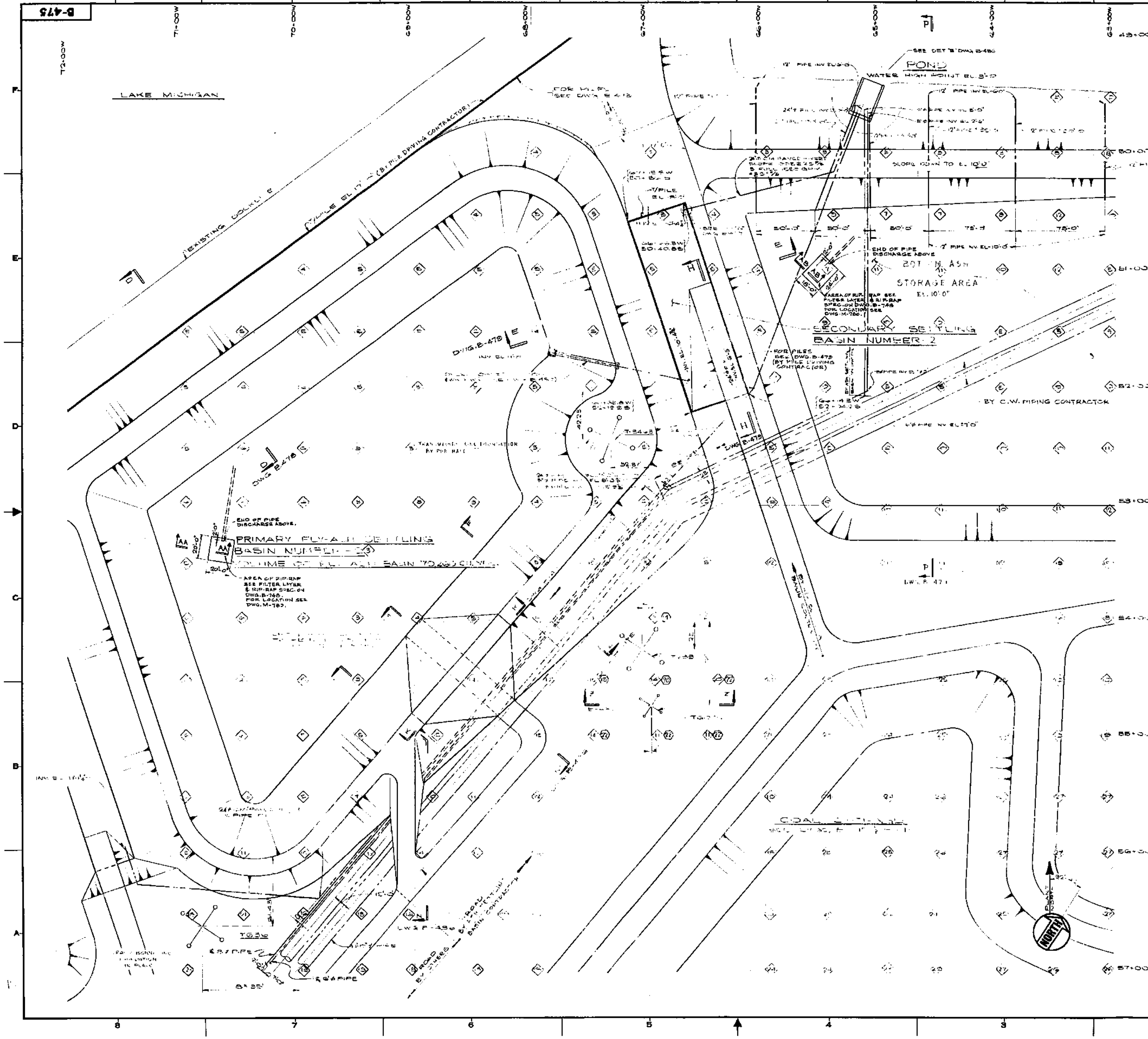
Rev.	Date	Init.	Description
	3-10-72	ASC	[illegible]
A	5-19-72	ASC	[illegible]
B	8-11-72	ASC	[illegible]
C	10-8-72	ASC	[illegible]
D	12/8/72	ASC	[illegible]
E	6-1-73	ASC	[illegible]

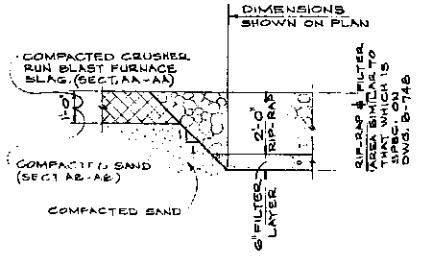
ASH SETTLING BASINS
PLAN BASIN NUMBER- 1
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

SCALE 1" = 30'-0"
DRAWN J. BNKOWSKI
CHECKED A. S. COHEN 5-18-72
ENGINEER
APPROVED

SARGENT & LUNDY ENGINEERS CHICAGO

DRAWING NO.
B-474





SECTION AA-AA (AS SHOWN) (DWG. B-474)
SECTION AB-AB (AS NOTED)
SCALE: ½"=1'-0"

NOTES

1. SEE DWG B-473 FOR NOTES
2. ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR, UNLESS NOTED.
3. 12" PIPE [illegible]

REFERENCE DRAWINGS

B-473	ASH SETTLING BASINS TOWERS - PILING & POND
B-478	ASH SETTLING BASINS SECTIONS & DETAILS SH. NO. 1
B-479	ASH SETTLING BASINS SECTIONS & DETAILS SH. NO. 2

R. N. BERGSTROM REGISTERED No. 7808 INDIANA RESIDENT OF ILLINOIS PROFESSIONAL ENGINEER

Drawing Release Record

Rev.	Date	Init.	Description
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A	5-9-72	ASC	[illegible]
B	8-11-72	ASC	[illegible]
C	10-3-72	ASC	[illegible]
D	2/8/72	ASC	[illegible]
E	6-?-72	ASC	[illegible]

ASH SETTLING BASIN
PLAN BASIN NUMBER-2

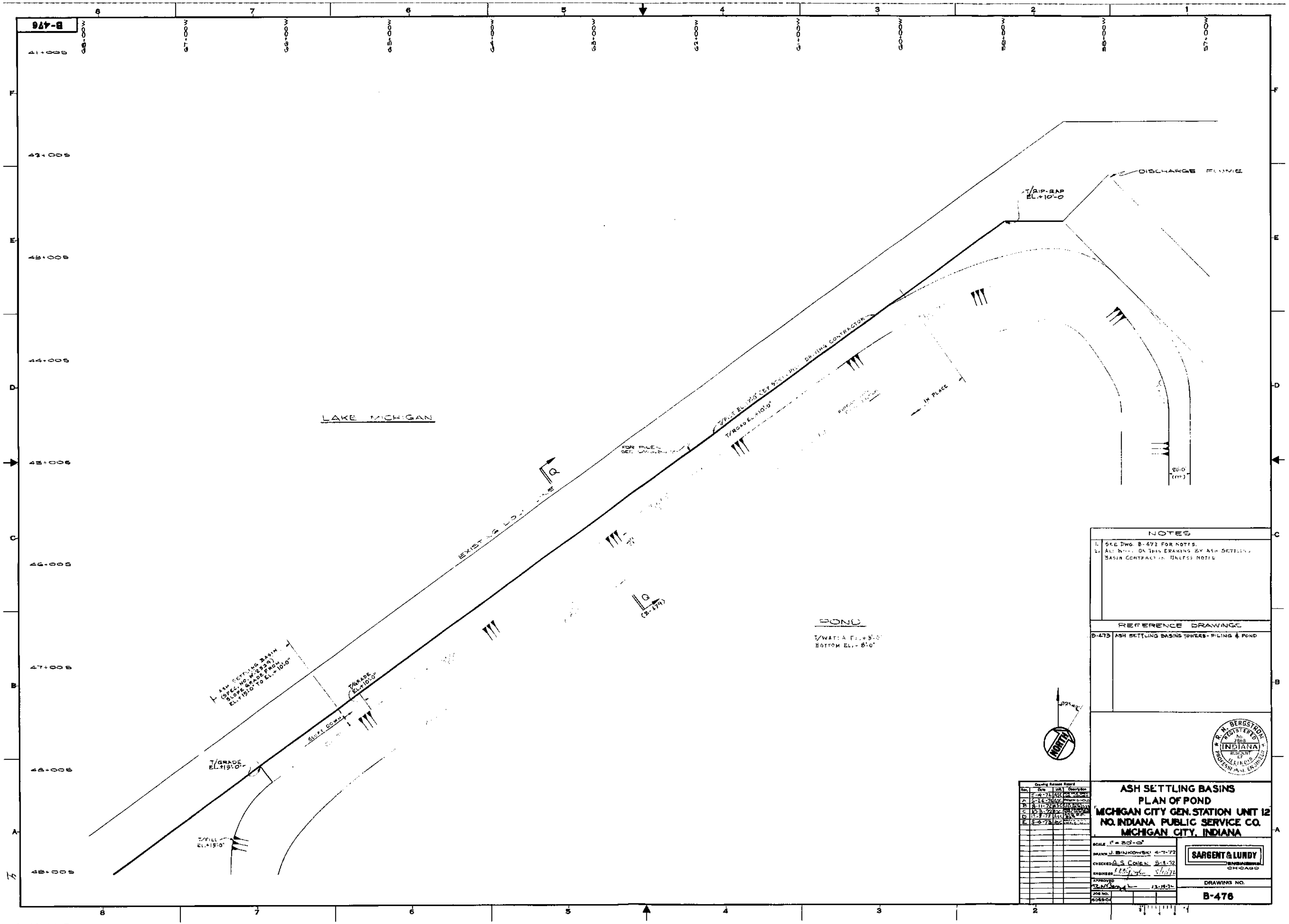
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

SCALE 1"=50'-0"
DRAWN J BINKOWSKI 2-10-72
CHECKED A.S. COHEN 5-18-72
ENGINEER [illegible]
APPROVED R.N. Bergstrom 12-17-72
JOB NO.

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO.
B-475

\Drawings\NIPSCO Drawing\B\B-0400\B-0450\B-0476.tif



NOTES

1. SEE DWG. B-472 FOR NOTES.
2. ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR UNLESS NOTED.

REFERENCE DRAWINGS

B-473 ASH SETTLING BASINS TOWERS - PILING & POND

R. N. BERGSTROM
REGISTERED No. 7868
INDIANA
RESIDENT OF ILLINOIS
PROFESSIONAL ENGINEER

Drawing Release Record

Rev.	Date	Init.	Description
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A	6-26-72	ASC	[illegible]
B	8-11-72	ASC	[illegible]
C	10-3-72	ASC	[illegible]
D	12-8-72	ASC	[illegible]
E	5-4-73	ASC	[illegible]

ASH SETTLING BASINS
PLAN OF POND
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

SCALE 1" = 30'-0"
DRAWN J. BINKOWSKI 4-7-72
CHECKED A. S. COHEN 5-1-72
ENGINEER [illegible]
APPROVED R. N. Bergstrom 12-11-7[illegible]
JOB NO. 4059-04

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO.
B-476

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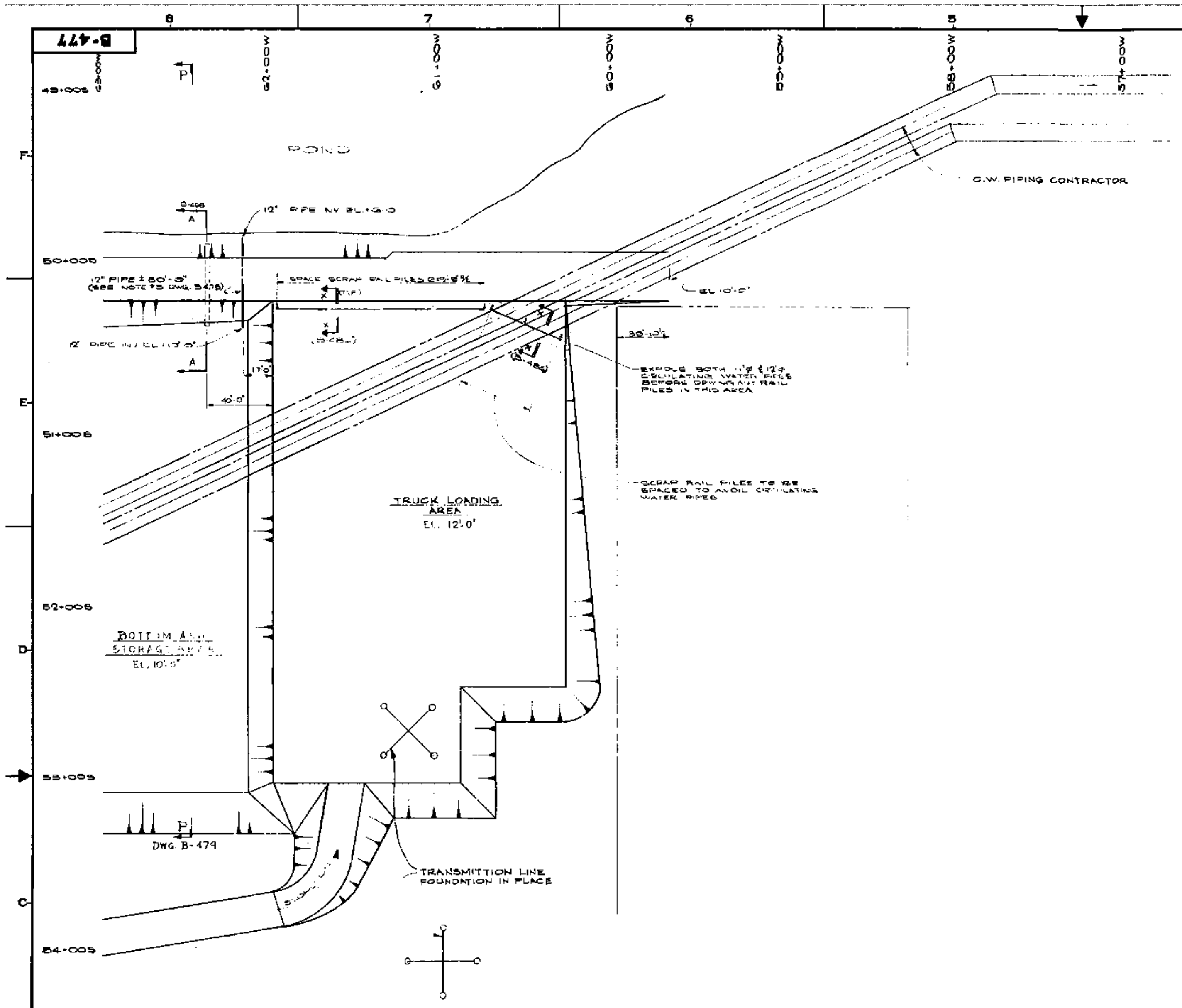
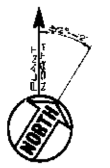
B-477





NOTES

1. SEE DWG. B-473 FOR NOTE.
2. ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR, UNLESS NOTED.

REFERENCE DRAWINGS

B-466	ASH SETTLING BASIN SECTIONS & DETAILS-SHT No 4
B-473	ASH SETTLING BASINS TOWER PILING & POND

R. N. BERGSTROM
No. 7808

Drawing Release Record

Rev.	Date	Init.	Description
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A	10-9-72	ASC	[illegible]
B	12-8-72	AJC	[illegible]
C	5-30-80	AKO	[illegible]
	—		Record Change

ASH SETTLING BASINS
PLAN
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

SCALE 1" = 30'-0"
DRAWN J. BINKOWSKI 4-10-72
CHECKED A. B. COHEN 5-16-72
ENGINEER LM Gordon 12/8/72
APPROVED RaBergstrom 12-8-72
JOB NO. 4058-04

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO.
B-477

B-478

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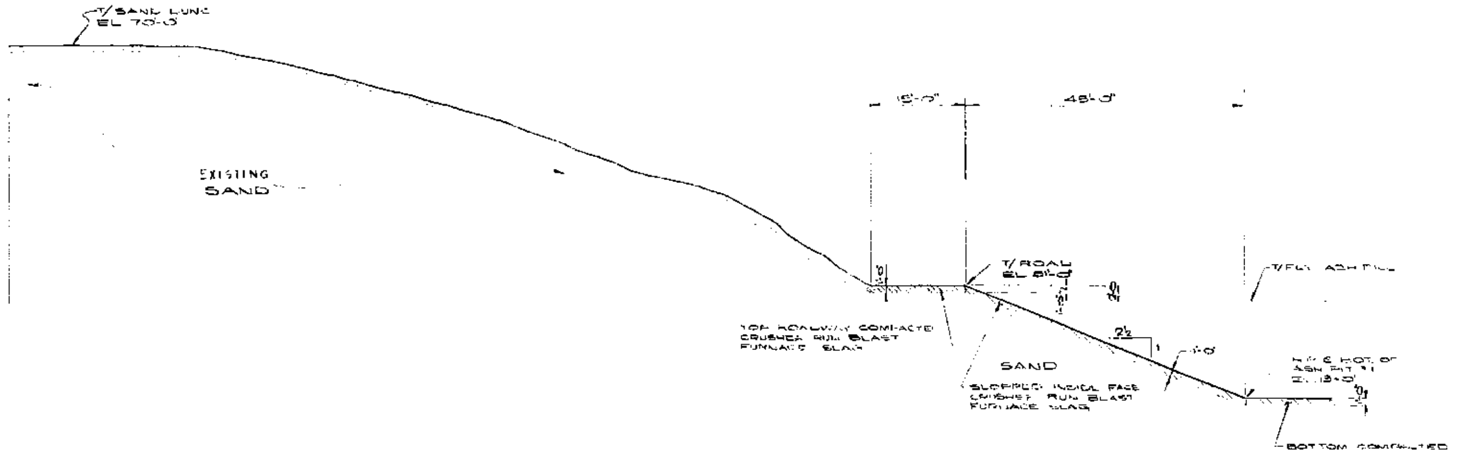
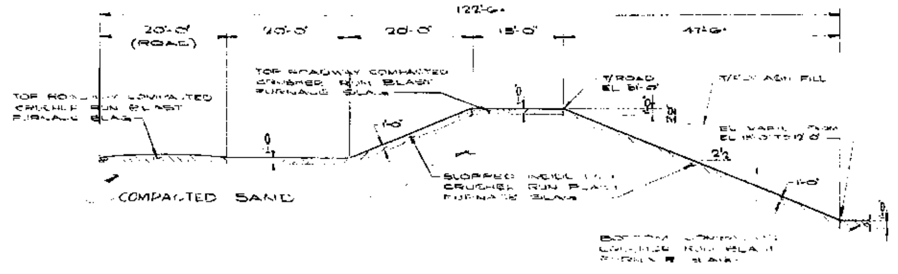
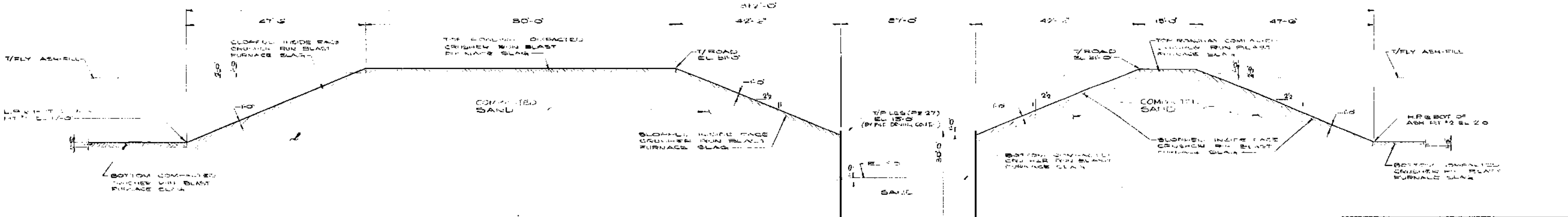


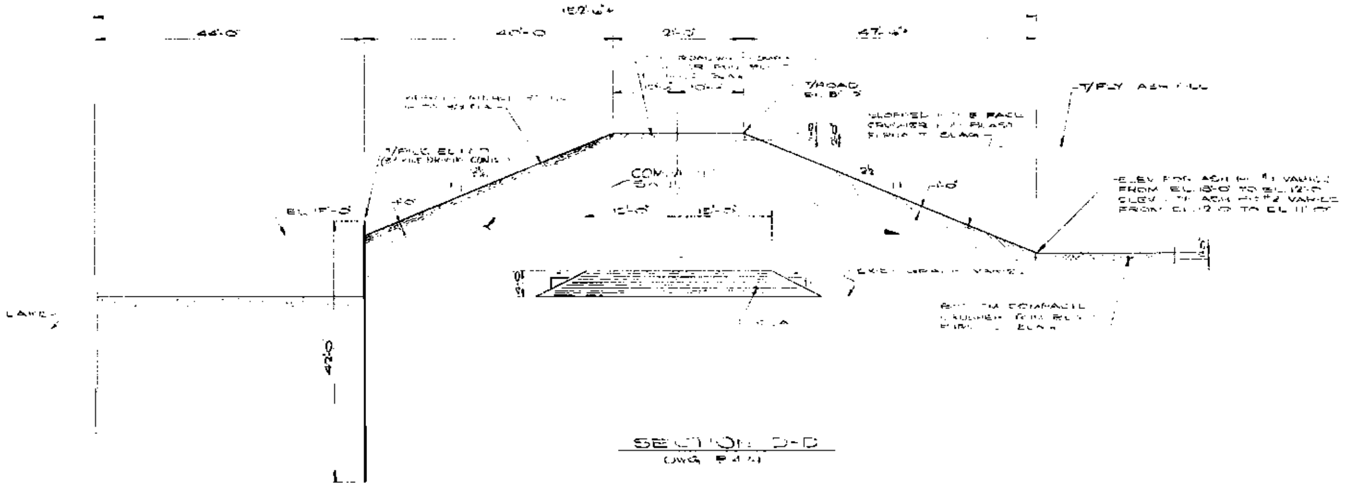
SECTION A-A
DWG B 474



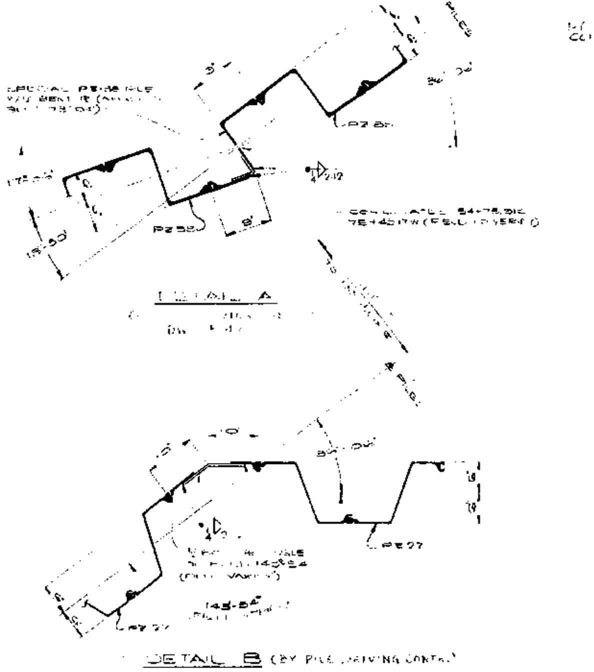
SECTION B-B
DWG B-474



SECTION C-C
DWG B-474



SECTION D-D
DWG B-474



DETAIL A

DETAIL B (BY PILE DRIVING CONTR.)
DWG B 475

NOTES	
1.	SEE DWG B-475 FOR NOTES
2.	ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR, UNLESS NOTED

REFERENCE DRAWINGS	
B-475	ASH SETTLING BASINS TOWERS-PILING & POND
B-474	ASH SETTLING BASINS PLAN-BASIN NUMBER-1

R. H. BERGSTROM
REGISTERED
No. 7868
INDIANA
RESIDENT OF ILLINOIS
PROFESSIONAL ENGINEER

Drawing Release Record

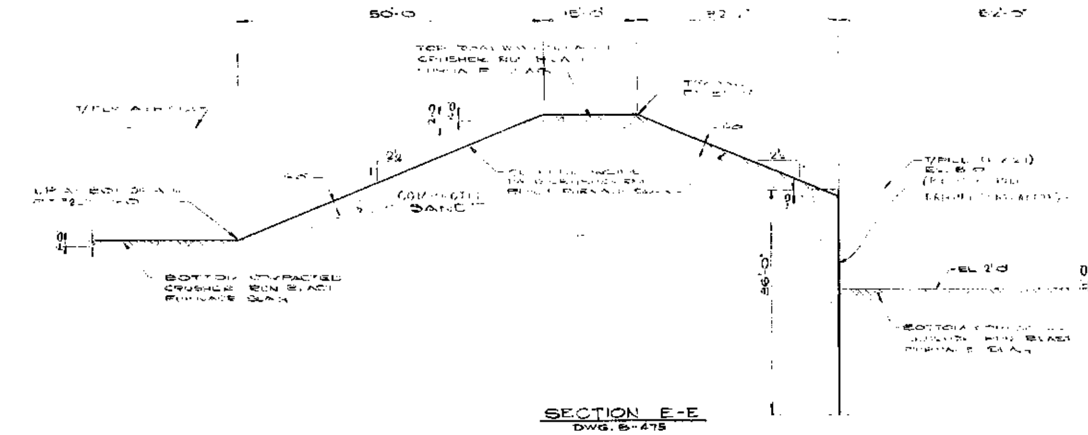
Rev.	Date	Init.	Description
	3-10-72	ASC	[illegible]
A	5-19-72	ASC	[illegible]
B	6-15-72	ASC	[illegible]
C	6-26-72	ASC	[illegible]
D	8-11-72	ASC	[illegible]
E	10-3-72	ASC	[illegible]

ASH SETTLING BASINS
SECTIONS & DETAILS SH. NO. 1
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

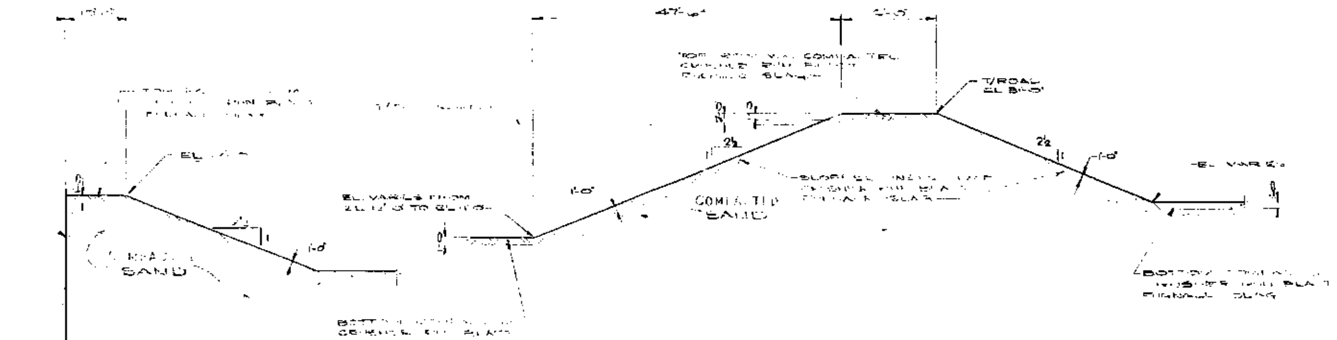
SCALE 1" = 10'-0"
DRAWN J. BINKOWSKI 2-17-72
CHECKED A. S. COHEN 5-18-72
ENGINEER
APPROVED
JOB NO. 4020-01

SARGENT & LUNDY
ENGINEERS
CHICAGO

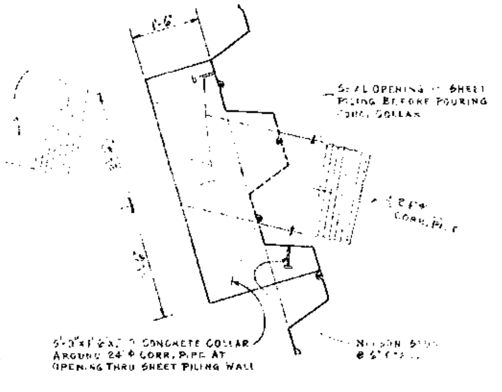
DRAWING NO.
B-478



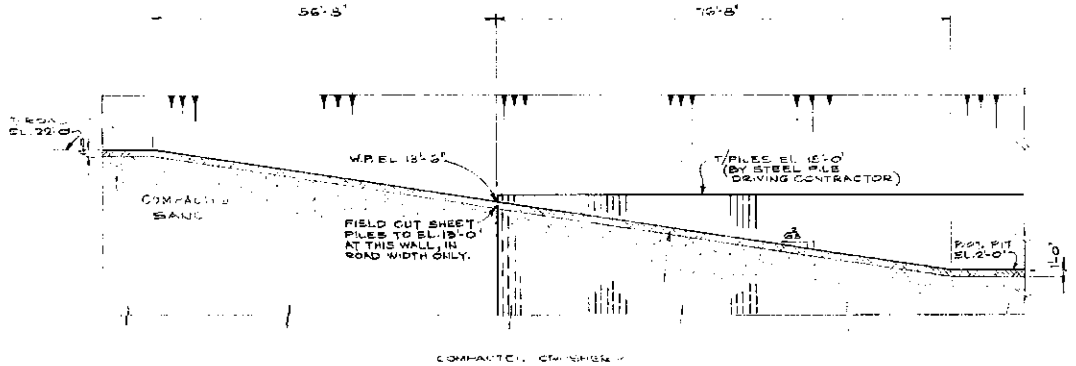
SECTION E-E
DWG. B-475



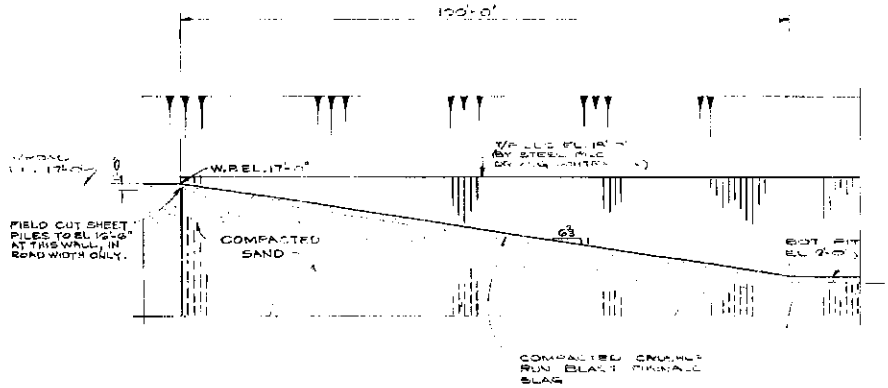
SECTION FF
DWG. B-475



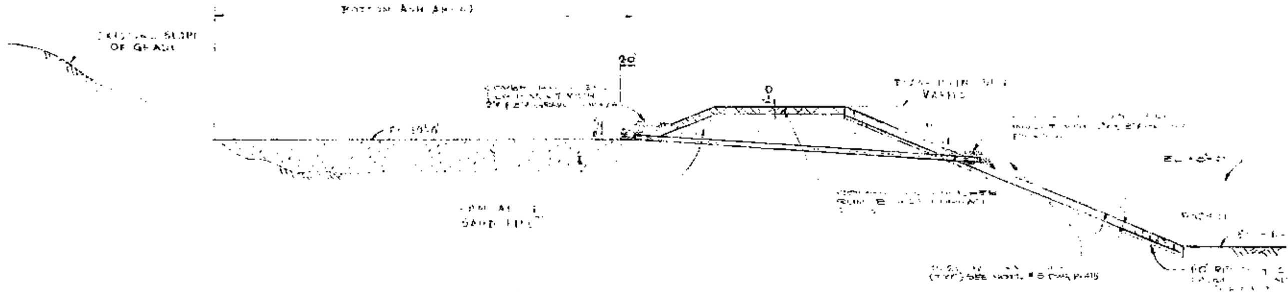
DETAIL-"F" (AS SHOWN)
DETAIL-"G" (SIMILAR)
DWG. B-474 & DWG. B-475
SCALE: 3/4"=1'-0"



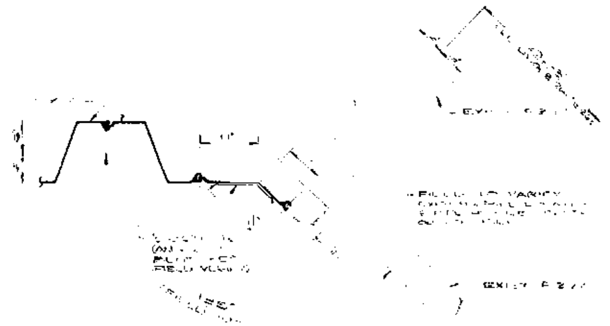
SECTION G-G
DWG. B-474



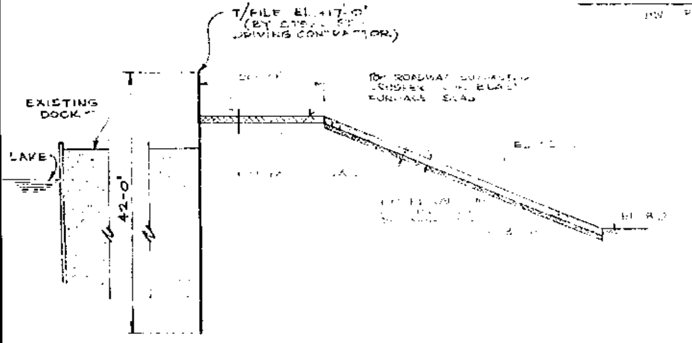
SECTION
DWG. B-475



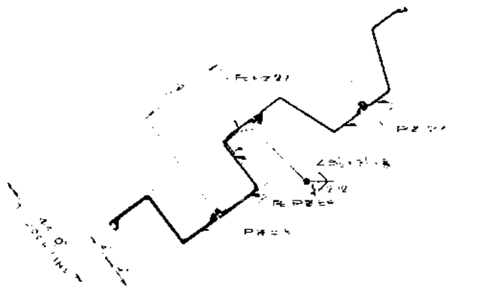
SECTION F-F
DWG. B-475



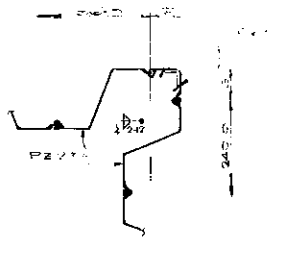
DETAIL



SECTION Q-Q
DWG. B-476



DETAIL C
DWG. B-475



DETAIL D
DWG. B-475

NOTES

1. SEE DWG. B-472 FOR NOTES.
2. ALL WORK ON THIS DRAWING BY ASH SETTLING BASIN CONTRACTOR, UNLESS NOTED.

REFERENCE DRAWINGS

B-473	ASH SETTLING BASINS TOWERS - PILING & POND
B-474	ASH SETTLING BASINS PLAN - BASIN NUMBER - 1
B-475	ASH SETTLING BASINS PLAN - BASIN NUMBER - 2

Drawing Release Record

Rev.	Date	Init.	Description
	3-6-72	ASC	[illegible]
A	5-19-72	ASC	[illegible]
B	6-5-72	ASC	[illegible]
C	7-26-72	ASC	[illegible]
D	8-11-72	ASC	[illegible]
E	10-3-72	ASC	[illegible]
F	12-8-72	ASC	[illegible]
G	5-4-73	ASC	[illegible]

R. N. BERGSTROM
REGISTERED
No. 7862
INDIANA

ASH SETTLING BASINS
SECTIONS & DETAILS SH. NO. 2
MICHIGAN CITY GEN. STATION UNIT 12
NO. INDIANA PUBLIC SERVICE CO.
MICHIGAN CITY, INDIANA

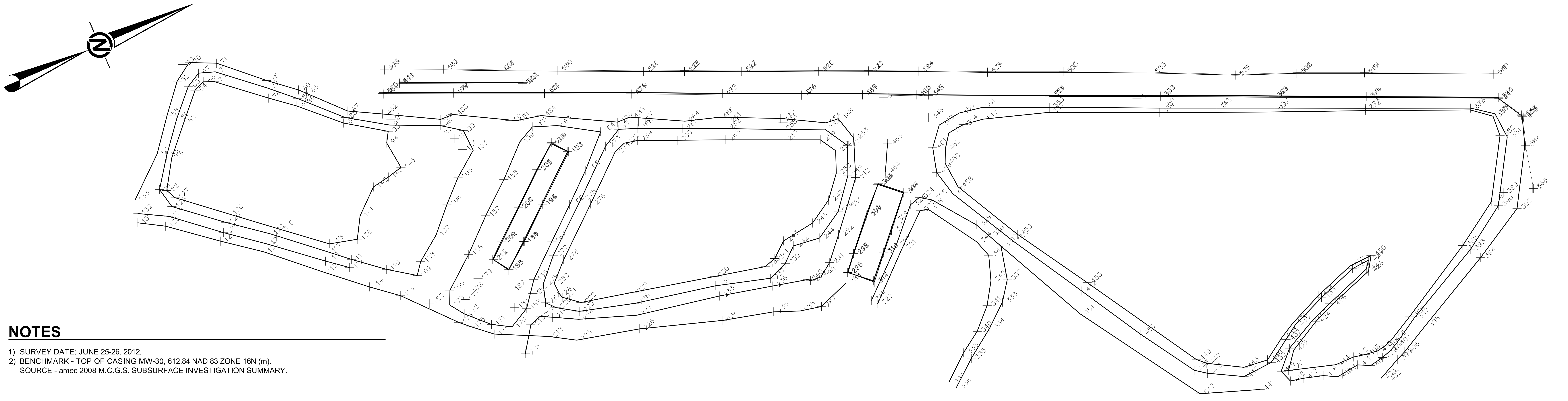
SCALE 1"=10'-0"
DRAWN J. BINKOWSKI 2-23-72
CHECKED A. S. COHEN 5-16-72
ENGINEER
APPROVED
JOB NO.

SARGENT & LUNDY
ENGINEERS
CHICAGO

DRAWING NO.
B-479

APPENDIX C

Data



NOTES

1) SURVEY DATE: JUNE 25-26, 2012.
2) BENCHMARK - TOP OF CASING MW-30, 612.84 NAD 83 ZONE 16N (m).
SOURCE - amec 2008 M.C.G.S. SUBSURFACE INVESTIGATION SUMMARY.

PT	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	5000.00	5000.00	609.09	cp1
2	5387.88	5271.60	609.78	cp2
3	5970.96	5344.72	609.48	cp3
4	6528.90	5364.42	590.92	cp4
6	6107.08	5187.55	594.50	cp6
50	4828.30	4833.21	609.35	sb4
51	4838.19	4840.48	609.27	top
52	4849.54	4846.95	607.06	toe
53	4882.29	4853.21	602.11	gs
54	4858.95	4779.29	609.60	top
55	4872.99	4789.21	609.24	top
56	4880.48	4796.16	606.93	toe
57	4902.99	4816.34	602.08	gs
58	4902.31	4721.76	609.45	top
59	4915.95	4734.28	609.49	top
60	4925.60	4744.75	606.65	toe
61	4940.43	4762.68	603.69	gs
62	4942.47	4672.02	609.31	top
63	4957.19	4688.61	609.12	top
64	4966.03	4699.68	606.69	toe
65	4977.30	4717.06	605.65	gs
66	4962.77	4647.63	609.84	mw
67	4983.56	4673.38	608.96	top
68	4985.79	4691.27	606.69	toe
69	4987.48	4712.10	605.70	gs
70	4975.27	4649.24	609.56	top
71	5020.57	4669.24	609.66	top
72	5012.22	4682.58	609.28	top
73	5004.01	4698.53	606.67	toe
74	4998.40	4713.41	605.85	gs
75	5005.45	4751.74	606.57	gs
76	5092.06	4732.76	609.73	top
77	5087.58	4745.53	609.52	top
78	5083.26	4763.34	607.18	toe
79	5077.48	4774.74	606.88	gs
80	5138.61	4770.70	609.11	top
81	5132.60	4778.41	609.73	sb3
82	5131.41	4784.58	609.57	top
83	5123.88	4795.54	608.24	toe
84	5118.35	4805.31	607.95	gs
85	5150.54	4779.44	609.19	piez
86	5136.85	4795.20	609.62	piez
87	5205.70	4839.75	609.39	top
88	5197.09	4848.72	609.31	top
89	5190.46	4856.65	607.08	toe
90	5182.03	4874.96	606.44	gs
91	5272.11	4883.42	609.64	top
92	5266.29	4892.18	609.45	top
93	5259.22	4901.69	606.64	toe
94	5248.84	4919.93	605.32	toe
95	5354.90	4917.87	609.46	top
96	5350.05	4928.21	609.17	top
97	5343.66	4941.91	605.74	toe
98	5333.78	4955.23	602.13	gs
99	5384.78	4951.91	609.39	top
100	5365.13	4959.26	605.77	toe
101	5343.91	4968.56	601.59	gs
102	5469.40	4967.64	609.64	piez
103	5387.73	4991.69	609.55	top
104	5370.69	4983.38	606.79	toe
105	5343.60	5026.41	609.51	top
106	5306.50	5063.61	609.74	top
107	5267.08	5107.16	609.68	top
108	5223.20	5140.82	609.41	top
109	5207.62	5161.79	609.54	top
110	5160.84	5130.14	609.42	top
111	5109.32	5089.38	609.53	top
112	5100.62	5101.79	609.76	top
113	5165.95	5183.62	603.56	toe
114	5120.32	5147.86	604.08	toe
115	5054.25	5091.41	604.72	toe
116	5065.15	5074.37	609.39	top
117	5075.03	5060.44	609.27	top
118	5083.50	5048.36	605.64	toe
119	5011.43	4989.96	605.83	toe
120	4991.40	4990.32	608.94	top
121	4979.26	5005.00	609.21	top
122	4968.67	5016.16	605.85	toe
123	4903.60	4968.22	605.70	toe
124	4914.77	4956.19	609.13	top
125	4926.06	4940.97	608.88	top
126	4936.61	4928.92	605.86	toe
127	4858.40	4864.46	606.43	toe
128	4847.05	4877.32	609.70	top
129	4835.15	4891.21	609.46	top
130	4822.68	4905.25	605.63	toe
131	4778.78	4880.68	605.91	toe
132	4785.40	4865.41	609.54	top
133	4789.71	4841.17	609.75	top
134	5027.26	4954.06	605.68	gs
135	5075.66	4890.43	606.18	gs
136	5138.29	4922.00	605.68	gs
137	5090.06	4961.14	604.96	gs
138	5133.12	5059.89	605.00	toe
139	5146.43	5069.12	608.10	gs
140	5170.70	5035.03	608.48	gs
141	5153.88	5022.80	605.30	toe
142	5196.01	4984.08	604.88	toe
143	5206.60	4995.17	607.71	gs
144	5227.31	4997.47	607.15	gs
145	5227.83	4977.49	603.49	toe
146	5255.52	4970.52	604.02	toe
147	5272.17	4984.03	601.02	gs
148	5298.64	5034.06	607.32	gs
149	5304.39	5017.87	601.52	gs
150	5287.49	5000.20	600.98	gs
151	5274.52	5013.61	605.92	gs
152	5387.88	5271.60	609.77	cp2-chk
153	5209.27	5216.34	606.72	top
154	5178.53	5241.02	603.57	er
155	5252.11	5208.98	609.60	top
156	5307.80	5162.10	609.80	top
157	5363.42	5109.58	610.02	top
158	5418.40	5061.83	609.98	top
159	5471.14	5010.33	609.60	top
160	5502.29	4993.75	609.30	top
161	5479.54	4972.01	609.64	top
162	5493.96	4989.31	609.40	sb1
163	5544.61	5008.79	609.57	top
164	5612.38	5049.35	609.80	top
165	5560.97	5102.79	609.86	top
166	5510.40	5149.49	610.20	top
167	5455.69	5197.94	610.02	top
168	5399.33	5249.20	609.96	top
169	5367.22	5292.12	607.67	top
170	5330.15	5312.99	604.29	top
171	5297.75	5294.69	605.64	top
172	5259.73	5258.33	605.63	top
173	5241.61	5233.58	606.27	top
174	5295.65	5312.49	603.61	toe
175	5261.46	5284.08	603.80	toe
176	5244.66	5268.78	603.84	toe
177	5270.98	5234.92	603.00	piez
178	5282.34	5225.01	602.08	toe
179	5306.98	5208.97	600.12	toe
180	5326.54	5226.98	599.30	gs
181	5343.79	5242.35	599.18	gs
182	5353.83	5250.42	600.07	toe
183	5347.92	5282.47	603.57	piez
184	5329.34	5263.83	601.38	sb2
185	5364.67	5215.11	587.86	fr
186	5364.72	5215.75	593.63	pil
187	5363.85	5216.19	593.65	back
188	5408.40	5178.65	585.23	front
189	5408.63	5179.16	589.95	water
190	5409.27	5178.88	593.35	pil
191	5410.39	5178.59	593.32	back
192	5464.80	5128.92	584.12	fr
193	5465.32	5129.54	589.84	water
194	5465.33	5129.74	593.68	pil
195	5466.12	5129.44	593.37	back
196	5544.14	5059.15	585.61	fr
197	5545.24	5060.35	593.75	pil
198	5545.72	5060.77	593.82	back
199	5521.95	5034.76	589.22	fr
200	5522.87	5033.22	593.72	pil
201	5523.28	5033.30	593.71	back
202	5480.30	5069.21	585.77	fr
203	5480.45	5068.38	593.58	pil
204	5480.36	5067.89	593.78	back
205	5422.62	5118.57	593.86	back
206	5422.66	5118.71	593.67	pil
207	5423.41	5119.27	585.78	fr
208	5371.94	5164.30	588.47	fr
209	5370.89	5163.72	593.51	pil
210	5371.21	5162.77	593.59	back
211	5345.20	5187.79	589.01	fr
212	5345.12	5187.10	593.62	pil
213	5344.47	5186.88	594.08	back
214	5351.60	5219.25	594.76	mh
215	5333.73	5366.83	603.07	top
216	5363.22	5322.21	605.84	top
217	5384.16	5314.83	607.93	top
218	5384.66	5354.28	602.56	toe
219	5404.22	5324.80	609.46	top
220	5416.70	5311.15	609.38	top
221	5434.38	5298.55	603.47	toe
222	5461.79	5319.98	603.99	toe
223	5452.80	5333.59	609.22	top
224	5446.32	5346.45	609.62	top
225	5428.81	5379.73	601.60	toe
226	5540.91	5404.56	601.73	toe
227	5546.05	5379.74	609.29	top
228	5550.68	5358.50	609.08	top
229	5555.23	5338.81	603.35	toe
230	5701.34	5368.96	603.20	toe
231	5696.95	5385.18	609.23	top
232	5699.02	5395.07	609.39	sb7
233	5696.84	5404.98	609.40	top
234	5685.41	5447.86	598.51	toe
235	5775.83	5468.63	597.64	toe
236	5792.30	5424.96	609.27	top
237	5794.01	5410.81	609.26	top
238	5793.54	5387.63	603.10	toe
239	5828.85	5396.30	609.38	top
240	5855.44	5438.58	609.61	top
241	5814.84	5380.73	603.27	toe
242	5854.66	5372.61	609.58	top
243	5841.86	5357.47	603.17	toe
244	5903.81	5377.47	609.88	top
245	5902.54	5347.99	603.33	toe
246	5952.57	5346.72	609.55	top
247	5944.66	5320.69	603.33	toe
248	6000.18	5296.86	609.40	sb5
249	5994.26	5292.71	609.26	top
250	5976.20	5281.43	603.36	toe
251	6014.27	5243.03	609.31	top
252	5991.02	5243.41	603.20	toe
253	6029.57	5234.73	609.45	top
254	5994.09	5190.09	609.77	top
255	5987.81	5200.02	609.35	top
256	5972.80	5214.77	603.17	toe
257	5911.83	5189.29	603.26	toe
258	5916.23	5170.80	609.40	top
259	5922.55	5160.17	609.75	top
260	5833.15	5130.52	609.61	sb6
261	5829.57	5119.81	609.65	top
262	5823.01	5130.46	609.28	top
263	5814.67	5148.84	603.25	toe
264	5760.11	5089.82	609.87	top
265	5751.51	5100.44	609.67	top
266	5734.32	5116.43	603.11	toe
267	5682.34	5058.90	610.09	top
268	5676.73	5069.09	609.58	top
269	5667.94	5089.43	603.14	toe
270	5647.19	5044.62	610.12	top
271	5644.55	5057.54	609.90	top
272	5644.12	5084.40	603.22	toe
273	5611.04	5076.58	609.68	top
274	5622.31	5093.22	603.33	toe
275	5533.43	5147.95	609.85	top
276	5546.03	5162.50	603.30	toe
277	5448.30	5222.37	609.80	top
278	5462.47	5236.78	603.52	toe
279	5411.80	5262.96	609.54	top
280	5430.55	5269.40	603.40	toe
281	5432.08	5291.19	603.23	toe
282	5402.78	5295.60	609.71	top
284	5970.96	5344.72	609.48	cp3
286	5820.81	5485.69	596.80	toe
287	5859.50	5493.14	596.14	toe
288	5916.29	5470.98	596.41	toe
289	5859.16	5442.49	609.45	top
290	5878.79	5443.47	609.94	top
291	5903.39	5425.37	609.99	top
292	5937.35	5385.54	609.52	top
293	5926.97	5454.67	588.91	fr
294	5926.64	5454.23	596.76	pil
295	5926.71	5454.04	596.79	back
296	5949.49	5426.47	596.37	back
297	5949.90	5426.53	596.46	pil
298	5950.13	5427.06	588.46	fr
299	5997.64	5373.19	587.30	fr
300	5997.54	5371.70	596.71	pil
301	5997.12	5371.24	596.27	back
302	6011.62	5356.78	589.77	water
303	6037.81	5328.45	587.79	fr
304	6038.07	5328.07	596.51	pil
305	6038.99	5327.49	595.91	back
306	6075.77	5359.55	595.25	back
307	6075.39	5359.64	596.64	pil
308	6074.45	5360.28	588.14	fr
309	6039.34	5400.48	587.40	fr
310	6039.91	5400.72	596.72	pil
311	6028.69	5415.29	594.89	back
312	6000.48	5446.79	595.35	back
313	6000.13	5446.45	596.92	pil
314	5999.62	5446.14	588.65	fr
315	5963.55	5486.29	588.75	fr
316	5963.42	5488.69	596.91	pil
317	5964.36	5489.03	595.15	back
318	5936.51	5504.89	595.41	sb12
319	5947.04	5517.33	595.59	top
320	5954.99	5527.32	591.43	toe
321	6033.24	5452.56	591.38	toe
322	6025.27	5443.70	595.01	top
323	6077.89	5385.32	594.98	top
324	6097.56	5379.03	595.10	top
325	6117.14	5391.89	594.99	top
326	6104.18	5404.54	592.82	toe
327	6090.34	5401.49	592.06	toe
328	6128.82	5407.43	594.86	sb11
329	6173.84	5464.18	594.30	top
330	6187.80	5491.13	593.98	mw
331	6200.23	5516.63	593.27	top
332	6187.23	5576.74	592.82	top
333	6163.98	5610.81	597.78	top
334	6124.68	5645.59	598.61	top
335	6073.26	5683.02	598.73	top
336	6027.66	5721.74	600.36	top
337	6019.37	5707.27	590.90	toe
338	6063.58	5668.58	590.36	toe
339	6038.20	5630.64	590.74	gs
340	6101.33	5642.31	590.17	toe
341	6135.95	5606.12	589.90	toe
342	6159.41	5567.34	589.48	toe
343	6173.28	5523.43	589.56	toe
344	6162.58	5492.74	589.04	toe
345	6183.93	5215.73	593.44	back
346	6184.99	5215.26	595.65	pil
347	6184.25	5214.66	589.02	fr
348	6168.05	5252.94	593.77	top
349	6180.98	5272.29	593.39	top
350	6222.74	5266.12	592.75	top
351	6262.96	5272.50	591.90	top
352	6221.52	5244.65	592.71	sb10
353	6384.11	5300.24	591.41	back
354	6385.72	5300.01	595.47	pil
355	6385.53	5299.65	583.94	fr
356	6376.79	5318.90	591.43	top
357	6373.21	5327.02	587.42	toe
358	6554.99	5404.80	586.17	water
359	6556.09	5403.89	587.31	toe
360	6560.33	5396.73	591.25	top
361	6569.13	5377.95	590.82	back
362	6569.72	5375.60	595.80	back
363	6569.58	5375.48	584.68	fr
364	6652.17	5434.73	590.88	mw
365	6655.09	5435.83	590.90	mw
366	6747.31	5481.71	587.84	toe
367	6750.60	5475.66	590.06	top
368	6756.23	5456.79	590.00	back
369	6756.89	5455.67	595.62	pil
370	6757.38	5455.13	584.22	fr
371	6830.37	5498.34	589.62	sb9
372	6900.85	5543.26	587.62	toe
373	6902.43	5539.19	589.17	top
374	6910.53	5521.57	589.08	back
375	6911.45	5520.78	595.65	pil
376	6912.08	5520.63	584.34	fr
377	7075.89	5614.57	587.62	toe
378	7077.48	5611.41	588.80	top
379	7114.27	5637.97	588.46	top
380	7109.39	5640.77	587.65	toe
381	7118.76	5684.99	588.55	top
382	7107.52	5677.63	586.40	toe
383	7131.94	5644.19	588.66	sb8
384	7130.34	5613.97	588.58	back-pil-7.10ft
385	7157.11	5659.35	587.92	back-pil-8.10ft
386	7157.77	5661.32	588.27	back-pil-2.50ft
387	7142.20	5711.04	588.55	back-pil-2.20ft
388	7125.32	5787.46	588.97	back-pil-1.80ft
389	7073.76	5774.76	588.95	mw
390	7056.29	5793.22	588.68	top
391	7047.21	5781.92	586.61	toe
392	7085.52	5811.18	588.84	top
393	6979.92	5846.79	588.51	top
394	6991.10	5867.45	588.46	top
395	6969.45	5835.01	586.31	toe
396	6850.88	5943.30	588.81	top
397	6838.46	5922.24	588.70	top
398	6832.38	5916.47	586.31	toe
399	6782.27	5979.23	589.24	top
400	6774.99	5960.50	588.95	top
401	6770.95	5948.39	586.36	toe
402	6748.83	6006.47	589.89	mw
403	6741.85	5999.68	589.89	top
404	6733.47	5971.18	588.86	top
405	6731.52	5949.24	586.40	toe
406	6799.14	5971.81	589.11	top
407	6789.97	5953.37	589.05	top
408	6783.61	5943.84	586.59	toe
409	6758.47	5966.07	588.84	top
410	6754.75	5951.79	586.59	toe
411	6711.70	5961.13	588.17	top
412	6710.70	5945.16	586.45	toe
413	6680.15	5965.69	588.53	top
414	6675.53	5945.83	586.51	toe
415	6670.45	5967.02	588.89	top
416	6647.20	5955.45	588.46	top-bldg
417	6612.89	5946.07	588.76	top-bldg
418	6588.76	5941.66	588.45	top
419	6579.85	5919.12	588.88	top
420	6592.84	5922.74	586.38	toe
421	6609.71	5886.40	589.05	top
422	6615.55	5892.51	586.57	toe
423	6668.76	5855.18	588.94	top
424	6672.05	5860.26	586.54	toe
425	6708.12	5839.41	588.64	top
426	6710.44	5843.51	586.47	toe
427	6792.92	5807.43	588.67	top
428	6794.98	5812.29	586.49	toe
429	6802.22	5793.97	588.77	top
430	6809.82	5788.33	586.49	toe
431	6770.04	5797.21	589.01	top
432	6767.54	5791.25	586.61	toe
433	6698.12	5824.04	588.85	top
434	6695.35	5818.27	586.51	toe
435	6635.47	5851.66	588.99	top
436	6632.77	5846.71	586.46	toe
437	6610.27	5869.24	588.91	top
438	6605.16	5862.83	586.34	toe
439	6569.54	5897.33	589.18	top
440	6565.12	5890.48	586.38	toe
441	6532.60	5934.67	591.23	top
442	6514.67	5902.14	593.18	top
443	6520.70	5886.46	586.37	toe
444	6514.29	5882.97	587.04	inv-12inch
445	6514.37	5880.50	586.50	inv-8inch
446	6455.98	5871.27	595.79	top
447	6460.96	5853.66	587.21	toe
448	6436.26	5857.25	589.75	top
449	6446.86	5840.47	587.00	toe
450	6371.29	5759.59	589.77	top
451	6285.18	5684.39	591.78	top
452	6303.69	5647.15	591.05	top
453	6318.31	5636.93	586.36	toe
454	6291.42	5612.11	589.34	top-12-pipe
455	6223.62	5516.29	592.51	top
456	6235.51	5508.28	586.61	toe
457	6156.20	5396.27	595.56	top
458	6169.71	5388.03	586.52	toe
459	6143.85	5349.72	594.86	top
460	6164.56	5339.84	586.66	toe
461	6154.78	5305.39	595.02	top
462	6174.64	5316.36	586.77	toe
463	6185.04	5295.70	590.50	top-4inch-pipe
464	6058.95	5313.21	595.53	toe
465	6082.03	5267.67	595.38	toe
466	6162.95	5207.30	594.19	back
467	6163.07	5207.43	595.68	pil
468	6073.80	5168.90	595.34	back
469	6074.23	5169.04	595.81	pil
470	5972.67	5127.10	595.85	back
471	5972.78	5126.86	595.86	pil
472	5840.36	5072.02	595.63	back
473	5840.03	5071.47	595.55	pil
474	5689.52	5006.52	593.51	back
475	5690.29	5007.59	595.95	pil
476	5545.63	4947.26	594.80	back
477	5545.27	4946.85	595.69	pil
478	5394.12	4884.02	593.29	back
479	5393.39	4883.82	595.27	pil
480	5276.89	4835.93	593.69	back
481	5276.43	4834.81	595.40	pil
482	5261.48	4868.66	609.19	top
483	5378.95	4918.50	609.17	top
484	5524.66	4981.20	609.38	top
485	5671.41	5045.03	609.51	top
486	5819.38	5107.00	608.83	top
487	5921.58	5151.53	609.43	top
488	6017.42	5191.88	608.39	top
489	6183.45	5168.72	580.71	back
490	6100.31	5133.76	580.84	back
491	6017.44	5099.05	581.45	back
492	5888.92	5046.52	581.40	back
493	5793.90	5006.67	582.39	back
494	5725.82	4978.47	581.92	back
495	5582.06	4917.93	582.32	back
496	5487.09	4877.67	581.53	back
497	5393.15	4837.18	582.01	back
498	5295.38	4796.64	583.35	back
499	5311.48	4829.19	584.49	back
500	5311.15	4829.24	586.51	pil
501	5311.76	4827.54	583.98	fr
502	5515.61	4914.44	583.45	back
503	5518.91	4914.89	586.91	pil
504	5517.65	4913.73	582.42	fr
505	6297.90	5217.86	581.47	back
506	6423.58	5270.32	580.89	back
507	6569.72	5331.88	580.70	back
508	6708.73	5394.19	581.44	back
509	6812.16	5433.28	580.75	back
510	6924.82	5480.27	580.32	back
511	7139.27	5570.73	581.09	back
512	6005.57	5302.00	609.50	top
513	6191.68	5292.33	586.66	toe
514	6221.35	5287.91	586.66	toe
515	6258.45	5292.70	586.66	toe
516	6164.74	5205.74	587.08	fr
517	6075.66	5167.53	585.11	fr
518	5974.53	5125.04	584.46	fr
519	5841.95	5069.75	583.54	fr
520	5691.92	5005.98	584.04	fr
521	5547.22	4945.19	582.98	fr
522	5395.23	4881.94	580.87	fr
523	5277.70	4833.43	586.00	fr
524	6184.55	5167.52	585.51	pil
525	6101.28	5132.81	585.44	pil
526	6018.48	5098.22	585.55	pil
527	5889.98	5045.29	585.49	pil
528	5795.12	5005.62	585.38	pil
529	5726.99	4977.39	585.52	pil
530	5583.34	4916.60	585.42	pil
531	5488.18	4876.48	585.22	pil
532	5394.36	4836.07	586.00	pil
533	5296.44	4795.70	585.85	pil
534	6298.76	5216.95	585.47	pil
535	6424.63	5269.23	585.38	pil
536	6570.87	5330.85	585.60	pil
537	6709.70	5393.14	584.43	pil
538	6813.15	5432.27	585.65	pil
539	6925.79	5479.00	585.52	pil
540	7140.45	5569.71	585.68	pil
541	7131.57	5615.32	595.67	pil
542	7158.06	5658.11	596.02	pil
543	7159.28	5663.25	590.76	pil
544	7143.34	5712.09	590.74	pil
545	7126.81	5788.87	590.77	pil
546	7131.32	5612.88	584.40	fr
547	6429.51	5900.27	592.00	top

Golder Associates

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
0						

PROJECT
NIPSCO
MICHIGAN CITY
GENERATING STATION
MICHIGAN CITY, INDIANA

TITLE
TOPOGRAPHIC SURVEY

PROJECT No.	123-88898	
FILE No.	12388898A001	
SCALE	AS SHOWN	
DESIGN	JBR	07/11/12
CADD	DJC	07/11/12
CHECK	JRR	08/27/12
REVIEW	MRF	08/27/12

1

K:\Projects\12x-Projects\123-88898_NIPSCO MCGS\A-Slope Stability Analysis\REV 0\DWG\12388898A001.dwg | Layout: TB-Report-VR-D2 | Modified: JSchmuecker 08/27/2012 1:59 PM | Plotted: JSchmuecker 08/27/12| Great Lakes

APPENDIX D

Geotechnical Laboratory Data

NIPSCO/GEO INVEST/MICHIGAN CITY/IN
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
BH-6	UD	40.0-42.0'	CL	17.4	30	17	13	0.04	99.6	86.4	45.0	-	-	2.75	17.4	115.9	-	T-C/U

ABBREVIATIONS:
LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES:
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	NIPSCO/GEO INVEST/MICHIGAN CITY/IN
PROJECT NUMBER	123-88898
SAMPLE ID	BH-6
SAMPLE TYPE	UD
DEPTH INTERVAL	40.0-42.5'
MACHINE SPEED (in/min)	0.0008
STRAIN RATE (%/min)	0.013
CELL PRESSURE (psi)	77.5
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION PRESSURE, σ_3 (psi)	7.5
PRESSURE, σ_3 (psf)	1080.0
FINAL "B" VALUE	1.00
t_{50} (minutes)	29.31
Mounting Method	Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.194	5.982	5.966
DIAMETER	7.244	2.852	2.831
AREA	41.22	6.39	6.30
VOLUME	626.23	38.22	37.56
WEIGHT (g)	1353.80		1344.35
% MOISTURE	18.2		17.42
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	134.9	pcf	
DRY DENSITY, calc (pcf)	114.1	pcf	
VOLUME OF SOLIDS	416.02	cm^3	
VOLUME OF VOIDS	210.22	cm^3	
VOID RATIO	0.505		
SATURATION	99.4		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	116.1
VOLUME OF SOLIDS	416.02
VOLUME OF VOIDS	199.47
VOID RATIO	0.479

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1344.35
WT SOIL & TARE, DRY (g)	1144.88
WT TARE (g)	0.00
WT MOISTURE (g)	199.47
WT DRY SOIL (g)	1144.88
% MOISTURE	17.42

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	13.8	70.4	0.0	0.00	1.00	6.30	5.966	0.0	1080.0	1080.0	1080.0	1.00	1080.0	0.0	0.00
3.8	0.003	30.6	71.7	187.2	0.05	1.00	6.30	5.963	384.1	1464.1	1276.9	892.8	1.43	1084.8	192.0	0.49
7.5	0.006	39.0	72.5	302.4	0.10	1.00	6.30	5.960	575.8	1655.8	1353.4	777.6	1.74	1065.5	287.9	0.53
11.3	0.009	45.1	72.8	345.6	0.15	1.00	6.31	5.957	714.9	1794.9	1449.3	734.4	1.97	1091.8	357.4	0.48
15.0	0.012	48.9	73.0	374.4	0.20	1.00	6.31	5.954	801.2	1881.2	1506.8	705.6	2.14	1106.2	400.6	0.47
18.8	0.015	52.7	73.3	417.6	0.25	1.00	6.31	5.951	887.5	1967.5	1549.9	662.4	2.34	1106.2	443.8	0.47
31.3	0.025	58.8	73.5	446.4	0.42	1.00	6.32	5.941	1025.0	2105.0	1658.6	633.6	2.62	1146.1	512.5	0.44
37.5	0.030	62.6	73.6	460.8	0.50	0.99	6.33	5.936	1110.6	2190.6	1729.8	619.2	2.79	1174.5	555.3	0.41
43.8	0.035	65.7	73.7	475.2	0.59	0.99	6.33	5.931	1180.2	2260.2	1785.0	604.8	2.95	1194.9	590.1	0.40
50.0	0.040	68.0	73.7	475.2	0.67	0.99	6.34	5.926	1231.4	2311.4	1836.2	604.8	3.04	1220.5	615.7	0.39
56.3	0.045	71.0	73.7	475.2	0.75	0.99	6.34	5.921	1298.5	2378.5	1903.3	604.8	3.15	1254.0	649.2	0.37
62.5	0.050	73.3	73.7	475.2	0.84	0.99	6.35	5.916	1349.6	2429.6	1954.4	604.8	3.23	1279.6	674.8	0.35
68.8	0.055	76.1	73.6	460.8	0.92	0.99	6.35	5.911	1411.9	2491.9	2031.1	619.2	3.28	1325.1	705.9	0.33
75.0	0.060	78.6	73.6	460.8	1.01	0.99	6.36	5.906	1467.3	2547.3	2086.5	619.2	3.37	1352.8	733.6	0.31
81.3	0.065	80.9	73.6	460.8	1.09	0.99	6.36	5.901	1518.1	2598.1	2137.3	619.2	3.45	1378.2	759.0	0.30
87.5	0.070	82.2	73.5	446.4	1.17	0.99	6.37	5.896	1546.2	2626.2	2179.8	633.6	3.44	1406.7	773.1	0.29

DU @ FAILURE	460.8
DEVIATORIC STRESS @ FAILURE	1518.1
EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.45
TECH	TW/AK
DATE	7/9/12
CHECK	
REVIEW	
APPROVE	

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	NIPSCO/GEO INVEST/MICHIGAN CITY/IN
PROJECT NUMBER	123-88898
SAMPLE ID	BH-6
SAMPLE TYPE	UD
DEPTH INTERVAL	40.0-42.5'
MACHINE SPEED (in/min)	0.0008
STRAIN RATE (%/min)	0.014
CELL PRESSURE (psi)	85.0
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION	
PRESSURE, σ_3 (psi)	15.0
PRESSURE, σ_3 (psf)	2160.0
FINAL "B" VALUE	-
t_{50} (minutes)	29.31

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.154	5.966	5.906
DIAMETER	7.191	2.831	2.829
AREA	40.62	6.30	6.29
VOLUME	615.48	37.56	37.12
WEIGHT (g)	1344.35		1337.15
% MOISTURE	17.4		16.79
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	136.3	pcf	
DRY DENSITY, calc (pcf)	116.1	pcf	
VOLUME OF SOLIDS	416.02	cm^3	
VOLUME OF VOIDS	199.47	cm^3	
VOID RATIO	0.479		
SATURATION	100.0		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	117.4
VOLUME OF SOLIDS	416.02
VOLUME OF VOIDS	192.27
VOID RATIO	0.462

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1337.15
WT SOIL & TARE, DRY (g)	1144.88
WT TARE (g)	0.00
WT MOISTURE (g)	192.27
WT DRY SOIL (g)	1144.88
% MOISTURE	16.79

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.060	18.7	70.4	0.0	1.02	0.99	6.35	5.906	0.0	2160.0	2160.0	2160.0	1.00	2160.0	0.0	0.00
5.0	0.064	74.1	74.0	518.4	1.08	0.99	6.35	5.902	1255.5	3415.5	2897.1	1641.6	1.76	2269.4	627.8	0.41
8.8	0.067	82.5	74.5	590.4	1.13	0.99	6.36	5.899	1445.2	3605.2	3014.8	1569.6	1.92	2292.2	722.6	0.41
12.5	0.070	89.3	74.9	648.0	1.19	0.99	6.36	5.896	1598.4	3758.4	3110.4	1512.0	2.06	2311.2	799.2	0.41
50.0	0.100	125.2	76.0	806.4	1.69	0.98	6.39	5.866	2398.7	4558.7	3752.3	1353.6	2.77	2553.0	1199.4	0.34
62.5	0.110	131.3	76.1	820.8	1.86	0.98	6.40	5.856	2531.8	4691.8	3871.0	1339.2	2.89	2605.1	1265.9	0.32
76.3	0.121	136.6	76.0	806.4	2.05	0.98	6.42	5.845	2645.9	4805.9	3999.5	1353.6	2.95	2676.6	1323.0	0.30
88.8	0.131	142.7	76.0	806.4	2.22	0.98	6.43	5.835	2778.0	4938.0	4131.6	1353.6	3.05	2742.6	1389.0	0.29
121.3	0.157	152.7	75.6	748.8	2.66	0.97	6.46	5.809	2988.5	5148.5	4399.7	1411.2	3.12	2905.5	1494.3	0.25
153.8	0.183	161.8	75.3	705.6	3.10	0.97	6.49	5.783	3177.0	5337.0	4631.4	1454.4	3.18	3042.9	1588.5	0.22
185.0	0.208	168.7	74.8	633.6	3.52	0.96	6.51	5.758	3315.7	5475.7	4842.1	1526.4	3.17	3184.2	1657.8	0.19
216.3	0.233	175.6	74.5	590.4	3.95	0.96	6.54	5.733	3453.0	5613.0	5022.6	1569.6	3.20	3296.1	1726.5	0.17
247.5	0.258	181.7	74.1	532.8	4.37	0.96	6.57	5.708	3571.4	5731.4	5198.6	1627.2	3.19	3412.9	1785.7	0.15
278.8	0.283	187.0	73.7	475.2	4.79	0.95	6.60	5.683	3671.2	5831.2	5356.0	1684.8	3.18	3520.4	1835.6	0.13
311.3	0.309	192.3	73.4	432.0	5.23	0.95	6.63	5.657	3769.3	5929.3	5497.3	1728.0	3.18	3612.7	1884.7	0.11
343.8	0.335	197.7	73.1	388.8	5.67	0.94	6.66	5.631	3868.5	6028.5	5639.7	1771.2	3.18	3705.5	1934.3	0.10
375.0	0.360	201.5	72.8	345.6	6.10	0.94	6.69	5.606	3932.9	6092.9	5747.3	1814.4	3.17	3780.9	1966.5	0.09
406.3	0.385	206.1	72.4	288.0	6.52	0.93	6.72	5.581	4013.7	6173.7	5885.7	1872.0	3.14	3878.8	2006.8	0.07
470.0	0.436	213.7	71.9	216.0	7.38	0.93	6.79	5.530	4137.9	6297.9	6081.9	1944.0	3.13	4012.9	2068.9	0.05
532.5	0.486	219.0	71.2	115.2	8.23	0.92	6.85	5.480	4211.5	6371.5	6256.3	2044.8	3.06	4150.6	2105.8	0.03
596.3	0.537	225.2	70.8	57.6	9.09	0.91	6.91	5.429	4301.0	6461.0	6403.4	2102.4	3.05	4252.9	2150.5	0.01
660.0	0.588	229.7	70.4	0.0	9.96	0.90	6.98	5.378	4353.0	6513.0	6513.0	2160.0	3.02	4336.5	2176.5	0.00
723.8	0.639	236.6	70.0	-57.6	10.82	0.89	7.05	5.327	4452.2	6612.2	6669.8	2217.6	3.01	4443.7	2226.1	-0.01
786.3	0.689	240.4	69.7	-100.8	11.67	0.88	7.12	5.277	4486.9	6646.9	6747.7	2260.8	2.98	4504.2	2243.4	-0.02
851.3	0.741	245.0	69.5	-129.6	12.55	0.87	7.19	5.225	4534.3	6694.3	6823.9	2289.6	2.98	4556.8	2267.2	-0.03
913.8	0.791	248.8	69.2	-172.8	13.39	0.87	7.26	5.175	4565.8	6725.8	6898.6	2332.8	2.96	4615.7	2282.9	-0.04
977.5	0.842	252.6	68.9	-216.0	14.26	0.86	7.33	5.124	4595.0	6755.0	6971.0	2376.0	2.93	4673.5	2297.5	-0.05
1041.3	0.893	256.4	68.8	-230.4	15.12	0.85	7.40	5.073	4622.6	6782.6	7013.0	2390.4	2.93	4701.7	2311.3	-0.05
1102.5	0.942	259.5	68.5	-273.6	15.95	0.84	7.48	5.024	4637.1	6797.1	7070.7	2433.6	2.91	4752.1	2318.5	-0.06
1167.5	0.994	262.5	68.4	-288.0	16.83	0.83	7.56	4.972	4645.7	6805.7	7093.7	2448.0	2.90	4770.8	2322.8	-0.06

DU @ FAILURE	705.6	DEVIATORIC STRESS @ FAILURE	3177.0	EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE	3.18	TECH	TW/AK
						DATE	7/9/12
						CHECK	
						REVIEW	
						APPROVE	

Golder Associates Inc.

MULTI-STAGE TRIAXIAL COMPRESSION TEST CONSOLIDATED UNDRAINED WITH PORE PRESSURE - MODIFIED ASTM D 4767

PROJECT TITLE	NIPSCO/GEO INVEST/MICHIGAN CITY/IN
PROJECT NUMBER	123-88898
SAMPLE ID	BH-6
SAMPLE TYPE	UD
DEPTH INTERVAL	40.0-42.5'
MACHINE SPEED (in/min)	0.0008
STRAIN RATE (%/min)	0.013
CELL PRESSURE (psi)	100.0
SAMPLE PRESSURE (psi)	70.0
EFF. CONSOLIDATION	
PRESSURE, σ_3 (psi)	30.0
PRESSURE, σ_3 (psf)	4320.0
FINAL "B" VALUE	1.00
t_{50} (minutes)	31.44

Mounting Method: Wet

INITIAL SAMPLE DATA	cm	in	corrected
HEIGHT	15.347	6.042	5.982
DIAMETER	7.252	2.855	2.810
AREA	41.30	6.40	6.20
VOLUME	633.85	38.68	37.11
WEIGHT (g)	1394.41		1369.81
% MOISTURE	16.5		14.49
SPECIFIC GRAVITY	2.75		
MOIST DENSITY (pcf)	137.3	pcf	
DRY DENSITY, calc (pcf)	117.8	pcf	
VOLUME OF SOLIDS	434.75	cm'	
VOLUME OF VOIDS	199.09	cm'	
VOID RATIO	0.458		
SATURATION	99.4		

CORRECTED SAMPLE DATA	
DRY DENSITY, calc (pcf)	122.8
VOLUME OF SOLIDS	434.75
VOLUME OF VOIDS	173.29
VOID RATIO	0.399

WATER CONTENT (% MOISTURE)	
WT SOIL & TARE, MOIST (g)	1369.81
WT SOIL & TARE, DRY (g)	1196.44
WT TARE (g)	0.00
WT MOISTURE (g)	173.37
WT DRY SOIL (g)	1196.44
% MOISTURE	14.49

TIME (MIN)	ACCUM. DEFLECT. (inches)	AXIAL LOAD (lbs)	PORE PRESS. (psi)=U	PWP change DU (psf) (acc)	ε % STRAIN (%)	(1-ε)	CORR. AREA (in 2)	CORR. HEIGHT (in)	DEV. STRESS (psf)	SIGMA 1 devstr+cp (σ_1)	SIGMA 1 EFF. (σ_1-dU)	SIGMA 3 EFF. (σ_3-dU)	EFF.PRN STR RATIO (σ_1'/ σ_3')	$\frac{(\sigma_1'+\sigma_3')}{2}$ (P)	$\frac{(\sigma_1-\sigma_3)}{2}$ (Q)	(A)
0.0	0.000	17.2	70.8	0.0	0.00	1.00	6.20	5.982	0.0	4320.0	4320.0	4320.0	1.00	4320.0	0.0	0
2.5	0.002	54.4	73.5	388.8	0.03	1.00	6.20	5.980	863.3	5183.3	4794.5	3931.2	1.22	4362.9	431.7	0.45
6.3	0.005	78.6	75.4	662.4	0.08	1.00	6.21	5.977	1424.2	5744.2	5081.8	3657.6	1.39	4369.7	712.1	0.47
10.0	0.008	92.4	76.8	864.0	0.13	1.00	6.21	5.974	1743.5	6063.5	5199.5	3456.0	1.50	4327.7	871.7	0.50
13.8	0.011	102.1	77.9	1022.4	0.18	1.00	6.21	5.971	1967.4	6287.4	5265.0	3297.6	1.60	4281.3	983.7	0.52
17.5	0.014	109.2	78.8	1152.0	0.23	1.00	6.22	5.968	2130.8	6450.8	5298.8	3168.0	1.67	4233.4	1065.4	0.54
30.0	0.024	127.1	81.0	1468.8	0.40	1.00	6.23	5.958	2541.1	6861.1	5392.3	2851.2	1.89	4121.8	1270.6	0.58
62.5	0.050	155.8	83.9	1886.4	0.84	0.99	6.26	5.932	3190.7	7510.7	5624.3	2433.6	2.31	4029.0	1595.4	0.59
87.5	0.070	171.5	84.8	2016.0	1.17	0.99	6.28	5.912	3540.2	7860.2	5844.2	2304.0	2.54	4074.1	1770.1	0.57
116.3	0.093	185.7	85.4	2102.4	1.55	0.98	6.30	5.889	3851.0	8171.0	6068.6	2217.6	2.74	4143.1	1925.5	0.55
147.5	0.118	197.6	85.6	2131.2	1.97	0.98	6.33	5.864	4105.4	8425.4	6294.2	2188.8	2.88	4241.5	2052.7	0.52
181.3	0.145	208.4	85.6	2131.2	2.42	0.98	6.36	5.837	4331.2	8651.2	6520.0	2188.8	2.98	4354.4	2165.6	0.49
211.3	0.169	217.0	85.5	2116.8	2.83	0.97	6.38	5.813	4507.4	8827.4	6710.6	2203.2	3.05	4456.9	2253.7	0.47
241.3	0.193	225.6	85.3	2088.0	3.23	0.97	6.41	5.789	4682.0	9002.0	6914.0	2232.0	3.10	4573.0	2341.0	0.45
268.8	0.215	233.4	85.0	2044.8	3.59	0.96	6.43	5.767	4838.7	9158.7	7113.9	2275.2	3.13	4694.6	2419.4	0.42
300.0	0.240	240.1	84.7	2001.6	4.01	0.96	6.46	5.742	4967.1	9287.1	7285.5	2318.4	3.14	4801.9	2483.5	0.40
363.8	0.291	251.7	84.0	1900.8	4.86	0.95	6.52	5.691	5179.1	9499.1	7598.3	2419.2	3.14	5008.8	2589.6	0.37
395.0	0.316	257.7	83.6	1843.2	5.28	0.95	6.55	5.666	5288.3	9608.3	7765.1	2476.8	3.14	5121.0	2644.2	0.35
453.8	0.363	266.6	83.0	1756.8	6.07	0.94	6.60	5.619	5438.5	9758.5	8001.7	2563.2	3.12	5282.5	2719.3	0.32
518.8	0.415	275.6	82.5	1684.8	6.94	0.93	6.67	5.567	5582.7	9902.7	8217.9	2635.2	3.12	5426.5	2791.3	0.30
577.5	0.462	283.0	81.9	1598.4	7.72	0.92	6.72	5.520	5694.0	10014.0	8415.6	2721.6	3.09	5568.6	2847.0	0.28
640.0	0.512	290.9	81.5	1540.8	8.56	0.91	6.78	5.470	5810.2	10130.2	8589.4	2779.2	3.09	5684.3	2905.1	0.27
702.5	0.562	297.2	81.0	1468.8	9.39	0.91	6.85	5.420	5889.6	10209.6	8740.8	2851.2	3.07	5796.0	2944.8	0.25
762.5	0.610	303.5	80.6	1411.2	10.20	0.90	6.91	5.372	5968.8	10288.8	8877.6	2908.8	3.05	5893.2	2984.4	0.24
825.0	0.660	309.9	80.2	1353.6	11.03	0.89	6.97	5.322	6045.4	10365.4	9011.8	2966.4	3.04	5989.1	3022.7	0.22
885.0	0.708	315.5	79.8	1296.0	11.84	0.88	7.04	5.274	6105.5	10425.5	9129.5	3024.0	3.02	6076.7	3052.7	0.21
1010.0	0.808	325.2	79.2	1209.6	13.51	0.86	7.17	5.174	6184.5	10504.5	9294.9	3110.4	2.99	6202.6	3092.2	0.20
1135.0	0.908	333.4	78.8	1152.0	15.18	0.85	7.31	5.074	6226.4	10546.4	9394.4	3168.0	2.97	6281.2	3113.2	0.19
1192.5	0.954	336.4	78.6	1123.2	15.95	0.84	7.38	5.028	6228.5	10548.5	9425.3	3196.8	2.95	6311.1	3114.3	0.18
1256.3	1.005	341.2	78.4	1094.4	16.80	0.83	7.46	4.977	6258.1	10578.1	9483.7	3225.6	2.94	6354.6	3129.0	0.17

DU @ FAILURE 2001.6

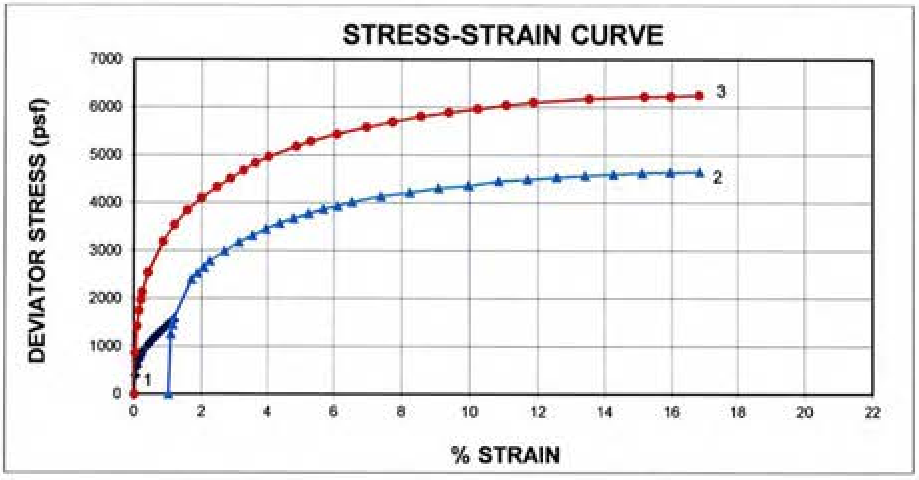
DEVIATORIC STRESS @ FAILURE 4967.1

EFFECTIVE PRINCIPLE STRESS RATIO @ FAILURE 3.14

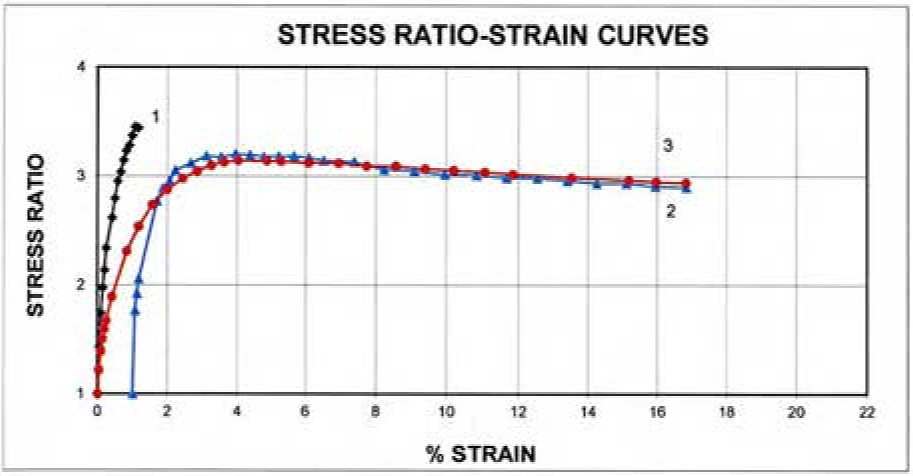
TECH	TW/AK
DATE	7/9/12
CHECK	
REVIEW	
APPROVE	

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

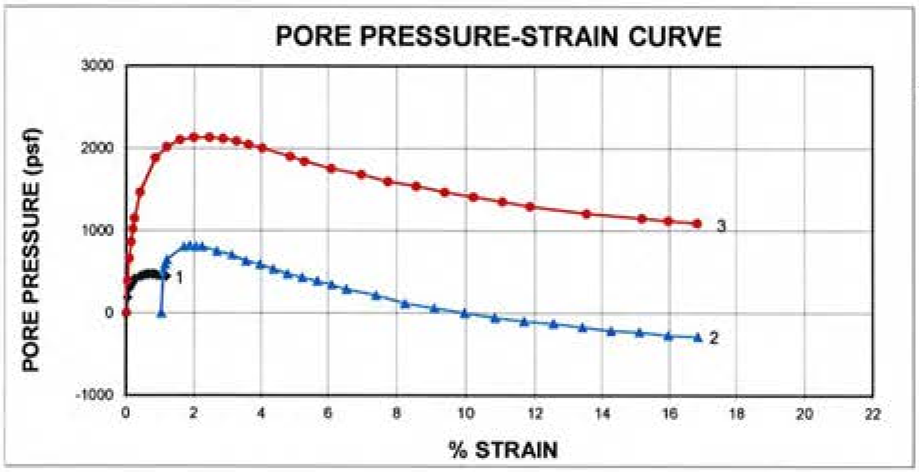
PROJECT NAME: **NIPSCO/GEO INVEST/MICHIGAN CITY/IN**
PROJECT NUMBER: **123-88898**
SAMPLE ID: **BH-6** DEPTH: **40.0-42.5'** Sample Type: **UD**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1080	114.1	18.2
2	2160	116.1	17.4
3	4320	117.8	16.5



2 - SPECIMEN - THREE CONFINING PRESSURES



Soil Description

Gray, SILTY CLAY, some medium to fine sand, trace fine gravel.

USCS CL

LL	PL	PI
30	17	13

Comments

-

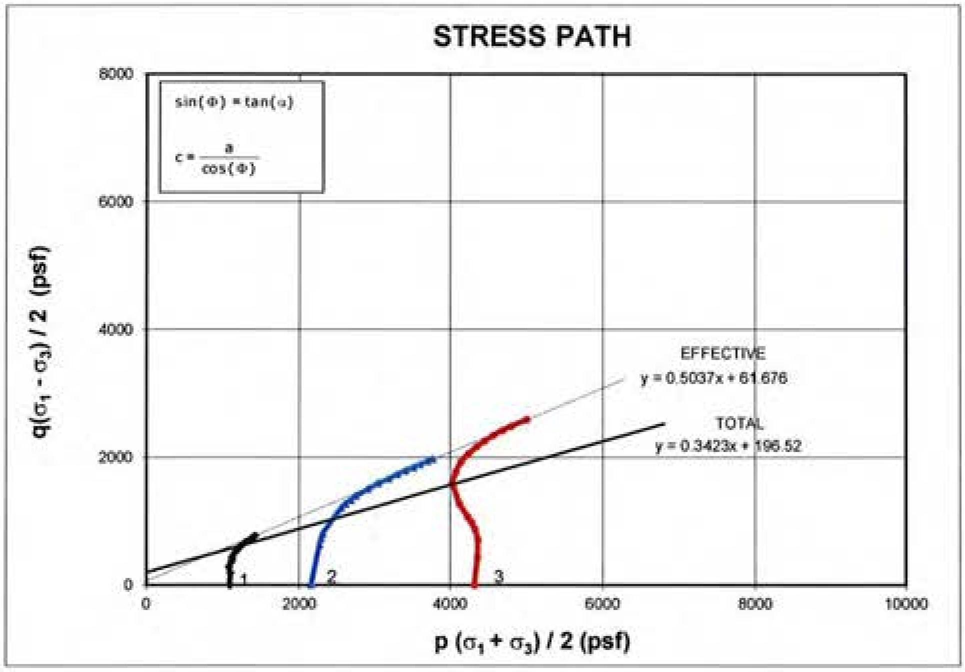
* Failure based on effective stress ratio.

CHECK
REVIEW
APPROVE

Golder Associates Inc.

MULTI-STAGE TRIAXIAL COMPRESSION TEST (CU/WPP)
MODIFIED - ASTM D 4767

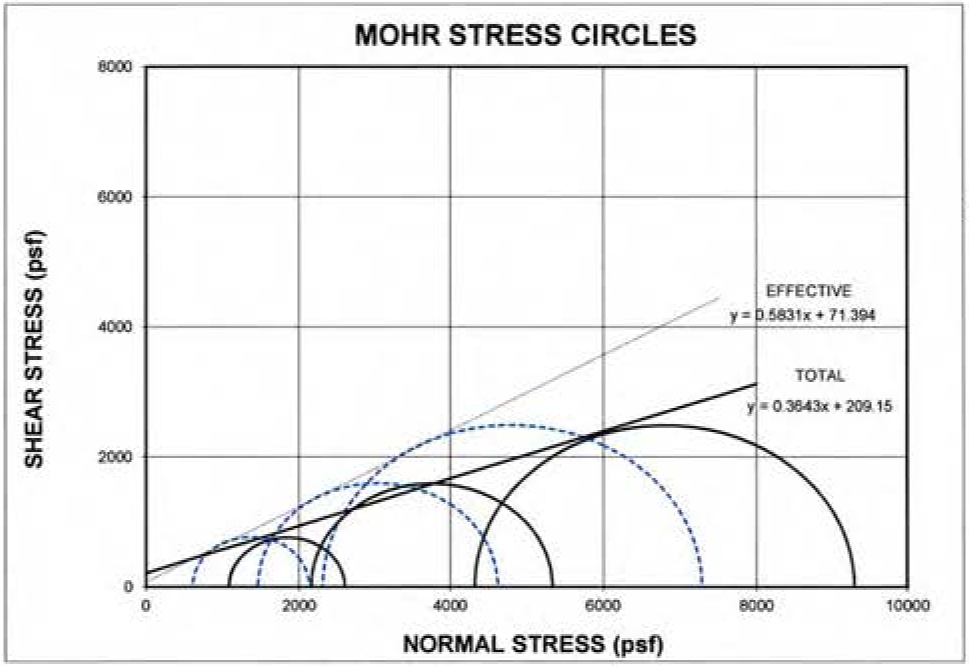
PROJECT NAME: **NIPSCO/GEO INVEST/MICHIGAN CITY/IN**
PROJECT NUMBER: **123-88898**
SAMPLE ID: **BH-6** DEPTH: **40.0-42.5'** Sample Type: **UD**



Specimen	Effective Confining Pressure (psf)	Initial Dry Density (pcf)	Initial Moisture Content (%)
1	1080	114.1	18.2
2	2160	116.1	17.4
3	4320	117.8	16.5

Specimen	Strain Rate (%)	Initial Saturation (%)	Saturation Before Shearing (%)
1	0.013	99.4	100.0
2	0.014	100.0	100.0
3	0.013	99.4	100.0

*TOTAL STRESS PARAMETER			*TOTAL STRENGTH PARAMETER		
α	=	18.9 °	ϕ	=	20.0 °
a	=	196.5 psf	c	=	209.2 psf
* EFFECTIVE STRESS PARAMETER			*EFFECTIVE STRENGTH PARAMETER		
α '	=	26.7 °	ϕ '	=	30.2 °
a '	=	61.7 psf	c '	=	71.4 psf



Soil Description

Gray, SILTY CLAY, some medium to fine sand, trace fine gravel.

USCS CL

LL	PL	PI
30	17	13

Comments

-

*** Failure based on effective stress ratio.**

CHECK	
REVIEW	
APPROVE	

NIPSCO-MCGS
123-88898
Geotechnical Laboratory Test Results

Sample Identification		Sample Depth (ft)	Soil Classification	In-situ Moisture %	Atterberg Limits				Grain Size Distribution			Additional Tests Conducted (See Notes)
Sample No.	Sample Type				LL	PL	PI	LI	% Finer #4 sieve	% Finer #200 sieve	% Finer 0.002 mm	
BH-1	Jar	1.0'-2.5'	SP	3.52	-	-	-	-	99.32	4.77	-	
BH-1	Jar	11.0'-12.5'	SP	5.93	-	-	-	-	94.10	4.43	-	
BH-1	Jar	28.5'-30.0'	SP	25.01	-	-	-	-	100.00	3.78	-	
BH-2	Jar	1.0'-2.5'	SP-SC	4.19	-	-	-	-	92.28	5.88	-	
BH-2	Jar	6.0'-7.5'	SP	1.90	-	-	-	-	97.13	2.30	-	
BH-2	Jar	13.5'-15.0'	SP	23.84	-	-	-	-	100.00	0.22	-	
BH-2	Jar	21.0'-22.5'	SP-SC	13.04	-	-	-	-	77.92	5.00	-	
BH-3	Jar	3.5'-5.0'	SC-SM	7.38	-	-	-	-	72.46	15.41	-	
BH-3	Jar	13.5'-15.0'	SP	6.57	-	-	-	-	99.89	0.72	-	
BH-3	Jar	23.5'-25.0'	SP	2.75	-	-	-	-	100.00	1.51	-	
BH-3	Jar	38.5'-40.0'	SP-SC	19.15	-	-	-	-	100.00	8.50	-	
BH-3	Jar	63.5'-65.0'	SP-SC	20.72	-	-	-	-	100.00	9.78	-	
BH-4	Jar	1.0'-2.5'	SP	3.33	-	-	-	-	93.13	2.07	-	
BH-4	Jar	8.5'-10.0'	SP	6.15	-	-	-	-	97.40	2.17	-	
BH-4	Jar	13.5'-15.0'	SP	3.49	-	-	-	-	100.00	0.08	-	
BH-4	Jar	33.5'-35.0'	SP	22.67	-	-	-	-	92.27	3.71	-	
BH-5	Jar	6.0'-7.5'	SP	4.21	-	-	-	-	91.41	2.71	-	
BH-5	Jar	13.5'-15.0'	SP	4.85	-	-	-	-	99.63	2.31	-	
BH-5	Jar	23.5'-25.0'	SP-SC	20.14	-	-	-	-	84.44	5.51	-	
BH-5	Jar	28.5'-30.0'	SW	16.71	-	-	-	-	95.47	2.65	-	
BH-5	Jar	33.5'-35.0'	SP	21.73	-	-	-	-	88.06	1.03	-	
BH-5	Jar	48.5'-50.0'	SP-SC	22.07	-	-	-	-	99.38	7.40	-	
BH-6	Jar	3.5'-5.0'	SP	3.17	-	-	-	-	100.00	0.39	-	
BH-6	Jar	18.5'-20.0'	SP	22.99	-	-	-	-	99.21	1.89	-	
BH-6	Jar	28.5'-30.0'	SP	22.64	-	-	-	-	100.00	1.42	-	
BH-6	Jar	33.5'-35.0'	SP-SC	37.85	-	-	-	-	99.04	11.84	-	
BH-7	Jar	1.0'-2.5'	SP-SC	7.85	-	-	-	-	79.12	10.15	-	
BH-7	Jar	8.5'-10.0'	SC-SM*	6.49	-	-	-	-	98.74	13.82	-	
BH-7	Jar	13.5'-15.0'	SC-SM*	11.68	-	-	-	-	93.61	13.81	-	
BH-7	Jar	23.5'-25.0'	SM	18.36	-	-	-	-	96.40	20.60	7.86	
BH-7	Jar	38.5'-40.0'	SP-SC	22.85	-	-	-	-	100.00	6.78	-	
BH-8	Jar	1.0'-2.5'	SP-SC*	9.73	-	-	-	-	93.78	10.52	-	
BH-8	Bag	8.5'-10.0'	SP	30.08	-	-	-	-	100.00	2.35	-	
BH-8	Bag	13.5'-15.0'	SM	38.81	-	-	-	-	99.00	43.00	2.04	
BH-8	Bag	23.5'-25.0'	SP	19.22	-	-	-	-	99.70	2.60	-	
BH-8	Bag	28.5'-30.0'	SC-SM	18.25	-	-	-	-	99.80	35.80	-	

ABBREVIATIONS:	**LIQUID LIMIT (LL)**
	PLASTIC LIMIT (PL)
	PLASTICITY INDEX (PI)
	LIQUIDITY INDEX (LI)
	SPECIFIC GRAVITY (Gs)
	MOISTURE (Mc)
NOTES:	***Classified Visually**

8/2/2012

NIPSCO-MCGS
123-88898
Geotechnical Laboratory Test Results

Sample Identification					Atterberg Limits				Grain Size Distribution			Additional Tests Conducted (See Notes)
Sample No.	Sample Type	Sample Depth (ft)	Soil Classification	In-situ Moisture %	LL	PL	PI	LI	% Finer #4 sieve	% Finer #200 sieve	% Finer 0.002 mm	
BH-9	Bag	1.0'-2.5'	SP-SM	9.37	-	-	-	-	99.80	9.20	-	
BH-9	Bag	8.5'-10.0'	SP-SC*	22.69	-	-	-	-	93.00	7.60	0.61	
BH-9	Bag	28.5'-30.0'	SP-SM	19.67	-	-	-	-	98.90	10.10	2.03	
BH-9	Bag	38.5'-40.0'	SC-SM	19.57	-	-	-	-	100.00	30.70	6.12	
BH-9	Bag	48.5'-50.0'	SM	22.54	-	-	-	-	100.00	18.10	0.02	
BH-10	Jar	3.5'-5.0'	SP	15.25	-	-	-	-	99.02	3.90	-	
BH-10	Jar	8.5'-10.0'	SP	24.47	-	-	-	-	99.28	1.34	-	
BH-10	Bag	13.5'-15.0'	SP	16.14	-	-	-	-	93.99	1.86	-	
BH-10	Bag	23.5'-25.0'	SP	19.37	-	-	-	-	80.84	1.52	-	
BH-10	Bag	58.5'-60.0'	SC-SM*	22.44	-	-	-	-	100.00	31.43	-	
BH-11	Bag	3.5'-5.0'	SW	13.29	-	-	-	-	55.91	1.26	-	
BH-11	Bag	11.0'-12.5'	SP	23.26	-	-	-	-	99.74	1.88	-	
BH-11	Bag	18.5'-20.0'	SP	18.76	-	-	-	-	88.67	0.51	-	
BH-12	Jar	3.5'-5.0'	SP	6.70	-	-	-	-	96.70	1.17	-	
BH-12	Jar	11.0'-12.5'	SP	20.73	-	-	-	-	97.33	2.02	-	
BH-12	Jar	33.5'-35.0'	SP-SC	21.88	-	-	-	-	100.00	7.78	-	

ABBREVIATIONS:	LIQUID LIMIT (LL)
	PLASTIC LIMIT (PL)
	PLASTICITY INDEX (PI)
	LIQUIDITY INDEX (LI)
	SPECIFIC GRAVITY (Gs)
	MOISTURE (Mc)
NOTES:	*Classified Visually

8/2/2012

NIPSCO-MCGS
123-88898
Geotechnical Laboratory Test Results

Sample Identification	Sample Type	Sample Depth (ft)	Soil Classification	In-situ Moisture %	Atterberg Limits				Grain Size Distribution			Additional Tests Conducted (See Notes)
Sample No.					LL	PL	PI	LI	% Finer #4 sieve	% Finer #200 sieve	% Finer 0.002 mm	
BH-1	Jar	38.5'-40.0'	CL	20.56	32	16	16	0.28	100.00	90.10	39.68	
BH-2	Bag	18.5'-20.0'	CL-ML	45.76	31	25	6	3.43	100.00	48.20	11.01	
BH-2	Jar	38.5'-40.0'	CL	16.37	28	15	13	0.10	99.90	84.70	30.83	
BH-2	Jar	48.5'-50.0'	CL	17.78	30	17	13	0.05	99.90	87.70	36.68	
BH-3	Jar	73.5'-75.0'	CL	15.27	28	14	14	0.80	100.00	89.20	35.40	
BH-4	Jar	23.5'-25.0'	ML	60.31	16	15	1	45.63	100.00	66.50	12.30	
BH-2	Jar	38.5'-40.0'	CL	16.37	28	15	13	0.10	99.90	84.70	30.83	
BH-2	Jar	48.5'-50.0'	CL	17.78	30	17	13	0.05	99.90	87.70	36.68	
BH-3	Jar	73.5'-75.0'	CL	15.27	28	14	14	0.80	100.00	89.20	35.40	
BH-6	Jar	43.5'-45.0'	CL	17.88	29	15	14	0.21	81.30	69.80	28.58	
BH-6	Jar	48.5'-50.0'	CL	17.09	31	17	14	0.04	100.00	88.30	34.77	
BH-8	Bag	18.5'-20.0'	ML	50.41	30	26	4	6.19	100.0	98.1	5.95	
BH-8	Bag	38.5'-40.0'	CL	15.17	26	14	12	0.14	99.20	82.70	32.43	
BH-8	Bag	53.5'-55.0'	CL	13.33	24	14	10	-0.12	99.90	83.20	30.56	
BH-8	Bag	68.5'-70.0'	CL*	14.74	-	-	-	-	100.00	76.70	13.60	
BH-9	Bag	33.5'-35.0'	CL	17.15	27	13	14	0.26	99.8	82.3	33.47	
BH-10	Bag	33.5'-35.0'	CL	20.04	30	18	12	0.18	86.40	75.00	32.28	
BH-10	Bag	48.5'-50.0'	CL	14.47	28	16	12	0.00	98.9	86.8	33.85	
BH-10	Bag	73.5'-75.0'	CL	14.78	24	14	10	0.07	100.00	95.10	30.78	
BH-11	Bag	28.5'-30.0'	CL	16.42	28	15	13	0.12	98.9	84.9	33.16	
BH-12	Jar	23.5'-25.0'	ML	21.18	15	15	0	0.00	100.00	69.80	4.10	
BH-12	Jar	38.5'-40.0'	MH	20.34	59	46	13	-1.99	100.00	89.90	5.56	

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)
NOTES: *Classified Visually

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-1
SAMPLE TYPE: JAR
SAMPLE DEPTH: 1.0'-2.5'

DESCRIPTION: Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	34.81
Weight of Dry Soil & Tare	34.10
Weight of Tare	13.93
Weight of Water	0.71
Weight of Dry Soil	20.17
Water Content	3.52%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-1
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	1.0'-2.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.81
Wt Dry Soil & Tare (gm)	(w2)	34.10
Weight of Tare (gm)	(w3)	13.93
Weight of Water (gm)	(w4=w1-w2)	0.71
Weight of Dry Soil (gm)	(w5=w2-w3)	20.17
Moisture Content (%)	(w4/w5)*100	3.52

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	32.05
Dry Soil & Tare (gm)	31.84
Tare Weight (gm)	10.98
Moisture Content (%)	1.01

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	339.95
	Tare Weight (gm)	96.53
(W6)	Total Dry Weight (gm)	240.99

SIEVE ANALYSIS

Tare Weight

96.58

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.58	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.58	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.58	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.58	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.58	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.58	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.58	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.58	0.00	0.00	100.00	0.375"	fine gravel
#4	98.22	1.64	0.68	99.32	#4	coarse sand
#10	102.51	5.93	2.46	97.54	#10	medium sand
#20	107.13	10.55	4.38	95.62	#20	medium sand
#40	117.03	20.45	8.49	91.51	#40	fine sand
#60	213.56	116.98	48.54	51.46	#60	fine sand
#100	321.92	225.34	93.50	6.50	#100	fine sand
#200	326.09	229.51	95.23	4.77	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.68
% C SAND	1.78
% M SAND	6.03
% F SAND	86.75
% FINES	4.77
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

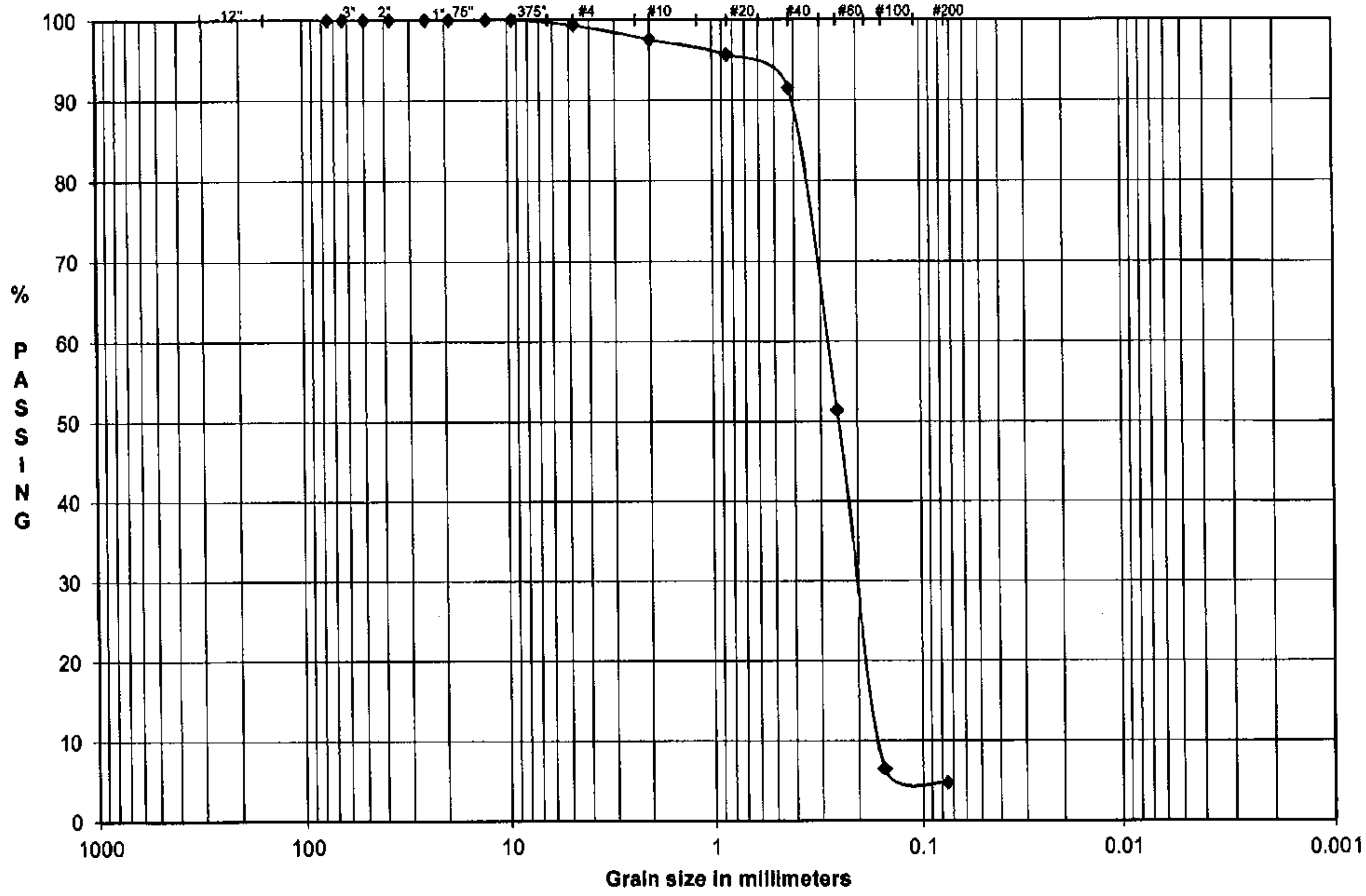
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.68	1.78	6.03	86.75	4.77

SAMPLE ID	BH-1
SAMPLE TYPE	JAR
SAMPLE DEPTH	1.0'-2.5'

LL	-
PL	-
PI	-

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	P.W.
REVIEW	BSW

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-1
SAMPLE TYPE: JAR
SAMPLE DEPTH: 11.0'-12.5'

DESCRIPTION: Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	34.33
Weight of Dry Soil & Tare	33.20
Weight of Tare	14.16
Weight of Water	1.13
Weight of Dry Soil	19.04
Water Content	5.93%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D. W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-1
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	11.0'-12.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.33
Wt Dry Soil & Tare (gm)	(w2)	33.20
Weight of Tare (gm)	(w3)	14.16
Weight of Water (gm)	(w4=w1-w2)	1.13
Weight of Dry Soil (gm)	(w5=w2-w3)	19.04
Moisture Content (%)	(w4/w5)*100	5.93

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	23.90
Dry Soil & Tare (gm)	23.88
Tare Weight (gm)	11.32
Moisture Content (%)	0.16

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	376.35
Tare Weight (gm)	95.84
(W6) Total Dry Weight (gm)	280.06

SIEVE ANALYSIS

Tare Weight

96.04

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.04	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.04	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.04	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.04	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.04	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.04	0.00	0.00	100.00	0.75"	fine gravel
0.50"	109.04	13.00	4.64	95.36	0.50"	fine gravel
0.375"	110.48	14.44	5.16	94.84	0.375"	fine gravel
#4	112.55	16.51	5.90	94.10	#4	coarse sand
#10	119.51	23.47	8.38	91.62	#10	medium sand
#20	128.38	32.34	11.55	88.45	#20	medium sand
#40	142.43	46.39	16.56	83.44	#40	fine sand
#60	251.65	155.61	55.56	44.44	#60	fine sand
#100	360.30	264.26	94.36	5.64	#100	fine sand
#200	363.70	267.66	95.57	4.43	#200	fines

% C GRAVEL	0.00
% F GRAVEL	5.90
% C SAND	2.49
% M SAND	8.18
% F SAND	79.01
% FINES	4.43
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

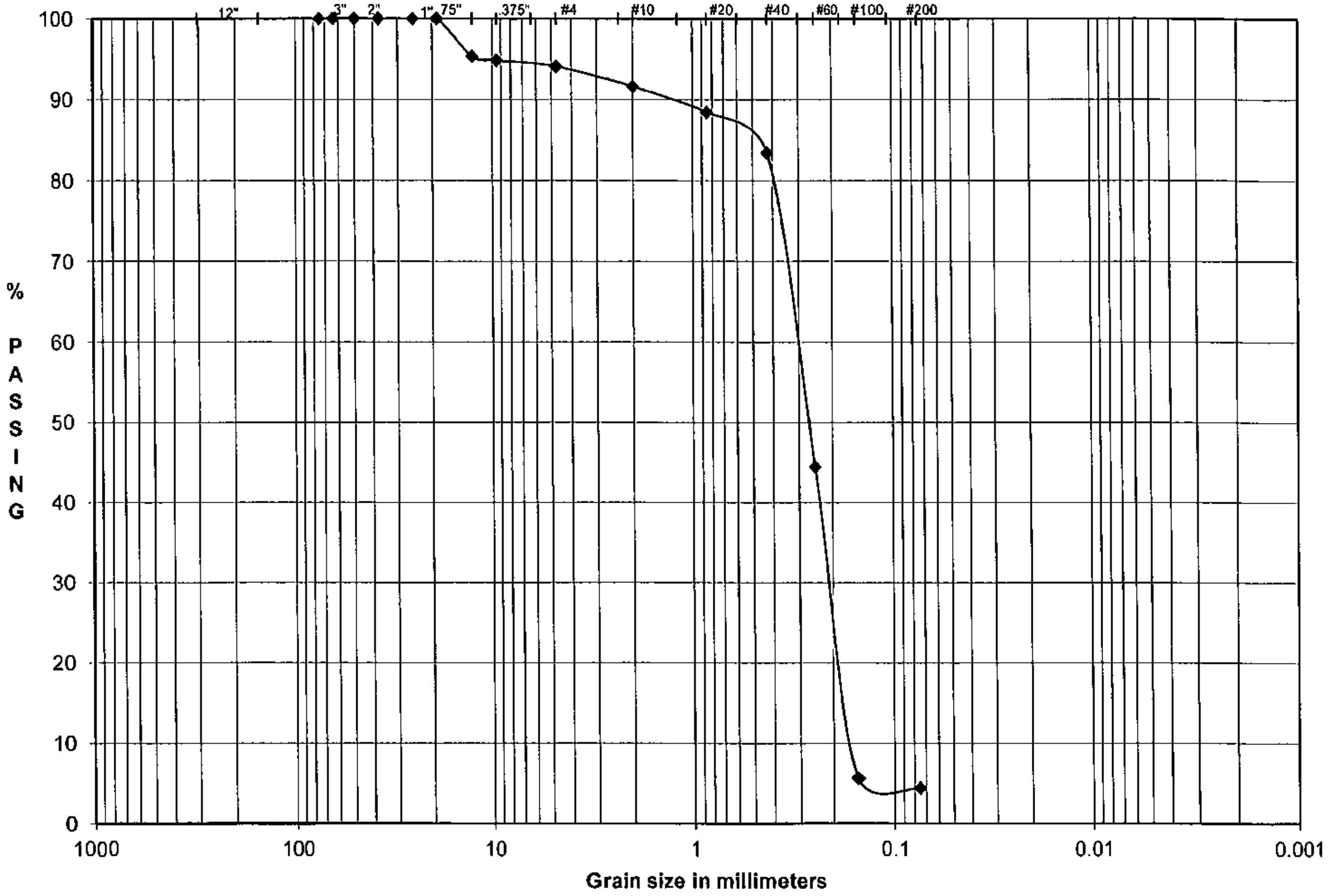
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D. W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	5.90	2.49	8.18	79.01	4.43

SAMPLE ID	BH-1
SAMPLE TYPE	JAR
SAMPLE DEPTH	11.0'-12.5'

LL	-
PL	-
PI	-

DESCRIPTION Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	V.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-1
SAMPLE TYPE: JAR
SAMPLE DEPTH: 28.5'-30.0'

DESCRIPTION: Light Yellowish Brown, POORLY GRADED SAND, trace fines, trace organics
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.96
Weight of Dry Soil & Tare	31.57
Weight of Tare	14.02
Weight of Water	4.39
Weight of Dry Soil	17.55
Water Content	25.01%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-1
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	28.5'-30.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.96
Wt Dry Soil & Tare (gm)	(w2)	31.57
Weight of Tare (gm)	(w3)	14.02
Weight of Water (gm)	(w4=w1-w2)	4.39
Weight of Dry Soil (gm)	(w5=w2-w3)	17.55
Moisture Content (%)	(w4/w5)*100	25.01

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	36.14
Dry Soil & Tare (gm)	35.72
Tare Weight (gm)	13.90
Moisture Content (%)	1.92

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	340.99
Tare Weight (gm)	95.38
(W6) Total Dry Weight (gm)	240.97

SIEVE ANALYSIS

Tare Weight

95.54

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.54	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.54	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.54	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.54	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.54	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.54	0.00	0.00	100.00	0.75"	fine gravel
0.50"	95.54	0.00	0.00	100.00	0.50"	fine gravel
0.375"	95.54	0.00	0.00	100.00	0.375"	fine gravel
#4	95.54	0.00	0.00	100.00	#4	coarse sand
#10	97.10	1.56	0.65	99.35	#10	medium sand
#20	98.72	3.18	1.32	98.68	#20	medium sand
#40	108.53	12.99	5.39	94.61	#40	fine sand
#60	195.60	100.06	41.52	58.48	#60	fine sand
#100	314.92	219.38	91.04	8.96	#100	fine sand
#200	327.41	231.87	96.22	3.78	#200	fines

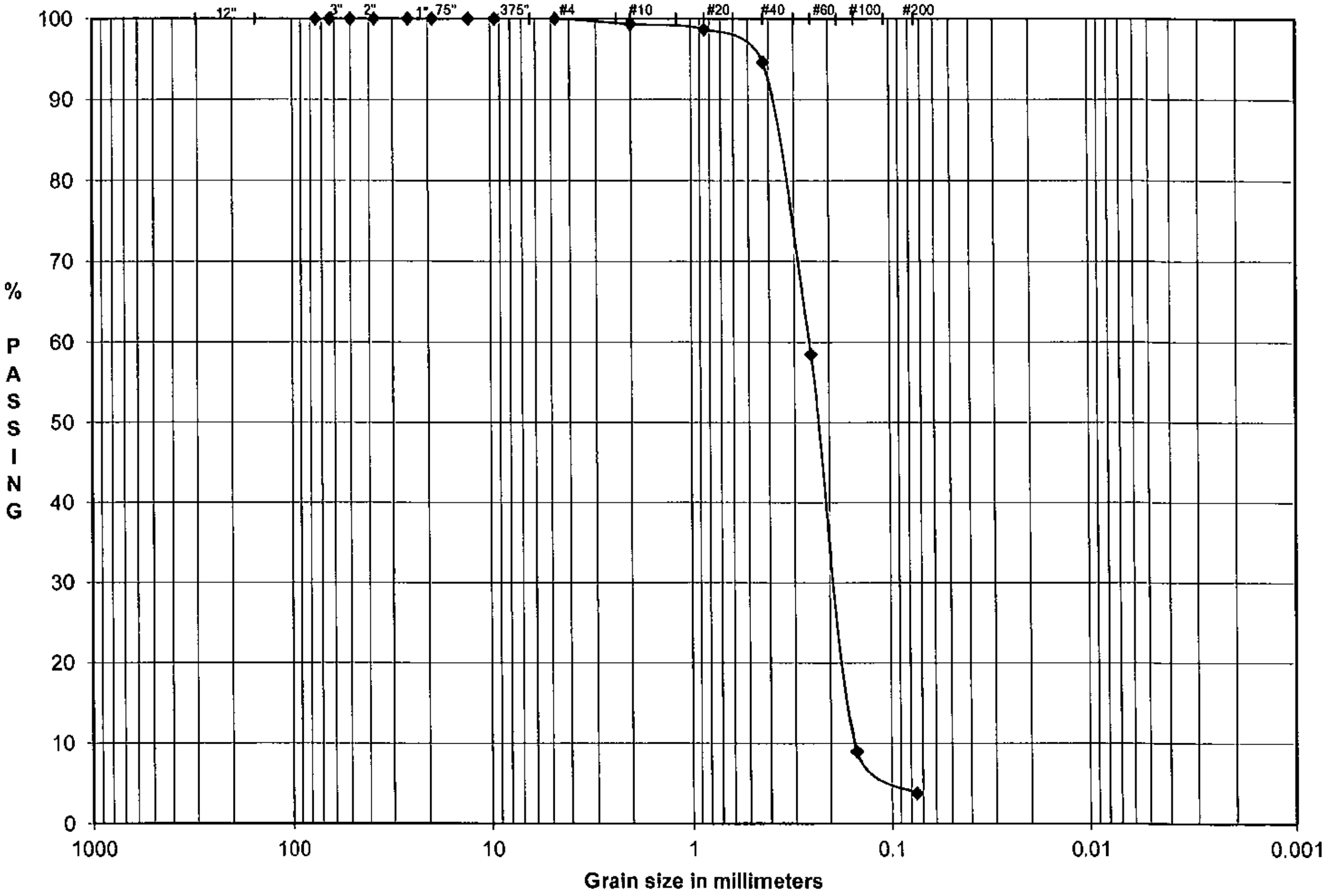
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	0.00	trace	0 to 5%	> 10% mostly medium (m)	**LL**	-
% C SAND	0.65	little	5 to 12%	< 10% fine (c-m)	**PL**	-
% M SAND	4.74	some	12 to 30%	< 10% coarse (m-f)	**PI**	-
% F SAND	90.83	and	30 to 50%	< 10% coarse and fine (m)	**Gs**	-
% FINES	3.78			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Light Yellowish Brown, POORLY GRADED SAND, trace fines, trace organics

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D. W.
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.65	4.74	90.83	3.78

SAMPLE ID	BH-1
SAMPLE TYPE	JAR
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Yellowish Brown, POORLY GRADED SAND, trace fines, trace organics

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 1.0'-2.5'

DESCRIPTION: Brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel
USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.86
Weight of Dry Soil & Tare	34.99
Weight of Tare	14.22
Weight of Water	0.87
Weight of Dry Soil	20.77
Water Content	4.19%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	V.M.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-2
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	1.0'-2.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.86
Wt Dry Soil & Tare (gm)	(w2)	34.99
Weight of Tare (gm)	(w3)	14.22
Weight of Water (gm)	(w4=w1-w2)	0.87
Weight of Dry Soil (gm)	(w5=w2-w3)	20.77
Moisture Content (%)	(w4/w5)*100	4.19

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	32.63
Dry Soil & Tare (gm)	32.41
Tare Weight (gm)	11.69
Moisture Content (%)	1.06

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	358.44
	Tare Weight (gm)	95.24
(W6)	Total Dry Weight (gm)	260.43

SIEVE ANALYSIS

Tare Weight

96.50

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.50	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.50	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.50	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.50	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.50	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	109.43	12.93	4.96	95.04	0.75"	fine gravel
0.50"	109.43	12.93	4.96	95.04	0.50"	fine gravel
0.375"	112.58	16.08	6.17	93.83	0.375"	fine gravel
#4	116.60	20.10	7.72	92.28	#4	coarse sand
#10	123.74	27.24	10.46	89.54	#10	medium sand
#20	136.02	39.52	15.17	84.83	#20	medium sand
#40	146.18	49.68	19.08	80.92	#40	fine sand
#60	218.37	121.87	46.79	53.21	#60	fine sand
#100	336.19	239.69	92.03	7.97	#100	fine sand
#200	341.63	245.13	94.12	5.88	#200	fines

% C GRAVEL	4.96
% F GRAVEL	2.75
% C SAND	2.74
% M SAND	8.62
% F SAND	75.05
% FINES	5.88
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

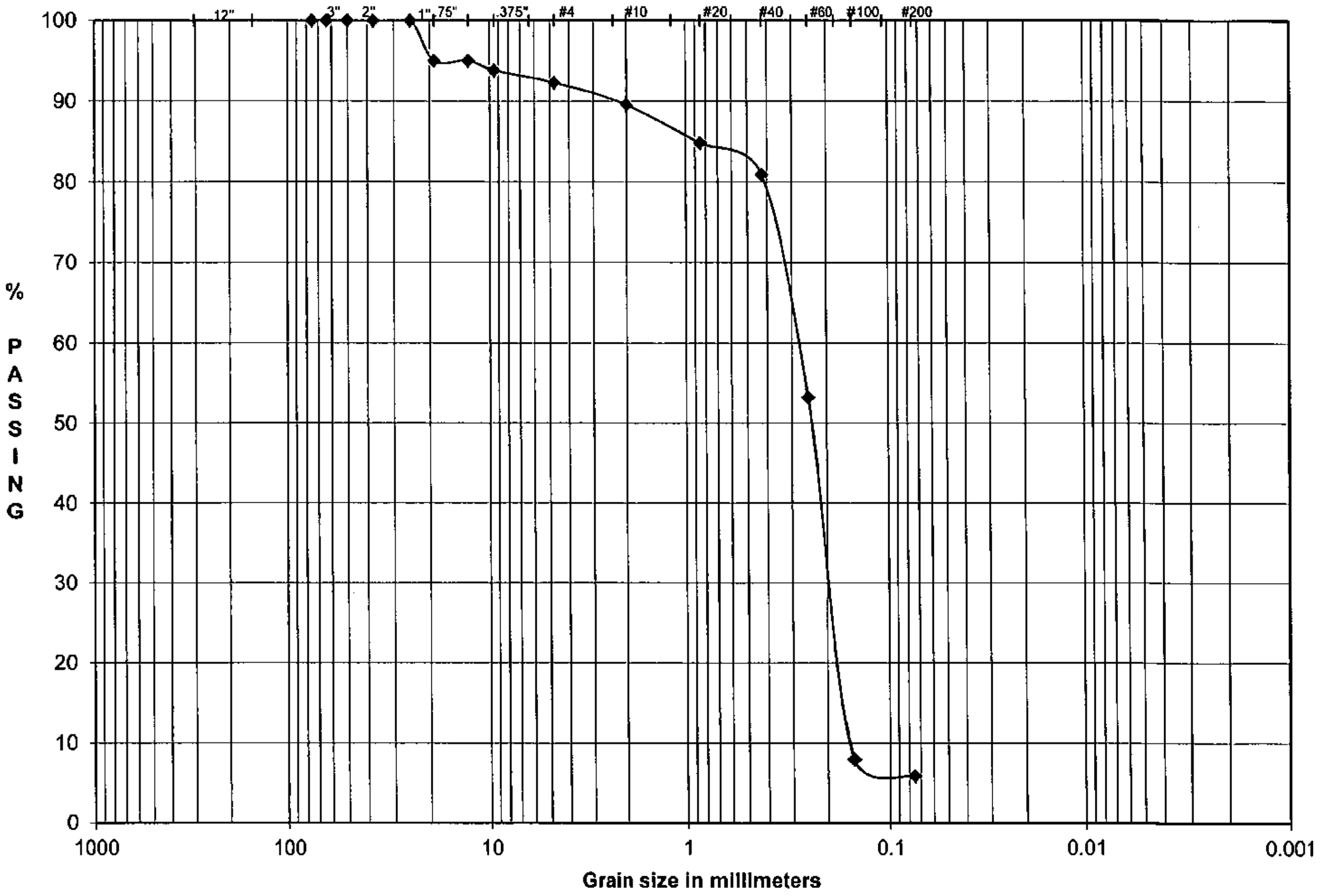
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	4.96	2.75	2.74	8.62	75.05	5.88

SAMPLE ID BH-2
SAMPLE TYPE JAR
SAMPLE DEPTH 1.0'-2.5'

LL -
PL -
PI -

DESCRIPTION Brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK DW
REVIEW BST

Template For Sand Grain-size and Perm

Global Information: PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 6.0'-7.5'

DESCRIPTION: Brown,POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.34
Weight of Dry Soil & Tare	34.94
Weight of Tare	13.91
Weight of Water	0.40
Weight of Dry Soil	21.03
Water Content	1.90%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-2
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	6.0'-7.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.34
Wt Dry Soil & Tare (gm)	(w2)	34.94
Weight of Tare (gm)	(w3)	13.91
Weight of Water (gm)	(w4=w1-w2)	0.40
Weight of Dry Soil (gm)	(w5=w2-w3)	21.03
Moisture Content (%)	(w4/w5)*100	1.90

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.28
Dry Soil & Tare (gm)	34.24
Tare Weight (gm)	11.21
Moisture Content (%)	0.17

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	346.38
	Tare Weight (gm)	96.02
(W6)	Total Dry Weight (gm)	249.93

SIEVE ANALYSIS

Tare Weight

96.08

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.08	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.08	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.08	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.08	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.08	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.08	0.00	0.00	100.00	0.75"	fine gravel
0.50"	102.37	6.29	2.52	97.48	0.50"	fine gravel
0.375"	102.37	6.29	2.52	97.48	0.375"	fine gravel
#4	103.26	7.18	2.87	97.13	#4	coarse sand
#10	141.55	45.47	18.19	81.81	#10	medium sand
#20	208.40	112.32	44.94	55.06	#20	medium sand
#40	237.69	141.61	56.66	43.34	#40	fine sand
#60	280.88	184.80	73.94	26.06	#60	fine sand
#100	336.10	240.02	96.04	3.96	#100	fine sand
#200	340.25	244.17	97.70	2.30	#200	fines

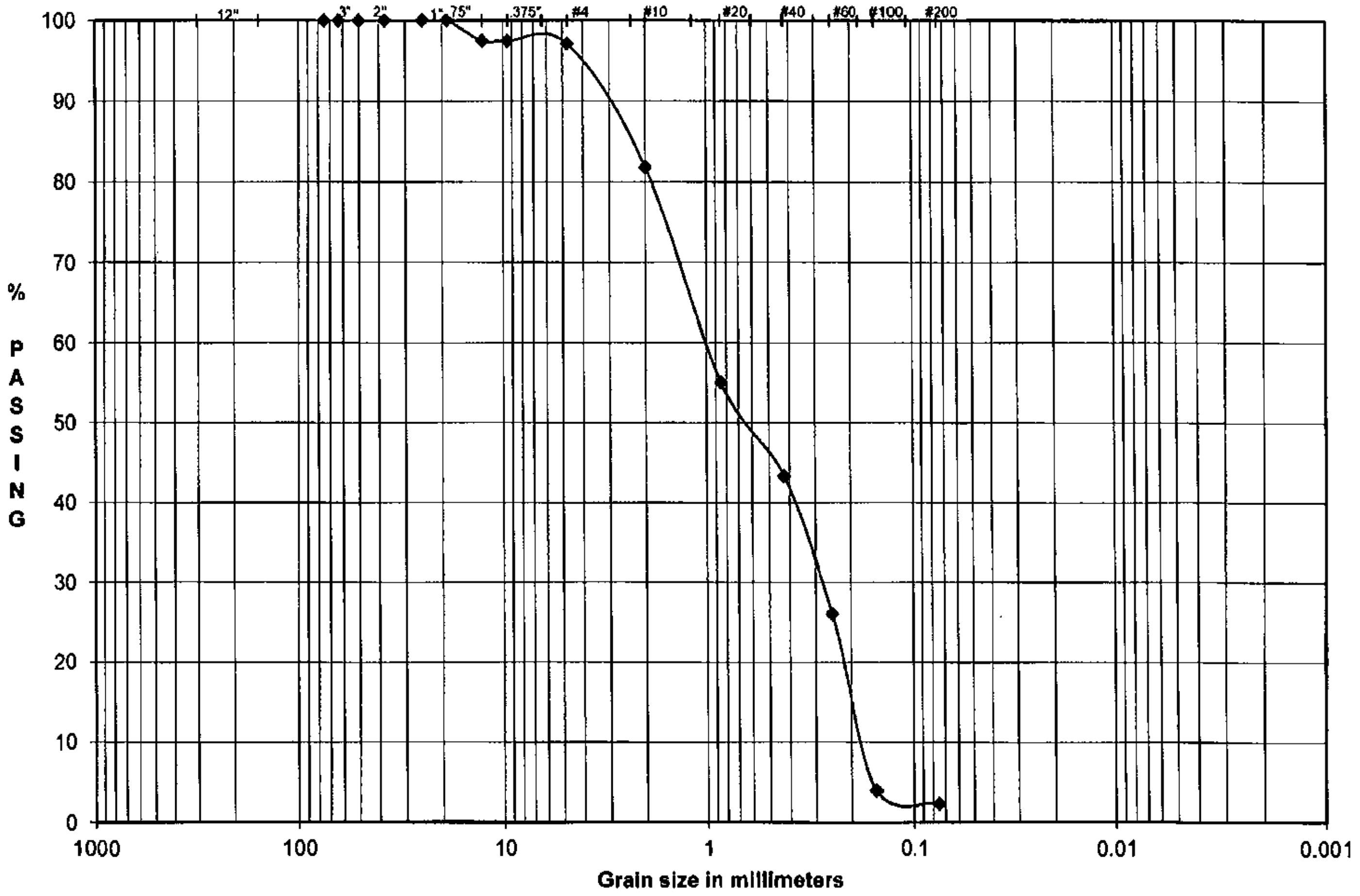
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	2.87	trace	0 to 5%	> 10% mostly medium (m)	**LL**	-
% C SAND	15.32	little	5 to 12%	< 10% fine (c-m)	**PL**	-
% M SAND	38.47	some	12 to 30%	< 10% coarse (m-f)	**PI**	-
% F SAND	41.04	and	30 to 50%	< 10% coarse and fine (m)	**Gs**	-
% FINES	2.30			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Brown,POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D. W.
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	2.87	15.32	38.47	41.04	2.30

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	6.0'-7.5'

LL	-
PL	-
PI	-

DESCRIPTION Brown,POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSN

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Very Pale Brown, POORLY GRADED SAND, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.42
Weight of Dry Soil & Tare	32.88
Weight of Tare	13.84
Weight of Water	4.54
Weight of Dry Soil	19.04
Water Content	23.84%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	RST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-2
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.42
Wt Dry Soil & Tare (gm)	(w2)	32.88
Weight of Tare (gm)	(w3)	13.84
Weight of Water (gm)	(w4=w1-w2)	4.54
Weight of Dry Soil (gm)	(w5=w2-w3)	19.04
Moisture Content (%)	(w4/w5)*100	23.84

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	44.20
Dry Soil & Tare (gm)	44.16
Tare Weight (gm)	14.11
Moisture Content (%)	0.13

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	314.04
Tare Weight (gm)	95.86
(W6) Total Dry Weight (gm)	217.89

SIEVE ANALYSIS

Tare Weight: 96.03

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.03	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.03	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.03	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.03	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.03	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.03	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.03	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.03	0.00	0.00	100.00	0.375"	fine gravel
#4	96.03	0.00	0.00	100.00	#4	coarse sand
#10	96.52	0.49	0.22	99.78	#10	medium sand
#20	97.40	1.37	0.63	99.37	#20	medium sand
#40	109.37	13.34	6.12	93.88	#40	fine sand
#60	228.59	132.56	60.84	39.16	#60	fine sand
#100	311.77	215.74	99.01	0.99	#100	fine sand
#200	313.44	217.41	99.78	0.22	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.22
% M SAND	5.90
% F SAND	93.66
% FINES	0.22
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

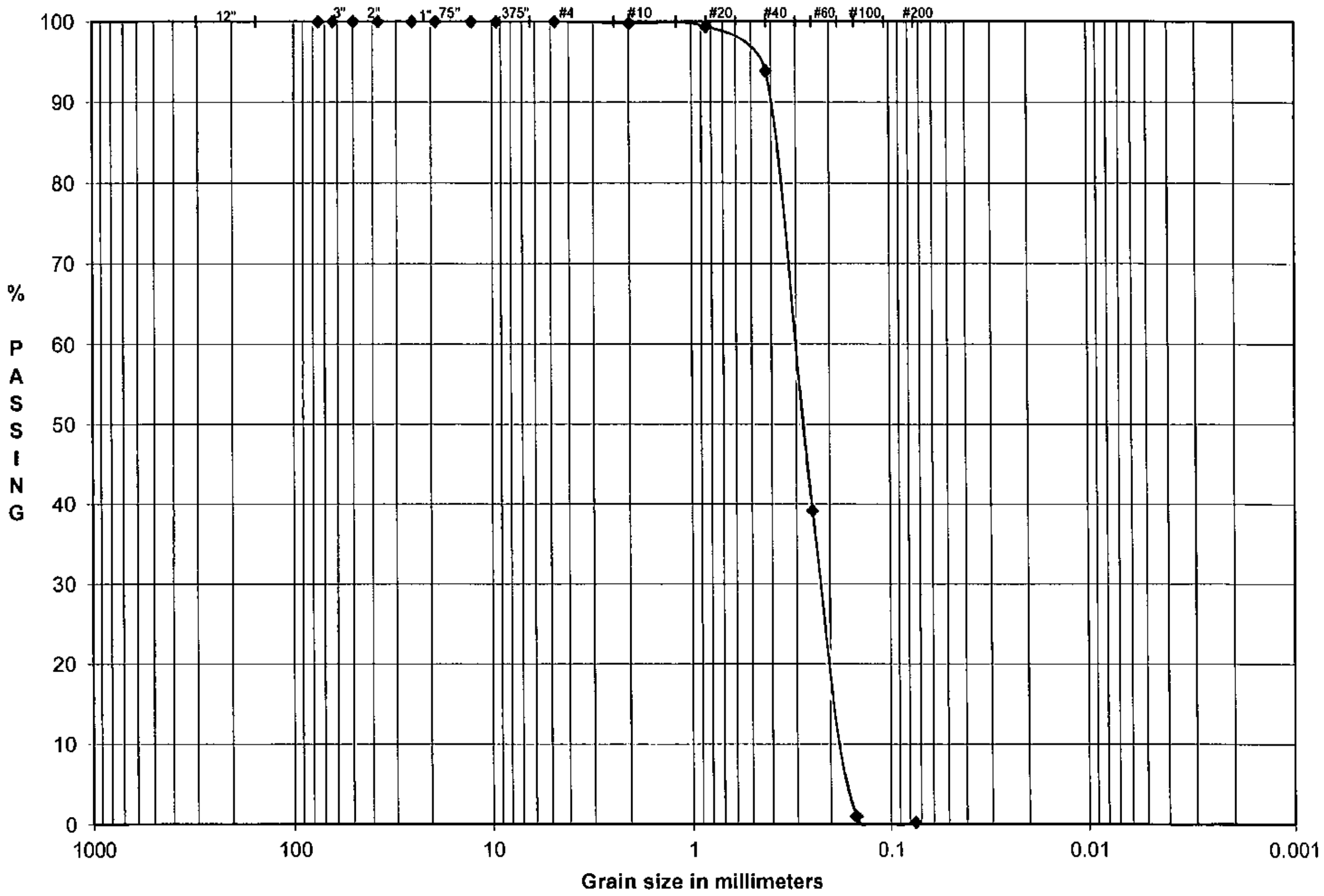
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Very Pale Brown, POORLY GRADED SAND, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.22	5.90	93.66	0.22

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	13.5'-15.0'

LL	-
PL	-
PI	-

DESCRIPTION Very Pale Brown, POORLY GRADED SAND, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSF

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 21.0'-22.5'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.57
Weight of Dry Soil & Tare	33.07
Weight of Tare	13.90
Weight of Water	2.50
Weight of Dry Soil	19.17
Water Content	13.04%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	DcW
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-2
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	21.0'-22.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.57
Wt Dry Soil & Tare (gm)	(w2)	33.07
Weight of Tare (gm)	(w3)	13.90
Weight of Water (gm)	(w4=w1-w2)	2.50
Weight of Dry Soil (gm)	(w5=w2-w3)	19.17
Moisture Content (%)	(w4/w5)*100	13.04

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.49
Dry Soil & Tare (gm)	35.42
Tare Weight (gm)	14.09
Moisture Content (%)	0.33

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	370.22
	Tare Weight (gm)	96.09
(W6)	Total Dry Weight (gm)	273.23

SIEVE ANALYSIS

Tare Weight

96.20

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.20	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.20	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.20	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.20	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.20	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.20	0.00	0.00	100.00	0.75"	fine gravel
0.50"	115.94	19.74	7.22	92.78	0.50"	fine gravel
0.375"	125.88	29.68	10.86	89.14	0.375"	fine gravel
#4	156.52	60.32	22.08	77.92	#4	coarse sand
#10	185.80	89.60	32.79	67.21	#10	medium sand
#20	203.61	107.41	39.31	60.69	#20	medium sand
#40	263.08	166.88	61.08	38.92	#40	fine sand
#60	327.41	231.21	84.62	15.38	#60	fine sand
#100	346.29	250.09	91.53	8.47	#100	fine sand
#200	355.78	259.58	95.00	5.00	#200	fines

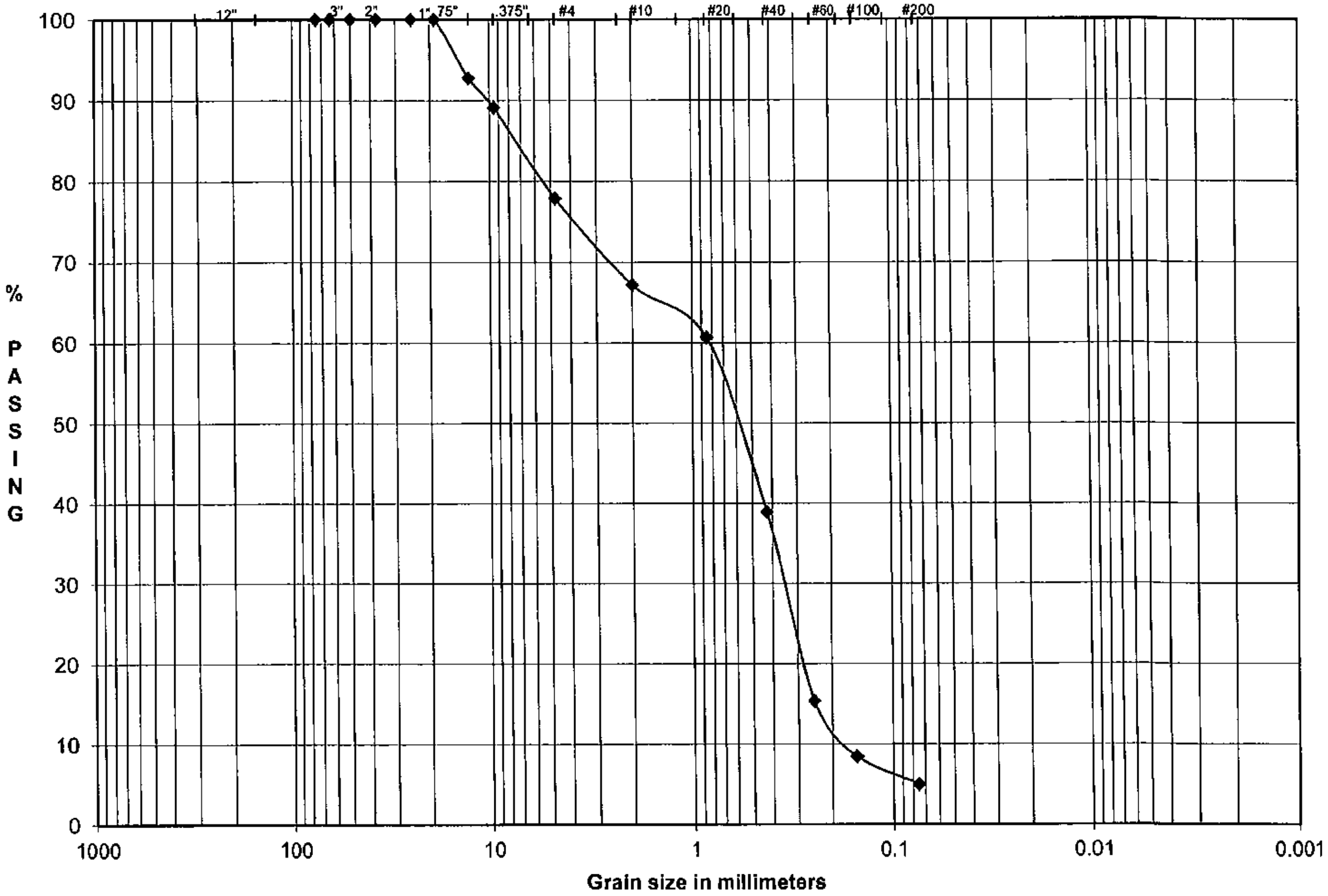
		Descriptive Terms				
% C GRAVEL	0.00			> 10% mostly coarse (c)		
% F GRAVEL	22.08	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	10.72	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	28.28	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	33.93	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	5.00			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSF

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	22.08	10.72	28.28	33.93	5.00

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	21.0'-22.5'

LL	-
PL	-
PI	-

DESCRIPTION	Light Gray, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL
USCS	SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSJ

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-3
SAMPLE TYPE: JAR
SAMPLE DEPTH: 3.5'-5.0'

DESCRIPTION: Brown, SILTY, CLAYEY SAND WITH GRAVEL
USCS: SC-SM

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.41
Weight of Dry Soil & Tare	33.94
Weight of Tare	14.02
Weight of Water	1.47
Weight of Dry Soil	19.92
Water Content	7.38%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	BS
REVIEW	BSt

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-3
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	3.5'-5.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.41
Wt Dry Soil & Tare (gm)	(w2)	33.94
Weight of Tare (gm)	(w3)	14.02
Weight of Water (gm)	(w4=w1-w2)	1.47
Weight of Dry Soil (gm)	(w5=w2-w3)	19.92
Moisture Content (%)	(w4/w5)*100	7.38

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	32.54
Dry Soil & Tare (gm)	31.76
Tare Weight (gm)	11.49
Moisture Content (%)	3.85

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	341.73
Tare Weight (gm)	95.12
(W6) Total Dry Weight (gm)	237.47

SIEVE ANALYSIS

Tare Weight: 95.10

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.10	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.10	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.10	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.10	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	140.38	45.28	19.07	80.93	1.0"	coarse gravel
0.75"	157.52	62.42	26.29	73.71	0.75"	fine gravel
0.50"	157.52	62.42	26.29	73.71	0.50"	fine gravel
0.375"	158.78	63.68	26.82	73.18	0.375"	fine gravel
#4	160.51	65.41	27.54	72.46	#4	coarse sand
#10	163.79	68.69	28.93	71.07	#10	medium sand
#20	166.32	71.22	29.99	70.01	#20	medium sand
#40	172.71	77.61	32.68	67.32	#40	fine sand
#60	228.78	133.68	56.29	43.71	#60	fine sand
#100	289.91	194.81	82.03	17.97	#100	fine sand
#200	295.97	200.87	84.59	15.41	#200	fines

% C GRAVEL	26.29
% F GRAVEL	1.26
% C SAND	1.38
% M SAND	3.76
% F SAND	51.91
% FINES	15.41
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

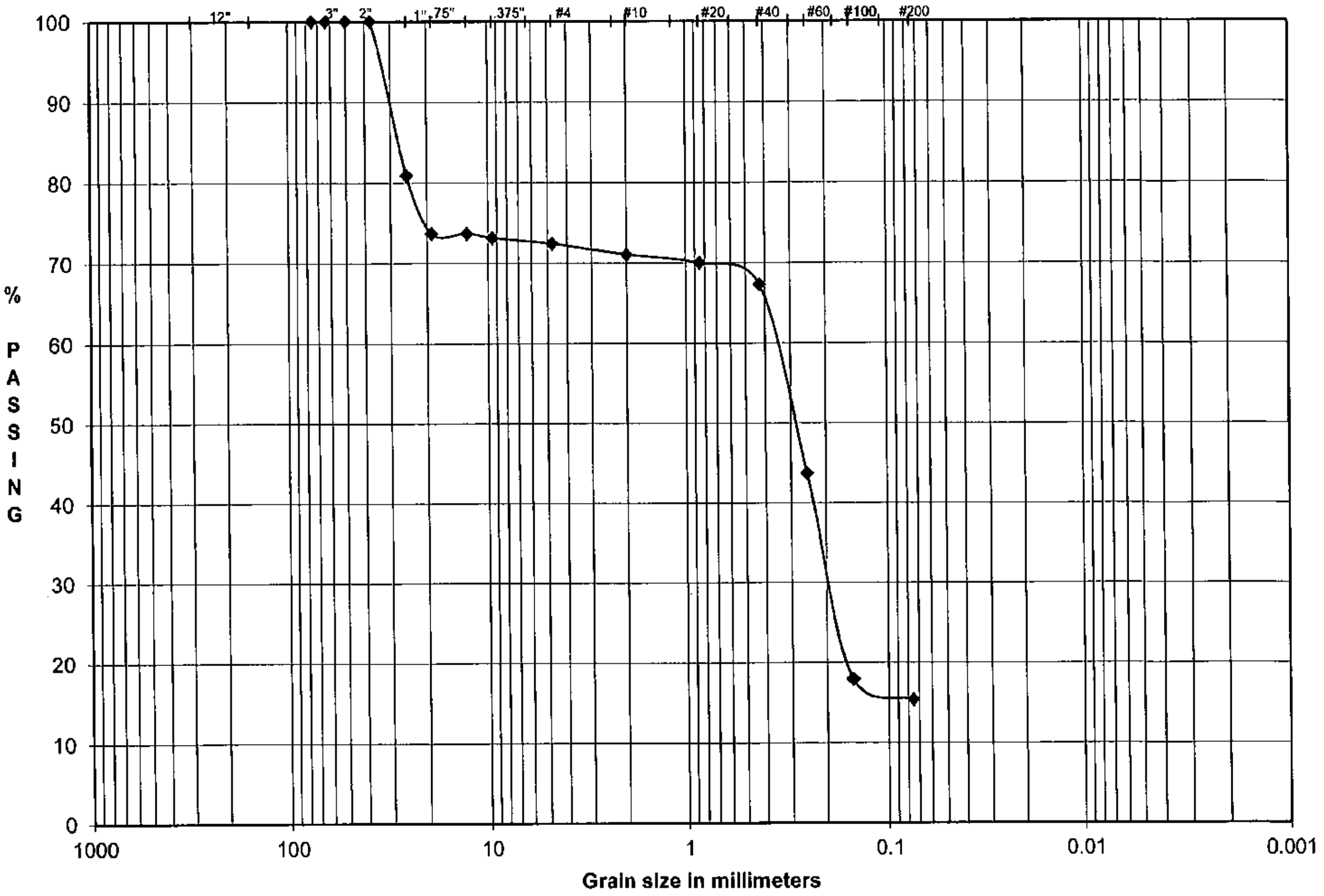
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, SILTY, CLAYEY SAND WITH GRAVEL

USCS SC-SM

TECH	CB
DATE	7/9/2012
CHECK	PJ
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	26.29	1.26	1.38	3.76	51.91	15.41

SAMPLE ID	BH-3
SAMPLE TYPE	JAR
SAMPLE DEPTH	3.5'-5.0'

LL	-
PL	-
PI	-

DESCRIPTION Brown, SILTY, CLAYEY SAND WITH GRAVEL

USCS SC-SM

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-3
SAMPLE TYPE: JAR
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	34.84
Weight of Dry Soil & Tare	33.57
Weight of Tare	14.24
Weight of Water	1.27
Weight of Dry Soil	19.33
Water Content	6.57%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-3
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.84
Wt Dry Soil & Tare (gm)	(w2)	33.57
Weight of Tare (gm)	(w3)	14.24
Weight of Water (gm)	(w4=w1-w2)	1.27
Weight of Dry Soil (gm)	(w5=w2-w3)	19.33
Moisture Content (%)	(w4/w5)*100	6.57

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	30.79
Dry Soil & Tare (gm)	30.77
Tare Weight (gm)	11.69
Moisture Content (%)	0.10

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	347.50
Tare Weight (gm)	98.34
(W6) Total Dry Weight (gm)	248.90

SIEVE ANALYSIS

Tare Weight

98.38

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	98.38	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	98.38	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	98.38	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	98.38	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	98.38	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	98.38	0.00	0.00	100.00	0.75"	fine gravel
0.50"	98.38	0.00	0.00	100.00	0.50"	fine gravel
0.375"	98.38	0.00	0.00	100.00	0.375"	fine gravel
#4	98.66	0.28	0.11	99.89	#4	coarse sand
#10	99.14	0.76	0.31	99.69	#10	medium sand
#20	99.77	1.39	0.56	99.44	#20	medium sand
#40	106.62	8.24	3.31	96.69	#40	fine sand
#60	232.37	133.99	53.83	46.17	#60	fine sand
#100	342.71	244.33	98.16	1.84	#100	fine sand
#200	345.49	247.11	99.28	0.72	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.11
% C SAND	0.19
% M SAND	3.01
% F SAND	95.97
% FINES	0.72
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

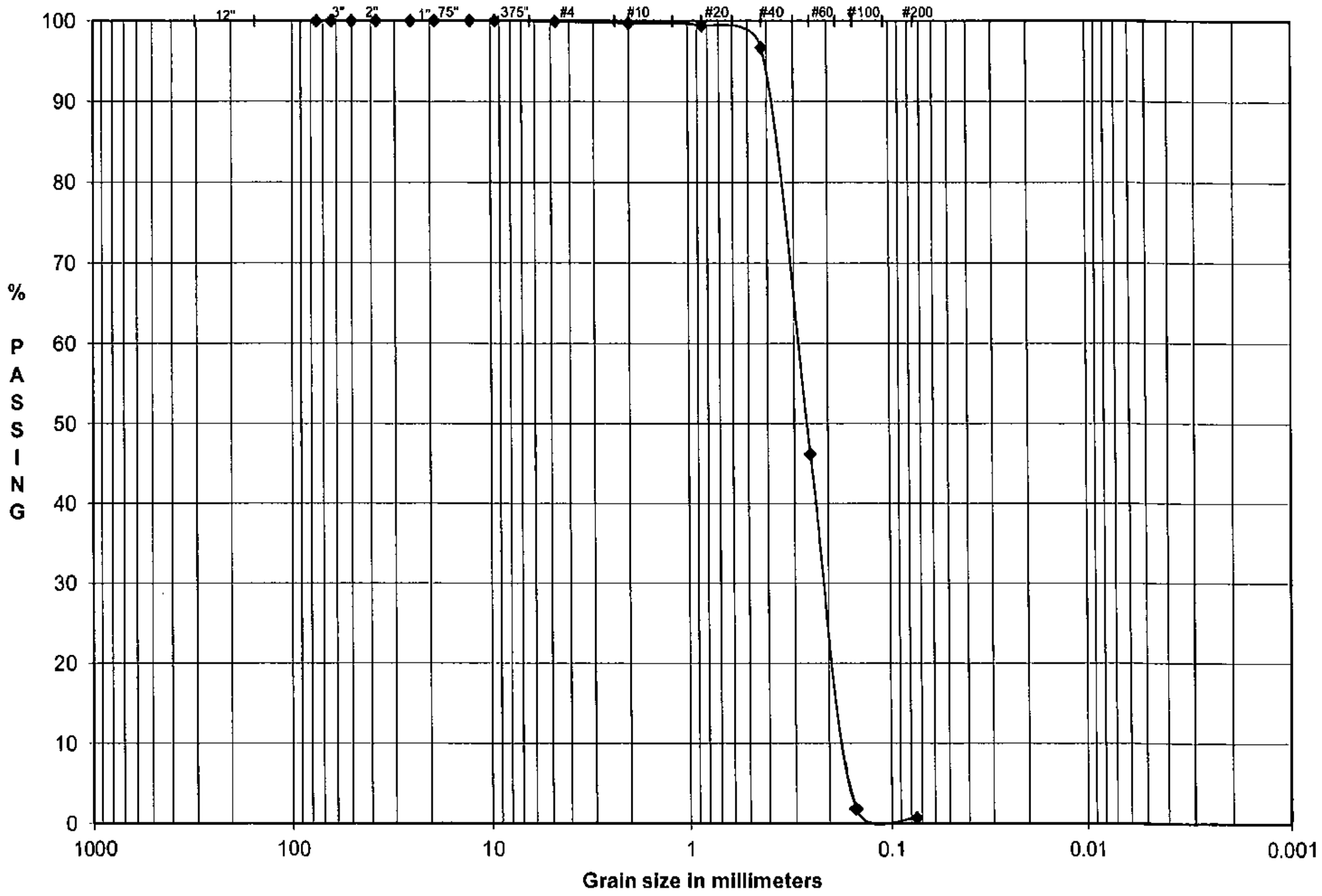
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	0.11	0.19	3.01	95.97	0.72

SAMPLE ID	BH-3	**LL**	-
SAMPLE TYPE	JAR	**PL**	-
SAMPLE DEPTH	13.5'-15.0'	**PI**	-

DESCRIPTION	Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	PST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-3
SAMPLE TYPE: JAR
SAMPLE DEPTH: 23.5'-25.0'

DESCRIPTION: Brown, POORLY GRADED SAND, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.47
Weight of Dry Soil & Tare	34.90
Weight of Tare	14.18
Weight of Water	0.57
Weight of Dry Soil	20.72
Water Content	2.75%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-3
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	23.5'-25.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.47
Wt Dry Soil & Tare (gm)	(w2)	34.90
Weight of Tare (gm)	(w3)	14.18
Weight of Water (gm)	(w4=w1-w2)	0.57
Weight of Dry Soil (gm)	(w5=w2-w3)	20.72
Moisture Content (%)	(w4/w5)*100	2.75

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	32.34
Dry Soil & Tare (gm)	32.25
Tare Weight (gm)	10.97
Moisture Content (%)	0.42

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	357.31
	Tare Weight (gm)	94.55
(W6)	Total Dry Weight (gm)	261.65

SIEVE ANALYSIS

Tare Weight

94.66

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	94.66	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	94.66	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	94.66	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	94.66	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	94.66	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	94.66	0.00	0.00	100.00	0.75"	fine gravel
0.50"	94.66	0.00	0.00	100.00	0.50"	fine gravel
0.375"	94.66	0.00	0.00	100.00	0.375"	fine gravel
#4	94.66	0.00	0.00	100.00	#4	coarse sand
#10	94.66	0.00	0.00	100.00	#10	medium sand
#20	94.92	0.26	0.10	99.90	#20	medium sand
#40	101.67	7.01	2.68	97.32	#40	fine sand
#60	235.71	141.05	53.91	46.09	#60	fine sand
#100	348.21	253.55	96.90	3.10	#100	fine sand
#200	352.37	257.71	98.49	1.51	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.00
% M SAND	2.68
% F SAND	95.81
% FINES	1.51
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

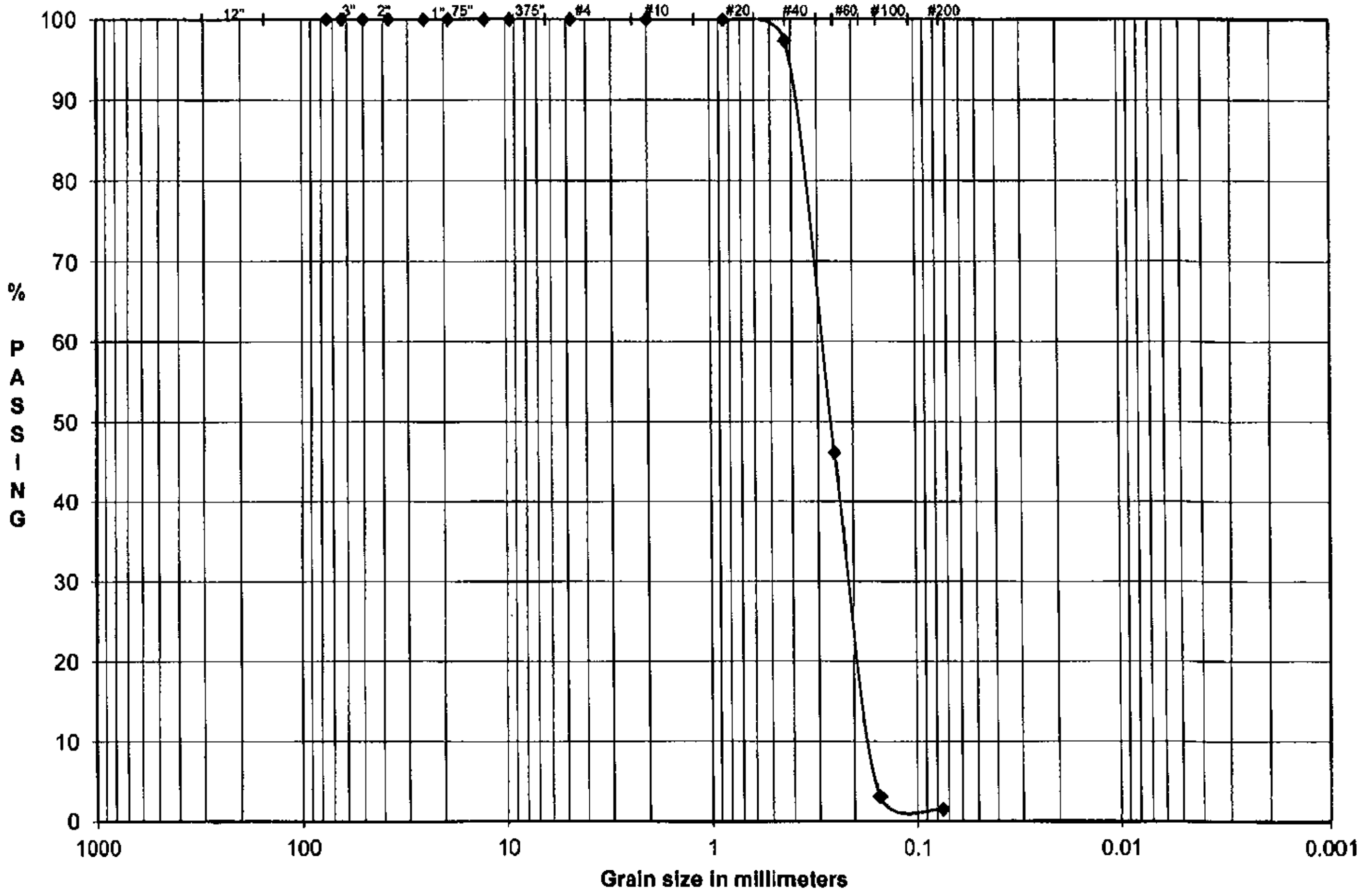
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, POORLY GRADED SAND, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D. W.
REVIEW	BSA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.00	2.68	95.81	1.51

SAMPLE ID BH-3
SAMPLE TYPE JAR
SAMPLE DEPTH 23.5'-25.0'

LL -
PL -
PI -

DESCRIPTION Brown, POORLY GRADED SAND, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W
REVIEW BST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-3
SAMPLE TYPE: JAR
SAMPLE DEPTH: 38.5'-40.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines
USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.27
Weight of Dry Soil & Tare	31.83
Weight of Tare	13.87
Weight of Water	3.44
Weight of Dry Soil	17.96
Water Content	19.15%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSV

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-3
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	38.5'-40.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.27
Wt Dry Soil & Tare (gm)	(w2)	31.83
Weight of Tare (gm)	(w3)	13.87
Weight of Water (gm)	(w4=w1-w2)	3.44
Weight of Dry Soil (gm)	(w5=w2-w3)	17.96
Moisture Content (%)	(w4/w5)*100	19.15

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	25.94
Dry Soil & Tare (gm)	25.92
Tare Weight (gm)	11.47
Moisture Content (%)	0.14

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	342.95
Tare Weight (gm)	96.81
(W6) Total Dry Weight (gm)	245.80

SIEVE ANALYSIS

Tare Weight

96.94

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.94	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.94	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.94	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.94	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.94	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.94	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.94	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.94	0.00	0.00	100.00	0.375"	fine gravel
#4	96.94	0.00	0.00	100.00	#4	coarse sand
#10	97.53	0.59	0.24	99.76	#10	medium sand
#20	101.85	4.91	2.00	98.00	#20	medium sand
#40	127.29	30.35	12.35	87.65	#40	fine sand
#60	244.62	147.68	60.08	39.92	#60	fine sand
#100	306.32	209.38	85.18	14.82	#100	fine sand
#200	321.85	224.91	91.50	8.50	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.24
% M SAND	12.11
% F SAND	79.15
% FINES	8.50
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

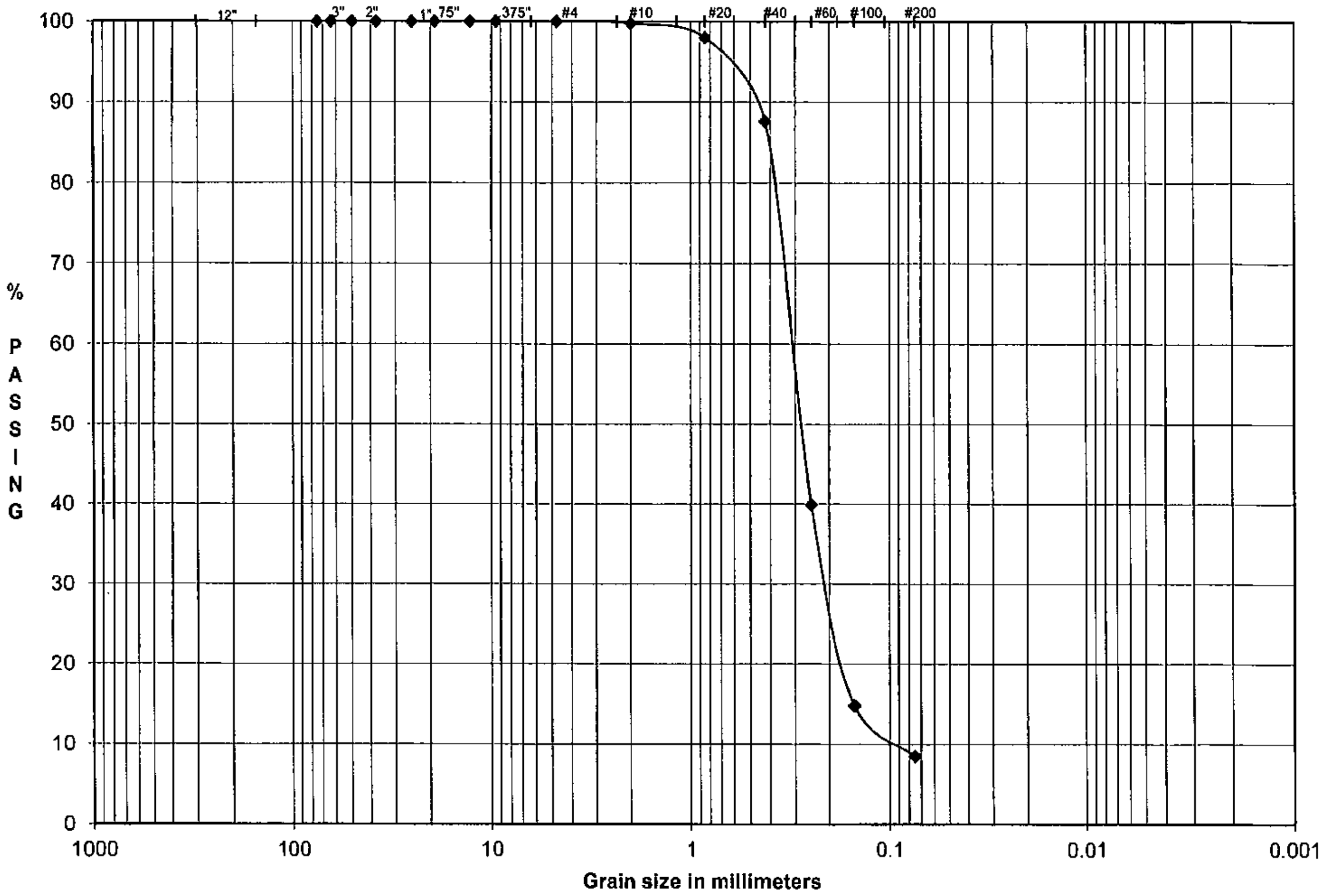
> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

LL	-
PL	-
PI	-
Gs	-

DESCRIPTION	Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines
USCS	SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		**SAND**			**FINES**
	0.00	0.00	0.00	0.24	12.11	79.15	8.50

SAMPLE ID	BH-3
SAMPLE TYPE	JAR
SAMPLE DEPTH	38.5'-40.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-3
SAMPLE TYPE: JAR
SAMPLE DEPTH: 63.5'-65.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines
USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.74
Weight of Dry Soil & Tare	32.84
Weight of Tare	14.02
Weight of Water	3.90
Weight of Dry Soil	18.82
Water Content	20.72%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-3
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	63.5'-65.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.74
Wt Dry Soil & Tare (gm)	(w2)	32.84
Weight of Tare (gm)	(w3)	14.02
Weight of Water (gm)	(w4=w1-w2)	3.90
Weight of Dry Soil (gm)	(w5=w2-w3)	18.82
Moisture Content (%)	(w4/w5)*100	20.72

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	36.33
Dry Soil & Tare (gm)	36.20
Tare Weight (gm)	14.03
Moisture Content (%)	0.59

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	357.11
Tare Weight (gm)	94.85
(W6) Total Dry Weight (gm)	260.73

SIEVE ANALYSIS

Tare Weight: 95.08

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.08	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.08	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.08	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.08	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.08	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.08	0.00	0.00	100.00	0.75"	fine gravel
0.50"	95.08	0.00	0.00	100.00	0.50"	fine gravel
0.375"	95.08	0.00	0.00	100.00	0.375"	fine gravel
#4	95.08	0.00	0.00	100.00	#4	coarse sand
#10	95.08	0.00	0.00	100.00	#10	medium sand
#20	95.12	0.04	0.02	99.98	#20	medium sand
#40	96.84	1.76	0.68	99.32	#40	fine sand
#60	158.41	63.33	24.29	75.71	#60	fine sand
#100	278.75	183.67	70.44	29.56	#100	fine sand
#200	330.31	235.23	90.22	9.78	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.00
% M SAND	0.68
% F SAND	89.54
% FINES	9.78
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

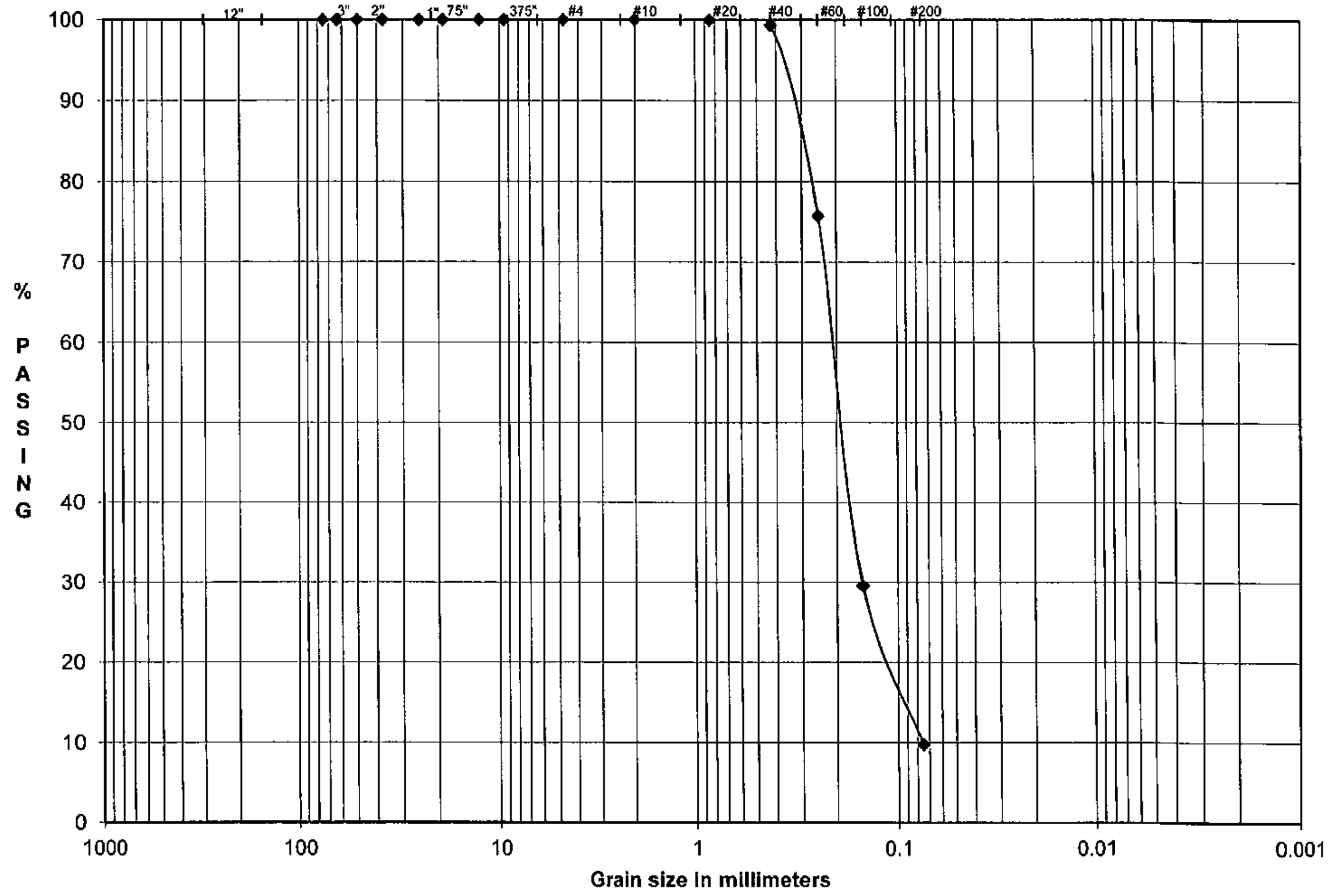
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BT

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.00	0.68	89.54	9.78

SAMPLE ID	BH-3
SAMPLE TYPE	JAR
SAMPLE DEPTH	63.5'-65.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	DW
REVIEW	BSJ

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME:	NIPSCO-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-4
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	1.0'-2.5'
DESCRIPTION:	Pale Brown, POORLY GRADED SAND, little gravel, trace fines
USCS:	SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	30.24
Weight of Dry Soil & Tare	29.72
Weight of Tare	14.09
Weight of Water	0.52
Weight of Dry Soil	15.63
Water Content	3.33%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-4
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	1.0'-2.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	30.24
Wt Dry Soil & Tare (gm)	(w2)	29.72
Weight of Tare (gm)	(w3)	14.09
Weight of Water (gm)	(w4=w1-w2)	0.52
Weight of Dry Soil (gm)	(w5=w2-w3)	15.63
Moisture Content (%)	(w4/w5)*100	3.33

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	24.46
Dry Soil & Tare (gm)	24.44
Tare Weight (gm)	11.68
Moisture Content (%)	0.16

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	379.09
	Tare Weight (gm)	95.30
(W6)	Total Dry Weight (gm)	283.35

SIEVE ANALYSIS

Tare Weight

95.42

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) ((wt ret/w6)*100)	% PASS (100-%ret)	SIEVE	
3.0"	95.42	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.42	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.42	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.42	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.42	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	113.03	17.61	6.22	93.78	0.75"	fine gravel
0.50"	113.03	17.61	6.22	93.78	0.50"	fine gravel
0.375"	114.53	19.11	6.74	93.26	0.375"	fine gravel
#4	114.88	19.46	6.87	93.13	#4	coarse sand
#10	115.94	20.52	7.24	92.76	#10	medium sand
#20	117.33	21.91	7.73	92.27	#20	medium sand
#40	125.48	30.06	10.61	89.39	#40	fine sand
#60	243.48	148.06	52.25	47.75	#60	fine sand
#100	368.78	273.36	96.48	3.52	#100	fine sand
#200	372.90	277.48	97.93	2.07	#200	fines

% C GRAVEL	6.22		
% F GRAVEL	0.65	LL	-
% C SAND	0.37	PL	-
% M SAND	3.37	PI	-
% F SAND	87.32	Gs	-
% FINES	2.07		
% TOTAL	100.00		

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

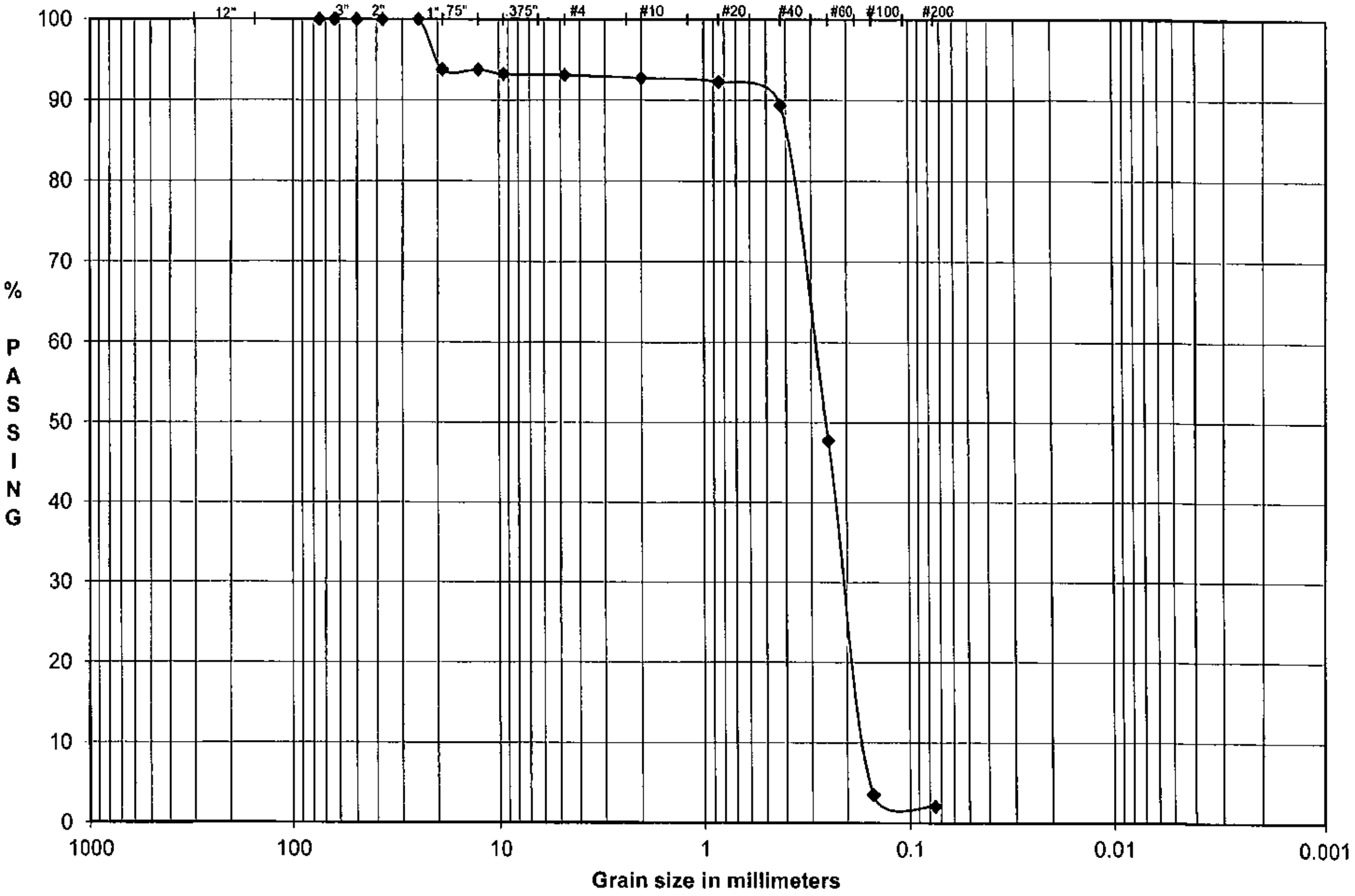
> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

DESCRIPTION Pale Brown, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	6.22	0.65	0.37	3.37	87.32	2.07

SAMPLE ID BH-4
SAMPLE TYPE JAR
SAMPLE DEPTH 1.0'-2.5'

LL -
PL -
PI -

DESCRIPTION Pale Brown, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-4
SAMPLE TYPE: JAR
SAMPLE DEPTH: 8.5'-10.0'

DESCRIPTION: Gray, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.11
Weight of Dry Soil & Tare	33.88
Weight of Tare	13.87
Weight of Water	1.23
Weight of Dry Soil	20.01
Water Content	6.15%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-4
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	8.5'-10.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.11
Wt Dry Soil & Tare (gm)	(w2)	33.88
Weight of Tare (gm)	(w3)	13.87
Weight of Water (gm)	(w4=w1-w2)	1.23
Weight of Dry Soil (gm)	(w5=w2-w3)	20.01
Moisture Content (%)	(w4/w5)*100	6.15

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	21.30
Dry Soil & Tare (gm)	21.26
Tare Weight (gm)	10.96
Moisture Content (%)	0.39

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	340.55
Tare Weight (gm)	97.18
(W6) Total Dry Weight (gm)	242.43

SIEVE ANALYSIS

Tare Weight: 97.42

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.42	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.42	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.42	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.42	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.42	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	97.42	0.00	0.00	100.00	0.75"	fine gravel
0.50"	101.02	3.60	1.48	98.52	0.50"	fine gravel
0.375"	103.06	5.64	2.33	97.67	0.375"	fine gravel
#4	103.73	6.31	2.60	97.40	#4	coarse sand
#10	104.57	7.15	2.95	97.05	#10	medium sand
#20	105.33	7.91	3.26	96.74	#20	medium sand
#40	110.55	13.13	5.42	94.58	#40	fine sand
#60	217.16	119.74	49.39	50.61	#60	fine sand
#100	329.35	231.93	95.67	4.33	#100	fine sand
#200	334.59	237.17	97.83	2.17	#200	fines

% C GRAVEL	0.00
% F GRAVEL	2.60
% C SAND	0.35
% M SAND	2.47
% F SAND	92.41
% FINES	2.17
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

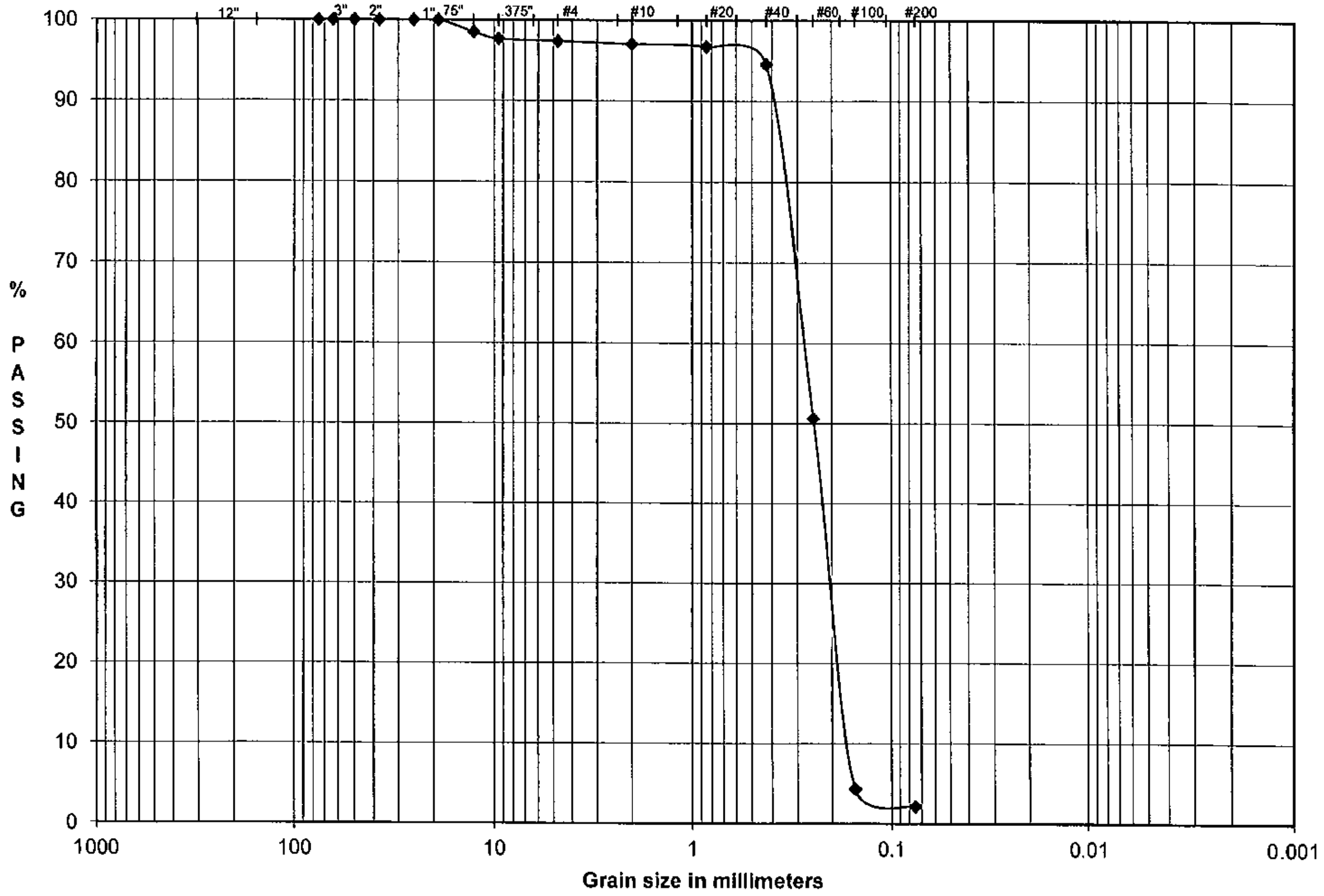
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Gray, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BJT

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	2.60	0.35	2.47	92.41	2.17

SAMPLE ID	BH-4
SAMPLE TYPE	JAR
SAMPLE DEPTH	8.5'-10.0'

LL	-
PL	-
PI	-

DESCRIPTION Gray, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME:	NIPSCO-MCGS
PROJECT NUMBER:	123-88898

SAMPLE ID:	BH-4
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	13.5'-15.0'

DESCRIPTION:	Pale Brown, POORLY GRADED SAND, trace fines
USCS:	SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.59
Weight of Dry Soil & Tare	35.82
Weight of Tare	13.74
Weight of Water	0.77
Weight of Dry Soil	22.08
Water Content	3.49%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-4
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.59
Wt Dry Soil & Tare (gm)	(w2)	35.82
Weight of Tare (gm)	(w3)	13.74
Weight of Water (gm)	(w4=w1-w2)	0.77
Weight of Dry Soil (gm)	(w5=w2-w3)	22.08
Moisture Content (%)	(w4/w5)*100	3.49

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	29.61
Dry Soil & Tare (gm)	29.60
Tare Weight (gm)	13.72
Moisture Content (%)	0.06

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	361.69
	Tare Weight (gm)	95.06
(W6)	Total Dry Weight (gm)	266.46

SIEVE ANALYSIS

Tare Weight

95.10

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.10	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.10	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.10	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.10	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.10	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.10	0.00	0.00	100.00	0.75"	fine gravel
0.50"	95.10	0.00	0.00	100.00	0.50"	fine gravel
0.375"	95.10	0.00	0.00	100.00	0.375"	fine gravel
#4	95.10	0.00	0.00	100.00	#4	coarse sand
#10	95.10	0.00	0.00	100.00	#10	medium sand
#20	95.20	0.10	0.04	99.96	#20	medium sand
#40	98.29	3.19	1.20	98.80	#40	fine sand
#60	240.03	144.93	54.39	45.61	#60	fine sand
#100	358.97	263.87	99.03	0.97	#100	fine sand
#200	361.34	266.24	99.92	0.08	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.00
% M SAND	1.20
% F SAND	98.72
% FINES	0.08
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

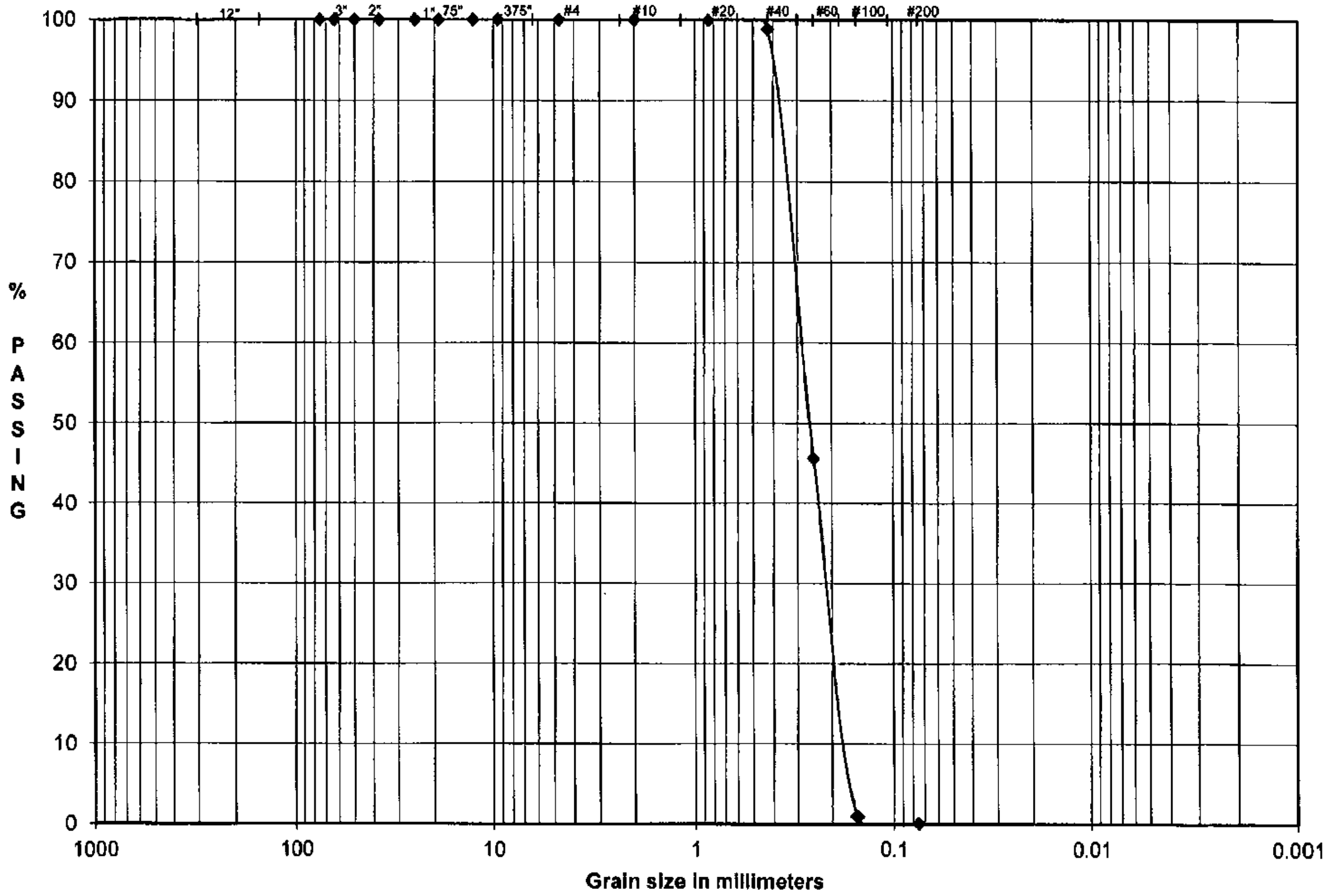
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.00	1.20	98.72	0.08

SAMPLE ID	BH-4
SAMPLE TYPE	JAR
SAMPLE DEPTH	13.5'-15.0'

LL	-
PL	-
PI	-

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	B.ST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-4
SAMPLE TYPE: JAR
SAMPLE DEPTH: 33.5'-35.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND, little gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	39.08
Weight of Dry Soil & Tare	34.43
Weight of Tare	13.92
Weight of Water	4.65
Weight of Dry Soil	20.51
Water Content	22.67%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-4
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	33.5'-35.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	39.08
Wt Dry Soil & Tare (gm)	(w2)	34.43
Weight of Tare (gm)	(w3)	13.92
Weight of Water (gm)	(w4=w1-w2)	4.65
Weight of Dry Soil (gm)	(w5=w2-w3)	20.51
Moisture Content (%)	(w4/w5)*100	22.67

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.93
Dry Soil & Tare (gm)	35.77
Tare Weight (gm)	14.08
Moisture Content (%)	0.74

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	379.84
Tare Weight (gm)	97.03
(W6) Total Dry Weight (gm)	280.74

SIEVE ANALYSIS

Tare Weight

97.16

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.16	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.16	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.16	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.16	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.16	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	97.16	0.00	0.00	100.00	0.75"	fine gravel
0.50"	107.79	10.63	3.79	96.21	0.50"	fine gravel
0.375"	112.74	15.58	5.55	94.45	0.375"	fine gravel
#4	118.85	21.69	7.73	92.27	#4	coarse sand
#10	128.64	31.48	11.21	88.79	#10	medium sand
#20	149.70	52.54	18.71	81.29	#20	medium sand
#40	197.19	100.03	35.63	64.37	#40	fine sand
#60	328.54	231.38	82.42	17.58	#60	fine sand
#100	363.85	266.69	95.00	5.00	#100	fine sand
#200	367.47	270.31	96.29	3.71	#200	fines

% C GRAVEL	0.00
% F GRAVEL	7.73
% C SAND	3.49
% M SAND	24.42
% F SAND	60.65
% FINES	3.71
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

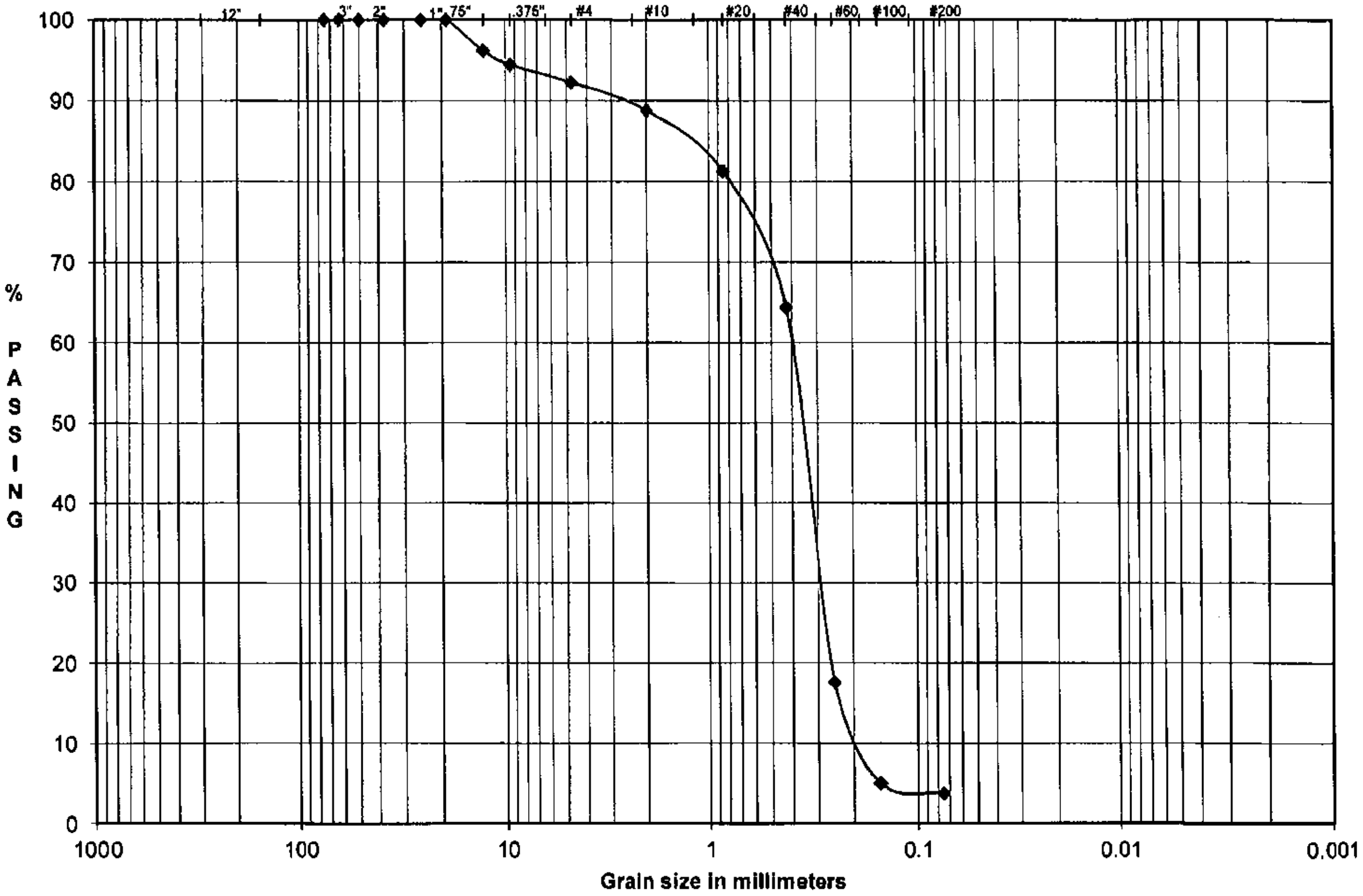
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	7.73	3.49	24.42	60.65	3.71

SAMPLE ID BH-4
SAMPLE TYPE JAR
SAMPLE DEPTH 33.5'-35.0'

LL -
PL -
PI -

DESCRIPTION Light Gray, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-5
SAMPLE TYPE: JAR
SAMPLE DEPTH: 6.0'-7.5'

DESCRIPTION: Light Gray, POORLY GRADED SAND, little gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.37
Weight of Dry Soil & Tare	35.47
Weight of Tare	14.10
Weight of Water	0.90
Weight of Dry Soil	21.37
Water Content	4.21%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	6.0'-7.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.37
Wt Dry Soil & Tare (gm)	(w2)	35.47
Weight of Tare (gm)	(w3)	14.10
Weight of Water (gm)	(w4=w1-w2)	0.90
Weight of Dry Soil (gm)	(w5=w2-w3)	21.37
Moisture Content (%)	(w4/w5)*100	4.21

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	29.47
Dry Soil & Tare (gm)	29.45
Tare Weight (gm)	14.02
Moisture Content (%)	0.13

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	346.33
	Tare Weight (gm)	95.92
(W6)	Total Dry Weight (gm)	250.09

SIEVE ANALYSIS

Tare Weight
96.04

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.04	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.04	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.04	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.04	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.04	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	112.90	16.86	6.74	93.26	0.75"	fine gravel
0.50"	112.90	16.86	6.74	93.26	0.50"	fine gravel
0.375"	114.73	18.69	7.47	92.53	0.375"	fine gravel
#4	117.51	21.47	8.59	91.41	#4	coarse sand
#10	122.24	26.20	10.48	89.52	#10	medium sand
#20	128.21	32.17	12.86	87.14	#20	medium sand
#40	140.54	44.50	17.79	82.21	#40	fine sand
#60	252.22	156.18	62.45	37.55	#60	fine sand
#100	336.23	240.19	96.04	3.96	#100	fine sand
#200	339.34	243.30	97.29	2.71	#200	fines

% C GRAVEL	6.74
% F GRAVEL	1.84
% C SAND	1.89
% M SAND	7.32
% F SAND	79.49
% FINES	2.71
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

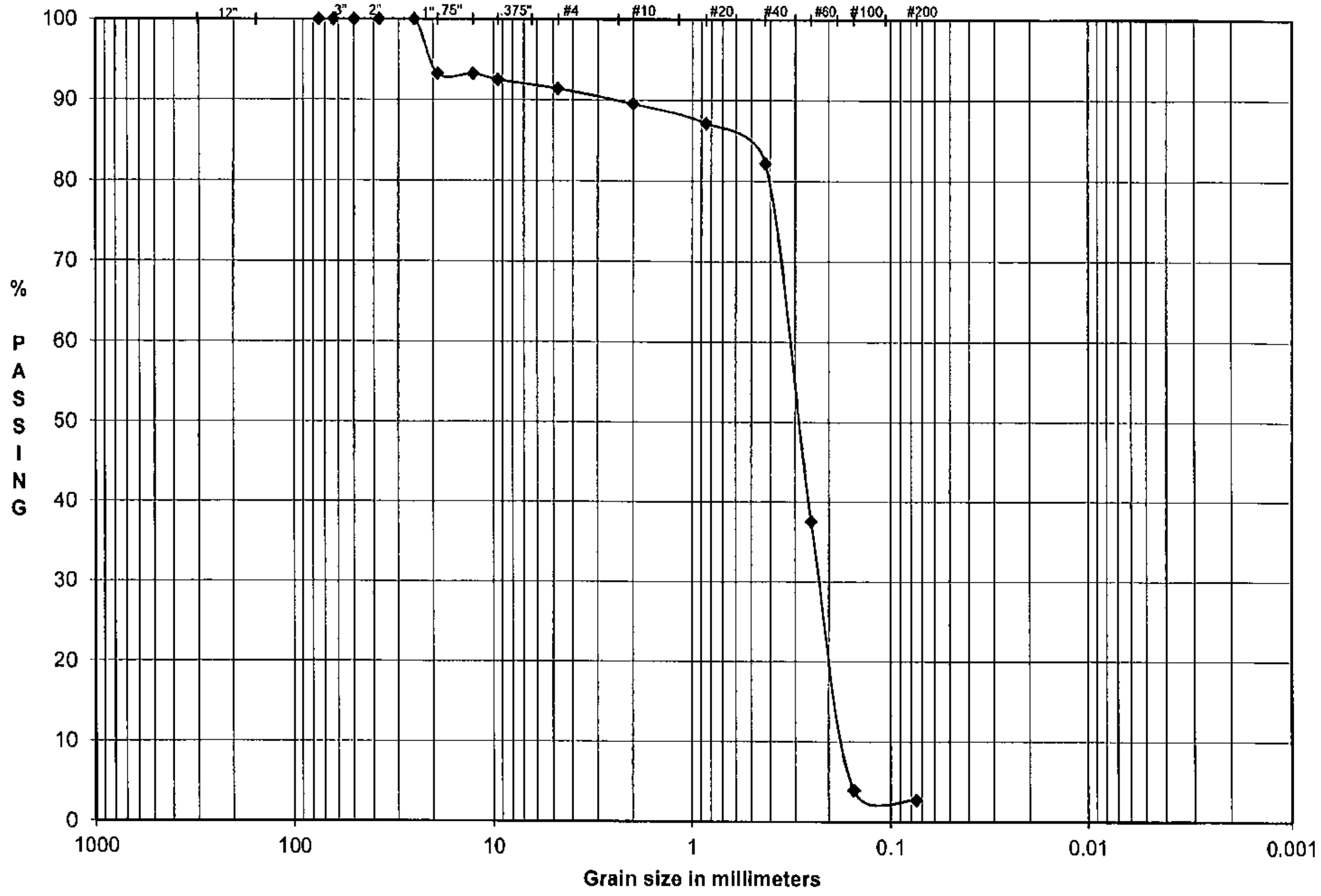
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	6.74	1.84	1.89	7.32	79.49	2.71

SAMPLE ID	BH-5
SAMPLE TYPE	JAR
SAMPLE DEPTH	6.0'-7.5'

LL	-
PL	-
PI	-

DESCRIPTION Light Gray, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSJ

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-5
SAMPLE TYPE: JAR
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Very Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.87
Weight of Dry Soil & Tare	35.82
Weight of Tare	14.15
Weight of Water	1.05
Weight of Dry Soil	21.67
Water Content	4.85%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.87
Wt Dry Soil & Tare (gm)	(w2)	35.82
Weight of Tare (gm)	(w3)	14.15
Weight of Water (gm)	(w4=w1-w2)	1.05
Weight of Dry Soil (gm)	(w5=w2-w3)	21.67
Moisture Content (%)	(w4/w5)*100	4.85

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	30.41
Dry Soil & Tare (gm)	30.38
Tare Weight (gm)	14.05
Moisture Content (%)	0.18

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	383.35
Tare Weight (gm)	96.39
(W6) Total Dry Weight (gm)	286.43

SIEVE ANALYSIS

Tare Weight

96.45

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) ((wt ret/w6)*100)	% PASS (100-%ret)	SIEVE	
3.0"	96.45	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.45	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.45	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.45	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.45	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.45	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.45	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.45	0.00	0.00	100.00	0.375"	fine gravel
#4	97.52	1.07	0.37	99.63	#4	coarse sand
#10	107.00	10.55	3.68	96.32	#10	medium sand
#20	117.79	21.34	7.45	92.55	#20	medium sand
#40	133.96	37.51	13.10	86.90	#40	fine sand
#60	300.81	204.36	71.35	28.65	#60	fine sand
#100	374.07	277.62	96.92	3.08	#100	fine sand
#200	376.26	279.81	97.69	2.31	#200	fines

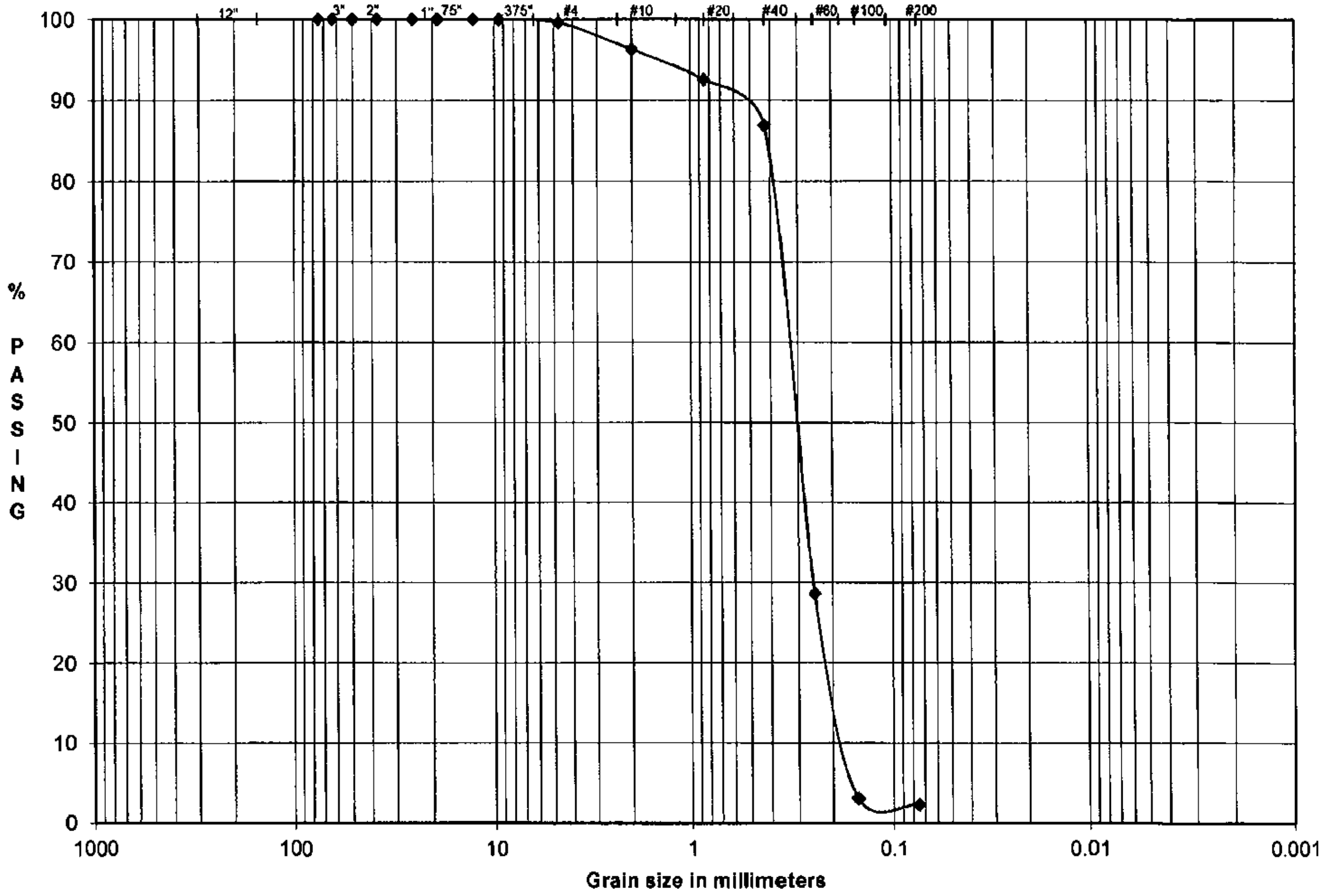
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	0.37	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	3.31	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	9.41	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	84.59	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	2.31			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Very Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.37	3.31	9.41	84.59	2.31

SAMPLE ID	BH-5	**LL**	-
SAMPLE TYPE	JAR	**PL**	-
SAMPLE DEPTH	13.5'-15.0'	**PI**	-

DESCRIPTION Very Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME:	NIPSCO-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-5
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	23.5'-25.0'
DESCRIPTION:	Pale Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL
USCS:	SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.65
Weight of Dry Soil & Tare	33.70
Weight of Tare	14.09
Weight of Water	3.95
Weight of Dry Soil	19.61
Water Content	20.14%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	23.5'-25.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.65
Wt Dry Soil & Tare (gm)	(w2)	33.70
Weight of Tare (gm)	(w3)	14.09
Weight of Water (gm)	(w4=w1-w2)	3.95
Weight of Dry Soil (gm)	(w5=w2-w3)	19.61
Moisture Content (%)	(w4/w5)*100	20.14

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	28.61
Dry Soil & Tare (gm)	28.47
Tare Weight (gm)	14.03
Moisture Content (%)	0.97

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	303.61
	Tare Weight (gm)	96.61
(W6)	Total Dry Weight (gm)	205.01

SIEVE ANALYSIS

Tare Weight

96.84

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.84	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.84	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.84	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.84	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.84	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.84	0.00	0.00	100.00	0.75"	fine gravel
0.50"	123.12	26.28	12.82	87.18	0.50"	fine gravel
0.375"	125.42	28.58	13.94	86.06	0.375"	fine gravel
#4	128.75	31.91	15.56	84.44	#4	coarse sand
#10	132.26	35.42	17.28	82.72	#10	medium sand
#20	136.08	39.24	19.14	80.86	#20	medium sand
#40	146.50	49.66	24.22	75.78	#40	fine sand
#60	205.52	108.68	53.01	46.99	#60	fine sand
#100	279.68	182.84	89.18	10.82	#100	fine sand
#200	290.56	193.72	94.49	5.51	#200	fines

% C GRAVEL	0.00		
% F GRAVEL	15.56		
% C SAND	1.71		
% M SAND	6.95		
% F SAND	70.27		
% FINES	5.51		
% TOTAL	100.00		

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

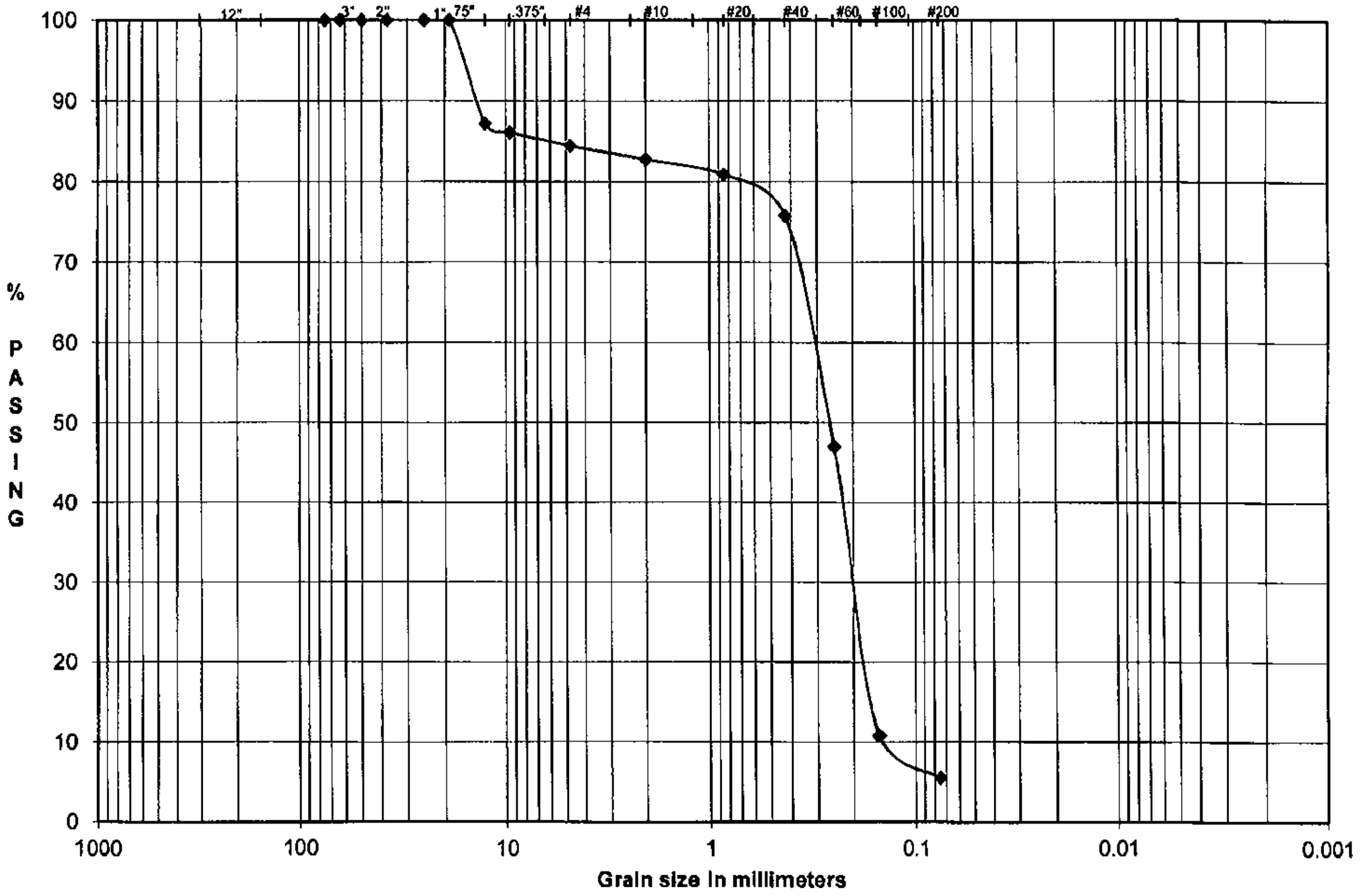
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Pale Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	15.56	1.71	6.95	70.27	5.51

SAMPLE ID	BH-5	**LL**	-
SAMPLE TYPE	JAR	**PL**	-
SAMPLE DEPTH	23.5'-25.0'	**PI**	-

DESCRIPTION Pale Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-5
SAMPLE TYPE: JAR
SAMPLE DEPTH: 28.5'-30.0'

DESCRIPTION: Black, WELL GRADED SAND, trace gravel, trace fines
USCS: SW

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.89
Weight of Dry Soil & Tare	33.64
Weight of Tare	14.19
Weight of Water	3.25
Weight of Dry Soil	19.45
Water Content	16.71%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	28.5'-30.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.89
Wt Dry Soil & Tare (gm)	(w2)	33.64
Weight of Tare (gm)	(w3)	14.19
Weight of Water (gm)	(w4=w1-w2)	3.25
Weight of Dry Soil (gm)	(w5=w2-w3)	19.45
Moisture Content (%)	(w4/w5)*100	16.71

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.39
Dry Soil & Tare (gm)	35.37
Tare Weight (gm)	14.08
Moisture Content (%)	0.09

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	341.06
	Tare Weight (gm)	92.74
(W6)	Total Dry Weight (gm)	248.09

SIEVE ANALYSIS

Tare Weight

92.99

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	92.99	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	92.99	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	92.99	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	92.99	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	92.99	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	92.99	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.94	3.95	1.59	98.41	0.50"	fine gravel
0.375"	97.95	4.96	2.00	98.00	0.375"	fine gravel
#4	104.23	11.24	4.53	95.47	#4	coarse sand
#10	145.76	52.77	21.27	78.73	#10	medium sand
#20	248.40	155.41	62.64	37.36	#20	medium sand
#40	293.47	200.48	80.81	19.19	#40	fine sand
#60	313.68	220.69	88.96	11.04	#60	fine sand
#100	327.91	234.92	94.69	5.31	#100	fine sand
#200	334.51	241.52	97.35	2.65	#200	fines

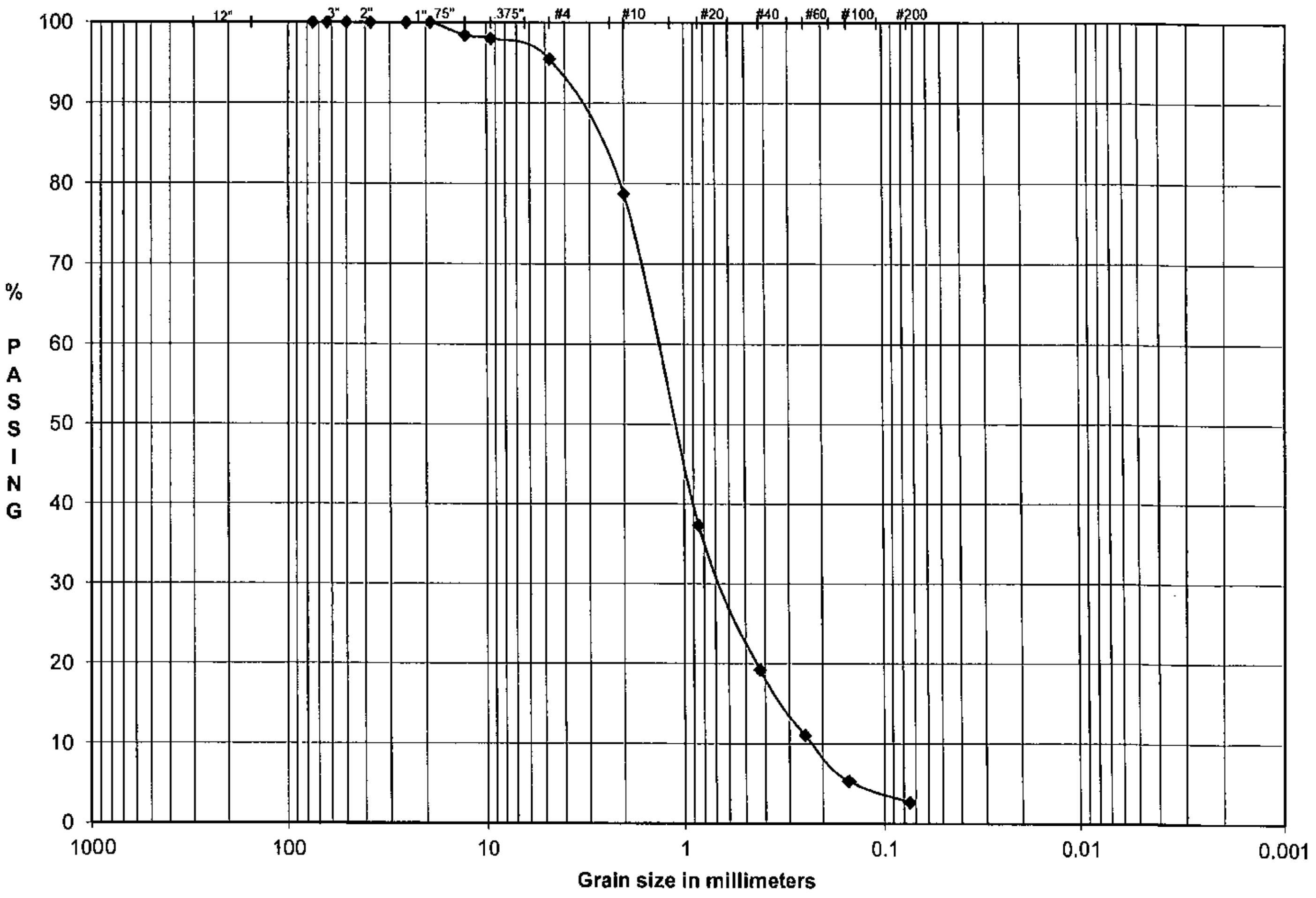
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	4.53	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	16.74	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	59.54	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	16.54	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	2.65			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Black, WELL GRADED SAND, trace gravel, trace fines

USCS SW

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	4.53	16.74	59.54	16.54	2.65

SAMPLE ID	BH-5
SAMPLE TYPE	JAR
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

DESCRIPTION Black, WELL GRADED SAND, trace gravel, trace fines

USCS SW

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BJT

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-5
SAMPLE TYPE: JAR
SAMPLE DEPTH: 33.5'-35.0'

DESCRIPTION: Light Brown, Black, POORLY GRADED SAND, little gravel, trace fines, trace organics
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.00
Weight of Dry Soil & Tare	31.25
Weight of Tare	13.99
Weight of Water	3.75
Weight of Dry Soil	17.26
Water Content	21.73%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	33.5'-35.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.00
Wt Dry Soil & Tare (gm)	(w2)	31.25
Weight of Tare (gm)	(w3)	13.99
Weight of Water (gm)	(w4=w1-w2)	3.75
Weight of Dry Soil (gm)	(w5=w2-w3)	17.26
Moisture Content (%)	(w4/w5)*100	21.73

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	30.92
Dry Soil & Tare (gm)	30.86
Tare Weight (gm)	13.92
Moisture Content (%)	0.35

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	352.71
	Tare Weight (gm)	99.55
(W6)	Total Dry Weight (gm)	252.27

SIEVE ANALYSIS

Tare Weight: 99.65

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	99.65	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	99.65	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	99.65	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	99.65	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	99.65	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	113.96	14.31	5.67	94.33	0.75"	fine gravel
0.50"	121.46	21.81	8.65	91.35	0.50"	fine gravel
0.375"	125.93	26.28	10.42	89.58	0.375"	fine gravel
#4	129.77	30.12	11.94	88.06	#4	coarse sand
#10	139.30	39.65	15.72	84.28	#10	medium sand
#20	157.07	57.42	22.76	77.24	#20	medium sand
#40	180.83	81.18	32.18	67.82	#40	fine sand
#60	279.76	180.11	71.40	28.60	#60	fine sand
#100	329.01	229.36	90.92	9.08	#100	fine sand
#200	349.31	249.66	98.97	1.03	#200	fines

% C GRAVEL	5.67
% F GRAVEL	6.27
% C SAND	3.78
% M SAND	16.46
% F SAND	66.79
% FINES	1.03
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

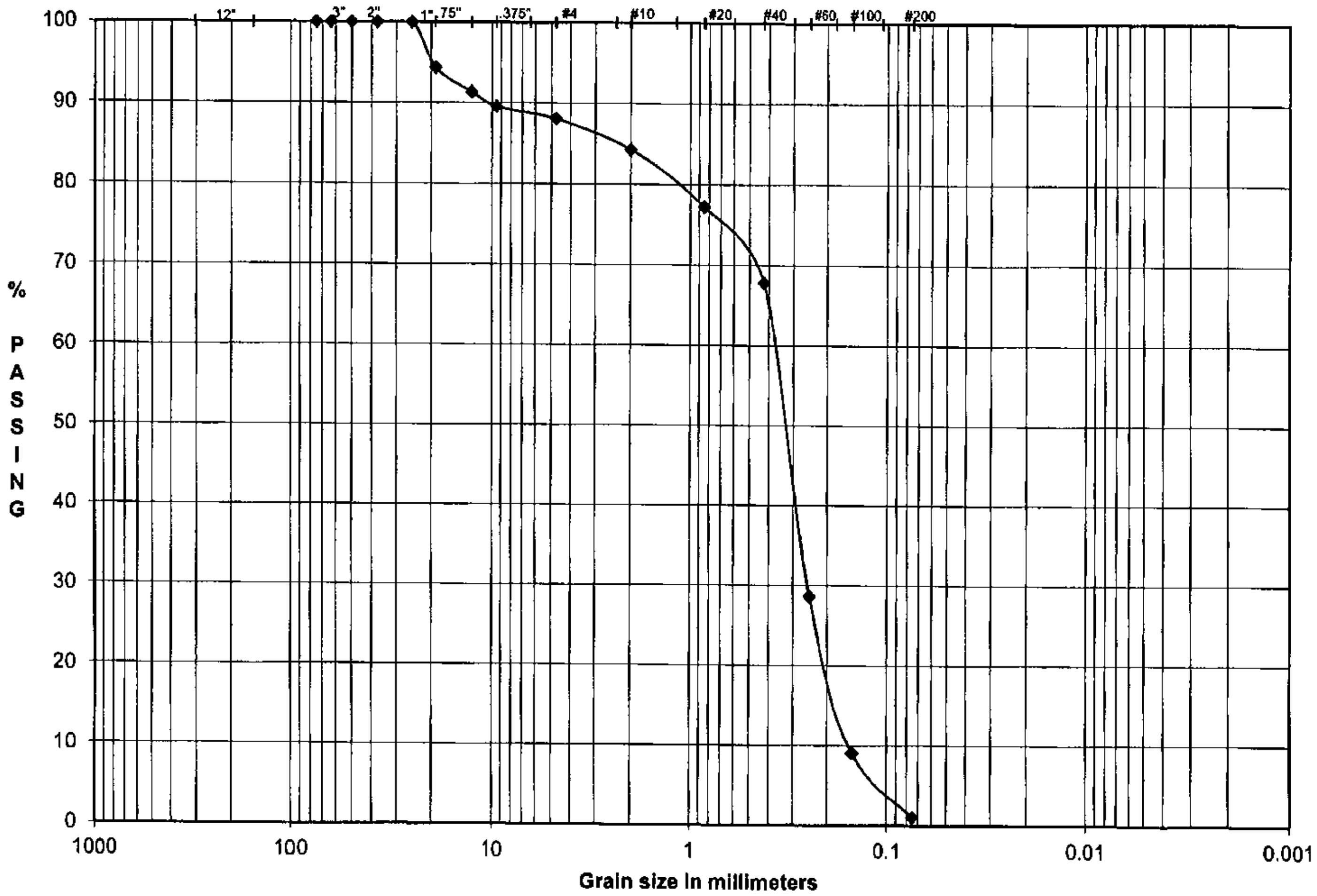
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Brown, Black, POORLY GRADED SAND, little gravel, trace fines, trace organics

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	5.67	6.27	3.78	16.46	66.79	1.03

SAMPLE ID	BH-5
SAMPLE TYPE	JAR
SAMPLE DEPTH	33.5'-35.0'

LL	-
PL	-
PI	-

DESCRIPTION	Light Brown, Black, POORLY GRADED SAND, little gravel, trace fines, trace organics
USCS	SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-5
SAMPLE TYPE: JAR
SAMPLE DEPTH: 48.5'-50.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH SILTY CLAY, trace gravel
USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.95
Weight of Dry Soil & Tare	32.01
Weight of Tare	14.16
Weight of Water	3.94
Weight of Dry Soil	17.85
Water Content	22.07%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	BS
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-5
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	48.5'-50.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.95
Wt Dry Soil & Tare (gm)	(w2)	32.01
Weight of Tare (gm)	(w3)	14.16
Weight of Water (gm)	(w4=w1-w2)	3.94
Weight of Dry Soil (gm)	(w5=w2-w3)	17.85
Moisture Content (%)	(w4/w5)*100	22.07

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	37.07
Dry Soil & Tare (gm)	36.98
Tare Weight (gm)	14.18
Moisture Content (%)	0.39

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	316.77
	Tare Weight (gm)	82.34
(W6)	Total Dry Weight (gm)	233.51

SIEVE ANALYSIS

Tare Weight

82.38

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	82.38	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	82.38	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	82.38	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	82.38	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	82.38	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	82.38	0.00	0.00	100.00	0.75"	fine gravel
0.50"	82.38	0.00	0.00	100.00	0.50"	fine gravel
0.375"	82.38	0.00	0.00	100.00	0.375"	fine gravel
#4	83.82	1.44	0.62	99.38	#4	coarse sand
#10	85.00	2.62	1.12	98.88	#10	medium sand
#20	85.46	3.08	1.32	98.68	#20	medium sand
#40	86.35	3.97	1.70	98.30	#40	fine sand
#60	113.32	30.94	13.25	86.75	#60	fine sand
#100	251.56	169.18	72.45	27.55	#100	fine sand
#200	298.61	216.23	92.60	7.40	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.62
% C SAND	0.51
% M SAND	0.58
% F SAND	90.90
% FINES	7.40
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

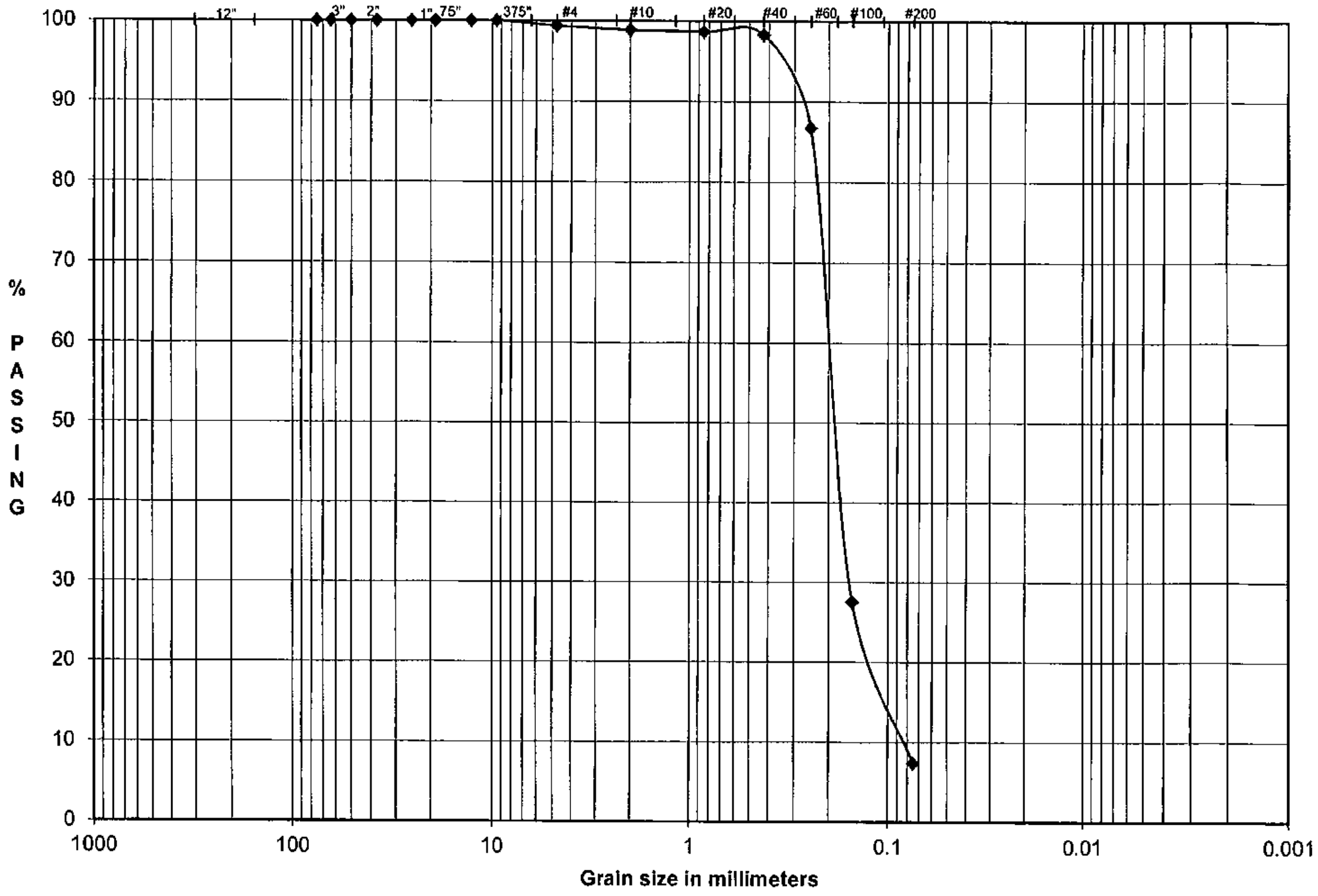
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, trace gravel

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		% Passing					
		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.62	0.51	0.58	90.90	7.40

SAMPLE ID	BH-5
SAMPLE TYPE	JAR
SAMPLE DEPTH	48.5'-50.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, trace gravel

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 3.5'-5.0'

DESCRIPTION: Light Brown, POORLY GRADED SAND, trace fines

USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.17
Weight of Dry Soil & Tare	35.49
Weight of Tare	14.06
Weight of Water	0.68
Weight of Dry Soil	21.43
Water Content	3.17%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-6
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	3.5'-5.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.17
Wt Dry Soil & Tare (gm)	(w2)	35.49
Weight of Tare (gm)	(w3)	14.06
Weight of Water (gm)	(w4=w1-w2)	0.68
Weight of Dry Soil (gm)	(w5=w2-w3)	21.43
Moisture Content (%)	(w4/w5)*100	3.17

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	32.16
Dry Soil & Tare (gm)	32.14
Tare Weight (gm)	10.89
Moisture Content (%)	0.09

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	367.18
	Tare Weight (gm)	95.69
(W6)	Total Dry Weight (gm)	271.23

SIEVE ANALYSIS

Tare Weight

95.77

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.77	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.77	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.77	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.77	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.77	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.77	0.00	0.00	100.00	0.75"	fine gravel
0.50"	95.77	0.00	0.00	100.00	0.50"	fine gravel
0.375"	95.77	0.00	0.00	100.00	0.375"	fine gravel
#4	95.77	0.00	0.00	100.00	#4	coarse sand
#10	95.77	0.00	0.00	100.00	#10	medium sand
#20	95.98	0.21	0.08	99.92	#20	medium sand
#40	100.98	5.21	1.92	98.08	#40	fine sand
#60	237.70	141.93	52.33	47.67	#60	fine sand
#100	363.10	267.33	98.56	1.44	#100	fine sand
#200	365.94	270.17	99.61	0.39	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.00
% M SAND	1.92
% F SAND	97.69
% FINES	0.39
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

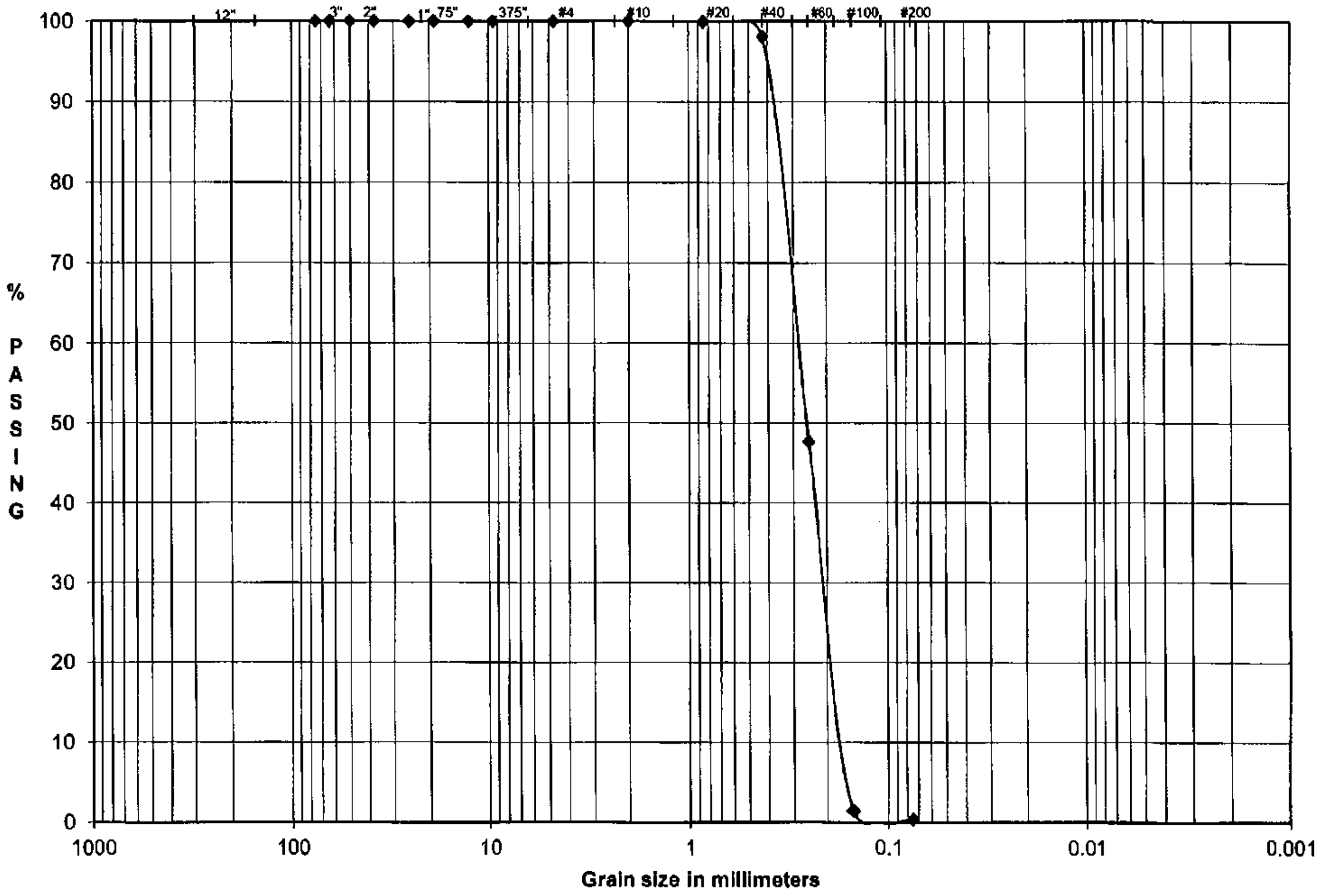
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Brown, POORLY GRADED SAND, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		% Passing					
		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.00	1.92	97.69	0.39

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	3.5'-5.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Brown, POORLY GRADED SAND, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSt

Template For Sand Grain-size and Perm

Global Information: PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 18.5'-20.0'

DESCRIPTION: Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.22
Weight of Dry Soil & Tare	31.28
Weight of Tare	14.14
Weight of Water	3.94
Weight of Dry Soil	17.14
Water Content	22.99%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	DST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-6
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	18.5'-20.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.22
Wt Dry Soil & Tare (gm)	(w2)	31.28
Weight of Tare (gm)	(w3)	14.14
Weight of Water (gm)	(w4=w1-w2)	3.94
Weight of Dry Soil (gm)	(w5=w2-w3)	17.14
Moisture Content (%)	(w4/w5)*100	22.99

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.43
Dry Soil & Tare (gm)	35.36
Tare Weight (gm)	13.98
Moisture Content (%)	0.33

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	346.68
	Tare Weight (gm)	99.85
(W6)	Total Dry Weight (gm)	246.02

SIEVE ANALYSIS

Tare Weight

99.92

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	99.92	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	99.92	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	99.92	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	99.92	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	99.92	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	99.92	0.00	0.00	100.00	0.75"	fine gravel
0.50"	99.92	0.00	0.00	100.00	0.50"	fine gravel
0.375"	99.92	0.00	0.00	100.00	0.375"	fine gravel
#4	101.86	1.94	0.79	99.21	#4	coarse sand
#10	103.05	3.13	1.27	98.73	#10	medium sand
#20	104.81	4.89	1.99	98.01	#20	medium sand
#40	112.72	12.80	5.20	94.80	#40	fine sand
#60	219.52	119.60	48.61	51.39	#60	fine sand
#100	337.96	238.04	96.75	3.25	#100	fine sand
#200	341.30	241.38	98.11	1.89	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.79
% C SAND	0.48
% M SAND	3.93
% F SAND	92.91
% FINES	1.89
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

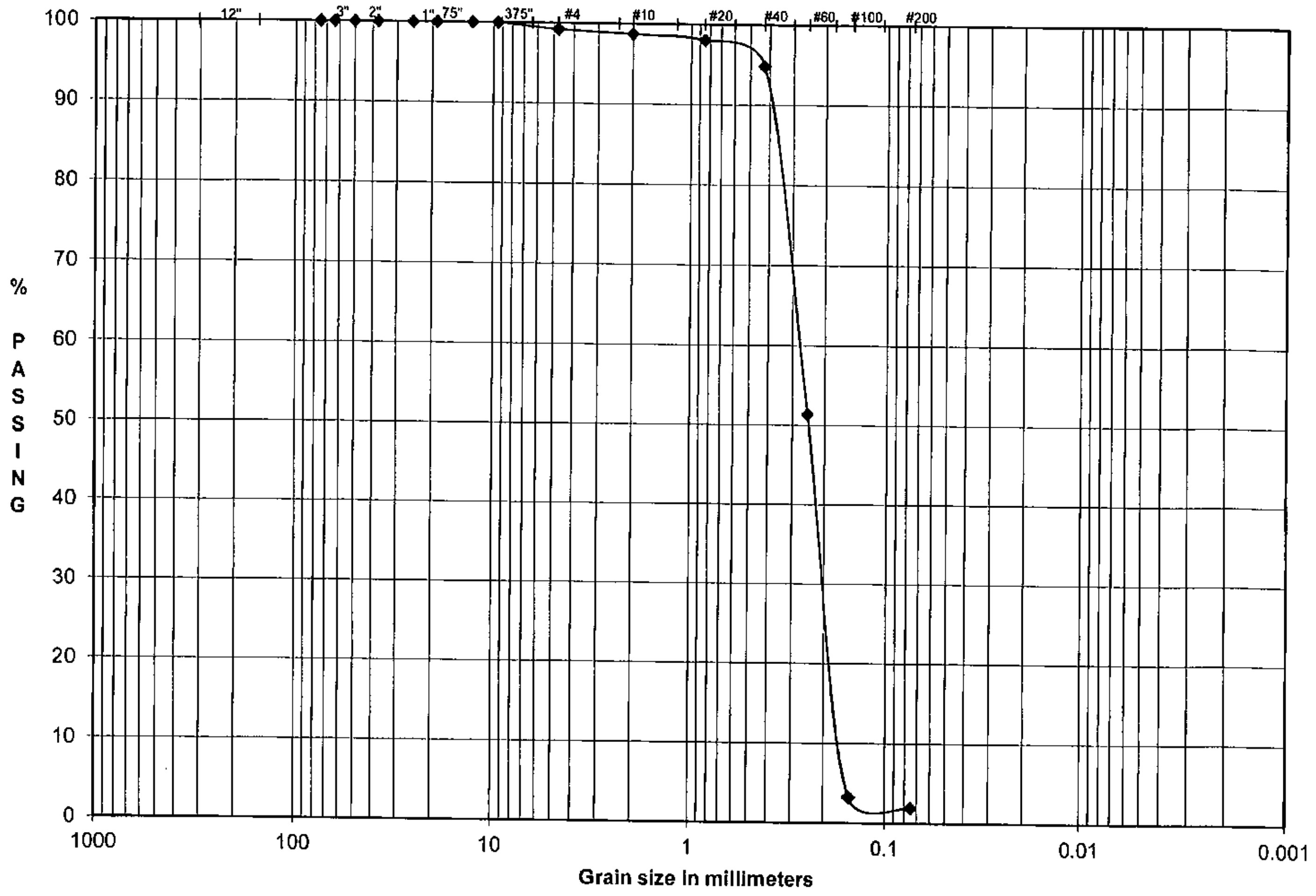
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W,
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	0.79	0.48	3.93	92.91	1.89

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	18.5'-20.0'

LL	-
PL	-
PI	-

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME:	NIPSCO-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-6
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	28.5'-30.0'
DESCRIPTION:	Light Gray, POORLY GRADED SAND, trace fines
USCS:	SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.38
Weight of Dry Soil & Tare	31.43
Weight of Tare	13.98
Weight of Water	3.95
Weight of Dry Soil	17.45
Water Content	22.64%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D. W.
REVIEW	BSV

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS
PROJECT NO.	123-88898
REMARKS	

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	28.5'-30.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.38
Wt Dry Soil & Tare (gm)	(w2)	31.43
Weight of Tare (gm)	(w3)	13.98
Weight of Water (gm)	(w4=w1-w2)	3.95
Weight of Dry Soil (gm)	(w5=w2-w3)	17.45
Moisture Content (%)	(w4/w5)*100	22.64

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	29.62
Dry Soil & Tare (gm)	29.60
Tare Weight (gm)	14.08
Moisture Content (%)	0.13

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	347.64
	Tare Weight (gm)	96.50
(W6)	Total Dry Weight (gm)	250.82

SIEVE ANALYSIS

Tare Weight: 96.79

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.79	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.79	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.79	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.79	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.79	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.79	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.79	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.79	0.00	0.00	100.00	0.375"	fine gravel
#4	96.79	0.00	0.00	100.00	#4	coarse sand
#10	97.26	0.47	0.19	99.81	#10	medium sand
#20	98.10	1.31	0.52	99.48	#20	medium sand
#40	106.23	9.44	3.76	96.24	#40	fine sand
#60	210.03	113.24	45.15	54.85	#60	fine sand
#100	336.91	240.12	95.74	4.26	#100	fine sand
#200	344.04	247.25	98.58	1.42	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.19
% M SAND	3.58
% F SAND	94.81
% FINES	1.42
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

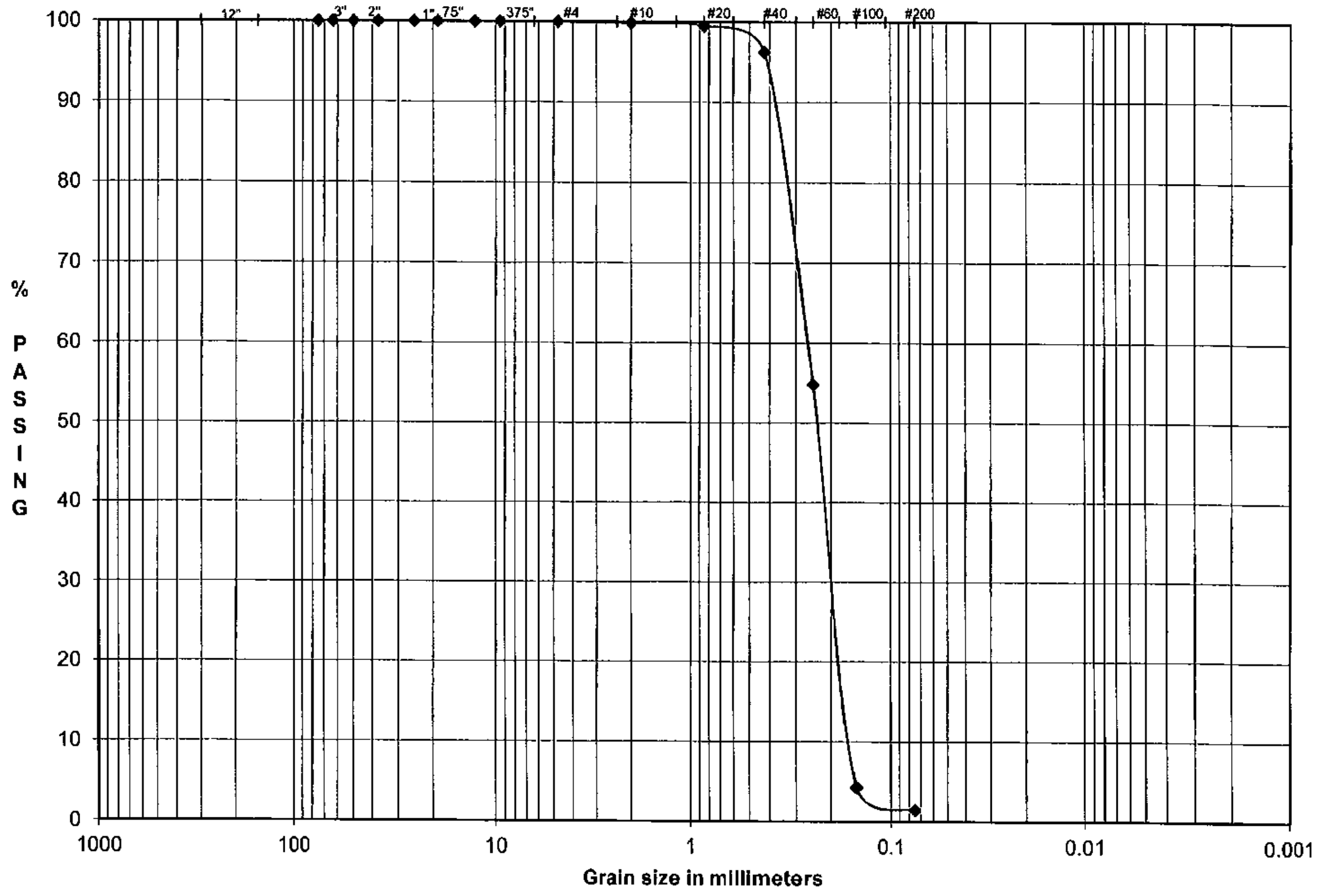
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.19	3.58	94.81	1.42

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

DESCRIPTION	Light Gray, POORLY GRADED SAND, trace fines
USCS	SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 33.5'-35.0'

DESCRIPTION: Light Brown, POORLY GRADED SAND WITH SILTY CLAY, trace gravel, trace organics

USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	38.23
Weight of Dry Soil & Tare	31.67
Weight of Tare	14.34
Weight of Water	6.56
Weight of Dry Soil	17.33
Water Content	37.85%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS
PROJECT NO.	123-88898
REMARKS	

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	33.5'-35.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	38.23
Wt Dry Soil & Tare (gm)	(w2)	31.67
Weight of Tare (gm)	(w3)	14.34
Weight of Water (gm)	(w4=w1-w2)	6.56
Weight of Dry Soil (gm)	(w5=w2-w3)	17.33
Moisture Content (%)	(w4/w5)*100	37.85

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	30.32
Dry Soil & Tare (gm)	28.84
Tare Weight (gm)	14.06
Moisture Content (%)	10.01

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	342.69
	Tare Weight (gm)	96.55
(W6)	Total Dry Weight (gm)	223.73

SIEVE ANALYSIS

Tare Weight

96.68

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.68	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.68	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.68	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.68	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.68	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.68	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.68	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.68	0.00	0.00	100.00	0.375"	fine gravel
#4	98.83	2.15	0.96	99.04	#4	coarse sand
#10	102.74	6.06	2.71	97.29	#10	medium sand
#20	106.87	10.19	4.55	95.45	#20	medium sand
#40	110.55	13.87	6.20	93.80	#40	fine sand
#60	148.27	51.59	23.06	76.94	#60	fine sand
#100	275.52	178.84	79.93	20.07	#100	fine sand
#200	293.92	197.24	88.16	11.84	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.96
% C SAND	1.75
% M SAND	3.49
% F SAND	81.96
% FINES	11.84
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

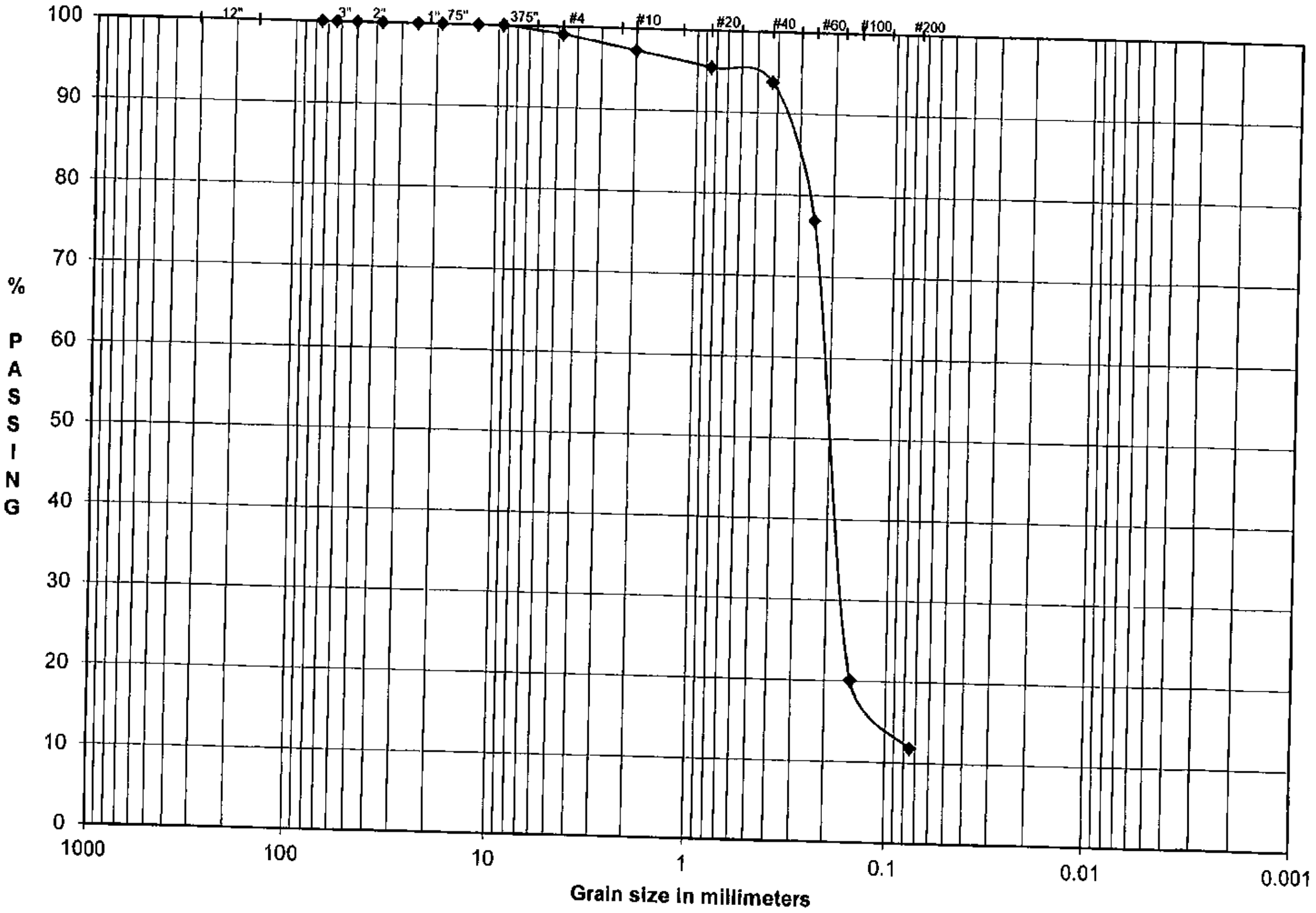
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Brown, POORLY GRADED SAND WITH SILTY CLAY, trace gravel, trace organics

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	PS
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



			% Passing				
Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	0.96	1.75	3.49	81.96	11.84

SAMPLE ID BH-6
SAMPLE TYPE JAR
SAMPLE DEPTH 33.5'-35.0'

LL -
PL -
PI -

DESCRIPTION Light Brown, POORLY GRADED SAND WITH SILTY CLAY, trace gravel, trace organics

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK
REVIEW

Golder Associates - Lansing, Michigan

BH6..33.5'-35.0'.xlsm

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-7
SAMPLE TYPE: JAR
SAMPLE DEPTH: 1.0'-2.5'

DESCRIPTION: Light Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.28
Weight of Dry Soil & Tare	34.65
Weight of Tare	13.88
Weight of Water	1.63
Weight of Dry Soil	20.77
Water Content	7.85%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.L.
REVIEW	BJT

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-7
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	1.0'-2.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.28
Wt Dry Soil & Tare (gm)	(w2)	34.65
Weight of Tare (gm)	(w3)	13.88
Weight of Water (gm)	(w4=w1-w2)	1.63
Weight of Dry Soil (gm)	(w5=w2-w3)	20.77
Moisture Content (%)	(w4/w5)*100	7.85

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.33
Dry Soil & Tare (gm)	34.19
Tare Weight (gm)	14.06
Moisture Content (%)	0.70

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	322.86
	Tare Weight (gm)	96.05
(W6)	Total Dry Weight (gm)	225.24

SIEVE ANALYSIS

Tare Weight

96.22

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.22	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.22	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.22	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.22	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.22	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	112.81	16.59	7.37	92.63	0.75"	fine gravel
0.50"	127.50	31.28	13.89	86.11	0.50"	fine gravel
0.375"	135.95	39.73	17.64	82.36	0.375"	fine gravel
#4	143.24	47.02	20.88	79.12	#4	coarse sand
#10	152.44	56.22	24.96	75.04	#10	medium sand
#20	160.95	64.73	28.74	71.26	#20	medium sand
#40	167.64	71.42	31.71	68.29	#40	fine sand
#60	195.89	99.67	44.25	55.75	#60	fine sand
#100	267.73	171.51	76.14	23.86	#100	fine sand
#200	298.60	202.38	89.85	10.15	#200	fines

% C GRAVEL	7.37
% F GRAVEL	13.51
% C SAND	4.08
% M SAND	6.75
% F SAND	58.14
% FINES	10.15
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

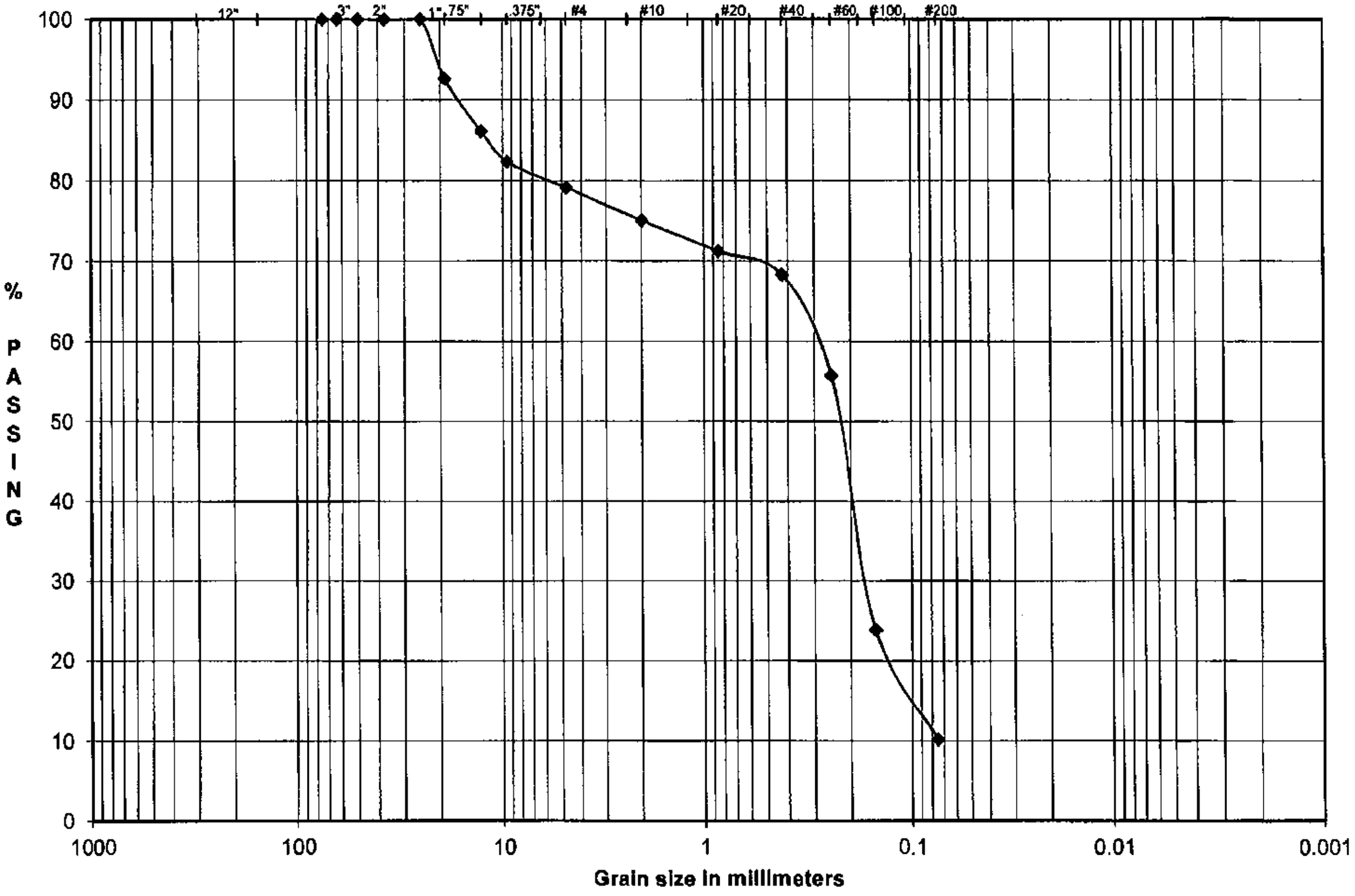
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BJT

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	7.37	13.51	4.08	6.75	58.14	10.15

SAMPLE ID BH-7
SAMPLE TYPE JAR
SAMPLE DEPTH 1.0'-2.5'

LL -
PL -
PI -

DESCRIPTION Light Brown, POORLY GRADED SAND WITH SILTY CLAY AND GRAVEL

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK DLW
REVIEW BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-7
SAMPLE TYPE: JAR
SAMPLE DEPTH: 8.5'-10.0'

DESCRIPTION: Light Brown, SILTY CLAYEY SAND, trace gravel

USCS: SC-SM*
*Classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.17
Weight of Dry Soil & Tare	35.76
Weight of Tare	14.04
Weight of Water	1.41
Weight of Dry Soil	21.72
Water Content	6.49%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	DPS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-7
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	8.5'-10.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.17
Wt Dry Soil & Tare (gm)	(w2)	35.76
Weight of Tare (gm)	(w3)	14.04
Weight of Water (gm)	(w4=w1-w2)	1.41
Weight of Dry Soil (gm)	(w5=w2-w3)	21.72
Moisture Content (%)	(w4/w5)*100	6.49

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	24.86
Dry Soil & Tare (gm)	24.84
Tare Weight (gm)	13.98
Moisture Content (%)	0.18

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	344.29
Tare Weight (gm)	95.06
(W6) Total Dry Weight (gm)	248.77

SIEVE ANALYSIS

Tare Weight

96.45

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.45	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.45	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.45	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.45	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.45	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.45	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.45	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.45	0.00	0.00	100.00	0.375"	fine gravel
#4	99.58	3.13	1.26	98.74	#4	coarse sand
#10	101.74	5.29	2.13	97.87	#10	medium sand
#20	104.55	8.10	3.26	96.74	#20	medium sand
#40	111.18	14.73	5.92	94.08	#40	fine sand
#60	214.57	118.12	47.48	52.52	#60	fine sand
#100	305.35	208.90	83.97	16.03	#100	fine sand
#200	310.84	214.39	86.18	13.82	#200	fines

% C GRAVEL	0.00
% F GRAVEL	1.26
% C SAND	0.87
% M SAND	3.79
% F SAND	80.26
% FINES	13.82
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

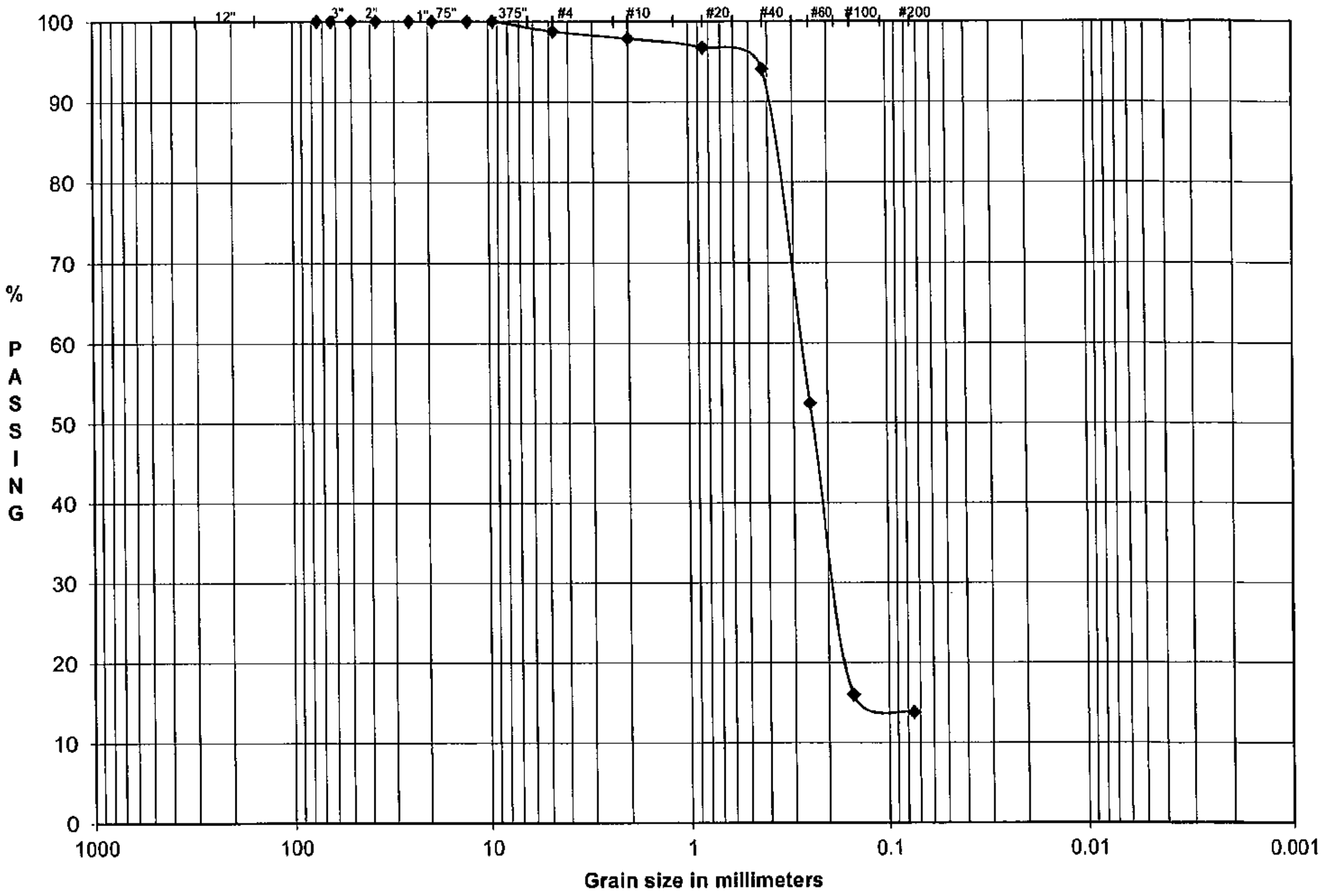
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Brown, SILTY CLAYEY SAND, trace gravel

USCS SC-SM*

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	1.26	0.87	3.79	80.26	13.82

SAMPLE ID BH-7
SAMPLE TYPE JAR
SAMPLE DEPTH 8.5'-10.0'

LL -
PL -
PI -

DESCRIPTION Light Brown, SILTY CLAYEY SAND, trace gravel

USCS SC-SM*

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK
REVIEW

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-7
SAMPLE TYPE: JAR
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Very Pale Brown, SILTY CLAYEY SAND, little gravel, trace organics
USCS: SC-SM*
*Classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.47
Weight of Dry Soil & Tare	33.23
Weight of Tare	14.06
Weight of Water	2.24
Weight of Dry Soil	19.17
Water Content	11.68%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	RS
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-7
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.47
Wt Dry Soil & Tare (gm)	(w2)	33.23
Weight of Tare (gm)	(w3)	14.06
Weight of Water (gm)	(w4=w1-w2)	2.24
Weight of Dry Soil (gm)	(w5=w2-w3)	19.17
Moisture Content (%)	(w4/w5)*100	11.68

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	23.75
Dry Soil & Tare (gm)	23.61
Tare Weight (gm)	11.21
Moisture Content (%)	1.13

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	386.61
Tare Weight (gm)	95.40
(W6) Total Dry Weight (gm)	287.96

SIEVE ANALYSIS

Tare Weight

95.58

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.58	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.58	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.58	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.58	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.58	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.58	0.00	0.00	100.00	0.75"	fine gravel
0.50"	103.39	7.81	2.71	97.29	0.50"	fine gravel
0.375"	110.51	14.93	5.18	94.82	0.375"	fine gravel
#4	113.97	18.39	6.39	93.61	#4	coarse sand
#10	124.60	29.02	10.08	89.92	#10	medium sand
#20	139.02	43.44	15.09	84.91	#20	medium sand
#40	152.97	57.39	19.93	80.07	#40	fine sand
#60	233.66	138.08	47.95	52.05	#60	fine sand
#100	337.21	241.63	83.91	16.09	#100	fine sand
#200	343.77	248.19	86.19	13.81	#200	fines

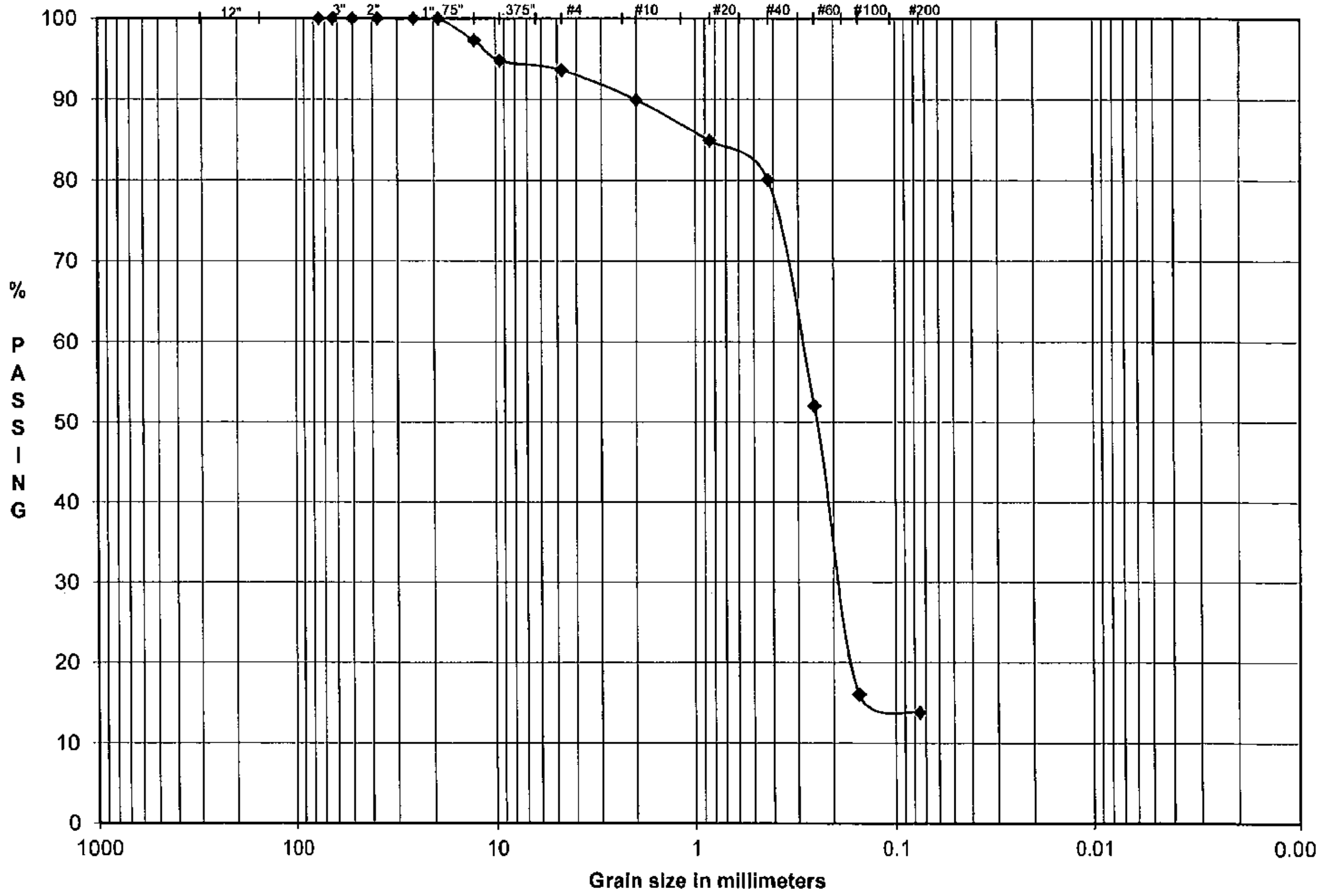
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	6.39	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	3.69	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	9.85	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	66.26	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	13.81			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Very Pale Brown, SILTY CLAYEY SAND, little gravel, trace organics

USCS SC-SM*

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	6.39	3.69	9.85	66.26	13.81

SAMPLE ID BH-7
SAMPLE TYPE JAR
SAMPLE DEPTH 13.5'-15.0'

LL -
PL -
PI -

DESCRIPTION Very Pale Brown, SILTY CLAYEY SAND, little gravel, trace organics

USCS SC-SM*

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK
REVIEW

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-7
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	23.5'-25.0'
DESCRIPTION:	Dark Grayish Brown, SILTY SAND, trace gravel
USCS:	SM

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	32.24
Weight of Dry Soil & Tare	29.42
Weight of Tare	14.06
Weight of Water	2.82
Weight of Dry Soil	15.36
Water Content	18.36%

TITLE BLOCK:

TECH	CB
DATE	7/18//12
CHECK	D.W.
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-7
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	23.5'-25.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)		
Weight of Dry Soil & Tare	(W2)		
Weight of Tare	(W3)		
Weight of Water	(W4=W1-W2)		
Weight of Dry Soil	(W5=W2-W3)		
Water Content	(W4/W5)*100		

NATURAL MOISTURE

Weight of Wet Soil & Tare	32.24
Weight of Dry Soil & Tare	29.42
Weight of Tare	14.06
Weight of Water	2.82
Weight of Dry Soil	15.36
Water Content	18.36%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows				
Weight of Wet Soil & Tare	(W6)	NON	PLASTIC	
Weight of Dry Soil & Tare	(W7)			
Weight of Tare	(W8)			
Weight of Water	(W9=W6-W7)			
Weight of Dry Soil	W10=W7-W8)			
Water Content	(W9/W10)*100			

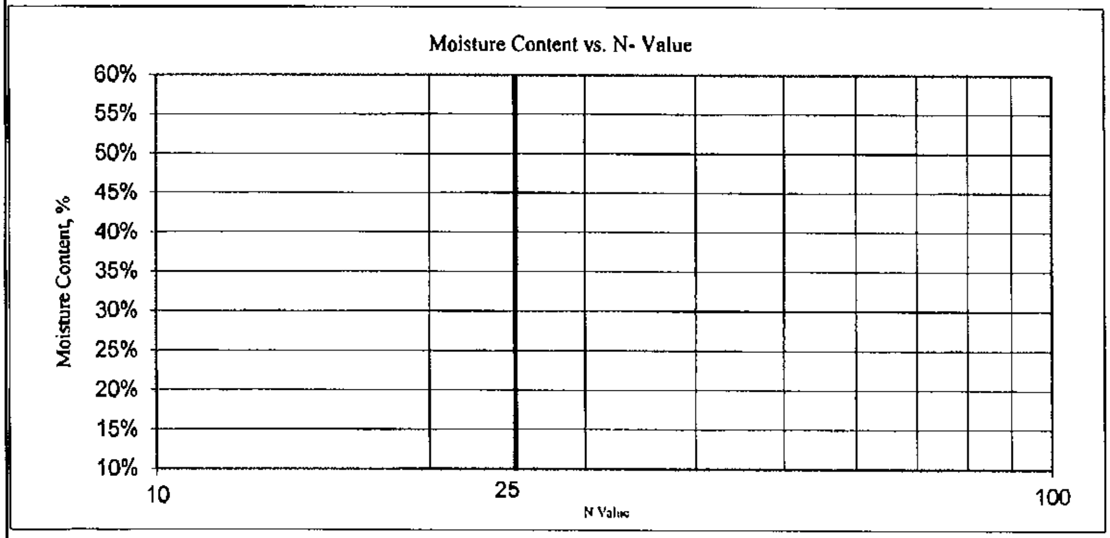
Blow	25
K - Value	1

Moisture content at 25 blow:

LIQUID LIMIT (Wl)		
PLASTIC LIMIT (Wp)		
PLASTICITY INDEX (Ip)		
LIQUIDITY INDEX (I)		
MOISTURE CONTENT		

DESCRIPTION: Dark Grayish Brown, SILTY SAND, trace gravel

USCS SM



TECH	CB
DATE	7/18//12
CHECK	D.W.
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-7
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	23.5'-25.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	32.24
Wt. Dry Soil & Tare (gm)	(W2)	29.42
Weight of Tare (gm)	(W3)	14.06
Weight of Water (gm)	(W4=W1-W2)	2.82
Weight of Dry Soil (gm)	(W5=W2-W3)	15.36
Moisture Content (%)	(W4/W5)*100	18.36%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	25.57
Dry Soil & Tare (gm)	25.54
Tare Weight (gm)	14.10
Moisture Content (%)	0.26

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	425.74	
Tare Weight (gm)	96.66	
Total Weight (gm)	328.22	(W6)

Plus #4 Material Sieve

TARE WEIGHT 14.07

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	14.07	0.0	100.0	12.0"	cobbles
3.0"	14.07	0.0	100.0	3.0"	coarse gravel
2.5"	14.07	0.0	100.0	2.5"	coarse gravel
2.0"	14.07	0.0	100.0	2.0"	coarse gravel
1.5"	14.07	0.0	100.0	1.5"	coarse gravel
1.0"	14.07	0.0	100.0	1.0"	coarse gravel
0.75"	14.07	0.0	100.0	0.75"	fine gravel
0.50"	17.07	0.9	99.1	0.50"	fine gravel
0.375"	19.27	1.6	98.4	0.375"	fine gravel
#4	25.78	3.6	96.4	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	61.80
Calculated Dry Wt. used in test (gm)	61.64
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	96.43

TARE WEIGHT 30.17

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.33	1.16	94.6	#10	medium sand
#20	33.64	3.47	91.0	#20	medium sand
#40	36.10	5.93	87.2	#40	fine sand
#60	51.01	20.84	63.8	#60	fine sand
#100	76.42	46.25	24.1	#100	fine sand
#200	78.67	48.50	20.6	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:26	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:28	2.00	18.5	21.00	0.013	5.83	12.67	13.3	1.00
7/19/2012	1:31	5.00	17.0	21.00	0.013	5.83	11.17	13.5	1.00
7/19/2012	1:41	15.00	16.0	21.00	0.013	5.83	10.17	13.7	1.00
7/19/2012	1:56	30.00	15.5	21.00	0.013	5.83	9.67	13.8	1.00
7/19/2012	2:26	60.00	13.5	21.00	0.013	5.83	7.67	14.2	1.00
7/19/2012	5:36	250.00	12.0	21.00	0.013	5.83	6.17	14.3	1.00
7/20/2012	1:26	1440.00	10.0	20.90	0.014	5.87	4.13	14.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0348	19.8	% COARSE GRAVEL	0.00	
0.0221	17.5	% FINE GRAVEL	3.57	3.57
0.0129	15.9	% COARSE SAND	1.81	
0.0091	15.1	% MEDIUM SAND	7.46	
0.0066	12.0	% FINE SAND	66.60	75.88
0.0032	9.6	% FINES	20.55	
0.0014	6.5	% TOTAL SAMPLE	100.00	

Description Dark Grayish Brown, SILTY SAND, trace gravel

USCS SM

-	LL
-	PL
-	PI

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DATE	7/18//12
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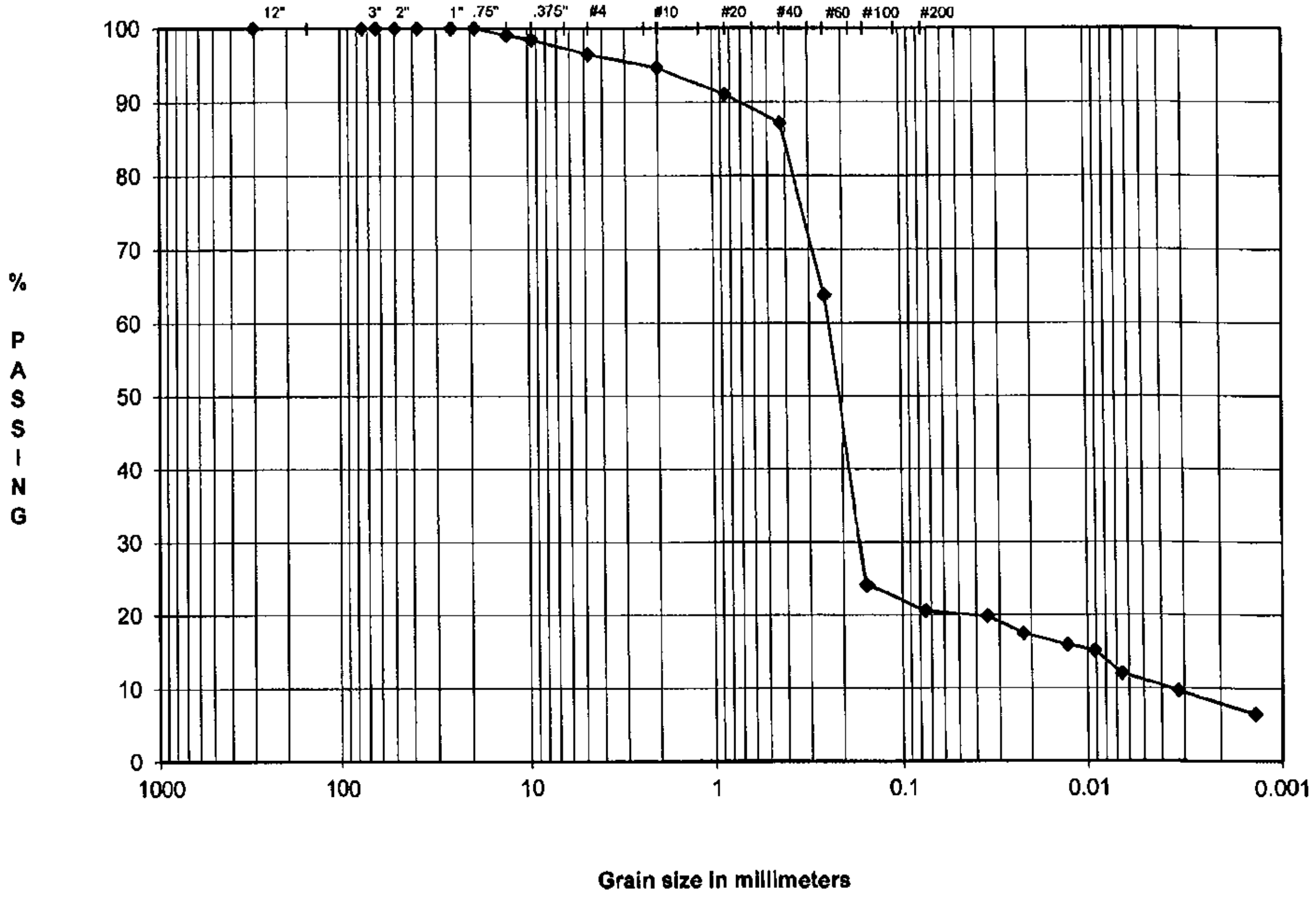
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		3.57		75.88			20.55

SAMPLE ID	BH-7
SAMPLE TYPE	JAR
SAMPLE DEPTH	23.5'-25.0'

LL	-
PL	-
PI	-

DESCRIPTION Dark Grayish Brown, SILTY SAND, trace gravel

USCS SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18//12
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-7
SAMPLE TYPE: JAR
SAMPLE DEPTH: 38.5'-40.0'

DESCRIPTION: Pale Brown, POORLY GRADED SAND WITH SILTY CLAY
USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	38.91
Weight of Dry Soil & Tare	34.27
Weight of Tare	13.96
Weight of Water	4.64
Weight of Dry Soil	20.31
Water Content	22.85%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
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REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-7
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	38.5'-40.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	38.91
Wt Dry Soil & Tare (gm)	(w2)	34.27
Weight of Tare (gm)	(w3)	13.96
Weight of Water (gm)	(w4=w1-w2)	4.64
Weight of Dry Soil (gm)	(w5=w2-w3)	20.31
Moisture Content (%)	(w4/w5)*100	22.85

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	33.94
Dry Soil & Tare (gm)	33.83
Tare Weight (gm)	14.16
Moisture Content (%)	0.56

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	341.37
	Tare Weight (gm)	96.52
(W6)	Total Dry Weight (gm)	243.49

SIEVE ANALYSIS

Tare Weight

96.77

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.77	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.77	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.77	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.77	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.77	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.77	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.77	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.77	0.00	0.00	100.00	0.375"	fine gravel
#4	96.77	0.00	0.00	100.00	#4	coarse sand
#10	97.06	0.29	0.12	99.88	#10	medium sand
#20	97.21	0.44	0.18	99.82	#20	medium sand
#40	98.12	1.35	0.55	99.45	#40	fine sand
#60	128.67	31.90	13.10	86.90	#60	fine sand
#100	269.26	172.49	70.84	29.16	#100	fine sand
#200	323.76	226.99	93.22	6.78	#200	fines

% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	0.00	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	0.12	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	0.44	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	92.67	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	6.78			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Pale Brown, POORLY GRADED SAND WITH SILTY CLAY

USCS SP-SC

TECH	CB
DATE	7/9/2012
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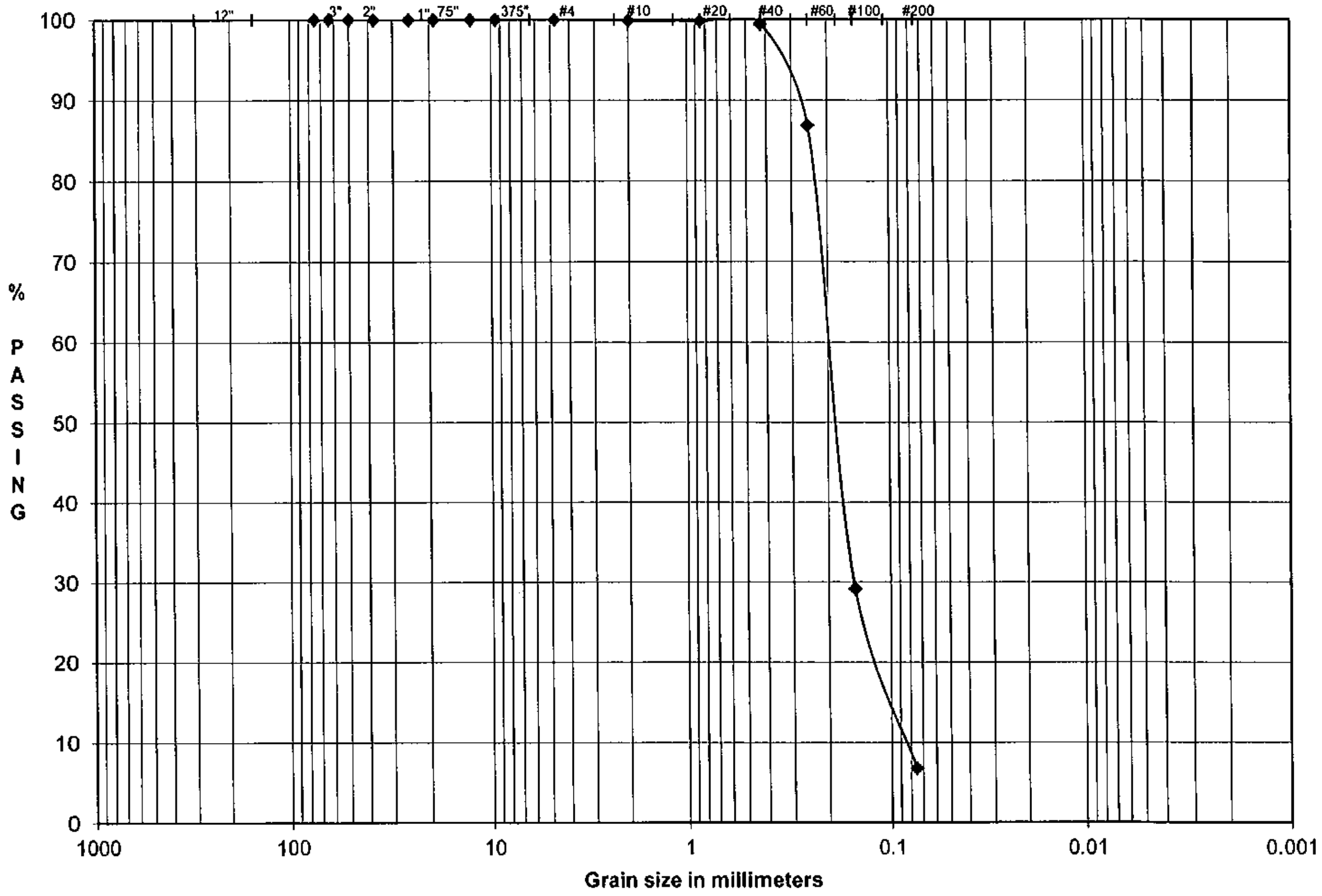
PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	0.00	0.12	0.44	92.67	6.78

SAMPLE ID	BH-7
SAMPLE TYPE	JAR
SAMPLE DEPTH	38.5'-40.0'

LL	-
PL	-
PI	-

DESCRIPTION Pale Brown, POORLY GRADED SAND WITH SILTY CLAY

USCS SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: JAR
SAMPLE DEPTH: 1.0'-2.5'

DESCRIPTION: Very pale brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel
USCS: SP-SC*
*Classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.27
Weight of Dry Soil & Tare	34.32
Weight of Tare	14.28
Weight of Water	1.95
Weight of Dry Soil	20.04
Water Content	9.73%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	TDS
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE NIPSCO-MCGS
PROJECT NO. 123-88898
REMARKS

SAMPLE ID BH-8
SAMPLE TYPE JAR
SAMPLE DEPTH 1.0'-2.5'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.27
Wt Dry Soil & Tare (gm)	(w2)	34.32
Weight of Tare (gm)	(w3)	14.28
Weight of Water (gm)	(w4=w1-w2)	1.95
Weight of Dry Soil (gm)	(w5=w2-w3)	20.04
Moisture Content (%)	(w4/w5)*100	9.73

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	38.59
Dry Soil & Tare (gm)	38.32
Tare Weight (gm)	14.02
Moisture Content (%)	1.11

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	435.92
Tare Weight (gm)	96.47
(W6) Total Dry Weight (gm)	335.72

SIEVE ANALYSIS

Tare Weight
96.54

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.54	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.54	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.54	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.54	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.54	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.54	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.54	0.00	0.00	100.00	0.50"	fine gravel
0.375"	104.95	8.41	2.51	97.49	0.375"	fine gravel
#4	117.43	20.89	6.22	93.78	#4	coarse sand
#10	151.27	54.73	16.30	83.70	#10	medium sand
#20	195.56	99.02	29.49	70.51	#20	medium sand
#40	216.22	119.68	35.65	64.35	#40	fine sand
#60	312.04	215.50	64.19	35.81	#60	fine sand
#100	390.89	294.35	87.68	12.32	#100	fine sand
#200	396.94	300.40	89.48	10.52	#200	fines

% C GRAVEL	0.00
% F GRAVEL	6.22
% C SAND	10.08
% M SAND	19.35
% F SAND	53.83
% FINES	10.52
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Very pale brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel

USCS SP-SC*

TECH CB
DATE 7/9/2012
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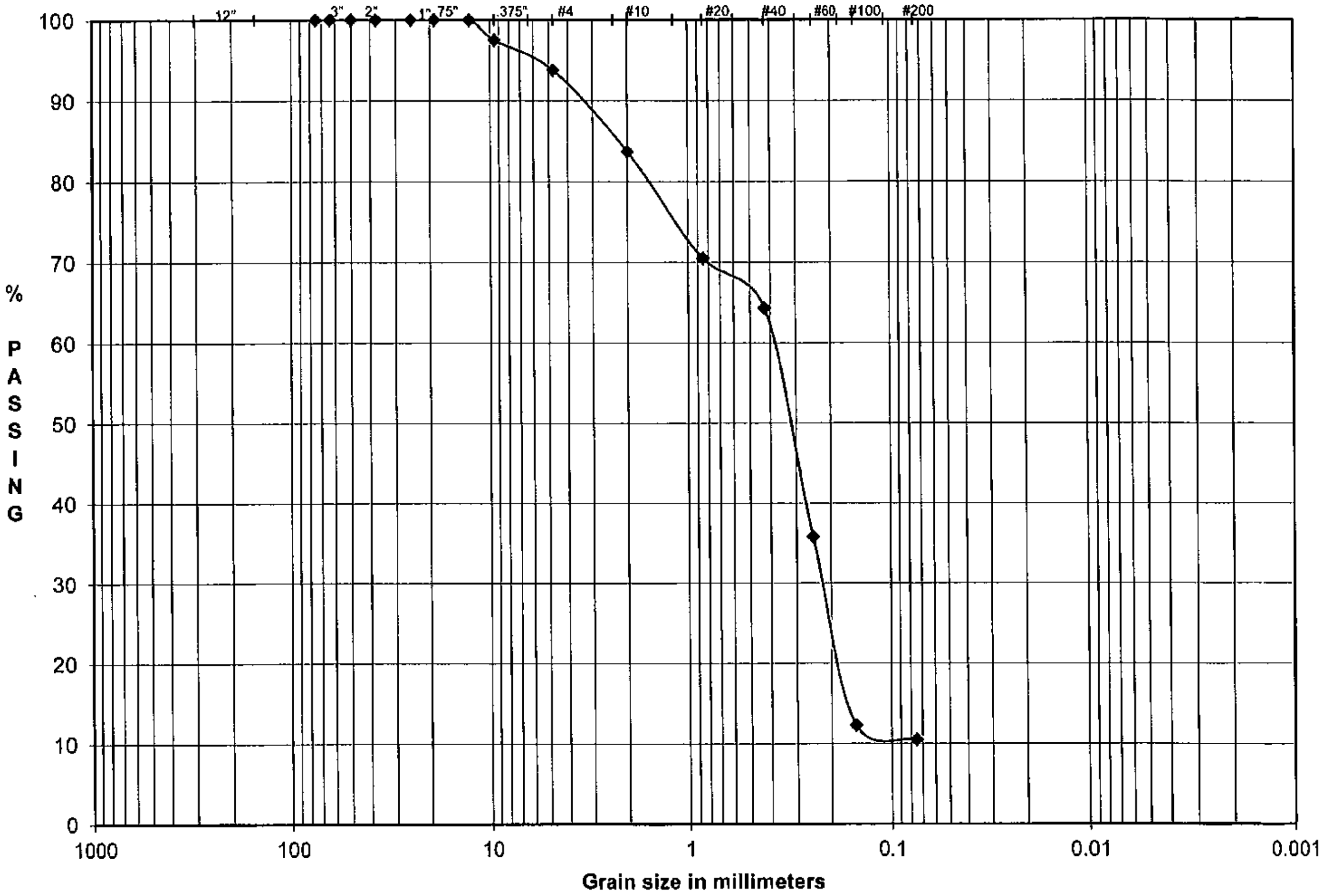
PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	0.00	6.22	10.08	19.35	53.83	10.52

SAMPLE ID	BH-8
SAMPLE TYPE	JAR
SAMPLE DEPTH	1.0'-2.5'

LL	-
PL	-
PI	-

DESCRIPTION Very pale brown, POORLY GRADED SAND WITH SILTY CLAY, little gravel

USCS SP-SC*

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 8.5'-10.0'

DESCRIPTION: Gray, POORLY GRADED SAND, trace fines, trace organics

USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	40.26
Weight of Dry Soil & Tare	34.62
Weight of Tare	15.87
Weight of Water	5.64
Weight of Dry Soil	18.75
Water Content	30.08%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-8
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	8.5'-10.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	40.26
Wt Dry Soil & Tare (gm)	(w2)	34.62
Weight of Tare (gm)	(w3)	15.87
Weight of Water (gm)	(w4=w1-w2)	5.64
Weight of Dry Soil (gm)	(w5=w2-w3)	18.75
Moisture Content (%)	(w4/w5)*100	30.08

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.95
Dry Soil & Tare (gm)	34.82
Tare Weight (gm)	13.74
Moisture Content (%)	0.62

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	376.23
Tare Weight (gm)	96.60
(W6) Total Dry Weight (gm)	277.92

SIEVE ANALYSIS

Tare Weight

96.75

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.75	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.75	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.75	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.75	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.75	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.75	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.75	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.75	0.00	0.00	100.00	0.375"	fine gravel
#4	96.75	0.00	0.00	100.00	#4	coarse sand
#10	97.06	0.31	0.11	99.89	#10	medium sand
#20	98.47	1.72	0.62	99.38	#20	medium sand
#40	107.02	10.27	3.70	96.30	#40	fine sand
#60	170.33	73.58	26.48	73.52	#60	fine sand
#100	345.83	249.08	89.62	10.38	#100	fine sand
#200	368.14	271.39	97.65	2.35	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.11
% M SAND	3.58
% F SAND	93.96
% FINES	2.35
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

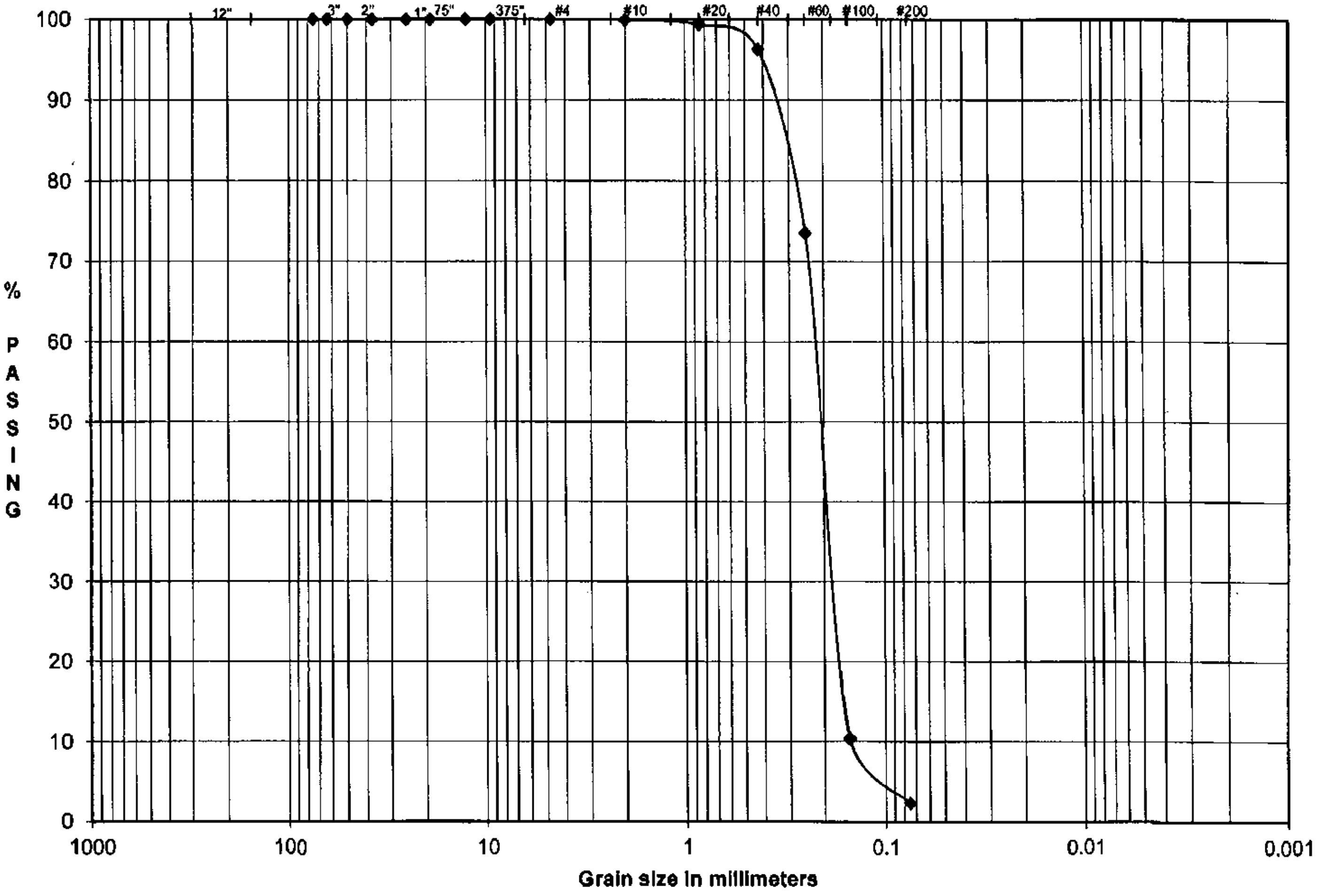
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Gray, POORLY GRADED SAND, trace fines, trace organics

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.11	3.58	93.96	2.35

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	8.5'-10.0'

LL	-
PL	-
PI	-

DESCRIPTION Gray, POORLY GRADED SAND, trace fines, trace organics

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information: PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Black, SILTY SAND, trace gravel

USCS: **SM**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	38.12
Weight of Dry Soil & Tare	31.34
Weight of Tare	13.87
Weight of Water	6.78
Weight of Dry Soil	17.47
Water Content	38.81%

TITLE BLOCK:

TECH	CB
DATE	07/18/12
CHECK	
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-8
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	13.5'-15.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)		
Weight of Dry Soil & Tare	(W2)		
Weight of Tare	(W3)		
Weight of Water	(W4=W1-W2)		
Weight of Dry Soil	(W5=W2-W3)		
Water Content	(W4/W5)*100		

NATURAL MOISTURE

Weight of Wet Soil & Tare	38.12
Weight of Dry Soil & Tare	31.34
Weight of Tare	13.87
Weight of Water	6.78
Weight of Dry Soil	17.47
Water Content	38.81%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows				
Weight of Wet Soil & Tare	(W6)			
Weight of Dry Soil & Tare	(W7)	NON	PLASTIC	
Weight of Tare	(W8)			
Weight of Water	(W9=W6-W7)			
Weight of Dry Soil	W10=W7-W8)			
Water Content	(W9/W10)*100			

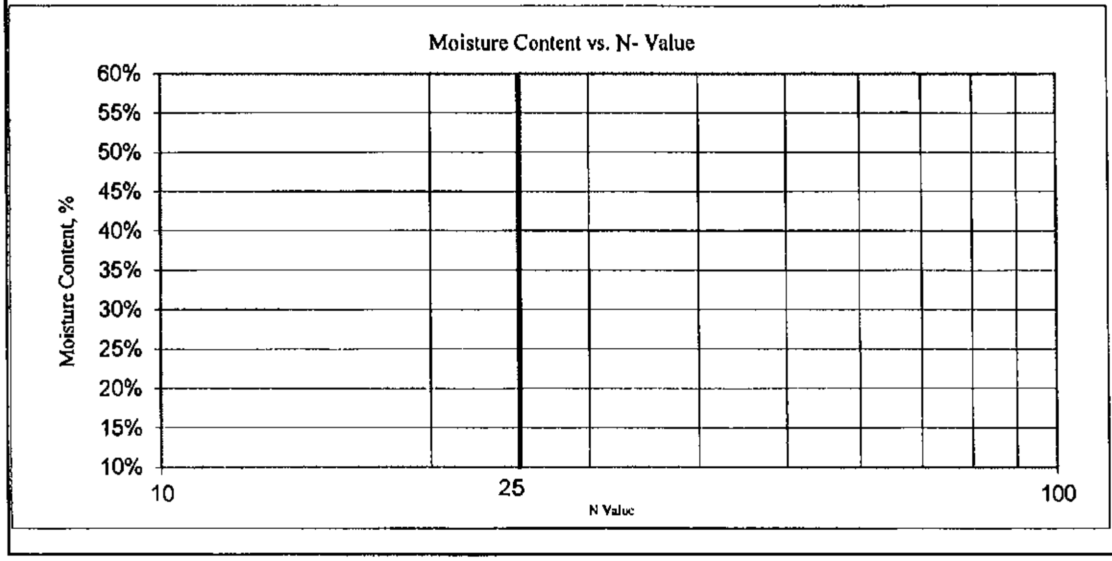
Blow	25
K - Value	1

Moisture content at 25 blow

LIQUID LIMIT (Wl)		
PLASTIC LIMIT (Wp)		
PLASTICITY INDEX (Ip)		
LIQUIDITY INDEX (I)		
MOISTURE CONTENT		

DESCRIPTION: Black, SILTY SAND, trace gravel

USCS SM



TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	13.5'-15.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	38.12
Wt. Dry Soil & Tare (gm)	(W2)	31.34
Weight of Tare (gm)	(W3)	13.87
Weight of Water (gm)	(W4=W1-W2)	6.78
Weight of Dry Soil (gm)	(W5=W2-W3)	17.47
Moisture Content (%)	(W4/W5)*100	38.81%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	36.36
Dry Soil & Tare (gm)	36.24
Tare Weight (gm)	14.16
Moisture Content (%)	0.54

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	479.06	
Tare Weight (gm)	96.85	
Total Weight (gm)	380.14	(W6)

Plus #4 Material Sieve

TARE WEIGHT 13.92

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	13.92	0.0	100.0	12.0"	cobbles
3.0"	13.92	0.0	100.0	3.0"	coarse gravel
2.5"	13.92	0.0	100.0	2.5"	coarse gravel
2.0"	13.92	0.0	100.0	2.0"	coarse gravel
1.5"	13.92	0.0	100.0	1.5"	coarse gravel
1.0"	13.92	0.0	100.0	1.0"	coarse gravel
0.75"	13.92	0.0	100.0	0.75"	fine gravel
0.50"	13.92	0.0	100.0	0.50"	fine gravel
0.375"	17.72	1.0	99.0	0.375"	fine gravel
#4	17.72	1.0	99.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	55.90
Calculated Dry Wt. used in test (gm)	55.60
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.00

TARE WEIGHT 30.49

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.54	0.05	98.9	#10	medium sand
#20	30.72	0.23	98.6	#20	medium sand
#40	31.57	1.08	97.1	#40	fine sand
#60	36.12	5.63	89.0	#60	fine sand
#100	56.68	26.19	52.4	#100	fine sand
#200	61.92	31.43	43.0	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:23	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:25	2.00	29.5	21.00	0.013	5.83	23.67	11.5	1.00
7/19/2012	2:28	5.00	24.5	21.00	0.013	5.83	18.67	12.4	1.00
7/19/2012	2:38	15.00	18.0	21.00	0.013	5.83	12.17	13.3	1.00
7/19/2012	2:53	30.00	13.75	21.00	0.013	5.83	7.92	14.2	1.00
7/19/2012	3:23	60.00	10.25	21.00	0.013	5.83	4.42	14.7	1.00
7/19/2012	6:33	250.00	7.0	21.00	0.013	5.83	1.17	15.2	1.00
7/20/2012	2:23	1440.00	7.0	20.90	0.014	5.87	1.13	15.2	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0323	42.1	% COARSE GRAVEL	0.00	
0.0212	33.2	% FINE GRAVEL	1.00	1.00
0.0127	21.7	% COARSE SAND	0.09	
0.0093	14.1	% MEDIUM SAND	1.83	
0.0067	7.9	% FINE SAND	54.04	55.97
0.0033	2.1	% FINES	43.03	
0.0014	2.0	% TOTAL SAMPLE	100.00	

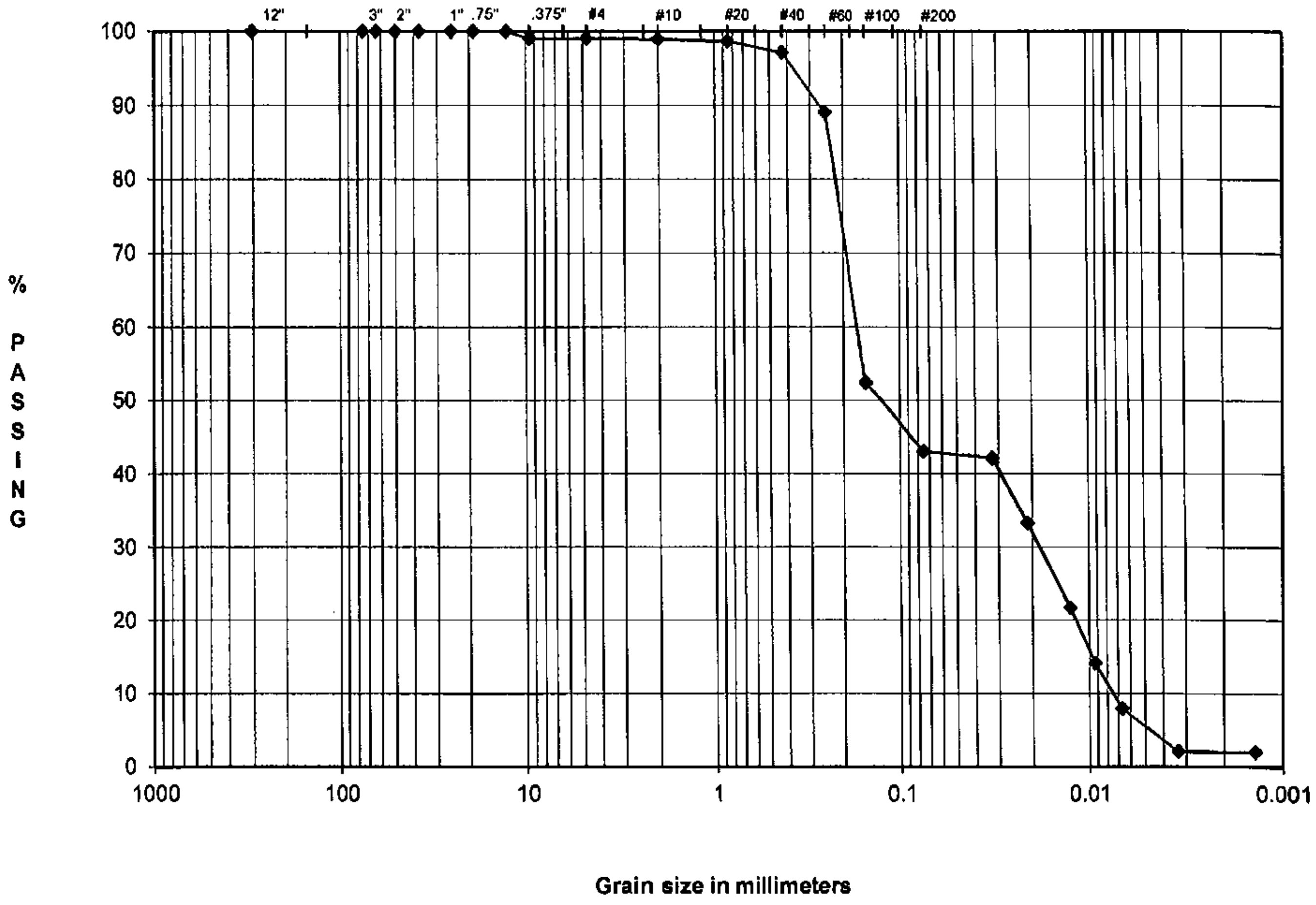
Description Black, SILTY SAND, trace gravel

USCS SM

-	LL
-	PL
-	PI

TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	**GRAVEL**		**SAND**			**FINES**
		1.00		55.97			43.03

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	13.5'-15.0'

LL	-
PL	-
PI	-

DESCRIPTION	Black, SILTY SAND, trace gravel
USCS	SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:
PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 23.5'-25.0'

DESCRIPTION: Yellow, POORLY GRADED SAND, trace gravel, trace fines

USCS: **SP**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.18
Weight of Dry Soil & Tare	31.75
Weight of Tare	13.90
Weight of Water	3.43
Weight of Dry Soil	17.85
Water Content	19.22%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	PS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	23.5'-25.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	35.18
Wt. Dry Soil & Tare (gm)	(W2)	31.75
Weight of Tare (gm)	(W3)	13.90
Weight of Water (gm)	(W4=W1-W2)	3.43
Weight of Dry Soil (gm)	(W5=W2-W3)	17.85
Moisture Content (%)	(W4/W5)*100	19.22%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	27.39
Dry Soil & Tare (gm)	27.39
Tare Weight (gm)	14.27
Moisture Content (%)	0.00

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	465.17	
Tare Weight (gm)	95.54	
Total Weight (gm)	369.63	(W6)

Plus #4 Material Sieve

TARE WEIGHT 13.61

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	13.61	0.0	100.0	**12.0"**	cobbles
3.0"	13.61	0.0	100.0	**3.0"**	coarse gravel
2.5"	13.61	0.0	100.0	**2.5"**	coarse gravel
2.0"	13.61	0.0	100.0	**2.0"**	coarse gravel
1.5"	13.61	0.0	100.0	**1.5"**	coarse gravel
1.0"	13.61	0.0	100.0	**1.0"**	coarse gravel
0.75"	13.61	0.0	100.0	**0.75"**	fine gravel
0.50"	13.61	0.0	100.0	**0.50"**	fine gravel
0.375"	13.61	0.0	100.0	**0.375"**	fine gravel
#4	14.70	0.3	99.7	**#4**	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	53.12
Calculated Dry Wt. used in test (gm)	53.12
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.71

TARE WEIGHT 30.68

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.62	0.94	**97.9**	**#10**	medium sand
#20	33.52	2.84	**94.4**	**#20**	medium sand
#40	38.42	7.74	**85.2**	**#40**	fine sand
#60	58.55	27.87	**47.4**	**#60**	fine sand
#100	77.43	46.75	**12.0**	**#100**	fine sand
#200	82.42	51.74	**2.6**	**#200**	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:28	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:30	2.00	6.5	21.00	0.013	5.83	0.67	15.3	1.00
7/19/2012	1:33	5.00	6.0	21.00	0.013	5.83	0.17	15.3	1.00
7/19/2012	1:43	15.00	6.0	21.00	0.013	5.83	0.17	15.3	1.00
7/19/2012	1:58	30.00	6.0	21.00	0.013	5.83	0.17	15.3	1.00
7/19/2012	2:28	60.00	5.5	21.00	0.013	5.83	-0.33	15.5	1.00
7/19/2012	5:38	250.00	5.25	21.00	0.013	5.83	-0.58	15.5	1.00
7/20/2012	1:28	1440.00	5.0	20.90	0.014	5.87	-0.87	15.5	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0373	1.3	% COARSE GRAVEL	0.00	
0.0236	0.3	% FINE GRAVEL	0.29	0.29
0.0136	0.3	% COARSE SAND	1.76	
0.0096	0.3	% MEDIUM SAND	12.76	
0.0069	-0.6	% FINE SAND	82.59	97.11
0.0034	-1.1	% FINES	2.59	
0.0014	-1.6	% TOTAL SAMPLE	100.00	

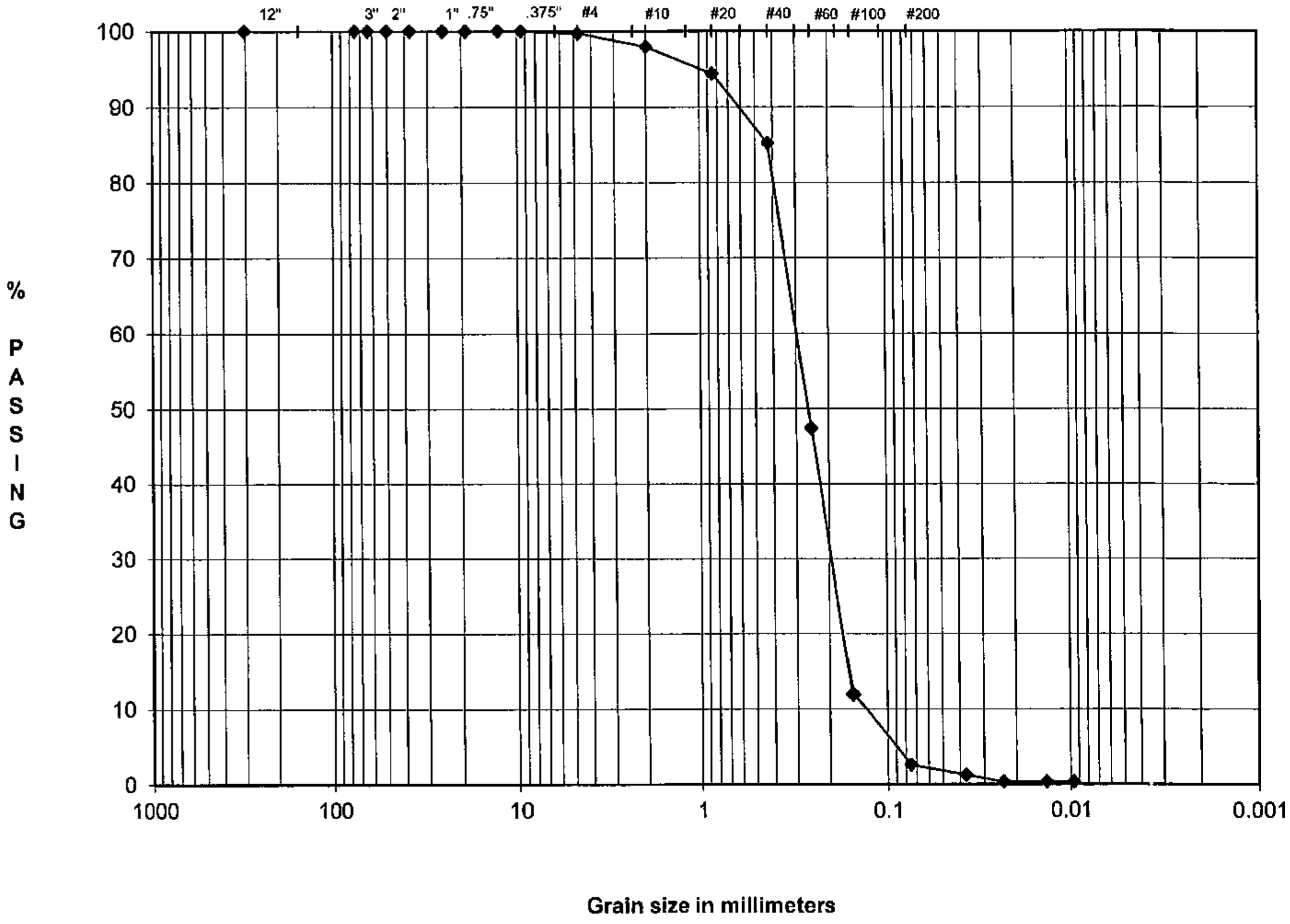
Description Yellow, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

-	LL
-	PL
-	PI

TECH	CB
DATE	7/9/2012
CHECK	PS
REVIEW	BSA

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.29		97.11			2.59

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	23.5'-25.0'

LL	-
PL	-
PI	-

DESCRIPTION	Yellow, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	TDS
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 28.5'-30.0'

DESCRIPTION: Light brownish gray, SILTY CLAYEY SAND, trace gravel

USCS: **SC-SM**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.10
31.8	31.80
13.72	13.72
Weight of Water	3.30
Weight of Dry Soil	18.08
Water Content	18.25%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	PJ
REVIEW	BGT

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	28.5'-30.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	35.10
Wt. Dry Soil & Tare (gm)	(W2)	31.80
Weight of Tare (gm)	(W3)	13.72
Weight of Water (gm)	(W4=W1-W2)	3.30
Weight of Dry Soil (gm)	(W5=W2-W3)	18.08
Moisture Content (%)	(W4/W5)*100	18.25%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	33.71
Dry Soil & Tare (gm)	33.62
Tare Weight (gm)	15.86
Moisture Content (%)	0.51

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	581.25	
Tare Weight (gm)	95.48	
Total Weight (gm)	483.32	(W6)

Plus #4 Material Sieve

TARE WEIGHT 13.92

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	13.92	0.0	100.0	12.0"	cobbles
3.0"	13.92	0.0	100.0	3.0"	coarse gravel
2.5"	13.92	0.0	100.0	2.5"	coarse gravel
2.0"	13.92	0.0	100.0	2.0"	coarse gravel
1.5"	13.92	0.0	100.0	1.5"	coarse gravel
1.0"	13.92	0.0	100.0	1.0"	coarse gravel
0.75"	13.92	0.0	100.0	0.75"	fine gravel
0.50"	13.92	0.0	100.0	0.50"	fine gravel
0.375"	13.92	0.0	100.0	0.375"	fine gravel
#4	15.06	0.2	99.8	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	53.58
Calculated Dry Wt. used in test (gm)	53.31
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.76

TARE WEIGHT 27.98

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	27.98	0.00	**99.8**	#10	medium sand
#20	28.13	0.15	**99.5**	#20	medium sand
#40	28.50	0.52	**98.8**	#40	fine sand
#60	35.70	7.72	**85.3**	#60	fine sand
#100	55.36	27.38	**48.5**	#100	fine sand
#200	62.18	34.20	**35.8**	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:13	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:15	2.00	23.5	21.00	0.013	5.83	17.67	12.5	1.00
7/19/2012	2:18	5.00	20.0	21.00	0.013	5.83	14.17	13.0	1.00
7/19/2012	2:28	15.00	17.0	21.00	0.013	5.83	11.17	13.5	1.00
7/19/2012	2:43	30.00	16.0	21.00	0.013	5.83	10.17	13.7	1.00
7/19/2012	3:13	60.00	14.75	21.00	0.013	5.83	8.92	14.0	1.00
7/19/2012	6:23	250.00	12.5	21.00	0.013	5.83	6.67	14.3	1.00
7/20/2012	2:13	1440.00	10.5	20.90	0.014	5.87	4.63	14.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0337	33.1	% COARSE GRAVEL	0.00	
0.0217	26.5	% FINE GRAVEL	0.24	0.24
0.0128	20.9	% COARSE SAND	0.00	
0.0091	19.0	% MEDIUM SAND	0.97	
0.0065	16.7	% FINE SAND	63.03	64.00
0.0032	12.5	% FINES	35.76	
0.0014	8.7	% TOTAL SAMPLE	100.00	

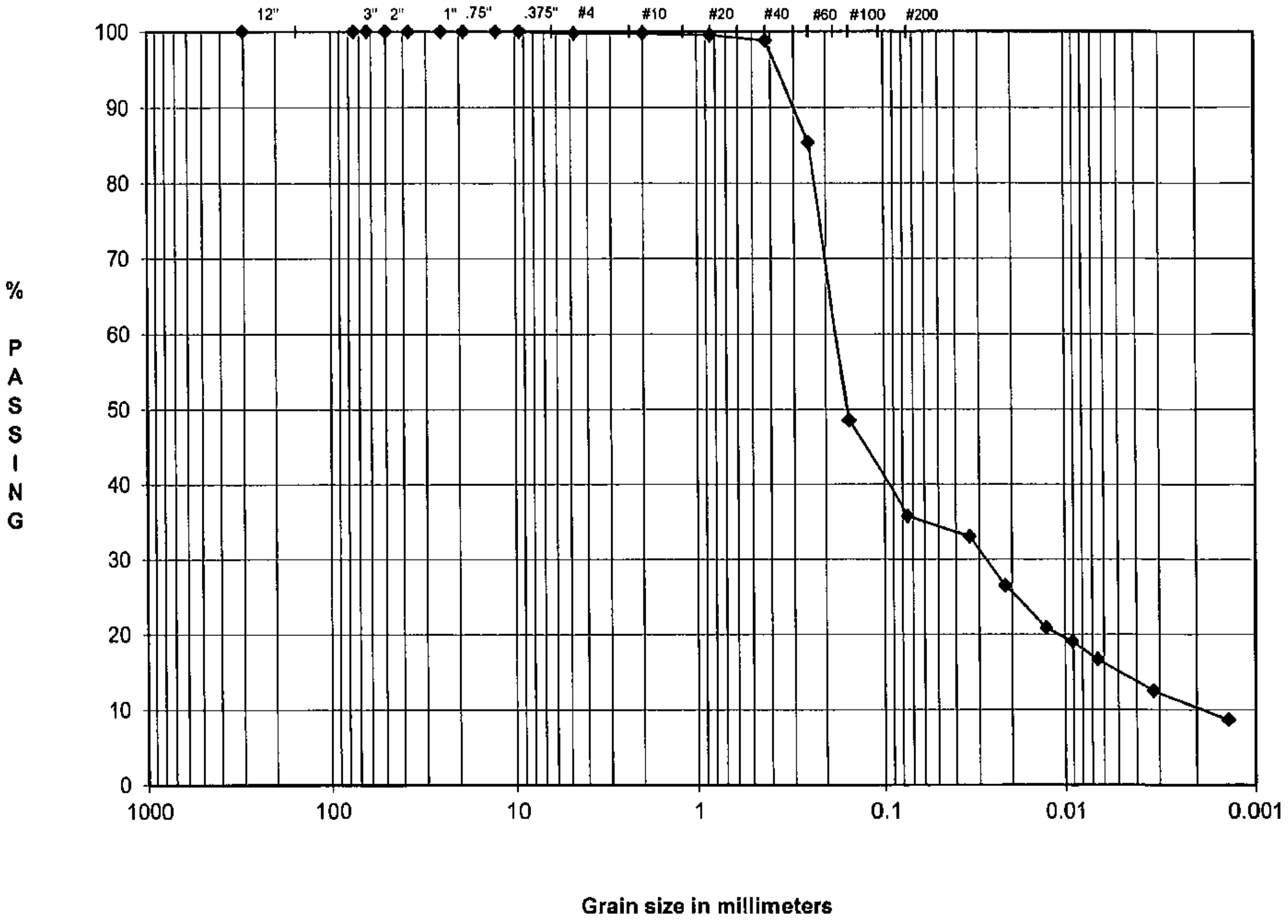
Description Light brownish gray, SILTY CLAYEY SAND, trace gravel

USCS SC-SM

-	LL
-	PL
-	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		**SAND**			**FINES**
		0.24		64.00			35.76

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

DESCRIPTION	Light brownish gray, SILTY CLAYEY SAND, trace gravel
USCS	SC-SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-9
SAMPLE TYPE: BAG
SAMPLE DEPTH: 1.0'-2.5'

DESCRIPTION: Black, POORLY GRADED SAND WITH SILT, trace gravel

USCS: **SP-SM**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	22.44
Weight of Dry Soil & Tare	21.73
Weight of Tare	14.15
Weight of Water	0.71
Weight of Dry Soil	7.58
Water Content	9.37%

TITLE BLOCK:

TECH	CW
DATE	07/09/12
CHECK	PS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	1.0'-2.5'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	22.44
Wt. Dry Soil & Tare (gm)	(W2)	21.73
Weight of Tare (gm)	(W3)	14.15
Weight of Water (gm)	(W4=W1-W2)	0.71
Weight of Dry Soil (gm)	(W5=W2-W3)	7.58
Moisture Content (%)	(W4/W5)*100	9.37%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	27.60
Dry Soil & Tare (gm)	27.57
Tare Weight (gm)	13.98
Moisture Content (%)	0.22

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	446.56	
Tare Weight (gm)	188.99	
Total Weight (gm)	257.00	(W6)

Plus #4 Material Sieve

TARE WEIGHT 11.33

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	11.33	0.0	100.0	12.0"	cobbles
3.0"	11.33	0.0	100.0	3.0"	coarse gravel
2.5"	11.33	0.0	100.0	2.5"	coarse gravel
2.0"	11.33	0.0	100.0	2.0"	coarse gravel
1.5"	11.33	0.0	100.0	1.5"	coarse gravel
1.0"	11.33	0.0	100.0	1.0"	coarse gravel
0.75"	11.33	0.0	100.0	0.75"	fine gravel
0.50"	11.33	0.0	100.0	0.50"	fine gravel
0.375"	11.33	0.0	100.0	0.375"	fine gravel
#4	11.97	0.2	99.8	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	58.69
Calculated Dry Wt. used in test (gm)	58.56
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.75

TARE WEIGHT 30.83

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.09	0.26	99.3	#10	medium sand
#20	31.63	0.80	98.4	#20	medium sand
#40	33.32	2.49	95.5	#40	fine sand
#60	47.30	16.47	71.7	#60	fine sand
#100	82.26	51.43	12.1	#100	fine sand
#200	83.98	53.15	9.2	#200	fines

HYDROMETER CALCULATIONS

DATE	TIME	ET	READING	TEMP	TEMP.COR.	HYD.COR.	READING	EFFECTIVE	
7/19/2012	2:21	(min)	R	T	K	Cc	C	LENGTH	A
7/19/2012	2:23	2.00	11.5	21.00	0.013	5.83	5.67	14.5	1.00
7/19/2012	2:26	5.00	10.5	21.00	0.013	5.83	4.67	14.7	1.00
7/19/2012	2:36	15.00	10.0	21.00	0.013	5.83	4.17	14.7	1.00
7/19/2012	2:51	30.00	9.0	21.00	0.013	5.83	3.17	14.8	1.00
7/19/2012	3:21	60.00	7.75	21.00	0.013	5.83	1.92	15.2	1.00
7/19/2012	6:31	250.00	6.5	21.00	0.013	5.83	0.67	15.3	1.00
7/20/2012	2:21	1440.00	6.0	20.90	0.014	5.87	0.13	15.3	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0363	9.7	% COBBLES	0.00	
0.0231	7.9	% COARSE GRAVEL	0.00	
0.0133	7.1	% FINE GRAVEL	0.25	0.25
0.0095	5.4	% COARSE SAND	0.44	
0.0068	3.3	% MEDIUM SAND	3.80	
0.0033	1.1	% FINE SAND	86.29	90.53
0.0014	0.2	% FINES	9.22	
		% TOTAL SAMPLE	100.00	

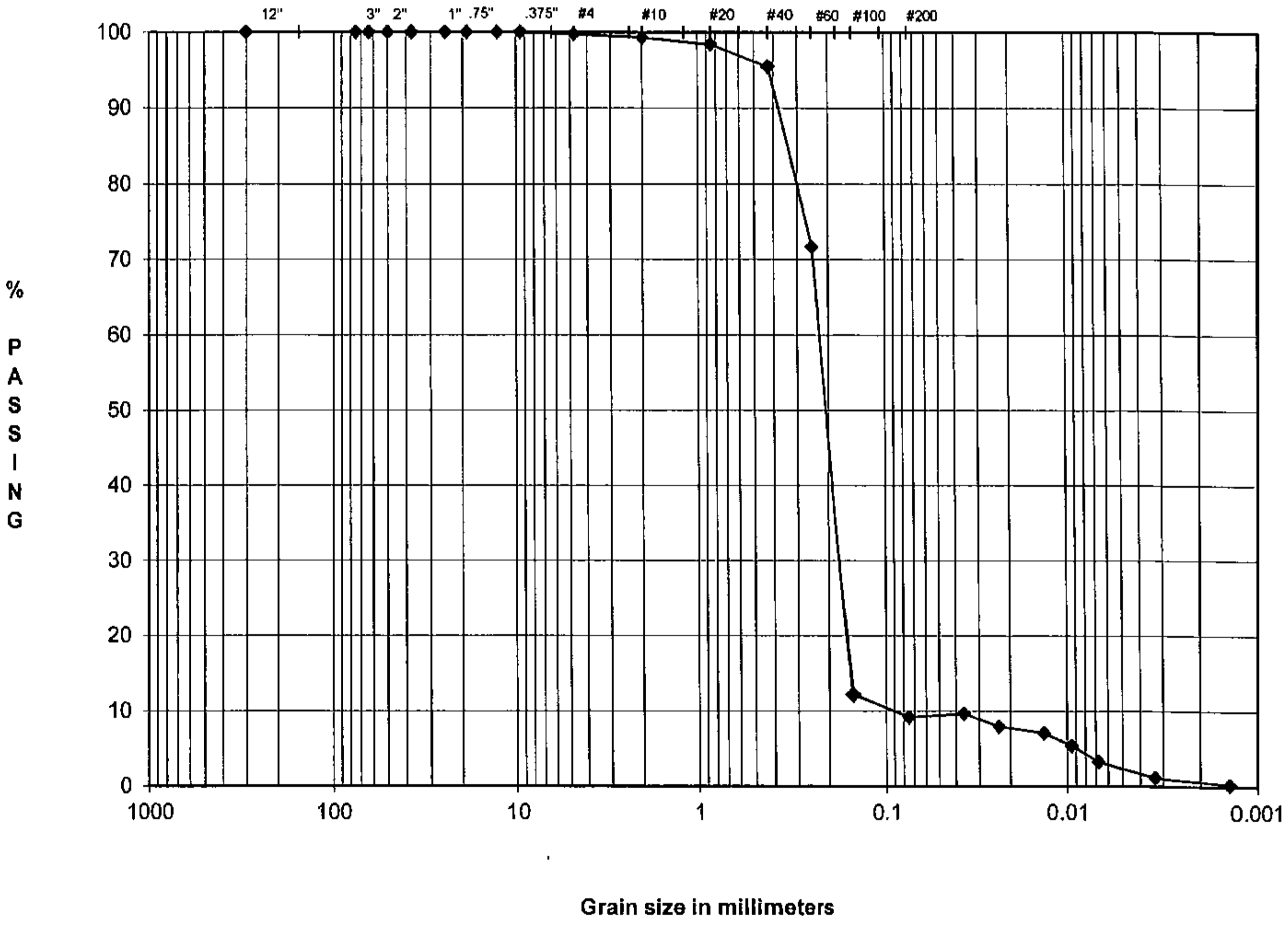
Description Black, POORLY GRADED SAND WITH SILT, trace gravel

USCS SP-SM

-	LL
-	PL
-	PI

TECH	CW
DATE	7/9/2012
CHECK	BS
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.25		90.53			9.22

SAMPLE ID	BH-9	**LL**	-
SAMPLE TYPE	BAG	**PL**	-
SAMPLE DEPTH	1.0'-2.5'	**PI**	-

DESCRIPTION Black, POORLY GRADED SAND WITH SILT, trace gravel

USCS SP-SM

Nipsco-MCGS
123-88898

TECH CW
DATE 7/9/2012
CHECK
REVIEW

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-9
SAMPLE TYPE: BAG
SAMPLE DEPTH: 8.5-10.0

DESCRIPTION: Black, POORLY GRADED SAND WITH SILTY, little gravel CLAY
USCS: SP-SC*
* Classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	61.92
Weight of Dry Soil & Tare	53.10
Weight of Tare	14.22
Weight of Water	8.82
Weight of Dry Soil	38.88
Water Content	22.69%

TITLE BLOCK:

TECH	CB
DATE	07/19/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	8.5-10.0

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	61.92
Wt. Dry Soil & Tare (gm)	(W2)	53.10
Weight of Tare (gm)	(W3)	14.22
Weight of Water (gm)	(W4=W1-W2)	8.82
Weight of Dry Soil (gm)	(W5=W2-W3)	38.88
Moisture Content (%)	(W4/W5)*100	22.69%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	25.72
Dry Soil & Tare (gm)	25.70
Tare Weight (gm)	13.75
Moisture Content (%)	0.17

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	597.90	
Tare Weight (gm)	188.36	
Total Weight (gm)	408.86	(W6)

Plus #4 Material Sieve

TARE WEIGHT 14.08

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	14.08	0.0	100.0	12.0"	cobbles
3.0"	14.08	0.0	100.0	3.0"	coarse gravel
2.5"	14.08	0.0	100.0	2.5"	coarse gravel
2.0"	14.08	0.0	100.0	2.0"	coarse gravel
1.5"	14.08	0.0	100.0	1.5"	coarse gravel
1.0"	14.08	0.0	100.0	1.0"	coarse gravel
0.75"	31.23	4.2	95.8	0.75"	fine gravel
0.50"	37.87	5.8	94.2	0.50"	fine gravel
0.375"	37.87	5.8	94.2	0.375"	fine gravel
#4	42.57	7.0	93.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	53.57
Calculated Dry Wt. used in test (gm)	53.48
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	93.03

TARE WEIGHT 28.02

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	29.43	1.41	90.6	#10	medium sand
#20	30.22	2.20	89.2	#20	medium sand
#40	32.80	4.78	84.7	#40	fine sand
#60	43.85	15.83	65.5	#60	fine sand
#100	74.32	46.30	12.5	#100	fine sand
#200	77.13	49.11	7.6	#200	fines

HYDROMETER CALCULATIONS

DATE	TIME	ET	READING	TEMP	TEMP.COR.	HYD.COR.	READING	EFFECTIVE	
7/19/2012	13:30	(min)	R	T	K	Cc	C	LENGTH	A
7/19/2012	13:32	2.00	10.5	21.00	0.013	5.83	4.67	14.7	1.00
7/19/2012	13:35	5.00	10.0	21.00	0.013	5.83	4.17	14.7	1.00
7/19/2012	13:45	15.00	9.3	21.00	0.013	5.83	3.42	14.8	1.00
7/19/2012	14:00	30.00	8.5	21.00	0.013	5.83	2.67	15.0	1.00
7/19/2012	14:30	60.00	7.5	21.00	0.013	5.83	1.67	15.2	1.00
7/19/2012	17:40	250.00	6.5	21.00	0.013	5.83	0.67	15.3	1.00
7/20/2012	13:30	1440.00	6.0	20.90	0.014	5.87	0.13	15.3	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0365	8.1	% COARSE GRAVEL	4.19	
0.0231	7.2	% FINE GRAVEL	2.77	6.97
0.0134	5.9	% COARSE SAND	2.45	
0.0095	4.6	% MEDIUM SAND	5.86	
0.0068	2.9	% FINE SAND	77.11	85.43
0.0033	1.2	% FINES	7.60	
0.0014	0.2	% TOTAL SAMPLE	100.00	

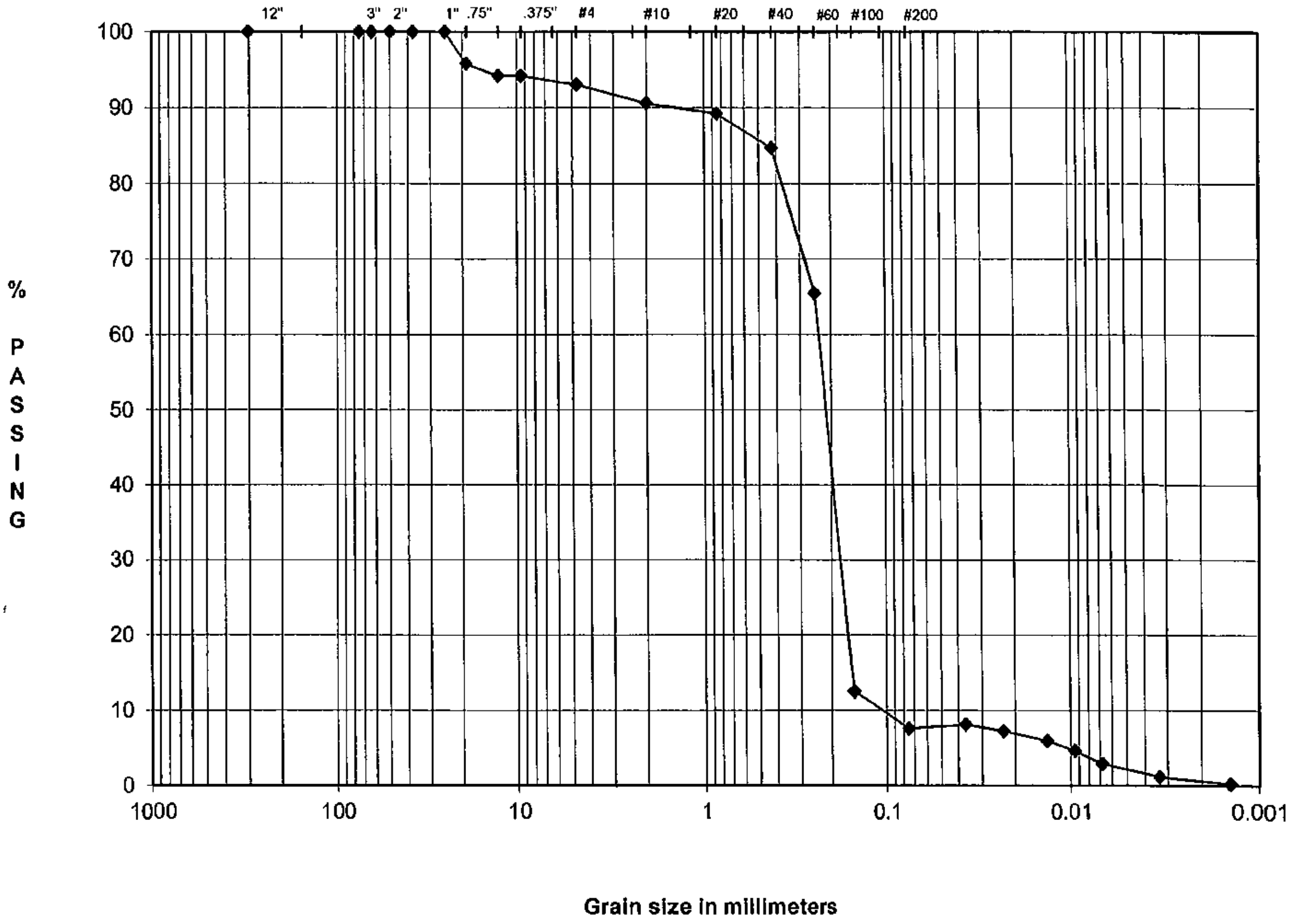
Description Black, POORLY GRADED SAND WITH SILTY, little gravel CLAY

USCS SP-SC*

-	LL
-	PL
-	PI

TECH	CB
DATE	7/19/2012
CHECK	P.M
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		6.97		85.43			7.60

SAMPLE ID BH-9
SAMPLE TYPE BAG
SAMPLE DEPTH 8.5-10.0

LL -
PL -
PI -

DESCRIPTION Black, POORLY GRADED SAND WITH SILTY, little gravel CLAY

USCS SP-SC*

Nipsco-MCGS
123-88898

TECH CB
DATE 7/19/2012
CHECK D.W.
REVIEW BW

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-9
SAMPLE TYPE: BAG
SAMPLE DEPTH: 28.5'-30.0'

DESCRIPTION: Olive Gray, POORLY GRADED SAND WITH SILT, trace gravel
USCS: **SP-SM**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	21.89
Weight of Dry Soil & Tare	20.56
Weight of Tare	13.80
Weight of Water	1.33
Weight of Dry Soil	6.76
Water Content	19.67%

TITLE BLOCK:

TECH	CB
DATE	07/25/12
CHECK	D. W.
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	28.5'-30.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	21.89
Wt. Dry Soil & Tare (gm)	(W2)	20.56
Weight of Tare (gm)	(W3)	13.80
Weight of Water (gm)	(W4=W1-W2)	1.33
Weight of Dry Soil (gm)	(W5=W2-W3)	6.76
Moisture Content (%)	(W4/W5)*100	19.67%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	37.12
Dry Soil & Tare (gm)	37.09
Tare Weight (gm)	14.07
Moisture Content (%)	0.13

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	281.90	
Tare Weight (gm)	185.69	
Total Weight (gm)	96.08	(W6)

Plus #4 Material Sieve

TARE WEIGHT 14.16

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	14.16	0.0	100.0	12.0"	cobbles
3.0"	14.16	0.0	100.0	3.0"	coarse gravel
2.5"	14.16	0.0	100.0	2.5"	coarse gravel
2.0"	14.16	0.0	100.0	2.0"	coarse gravel
1.5"	14.16	0.0	100.0	1.5"	coarse gravel
1.0"	14.16	0.0	100.0	1.0"	coarse gravel
0.75"	14.16	0.0	100.0	0.75"	fine gravel
0.50"	14.16	0.0	100.0	0.50"	fine gravel
0.375"	14.16	0.0	100.0	0.375"	fine gravel
#4	15.18	1.1	98.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	55.38
Calculated Dry Wt. used in test (gm)	55.31
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	98.94

TARE WEIGHT 30.45

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.26	0.81	97.5	#10	medium sand
#20	31.68	1.23	96.7	#20	medium sand
#40	32.63	2.18	95.0	#40	fine sand
#60	40.28	9.83	81.4	#60	fine sand
#100	69.70	39.25	28.7	#100	fine sand
#200	80.10	49.65	10.1	#200	fines

HYDROMETER CALCULATIONS

DATE 7/26/2012	TIME 1:45	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/26/2012	1:47	2.00	10.5	20.70	0.014	5.93	4.57	14.7	1.00
7/26/2012	1:50	5.00	9.0	20.70	0.014	5.93	3.07	14.8	1.00
7/26/2012	2:00	15.00	8.5	20.70	0.014	5.93	2.57	15.0	1.00
7/26/2012	2:15	30.00	8.0	20.70	0.014	5.93	2.07	15.0	1.00
7/26/2012	2:57	72.00	7.5	20.70	0.014	5.93	1.57	15.2	1.00
7/26/2012	5:55	250.00	7.0	21.20	0.013	5.77	1.23	15.2	1.00
7/27/2012	1:45	1440.00	7.0	20.70	0.014	5.93	1.07	15.2	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0370	8.2	% COARSE GRAVEL	0.00	
0.0235	5.5	% FINE GRAVEL	1.06	1.06
0.0137	4.6	% COARSE SAND	1.45	
0.0097	3.7	% MEDIUM SAND	2.45	
0.0063	2.8	% FINE SAND	84.92	88.82
0.0033	2.2	% FINES	10.12	
0.0014	1.9	% TOTAL SAMPLE	100.00	

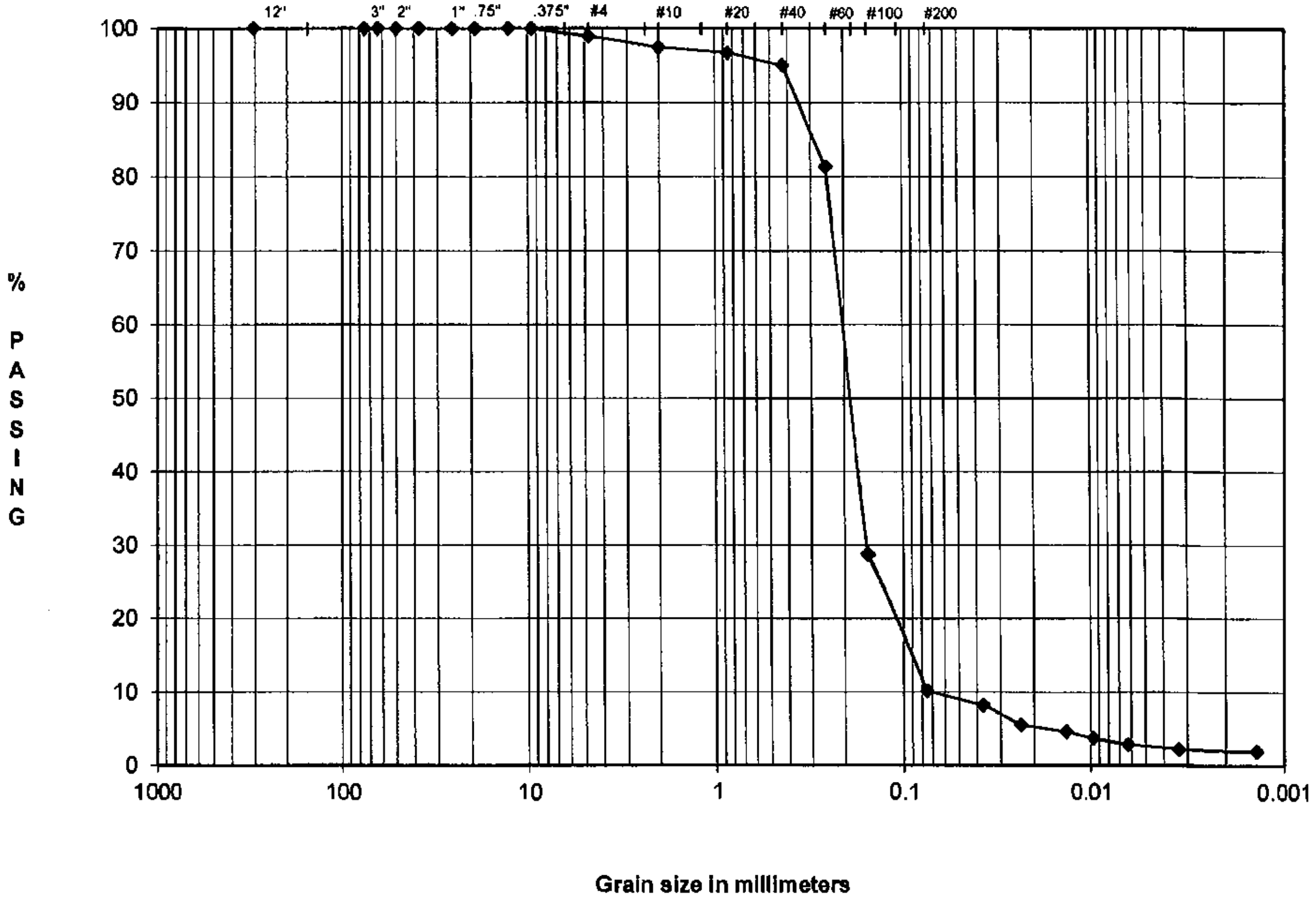
Description Olive Gray, POORLY GRADED SAND WITH SILT, trace gravel

USCS SP-SM

-	LL
-	PL
-	PI

TECH	CB
DATE	7/25/2012
CHECK	D.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		1.06		88.82			10.12

SAMPLE ID	BH-9
SAMPLE TYPE	BAG
SAMPLE DEPTH	28.5'-30.0'

LL	-
PL	-
PI	-

DESCRIPTION Olive Gray, POORLY GRADED SAND WITH SILT, trace gravel

USCS SP-SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/25/2012
CHECK	D.W.
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:	PROJECT NAME:	Nipsco-MCGS
	PROJECT NUMBER:	123-88898
	SAMPLE ID:	BH-9
	SAMPLE TYPE:	BAG
	SAMPLE DEPTH:	38.5'-40.0'
	DESCRIPTION:	Grayish brown, SILTY CLAYEY SAND, trace gravel
	USCS:	**SC-SM**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	54.77
Weight of Dry Soil & Tare	48.13
Weight of Tare	14.20
Weight of Water	6.64
Weight of Dry Soil	33.93
Water Content	19.57%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	TPS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	38.5'-40.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	54.77
Wt. Dry Soil & Tare (gm)	(W2)	48.13
Weight of Tare (gm)	(W3)	14.20
Weight of Water (gm)	(W4=W1-W2)	6.64
Weight of Dry Soil (gm)	(W5=W2-W3)	33.93
Moisture Content (%)	(W4/W5)*100	19.57%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	27.16
Dry Soil & Tare (gm)	27.13
Tare Weight (gm)	14.02
Moisture Content (%)	0.23

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	597.28	
Tare Weight (gm)	184.96	
Total Weight (gm)	411.38	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	58.58
Calculated Dry Wt. used in test (gm)	58.45
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 28.46

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.50	0.04	99.9	#10	medium sand
#20	28.69	0.23	99.6	#20	medium sand
#40	29.01	0.55	99.1	#40	fine sand
#60	31.32	2.86	95.1	#60	fine sand
#100	52.12	23.66	59.5	#100	fine sand
#200	68.94	40.48	30.7	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:11	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:13	2.00	19.0	21.00	0.013	5.83	13.17	13.2	1.00
7/19/2012	2:16	5.00	16.5	21.00	0.013	5.83	10.67	13.7	1.00
7/19/2012	2:26	15.00	14.0	21.00	0.013	5.83	8.17	14.0	1.00
7/19/2012	2:41	30.00	12.75	21.00	0.013	5.83	6.92	14.3	1.00
7/19/2012	3:11	60.00	11.5	21.00	0.013	5.83	5.67	14.5	1.00
7/19/2012	6:21	250.00	10.0	21.00	0.013	5.83	4.17	14.7	1.00
7/20/2012	2:11	1440.00	9.0	20.90	0.014	5.87	3.13	14.8	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0346	22.5	% COBBLES	0.00	
0.0223	18.3	% COARSE GRAVEL	0.00	
0.0130	14.0	% FINE GRAVEL	0.00	0.00
0.0093	11.8	% COARSE SAND	0.07	
0.0066	9.7	% MEDIUM SAND	0.87	
0.0033	7.1	% FINE SAND	68.32	69.26
0.0014	5.4	% FINES	30.74	
		% TOTAL SAMPLE	100.00	

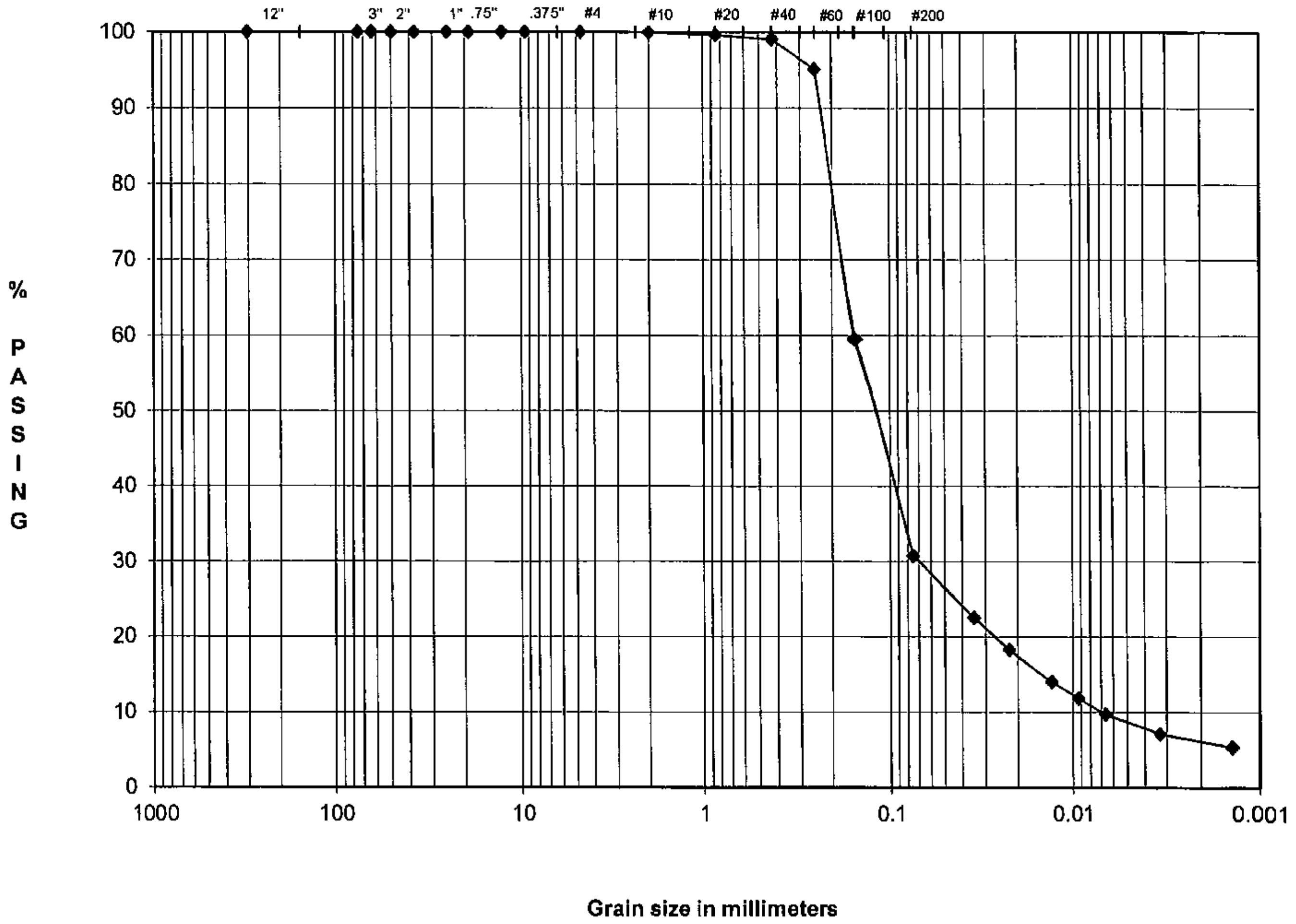
Description Grayish brown, SILTY CLAYEY SAND, trace gravel

USCS SC-SM

-	LL
-	PL
-	PI

TECH	CB
DATE	7/9/2012
CHECK	BS
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.00		69.26			30.74

SAMPLE ID	BH-9
SAMPLE TYPE	BAG
SAMPLE DEPTH	38.5'-40.0'

LL	-
PL	-
PI	-

DESCRIPTION Grayish brown, SILTY CLAYEY SAND, trace gravel

USCS SC-SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	TPS
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-9
SAMPLE TYPE: BAG
SAMPLE DEPTH: 48.5'-50.0'

DESCRIPTION: Light Olive Brown, SILTY SAND,

USCS: SM

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	72.02
Weight of Dry Soil & Tare	61.35
Weight of Tare	14.01
Weight of Water	10.67
Weight of Dry Soil	47.34
Water Content	22.54%

TITLE BLOCK:

TECH	CB
DATE	07/25/12
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	48.5'-50.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	72.02
Wt. Dry Soil & Tare (gm)	(W2)	61.35
Weight of Tare (gm)	(W3)	14.01
Weight of Water (gm)	(W4=W1-W2)	10.67
Weight of Dry Soil (gm)	(W5=W2-W3)	47.34
Moisture Content (%)	(W4/W5)*100	22.54%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	46.18
Dry Soil & Tare (gm)	46.15
Tare Weight (gm)	15.86
Moisture Content (%)	0.10

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	597.63	
Tare Weight (gm)	231.17	
Total Weight (gm)	366.10	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	52.43
Calculated Dry Wt. used in test (gm)	52.38
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.68

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.68	0.00	100.0	#10	medium sand
#20	30.68	0.00	100.0	#20	medium sand
#40	30.70	0.02	100.0	#40	fine sand
#60	30.73	0.05	99.9	#60	fine sand
#100	38.17	7.49	85.7	#100	fine sand
#200	73.60	42.92	18.1	#200	fines

HYDROMETER CALCULATIONS

DATE 7/27/2012	TIME 1:30	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/27/2012	1:32	2.00	9.0	20.70	0.014	5.93	3.07	14.8	1.00
7/27/2012	1:35	5.00	8.0	20.70	0.014	5.93	2.07	15.0	1.00
7/27/2012	1:45	15.00	7.5	20.70	0.014	5.93	1.57	15.2	1.00
7/27/2012	2:00	30.00	7.0	20.70	0.014	5.93	1.07	15.2	1.00
7/27/2012	2:41	71.00	6.5	20.70	0.014	5.93	0.57	15.3	1.00
7/27/2012	5:40	250.00	6.0	21.20	0.013	5.77	0.23	15.3	1.00
7/28/2012	1:30	1440.00	6.0	20.70	0.014	5.93	0.07	15.3	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0371	5.9	% COBBLES	0.00	
0.0236	3.9	% COARSE GRAVEL	0.00	
0.0137	3.0	% FINE GRAVEL	0.00	0.00
0.0097	2.0	% COARSE SAND	0.00	
0.0063	1.1	% MEDIUM SAND	0.04	
0.0033	0.4	% FINE SAND	81.90	81.94
0.0014	0.1	% FINES	18.06	
		% TOTAL SAMPLE	100.00	

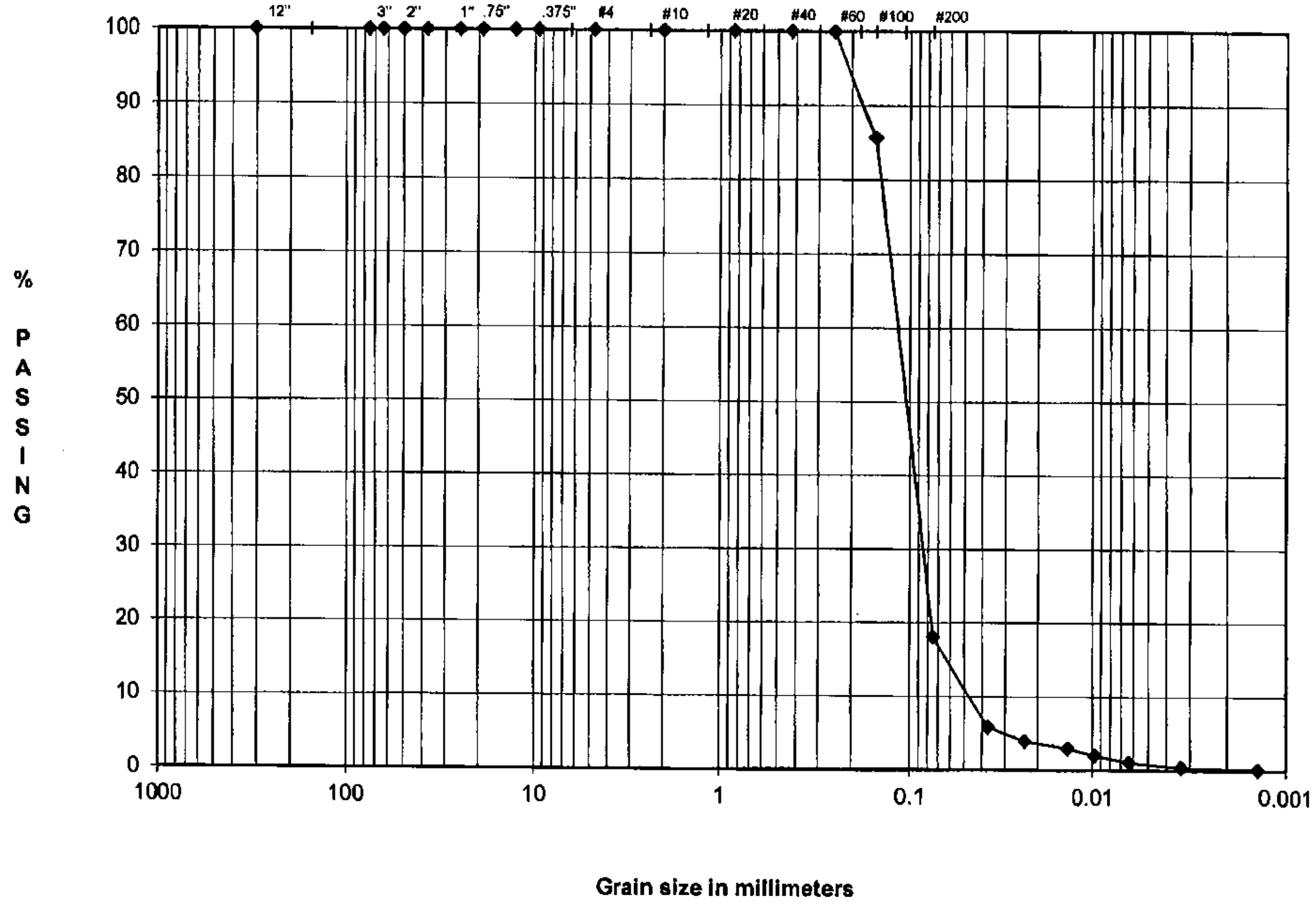
Description Light Olive Brown, SILTY SAND,

USCS SM

-	LL
-	PL
-	PI

TECH	CB
DATE	7/25/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		81.94			18.06

SAMPLE ID	BH-9
SAMPLE TYPE	BAG
SAMPLE DEPTH	48.5'-50.0'

LL	-
PL	-
PI	-

DESCRIPTION Light Olive Brown, SILTY SAND,

USCS SM

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/25/2012
CHECK	
REVIEW	

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: JAR
SAMPLE DEPTH: 3.5'-5.0'

DESCRIPTION: Light grey, Black, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.54
Weight of Dry Soil & Tare	33.56
Weight of Tare	14.02
Weight of Water	2.98
Weight of Dry Soil	19.54
Water Content	15.25%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-10
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	3.5'-5.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.54
Wt Dry Soil & Tare (gm)	(w2)	33.56
Weight of Tare (gm)	(w3)	14.02
Weight of Water (gm)	(w4=w1-w2)	2.98
Weight of Dry Soil (gm)	(w5=w2-w3)	19.54
Moisture Content (%)	(w4/w5)*100	15.25

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.09
Dry Soil & Tare (gm)	33.93
Tare Weight (gm)	14.16
Moisture Content (%)	0.81

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	355.71
	Tare Weight (gm)	94.62
(W6)	Total Dry Weight (gm)	258.99

SIEVE ANALYSIS

Tare Weight

94.67

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	94.67	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	94.67	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	94.67	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	94.67	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	94.67	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	94.67	0.00	0.00	100.00	0.75"	fine gravel
0.50"	94.67	0.00	0.00	100.00	0.50"	fine gravel
0.375"	94.67	0.00	0.00	100.00	0.375"	fine gravel
#4	97.21	2.54	0.98	99.02	#4	coarse sand
#10	107.10	12.43	4.80	95.20	#10	medium sand
#20	123.79	29.12	11.24	88.76	#20	medium sand
#40	134.81	40.14	15.50	84.50	#40	fine sand
#60	264.17	169.50	65.45	34.55	#60	fine sand
#100	339.65	244.98	94.59	5.41	#100	fine sand
#200	343.57	248.90	96.10	3.90	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.98
% C SAND	3.82
% M SAND	10.70
% F SAND	80.60
% FINES	3.90
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

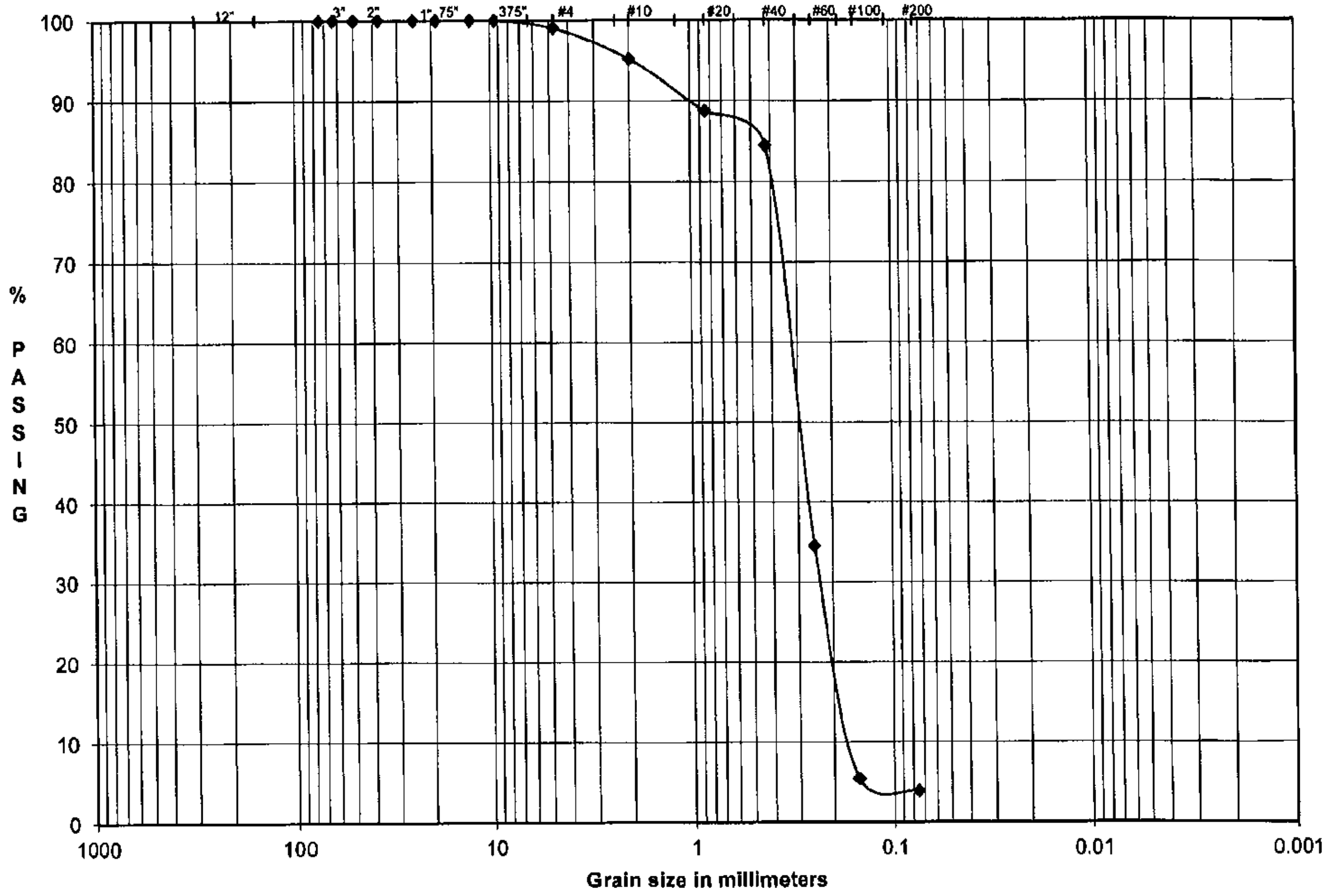
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light grey, Black, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	O.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.98	3.82	10.70	80.60	3.90

SAMPLE ID BH-10
SAMPLE TYPE JAR
SAMPLE DEPTH 3.5'-5.0'

LL -
PL -
PI -

DESCRIPTION Light grey, Black, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 8.5'-10.0'

DESCRIPTION: Brown, POORLY GRADED SAND, trace gravel, trace fines, trace organics
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	38.56
Weight of Dry Soil & Tare	33.73
Weight of Tare	13.99
Weight of Water	4.83
Weight of Dry Soil	19.74
Water Content	24.47%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-10
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	8.5'-10.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	38.56
Wt Dry Soil & Tare (gm)	(w2)	33.73
Weight of Tare (gm)	(w3)	13.99
Weight of Water (gm)	(w4=w1-w2)	4.83
Weight of Dry Soil (gm)	(w5=w2-w3)	19.74
Moisture Content (%)	(w4/w5)*100	24.47

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	31.59
Dry Soil & Tare (gm)	31.54
Tare Weight (gm)	13.91
Moisture Content (%)	0.28

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	345.73
Tare Weight (gm)	95.07
(W6) Total Dry Weight (gm)	249.95

SIEVE ANALYSIS

Tare Weight: 95.12

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.12	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.12	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.12	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.12	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.12	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.12	0.00	0.00	100.00	0.75"	fine gravel
0.50"	95.12	0.00	0.00	100.00	0.50"	fine gravel
0.375"	95.12	0.00	0.00	100.00	0.375"	fine gravel
#4	96.92	1.80	0.72	99.28	#4	coarse sand
#10	102.30	7.18	2.87	97.13	#10	medium sand
#20	109.43	14.31	5.73	94.27	#20	medium sand
#40	122.81	27.69	11.08	88.92	#40	fine sand
#60	234.96	139.84	55.95	44.05	#60	fine sand
#100	334.84	239.72	95.91	4.09	#100	fine sand
#200	341.73	246.61	98.66	1.34	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.72
% C SAND	2.15
% M SAND	8.21
% F SAND	87.59
% FINES	1.34
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

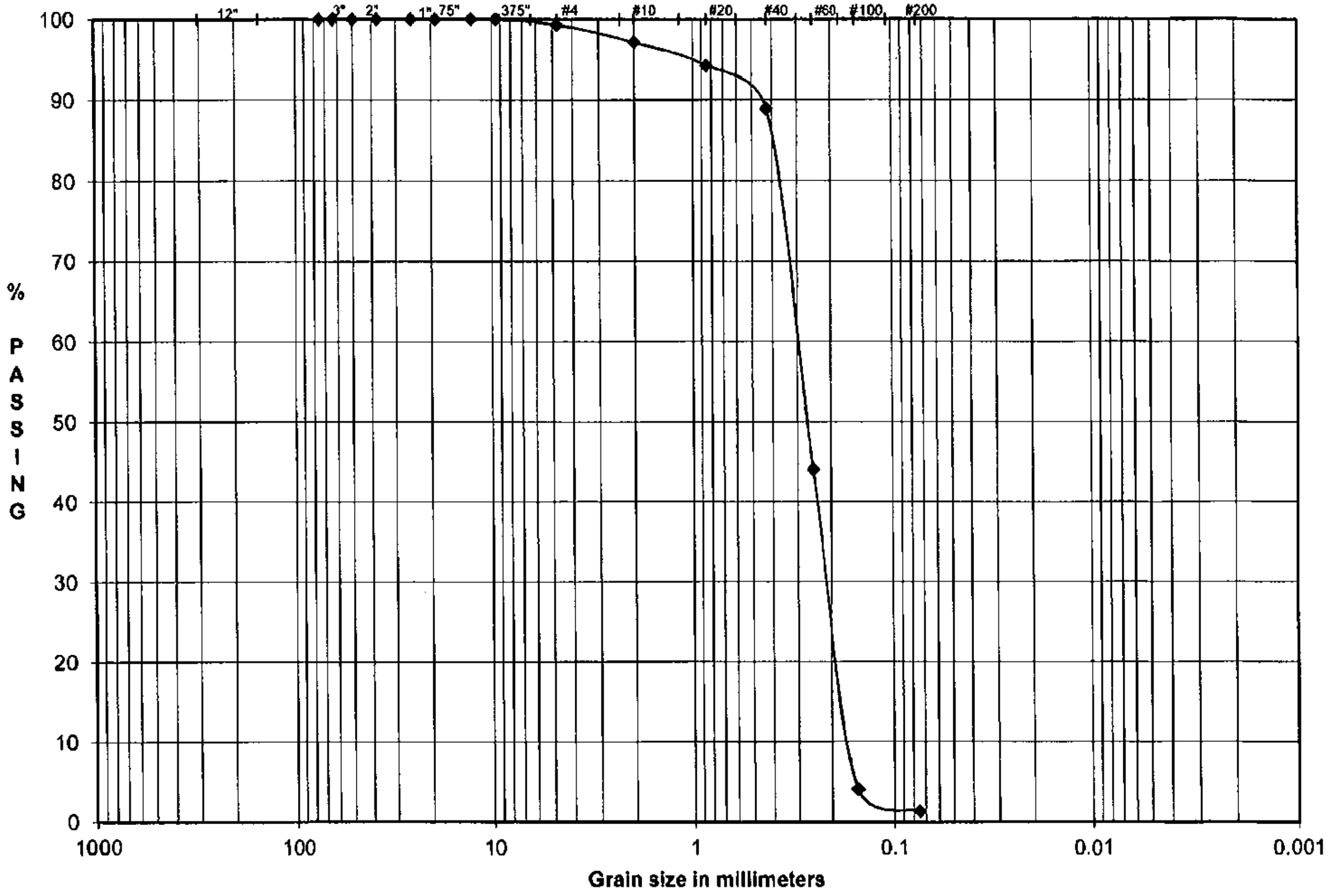
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines, trace organics

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.72	2.15	8.21	87.59	1.34

SAMPLE ID BH-10
SAMPLE TYPE BAG
SAMPLE DEPTH 8.5'-10.0'

LL -
PL -
PI -

DESCRIPTION Brown, POORLY GRADED SAND, trace gravel, trace fines, trace organics

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW BSV

Template For Sand Grain-size and Perm

Global Information:
PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 13.5'-15.0'

DESCRIPTION: Gray, Black, POORLY GRADED SAND, little gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.56
Weight of Dry Soil & Tare	34.31
Weight of Tare	14.17
Weight of Water	3.25
Weight of Dry Soil	20.14
Water Content	16.14%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	DLW
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-10
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	13.5'-15.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.56
Wt Dry Soil & Tare (gm)	(w2)	34.31
Weight of Tare (gm)	(w3)	14.17
Weight of Water (gm)	(w4=w1-w2)	3.25
Weight of Dry Soil (gm)	(w5=w2-w3)	20.14
Moisture Content (%)	(w4/w5)*100	16.14

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	36.52
Dry Soil & Tare (gm)	36.46
Tare Weight (gm)	14.16
Moisture Content (%)	0.27

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	434.92
Tare Weight (gm)	97.36
(W6) Total Dry Weight (gm)	336.65

SIEVE ANALYSIS

Tare Weight: 97.47

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.47	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.47	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.47	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.47	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.47	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	104.20	6.73	2.00	98.00	0.75"	fine gravel
0.50"	104.20	6.73	2.00	98.00	0.50"	fine gravel
0.375"	105.58	8.11	2.41	97.59	0.375"	fine gravel
#4	117.69	20.22	6.01	93.99	#4	coarse sand
#10	187.84	90.37	26.84	73.16	#10	medium sand
#20	253.95	156.48	46.48	53.52	#20	medium sand
#40	274.69	177.22	52.64	47.36	#40	fine sand
#60	338.77	241.30	71.68	28.32	#60	fine sand
#100	420.15	322.68	95.85	4.15	#100	fine sand
#200	427.86	330.39	98.14	1.86	#200	fines

% C GRAVEL	2.00
% F GRAVEL	4.01
% C SAND	20.84
% M SAND	25.80
% F SAND	45.50
% FINES	1.86
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

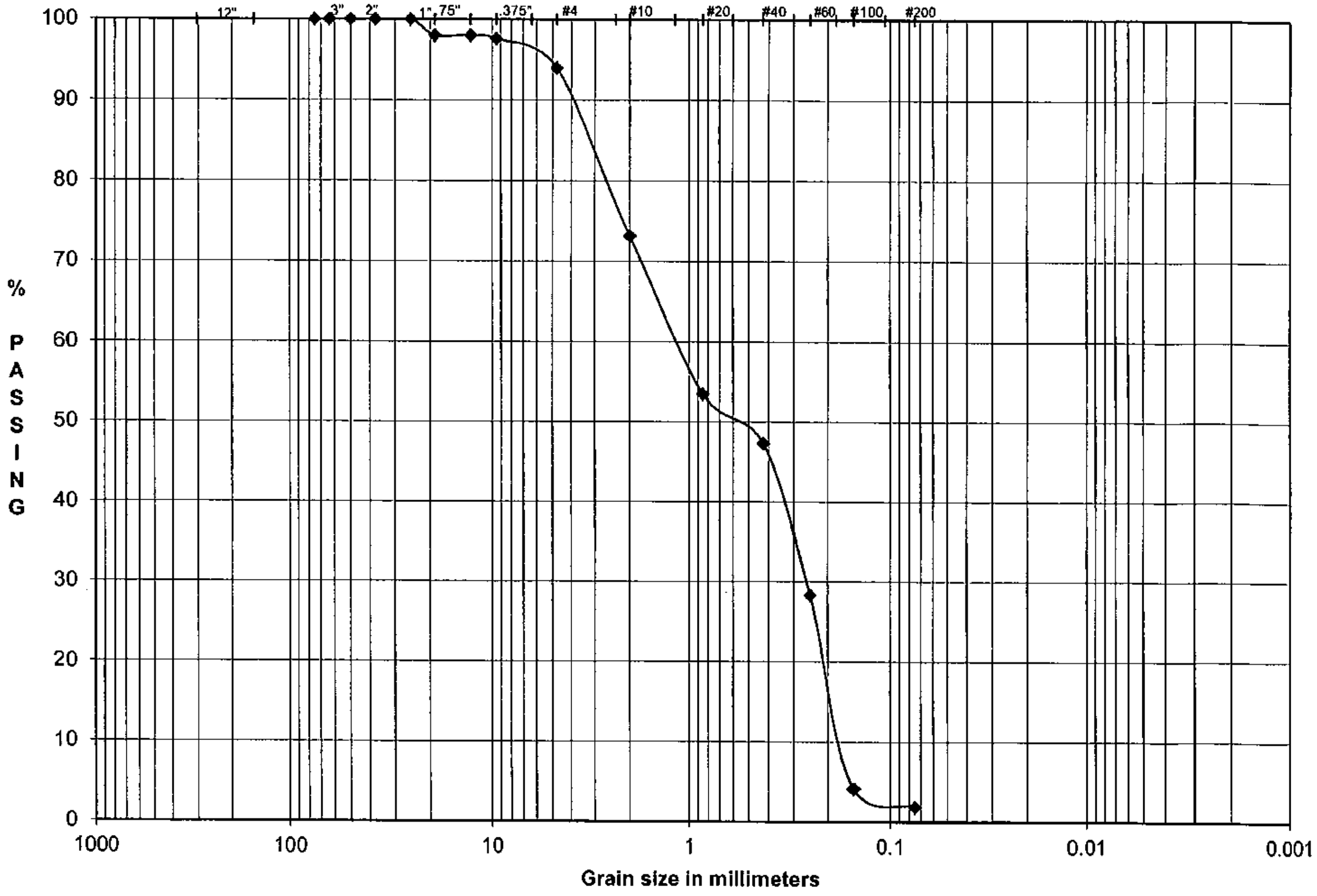
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BJT

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	2.00	4.01	20.84	25.80	45.50	1.86

SAMPLE ID	BH-10
SAMPLE TYPE	BAG
SAMPLE DEPTH	13.5'-15.0'

LL	-
PL	-
PI	-

DESCRIPTION Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	DuW.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 23.5'-25.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH GRAVEL, trace fines, trace organics

USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	35.49
Weight of Dry Soil & Tare	31.97
Weight of Tare	13.80
Weight of Water	3.52
Weight of Dry Soil	18.17
Water Content	19.37%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-10
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	23.5'-25.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	35.49
Wt Dry Soil & Tare (gm)	(w2)	31.97
Weight of Tare (gm)	(w3)	13.80
Weight of Water (gm)	(w4=w1-w2)	3.52
Weight of Dry Soil (gm)	(w5=w2-w3)	18.17
Moisture Content (%)	(w4/w5)*100	19.37

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	29.83
Dry Soil & Tare (gm)	29.79
Tare Weight (gm)	14.11
Moisture Content (%)	0.26

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	402.41
Tare Weight (gm)	94.66
(W6) Total Dry Weight (gm)	306.97

SIEVE ANALYSIS

Tare Weight

94.83

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	94.83	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	94.83	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	94.83	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	94.83	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	94.83	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	115.74	20.91	6.81	93.19	0.75"	fine gravel
0.50"	126.77	31.94	10.41	89.59	0.50"	fine gravel
0.375"	130.09	35.26	11.49	88.51	0.375"	fine gravel
#4	153.66	58.83	19.16	80.84	#4	coarse sand
#10	168.48	73.65	23.99	76.01	#10	medium sand
#20	178.86	84.03	27.37	72.63	#20	medium sand
#40	193.18	98.35	32.04	67.96	#40	fine sand
#60	290.39	195.56	63.71	36.29	#60	fine sand
#100	386.99	292.16	95.18	4.82	#100	fine sand
#200	397.14	302.31	98.48	1.52	#200	fines

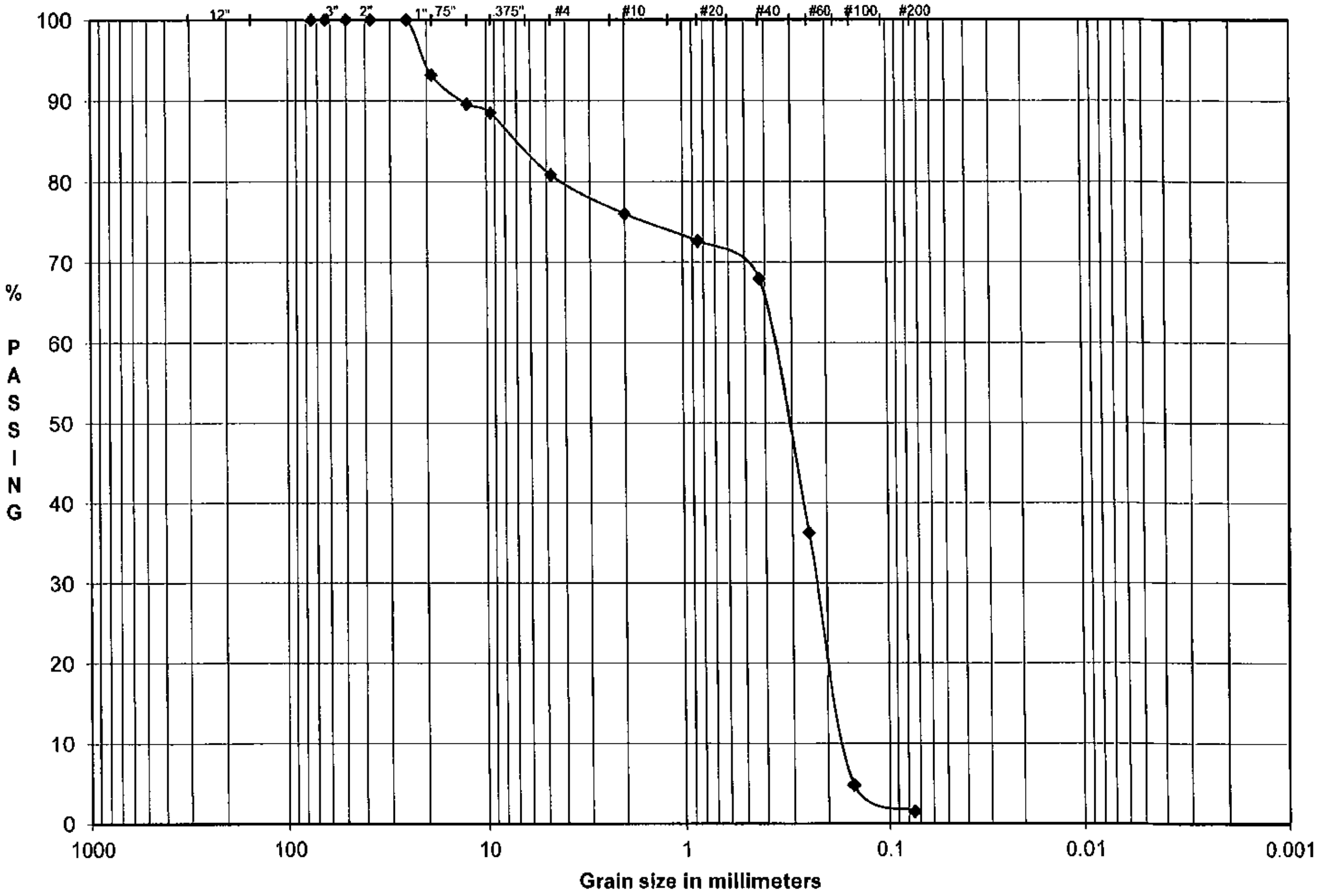
		Descriptive Terms				
% C GRAVEL	6.81			> 10% mostly coarse (c)		
% F GRAVEL	12.35	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	4.83	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	8.05	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	66.44	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	1.52			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Light Gray, POORLY GRADED SAND WITH GRAVEL, trace fines, trace organics

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		Gravel		SAND			FINES
	0.00	6.81	12.35	4.83	8.05	66.44	1.52

SAMPLE ID BH-10
SAMPLE TYPE BAG
SAMPLE DEPTH 23.5'-25.0'

LL -
PL -
PI -

DESCRIPTION Light Gray, POORLY GRADED SAND WITH GRAVEL, trace fines, trace organics

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW B.T.

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 58.5'-60.0'

DESCRIPTION: Very Light Gray, SILTY CLAYEY SAND

USCS: SC-SM*

*Classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	34.12
Weight of Dry Soil & Tare	30.42
Weight of Tare	13.93
Weight of Water	3.70
Weight of Dry Soil	16.49
Water Content	22.44%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-10
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	58.5'-60.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	34.12
Wt Dry Soil & Tare (gm)	(w2)	30.42
Weight of Tare (gm)	(w3)	13.93
Weight of Water (gm)	(w4=w1-w2)	3.70
Weight of Dry Soil (gm)	(w5=w2-w3)	16.49
Moisture Content (%)	(w4/w5)*100	22.44

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	37.08
Dry Soil & Tare (gm)	36.55
Tare Weight (gm)	14.27
Moisture Content (%)	2.38

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	417.34
Tare Weight (gm)	97.02
(W6) Total Dry Weight (gm)	312.88

SIEVE ANALYSIS

Tare Weight

97.20

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.20	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.20	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.20	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.20	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.20	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	97.20	0.00	0.00	100.00	0.75"	fine gravel
0.50"	97.20	0.00	0.00	100.00	0.50"	fine gravel
0.375"	97.20	0.00	0.00	100.00	0.375"	fine gravel
#4	97.20	0.00	0.00	100.00	#4	coarse sand
#10	97.40	0.20	0.06	99.94	#10	medium sand
#20	97.80	0.60	0.19	99.81	#20	medium sand
#40	98.15	0.95	0.30	99.70	#40	fine sand
#60	98.51	1.31	0.42	99.58	#60	fine sand
#100	179.74	82.54	26.38	73.62	#100	fine sand
#200	311.73	214.53	68.57	31.43	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.06
% M SAND	0.24
% F SAND	68.26
% FINES	31.43
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

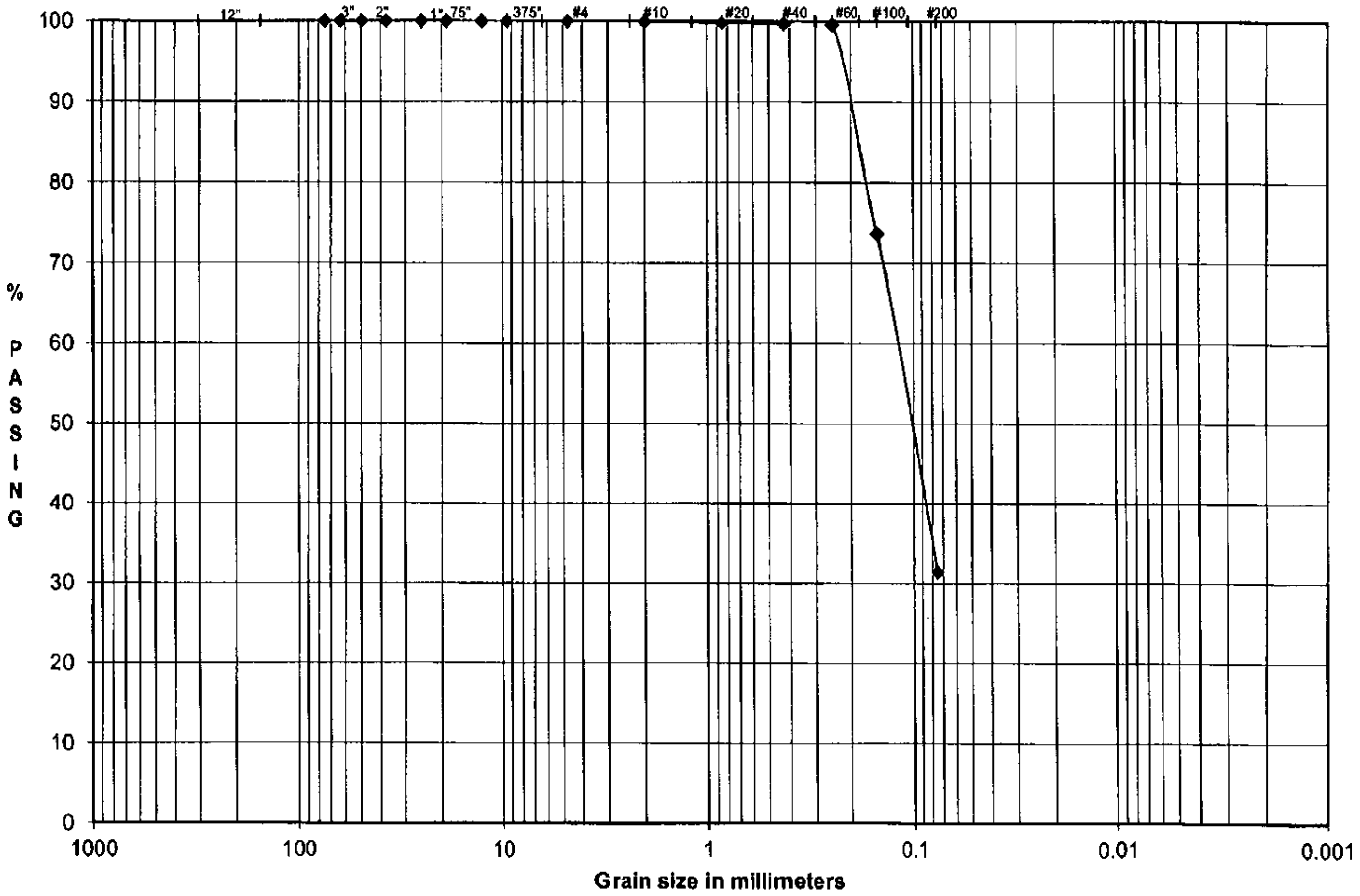
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Very Light Gray, SILTY CLAYEY SAND

USCS SC-SM*

TECH	CB
DATE	7/9/2012
CHECK	P.W.
REVIEW	BSJ

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.06	0.24	68.26	31.43

SAMPLE ID	BH-10
SAMPLE TYPE	BAG
SAMPLE DEPTH	58.5'-60.0'

LL	-
PL	-
PI	-

DESCRIPTION	Very Light Gray, SILTY CLAYEY SAND
USCS	SC-SM*

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-11
SAMPLE TYPE: BAG
SAMPLE DEPTH: 3.5'-5.0'

DESCRIPTION: Gray, WELL GRADED SAND WITH GRAVEL, trace fines
USCS: SW

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.75
Weight of Dry Soil & Tare	34.04
Weight of Tare	13.65
Weight of Water	2.71
Weight of Dry Soil	20.39
Water Content	13.29%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-11
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	3.5'-5.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.75
Wt Dry Soil & Tare (gm)	(w2)	34.04
Weight of Tare (gm)	(w3)	13.65
Weight of Water (gm)	(w4=w1-w2)	2.71
Weight of Dry Soil (gm)	(w5=w2-w3)	20.39
Moisture Content (%)	(w4/w5)*100	13.29

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.89
Dry Soil & Tare (gm)	33.49
Tare Weight (gm)	14.27
Moisture Content (%)	7.28

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	335.37
Tare Weight (gm)	97.06
(W6) Total Dry Weight (gm)	222.13

SIEVE ANALYSIS

Tare Weight

97.28

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.28	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.28	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.28	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.28	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.28	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	97.28	0.00	0.00	100.00	0.75"	fine gravel
0.50"	113.92	16.64	7.49	92.51	0.50"	fine gravel
0.375"	134.55	37.27	16.78	83.22	0.375"	fine gravel
#4	195.22	97.94	44.09	55.91	#4	coarse sand
#10	244.50	147.22	66.28	33.72	#10	medium sand
#20	277.32	180.04	81.05	18.95	#20	medium sand
#40	295.92	198.64	89.43	10.57	#40	fine sand
#60	305.90	208.62	93.92	6.08	#60	fine sand
#100	312.04	214.76	96.68	3.32	#100	fine sand
#200	316.61	219.33	98.74	1.26	#200	fines

% C GRAVEL	0.00
% F GRAVEL	44.09
% C SAND	22.19
% M SAND	23.15
% F SAND	9.31
% FINES	1.26
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

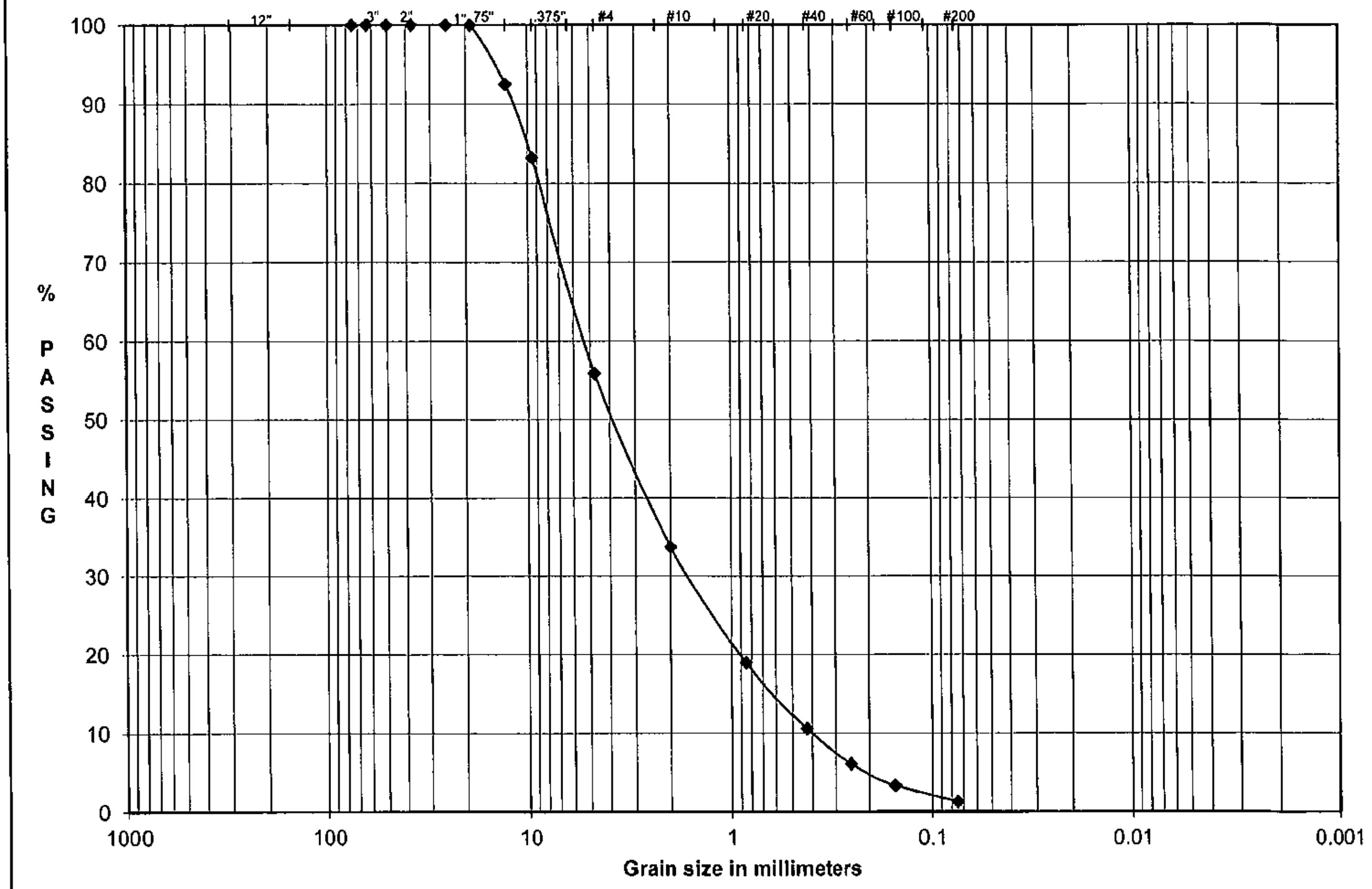
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Gray, WELL GRADED SAND WITH GRAVEL, trace fines

USCS SW

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	PSH

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	44.09	22.19	23.15	9.31	1.26

SAMPLE ID	BH-11
SAMPLE TYPE	BAG
SAMPLE DEPTH	3.5'-5.0'

LL	-
PL	-
PI	-

DESCRIPTION Gray, WELL GRADED SAND WITH GRAVEL, trace fines

USCS SW

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-11
SAMPLE TYPE: BAG
SAMPLE DEPTH: 11.0'-12.5

DESCRIPTION: Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	38.62
Weight of Dry Soil & Tare	34.01
Weight of Tare	14.19
Weight of Water	4.61
Weight of Dry Soil	19.82
Water Content	23.26%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-11
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	11.0'-12.5

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	38.62
Wt Dry Soil & Tare (gm)	(w2)	34.01
Weight of Tare (gm)	(w3)	14.19
Weight of Water (gm)	(w4=w1-w2)	4.61
Weight of Dry Soil (gm)	(w5=w2-w3)	19.82
Moisture Content (%)	(w4/w5)*100	23.26

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.64
Dry Soil & Tare (gm)	35.56
Tare Weight (gm)	14.06
Moisture Content (%)	0.37

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	390.16
Tare Weight (gm)	97.19
(W6) Total Dry Weight (gm)	291.88

SIEVE ANALYSIS

Tare Weight

97.47

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	97.47	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	97.47	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	97.47	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	97.47	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	97.47	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	97.47	0.00	0.00	100.00	0.75"	fine gravel
0.50"	97.47	0.00	0.00	100.00	0.50"	fine gravel
0.375"	97.47	0.00	0.00	100.00	0.375"	fine gravel
#4	98.24	0.77	0.26	99.74	#4	coarse sand
#10	98.77	1.30	0.45	99.55	#10	medium sand
#20	99.48	2.01	0.69	99.31	#20	medium sand
#40	106.43	8.96	3.07	96.93	#40	fine sand
#60	247.42	149.95	51.37	48.63	#60	fine sand
#100	377.49	280.02	95.94	4.06	#100	fine sand
#200	383.86	286.39	98.12	1.88	#200	fines

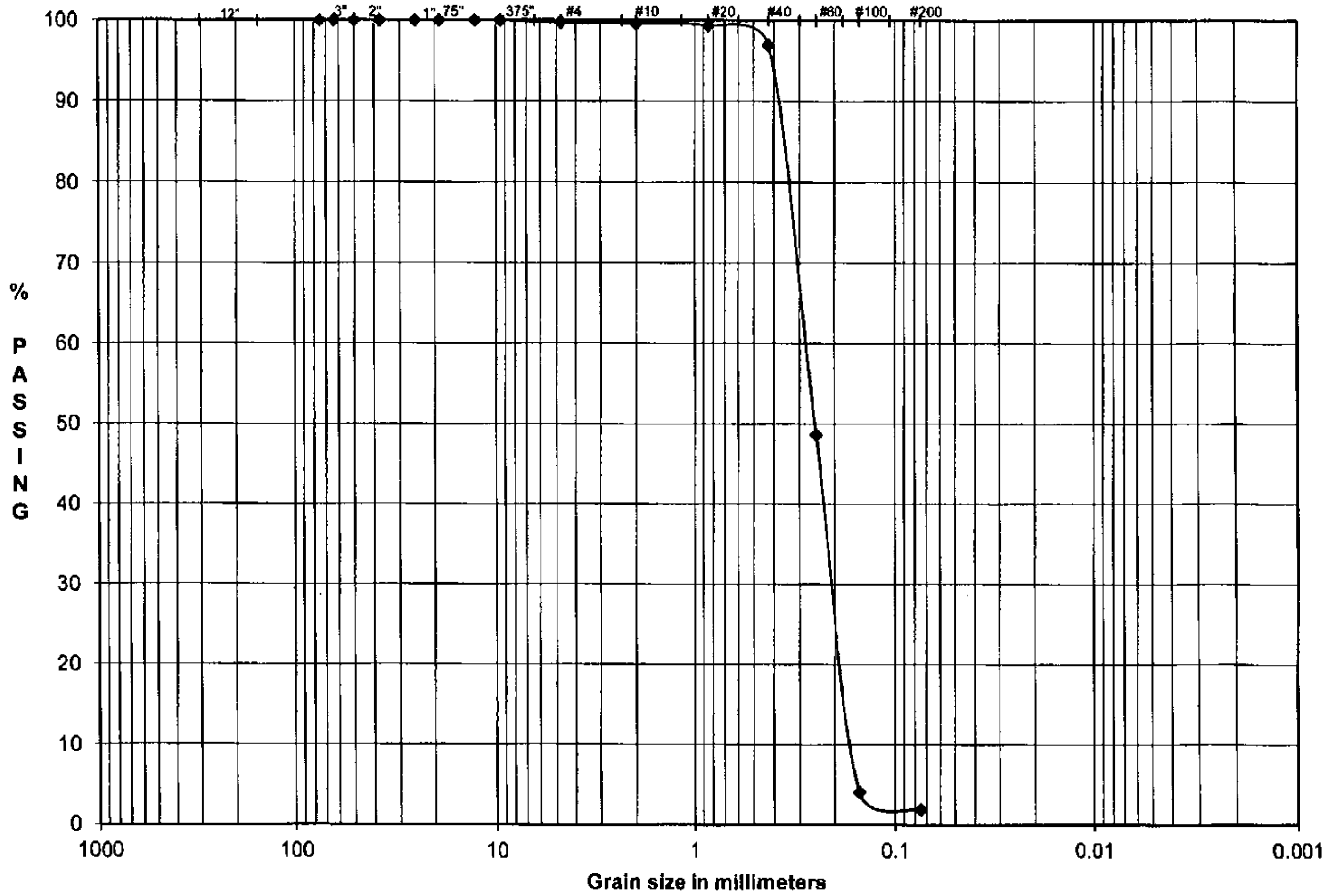
% C GRAVEL	0.00	Descriptive Terms		> 10% mostly coarse (c)		
% F GRAVEL	0.26	trace	0 to 5%	> 10% mostly medium (m)	LL	-
% C SAND	0.18	little	5 to 12%	< 10% fine (c-m)	PL	-
% M SAND	2.62	some	12 to 30%	< 10% coarse (m-f)	PI	-
% F SAND	95.05	and	30 to 50%	< 10% coarse and fine (m)	Gs	-
% FINES	1.88			< 10% coarse and medium (f)		
% TOTAL	100.00			> 10% equal amounts each (c-f)		

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.26	0.18	2.62	95.05	1.88

SAMPLE ID	BH-11	**LL**	-
SAMPLE TYPE	BAG	**PL**	-
SAMPLE DEPTH	11.0'-12.5	**PI**	-

DESCRIPTION	Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS	SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	P.W
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-11
SAMPLE TYPE: BAG
SAMPLE DEPTH: 18.5'-20.0'

DESCRIPTION: Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.87
Weight of Dry Soil & Tare	34.11
Weight of Tare	14.07
Weight of Water	3.76
Weight of Dry Soil	20.04
Water Content	18.76%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	P.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-11
PROJECT NO.	123-88898	**SAMPLE TYPE**	BAG
REMARKS		**SAMPLE DEPTH**	18.5'-20.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.87
Wt Dry Soil & Tare (gm)	(w2)	34.11
Weight of Tare (gm)	(w3)	14.07
Weight of Water (gm)	(w4=w1-w2)	3.76
Weight of Dry Soil (gm)	(w5=w2-w3)	20.04
Moisture Content (%)	(w4/w5)*100	18.76

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.48
Dry Soil & Tare (gm)	35.45
Tare Weight (gm)	13.92
Moisture Content (%)	0.14

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	421.63
Tare Weight (gm)	99.85
(W6) Total Dry Weight (gm)	321.33

SIEVE ANALYSIS

Tare Weight

99.97

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	99.97	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	99.97	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	99.97	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	99.97	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	99.97	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	112.71	12.74	3.96	96.04	0.75"	fine gravel
0.50"	121.02	21.05	6.55	93.45	0.50"	fine gravel
0.375"	122.32	22.35	6.96	93.04	0.375"	fine gravel
#4	136.37	36.40	11.33	88.67	#4	coarse sand
#10	162.82	62.85	19.56	80.44	#10	medium sand
#20	180.82	80.85	25.16	74.84	#20	medium sand
#40	202.09	102.12	31.78	68.22	#40	fine sand
#60	340.79	240.82	74.94	25.06	#60	fine sand
#100	416.51	316.54	98.51	1.49	#100	fine sand
#200	419.67	319.70	99.49	0.51	#200	fines

% C GRAVEL	3.96
% F GRAVEL	7.36
% C SAND	8.23
% M SAND	12.22
% F SAND	67.71
% FINES	0.51
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

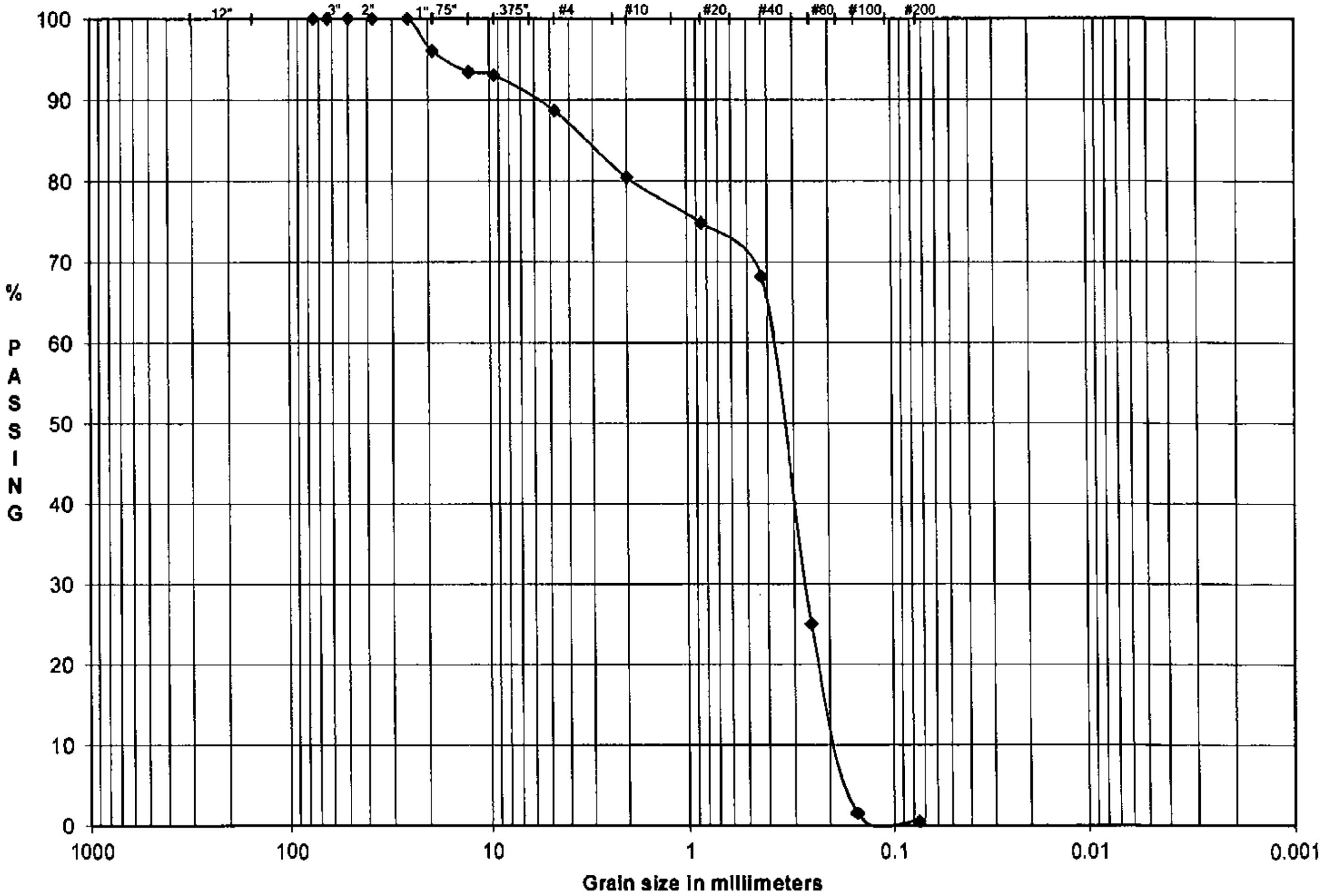
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	3.96	7.36	8.23	12.22	67.71	0.51

SAMPLE ID	BH-11	**LL**	-
SAMPLE TYPE	BAG	**PL**	-
SAMPLE DEPTH	18.5'-20.0'	**PI**	-

DESCRIPTION Light Gray, Black, POORLY GRADED SAND, little gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSJ

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-12
SAMPLE TYPE: JAR
SAMPLE DEPTH: 3.5'-5.0'

DESCRIPTION: Pale Brown, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.13
Weight of Dry Soil & Tare	35.66
Weight of Tare	13.72
Weight of Water	1.47
Weight of Dry Soil	21.94
Water Content	6.70%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-12
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	3.5'-5.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.13
Wt Dry Soil & Tare (gm)	(w2)	35.66
Weight of Tare (gm)	(w3)	13.72
Weight of Water (gm)	(w4=w1-w2)	1.47
Weight of Dry Soil (gm)	(w5=w2-w3)	21.94
Moisture Content (%)	(w4/w5)*100	6.70

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	37.56
Dry Soil & Tare (gm)	37.43
Tare Weight (gm)	14.09
Moisture Content (%)	0.56

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

	Weight Of Sample (gm)	361.93
	Tare Weight (gm)	96.05
(W6)	Total Dry Weight (gm)	264.41

SIEVE ANALYSIS

Tare Weight: 96.07

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.07	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.07	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.07	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.07	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.07	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.07	0.00	0.00	100.00	0.75"	fine gravel
0.50"	102.72	6.65	2.52	97.48	0.50"	fine gravel
0.375"	102.72	6.65	2.52	97.48	0.375"	fine gravel
#4	104.80	8.73	3.30	96.70	#4	coarse sand
#10	106.38	10.31	3.90	96.10	#10	medium sand
#20	108.53	12.46	4.71	95.29	#20	medium sand
#40	122.52	26.45	10.00	90.00	#40	fine sand
#60	261.95	165.88	62.74	37.26	#60	fine sand
#100	354.95	258.88	97.91	2.09	#100	fine sand
#200	357.39	261.32	98.83	1.17	#200	fines

% C GRAVEL	0.00
% F GRAVEL	3.30
% C SAND	0.60
% M SAND	6.10
% F SAND	88.83
% FINES	1.17
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

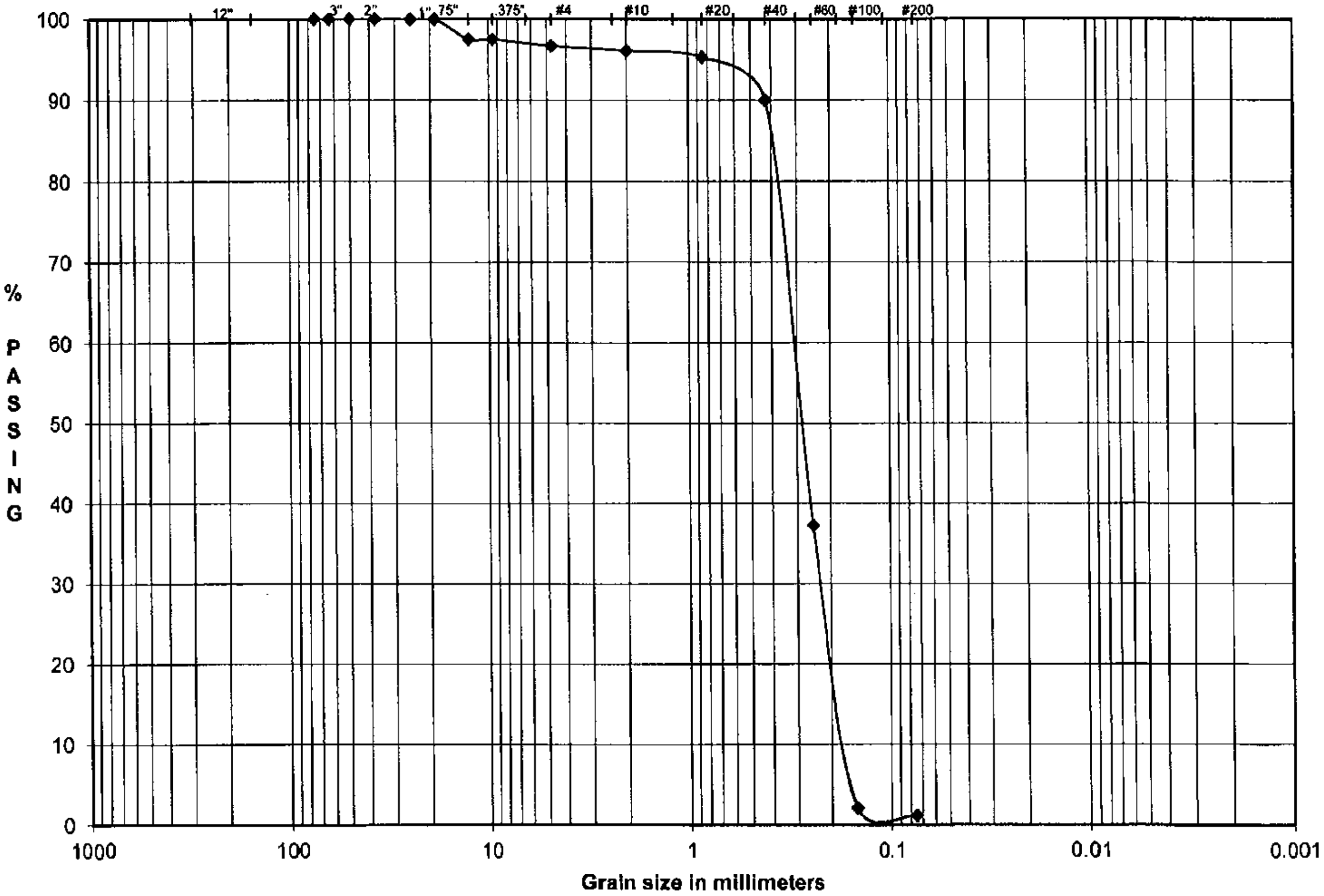
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	3.30	0.60	6.10	88.83	1.17

SAMPLE ID	BH-12
SAMPLE TYPE	JAR
SAMPLE DEPTH	3.5'-5.0'

LL	-
PL	-
PI	-

DESCRIPTION Pale Brown, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-12
SAMPLE TYPE: JAR
SAMPLE DEPTH: 11.0'-12.5

DESCRIPTION: Gray, POORLY GRADED SAND, trace gravel, trace fines
USCS: SP

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	37.96
Weight of Dry Soil & Tare	33.86
Weight of Tare	14.08
Weight of Water	4.10
Weight of Dry Soil	19.78
Water Content	20.73%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-12
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	11.0'-12.5

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	37.96
Wt Dry Soil & Tare (gm)	(w2)	33.86
Weight of Tare (gm)	(w3)	14.08
Weight of Water (gm)	(w4=w1-w2)	4.10
Weight of Dry Soil (gm)	(w5=w2-w3)	19.78
Moisture Content (%)	(w4/w5)*100	20.73

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	33.15
Dry Soil & Tare (gm)	33.13
Tare Weight (gm)	13.99
Moisture Content (%)	0.10

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	323.42
Tare Weight (gm)	95.50
(W6) Total Dry Weight (gm)	227.68

SIEVE ANALYSIS

Tare Weight

95.50

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	95.50	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	95.50	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	95.50	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	95.50	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	95.50	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	95.50	0.00	0.00	100.00	0.75"	fine gravel
0.50"	99.03	3.53	1.55	98.45	0.50"	fine gravel
0.375"	100.76	5.26	2.31	97.69	0.375"	fine gravel
#4	101.57	6.07	2.67	97.33	#4	coarse sand
#10	104.82	9.32	4.09	95.91	#10	medium sand
#20	108.38	12.88	5.66	94.34	#20	medium sand
#40	127.23	31.73	13.94	86.06	#40	fine sand
#60	270.08	174.58	76.68	23.32	#60	fine sand
#100	314.86	219.36	96.34	3.66	#100	fine sand
#200	318.59	223.09	97.98	2.02	#200	fines

% C GRAVEL	0.00
% F GRAVEL	2.67
% C SAND	1.43
% M SAND	9.84
% F SAND	84.05
% FINES	2.02
% TOTAL	100.00

Descriptive Terms

trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

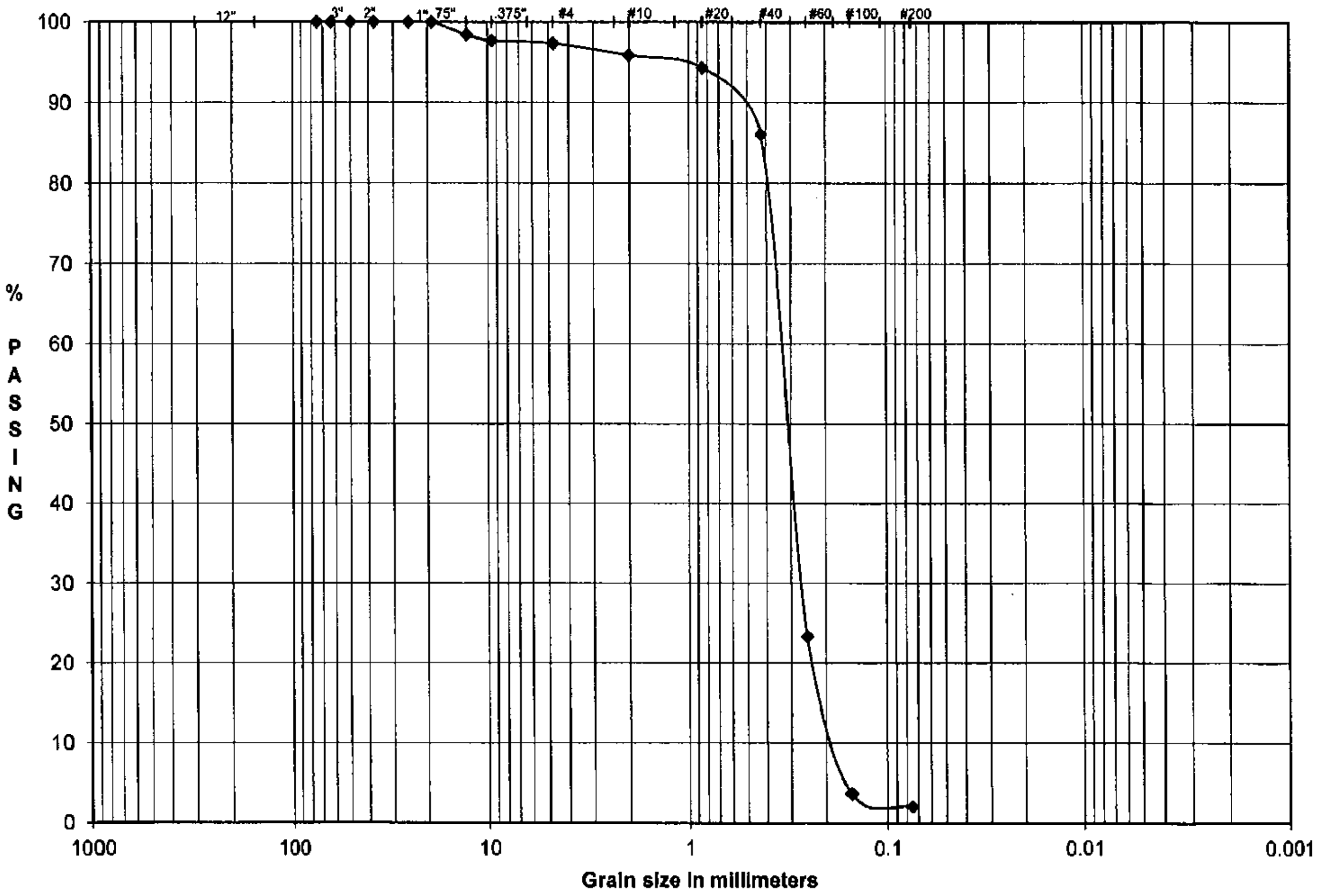
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Gray, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	2.67	1.43	9.84	84.05	2.02

SAMPLE ID BH-12
SAMPLE TYPE JAR
SAMPLE DEPTH 11.0'-12.5

LL -
PL -
PI -

DESCRIPTION Gray, POORLY GRADED SAND, trace gravel, trace fines

USCS SP

NIPSCO-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK D.W.
REVIEW ESN

Template For Sand Grain-size and Perm

Global Information:

PROJECT NAME: NIPSCO-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-12
SAMPLE TYPE: JAR
SAMPLE DEPTH: 33.5'-35.0'

DESCRIPTION: Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines

USCS: SP-SC

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	36.63
Weight of Dry Soil & Tare	32.58
Weight of Tare	14.07
Weight of Water	4.05
Weight of Dry Soil	18.51
Water Content	21.88%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM D 421, D 2217, D 1140, C 117, D 422, C 136, C 142

PROJECT TITLE	NIPSCO-MCGS	**SAMPLE ID**	BH-12
PROJECT NO.	123-88898	**SAMPLE TYPE**	JAR
REMARKS		**SAMPLE DEPTH**	33.5'-35.0'

WATER CONTENT (Delivered Moisture)

Wt Wet Soil & Tare (gm)	(w1)	36.63
Wt Dry Soil & Tare (gm)	(w2)	32.58
Weight of Tare (gm)	(w3)	14.07
Weight of Water (gm)	(w4=w1-w2)	4.05
Weight of Dry Soil (gm)	(w5=w2-w3)	18.51
Moisture Content (%)	(w4/w5)*100	21.88

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	33.58
Dry Soil & Tare (gm)	33.49
Tare Weight (gm)	13.64
Moisture Content (%)	0.45

Total Weight Of Sample Used For Sieve Corrected For Hygroscopic Moisture

Weight Of Sample (gm)	342.16
Tare Weight (gm)	96.34
(W6) Total Dry Weight (gm)	244.71

SIEVE ANALYSIS

Tare Weight

96.36

	Wt Ret +Tare	(Wt-Tare)	Cumulative (%Retained) {(wt ret/w6)*100}	% PASS (100-%ret)	SIEVE	
3.0"	96.36	0.00	0.00	100.00	3.0"	coarse gravel
2.5"	96.36	0.00	0.00	100.00	2.5"	coarse gravel
2.0"	96.36	0.00	0.00	100.00	2.0"	coarse gravel
1.5"	96.36	0.00	0.00	100.00	1.5"	coarse gravel
1.0"	96.36	0.00	0.00	100.00	1.0"	coarse gravel
0.75"	96.36	0.00	0.00	100.00	0.75"	fine gravel
0.50"	96.36	0.00	0.00	100.00	0.50"	fine gravel
0.375"	96.36	0.00	0.00	100.00	0.375"	fine gravel
#4	96.36	0.00	0.00	100.00	#4	coarse sand
#10	96.36	0.00	0.00	100.00	#10	medium sand
#20	96.40	0.04	0.02	99.98	#20	medium sand
#40	96.66	0.30	0.12	99.88	#40	fine sand
#60	161.51	65.15	26.62	73.38	#60	fine sand
#100	294.83	198.47	81.10	18.90	#100	fine sand
#200	321.54	225.18	92.02	7.98	#200	fines

% C GRAVEL	0.00
% F GRAVEL	0.00
% C SAND	0.00
% M SAND	0.12
% F SAND	91.90
% FINES	7.98
% TOTAL	100.00

Descriptive Terms	
trace	0 to 5%
little	5 to 12%
some	12 to 30%
and	30 to 50%

> 10% mostly coarse (c)
> 10% mostly medium (m)
< 10% fine (c-m)
< 10% coarse (m-f)
< 10% coarse and fine (m)
< 10% coarse and medium (f)
> 10% equal amounts each (c-f)

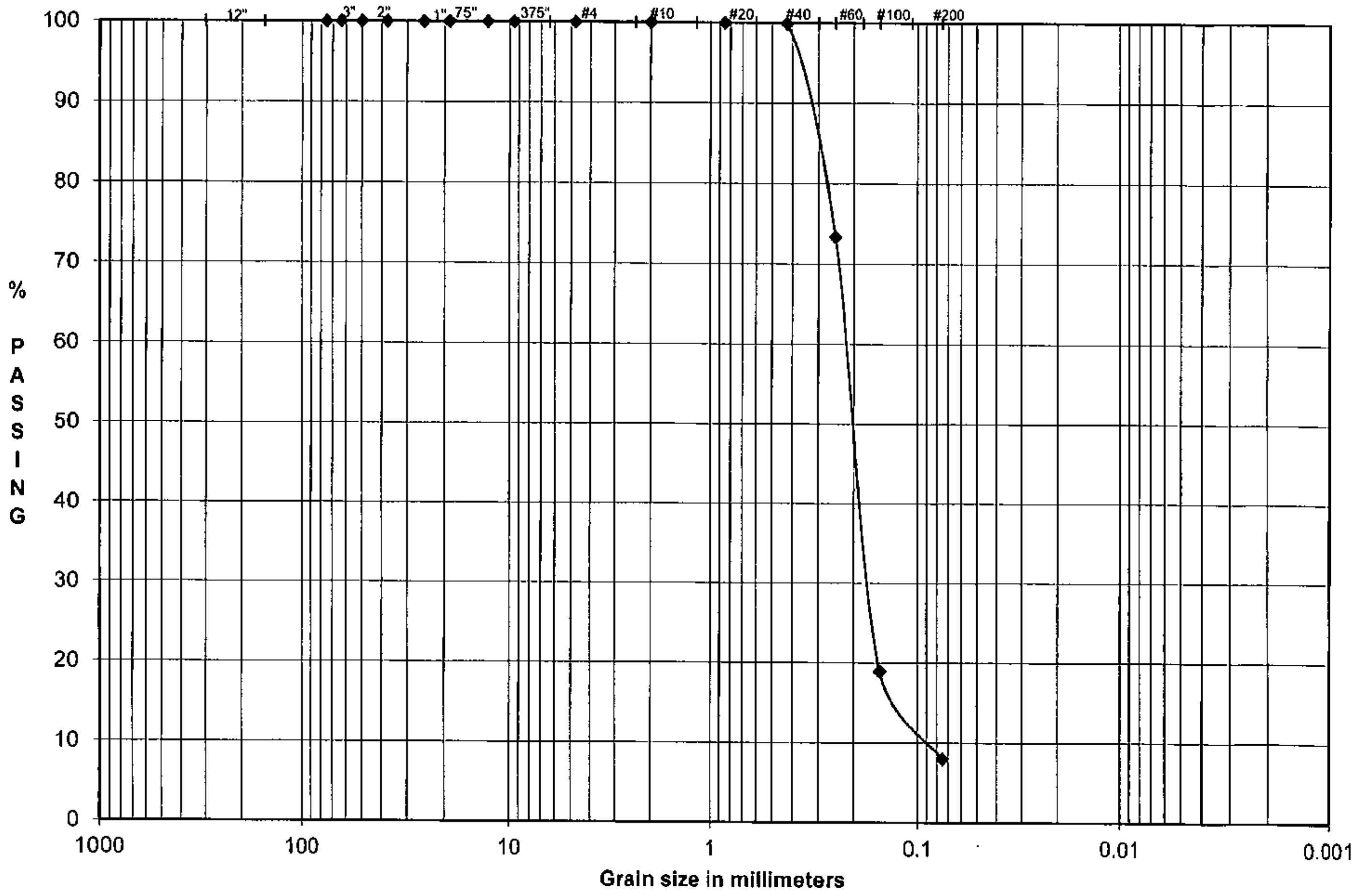
LL	-
PL	-
PI	-
Gs	-

DESCRIPTION Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines

USCS SP-SC

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



% Passing

		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	Gravel		SAND			FINES
	0.00	0.00	0.00	0.00	0.12	91.90	7.98

SAMPLE ID	BH-12
SAMPLE TYPE	JAR
SAMPLE DEPTH	33.5'-35.0'

LL	-
PL	-
PI	-

DESCRIPTION	Light Gray, POORLY GRADED SAND WITH SILTY CLAY, little fines
USCS	SP-SC

NIPSCO-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	D.W.
REVIEW	BSJ

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-1
SAMPLE TYPE: JAR
SAMPLE DEPTH: 38.5'-40.0'

DESCRIPTION: Dark gray, LEAN CLAY, little sand

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	24.87
Weight of Dry Soil & Tare	23.03
Weight of Tare	14.08
Weight of Water	1.84
Weight of Dry Soil	8.95
Water Content	20.56%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	TD
REVIEW	RSV

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-1
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	38.5'-40.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	19.58	19.18
Weight of Dry Soil & Tare	(W2)	18.81	18.48
Weight of Tare	(W3)	14.06	14.11
Weight of Water	(W4=W1-W2)	0.77	0.70
Weight of Dry Soil	(W5=W2-W3)	4.75	4.37
Water Content	(W4/W5)*100	16.21%	16.02%

NATURAL MOISTURE

Weight of Wet Soil & Tare	24.87
Weight of Dry Soil & Tare	23.03
Weight of Tare	14.08
Weight of Water	1.84
Weight of Dry Soil	8.95
Water Content	20.56%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		33	20	18
Weight of Wet Soil & Tare	(W6)	25.18	25.94	24.35
Weight of Dry Soil & Tare	(W7)	22.54	23.05	21.65
Weight of Tare	(W8)	13.93	14.29	13.74
Weight of Water	(W9=W6-W7)	2.64	2.89	2.70
Weight of Dry Soil	W10=W7-W8)	8.61	8.76	7.91
Water Content	(W9/W10)*100	30.66%	32.99%	34.13%

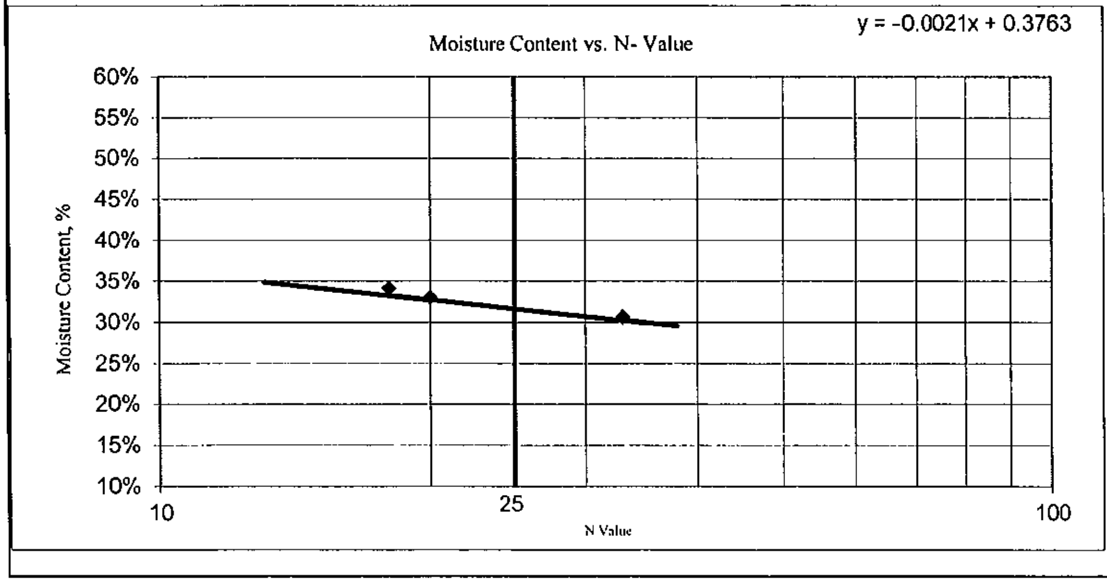
Blow	25
K - Value	1

Moisture content at 25 blow: 32.38%

LIQUID LIMIT (Wl)	32.38	32
PLASTIC LIMIT (Wp)	16.11	16
PLASTICITY INDEX (Ip)		16
LIQUIDITY INDEX (I)		0.28
MOISTURE CONTENT		20.56%

DESCRIPTION: Dark gray, LEAN CLAY, little sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	TDS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-1
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	38.5'-40.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	24.87
Wt. Dry Soil & Tare (gm)	(W2)	23.03
Weight of Tare (gm)	(W3)	14.08
Weight of Water (gm)	(W4=W1-W2)	1.84
Weight of Dry Soil (gm)	(W5=W2-W3)	8.95
Moisture Content (%)	(W4/W5)*100	20.56%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	29.42
Dry Soil & Tare (gm)	29.00
Tare Weight (gm)	13.91
Moisture Content (%)	2.78

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	358.34	
Tare Weight (gm)	95.03	
Total Weight (gm)	256.18	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	53.36
Calculated Dry Wt. used in test (gm)	51.92
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 28.05

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.13	0.08	99.8	#10	medium sand
#20	28.44	0.39	99.2	#20	medium sand
#40	28.84	0.79	98.5	#40	fine sand
#60	29.49	1.44	97.2	#60	fine sand
#100	30.63	2.58	95.0	#100	fine sand
#200	33.19	5.14	90.1	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:26	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:28	2.00	50.0	21.00	0.013	5.83	44.17	8.1	1.00
7/19/2012	1:31	5.00	45.0	21.00	0.013	5.83	39.17	8.9	1.00
7/19/2012	1:41	15.00	41.0	21.00	0.013	5.83	35.17	9.6	1.00
7/19/2012	1:56	30.00	38.5	21.00	0.013	5.83	32.67	10.1	1.00
7/19/2012	2:26	60.00	34.5	21.00	0.013	5.83	28.67	10.7	1.00
7/19/2012	5:36	250.00	29.5	21.40	0.013	5.70	23.80	11.5	1.00
7/20/2012	1:26	1440.00	22.0	22.10	0.013	5.47	16.53	12.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0271	85.1	% COARSE GRAVEL	0.00	
0.0180	75.4	% FINE GRAVEL	0.00	0.00
0.0108	67.7	% COARSE SAND	0.15	
0.0078	62.9	% MEDIUM SAND	1.37	
0.0057	55.2	% FINE SAND	8.38	9.90
0.0029	45.8	% FINES	90.10	
0.0013	31.8	% TOTAL SAMPLE	100.00	

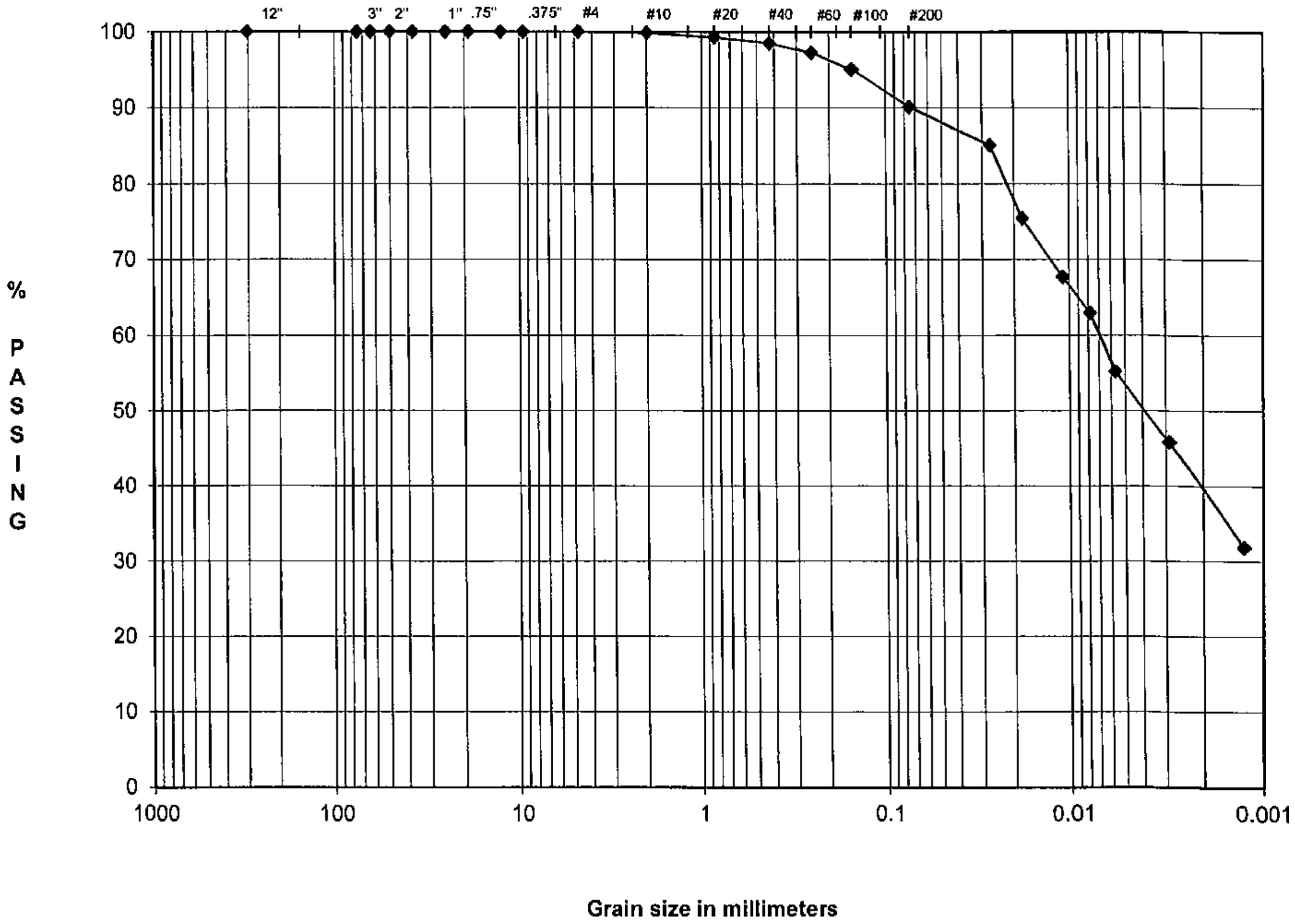
Description Dark gray, LEAN CLAY, little sand

USCS CL

32	LL
16	PL
16	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	**GRAVEL**		**SAND**			**FINES**
		0.00		9.90			90.10

SAMPLE ID BH-1
SAMPLE TYPE JAR
SAMPLE DEPTH 38.5'-40.0'

LL 32
PL 16
PI 16

DESCRIPTION Dark gray, LEAN CLAY, little sand

USCS CL

Nipsco-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK
REVIEW

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 18.5'-20.0'

DESCRIPTION: Very Dark Grayish Brown, SANDY SILTY CLAY

USCS: **CL-ML**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	19.93
Weight of Dry Soil & Tare	17.34
Weight of Tare	11.68
Weight of Water	2.59
Weight of Dry Soil	5.66
Water Content	45.76%

TITLE BLOCK:

TECH	CB
DATE	07/18/12
CHECK	D.W.
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-2
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	18.5'-20.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.28	18.05
Weight of Dry Soil & Tare	(W2)	17.50	17.20
Weight of Tare	(W3)	14.31	13.92
Weight of Water	(W4=W1-W2)	0.78	0.85
Weight of Dry Soil	(W5=W2-W3)	3.19	3.28
Water Content	(W4/W5)*100	24.45%	25.91%

NATURAL MOISTURE

Weight of Wet Soil & Tare	19.93
Weight of Dry Soil & Tare	17.34
Weight of Tare	11.68
Weight of Water	2.59
Weight of Dry Soil	5.66
Water Content	45.76%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		28	26	15
Weight of Wet Soil & Tare	(W6)	26.36	28.43	24.22
Weight of Dry Soil & Tare	(W7)	23.46	25.10	21.67
Weight of Tare	(W8)	14.03	14.34	14.09
Weight of Water	(W9=W6-W7)	2.90	3.33	2.55
Weight of Dry Soil	W10=W7-W8)	9.43	10.76	7.58
Water Content	(W9/W10)*100	30.75%	30.95%	33.64%

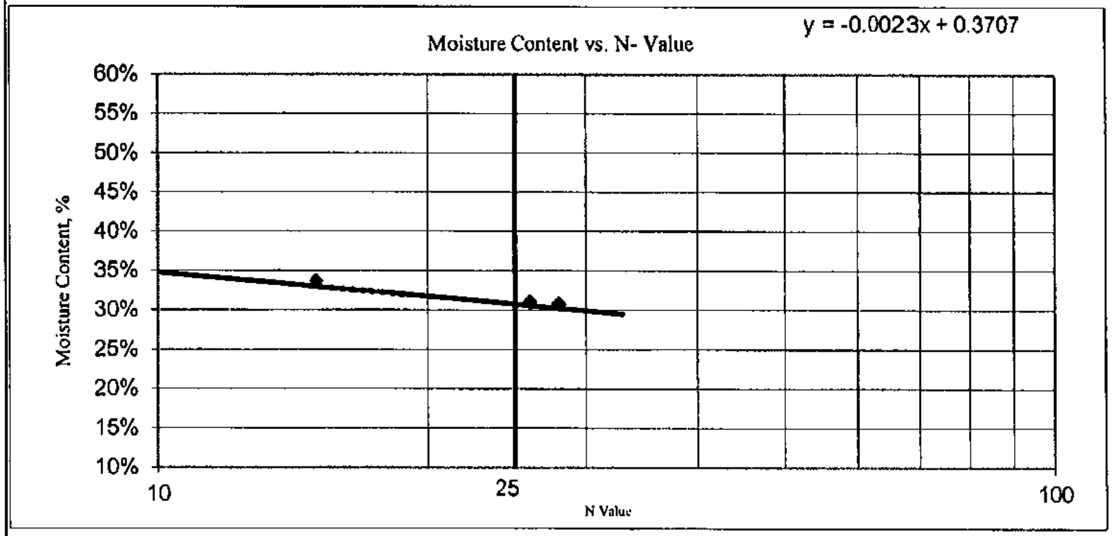
Blow	25
K - Value	1

Moisture content at 25 blow: 31.32%

LIQUID LIMIT (Wl)	31.32	31
PLASTIC LIMIT (Wp)	25.18	25
PLASTICITY INDEX (Ip)		6
LIQUIDITY INDEX (I)		3.43
MOISTURE CONTENT		45.76%

DESCRIPTION: Very Dark Grayish Brown, SANDY SILTY CLAY

USCS CL-ML



TECH	CB
DATE	7/18/2012
CHECK	D.W.
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-2
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	18.5'-20.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	19.93
Wt. Dry Soil & Tare (gm)	(W2)	17.34
Weight of Tare (gm)	(W3)	11.68
Weight of Water (gm)	(W4=W1-W2)	2.59
Weight of Dry Soil (gm)	(W5=W2-W3)	5.66
Moisture Content (%)	(W4/W5)*100	45.76%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	26.35
Dry Soil & Tare (gm)	26.23
Tare Weight (gm)	14.16
Moisture Content (%)	0.99

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	345.21	
Tare Weight (gm)	96.02	
Total Weight (gm)	246.74	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.16
Calculated Dry Wt. used in test (gm)	50.66
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.83

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.90	0.07	99.9	#10	medium sand
#20	31.90	1.07	97.9	#20	medium sand
#40	33.24	2.41	95.2	#40	fine sand
#60	39.25	8.42	83.4	#60	fine sand
#100	54.99	24.16	52.3	#100	fine sand
#200	57.06	26.23	48.2	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:24	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:26	2.00	27.0	21.00	0.013	5.83	21.17	11.9	1.00
7/19/2012	1:29	5.00	24.5	21.00	0.013	5.83	18.67	12.4	1.00
7/19/2012	1:39	15.00	22.0	21.00	0.013	5.83	16.17	12.7	1.00
7/19/2012	1:54	30.00	20.0	21.00	0.013	5.83	14.17	13.0	1.00
7/19/2012	2:24	60.00	17.0	21.00	0.013	5.83	11.17	13.5	1.00
7/19/2012	5:34	250.00	13.25	21.00	0.013	5.83	7.42	14.2	1.00
7/20/2012	1:24	1440.00	10.0	20.90	0.014	5.87	4.13	14.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0329	41.8	% COBBLES	0.00	
0.0212	36.9	% COARSE GRAVEL	0.00	
0.0124	31.9	% FINE GRAVEL	0.00	0.00
0.0089	28.0	% COARSE SAND	0.14	
0.0064	22.0	% MEDIUM SAND	4.62	
0.0032	14.6	% FINE SAND	47.02	51.78
0.0014	8.2	% FINES	48.22	
		% TOTAL SAMPLE	100.00	

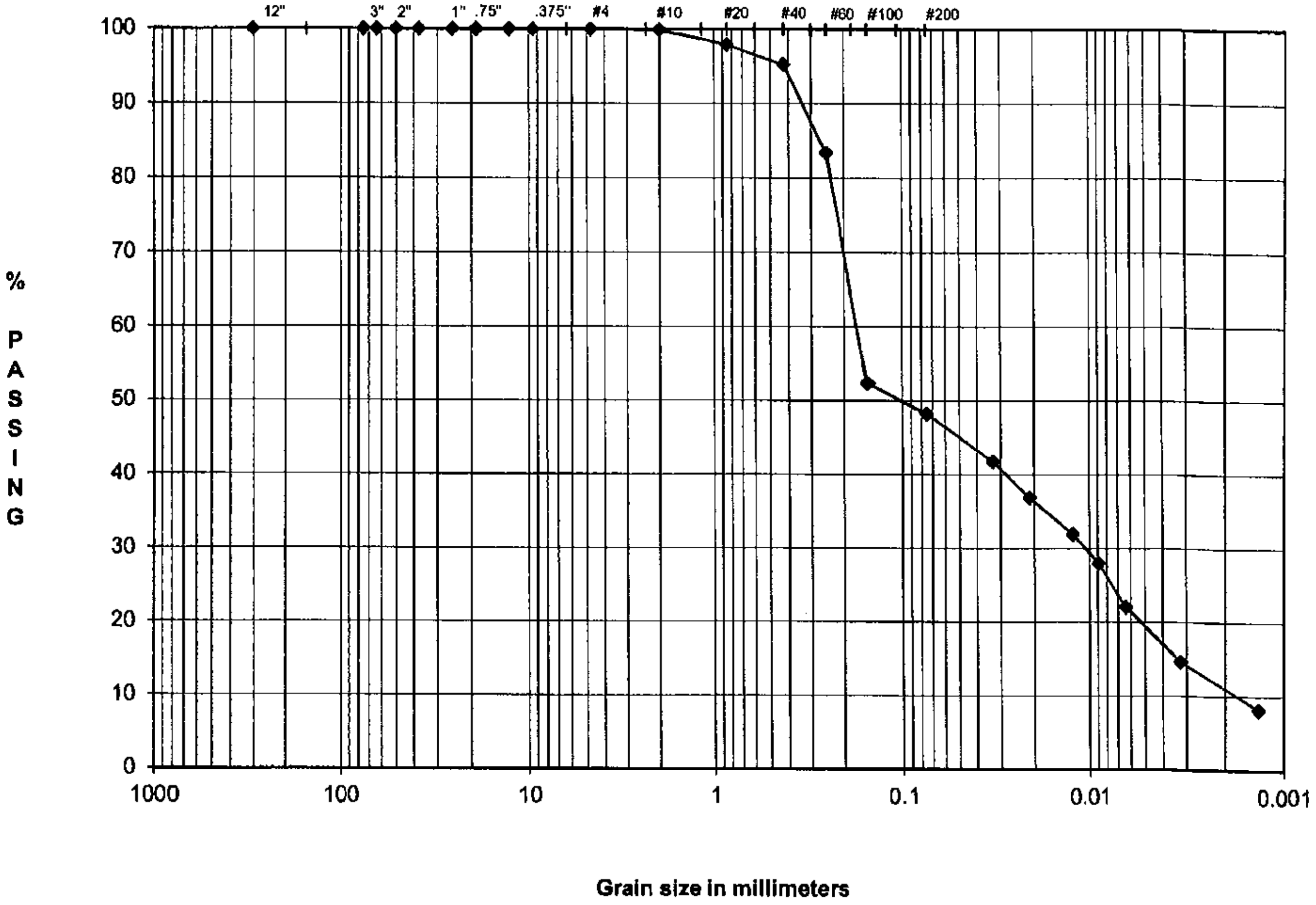
Description Very Dark Grayish Brown, SANDY SILTY CLAY

USCS CL-ML

31	LL
25	PL
6	PI

TECH	CB
DATE	7/18/2012
CHECK	D.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		51.78			48.22

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	18.5'-20.0'

LL	31
PL	25
PI	6

DESCRIPTION Very Dark Grayish Brown, SANDY SILTY CLAY

USCS CL-ML

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information: PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-2
SAMPLE TYPE: JAR
SAMPLE DEPTH: 38.5'-40.0'

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	20.52
Weight of Dry Soil & Tare	19.60
Weight of Tare	13.98
Weight of Water	0.92
Weight of Dry Soil	5.62
Water Content	16.37%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	EST
REVIEW	PJ

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-2
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	38.5'-40.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.27	18.40
Weight of Dry Soil & Tare	(W2)	17.70	17.83
Weight of Tare	(W3)	13.98	13.99
Weight of Water	(W4=W1-W2)	0.57	0.57
Weight of Dry Soil	(W5=W2-W3)	3.72	3.84
Water Content	(W4/W5)*100	15.32%	14.84%

NATURAL MOISTURE

Weight of Wet Soil & Tare	20.52
Weight of Dry Soil & Tare	19.60
Weight of Tare	13.98
Weight of Water	0.92
Weight of Dry Soil	5.62
Water Content	16.37%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		32	24	19
Weight of Wet Soil & Tare	(W6)	24.50	24.86	24.55
Weight of Dry Soil & Tare	(W7)	22.33	22.49	22.20
Weight of Tare	(W8)	14.34	14.09	14.04
Weight of Water	(W9=W6-W7)	2.17	2.37	2.35
Weight of Dry Soil	W10=W7-W8)	7.99	8.40	8.16
Water Content	(W9/W10)*100	27.16%	28.21%	28.80%

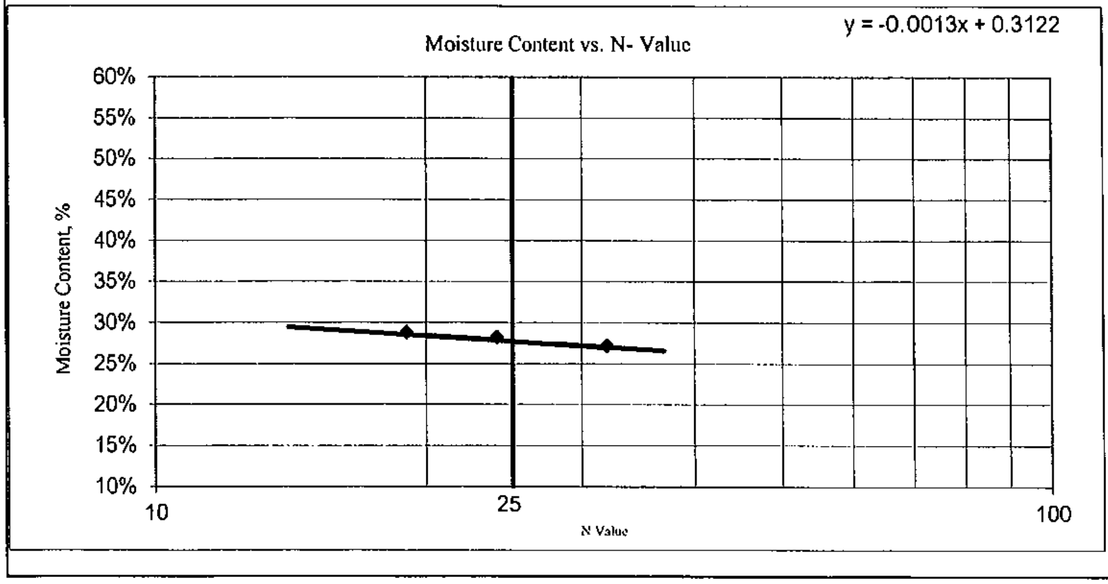
Blow	25
K - Value	1

Moisture content at 25 blow: 27.97%

LIQUID LIMIT (Wl)	27.97	28
PLASTIC LIMIT (Wp)	15.08	15
PLASTICITY INDEX (Ip)		13
LIQUIDITY INDEX (I)		0.10
MOISTURE CONTENT		16.37%

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	BSJ
REVIEW	PS

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-2
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	38.5'-40.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	20.52
Wt. Dry Soil & Tare (gm)	(W2)	19.60
Weight of Tare (gm)	(W3)	13.98
Weight of Water (gm)	(W4=W1-W2)	0.92
Weight of Dry Soil (gm)	(W5=W2-W3)	5.62
Moisture Content (%)	(W4/W5)*100	16.37%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	24.21
Dry Soil & Tare (gm)	24.20
Tare Weight (gm)	14.33
Moisture Content (%)	0.10

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	372.77	
Tare Weight (gm)	95.40	
Total Weight (gm)	277.09	(W6)

Plus #4 Material Sieve

TARE WEIGHT 11.47

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	11.47	0.0	100.0	12.0"	cobbles
3.0"	11.47	0.0	100.0	3.0"	coarse gravel
2.5"	11.47	0.0	100.0	2.5"	coarse gravel
2.0"	11.47	0.0	100.0	2.0"	coarse gravel
1.5"	11.47	0.0	100.0	1.5"	coarse gravel
1.0"	11.47	0.0	100.0	1.0"	coarse gravel
0.75"	11.47	0.0	100.0	0.75"	fine gravel
0.50"	11.47	0.0	100.0	0.50"	fine gravel
0.375"	11.47	0.0	100.0	0.375"	fine gravel
#4	11.84	0.1	99.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	50.36
Calculated Dry Wt. used in test (gm)	50.31
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.87

TARE WEIGHT 30.45

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.85	0.40	99.1	#10	medium sand
#20	31.29	0.84	98.2	#20	medium sand
#40	31.79	1.34	97.2	#40	fine sand
#60	32.45	2.00	95.9	#60	fine sand
#100	33.64	3.19	93.5	#100	fine sand
#200	38.08	7.63	84.7	#200	fines

HYDROMETER CALCULATIONS

DATE 7/9/2012	TIME 1:14	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/9/2012	1:16	2.00	42.0	21.00	0.013	5.83	36.17	9.4	1.00
7/9/2012	1:19	5.00	37.5	21.00	0.013	5.83	31.67	10.2	1.00
7/9/2012	1:29	15.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/9/2012	1:44	30.00	30.5	21.00	0.013	5.83	24.67	11.4	1.00
7/9/2012	2:14	60.00	28.5	21.00	0.013	5.83	22.67	11.7	1.00
7/9/2012	5:24	250.00	24.0	21.40	0.013	5.70	18.30	12.4	1.00
7/10/2012	1:14	1440.00	18.0	22.10	0.013	5.47	12.53	13.3	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0292	71.8	% COARSE GRAVEL	0.00	
0.0193	62.9	% FINE GRAVEL	0.13	0.13
0.0116	51.9	% COARSE SAND	0.79	
0.0083	49.0	% MEDIUM SAND	1.87	
0.0060	45.0	% FINE SAND	12.49	15.15
0.0030	36.3	% FINES	84.72	
0.0013	24.9	% TOTAL SAMPLE	100.00	

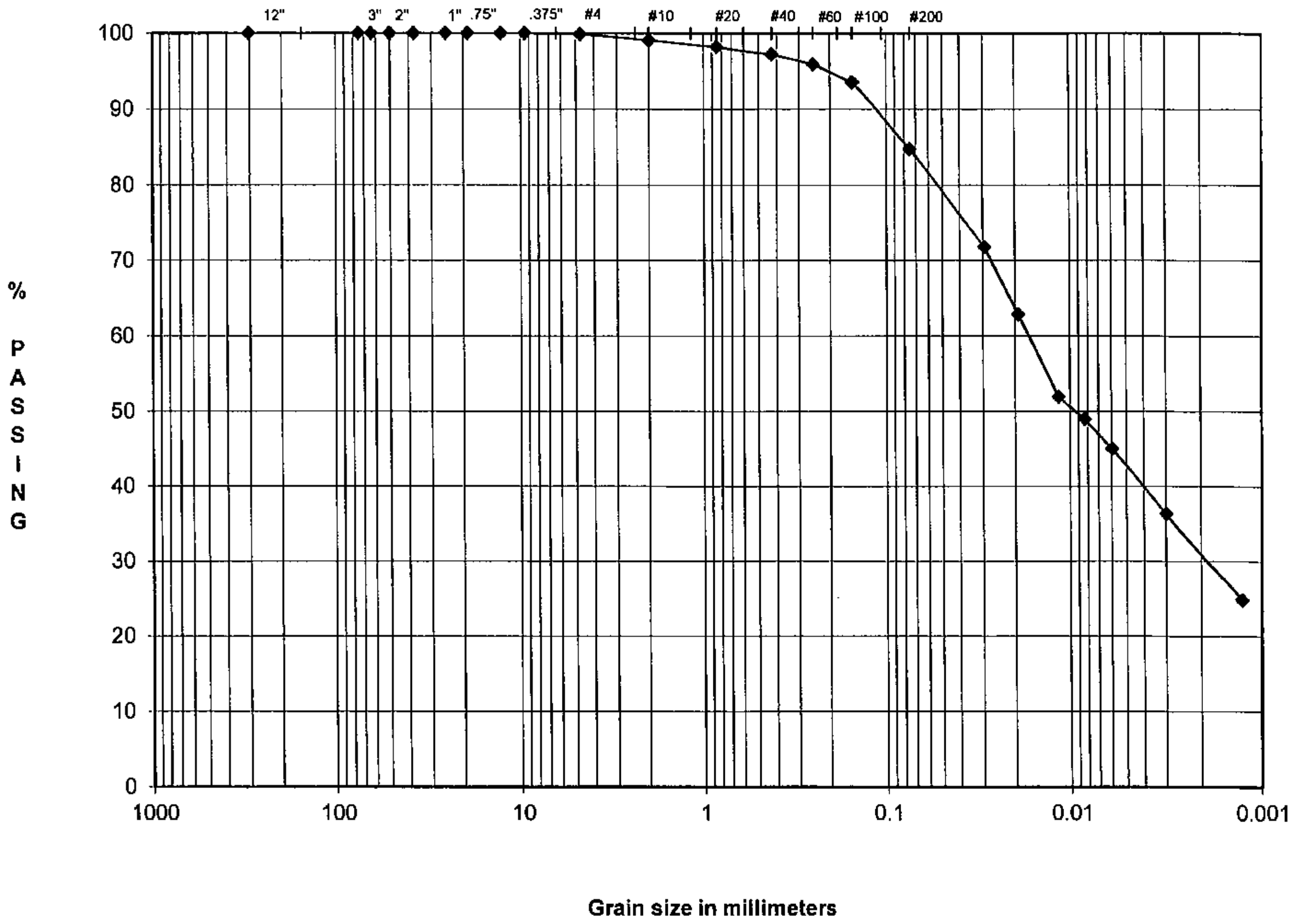
Description Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

28	LL
15	PL
13	PI

TECH	CB
DATE	7/9/2012
CHECK	BSV
REVIEW	TDS

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.13		15.15			84.72

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	38.5'-40.0'

LL	28
PL	15
PI	13

DESCRIPTION Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	BST
REVIEW	BS

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-2
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	48.5'-50.0'
DESCRIPTION:	Dark gray, LEAN CLAY, trace gravel, some sand
USCS:	CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	24.73
Weight of Dry Soil & Tare	23.10
Weight of Tare	13.93
Weight of Water	1.63
Weight of Dry Soil	9.17
Water Content	17.78%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	PS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-2
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	48.5'-50.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.21	18.31
Weight of Dry Soil & Tare	(W2)	17.57	17.68
Weight of Tare	(W3)	13.93	13.88
Weight of Water	(W4=W1-W2)	0.64	0.63
Weight of Dry Soil	(W5=W2-W3)	3.64	3.80
Water Content	(W4/W5)*100	17.58%	16.58%

NATURAL MOISTURE

Weight of Wet Soil & Tare	24.73
Weight of Dry Soil & Tare	23.10
Weight of Tare	13.93
Weight of Water	1.63
Weight of Dry Soil	9.17
Water Content	17.78%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		31	20	16
Weight of Wet Soil & Tare	(W6)	24.86	25.94	27.05
Weight of Dry Soil & Tare	(W7)	22.39	23.22	23.99
Weight of Tare	(W8)	13.98	14.28	14.14
Weight of Water	(W9=W6-W7)	2.47	2.72	3.06
Weight of Dry Soil	W10=W7-W8)	8.41	8.94	9.85
Water Content	(W9/W10)*100	29.37%	30.43%	31.07%

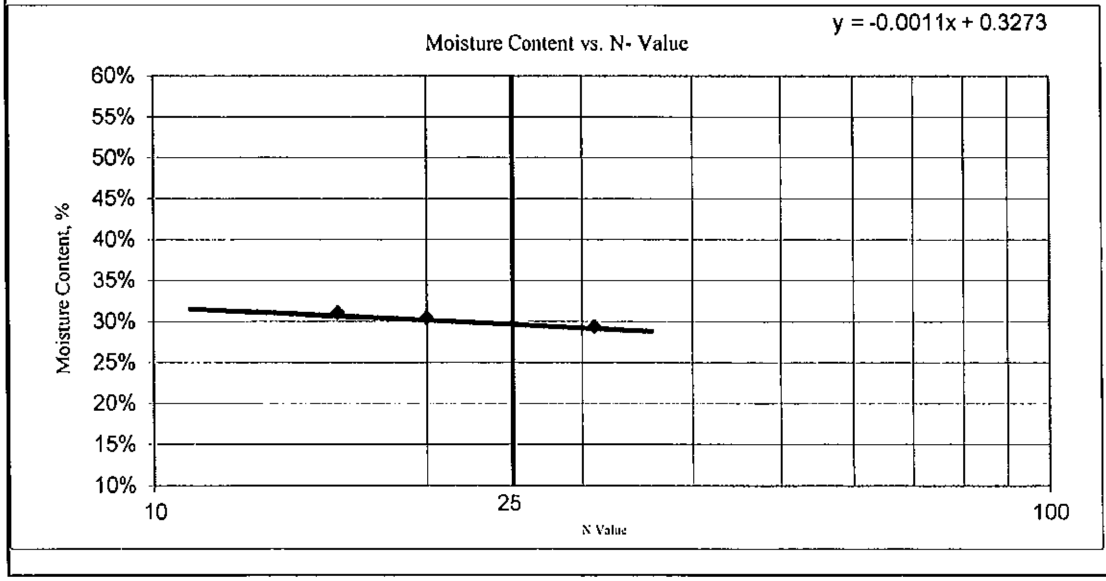
Blow	25
K - Value	1

Moisture content at 25 blow: 29.98%

LIQUID LIMIT (Wl)	29.98	30
PLASTIC LIMIT (Wp)	17.08	17
PLASTICITY INDEX (Ip)		13
LIQUIDITY INDEX (I)		0.05
MOISTURE CONTENT		17.78%

DESCRIPTION: Dark gray, LEAN CLAY, trace gravel, some sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-2
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	48.5'-50.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	24.73
Wt. Dry Soil & Tare (gm)	(W2)	23.10
Weight of Tare (gm)	(W3)	13.93
Weight of Water (gm)	(W4=W1-W2)	1.63
Weight of Dry Soil (gm)	(W5=W2-W3)	9.17
Moisture Content (%)	(W4/W5)*100	17.78%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.47
Dry Soil & Tare (gm)	33.83
Tare Weight (gm)	13.73
Moisture Content (%)	3.18

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	351.38	
Tare Weight (gm)	95.96	
Total Weight (gm)	247.54	(W6)

Plus #4 Material Sieve

TARE WEIGHT 10.96

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	10.96	0.0	100.0	12.0"	cobbles
3.0"	10.96	0.0	100.0	3.0"	coarse gravel
2.5"	10.96	0.0	100.0	2.5"	coarse gravel
2.0"	10.96	0.0	100.0	2.0"	coarse gravel
1.5"	10.96	0.0	100.0	1.5"	coarse gravel
1.0"	10.96	0.0	100.0	1.0"	coarse gravel
0.75"	10.96	0.0	100.0	0.75"	fine gravel
0.50"	10.96	0.0	100.0	0.50"	fine gravel
0.375"	10.96	0.0	100.0	0.375"	fine gravel
#4	11.21	0.1	99.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	50.23
Calculated Dry Wt. used in test (gm)	48.68
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.90

TARE WEIGHT 28.04

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.39	0.35	99.2	#10	medium sand
#20	28.86	0.82	98.2	#20	medium sand
#40	29.38	1.34	97.1	#40	fine sand
#60	29.96	1.92	96.0	#60	fine sand
#100	30.68	2.64	94.5	#100	fine sand
#200	33.97	5.93	87.7	#200	fines

HYDROMETER CALCULATIONS

DATE 7/9/2012	TIME 1:08	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/9/2012	1:10	2.00	44.0	21.00	0.013	5.83	38.17	9.1	1.00
7/9/2012	1:13	5.00	40.5	21.00	0.013	5.83	34.67	9.7	1.00
7/9/2012	1:23	15.00	36.0	21.00	0.013	5.83	30.17	10.4	1.00
7/9/2012	1:38	30.00	34.5	21.00	0.013	5.83	28.67	10.7	1.00
7/9/2012	2:08	60.00	31.0	21.00	0.013	5.83	25.17	11.2	1.00
7/9/2012	5:18	250.00	26.0	21.40	0.013	5.70	20.30	12.0	1.00
7/10/2012	1:08	1440.00	20.5	22.10	0.013	5.47	15.03	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0288	78.3	% COARSE GRAVEL	0.00	
0.0188	71.1	% FINE GRAVEL	0.10	0.10
0.0112	61.9	% COARSE SAND	0.72	
0.0081	58.8	% MEDIUM SAND	2.03	
0.0058	51.6	% FINE SAND	9.42	12.17
0.0030	41.7	% FINES	87.73	
0.0013	30.8	% TOTAL SAMPLE	100.00	

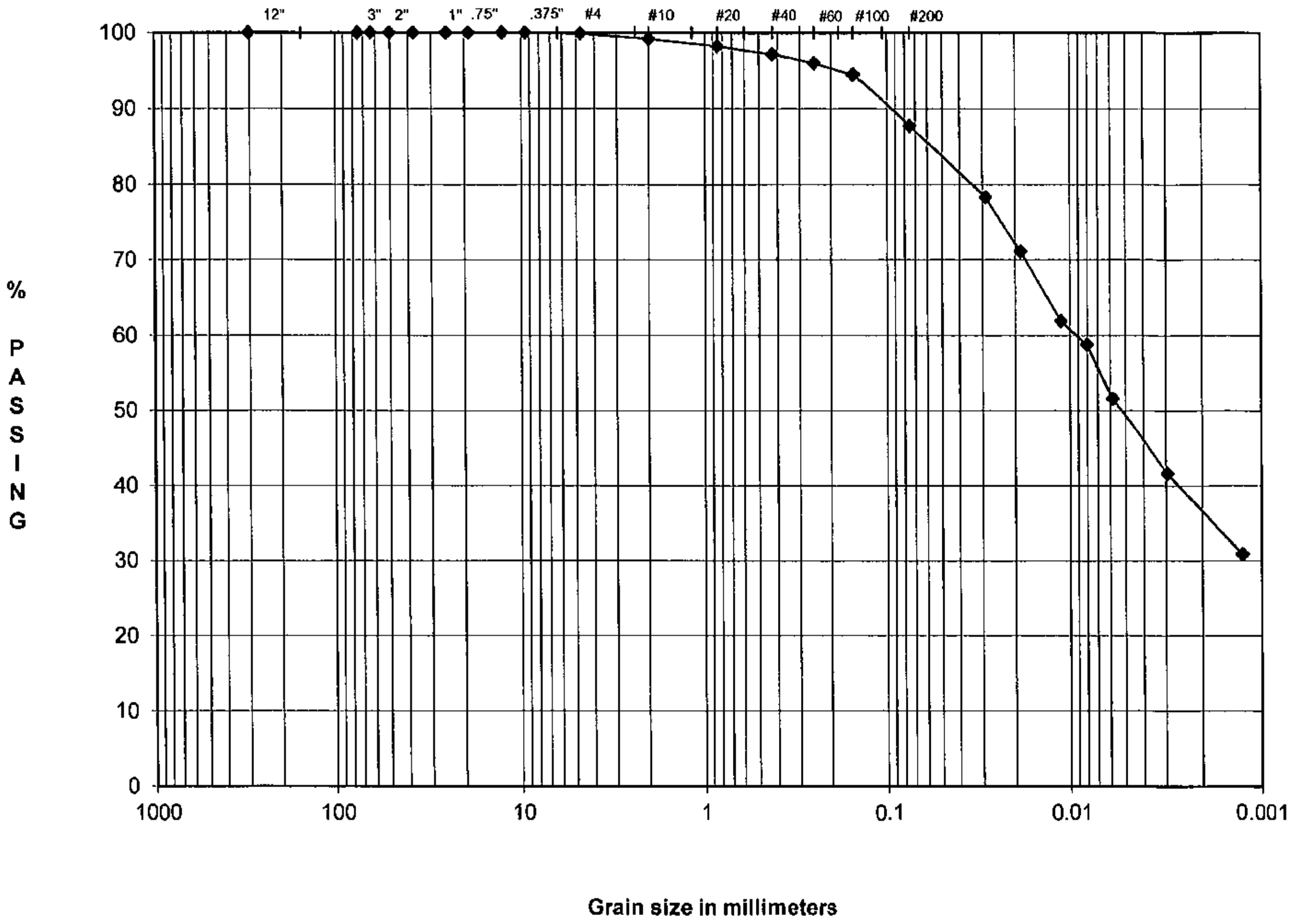
Description Dark gray, LEAN CLAY, trace gravel, some sand

USCS CL

30	LL
17	PL
13	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.10		12.17			87.73

SAMPLE ID	BH-2
SAMPLE TYPE	JAR
SAMPLE DEPTH	48.5'-50.0'

LL	30
PL	17
PI	13

DESCRIPTION Dark gray, LEAN CLAY, trace gravel, some sand

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	BS
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-3
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	73.5'-75.0'
DESCRIPTION:	Dark gray, LEAN CLAY, little sand
USCS:	**CL**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	27.07
Weight of Dry Soil & Tare	25.34
Weight of Tare	14.01
Weight of Water	1.73
Weight of Dry Soil	11.33
Water Content	15.27%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	PS
REVIEW	PSJ

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-3
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	73.5'-75.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	19.47	18.92
Weight of Dry Soil & Tare	(W2)	18.80	18.30
Weight of Tare	(W3)	14.09	13.87
Weight of Water	(W4=W1-W2)	0.67	0.62
Weight of Dry Soil	(W5=W2-W3)	4.71	4.43
Water Content	(W4/W5)*100	14.23%	14.00%

NATURAL MOISTURE

Weight of Wet Soil & Tare	27.07
Weight of Dry Soil & Tare	25.34
Weight of Tare	14.01
Weight of Water	1.73
Weight of Dry Soil	11.33
Water Content	15.27%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		30	24	15
Weight of Wet Soil & Tare	(W6)	24.31	22.65	26.43
Weight of Dry Soil & Tare	(W7)	21.55	20.14	22.91
Weight of Tare	(W8)	11.41	11.21	11.32
Weight of Water	(W9=W6-W7)	2.76	2.51	3.52
Weight of Dry Soil	W10=W7-W8)	10.14	8.93	11.59
Water Content	(W9/W10)*100	27.22%	28.11%	30.37%

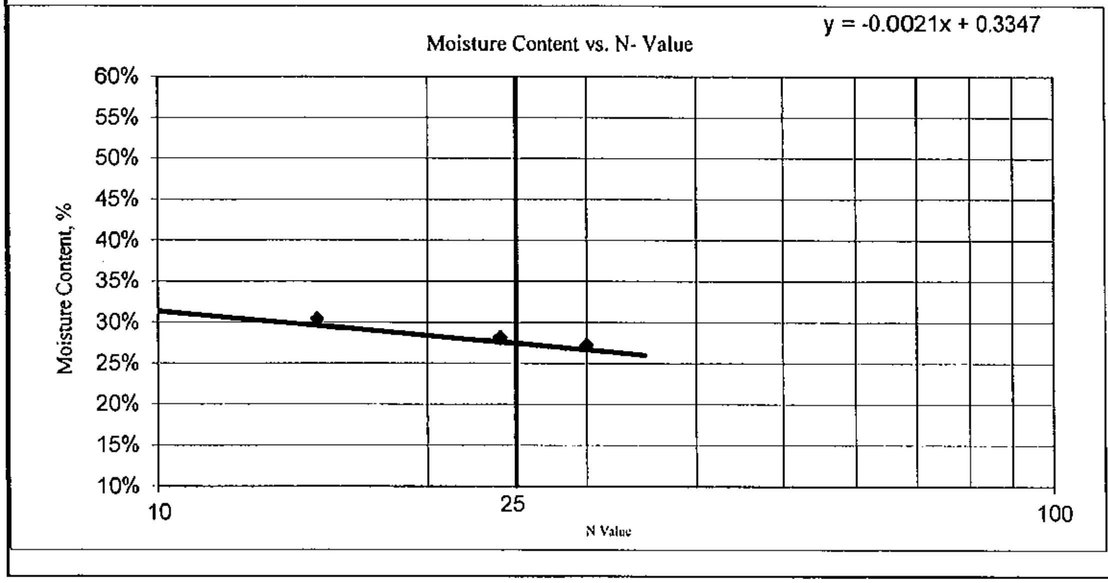
Blow	25
K - Value	1

Moisture content at 25 blow: 28.22%

LIQUID LIMIT (Wl)	28.22	28
PLASTIC LIMIT (Wp)	14.11	14
PLASTICITY INDEX (Ip)		14
LIQUIDITY INDEX (I)		0.08
MOISTURE CONTENT		15.27%

DESCRIPTION: Dark gray, LEAN CLAY, little sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	PF
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-3
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	73.5'-75.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	27.07
Wt. Dry Soil & Tare (gm)	(W2)	25.34
Weight of Tare (gm)	(W3)	14.01
Weight of Water (gm)	(W4=W1-W2)	1.73
Weight of Dry Soil (gm)	(W5=W2-W3)	11.33
Moisture Content (%)	(W4/W5)*100	15.27%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	31.81
Dry Soil & Tare (gm)	31.40
Tare Weight (gm)	14.07
Moisture Content (%)	2.37

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	380.17	
Tare Weight (gm)	95.97	
Total Weight (gm)	277.63	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.68
Calculated Dry Wt. used in test (gm)	50.49
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.49

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.69	0.20	99.6	#10	medium sand
#20	31.00	0.51	99.0	#20	medium sand
#40	31.47	0.98	98.1	#40	fine sand
#60	32.55	2.06	95.9	#60	fine sand
#100	33.14	2.65	94.8	#100	fine sand
#200	35.92	5.43	89.2	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:20	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:22	2.00	45.0	21.21	0.013	5.76	39.24	8.9	1.00
7/19/2012	1:25	5.00	40.0	21.00	0.013	5.83	34.17	9.7	1.00
7/19/2012	1:35	15.00	36.0	21.00	0.013	5.83	30.17	10.4	1.00
7/19/2012	1:50	30.00	33.5	21.00	0.013	5.83	27.67	10.9	1.00
7/19/2012	2:20	60.00	31.5	21.00	0.013	5.83	25.67	11.2	1.00
7/19/2012	5:30	250.00	26.0	21.40	0.013	5.70	20.30	12.0	1.00
7/20/2012	1:20	1440.00	20.5	22.10	0.013	5.47	15.03	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0284	77.7	% COARSE GRAVEL	0.00	
0.0188	67.7	% FINE GRAVEL	0.00	0.00
0.0112	59.8	% COARSE SAND	0.40	
0.0081	54.8	% MEDIUM SAND	1.54	
0.0058	50.8	% FINE SAND	8.81	10.76
0.0030	40.2	% FINES	89.24	
0.0013	29.8	% TOTAL SAMPLE	100.00	

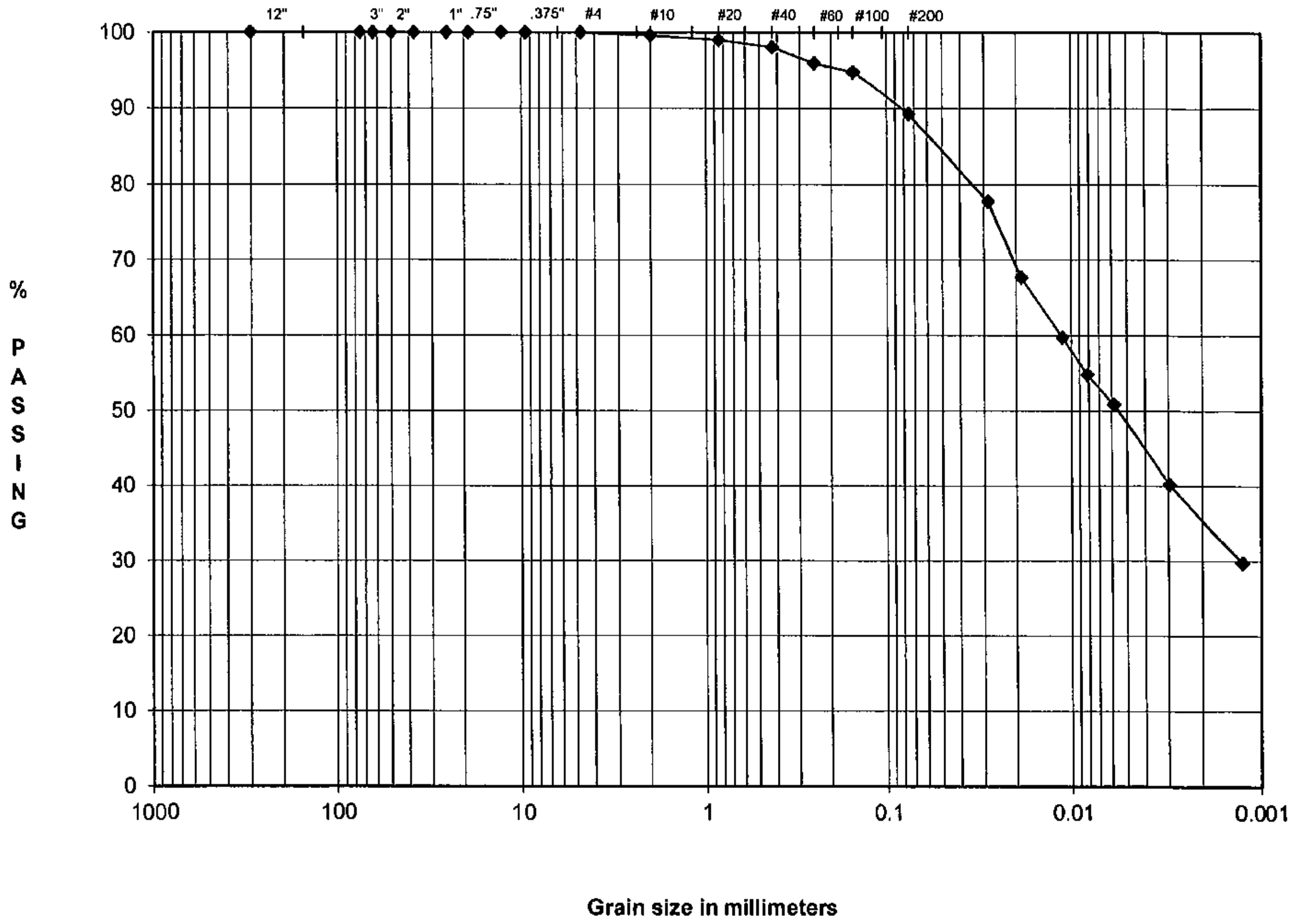
Description Dark gray, LEAN CLAY, little sand

USCS CL

28	LL
14	PL
14	PI

TECH	CB
DATE	7/9/2012
CHECK	RDS
REVIEW	DGT

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	GRAVEL Coarse	GRAVEL Fine	SAND Cor	SAND Med	SAND Fine	FINES SILT OR CLAY
		0.00		10.76			89.24

SAMPLE ID	BH-3
SAMPLE TYPE	JAR
SAMPLE DEPTH	73.5'-75.0'

LL	28
PL	14
PI	14

DESCRIPTION	Dark gray, LEAN CLAY, little sand
USCS	CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	RS
REVIEW	BJT

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-4
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	23.5'-25.0'
DESCRIPTION:	Dark grayish brown, SANDY SILT
USCS:	ML

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	27.35
Weight of Dry Soil & Tare	22.35
Weight of Tare	14.06
Weight of Water	5.00
Weight of Dry Soil	8.29
Water Content	60.31%

TITLE BLOCK:

TECH	CB
DATE	07/19/12
CHECK	PS
REVIEW	EST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE Nipsco-MCGS
PROJECT NUMBER 123-88898

SAMPLE ID BH-4
SAMPLE TYPE JAR
SAMPLE DEPTH 23.5'-25.0'

SAMPLE PREPARATION

Wet or Dry: Wet
Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.02	18.07
Weight of Dry Soil & Tare	(W2)	17.48	17.56
Weight of Tare	(W3)	13.83	14.06
Weight of Water	(W4=W1-W2)	0.54	0.51
Weight of Dry Soil	(W5=W2-W3)	3.65	3.50
Water Content	(W4/W5)*100	14.79%	14.57%

NATURAL MOISTURE

Weight of Wet Soil & Tare	27.35
Weight of Dry Soil & Tare	22.35
Weight of Tare	14.06
Weight of Water	5.00
Weight of Dry Soil	8.29
Water Content	60.31%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		33	26	18
Weight of Wet Soil & Tare	(W6)	22.15	21.76	21.25
Weight of Dry Soil & Tare	(W7)	21.08	20.67	20.19
Weight of Tare	(W8)	13.94	14.18	14.10
Weight of Water	(W9=W6-W7)	1.07	1.09	1.06
Weight of Dry Soil	W10=W7-W8)	7.14	6.49	6.09
Water Content	(W9/W10)*100	14.99%	16.80%	17.41%

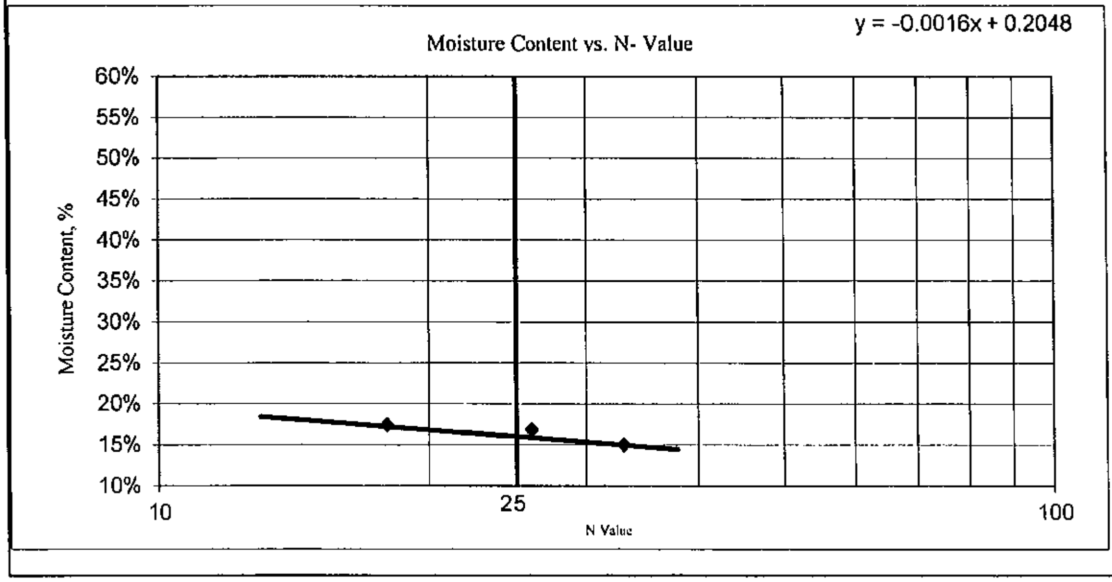
Blow	25
K - Value	1

Moisture content at 25 blow: 16.36%

LIQUID LIMIT (Wl)	16.36	16
PLASTIC LIMIT (Wp)	14.68	15
PLASTICITY INDEX (Ip)		1
LIQUIDITY INDEX (I)		45.63
MOISTURE CONTENT		60.31%

DESCRIPTION: Dark grayish brown, SANDY SILT

USCS ML



TECH CB
DATE 7/19/2012
CHECK BS
REVIEW BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-4
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	23.5'-25.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	27.35
Wt. Dry Soil & Tare (gm)	(W2)	22.35
Weight of Tare (gm)	(W3)	14.06
Weight of Water (gm)	(W4=W1-W2)	5.00
Weight of Dry Soil (gm)	(W5=W2-W3)	8.29
Moisture Content (%)	(W4/W5)*100	60.31%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	20.72
Dry Soil & Tare (gm)	20.64
Tare Weight (gm)	14.09
Moisture Content (%)	1.22

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	268.80	
Tare Weight (gm)	96.08	
Total Weight (gm)	170.64	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	**12.0"**	cobbles
3.0"	0.00	0.0	100.0	**3.0"**	coarse gravel
2.5"	0.00	0.0	100.0	**2.5"**	coarse gravel
2.0"	0.00	0.0	100.0	**2.0"**	coarse gravel
1.5"	0.00	0.0	100.0	**1.5"**	coarse gravel
1.0"	0.00	0.0	100.0	**1.0"**	coarse gravel
0.75"	0.00	0.0	100.0	**0.75"**	fine gravel
0.50"	0.00	0.0	100.0	**0.50"**	fine gravel
0.375"	0.00	0.0	100.0	**0.375"**	fine gravel
#4	0.00	0.0	100.0	**#4**	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	54.82
Calculated Dry Wt. used in test (gm)	54.16
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 28.47

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.52	0.05	**99.9**	#10	medium sand
#20	28.60	0.13	**99.8**	#20	medium sand
#40	29.38	0.91	**98.3**	#40	fine sand
#60	33.12	4.65	**91.4**	#60	fine sand
#100	43.94	15.47	**71.4**	#100	fine sand
#200	46.59	18.12	**66.5**	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:15	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:17	2.00	39.5	21.00	0.013	5.83	33.67	9.9	1.00
7/19/2012	2:20	5.00	36.0	21.00	0.013	5.83	30.17	10.4	1.00
7/19/2012	2:30	15.00	29.5	21.00	0.013	5.83	23.67	11.5	1.00
7/19/2012	2:45	30.00	25.0	21.00	0.013	5.83	19.17	12.2	1.00
7/19/2012	3:15	60.00	21.0	21.00	0.013	5.83	15.17	12.9	1.00
7/19/2012	6:25	250.00	15.0	21.00	0.013	5.83	9.17	13.8	1.00
7/20/2012	2:15	1440.00	10.5	20.90	0.014	5.87	4.63	14.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0300	62.2	% COBBLES	0.00	
0.0194	55.7	% COARSE GRAVEL	0.00	
0.0118	43.7	% FINE GRAVEL	0.00	0.00
0.0086	35.4	% COARSE SAND	0.09	
0.0063	28.0	% MEDIUM SAND	1.59	
0.0032	16.9	% FINE SAND	31.78	33.46
0.0014	8.6	% FINES	66.54	
		% TOTAL SAMPLE	100.00	

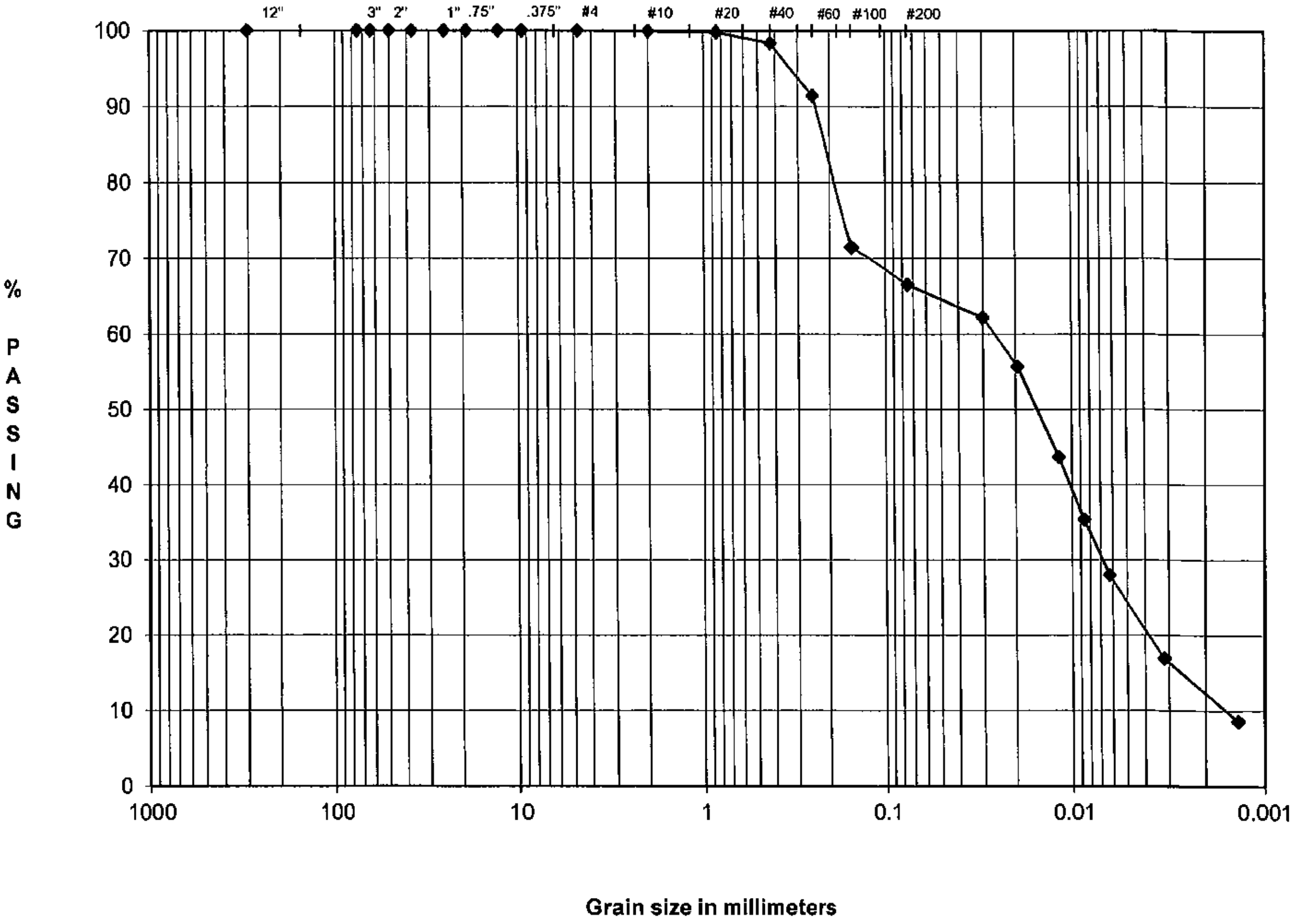
Description Dark grayish brown, SANDY SILT

USCS ML

16	LL
15	PL
1	PI

TECH	CB
DATE	7/19/2012
CHECK	JPS
REVIEW	BST

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.00		33.46			66.54

SAMPLE ID	BH-4
SAMPLE TYPE	JAR
SAMPLE DEPTH	23.5'-25.0'

LL	16
PL	15
PI	1

DESCRIPTION	Dark grayish brown, SANDY SILT
USCS	ML

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/19/2012
CHECK	BS
REVIEW	BSJ

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 43.5'-45.0'

DESCRIPTION: Dark gray, GRAVELLY LEAN CLAY, little sand

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	21.02
Weight of Dry Soil & Tare	19.96
Weight of Tare	14.03
Weight of Water	1.06
Weight of Dry Soil	5.93
Water Content	17.88%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	BSV
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-6
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	43.5'-45.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	16.03	15.13
Weight of Dry Soil & Tare	(W2)	15.43	14.60
Weight of Tare	(W3)	11.48	10.96
Weight of Water	(W4=W1-W2)	0.60	0.53
Weight of Dry Soil	(W5=W2-W3)	3.95	3.64
Water Content	(W4/W5)*100	15.19%	14.56%

NATURAL MOISTURE

Weight of Wet Soil & Tare	21.02
Weight of Dry Soil & Tare	19.96
Weight of Tare	14.03
Weight of Water	1.06
Weight of Dry Soil	5.93
Water Content	17.88%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		31	26	20
Weight of Wet Soil & Tare	(W6)	23.29	21.40	23.52
Weight of Dry Soil & Tare	(W7)	20.57	19.16	20.83
Weight of Tare	(W8)	10.88	11.40	11.69
Weight of Water	(W9=W6-W7)	2.72	2.24	2.69
Weight of Dry Soil	W10=W7-W8)	9.69	7.76	9.14
Water Content	(W9/W10)*100	28.07%	28.87%	29.43%

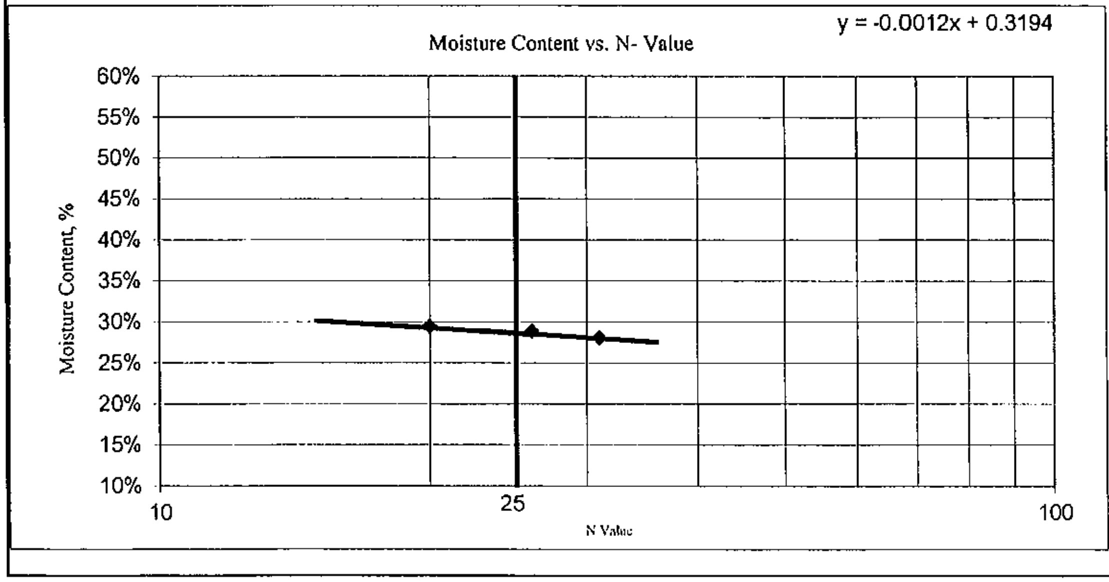
Blow	25
K - Value	1

Moisture content at 25 blow: 28.94%

LIQUID LIMIT (Wl)	28.94	29
PLASTIC LIMIT (Wp)	14.88	15
PLASTICITY INDEX (Ip)		14
LIQUIDITY INDEX (I)		0.21
MOISTURE CONTENT		17.88%

DESCRIPTION: Dark gray, GRAVELLY LEAN CLAY, little sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	BSJ
REVIEW	BJ

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-6
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	43.5'-45.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	21.02
Wt. Dry Soil & Tare (gm)	(W2)	19.96
Weight of Tare (gm)	(W3)	14.03
Weight of Water (gm)	(W4=W1-W2)	1.06
Weight of Dry Soil (gm)	(W5=W2-W3)	5.93
Moisture Content (%)	(W4/W5)*100	17.88%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	26.26
Dry Soil & Tare (gm)	26.01
Tare Weight (gm)	14.06
Moisture Content (%)	2.09

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	337.90	
Tare Weight (gm)	98.35	
Total Weight (gm)	234.64	(W6)

Plus #4 Material Sieve

TARE WEIGHT 11.69

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	11.69	0.0	100.0	12.0"	cobbles
3.0"	11.69	0.0	100.0	3.0"	coarse gravel
2.5"	11.69	0.0	100.0	2.5"	coarse gravel
2.0"	11.69	0.0	100.0	2.0"	coarse gravel
1.5"	11.69	0.0	100.0	1.5"	coarse gravel
1.0"	55.33	18.6	81.4	1.0"	coarse gravel
0.75"	55.33	18.6	81.4	0.75"	fine gravel
0.50"	55.33	18.6	81.4	0.50"	fine gravel
0.375"	55.33	18.6	81.4	0.375"	fine gravel
#4	55.59	18.7	81.3	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.05
Calculated Dry Wt. used in test (gm)	50.00
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	81.29

TARE WEIGHT 30.46

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.05	0.59	**80.3**	#10	medium sand
#20	31.36	0.90	**79.8**	#20	medium sand
#40	31.90	1.44	**78.9**	#40	fine sand
#60	32.60	2.14	**77.8**	#60	fine sand
#100	33.77	3.31	**75.9**	#100	fine sand
#200	37.52	7.06	**69.8**	#200	fines

HYDROMETER CALCULATIONS

DATE 7/9/2012	TIME 1:16	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/9/2012	1:18	2.00	44.0	21.00	0.013	5.83	38.17	9.1	1.00
7/9/2012	1:21	5.00	39.5	21.00	0.013	5.83	33.67	9.9	1.00
7/9/2012	1:31	15.00	36.0	21.00	0.013	5.83	30.17	10.4	1.00
7/9/2012	1:46	30.00	33.5	21.00	0.013	5.83	27.67	10.9	1.00
7/9/2012	2:16	60.00	31.0	21.00	0.013	5.83	25.17	11.2	1.00
7/9/2012	5:26	250.00	25.5	21.40	0.013	5.70	19.80	12.2	1.00
7/10/2012	1:16	1440.00	20.5	22.10	0.013	5.47	15.03	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0288	62.0	% COBBLES	0.00	
0.0190	54.7	% COARSE GRAVEL	18.60	
0.0112	49.0	% FINE GRAVEL	0.11	18.71
0.0081	45.0	% COARSE SAND	0.96	
0.0058	40.9	% MEDIUM SAND	1.38	
0.0030	32.2	% FINE SAND	9.14	11.48
0.0013	24.4	% FINES	69.81	
		% TOTAL SAMPLE	100.00	

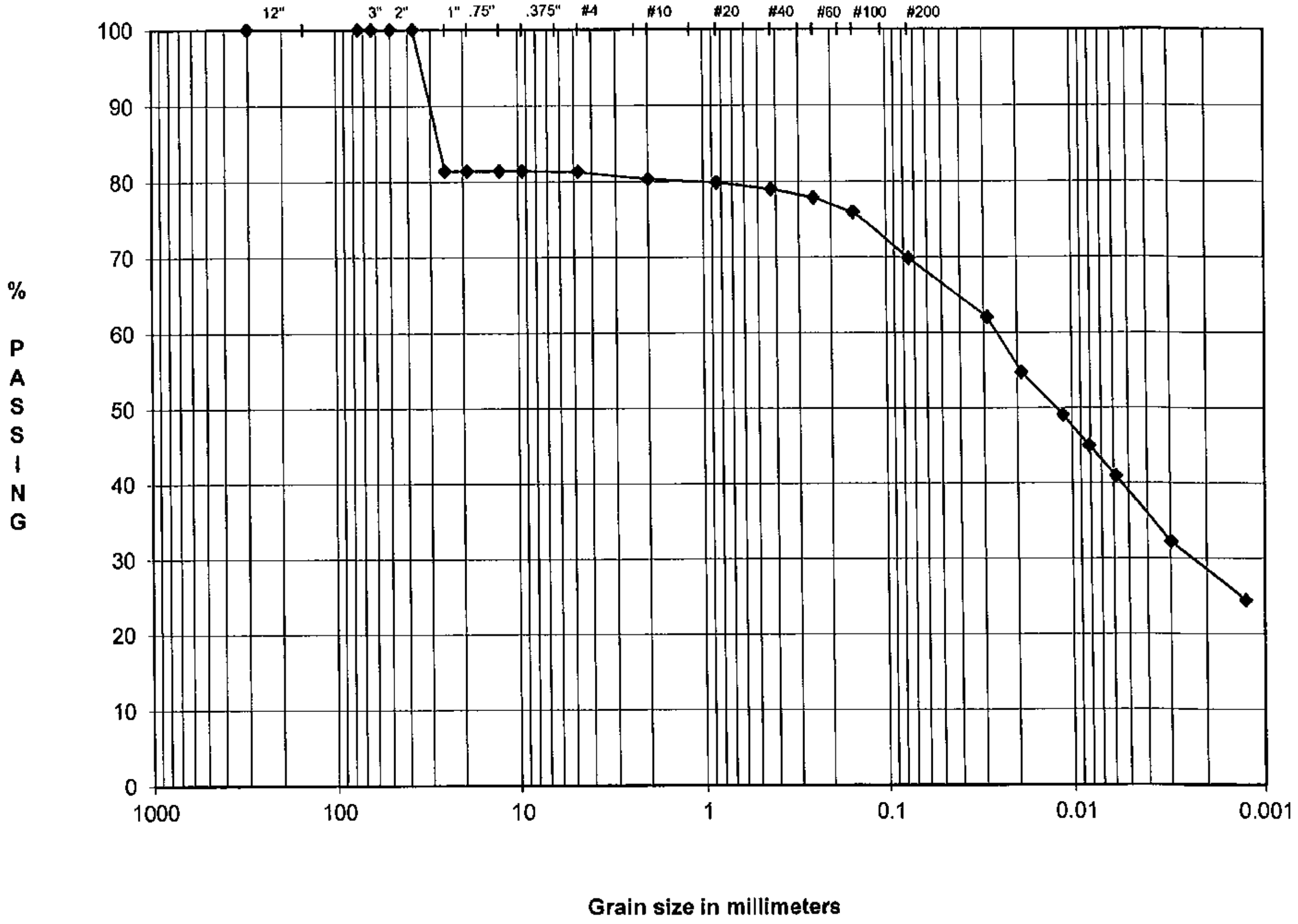
Description Dark gray, GRAVELLY LEAN CLAY, little sand

USCS CL

29	LL
15	PL
14	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		18.71		11.48			69.81

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	43.5'-45.0'

LL	29
PL	15
PI	14

DESCRIPTION	Dark gray, GRAVELLY LEAN CLAY, little sand
USCS	CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 48.5'-50.0'

DESCRIPTION: Dark gray, LEAN CLAY, little sand

USCS: **CL**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	23.74
Weight of Dry Soil & Tare	22.34
Weight of Tare	14.15
Weight of Water	1.40
Weight of Dry Soil	8.19
Water Content	17.09%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	TBS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE Nipsco-MCGS
PROJECT NUMBER 123-88898

SAMPLE ID BH-6
SAMPLE TYPE JAR
SAMPLE DEPTH 48.5'-50.0'

SAMPLE PREPARATION

Wet or Dry: Wet
Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.31	18.38
Weight of Dry Soil & Tare	(W2)	17.66	17.72
Weight of Tare	(W3)	13.84	13.64
Weight of Water	(W4=W1-W2)	0.65	0.66
Weight of Dry Soil	(W5=W2-W3)	3.82	4.08
Water Content	(W4/W5)*100	17.02%	16.18%

NATURAL MOISTURE

Weight of Wet Soil & Tare	23.74
Weight of Dry Soil & Tare	22.34
Weight of Tare	14.15
Weight of Water	1.40
Weight of Dry Soil	8.19
Water Content	17.09%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		31	22	20
Weight of Wet Soil & Tare	(W6)	26.89	24.74	25.50
Weight of Dry Soil & Tare	(W7)	23.95	22.22	22.75
Weight of Tare	(W8)	14.02	14.02	14.11
Weight of Water	(W9=W6-W7)	2.94	2.52	2.75
Weight of Dry Soil	W10=W7-W8)	9.93	8.20	8.64
Water Content	(W9/W10)*100	29.61%	30.73%	31.83%

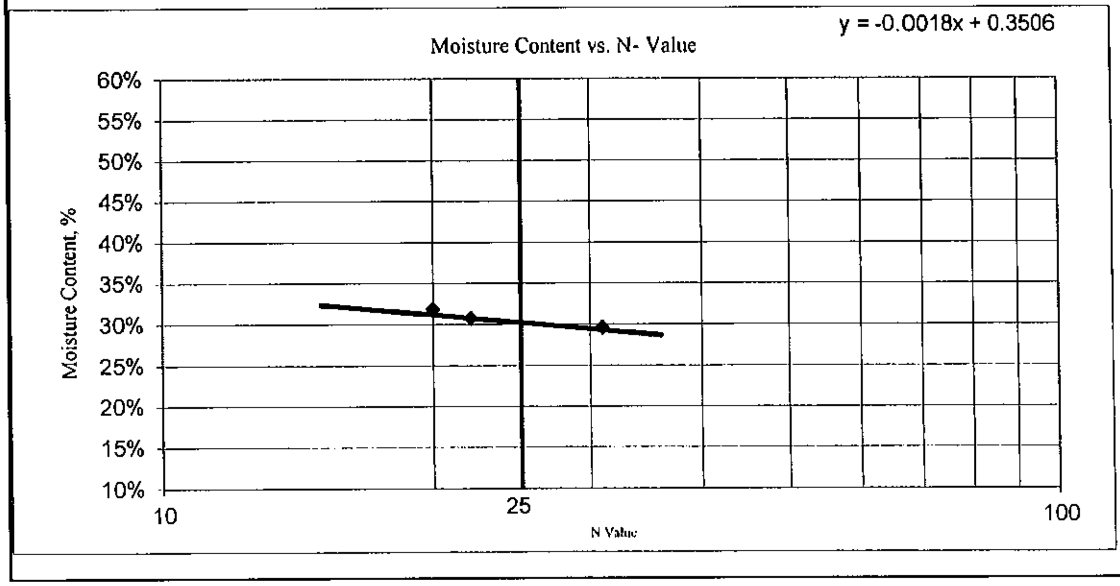
Blow	25
K - Value	1

Moisture content at 25 blow: 30.56%

LIQUID LIMIT (Wl)	30.56	31
PLASTIC LIMIT (Wp)	16.60	17
PLASTICITY INDEX (Ip)		14
LIQUIDITY INDEX (I)		0.04
MOISTURE CONTENT		17.09%

DESCRIPTION: Dark gray, LEAN CLAY, little sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	PS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE: Nipsco-MCGS
PROJECT NO.: 123-88898

SAMPLE ID: BH-6
SAMPLE TYPE: JAR
SAMPLE DEPTH: 48.5'-50.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	23.74
Wt. Dry Soil & Tare (gm)	(W2)	22.34
Weight of Tare (gm)	(W3)	14.15
Weight of Water (gm)	(W4=W1-W2)	1.40
Weight of Dry Soil (gm)	(W5=W2-W3)	8.19
Moisture Content (%)	(W4/W5)*100	17.09%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	34.60
Dry Soil & Tare (gm)	34.11
Tare Weight (gm)	13.98
Moisture Content (%)	2.43

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	353.29	
Tare Weight (gm)	96.76	
Total Weight (gm)	250.43	(W6)

Plus #4 Material Sieve

TARE WEIGHT: 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.10
Calculated Dry Wt. used in test (gm)	49.89
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT: 28.49

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.86	0.37	99.3	#10	medium sand
#20	29.33	0.84	98.3	#20	medium sand
#40	29.75	1.26	97.5	#40	fine sand
#60	30.28	1.79	96.4	#60	fine sand
#100	31.11	2.62	94.7	#100	fine sand
#200	34.35	5.86	88.3	#200	fines

HYDROMETER CALCULATIONS

DATE 7/9/2012	TIME 1:04	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/9/2012	1:06	2.00	45.0	21.00	0.013	5.83	39.17	8.9	1.00
7/9/2012	1:09	5.00	41.5	21.00	0.013	5.83	35.67	9.6	1.00
7/9/2012	1:19	15.00	36.5	21.00	0.013	5.83	30.67	10.4	1.00
7/9/2012	1:34	30.00	34.0	21.00	0.013	5.83	28.17	10.7	1.00
7/9/2012	2:04	60.00	31.5	21.00	0.013	5.83	25.67	11.2	1.00
7/9/2012	5:14	250.00	25.5	21.40	0.013	5.70	19.80	12.2	1.00
7/10/2012	1:04	1440.00	20.0	22.10	0.013	5.47	14.53	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING
0.0284	78.5
0.0187	71.5
0.0112	61.5
0.0081	56.5
0.0058	51.5
0.0030	39.7
0.0013	29.1

% COBBLES	0.00	
% COARSE GRAVEL	0.00	
% FINE GRAVEL	0.00	0.00
% COARSE SAND	0.74	
% MEDIUM SAND	1.78	
% FINE SAND	9.22	11.75
% FINES	88.25	
% TOTAL SAMPLE	100.00	

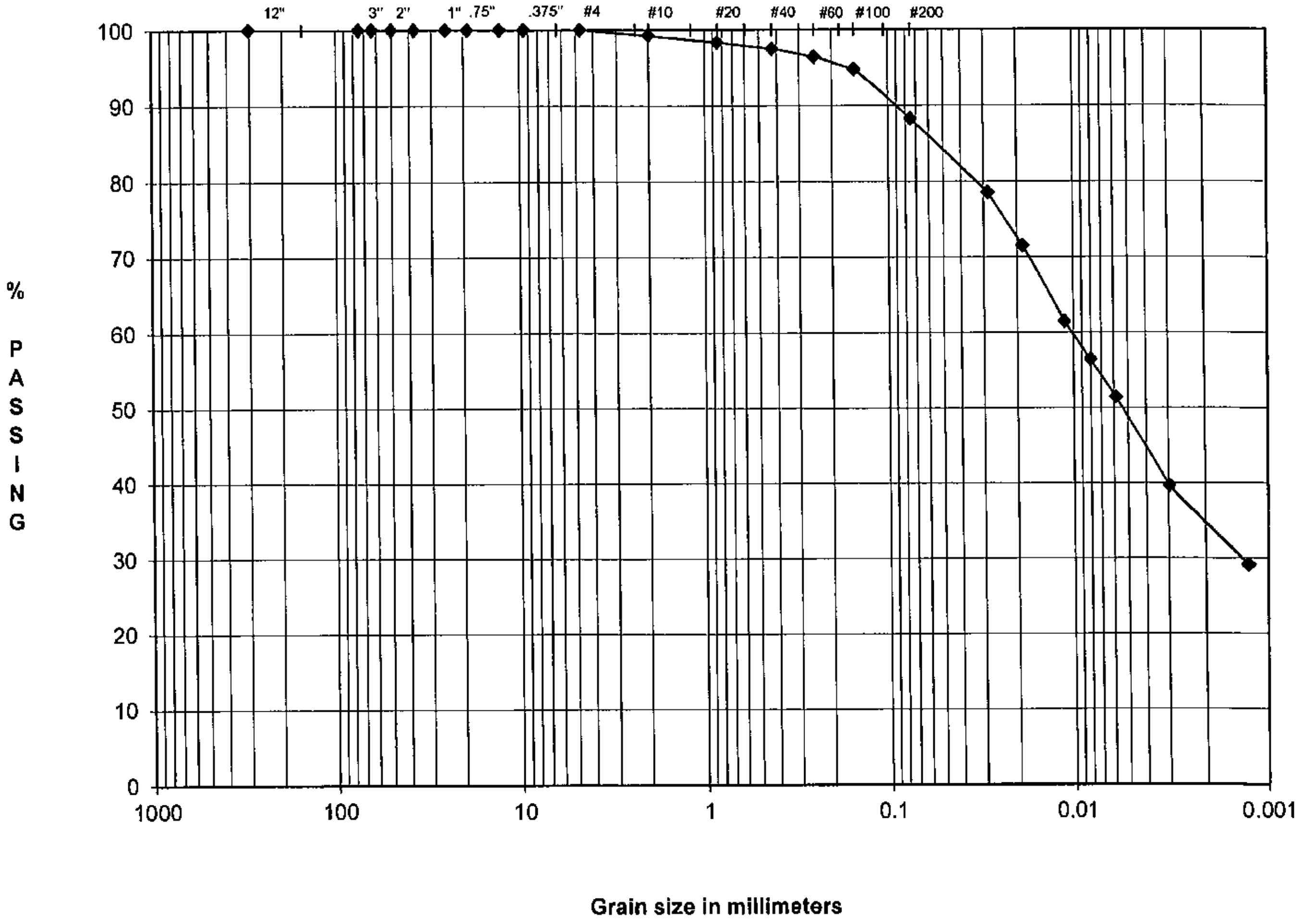
Description Dark gray, LEAN CLAY, little sand

USCS CL

31	LL
17	PL
14	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		11.75			88.25

SAMPLE ID	BH-6
SAMPLE TYPE	JAR
SAMPLE DEPTH	48.5'-50.0'

LL	31
PL	17
PI	14

DESCRIPTION Dark gray, LEAN CLAY, little sand

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	BS
REVIEW	BJT

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-8
SAMPLE TYPE:	BAG
SAMPLE DEPTH:	18.5'-20.0'
DESCRIPTION:	Black, SILT, trace sand
USCS:	ML

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	26.85
Weight of Dry Soil & Tare	22.53
Weight of Tare	13.96
Weight of Water	4.32
Weight of Dry Soil	8.57
Water Content	50.41%

TITLE BLOCK:

TECH	CB
DATE	07/18/12
CHECK	
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-8
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	18.5'-20.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	17.02	15.72
Weight of Dry Soil & Tare	(W2)	16.38	15.35
Weight of Tare	(W3)	13.93	13.88
Weight of Water	(W4=W1-W2)	0.64	0.37
Weight of Dry Soil	(W5=W2-W3)	2.45	1.47
Water Content	(W4/W5)*100	26.12%	25.17%

NATURAL MOISTURE

Weight of Wet Soil & Tare	26.85
Weight of Dry Soil & Tare	22.53
Weight of Tare	13.96
Weight of Water	4.32
Weight of Dry Soil	8.57
Water Content	50.41%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		33	28	18
Weight of Wet Soil & Tare	(W6)	26.39	26.28	26.40
Weight of Dry Soil & Tare	(W7)	23.57	23.49	23.50
Weight of Tare	(W8)	13.80	14.09	14.14
Weight of Water	(W9=W6-W7)	2.82	2.79	2.90
Weight of Dry Soil	W10=W7-W8)	9.77	9.40	9.36
Water Content	(W9/W10)*100	28.86%	29.68%	30.98%

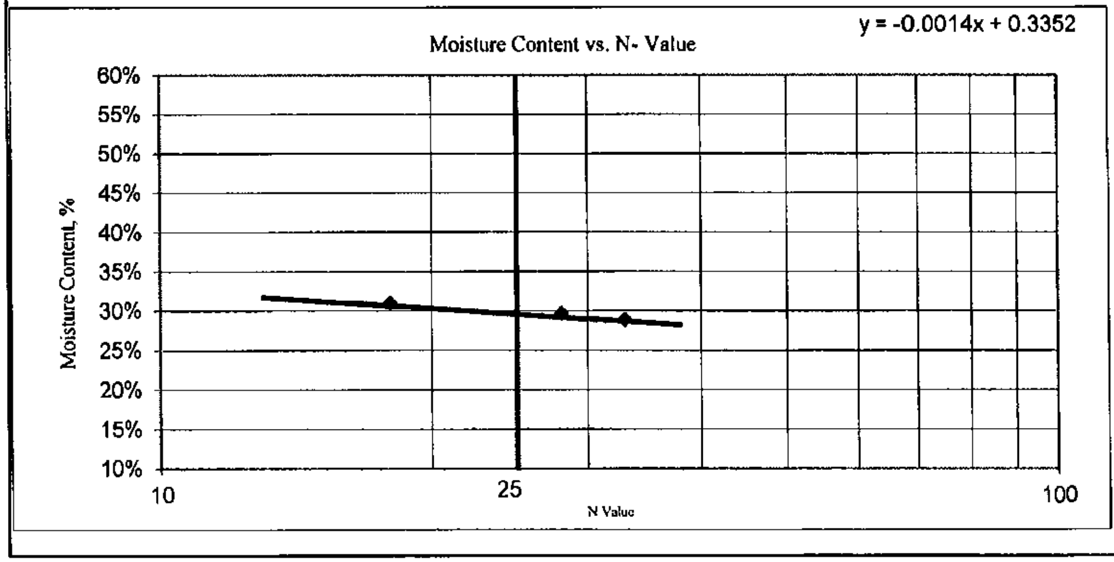
Blow	25
K - Value	1

Moisture content at 25 blow: 30.02%

LIQUID LIMIT (Wl)	30.02	30
PLASTIC LIMIT (Wp)	25.65	26
PLASTICITY INDEX (Ip)		4
LIQUIDITY INDEX (I)		6.19
MOISTURE CONTENT		50.41%

DESCRIPTION: Black, SILT, trace sand

USCS ML



TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	18.5'-20.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	26.85
Wt. Dry Soil & Tare (gm)	(W2)	22.53
Weight of Tare (gm)	(W3)	13.96
Weight of Water (gm)	(W4=W1-W2)	4.32
Weight of Dry Soil (gm)	(W5=W2-W3)	8.57
Moisture Content (%)	(W4/W5)*100	50.41%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	25.24
Dry Soil & Tare (gm)	25.06
Tare Weight (gm)	14.02
Moisture Content (%)	1.63

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	315.28	
Tare Weight (gm)	96.02	
Total Weight (gm)	215.74	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.21
Calculated Dry Wt. used in test (gm)	50.39
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.45

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.45	0.00	100.0	#10	medium sand
#20	30.47	0.02	100.0	#20	medium sand
#40	30.51	0.06	99.9	#40	fine sand
#60	30.57	0.12	99.8	#60	fine sand
#100	30.67	0.22	99.6	#100	fine sand
#200	31.42	0.97	98.1	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:20	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:22	2.00	48.0	21.00	0.013	5.83	42.17	8.4	1.00
7/19/2012	1:25	5.00	41.5	21.00	0.013	5.83	35.67	9.6	1.00
7/19/2012	1:35	15.00	27.0	21.00	0.013	5.83	21.17	11.9	1.00
7/19/2012	1:50	30.00	19.0	21.00	0.013	5.83	13.17	13.2	1.00
7/19/2012	2:20	60.00	14.5	21.00	0.013	5.83	8.67	14.0	1.00
7/19/2012	5:30	250.00	10.0	21.00	0.013	5.83	4.17	14.7	1.00
7/20/2012	1:20	1440.00	8.0	20.90	0.014	5.87	2.13	15.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0276	83.7	% COARSE GRAVEL	0.00	
0.0187	70.8	% FINE GRAVEL	0.00	0.00
0.0120	42.0	% COARSE SAND	0.00	
0.0089	26.1	% MEDIUM SAND	0.12	
0.0065	17.2	% FINE SAND	1.81	1.93
0.0033	8.3	% FINES	98.07	
0.0014	4.2	% TOTAL SAMPLE	100.00	

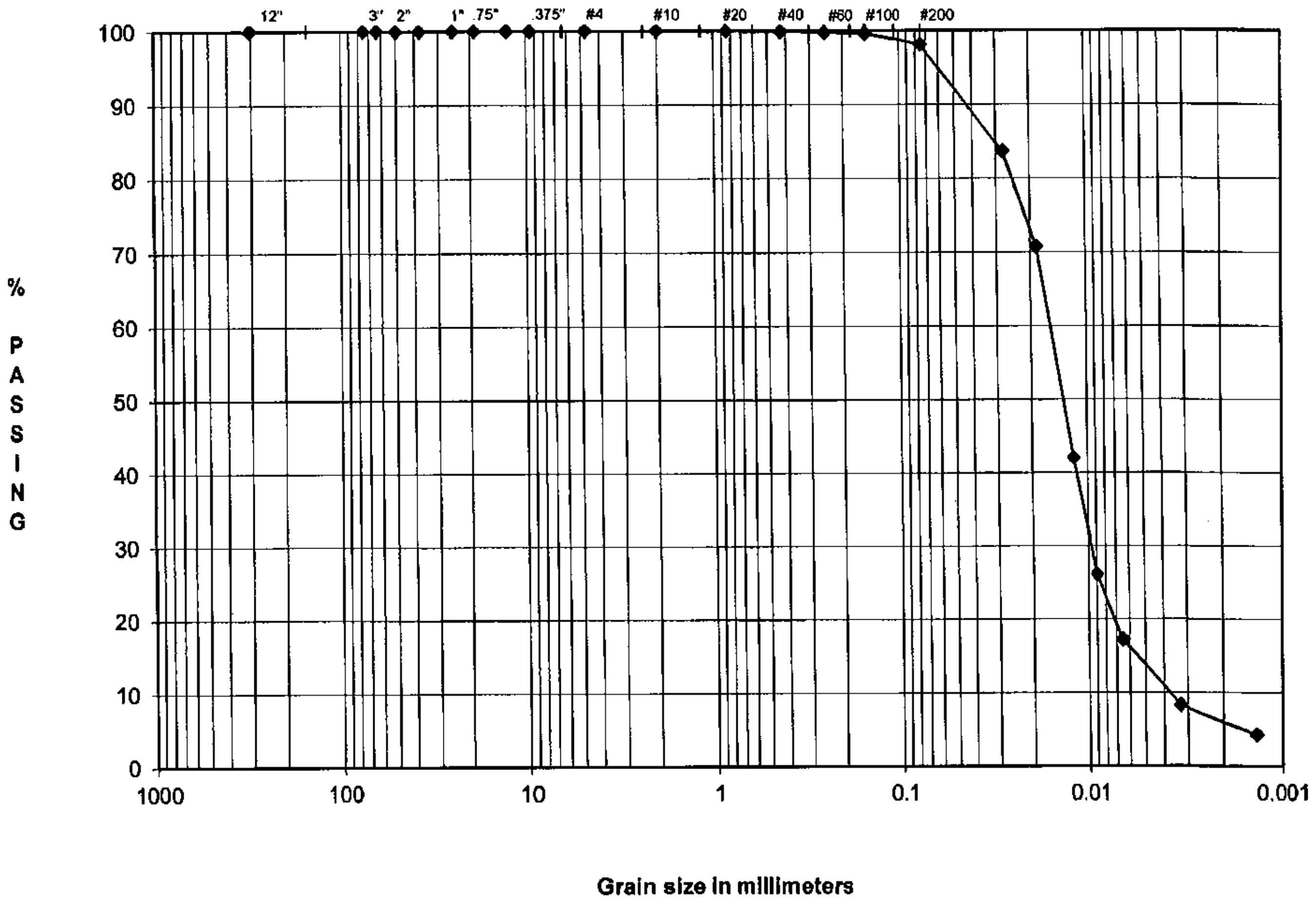
Description Black, SILT, trace sand

USCS ML

30	LL
26	PL
4	PI

TECH CB
DATE 7/18/2012
CHECK
REVIEW

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		1.93			98.07

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	18.5'-20.0'

LL	30
PL	26
PI	4

DESCRIPTION	Black, SILT, trace sand
USCS	ML

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:
PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 38.5'-40.0'

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS: **CL**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	23.26
Weight of Dry Soil & Tare	22.04
Weight of Tare	14.00
Weight of Water	1.22
Weight of Dry Soil	8.04
Water Content	15.17%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	RPS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	**BH-8**
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	**BAG**
		SAMPLE DEPTH	**38.5'-40.0'**

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	17.45	18.33
Weight of Dry Soil & Tare	(W2)	17.06	17.74
Weight of Tare	(W3)	13.99	13.64
Weight of Water	(W4=W1-W2)	0.39	0.59
Weight of Dry Soil	(W5=W2-W3)	3.07	4.10
Water Content	(W4/W5)*100	12.70%	14.39%

NATURAL MOISTURE

Weight of Wet Soil & Tare	23.26
Weight of Dry Soil & Tare	22.04
Weight of Tare	14.00
Weight of Water	1.22
Weight of Dry Soil	8.04
Water Content	15.17%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		35	25	18
Weight of Wet Soil & Tare	(W6)	24.67	25.46	25.21
Weight of Dry Soil & Tare	(W7)	22.60	23.18	22.80
Weight of Tare	(W8)	13.99	14.10	14.05
Weight of Water	(W9=W6-W7)	2.07	2.28	2.41
Weight of Dry Soil	W10=W7-W8)	8.61	9.08	8.75
Water Content	(W9/W10)*100	24.04%	25.11%	27.54%

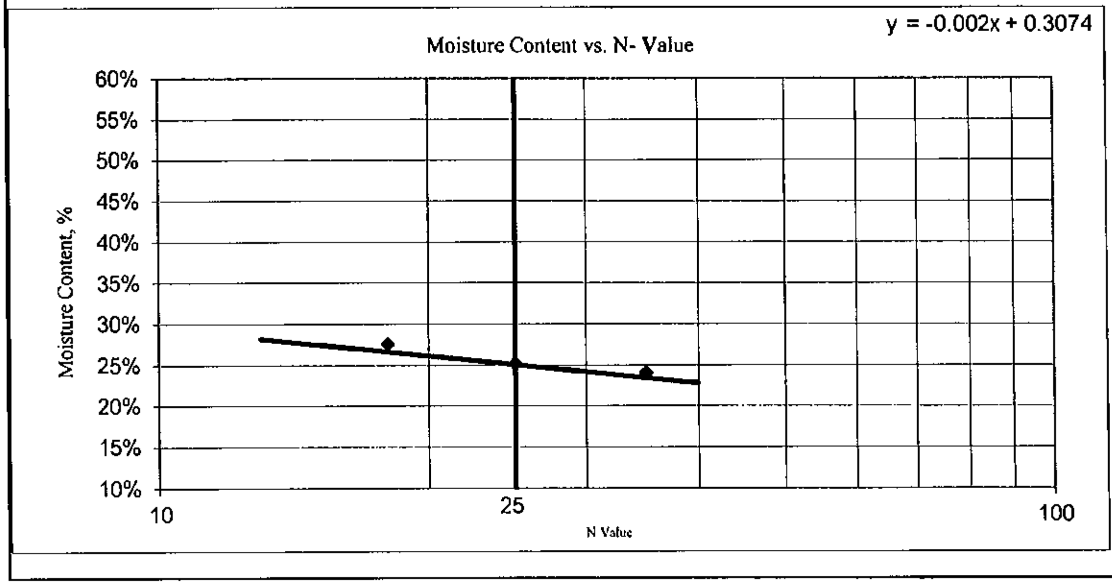
Blow	25
K - Value	1

Moisture content at 25 blow: 25.74%

LIQUID LIMIT (Wl)	**25.74**	**26**
PLASTIC LIMIT (Wp)	**13.55**	**14**
PLASTICITY INDEX (Ip)		**12**
LIQUIDITY INDEX (I)		**0.14**
MOISTURE CONTENT		**15.17%**

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	38.5'-40.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	23.26
Wt. Dry Soil & Tare (gm)	(W2)	22.04
Weight of Tare (gm)	(W3)	14.00
Weight of Water (gm)	(W4=W1-W2)	1.22
Weight of Dry Soil (gm)	(W5=W2-W3)	8.04
Moisture Content (%)	(W4/W5)*100	15.17%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	35.13
Dry Soil & Tare (gm)	34.43
Tare Weight (gm)	14.11
Moisture Content (%)	3.44

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	325.05	
Tare Weight (gm)	82.34	
Total Weight (gm)	234.63	(W6)

Plus #4 Material Sieve

TARE WEIGHT 10.79

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	10.79	0.0	100.0	12.0"	cobbles
3.0"	10.79	0.0	100.0	3.0"	coarse gravel
2.5"	10.79	0.0	100.0	2.5"	coarse gravel
2.0"	10.79	0.0	100.0	2.0"	coarse gravel
1.5"	10.79	0.0	100.0	1.5"	coarse gravel
1.0"	10.79	0.0	100.0	1.0"	coarse gravel
0.75"	10.79	0.0	100.0	0.75"	fine gravel
0.50"	10.79	0.0	100.0	0.50"	fine gravel
0.375"	10.79	0.0	100.0	0.375"	fine gravel
#4	12.70	0.8	99.2	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	52.49
Calculated Dry Wt. used in test (gm)	50.74
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.19

TARE WEIGHT 30.83

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.30	0.47	98.3	#10	medium sand
#20	31.92	1.09	97.1	#20	medium sand
#40	32.85	2.02	95.2	#40	fine sand
#60	34.24	3.41	92.5	#60	fine sand
#100	36.34	5.51	88.4	#100	fine sand
#200	39.28	8.45	82.7	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:22	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:24	2.00	43.0	21.00	0.013	5.83	37.17	9.2	1.00
7/19/2012	1:27	5.00	39.5	21.00	0.013	5.83	33.67	9.9	1.00
7/19/2012	1:37	15.00	35.5	21.00	0.013	5.83	29.67	10.6	1.00
7/19/2012	1:52	30.00	33.0	21.00	0.013	5.83	27.17	10.9	1.00
7/19/2012	2:22	60.00	30.5	21.00	0.013	5.83	24.67	11.4	1.00
7/19/2012	5:32	250.00	25.0	21.40	0.013	5.70	19.30	12.2	1.00
7/20/2012	1:22	1440.00	19.0	22.10	0.013	5.47	13.53	13.2	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0289	72.7	% COBBLES	0.00	
0.0190	65.8	% COARSE GRAVEL	0.00	
0.0113	58.0	% FINE GRAVEL	0.81	0.81
0.0081	53.1	% COARSE SAND	0.92	
0.0059	48.2	% MEDIUM SAND	3.03	
0.0030	37.7	% FINE SAND	12.57	16.52
0.0013	26.4	% FINES	82.67	
		% TOTAL SAMPLE	100.00	

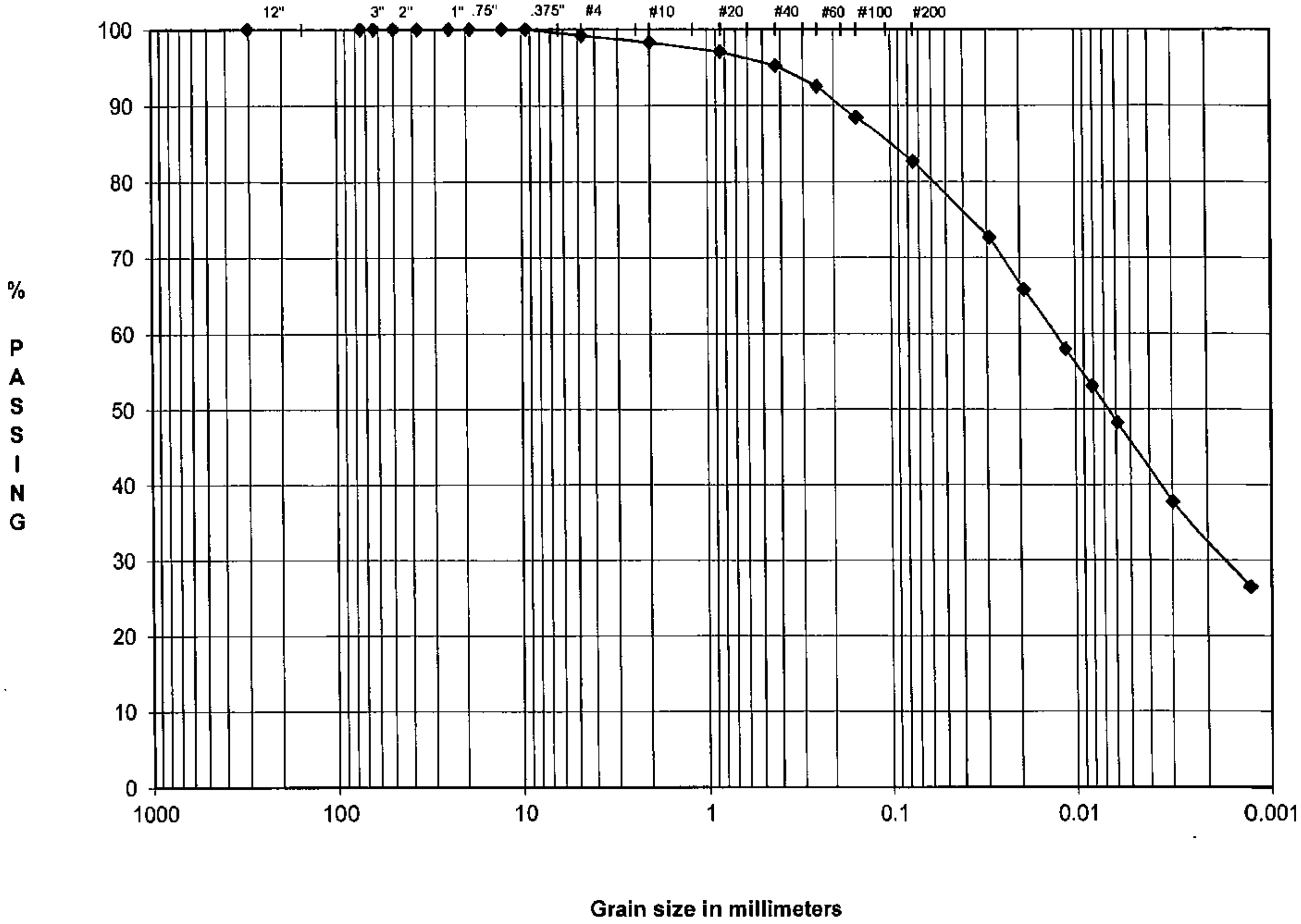
Description Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

26	LL
14	PL
12	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.81		16.52			82.67

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	38.5'-40.0'

LL	26
PL	14
PI	12

DESCRIPTION	Dark gray, LEAN CLAY WITH SAND, trace gravel
USCS	CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information: PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-8
SAMPLE TYPE: BAG
SAMPLE DEPTH: 53.5'-55.0'

DESCRIPTION: Dark Gray, LEAN CLAY WITH SAND, trace gravel

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	24.24
Weight of Dry Soil & Tare	23.02
Weight of Tare	13.87
Weight of Water	1.22
Weight of Dry Soil	9.15
Water Content	13.33%

TITLE BLOCK:

TECH	CB
DATE	07/11/12
CHECK	D.W.
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-8
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	53.5'-55.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.29	18.33
Weight of Dry Soil & Tare	(W2)	17.75	17.78
Weight of Tare	(W3)	14.03	13.98
Weight of Water	(W4=W1-W2)	0.54	0.55
Weight of Dry Soil	(W5=W2-W3)	3.72	3.80
Water Content	(W4/W5)*100	14.52%	14.47%

NATURAL MOISTURE

Weight of Wet Soil & Tare	24.24
Weight of Dry Soil & Tare	23.02
Weight of Tare	13.87
Weight of Water	1.22
Weight of Dry Soil	9.15
Water Content	13.33%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		31	24	18
Weight of Wet Soil & Tare	(W6)	24.77	24.32	21.91
Weight of Dry Soil & Tare	(W7)	22.34	21.75	19.66
Weight of Tare	(W8)	11.48	10.95	10.79
Weight of Water	(W9=W6-W7)	2.43	2.57	2.25
Weight of Dry Soil	W10=W7-W8)	10.86	10.80	8.87
Water Content	(W9/W10)*100	22.38%	23.80%	25.37%

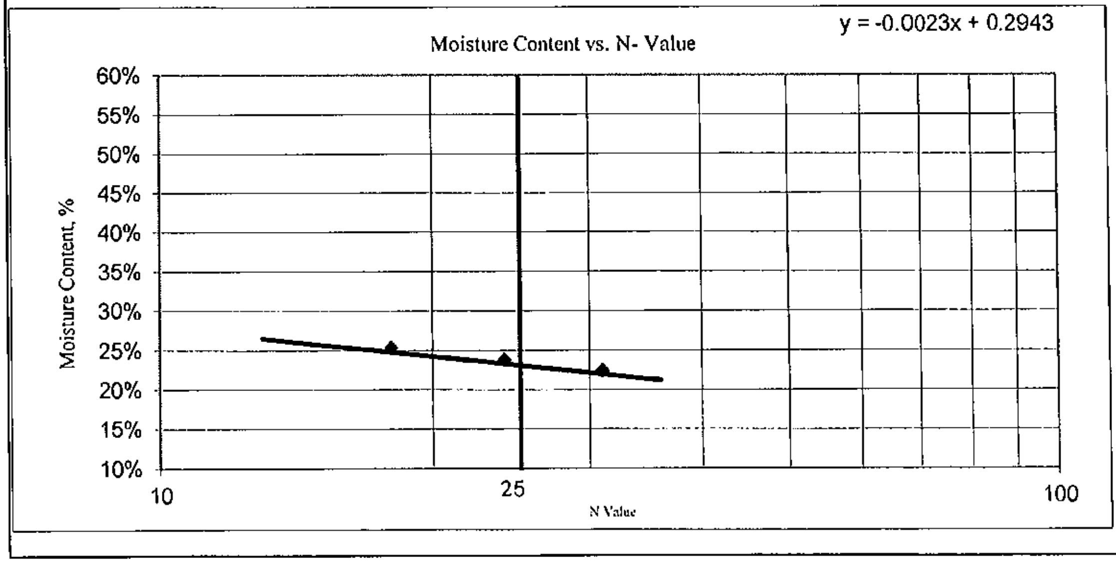
Blow	25
K - Value	1

Moisture content at 25 blow: 23.68%

LIQUID LIMIT (Wl)	23.68	24
PLASTIC LIMIT (Wp)	14.49	14
PLASTICITY INDEX (Ip)		10
LIQUIDITY INDEX (I)		-0.12
MOISTURE CONTENT		13.33%

DESCRIPTION: Dark Gray, LEAN CLAY WITH SAND, trace gravel

USCS CL



TECH	CB
DATE	7/11/2012
CHECK	D.W.
REVIEW	BJT

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	53.5'-55.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	24.24
Wt. Dry Soil & Tare (gm)	(W2)	23.02
Weight of Tare (gm)	(W3)	13.87
Weight of Water (gm)	(W4=W1-W2)	1.22
Weight of Dry Soil (gm)	(W5=W2-W3)	9.15
Moisture Content (%)	(W4/W5)*100	13.33%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	28.43
Dry Soil & Tare (gm)	28.28
Tare Weight (gm)	14.15
Moisture Content (%)	1.06

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	466.34	
Tare Weight (gm)	188.58	
Total Weight (gm)	274.84	(W6)

Plus #4 Material Sieve

TARE WEIGHT 14.02

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	14.02	0.0	100.0	12.0"	cobbles
3.0"	14.02	0.0	100.0	3.0"	coarse gravel
2.5"	14.02	0.0	100.0	2.5"	coarse gravel
2.0"	14.02	0.0	100.0	2.0"	coarse gravel
1.5"	14.02	0.0	100.0	1.5"	coarse gravel
1.0"	14.02	0.0	100.0	1.0"	coarse gravel
0.75"	14.02	0.0	100.0	0.75"	fine gravel
0.50"	14.02	0.0	100.0	0.50"	fine gravel
0.375"	14.02	0.0	100.0	0.375"	fine gravel
#4	14.33	0.1	99.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.25
Calculated Dry Wt. used in test (gm)	50.71
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.89

TARE WEIGHT 30.19

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.54	0.35	99.2	#10	medium sand
#20	30.76	0.57	98.8	#20	medium sand
#40	31.03	0.84	98.2	#40	fine sand
#60	31.34	1.15	97.6	#60	fine sand
#100	32.56	2.37	95.2	#100	fine sand
#200	38.68	8.49	83.2	#200	fines

HYDROMETER CALCULATIONS

DATE 7/13/2012	TIME 13:12	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/13/2012	13:14	2.00	42.0	21.00	0.013	5.83	36.17	9.4	1.00
7/13/2012	13:17	5.00	37.5	21.00	0.013	5.83	31.67	10.2	1.00
7/13/2012	13:27	15.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/13/2012	13:42	30.00	31.0	21.00	0.013	5.83	25.17	11.2	1.00
7/13/2012	14:12	60.00	28.0	21.00	0.013	5.83	22.17	11.7	1.00
7/13/2012	17:22	250.00	23.5	21.40	0.013	5.70	17.80	12.5	1.00
7/14/2012	13:12	1440.00	18.5	22.10	0.013	5.47	13.03	13.3	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0292	71.2	% COBBLES	0.00	
0.0193	62.4	% COARSE GRAVEL	0.00	
0.0116	51.5	% FINE GRAVEL	0.11	0.11
0.0082	49.6	% COARSE SAND	0.69	
0.0060	43.7	% MEDIUM SAND	0.97	
0.0030	35.1	% FINE SAND	15.07	16.72
0.0013	25.7	% FINES	83.16	
		% TOTAL SAMPLE	100.00	

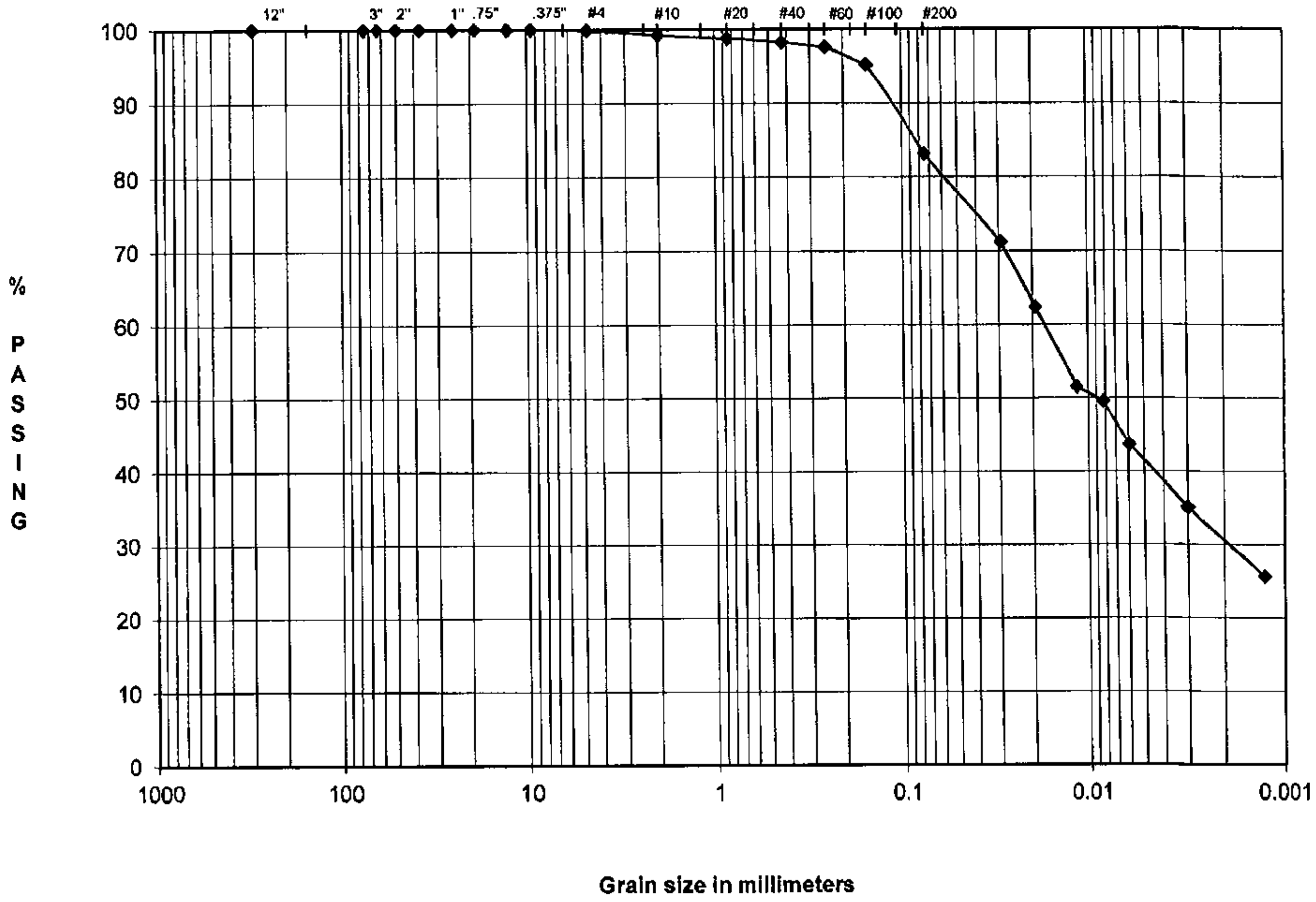
Description Dark Gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

24	LL
14	PL
10	PI

TECH	CB
DATE	7/11/2012
CHECK	D.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.11		16.72			83.16

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	53.5'-55.0'

LL	24
PL	14
PI	10

DESCRIPTION Dark Gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/11/2012
CHECK	D.W.
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Gray.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898

SAMPLE ID:	BH-8
SAMPLE TYPE:	BAG
SAMPLE DEPTH:	68.5'-70.0'

DESCRIPTION: Dark Gray, LEAN CLAY WITH SAND

USCS: CL*

*classified visually

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	32.32
Weight of Dry Soil & Tare	29.95
Weight of Tare	13.87
Weight of Water	2.37
Weight of Dry Soil	16.08
Water Content	14.74%

TITLE BLOCK:

TECH	CB
DATE	07/11/12
CHECK	D.W.
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-8
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	68.5'-70.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	32.32
Wt. Dry Soil & Tare (gm)	(W2)	29.95
Weight of Tare (gm)	(W3)	13.87
Weight of Water (gm)	(W4=W1-W2)	2.37
Weight of Dry Soil (gm)	(W5=W2-W3)	16.08
Moisture Content (%)	(W4/W5)*100	14.74%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	40.86
Dry Soil & Tare (gm)	40.72
Tare Weight (gm)	13.99
Moisture Content (%)	0.52

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	561.38	
Tare Weight (gm)	193.53	
Total Weight (gm)	365.93	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	50.55
Calculated Dry Wt. used in test (gm)	50.29
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.51

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.53	0.02	100.0	#10	medium sand
#20	30.60	0.09	99.8	#20	medium sand
#40	30.71	0.20	99.6	#40	fine sand
#60	30.86	0.35	99.3	#60	fine sand
#100	31.62	1.11	97.8	#100	fine sand
#200	42.25	11.74	76.7	#200	fines

HYDROMETER CALCULATIONS

DATE 7/13/2012	TIME	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/13/2012	0:02	2.00	30.0	21.00	0.013	5.83	24.17	11.4	1.00
7/13/2012	0:05	5.00	23.5	21.00	0.013	5.83	17.67	12.5	1.00
7/13/2012	0:15	15.00	18.0	21.00	0.013	5.83	12.17	13.3	1.00
7/13/2012	0:30	30.00	17.5	21.00	0.013	5.83	11.67	13.5	1.00
7/13/2012	1:00	60.00	16.0	21.00	0.013	5.83	10.17	13.7	1.00
7/13/2012	4:10	250.00	13.5	21.40	0.013	5.70	7.80	14.2	1.00
7/14/2012	0:00	1440.00	11.5	22.10	0.013	5.47	6.03	14.5	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
0.0322	48.1	% COBBLES	0.00	
0.0213	35.1	% COARSE GRAVEL	0.00	
0.0127	24.2	% FINE GRAVEL	0.00	0.00
0.0090	23.2	% COARSE SAND	0.04	
0.0064	20.2	% MEDIUM SAND	0.36	
0.0032	15.5	% FINE SAND	22.95	23.35
0.0013	12.0	% FINES	76.65	
		% TOTAL SAMPLE	100.00	

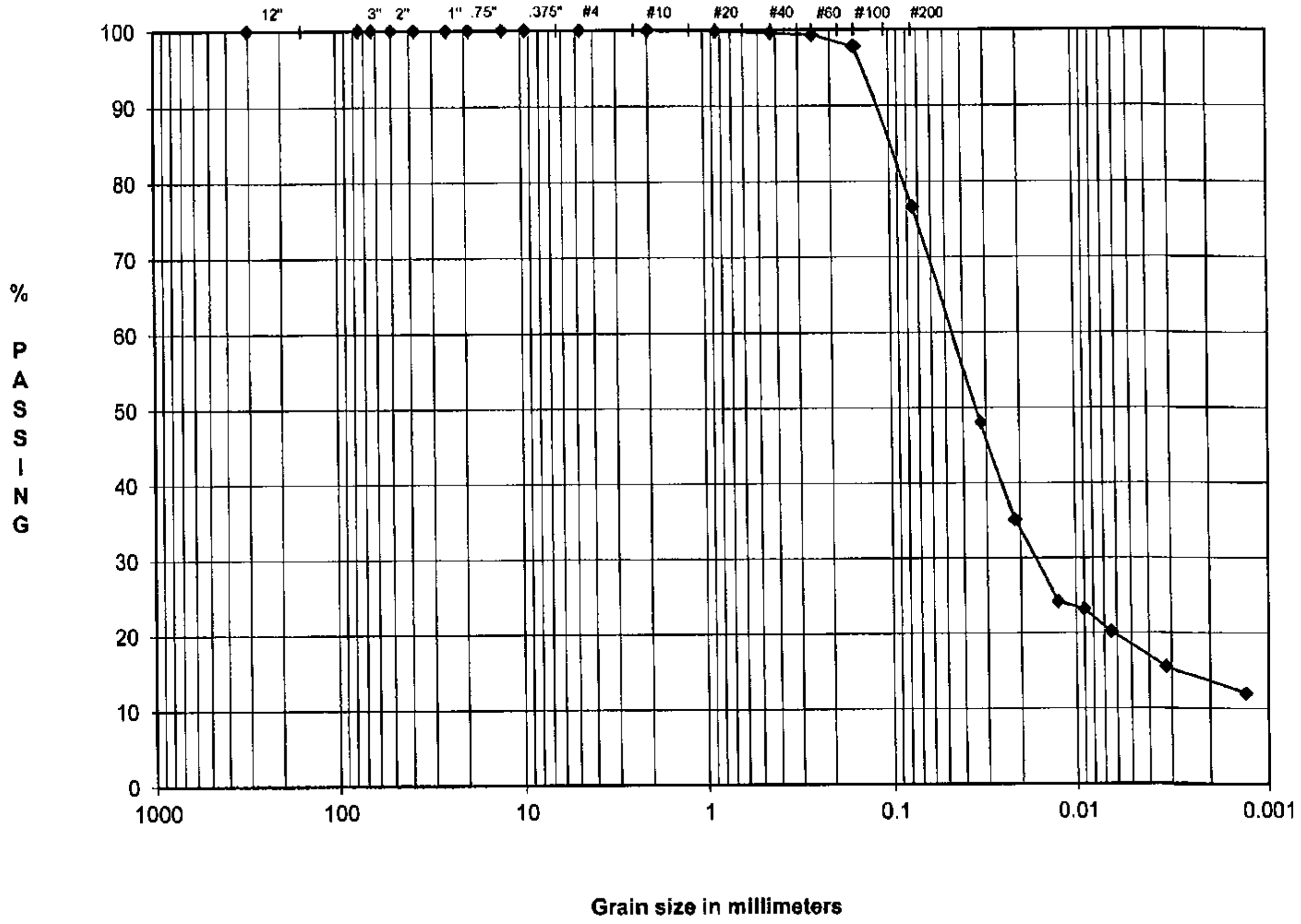
Description Dark Gray, LEAN CLAY WITH SAND

USCS CL*

0	LL
#DIV/0!	PL
#DIV/0!	PI

TECH	CB
DATE	7/11/2012
CHECK	D.W.
REVIEW	BSJ

PARTICLE SIZE DISTRIBUT1ON ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		23.35			76.65

SAMPLE ID	BH-8
SAMPLE TYPE	BAG
SAMPLE DEPTH	68.5'-70.0'

LL	0
PL	#DIV/0!
PI	#DIV/0!

DESCRIPTION Dark Gray, LEAN CLAY WITH SAND

USCS CL*

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/11/2012
CHECK	D.W.
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-9
SAMPLE TYPE: BAG
SAMPLE DEPTH: 33.5'-35.0'

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	27.35
Weight of Dry Soil & Tare	25.40
Weight of Tare	14.03
Weight of Water	1.95
Weight of Dry Soil	11.37
Water Content	17.15%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	TOS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-9
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	33.5'-35.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.12	18.27
Weight of Dry Soil & Tare	(W2)	17.64	17.77
Weight of Tare	(W3)	14.02	14.12
Weight of Water	(W4=W1-W2)	0.48	0.50
Weight of Dry Soil	(W5=W2-W3)	3.62	3.65
Water Content	(W4/W5)*100	13.26%	13.70%

NATURAL MOISTURE

Weight of Wet Soil & Tare	27.35
Weight of Dry Soil & Tare	25.40
Weight of Tare	14.03
Weight of Water	1.95
Weight of Dry Soil	11.37
Water Content	17.15%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		31	20	16
Weight of Wet Soil & Tare	(W6)	26.82	25.22	25.69
Weight of Dry Soil & Tare	(W7)	24.22	22.85	23.07
Weight of Tare	(W8)	14.34	14.16	13.98
Weight of Water	(W9=W6-W7)	2.60	2.37	2.62
Weight of Dry Soil	W10=W7-W8)	9.88	8.69	9.09
Water Content	(W9/W10)*100	26.32%	27.27%	28.82%

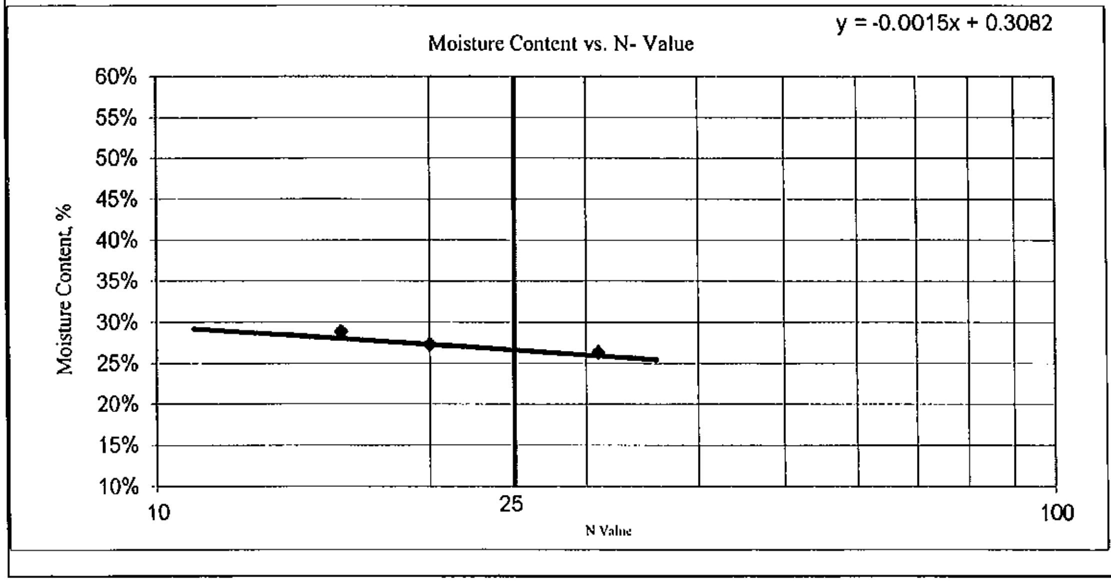
Blow	25
K - Value	1

Moisture content at 25 blow: 27.07%

LIQUID LIMIT (Wl)	27.07	27
PLASTIC LIMIT (Wp)	13.48	13
PLASTICITY INDEX (Ip)		14
LIQUIDITY INDEX (I)		0.26
MOISTURE CONTENT		17.15%

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	BS
REVIEW	BSJ

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-9
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	33.5'-35.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	27.35
Wt. Dry Soil & Tare (gm)	(W2)	25.40
Weight of Tare (gm)	(W3)	14.03
Weight of Water (gm)	(W4=W1-W2)	1.95
Weight of Dry Soil (gm)	(W5=W2-W3)	11.37
Moisture Content (%)	(W4/W5)*100	17.15%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	22.26
Dry Soil & Tare (gm)	22.22
Tare Weight (gm)	13.64
Moisture Content (%)	0.47

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	460.82	
Tare Weight (gm)	189.08	
Total Weight (gm)	270.48	(W6)

Plus #4 Material Sieve

TARE WEIGHT 11.22

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	11.22	0.0	100.0	**12.0"**	cobbles
3.0"	11.22	0.0	100.0	**3.0"**	coarse gravel
2.5"	11.22	0.0	100.0	**2.5"**	coarse gravel
2.0"	11.22	0.0	100.0	**2.0"**	coarse gravel
1.5"	11.22	0.0	100.0	**1.5"**	coarse gravel
1.0"	11.22	0.0	100.0	**1.0"**	coarse gravel
0.75"	11.22	0.0	100.0	**0.75"**	fine gravel
0.50"	11.22	0.0	100.0	**0.50"**	fine gravel
0.375"	11.22	0.0	100.0	**0.375"**	fine gravel
#4	11.76	0.2	99.8	**#4**	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	54.35
Calculated Dry Wt. used in test (gm)	54.10
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	99.80

TARE WEIGHT 30.18

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.97	0.79	**98.3**	#10	medium sand
#20	31.54	1.36	**97.3**	#20	medium sand
#40	32.40	2.22	**95.7**	#40	fine sand
#60	33.78	3.60	**93.2**	#60	fine sand
#100	36.12	5.94	**88.8**	#100	fine sand
#200	39.68	9.50	**82.3**	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:18	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:20	2.00	46.0	21.00	0.013	5.83	40.17	8.8	1.00
7/19/2012	1:23	5.00	41.0	21.00	0.013	5.83	35.17	9.6	1.00
7/19/2012	1:33	15.00	38.0	21.00	0.013	5.83	32.17	10.1	1.00
7/19/2012	1:48	30.00	35.5	21.00	0.013	5.83	29.67	10.6	1.00
7/19/2012	2:18	60.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/19/2012	5:28	250.00	26.5	21.40	0.013	5.70	20.80	12.0	1.00
7/20/2012	1:18	1440.00	20.5	22.10	0.013	5.47	15.03	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0283	74.1	% COARSE GRAVEL	0.00	
0.0187	64.9	% FINE GRAVEL	0.20	0.20
0.0111	59.3	% COARSE SAND	1.46	
0.0080	54.7	% MEDIUM SAND	2.64	
0.0058	48.3	% FINE SAND	13.43	17.53
0.0030	38.4	% FINES	82.27	
0.0013	27.7	% TOTAL SAMPLE	100.00	

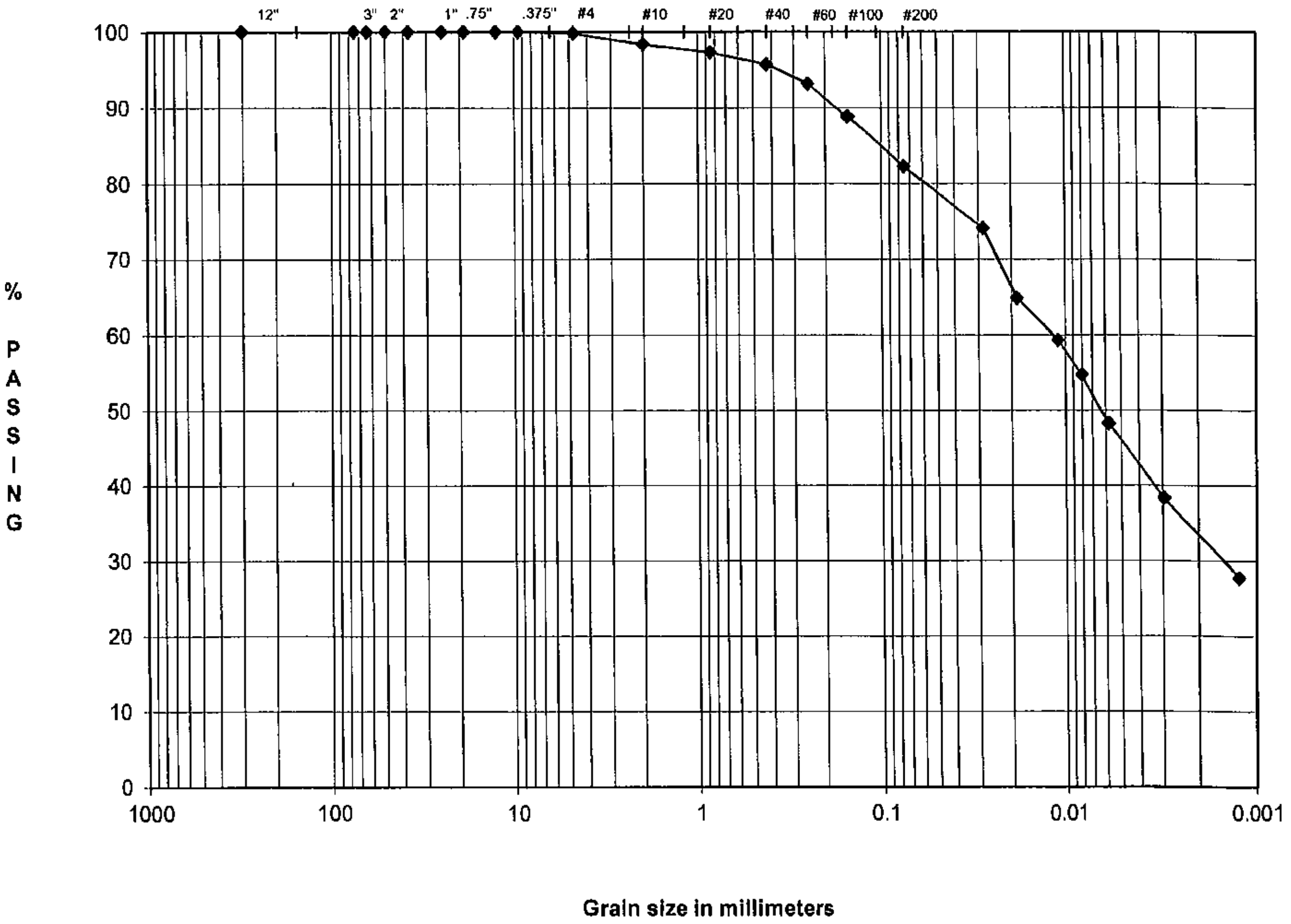
Description Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

27	LL
13	PL
14	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		0.20		17.53			82.27

SAMPLE ID	BH-9
SAMPLE TYPE	BAG
SAMPLE DEPTH	33.5'-35.0'

LL	27
PL	13
PI	14

DESCRIPTION	Dark gray, LEAN CLAY WITH SAND, trace gravel
USCS	CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	DS
REVIEW	BV

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-10
SAMPLE TYPE:	BAG
SAMPLE DEPTH:	33.5'-35.0'
DESCRIPTION:	Dark gray, LEAN CLAY WITH GRAVEL, little sand
USCS:	**CL**

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	20.56
Weight of Dry Soil & Tare	19.44
Weight of Tare	13.85
Weight of Water	1.12
Weight of Dry Soil	5.59
Water Content	20.04%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	BSJ
REVIEW	PS

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-10
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	33.5'-35.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	18.61	18.72
Weight of Dry Soil & Tare	(W2)	17.94	17.96
Weight of Tare	(W3)	14.16	13.74
Weight of Water	(W4=W1-W2)	0.67	0.76
Weight of Dry Soil	(W5=W2-W3)	3.78	4.22
Water Content	(W4/W5)*100	17.72%	18.01%

NATURAL MOISTURE

Weight of Wet Soil & Tare	20.56
Weight of Dry Soil & Tare	19.44
Weight of Tare	13.85
Weight of Water	1.12
Weight of Dry Soil	5.59
Water Content	20.04%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		35	24	20
Weight of Wet Soil & Tare	(W6)	26.87	27.08	25.54
Weight of Dry Soil & Tare	(W7)	24.03	24.06	22.76
Weight of Tare	(W8)	14.02	14.08	13.88
Weight of Water	(W9=W6-W7)	2.84	3.02	2.78
Weight of Dry Soil	W10=W7-W8)	10.01	9.98	8.88
Water Content	(W9/W10)*100	28.37%	30.26%	31.31%

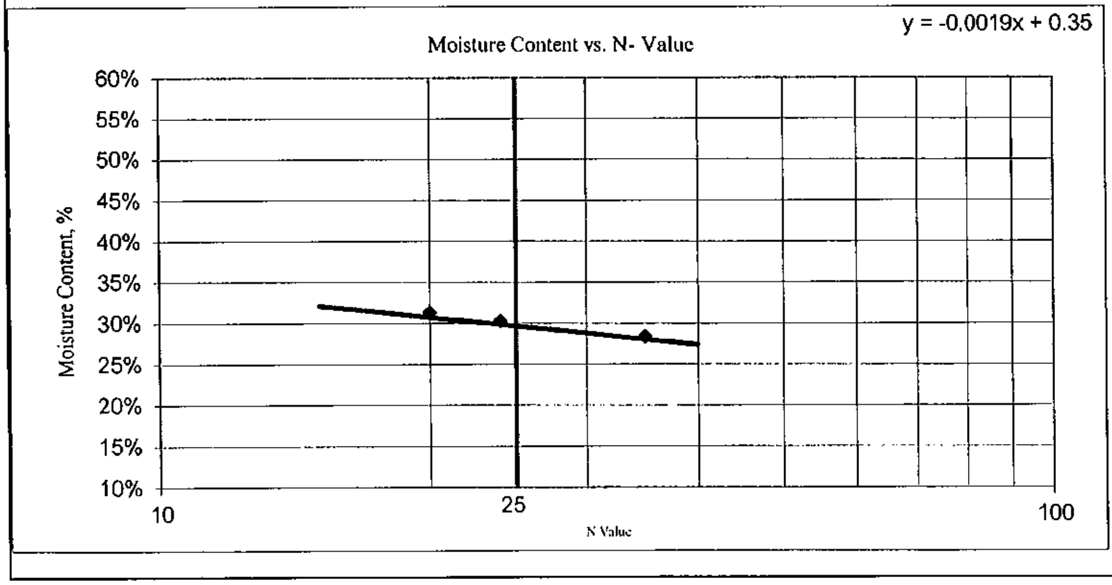
Blow	25
K - Value	1

Moisture content at 25 blow: 30.25%

LIQUID LIMIT (Wl)	30.25	30
PLASTIC LIMIT (Wp)	17.87	18
PLASTICITY INDEX (Ip)		12
LIQUIDITY INDEX (I)		0.18
MOISTURE CONTENT		20.04%

DESCRIPTION: Dark gray, LEAN CLAY WITH GRAVEL, little sand

USCS CL



TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-10
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	33.5'-35.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	20.56
Wt. Dry Soil & Tare (gm)	(W2)	19.44
Weight of Tare (gm)	(W3)	13.85
Weight of Water (gm)	(W4=W1-W2)	1.12
Weight of Dry Soil (gm)	(W5=W2-W3)	5.59
Moisture Content (%)	(W4/W5)*100	20.04%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	39.36
Dry Soil & Tare (gm)	38.61
Tare Weight (gm)	14.27
Moisture Content (%)	3.08

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	390.34	
Tare Weight (gm)	92.92	
Total Weight (gm)	288.53	(W6)

Plus #4 Material Sieve

TARE WEIGHT 10.89

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	10.89	0.0	100.0	12.0"	cobbles
3.0"	10.89	0.0	100.0	3.0"	coarse gravel
2.5"	10.89	0.0	100.0	2.5"	coarse gravel
2.0"	10.89	0.0	100.0	2.0"	coarse gravel
1.5"	10.89	0.0	100.0	1.5"	coarse gravel
1.0"	49.64	13.4	86.6	1.0"	coarse gravel
0.75"	49.64	13.4	86.6	0.75"	fine gravel
0.50"	49.64	13.4	86.6	0.50"	fine gravel
0.375"	49.64	13.4	86.6	0.375"	fine gravel
#4	50.24	13.6	86.4	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	50.70
Calculated Dry Wt. used in test (gm)	49.18
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	86.36

TARE WEIGHT 30.82

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	31.04	0.22	**86.0**	#10	medium sand
#20	31.54	0.72	**85.1**	#20	medium sand
#40	32.10	1.28	**84.1**	#40	fine sand
#60	32.81	1.99	**82.9**	#60	fine sand
#100	34.14	3.32	**80.5**	#100	fine sand
#200	37.27	6.45	**75.0**	#200	fines

HYDROMETER CALCULATIONS

DATE 7/9/2012	TIME 1:06	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/9/2012	1:08	2.00	45.5	21.00	0.013	5.83	39.67	8.9	1.00
7/9/2012	1:11	5.00	41.5	21.00	0.013	5.83	35.67	9.6	1.00
7/9/2012	1:21	15.00	36.0	21.00	0.013	5.83	30.17	10.4	1.00
7/9/2012	1:36	30.00	35.0	21.00	0.013	5.83	29.17	10.6	1.00
7/9/2012	2:06	60.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/9/2012	5:16	250.00	26.5	21.40	0.013	5.70	20.80	12.0	1.00
7/10/2012	1:06	1440.00	21.0	22.10	0.013	5.47	15.53	12.9	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0284	69.7	% COARSE GRAVEL	13.43	
0.0187	62.6	% FINE GRAVEL	0.21	13.64
0.0112	53.0	% COARSE SAND	0.39	
0.0080	51.2	% MEDIUM SAND	1.86	
0.0058	45.9	% FINE SAND	9.08	11.33
0.0030	36.5	% FINES	75.04	
0.0013	27.3	% TOTAL SAMPLE	100.00	

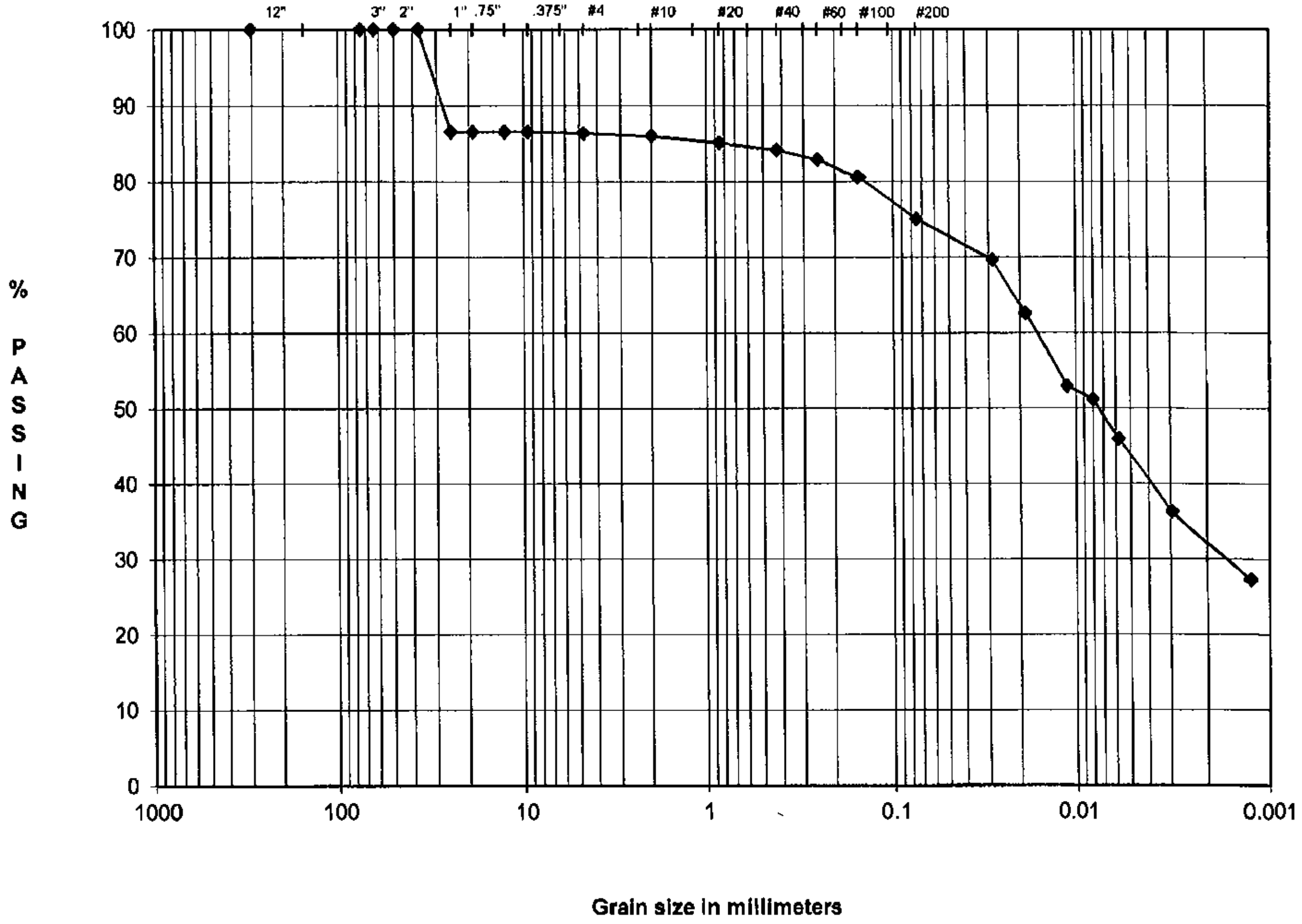
Description Dark gray, LEAN CLAY WITH GRAVEL, little sand

USCS CL

30	LL
18	PL
12	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		13.64		11.33			75.04

SAMPLE ID	BH-10	**LL**	30
SAMPLE TYPE	BAG	**PL**	18
SAMPLE DEPTH	33.5'-35.0'	**PI**	12

DESCRIPTION Dark gray, LEAN CLAY WITH GRAVEL, little sand

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 48.5'-50.0'

DESCRIPTION: Light brownish gray, LEAN CLAY, trace gravel, some sand

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	24.11
Weight of Dry Soil & Tare	22.78
Weight of Tare	14.18
Weight of Water	1.33
Weight of Dry Soil	8.60
Water Content	15.47%

TITLE BLOCK:

TECH	CB
DATE	07/19/12
CHECK	PS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-10
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	48.5'-50.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	19.54	18.34
Weight of Dry Soil & Tare	(W2)	18.81	17.71
Weight of Tare	(W3)	14.15	13.60
Weight of Water	(W4=W1-W2)	0.73	0.63
Weight of Dry Soil	(W5=W2-W3)	4.66	4.11
Water Content	(W4/W5)*100	15.67%	15.33%

NATURAL MOISTURE

Weight of Wet Soil & Tare	24.11
Weight of Dry Soil & Tare	22.78
Weight of Tare	14.18
Weight of Water	1.33
Weight of Dry Soil	8.60
Water Content	15.47%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		29	20	16
Weight of Wet Soil & Tare	(W6)	26.06	24.10	25.89
Weight of Dry Soil & Tare	(W7)	23.43	21.88	23.25
Weight of Tare	(W8)	13.91	14.01	14.07
Weight of Water	(W9=W6-W7)	2.63	2.22	2.64
Weight of Dry Soil	W10=W7-W8)	9.52	7.87	9.18
Water Content	(W9/W10)*100	27.63%	28.21%	28.76%

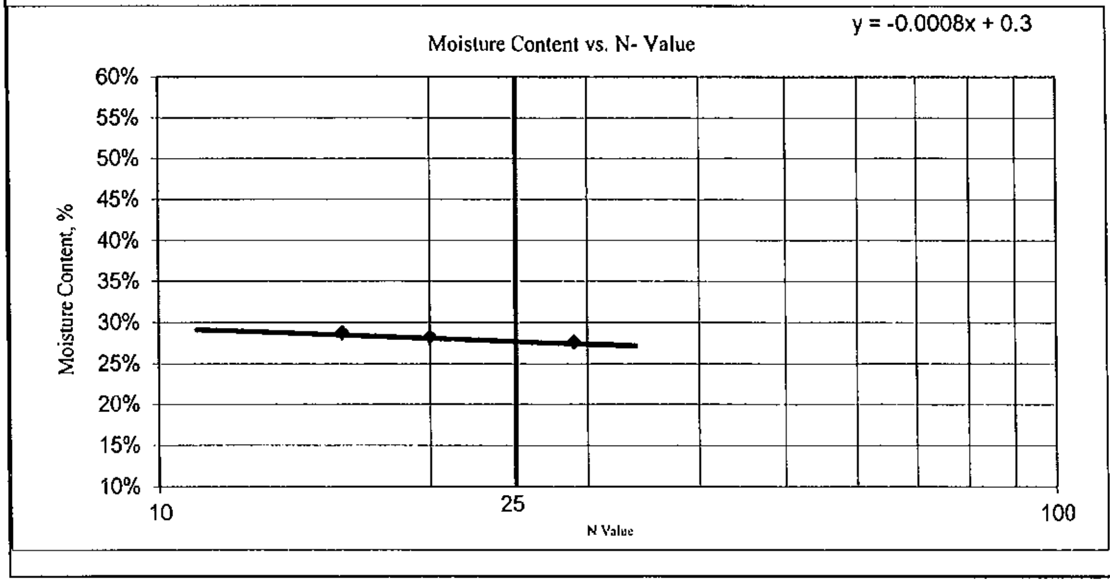
Blow	25
K - Value	1

Moisture content at 25 blow: 28.00%

LIQUID LIMIT (Wl)	28	28
PLASTIC LIMIT (Wp)	15.50	16
PLASTICITY INDEX (Ip)		12
LIQUIDITY INDEX (I)		0.00
MOISTURE CONTENT		15.47%

DESCRIPTION: Light brownish gray, LEAN CLAY, trace gravel, some sand

USCS CL



TECH	CB
DATE	7/19/2012
CHECK	BS
REVIEW	BST

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-10
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	48.5'-50.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	24.11
Wt. Dry Soil & Tare (gm)	(W2)	22.78
Weight of Tare (gm)	(W3)	14.18
Weight of Water (gm)	(W4=W1-W2)	1.33
Weight of Dry Soil (gm)	(W5=W2-W3)	8.60
Moisture Content (%)	(W4/W5)*100	15.47%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	30.56
Dry Soil & Tare (gm)	30.39
Tare Weight (gm)	13.85
Moisture Content (%)	1.03

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	503.83	
Tare Weight (gm)	95.06	
Total Weight (gm)	404.61	(W6)

Plus #4 Material Sieve

TARE WEIGHT 10.98

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	10.98	0.0	100.0	12.0"	cobbles
3.0"	10.98	0.0	100.0	3.0"	coarse gravel
2.5"	10.98	0.0	100.0	2.5"	coarse gravel
2.0"	10.98	0.0	100.0	2.0"	coarse gravel
1.5"	10.98	0.0	100.0	1.5"	coarse gravel
1.0"	10.98	0.0	100.0	1.0"	coarse gravel
0.75"	10.98	0.0	100.0	0.75"	fine gravel
0.50"	10.98	0.0	100.0	0.50"	fine gravel
0.375"	12.93	0.5	99.5	0.375"	fine gravel
#4	15.53	1.1	98.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	55.57
Calculated Dry Wt. used in test (gm)	55.00
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	98.88

TARE WEIGHT 30.45

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.91	0.46	98.0	#10	medium sand
#20	31.43	0.98	97.1	#20	medium sand
#40	31.96	1.51	96.2	#40	fine sand
#60	32.47	2.02	95.2	#60	fine sand
#100	33.44	2.99	93.5	#100	fine sand
#200	37.16	6.71	86.8	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:15	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:17	2.00	48.0	21.00	0.013	5.83	42.17	8.4	1.00
7/19/2012	2:20	5.00	44.5	21.00	0.013	5.83	38.67	9.1	1.00
7/19/2012	2:30	15.00	40.0	21.00	0.013	5.83	34.17	9.7	1.00
7/19/2012	2:45	30.00	36.25	21.00	0.013	5.83	30.42	10.4	1.00
7/19/2012	3:15	60.00	33.0	21.00	0.013	5.83	27.17	10.9	1.00
7/19/2012	6:25	250.00	27.0	21.00	0.013	5.83	21.17	11.9	1.00
7/20/2012	2:15	1440.00	22.0	20.90	0.014	5.87	16.13	12.7	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0276	75.8	% COARSE GRAVEL	0.00	
0.0182	69.5	% FINE GRAVEL	1.12	1.12
0.0108	61.4	% COARSE SAND	0.83	
0.0079	54.7	% MEDIUM SAND	1.89	
0.0057	48.8	% FINE SAND	9.35	12.06
0.0029	38.0	% FINES	86.81	
0.0013	29.0	% TOTAL SAMPLE	100.00	

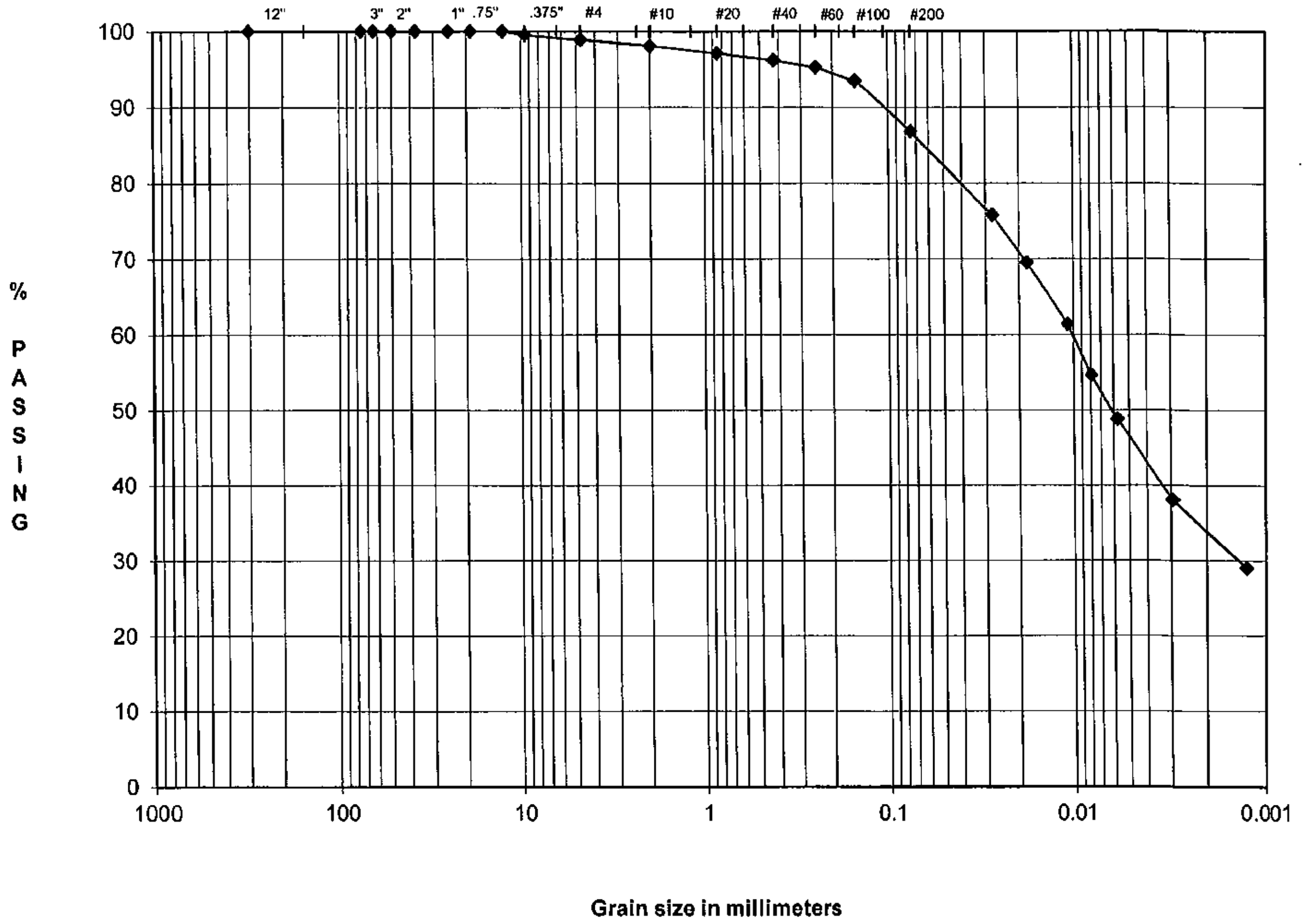
Description Light brownish gray, LEAN CLAY, trace gravel, some sand

USCS CL

28	LL
16	PL
12	PI

TECH	CB
DATE	7/19/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		1.12		12.06			86.81

SAMPLE ID	BH-10
SAMPLE TYPE	BAG
SAMPLE DEPTH	48.5'-50.0'

LL	28
PL	16
PI	12

DESCRIPTION Light brownish gray, LEAN CLAY, trace gravel, some sand

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/19/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-10
SAMPLE TYPE: BAG
SAMPLE DEPTH: 73.5'-75.0'

DESCRIPTION: Grayish brown, LEAN CLAY, trace sand

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	33.56
Weight of Dry Soil & Tare	31.03
Weight of Tare	13.91
Weight of Water	2.53
Weight of Dry Soil	17.12
Water Content	14.78%

TITLE BLOCK:

TECH	CB
DATE	07/19/12
CHECK	
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	**BH-10**
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	**BAG**
		SAMPLE DEPTH	**73.5'-75.0'**

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	19.03	20.91
Weight of Dry Soil & Tare	(W2)	18.39	20.08
Weight of Tare	(W3)	13.82	14.18
Weight of Water	(W4=W1-W2)	0.64	0.83
Weight of Dry Soil	(W5=W2-W3)	4.57	5.90
Water Content	(W4/W5)*100	14.00%	14.07%

NATURAL MOISTURE

Weight of Wet Soil & Tare	33.56
Weight of Dry Soil & Tare	31.03
Weight of Tare	13.91
Weight of Water	2.53
Weight of Dry Soil	17.12
Water Content	14.78%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		29	26	18
Weight of Wet Soil & Tare	(W6)	27.59	29.61	25.88
Weight of Dry Soil & Tare	(W7)	24.97	26.65	23.52
Weight of Tare	(W8)	13.92	14.19	14.16
Weight of Water	(W9=W6-W7)	2.62	2.96	2.36
Weight of Dry Soil	W10=W7-W8)	11.05	12.46	9.36
Water Content	(W9/W10)*100	23.71%	23.76%	25.21%

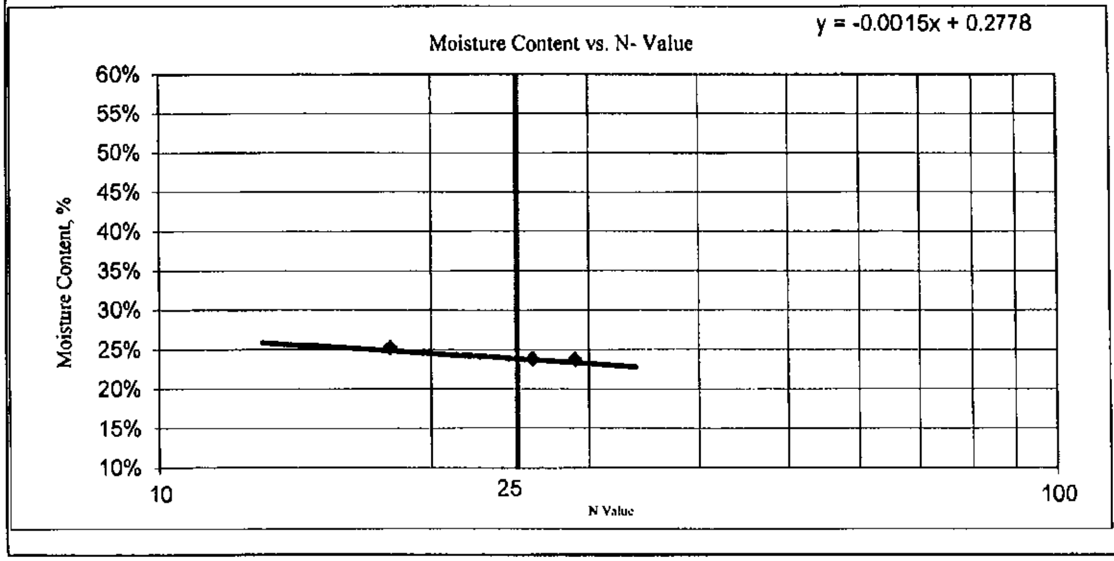
Blow	25
K - Value	1

Moisture content at 25 blow: 24.03%

LIQUID LIMIT (Wl)	**24.03**	**24**
PLASTIC LIMIT (Wp)	**14.04**	**14**
PLASTICITY INDEX (Ip)		**10**
LIQUIDITY INDEX (I)		**0.07**
MOISTURE CONTENT		**14.78%**

DESCRIPTION: Grayish brown, LEAN CLAY, trace sand

USCS CL



TECH	CB
DATE	7/19/2012
CHECK	Daw,
REVIEW	BSt

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-10
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	73.5'-75.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	33.56
Wt. Dry Soil & Tare (gm)	(W2)	31.03
Weight of Tare (gm)	(W3)	13.91
Weight of Water (gm)	(W4=W1-W2)	2.53
Weight of Dry Soil (gm)	(W5=W2-W3)	17.12
Moisture Content (%)	(W4/W5)*100	14.78%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	28.35
Dry Soil & Tare (gm)	28.25
Tare Weight (gm)	14.11
Moisture Content (%)	0.71

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	462.43	
Tare Weight (gm)	95.77	
Total Weight (gm)	364.09	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	53.06
Calculated Dry Wt. used in test (gm)	52.69
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.69

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.69	0.00	100.0	#10	medium sand
#20	30.71	0.02	100.0	#20	medium sand
#40	30.76	0.07	99.9	#40	fine sand
#60	30.81	0.12	99.8	#60	fine sand
#100	30.93	0.24	99.5	#100	fine sand
#200	33.25	2.56	95.1	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:17	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:19	2.00	45.0	21.00	0.013	5.83	39.17	8.9	1.00
7/19/2012	2:22	5.00	40.0	21.00	0.013	5.83	34.17	9.7	1.00
7/19/2012	2:32	15.00	35.0	21.00	0.013	5.83	29.17	10.6	1.00
7/19/2012	2:47	30.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/19/2012	3:17	60.00	28.5	21.00	0.013	5.83	22.67	11.7	1.00
7/19/2012	6:27	250.00	24.0	21.00	0.013	5.83	18.17	12.4	1.00
7/20/2012	2:17	1440.00	20.0	20.90	0.014	5.87	14.13	13.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0284	74.3	% COARSE GRAVEL	0.00	
0.0188	64.8	% FINE GRAVEL	0.00	0.00
0.0113	55.4	% COARSE SAND	0.00	
0.0082	49.7	% MEDIUM SAND	0.13	
0.0060	43.0	% FINE SAND	4.73	4.86
0.0030	34.5	% FINES	95.14	
0.0013	26.8	% TOTAL SAMPLE	100.00	

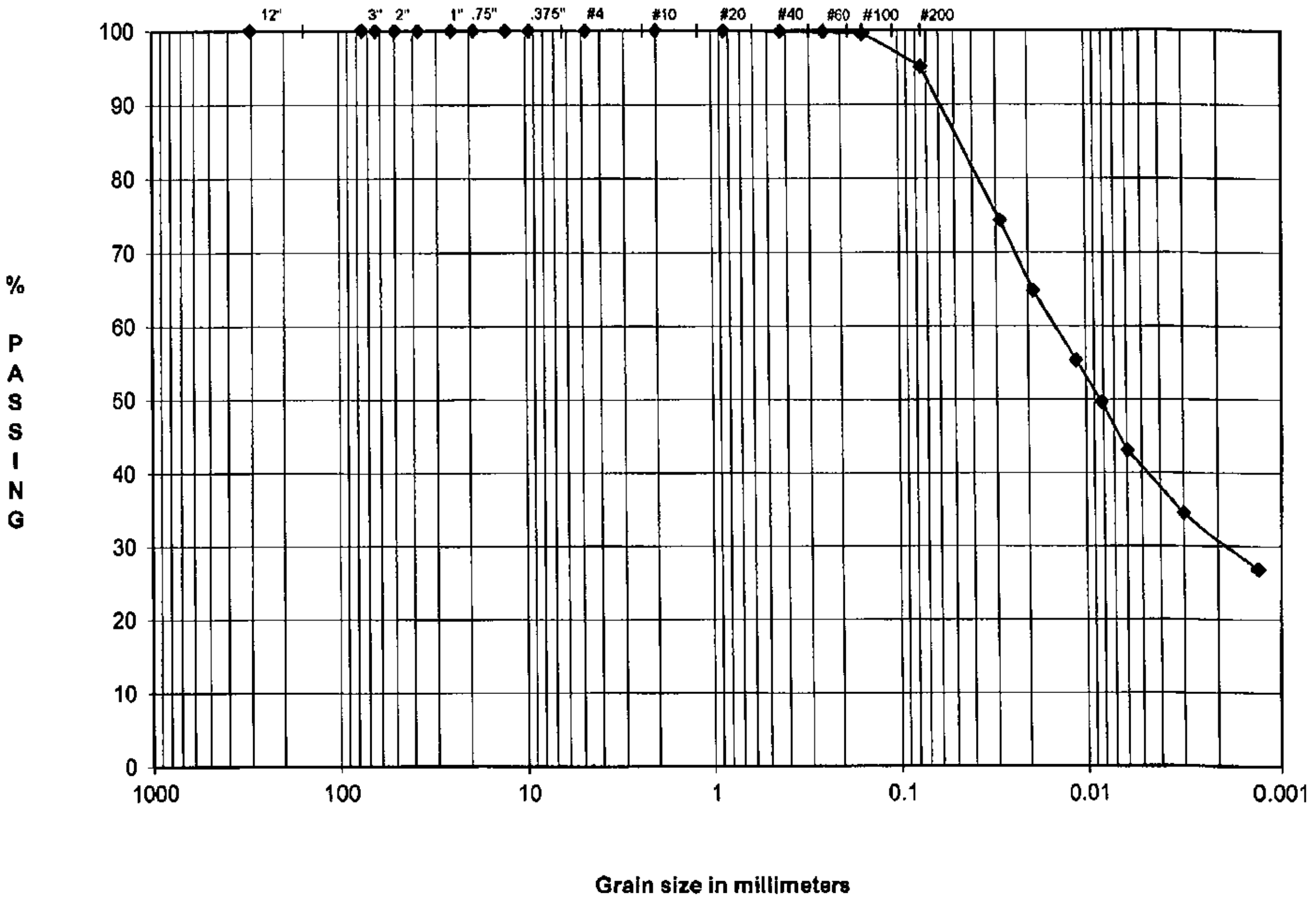
Description Grayish brown, LEAN CLAY, trace sand

USCS CL

24	LL
14	PL
10	PI

TECH	CB
DATE	7/19/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		4.86			95.14

SAMPLE ID	BH-10
SAMPLE TYPE	BAG
SAMPLE DEPTH	73.5'-75.0'

LL	24
PL	14
PI	10

DESCRIPTION Grayish brown, LEAN CLAY, trace sand

USCS CL

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/19/2012
CHECK	D.W.
REVIEW	BST

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME: Nipsco-MCGS
PROJECT NUMBER: 123-88898

SAMPLE ID: BH-11
SAMPLE TYPE: BAG
SAMPLE DEPTH: 28.5'-30.0'

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS: CL

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	26.51
Weight of Dry Soil & Tare	24.76
Weight of Tare	14.10
Weight of Water	1.75
Weight of Dry Soil	10.66
Water Content	16.42%

TITLE BLOCK:

TECH	CB
DATE	07/09/12
CHECK	PS
REVIEW	BST

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-11
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	BAG
		SAMPLE DEPTH	28.5'-30.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	19.36	19.05
Weight of Dry Soil & Tare	(W2)	18.66	18.37
Weight of Tare	(W3)	13.92	13.84
Weight of Water	(W4=W1-W2)	0.70	0.68
Weight of Dry Soil	(W5=W2-W3)	4.74	4.53
Water Content	(W4/W5)*100	14.77%	15.01%

NATURAL MOISTURE

Weight of Wet Soil & Tare	26.51
Weight of Dry Soil & Tare	24.76
Weight of Tare	14.10
Weight of Water	1.75
Weight of Dry Soil	10.66
Water Content	16.42%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		35	24	16
Weight of Wet Soil & Tare	(W6)	24.37	26.95	26.46
Weight of Dry Soil & Tare	(W7)	22.19	24.14	23.65
Weight of Tare	(W8)	13.87	14.04	14.01
Weight of Water	(W9=W6-W7)	2.18	2.81	2.81
Weight of Dry Soil	W10=W7-W8)	8.32	10.10	9.64
Water Content	(W9/W10)*100	26.20%	27.82%	29.15%

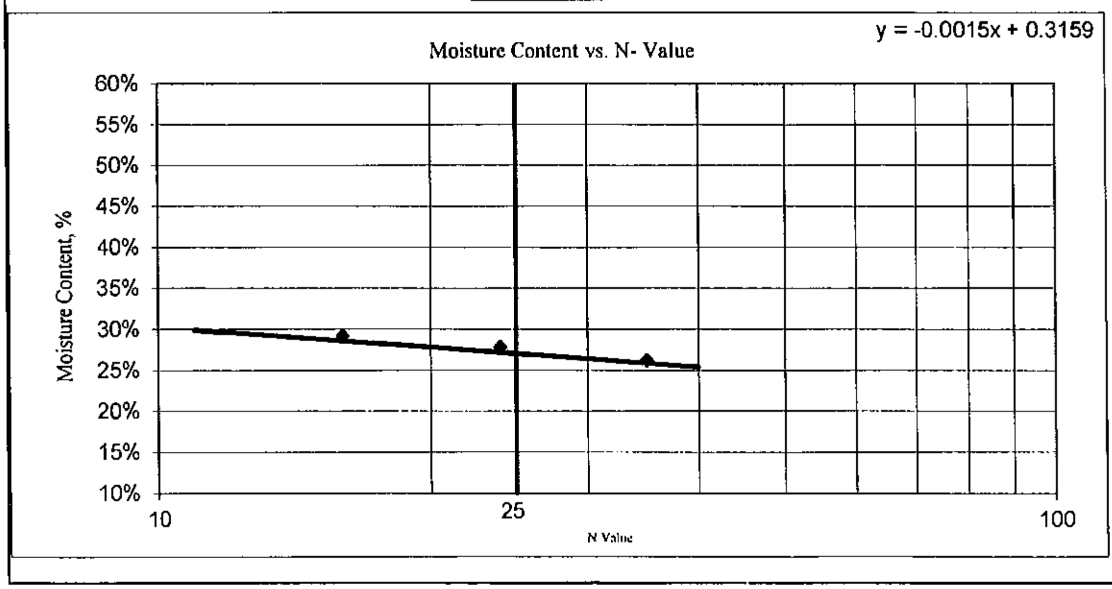
Blow	25
K - Value	1

Moisture content at 25 blow: 27.84%

LIQUID LIMIT (Wl)	27.84	28
PLASTIC LIMIT (Wp)	14.89	15
PLASTICITY INDEX (Ip)		13
LIQUIDITY INDEX (I)		0.12
MOISTURE CONTENT		16.42%

DESCRIPTION: Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS: CL



TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-11
PROJECT NO.	123-88898	SAMPLE TYPE	BAG
		SAMPLE DEPTH	28.5'-30.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	26.51
Wt. Dry Soil & Tare (gm)	(W2)	24.76
Weight of Tare (gm)	(W3)	14.10
Weight of Water (gm)	(W4=W1-W2)	1.75
Weight of Dry Soil (gm)	(W5=W2-W3)	10.66
Moisture Content (%)	(W4/W5)*100	16.42%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	40.10
Dry Soil & Tare (gm)	39.34
Tare Weight (gm)	15.69
Moisture Content (%)	3.21

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	447.70	
Tare Weight (gm)	99.62	
Total Weight (gm)	337.24	(W6)

Plus #4 Material Sieve

TARE WEIGHT 30.69

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	30.69	0.0	100.0	12.0"	cobbles
3.0"	30.69	0.0	100.0	3.0"	coarse gravel
2.5"	30.69	0.0	100.0	2.5"	coarse gravel
2.0"	30.69	0.0	100.0	2.0"	coarse gravel
1.5"	30.69	0.0	100.0	1.5"	coarse gravel
1.0"	30.69	0.0	100.0	1.0"	coarse gravel
0.75"	30.69	0.0	100.0	0.75"	fine gravel
0.50"	34.39	1.1	98.9	0.50"	fine gravel
0.375"	34.39	1.1	98.9	0.375"	fine gravel
#4	34.39	1.1	98.9	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	51.79
Calculated Dry Wt. used in test (gm)	50.18
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	98.90

TARE WEIGHT 28.51

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	28.82	0.31	98.3	#10	medium sand
#20	29.26	0.75	97.4	#20	medium sand
#40	29.70	1.19	96.6	#40	fine sand
#60	30.54	2.03	94.9	#60	fine sand
#100	31.90	3.39	92.2	#100	fine sand
#200	35.60	7.09	84.9	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:24	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:26	2.00	44.0	21.00	0.013	5.83	38.17	9.1	1.00
7/19/2012	1:29	5.00	39.0	21.00	0.013	5.83	33.17	9.9	1.00
7/19/2012	1:39	15.00	35.0	21.00	0.013	5.83	29.17	10.6	1.00
7/19/2012	1:54	30.00	32.0	21.00	0.013	5.83	26.17	11.1	1.00
7/19/2012	2:24	60.00	29.0	21.00	0.013	5.83	23.17	11.5	1.00
7/19/2012	5:34	250.00	25.0	21.40	0.013	5.70	19.30	12.2	1.00
7/20/2012	1:24	1440.00	19.5	22.10	0.013	5.47	14.03	13.2	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0288	75.2	% COARSE GRAVEL	0.00	
0.0190	65.4	% FINE GRAVEL	1.10	1.10
0.0113	57.5	% COARSE SAND	0.61	
0.0082	51.6	% MEDIUM SAND	1.73	
0.0059	45.7	% FINE SAND	11.63	13.97
0.0030	38.0	% FINES	84.93	
0.0013	27.6	% TOTAL SAMPLE	100.00	

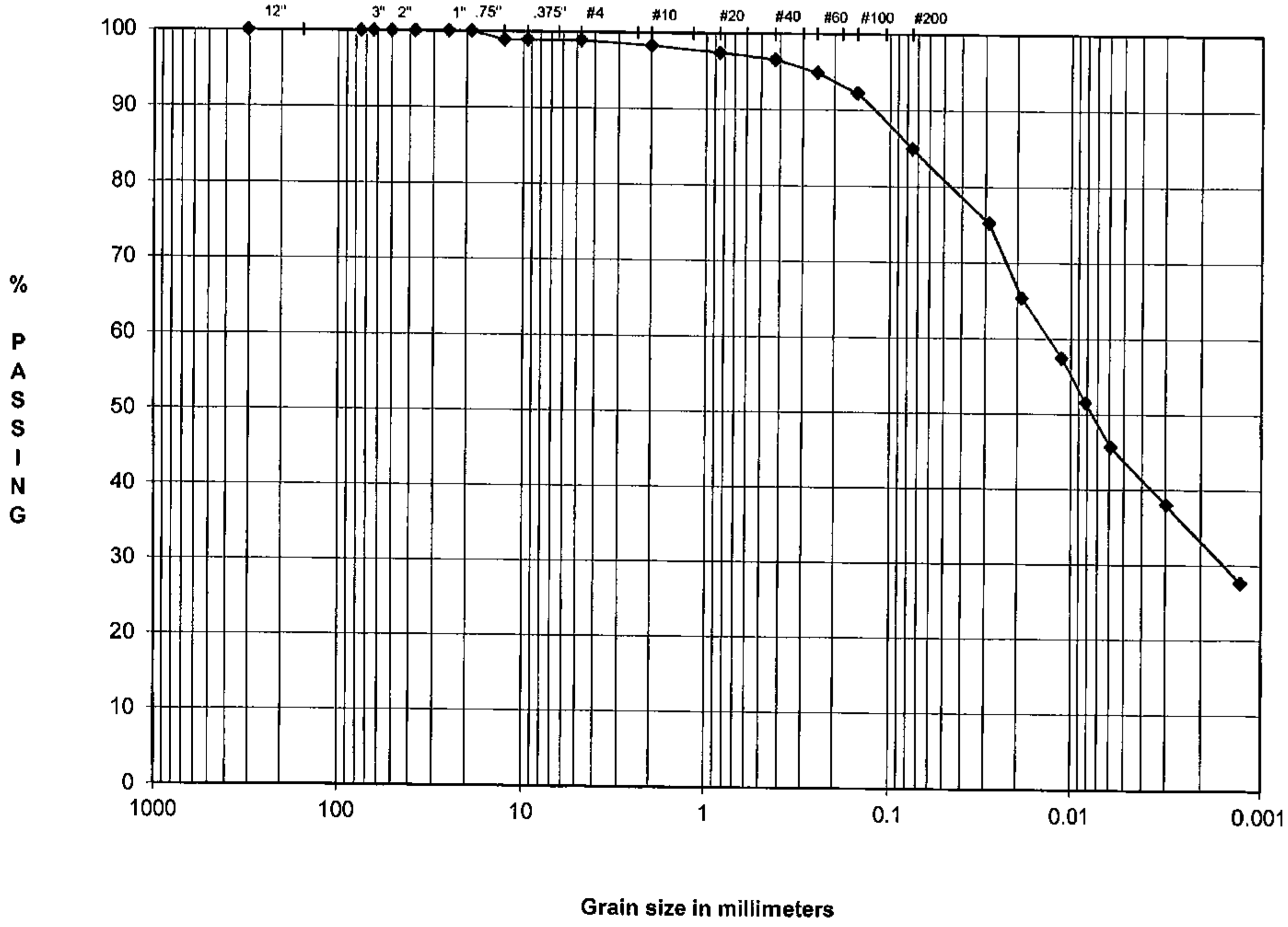
Description Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

28	LL
15	PL
13	PI

TECH	CB
DATE	7/9/2012
CHECK	
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



		Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
Boulders	Cobbles	GRAVEL		SAND			FINES
		1.10		13.97			84.93

SAMPLE ID BH-11
SAMPLE TYPE BAG
SAMPLE DEPTH 28.5'-30.0'

LL 28
PL 15
PI 13

DESCRIPTION Dark gray, LEAN CLAY WITH SAND, trace gravel

USCS CL

Nipsco-MCGS
123-88898

TECH CB
DATE 7/9/2012
CHECK PS
REVIEW BSJ

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-12
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	23.5'-25.0'
DESCRIPTION:	Olive Brown, SANDY SILT
USCS:	ML

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	29.23
Weight of Dry Soil & Tare	26.61
Weight of Tare	14.24
Weight of Water	2.62
Weight of Dry Soil	12.37
Water Content	21.18%

TITLE BLOCK:

TECH	CB
DATE	07/18/12
CHECK	D, W,
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	**BH-12**
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	**JAR**
		SAMPLE DEPTH	**23.5'-25.0'**

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	16.75	15.01
Weight of Dry Soil & Tare	(W2)	15.99	14.48
Weight of Tare	(W3)	10.96	10.89
Weight of Water	(W4=W1-W2)	0.76	0.53
Weight of Dry Soil	(W5=W2-W3)	5.03	3.59
Water Content	(W4/W5)*100	15.11%	14.76%

NATURAL MOISTURE

Weight of Wet Soil & Tare	29.23
Weight of Dry Soil & Tare	26.61
Weight of Tare	14.24
Weight of Water	2.62
Weight of Dry Soil	12.37
Water Content	21.18%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		30	24	16
Weight of Wet Soil & Tare	(W6)	28.90	31.64	34.84
Weight of Dry Soil & Tare	(W7)	26.94	29.28	32.05
Weight of Tare	(W8)	14.07	13.84	13.92
Weight of Water	(W9=W6-W7)	1.96	2.36	2.79
Weight of Dry Soil	W10=W7-W8)	12.87	15.44	18.13
Water Content	(W9/W10)*100	15.23%	15.28%	15.39%

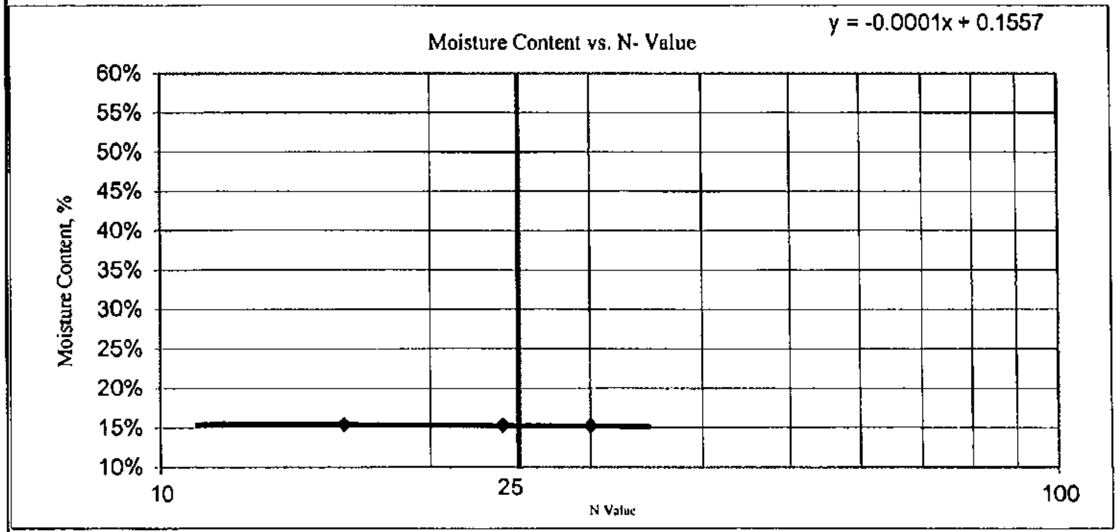
Blow	25
K - Value	1

Moisture content at 25 blow: 15.32%

LIQUID LIMIT (WI)	15.32	15
PLASTIC LIMIT (Wp)	14.94	15
PLASTICITY INDEX (Ip)		0
LIQUIDITY INDEX (I)		0.00
MOISTURE CONTENT		21.18%

DESCRIPTION: Olive Brown, SANDY SILT

USCS ML



TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-12
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	23.5'-25.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	29.23
Wt. Dry Soil & Tare (gm)	(W2)	26.61
Weight of Tare (gm)	(W3)	14.24
Weight of Water (gm)	(W4=W1-W2)	2.62
Weight of Dry Soil (gm)	(W5=W2-W3)	12.37
Moisture Content (%)	(W4/W5)*100	21.18%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	27.95
Dry Soil & Tare (gm)	27.93
Tare Weight (gm)	13.98
Moisture Content (%)	0.14

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	392.16	
Tare Weight (gm)	94.96	
Total Weight (gm)	296.77	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	52.41
Calculated Dry Wt. used in test (gm)	52.33
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.49

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.49	0.00	100.0	#10	medium sand
#20	30.51	0.02	100.0	#20	medium sand
#40	30.53	0.04	99.9	#40	fine sand
#60	31.54	1.05	98.0	#60	fine sand
#100	40.08	9.59	81.7	#100	fine sand
#200	46.29	15.80	69.8	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 1:22	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	1:24	2.00	23.0	21.00	0.013	5.83	17.17	12.5	1.00
7/19/2012	1:27	5.00	16.5	21.00	0.013	5.83	10.67	13.7	1.00
7/19/2012	1:37	15.00	11.5	21.00	0.013	5.83	5.67	14.5	1.00
7/19/2012	1:52	30.00	10.5	21.00	0.013	5.83	4.67	14.7	1.00
7/19/2012	2:22	60.00	9.5	21.00	0.013	5.83	3.67	14.8	1.00
7/19/2012	5:32	250.00	8.0	21.00	0.013	5.83	2.17	15.0	1.00
7/20/2012	1:22	1440.00	8.0	20.90	0.014	5.87	2.13	15.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0337	32.8	% COARSE GRAVEL	0.00	
0.0223	20.4	% FINE GRAVEL	0.00	0.00
0.0133	10.8	% COARSE SAND	0.00	
0.0094	8.9	% MEDIUM SAND	0.08	
0.0067	7.0	% FINE SAND	30.11	30.19
0.0033	4.1	% FINES	69.81	
0.0014	4.1	% TOTAL SAMPLE	100.00	

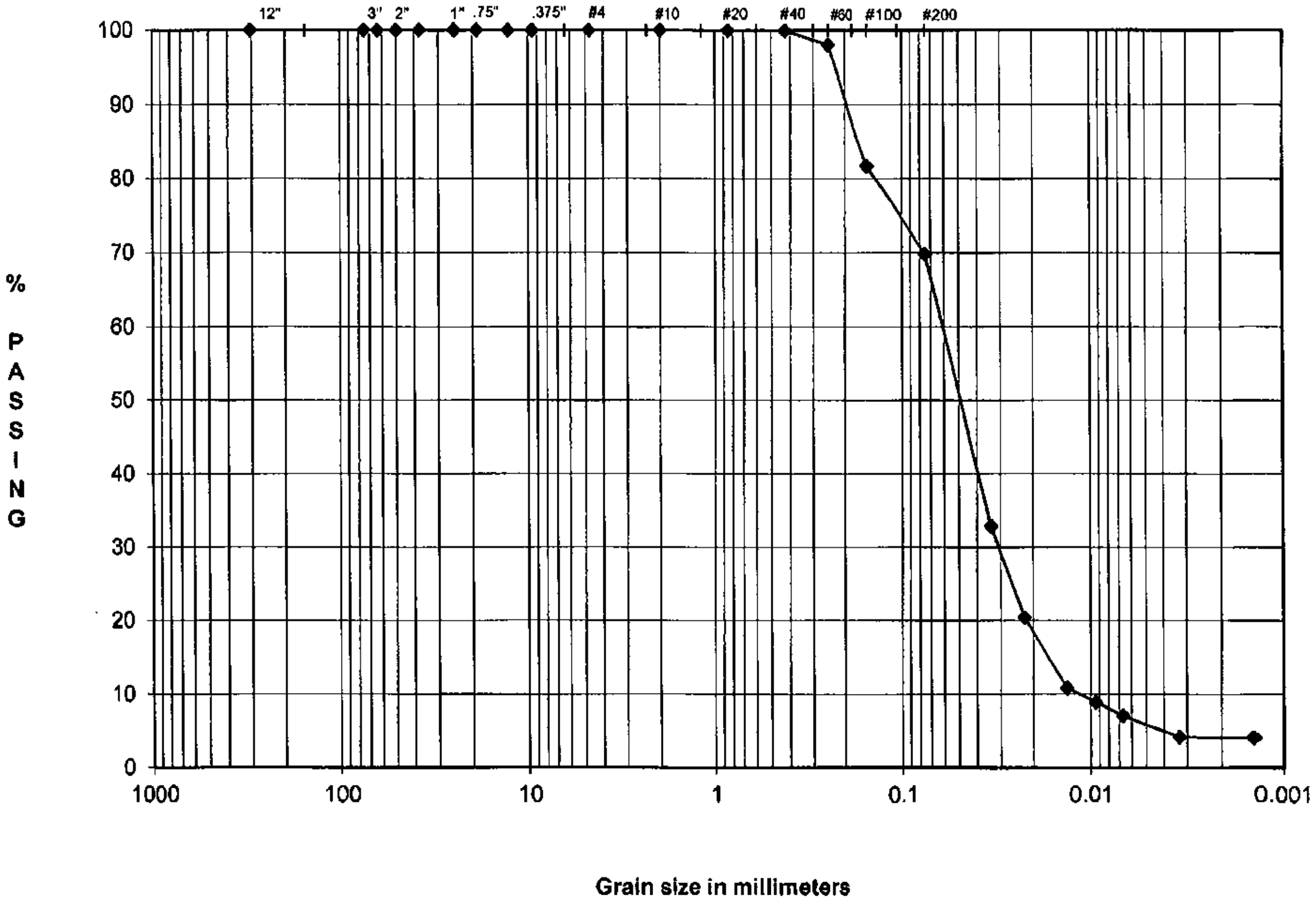
Description Olive Brown, SANDY SILT

USCS ML

15	LL
15	PL
0	PI

TECH	CB
DATE	7/18/2012
CHECK	D.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		30.19			69.81

SAMPLE ID	BH-12
SAMPLE TYPE	JAR
SAMPLE DEPTH	23.5'-25.0'

LL	15
PL	15
PI	0

DESCRIPTION	Olive Brown, SANDY SILT
USCS	ML

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18/2012
CHECK	
REVIEW	

Template For Proctor, Sieve-Hydro, Atterberg, and Spec Grav.

Global Information:

PROJECT NAME:	Nipsco-MCGS
PROJECT NUMBER:	123-88898
SAMPLE ID:	BH-12
SAMPLE TYPE:	JAR
SAMPLE DEPTH:	38.5'-40.0'
DESCRIPTION:	Light Olive Brown, ELASTIC SILT, little sand
USCS:	MH

AS-RECEIVED MOISTURE CONTENT:

Weight of Wet Soil & Tare	34.50
Weight of Dry Soil & Tare	31.05
Weight of Tare	14.09
Weight of Water	3.45
Weight of Dry Soil	16.96
Water Content	20.34%

TITLE BLOCK:

TECH	CB
DATE	07/18/12
CHECK	
REVIEW	

ATTERBERG LIMITS
ASTM D-4318

PROJECT TITLE	Nipsco-MCGS	**SAMPLE ID**	BH-12
PROJECT NUMBER	123-88898	**SAMPLE TYPE**	JAR
		SAMPLE DEPTH	38.5'-40.0'

SAMPLE PREPARATION

Wet or Dry: Wet

Minus #40 Sieve: Yes (yes or no)

PLASTIC LIMIT DETERMINATION

Weight of Wet Soil & Tare	(W1)	17.88	19.28
Weight of Dry Soil & Tare	(W2)	16.70	17.66
Weight of Tare	(W3)	14.13	14.18
Weight of Water	(W4=W1-W2)	1.18	1.62
Weight of Dry Soil	(W5=W2-W3)	2.57	3.48
Water Content	(W4/W5)*100	45.91%	46.55%

NATURAL MOISTURE

Weight of Wet Soil & Tare	34.50
Weight of Dry Soil & Tare	31.05
Weight of Tare	14.09
Weight of Water	3.45
Weight of Dry Soil	16.96
Water Content	20.34%

LIQUID LIMIT DETERMINATION

Range of Blows		25 - 35	20 - 30	15 - 25
Number of Blows		34	28	15
Weight of Wet Soil & Tare	(W6)	24.38	23.44	23.38
Weight of Dry Soil & Tare	(W7)	20.57	20.02	19.92
Weight of Tare	(W8)	14.02	14.18	14.19
Weight of Water	(W9=W6-W7)	3.81	3.42	3.46
Weight of Dry Soil	W10=W7-W8)	6.55	5.84	5.73
Water Content	(W9/W10)*100	58.17%	58.56%	60.38%

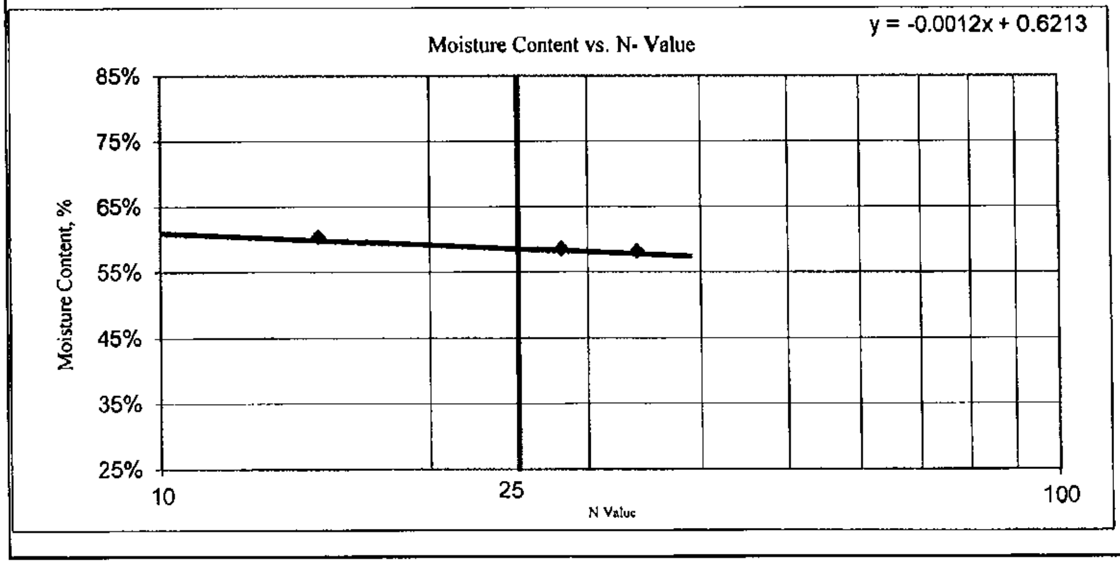
Blow	25
K - Value	1

Moisture content at 25 blow: 59.13%

LIQUID LIMIT (Wl)	59.13	59
PLASTIC LIMIT (Wp)	46.23	46
PLASTICITY INDEX (Ip)		13
LIQUIDITY INDEX (I)		-1.99
MOISTURE CONTENT		20.34%

DESCRIPTION: Light Olive Brown, ELASTIC SILT, little sand

USCS MH



TECH	CB
DATE	7/18/2012
CHECK	D.W.
REVIEW	

ASTM GRAIN SIZE ANALYSIS
ASTM C117, C136, D421, D422, D1140 and D2217

PROJECT TITLE	Nipsco-MCGS	SAMPLE ID	BH-12
PROJECT NO.	123-88898	SAMPLE TYPE	JAR
		SAMPLE DEPTH	38.5'-40.0'

AS RECEIVED WATER CONTENT

Wt. Wet Soil & Tare (gm)	(W1)	34.50
Wt. Dry Soil & Tare (gm)	(W2)	31.05
Weight of Tare (gm)	(W3)	14.09
Weight of Water (gm)	(W4=W1-W2)	3.45
Weight of Dry Soil (gm)	(W5=W2-W3)	16.96
Moisture Content (%)	(W4/W5)*100	20.34%

Hygroscopic Moisture For Sieve Sample

Wet Soil & Tare (gm)	28.72
Dry Soil & Tare (gm)	28.68
Tare Weight (gm)	14.35
Moisture Content (%)	0.28

Total Weight of Sample Used For Sieve Analysis Corrected For Hygroscopic Moisture

Weight + Tare, Before Separating On The #4 Sieve (gm)	384.94	
Tare Weight (gm)	96.17	
Total Weight (gm)	287.97	(W6)

Plus #4 Material Sieve

TARE WEIGHT 0.00

	(Wt+Tare)	(((Wt-Tare)/W6)*100)	%PASSING		
12.0"	0.00	0.0	100.0	12.0"	cobbles
3.0"	0.00	0.0	100.0	3.0"	coarse gravel
2.5"	0.00	0.0	100.0	2.5"	coarse gravel
2.0"	0.00	0.0	100.0	2.0"	coarse gravel
1.5"	0.00	0.0	100.0	1.5"	coarse gravel
1.0"	0.00	0.0	100.0	1.0"	coarse gravel
0.75"	0.00	0.0	100.0	0.75"	fine gravel
0.50"	0.00	0.0	100.0	0.50"	fine gravel
0.375"	0.00	0.0	100.0	0.375"	fine gravel
#4	0.00	0.0	100.0	#4	coarse sand

HYDROMETER ANALYSIS

Specific Gravity	(assumed)	2.65
Amount Dispersing Agent (ml)		125.00
Type Dispersion Device		Mechanical
Length of Dispersion Period		1 Minute

Weight of Sample Used For Hydrometer Test

Weight of Sample Wet or Dry (gm)	55.34
Calculated Dry Wt. used in test (gm)	55.19
Hydrometer Bulb Number	624378
% Pass #4 Sieve For Whole Sample	100.00

TARE WEIGHT 30.17

HYDROMETER BACKSIEVE (Percent Passing #10 - #200 Sieves)

	(Wt+Tare)	Cumul Wt. Retained	% PASSING		
#10	30.23	0.06	99.9	#10	medium sand
#20	30.25	0.08	99.9	#20	medium sand
#40	30.29	0.12	99.8	#40	fine sand
#60	30.41	0.24	99.6	#60	fine sand
#100	30.82	0.65	98.8	#100	fine sand
#200	35.72	5.55	89.9	#200	fines

HYDROMETER CALCULATIONS

DATE 7/19/2012	TIME 2:19	ET (min)	READING R	TEMP T	TEMP.COR. K	HYD.COR. Cc	READING C	EFFECTIVE LENGTH	A
7/19/2012	2:21	2.00	31.5	21.00	0.013	5.83	25.67	11.2	1.00
7/19/2012	2:24	5.00	21.5	21.00	0.013	5.83	15.67	12.9	1.00
7/19/2012	2:34	15.00	16.0	21.00	0.013	5.83	10.17	13.7	1.00
7/19/2012	2:49	30.00	13.0	21.00	0.013	5.83	7.17	14.2	1.00
7/19/2012	3:19	60.00	10.5	21.00	0.013	5.83	4.67	14.7	1.00
7/19/2012	6:29	250.00	9.5	21.00	0.013	5.83	3.67	14.8	1.00
7/20/2012	2:19	1440.00	8.5	20.90	0.014	5.87	2.63	15.0	1.00

GRAIN SIZE PERCENTAGES

Particle Diameter	% PASSING			
		% COBBLES	0.00	
0.0319	46.5	% COARSE GRAVEL	0.00	
0.0217	28.4	% FINE GRAVEL	0.00	0.00
0.0129	18.4	% COARSE SAND	0.11	
0.0093	13.0	% MEDIUM SAND	0.11	
0.0067	8.5	% FINE SAND	9.84	10.06
0.0033	6.6	% FINES	89.94	
0.0014	4.8	% TOTAL SAMPLE	100.00	

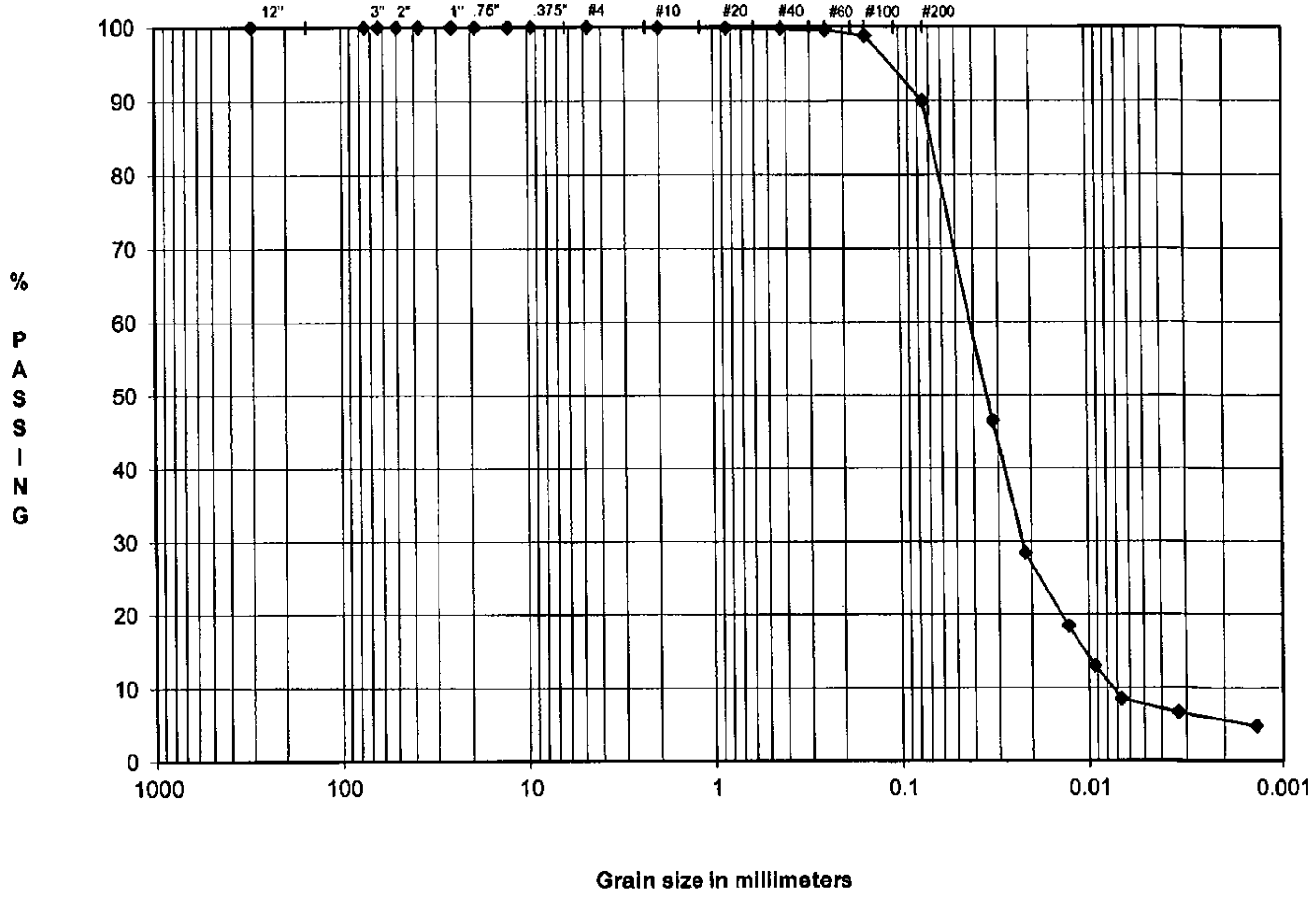
Description Light Olive Brown, ELASTIC SILT, little sand

USCS MH

59	LL
46	PL
13	PI

TECH	CB
DATE	7/18/2012
CHECK	B.W.
REVIEW	

PARTICLE SIZE DISTRIBUTION ASTM D 421 AND D 422
US STANDARD SIEVE OPENING SIZES



Boulders	Cobbles	Coarse	Fine	Cor	Med	Fine	SILT OR CLAY
		GRAVEL		SAND			FINES
		0.00		10.06			89.94

SAMPLE ID	BH-12
SAMPLE TYPE	JAR
SAMPLE DEPTH	38.5'-40.0'

LL	59
PL	46
PI	13

DESCRIPTION	Light Olive Brown, ELASTIC SILT, little sand
USCS	MH

Nipsco-MCGS
123-88898

TECH	CB
DATE	7/18/2012
CHECK	D.W.
REVIEW	

APPENDIX E

Slope Stability Analyses

Golder Associates

SUBJECT		SLOPE STABILITY SUMMARY			
Job No.	12388898	Made By	JRR	Date	8/27/2012
Ref.	NIPSCO	Checked	MJW	Sheet	of
	Michigan City, IN	Reviewed	MRF		

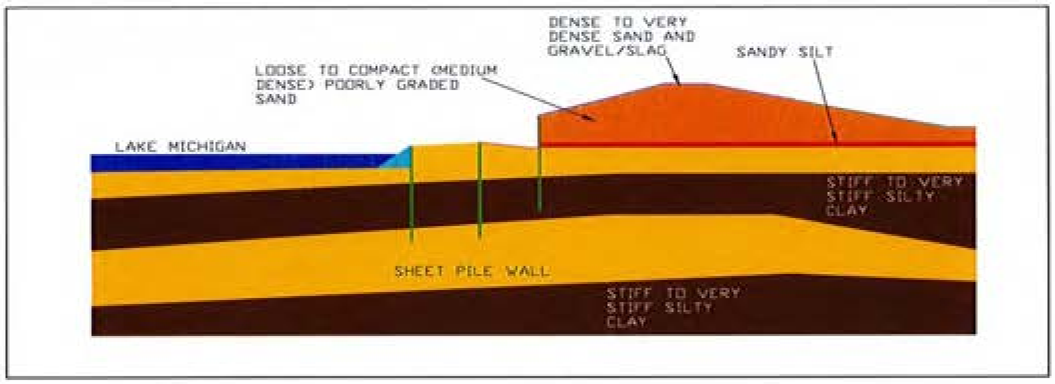
OBJECTIVE:

To analyze the stability of the four existing hydraulic structures at the NIPSCO Michigan City Generating Station (MCGS) for the following conditions:
- Steady seepage - global
- Steady seepage-existing pool on the downstream slope
- Rapid drawdown on the upstream slope; and
- Seismic (pseudo-static) with normal pool and steady seepage on the downstream slope. Probability of Exceedance 2% in 50 years.

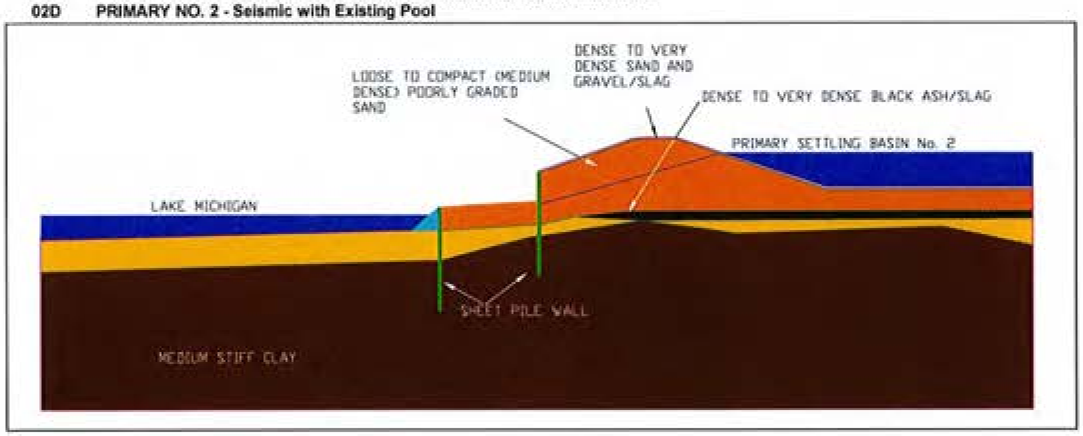
The four hydraulic structures are:
01 - Primary Number 1 (Primary No. 1)
02 - Primary Number 2 (Primary No. 2)
03 - Secondary Number 1 (Secondary No. 1)
04 - Secondary Number 2 (Secondary No. 2)
05 - Final Settling Pond (FSP)
06 - Bottom Ash Area (BAA) - No analyses were performed on the BAA. The BAA surface slopes toward the FSP, with a small embankment on the NW side approximately 2-feet in height. This embankment is shared with the FSP. The BAA does not satisfy the criteria set forth by the U.S. EPA for units requiring further evaluation.

CONDITIONS:

CASE 01 - PRIMARY NO. 1
01A PRIMARY NO. 1 - Steady Seepage - Global
01B PRIMARY NO. 1 - Steady Seepage - Existing Pool
01C PRIMARY NO. 1 - Steady Seepage - Rapid Drawdown on Upstream Slope
01D PRIMARY NO. 1 - Seismic with Existing Pool

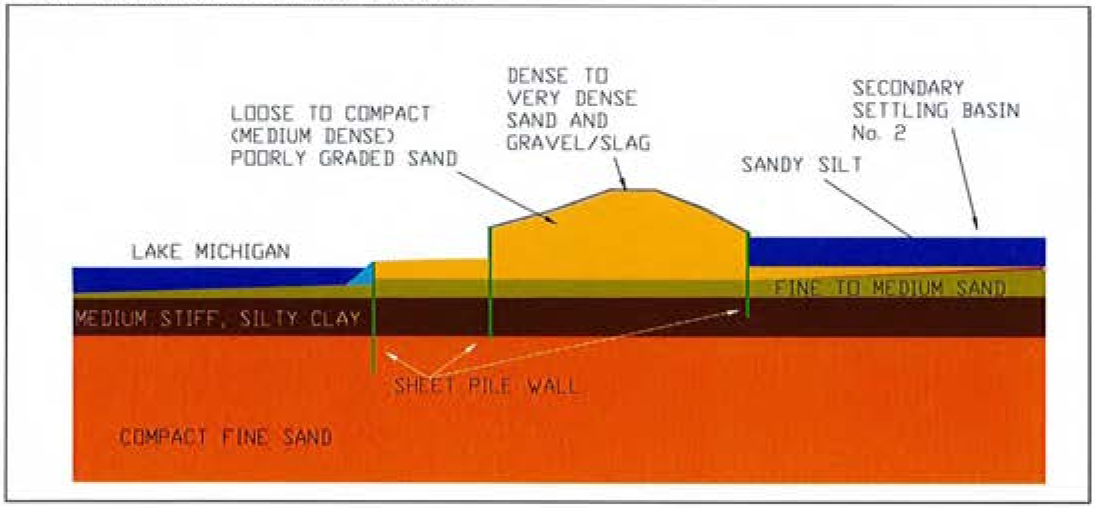


CASE 02 - PRIMARY NO. 2
02A PRIMARY NO. 2 - Steady Seepage - Global
02B PRIMARY NO. 2 - Steady Seepage - Existing Pool
02C PRIMARY NO. 2 - Steady Seepage - Rapid Drawdown on Upstream Slope
02D PRIMARY NO. 2 - Seismic with Existing Pool



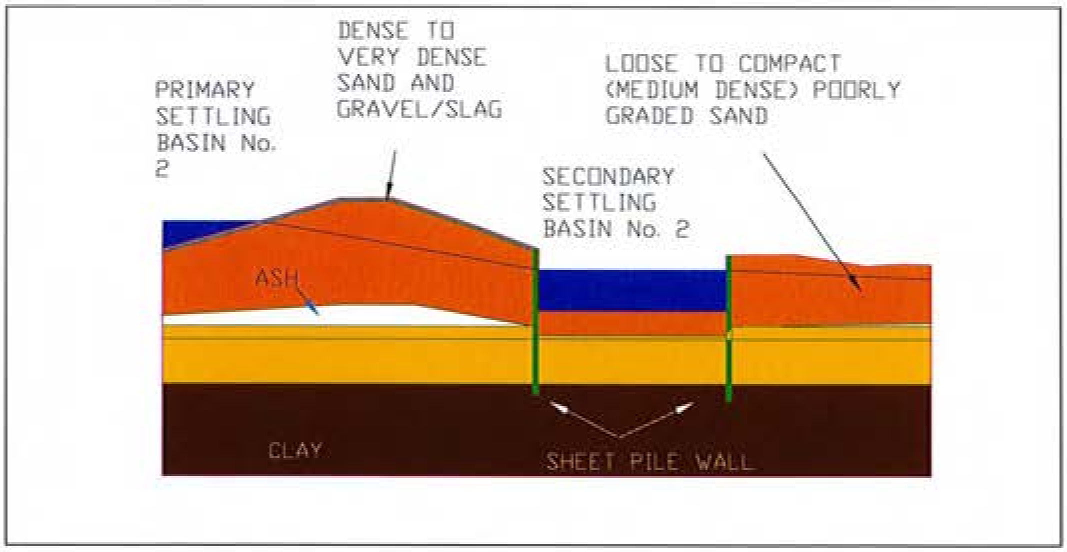
CASE 03 - SECONDARY NO. 1

03A	**SECONDARY NO. 1 - Steady Seepage - Global**
03B	**SECONDARY NO. 1 - Steady Seepage - Existing Pool**
03C	**SECONDARY NO. 1 - Steady Seepage - Rapid Drawdown on Upstream Slope**
03D	**SECONDARY NO. 1 - Seismic with Existing Pool**



CASE 04 - SECONDARY NO. 2

04A	**SECONDARY NO. 2 - Steady Seepage - Global**
04B	**SECONDARY NO. 2 - Steady Seepage - Existing Pool**
04C	**SECONDARY NO. 2 - Steady Seepage - Rapid Drawdown on Upstream Slope**
04D	**SECONDARY NO. 2 - Seismic with Existing Pool**

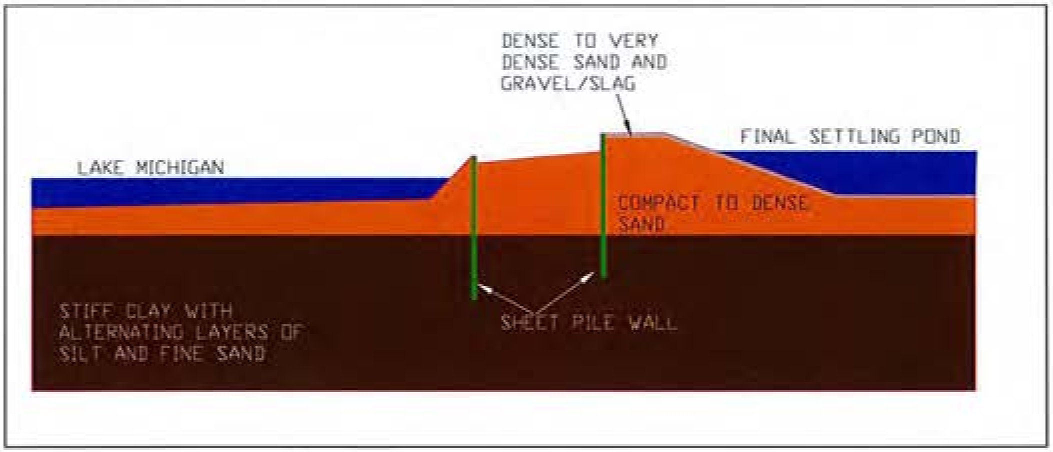


Golder Associates

SUBJECT		SLOPE STABILITY SUMMARY				
Job No.	12388898	Made By	JRR	Date	8/27/2012	
Ref.	NIPSCO	Checked	MJW	Sheet		of
	Michigan City, IN	Reviewed	MRF			

CASE 05 - FINAL SETTLING POND

05A **FSP - Steady Seepage - Global**
05B **FSP - Steady Seepage - Existing Pool**
05C **FSP - Steady Seepage - Rapid Drawdown on Upstream Slope**
05D **FSP - Seismic with Existing Pool**



ASSUMPTIONS:

1) Material Properties used for analysis are shown below. Properties were estimated based on the field exploration and laboratory testing.

Material	Internal Friction Angle (°)	Cohesion (psf)	Dry Unit Weight (pcf)	Saturated Unit Weight (pcf)	Undrained Shear Strength (psf)	Layer Thickness (ft)	Hydraulic Conductivity (cm/s)
Loose to Medium Dense Fill	33	0	100	110	NA	Varies	$1x10^{-3}$
Large Limestone Riprap	45	0	140	145	NA	Varies	100
8-inch Riprap	45	0	140	145	NA	1	100
Crushed Blast Furnace Slag	40	0	120	130	NA	Varies	1
Medium Dense Bottom Ash Fill	35	0	100	110	NA	Varies	1x10-3
Loose Silty Sand	30	0	100	120	NA	Varies	$1x10^{-3}$
Medium to Very Stiff Clay	30	70	116	136	750-2500	Varies	$1x10^{-6}$
Native Sand	40	0	110	120	NA	Varies	$3x10^{-3}$

2) Drained shear strengths were used for this analysis for longterm conditions.

3) Factor of Safety Acceptance Criteria
The acceptance criteria is based on the values published by the US Army Corps of Engineers, EM 1110-2-1902.

Analysis Condition	Required FS	Slope
Steady Seepage - Global - Existing Pool	1.5	Downstream
Steady Seepage - Local - Existing Pool	1.4	Downstream
Rapid Drawdown - Existing Pool	1.3	Upstream
Seismic - Existing Pool	1.0	Downstream

4) Seismic Hazard
Seismic Value of 0.1319 x gravity, g (for 2% probability of earthquake in 50 years.) (Ref. 3).

Golder Associates

SUBJECT	**SLOPE STABILITY SUMMARY**				
Job No.	12388898	Made By	JRR	Date	8/27/2012
Ref.	NIPSCO	Checked	MJW	Sheet	of
	Michigan City, IN	Reviewed	MRF		

CALCULATIONS:

PRIMARY NO. 1

01	01A	01B	01C	01D	
Circular	2.40	2.20	1.84	1.48	Janbu Min.
Block	2.46	2.19	1.98	1.54	Janbu Min.
Circular	2.96	2.29	2.03	1.56	Spencer
Block	3.53	2.27	2.17	1.88	Spencer

PRIMARY NO. 2

02	02A	02B	02C	02D	
Circular	1.90	2.15	1.59	1.46	Janbu Min.
Circular	2.35	2.25	1.74	1.53	Spencer

SECONDARY NO. 1

03	03A	03B	03C	03D	
Circular	2.59	2.13	1.59	1.49	Janbu Min.
Circular	3.26	2.22	1.64	1.56	Spencer

SECONDARY NO. 2

04	04A	04B	04C	04D	
Circular	1.83	2.09	2.09	1.44	Janbu Min.
Circular	2.40	2.14	2.14	1.50	Spencer

FINAL SETTLING POND

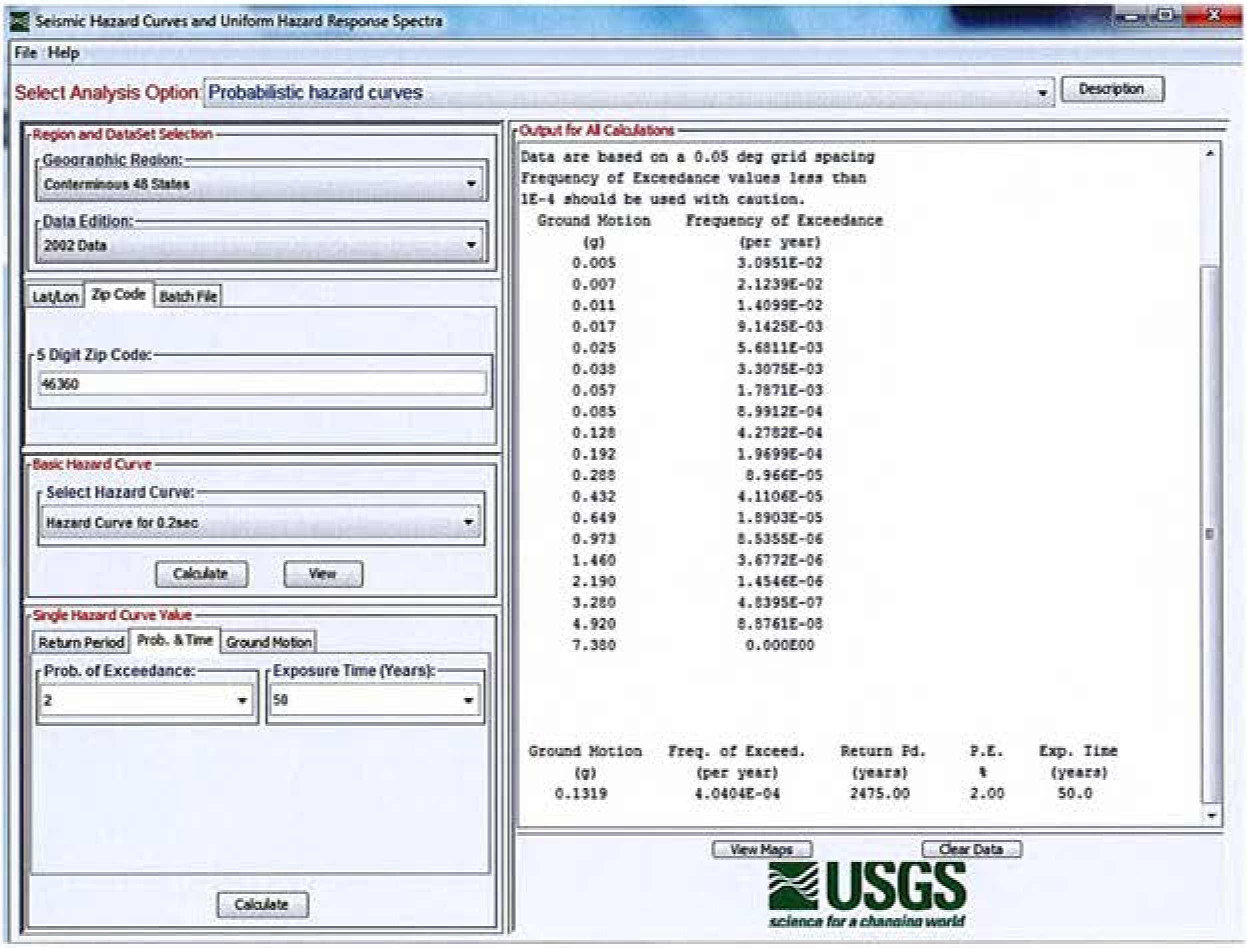
05	05A	05B	05C	05D	
Circular	3.12	1.81	1.35	1.04	Janbu Min.
Block	3.11	1.92	1.43	1.17	Janbu Min.
Circular	4.05	1.94	1.50	1.10	Spencer
Block	4.31	2.10	1.59	1.24	Spencer

CONCLUSIONS:

Using the strength parameters that were conservatively estimated from the latest geotechnical exploration and previous boring information, each of the 5 hydraulic structures meets the Acceptance Criteria for the conditions analyzed.

REFERENCES:

1) Rocscience Inc. (2006) "SLIDE ver 6.018, 2D Limit Equilibrium Slope Stability for Soil & Rock Slopes"
2) United States Army Corps of Engineers, Slope Stability, EM 1110-2-1902, 10/31/2003
3) United States Geological Society (USGS), Earthquake Ground Motion Tool, version 5.0.9, 10/26/2008



Select Analysis Option: Probabilistic hazard curves

Geographic Region: Conterminous 48 States

Data Edition: 2002 Data

5 Digit Zip Code: 46360

Select Hazard Curve: Hazard Curve for 0.2sec

Prob. of Exceedance: 2

Exposure Time (Years): 50

```
Data are based on a 0.05 deg grid spacing
Frequency of Exceedance values less than
1E-4 should be used with caution.
  Ground Motion    Frequency of Exceedance
       (g)               (per year)
      0.005             3.0951E-02
      0.007             2.1239E-02
      0.011             1.4099E-02
      0.017             9.1425E-03
      0.025             5.6811E-03
      0.038             3.3075E-03
      0.057             1.7871E-03
      0.085             8.9912E-04
      0.128             4.2782E-04
      0.192             1.9699E-04
      0.288              8.966E-05
      0.432             4.1106E-05
      0.649             1.8903E-05
      0.973             8.5355E-06
      1.460             3.6772E-06
      2.190             1.4546E-06
      3.280             4.8395E-07
      4.920             8.8761E-08
      7.380              0.000E00


 Ground Motion   Freq. of Exceed.   Return Pd.   P.E.   Exp. Time
      (g)          (per year)        (years)      %      (years)
    0.1319        4.0404E-04        2475.00     2.00      50.0
```

FIGURE MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR THE CONTERMINOUS UNITED STATES, OF 0.2 SEC SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

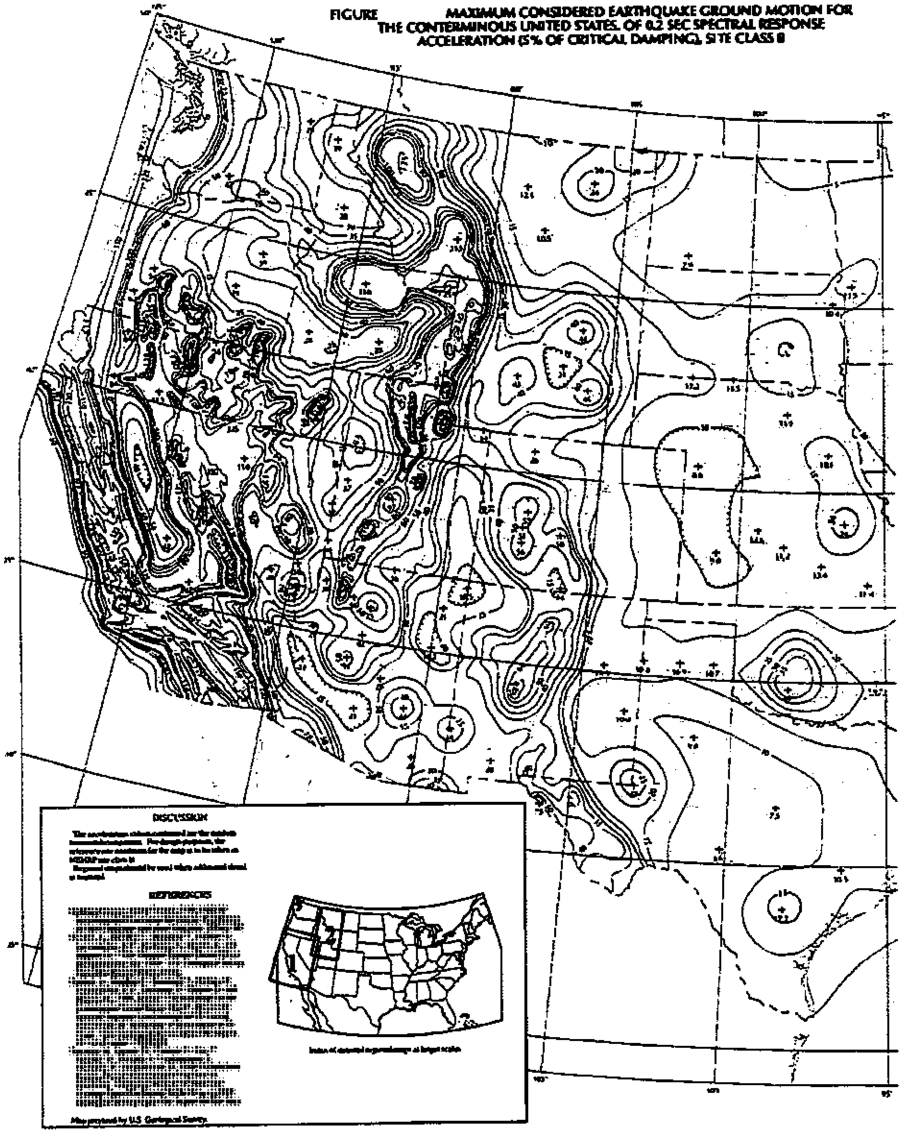
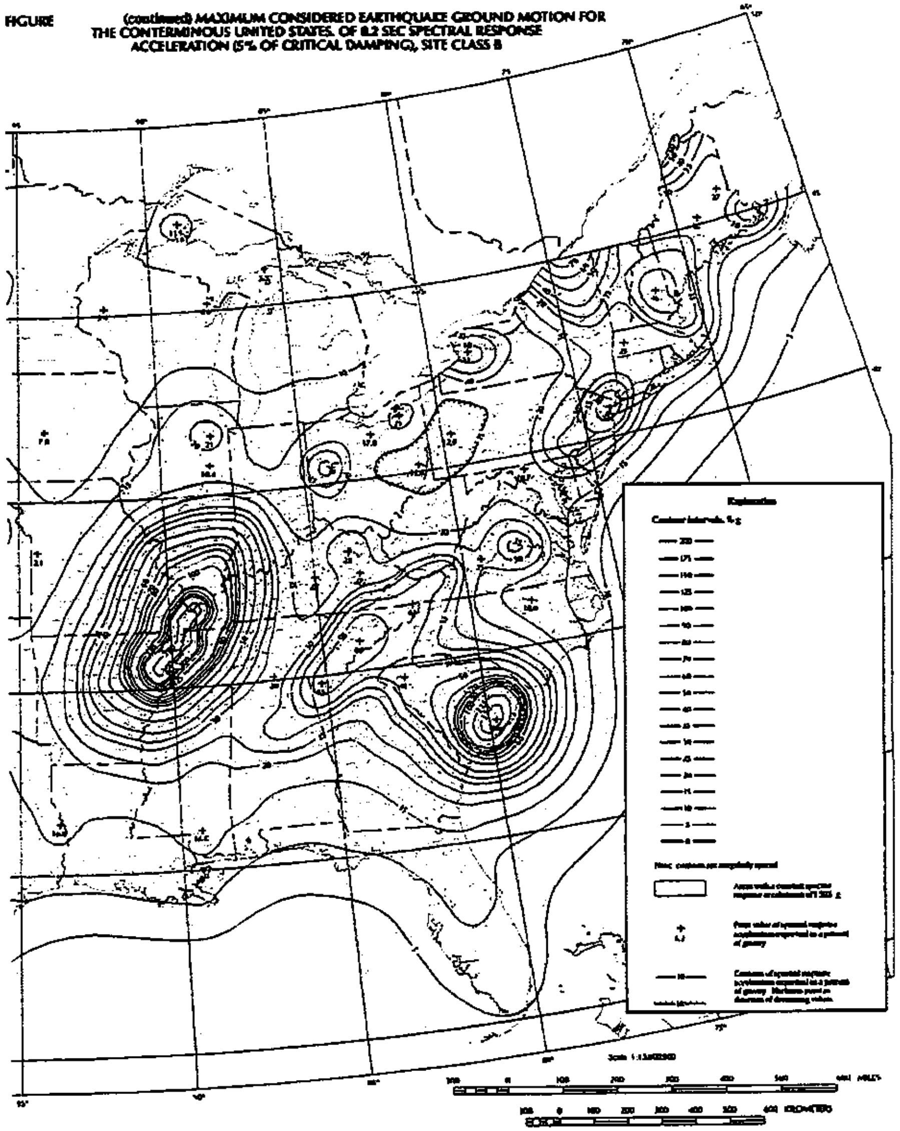
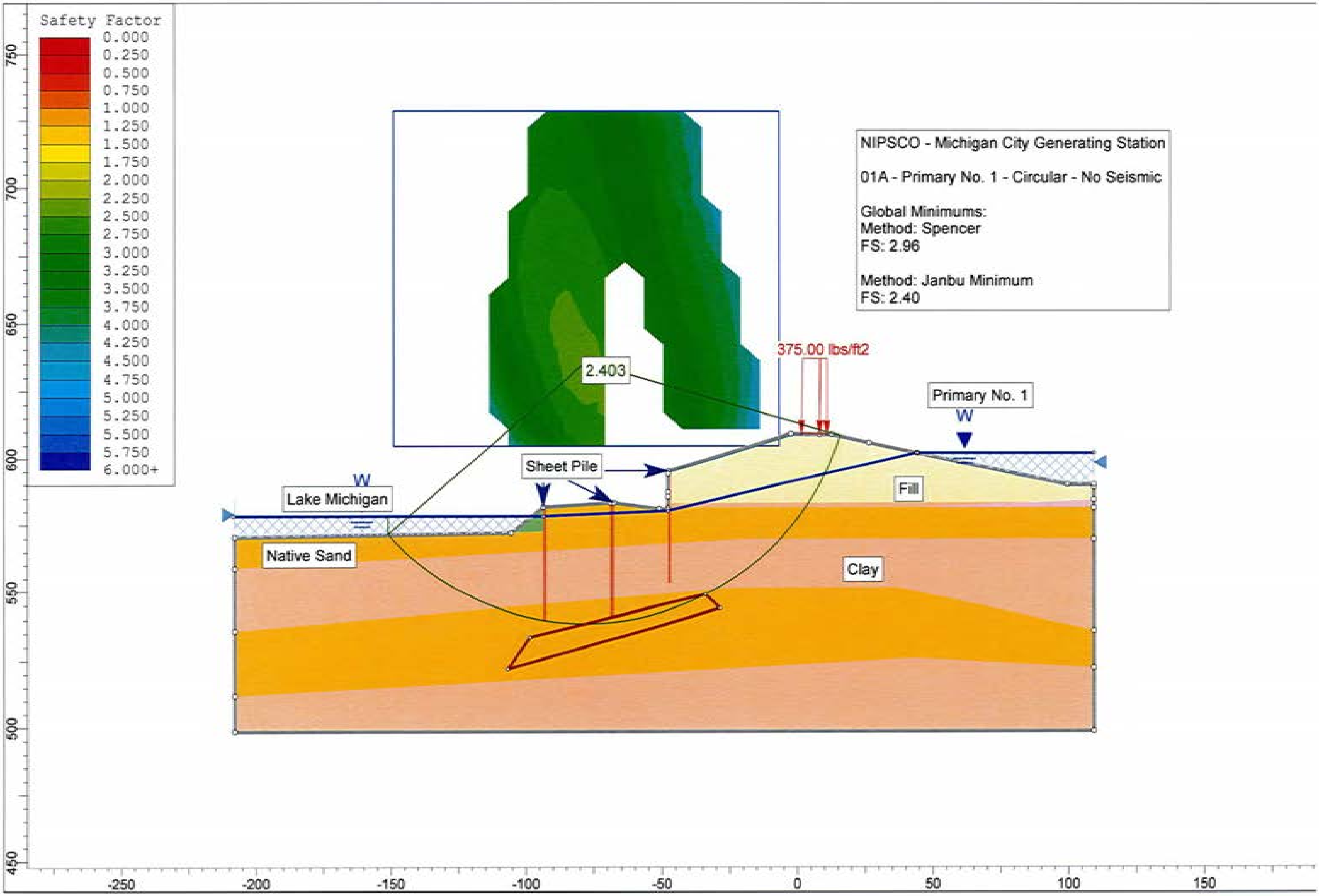


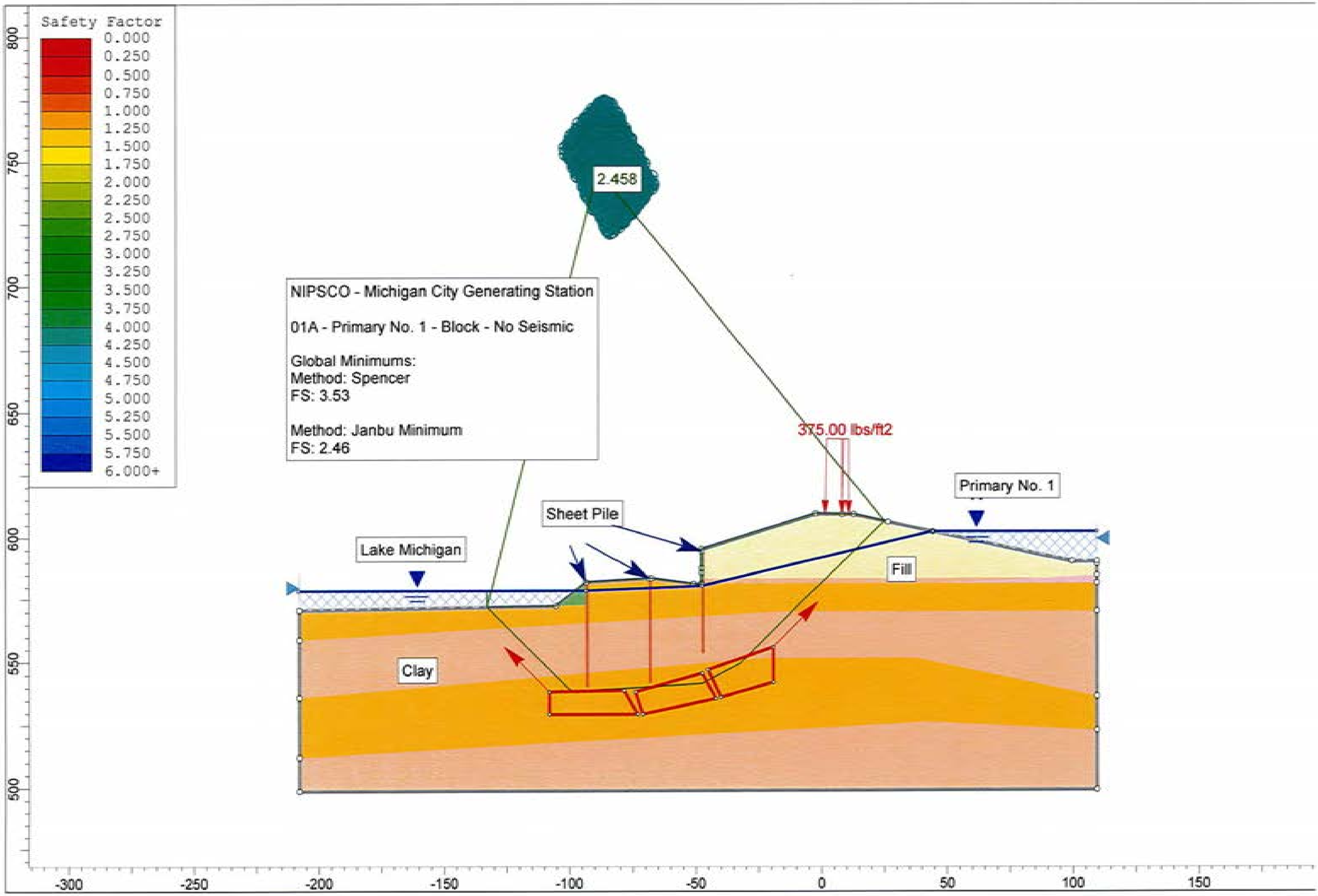
FIGURE (continued) MAXIMUM CONSIDERED EARTHQUAKE GROUND MOTION FOR THE CONTERMINOUS UNITED STATES, OF 0.2 SEC SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B





Primary No. 1.slim

7/16/2012, 10:31:52 AI



NIPSCO - Michigan City Generating Station

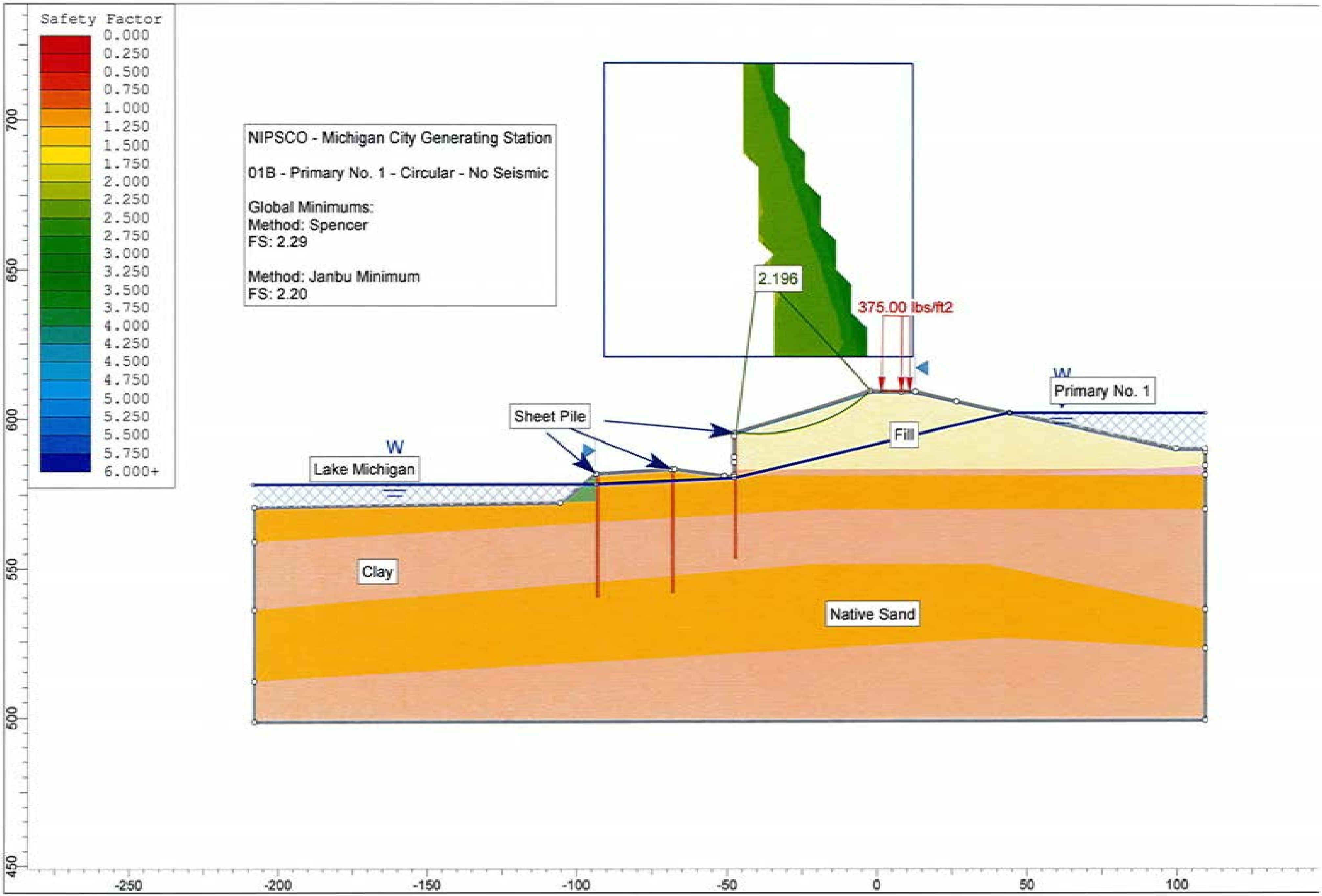
01A - Primary No. 1 - Block - No Seismic

Global Minimums:
Method: Spencer
FS: 3.53

Method: Janbu Minimum
FS: 2.46

Primary No. 1-BLOCK.slim

7/16/2012, 10:31:52 A



NIPSCO - Michigan City Generating Station

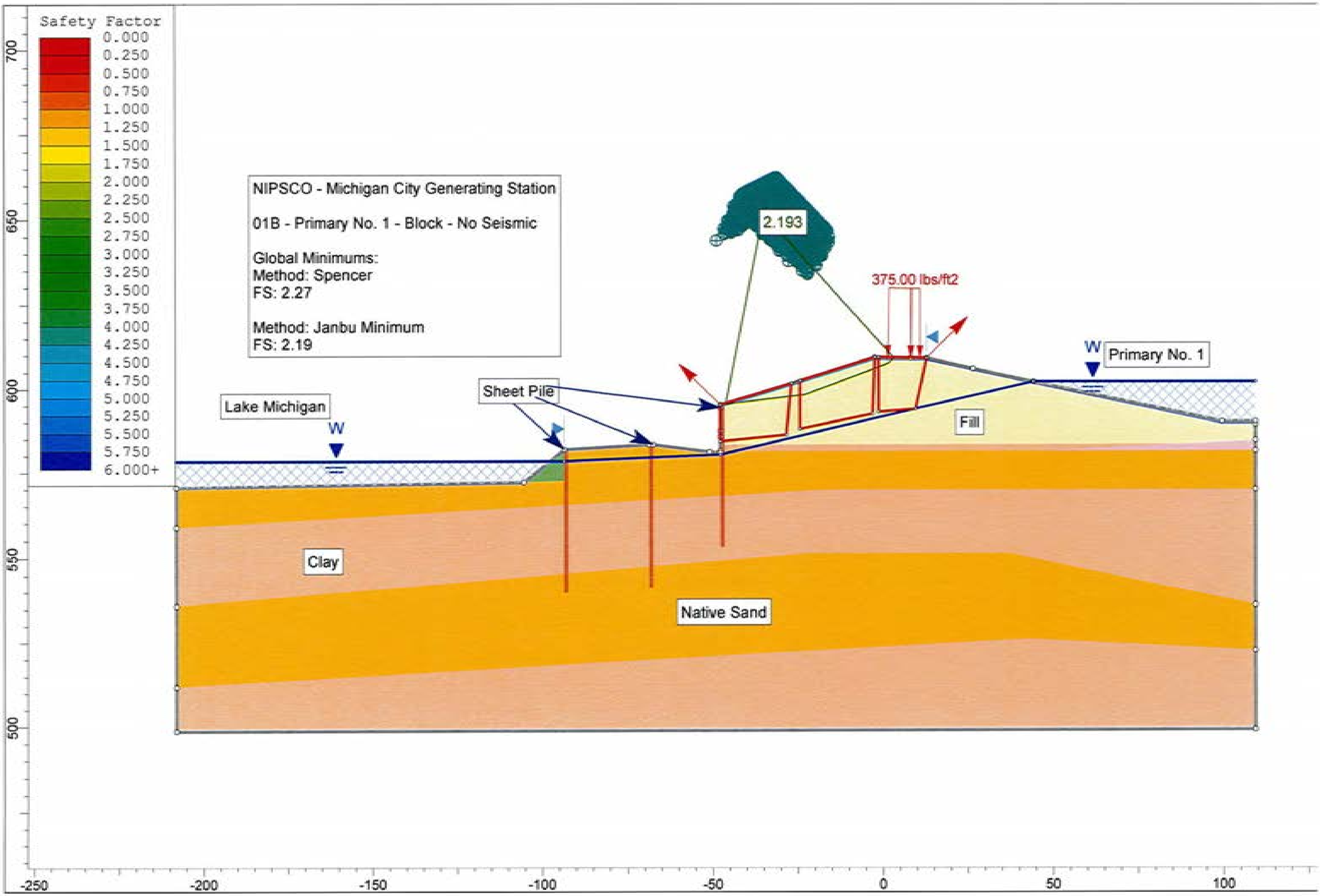
01B - Primary No. 1 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 2.29

Method: Janbu Minimum
FS: 2.20

Primary No. 1.slim

7/16/2012, 10:31:52 AM



Primary No. 1-BLOCK.slim

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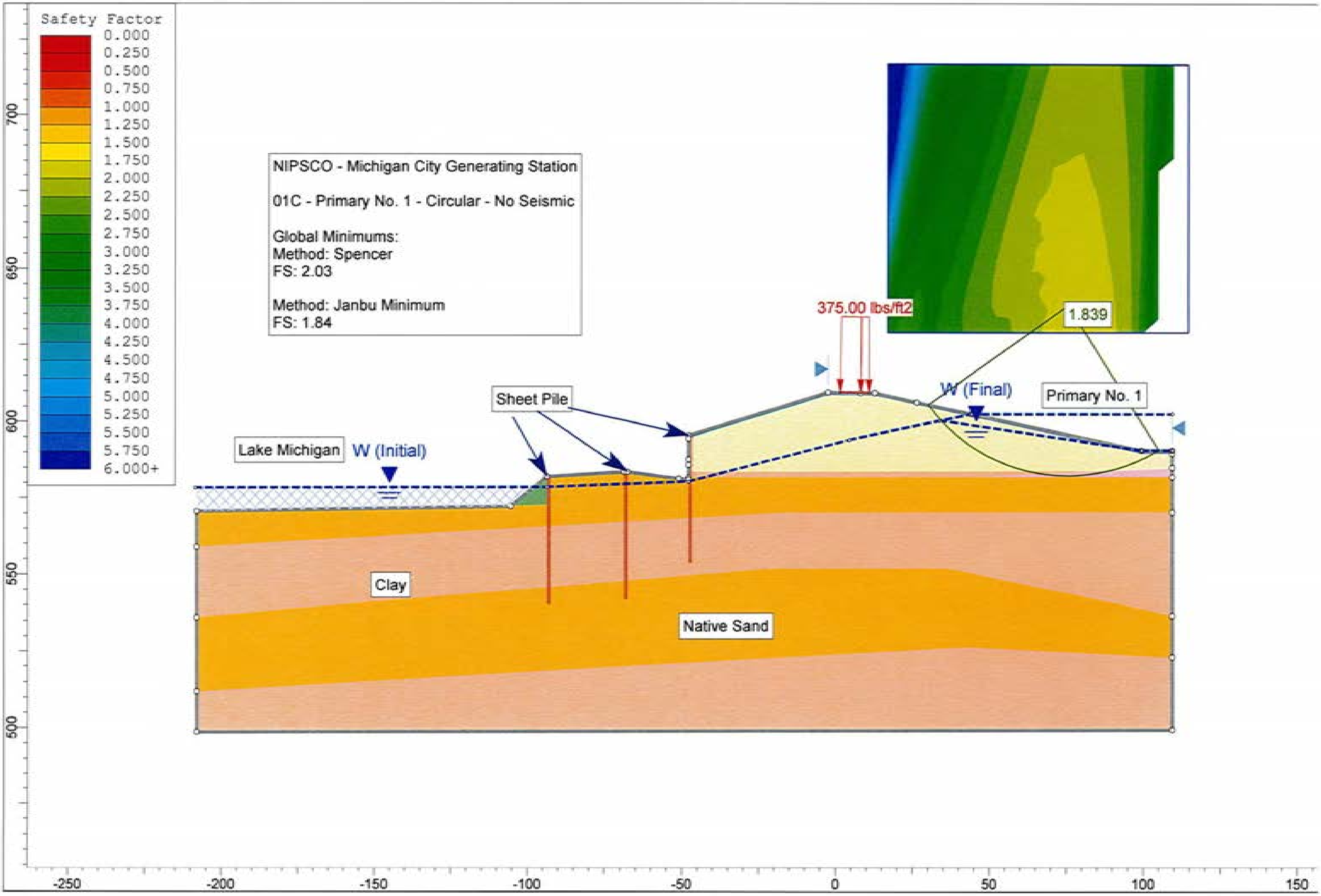

Primary No. 1-rapid.slim

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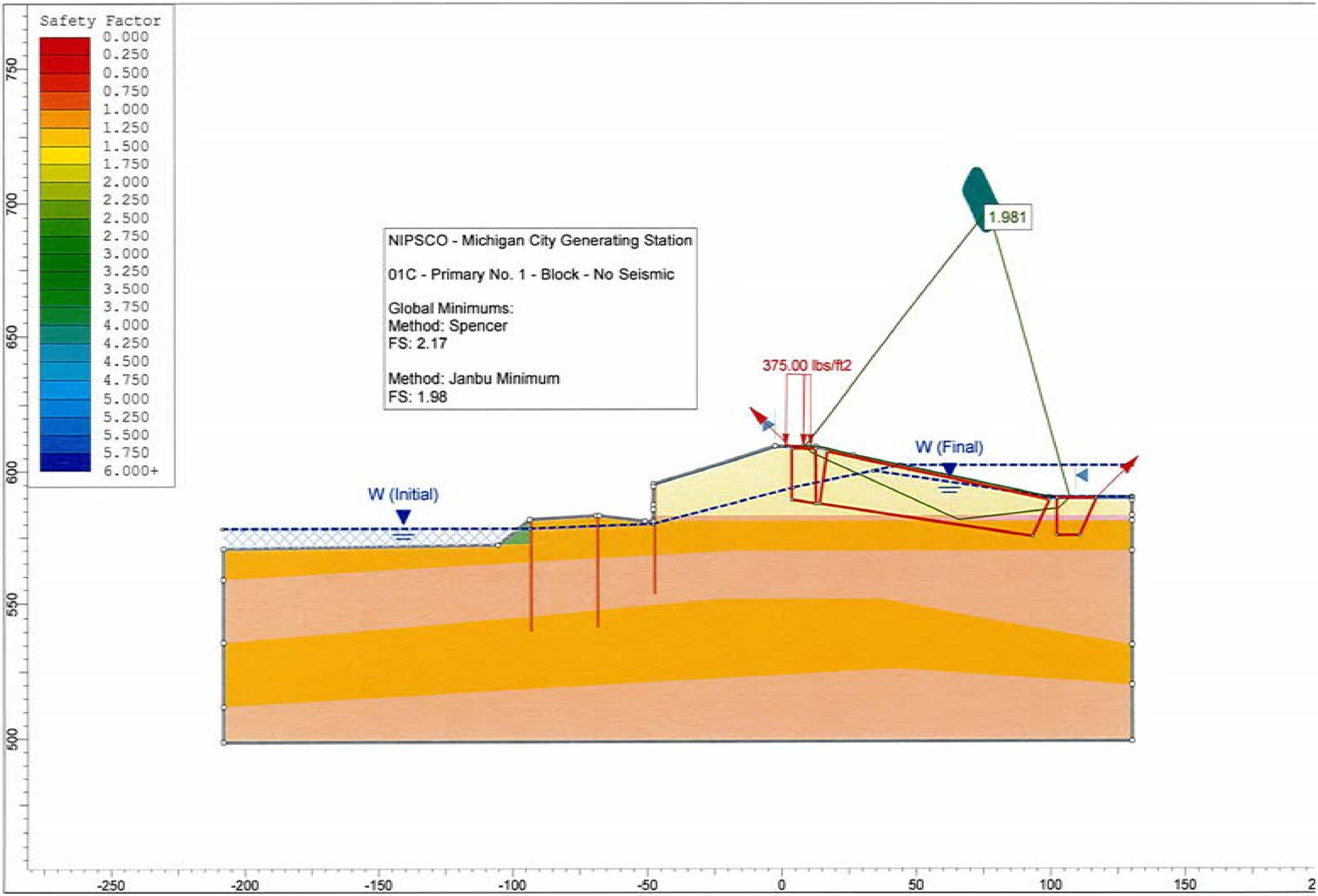

Primary No. 1-rapid-BLOCK.slim

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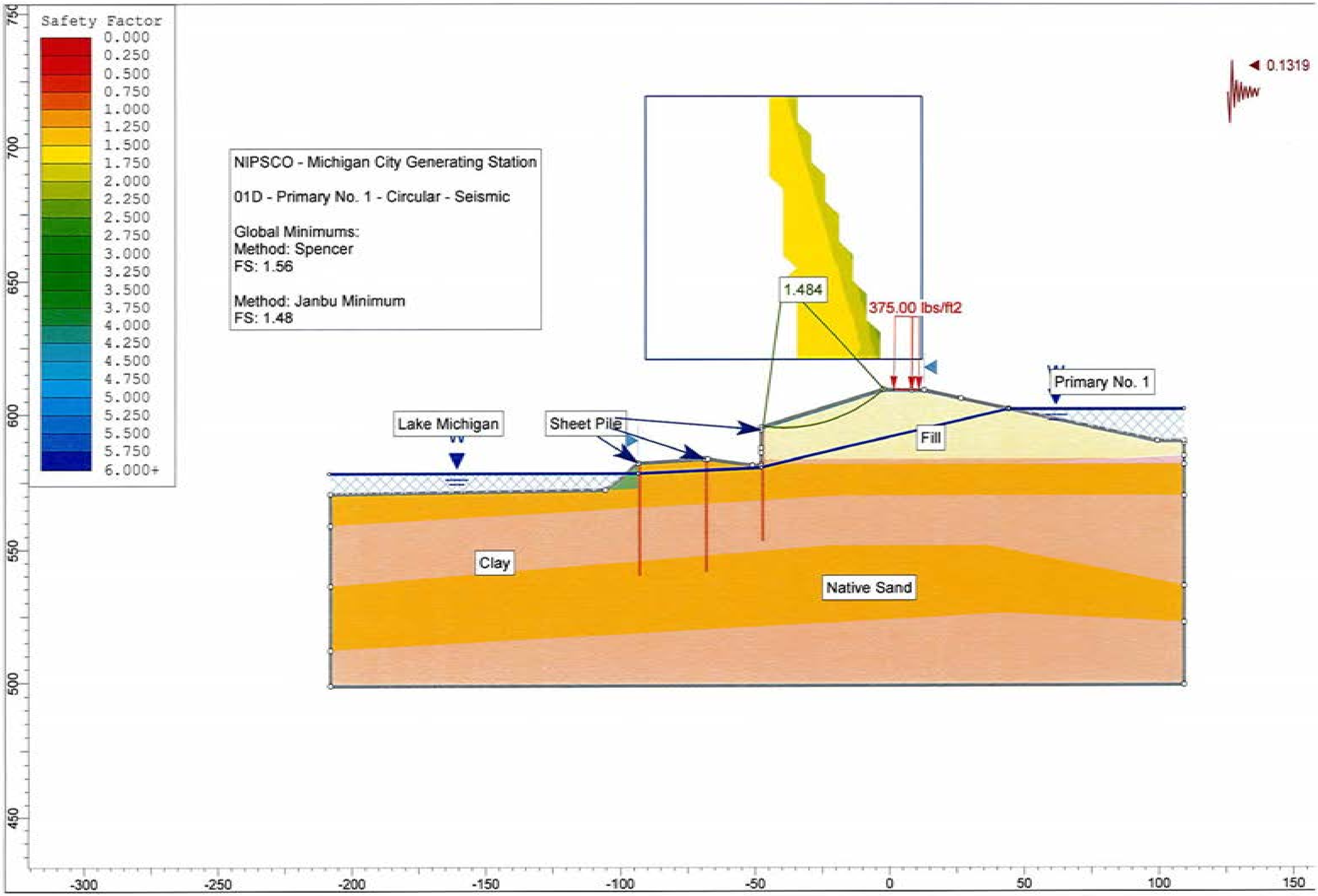


NIPSCO - Michigan City Generating Station

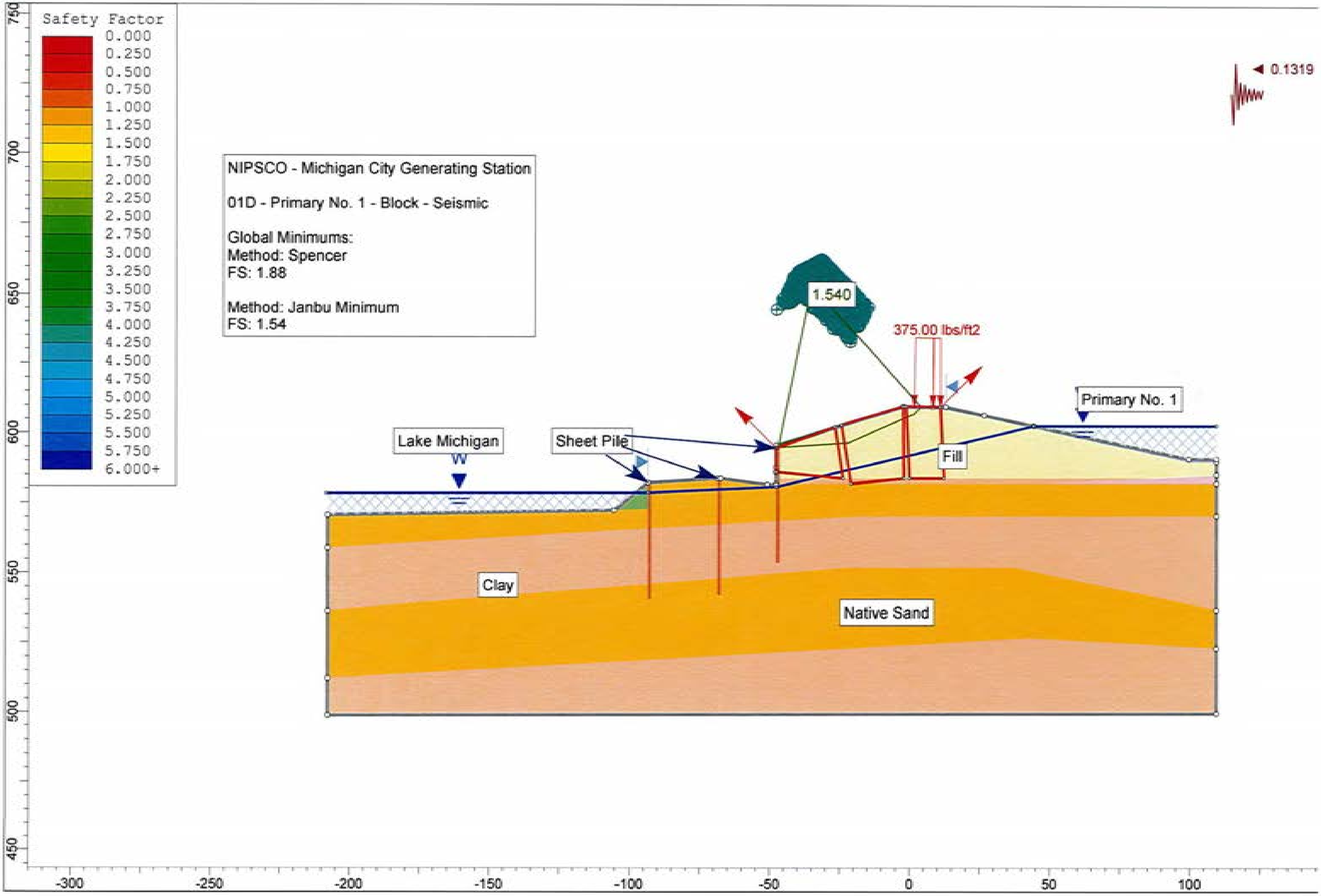
01D - Primary No. 1 - Circular - Seismic

Global Minimums:
Method: Spencer
FS: 1.56

Method: Janbu Minimum
FS: 1.48

Primary No. 1-SEISMIC.slim

7/16/2012, 10:31:52 A



Primary No. 1-SEISMIC.slim

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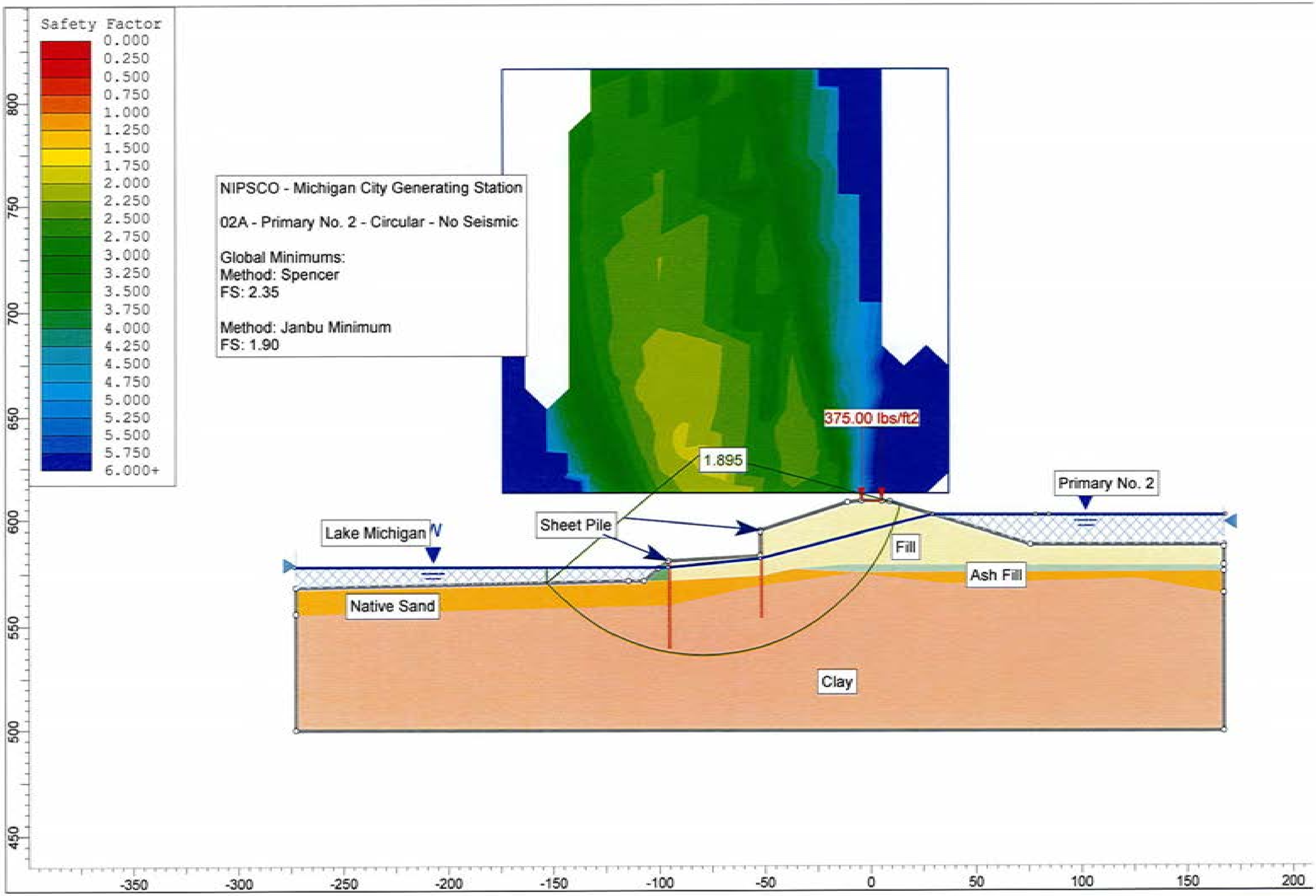


NIPSCO - Michigan City Generating Station

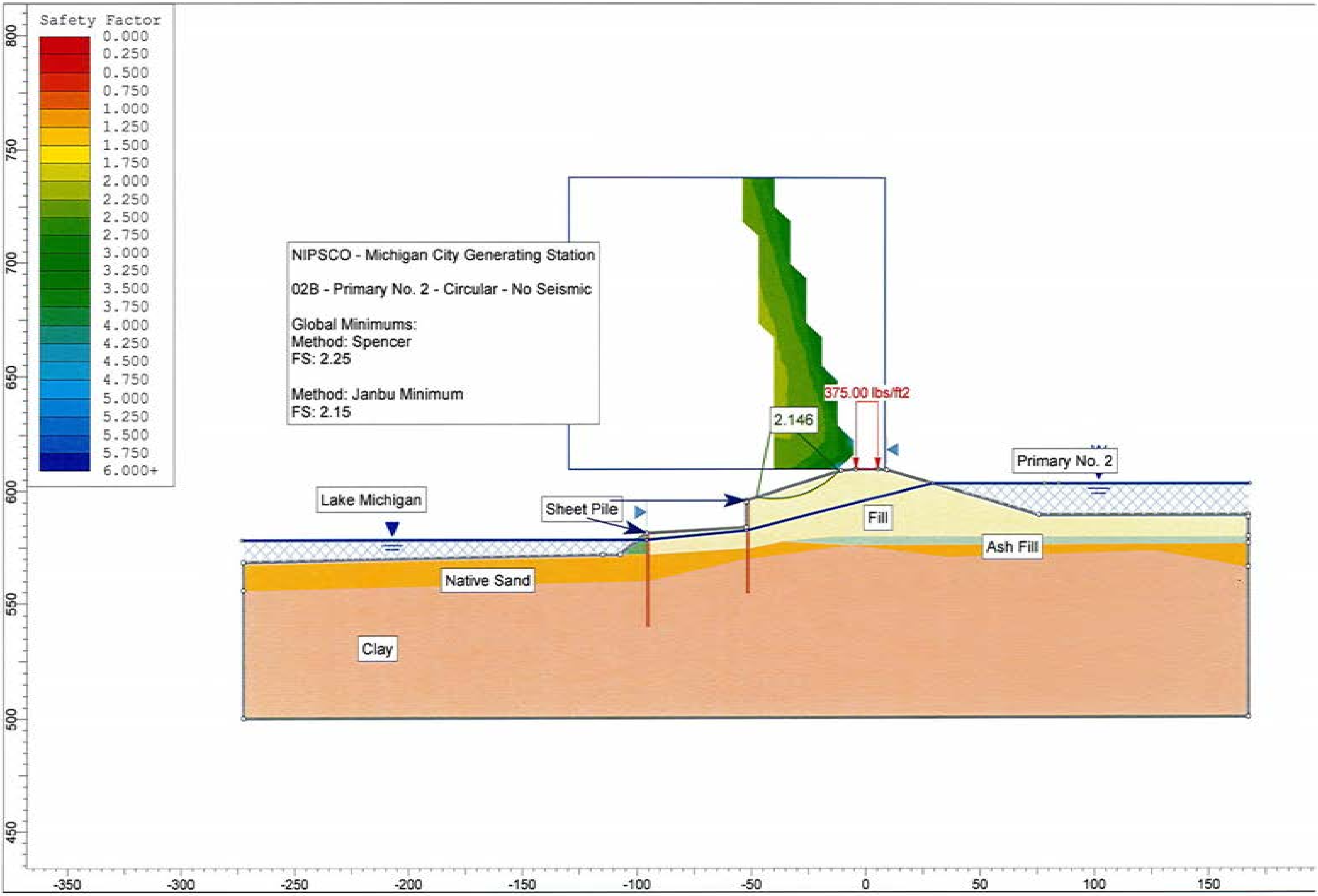
02A - Primary No. 2 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 2.35

Method: Janbu Minimum
FS: 1.90

Primary No 2 updated wz_pile.slim

Golder 7/16/2012, 10:31:52 A



NIPSCO - Michigan City Generating Station

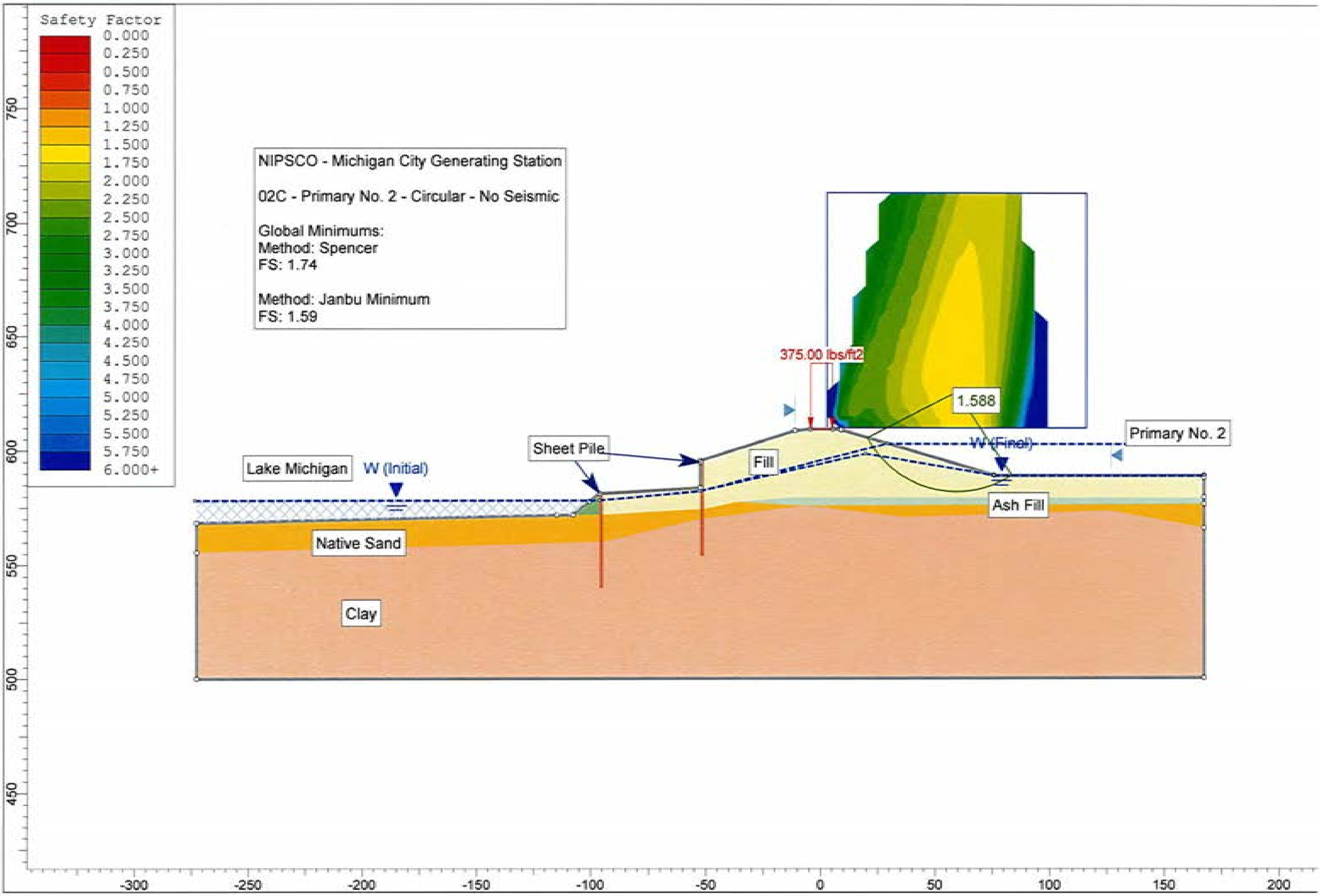
02B - Primary No. 2 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 2.25

Method: Janbu Minimum
FS: 2.15

Primary No 2 updated wz_pile.slim

Golder 7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

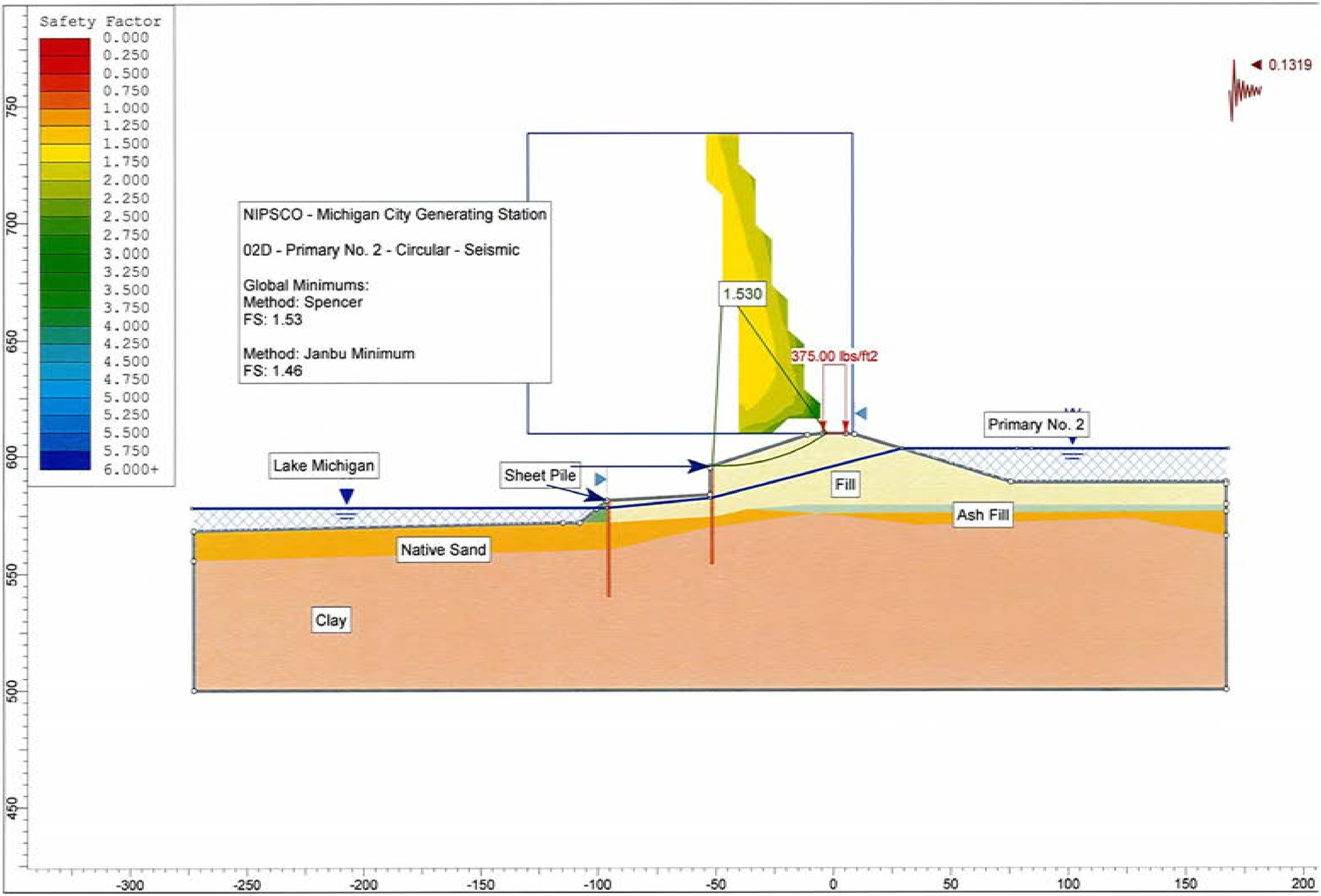
02C - Primary No. 2 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 1.74

Method: Janbu Minimum
FS: 1.59

Primary No 2 updated wz_pile-rapid.slim

Golder 7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

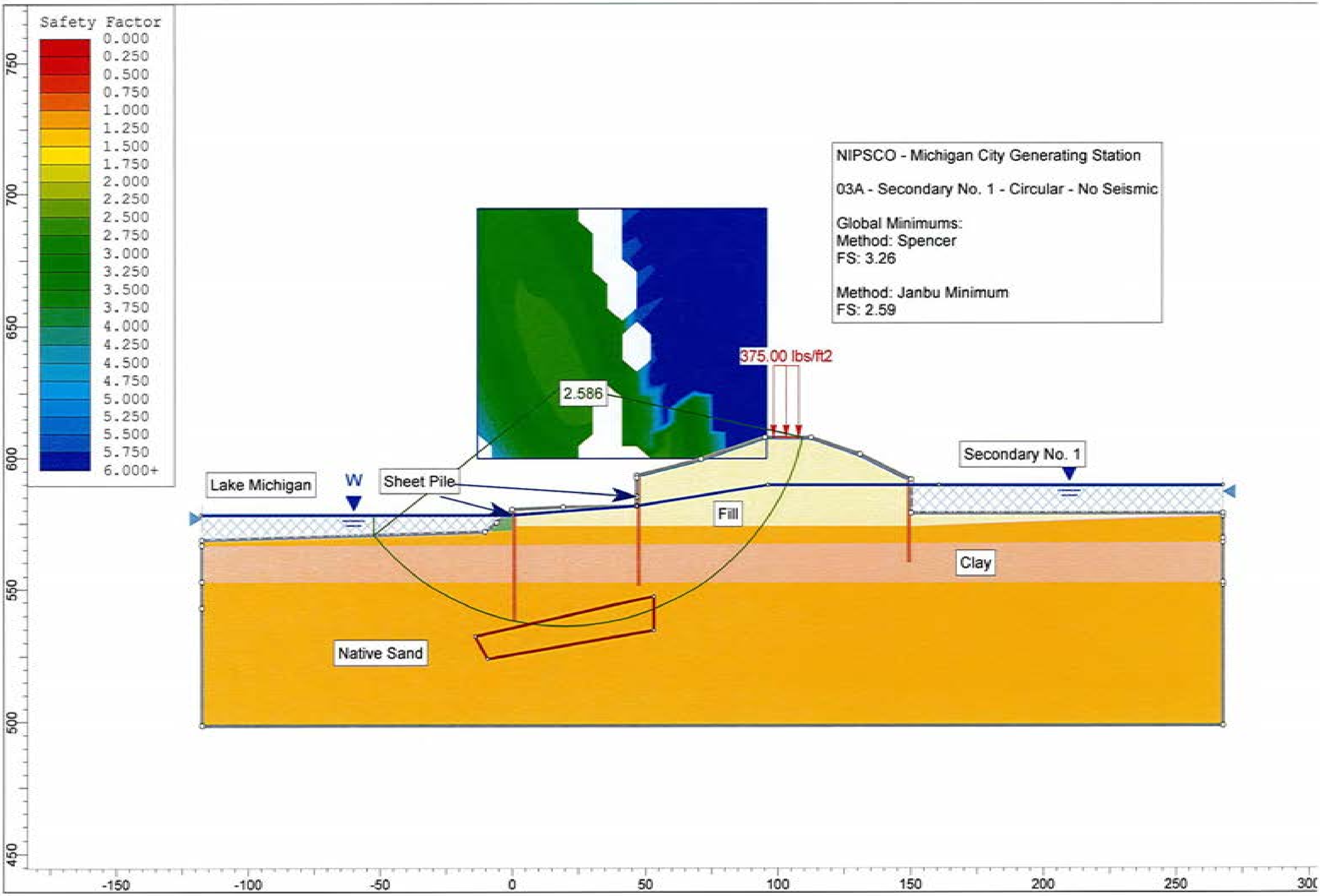
02D - Primary No. 2 - Circular - Seismic

Global Minimums:
Method: Spencer
FS: 1.53

Method: Janbu Minimum
FS: 1.46

Primary No 2 updated wz_pile.slim

Golder 7/16/2012, 10:31:52 AM



Secondary No.1.slim

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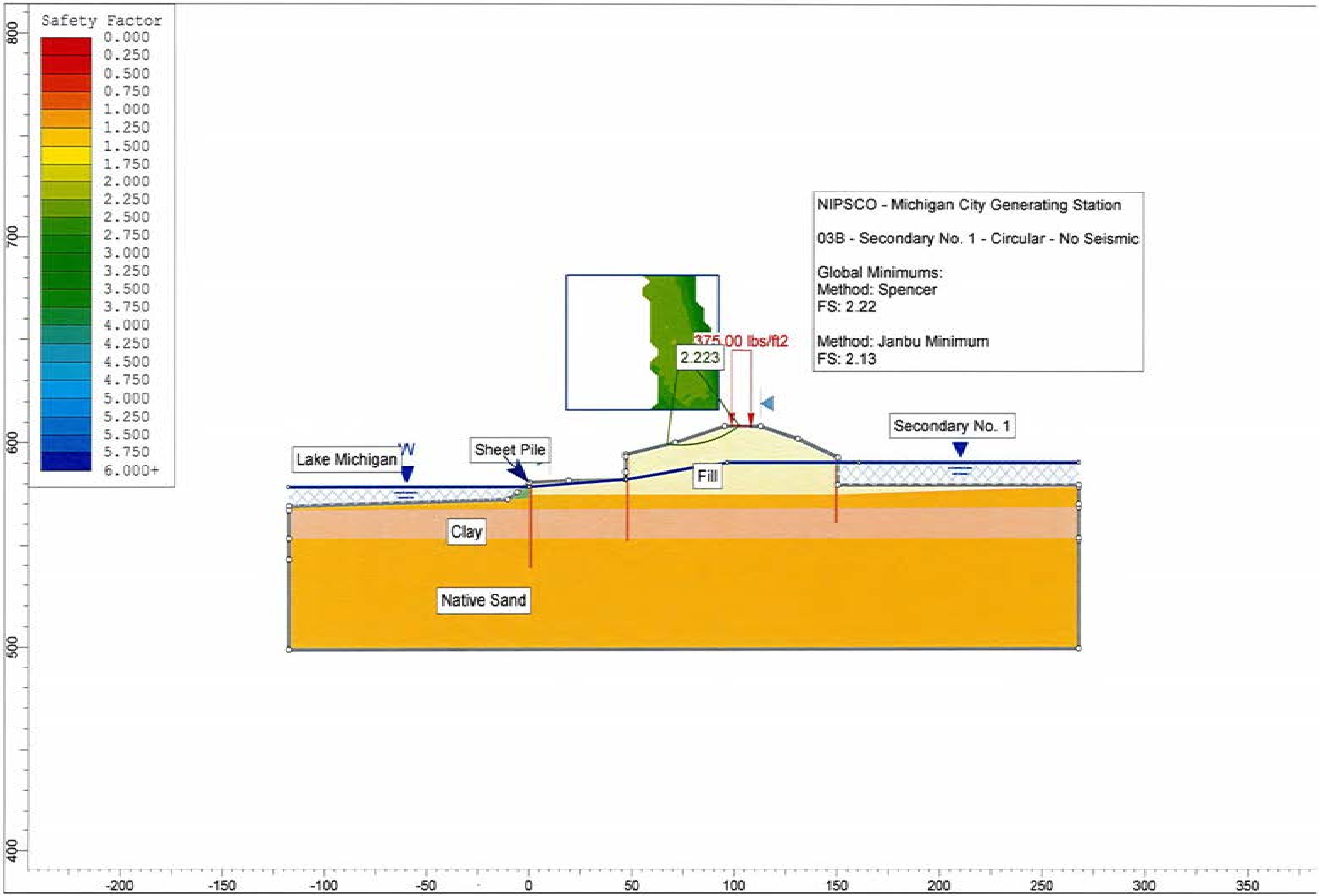


NIPSCO - Michigan City Generating Station

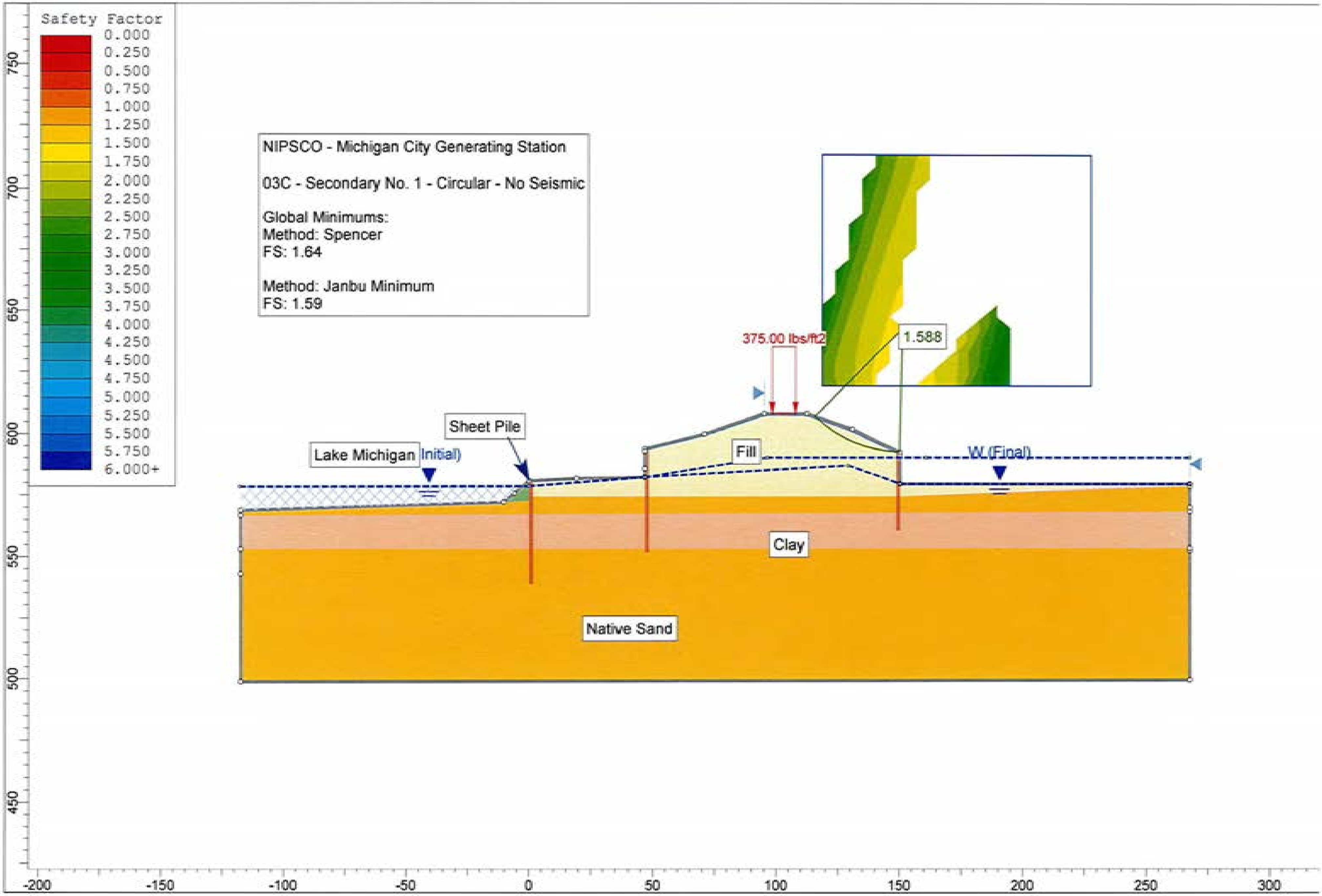
03B - Secondary No. 1 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 2.22

Method: Janbu Minimum
FS: 2.13

Secondary No.1.slim

7/10/2012, 10:58:47 AM



NIPSCO - Michigan City Generating Station

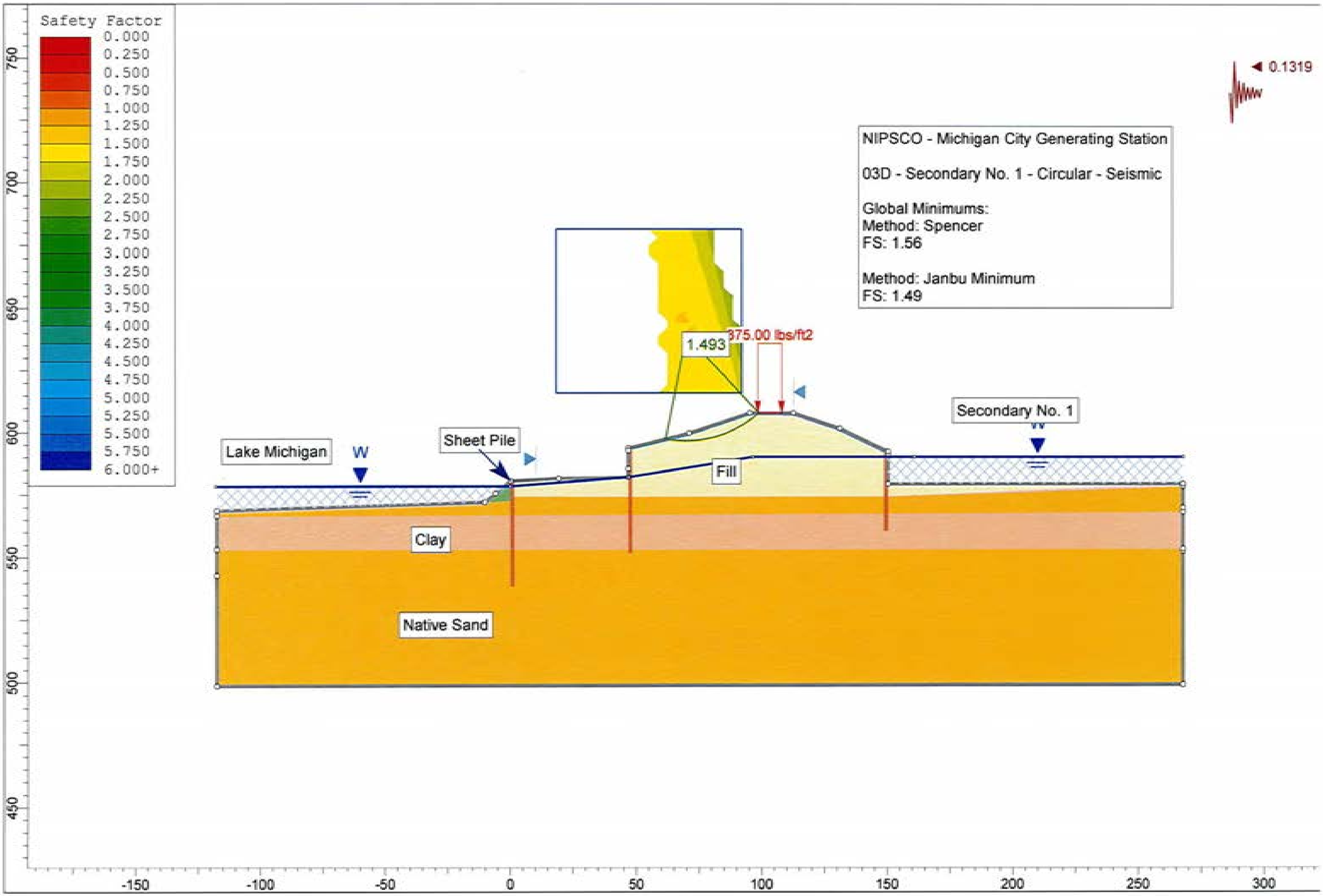
03C - Secondary No. 1 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 1.64

Method: Janbu Minimum
FS: 1.59

Secondary No.1-rapid.slim

7/10/2012, 10:58:47 AM



NIPSCO - Michigan City Generating Station

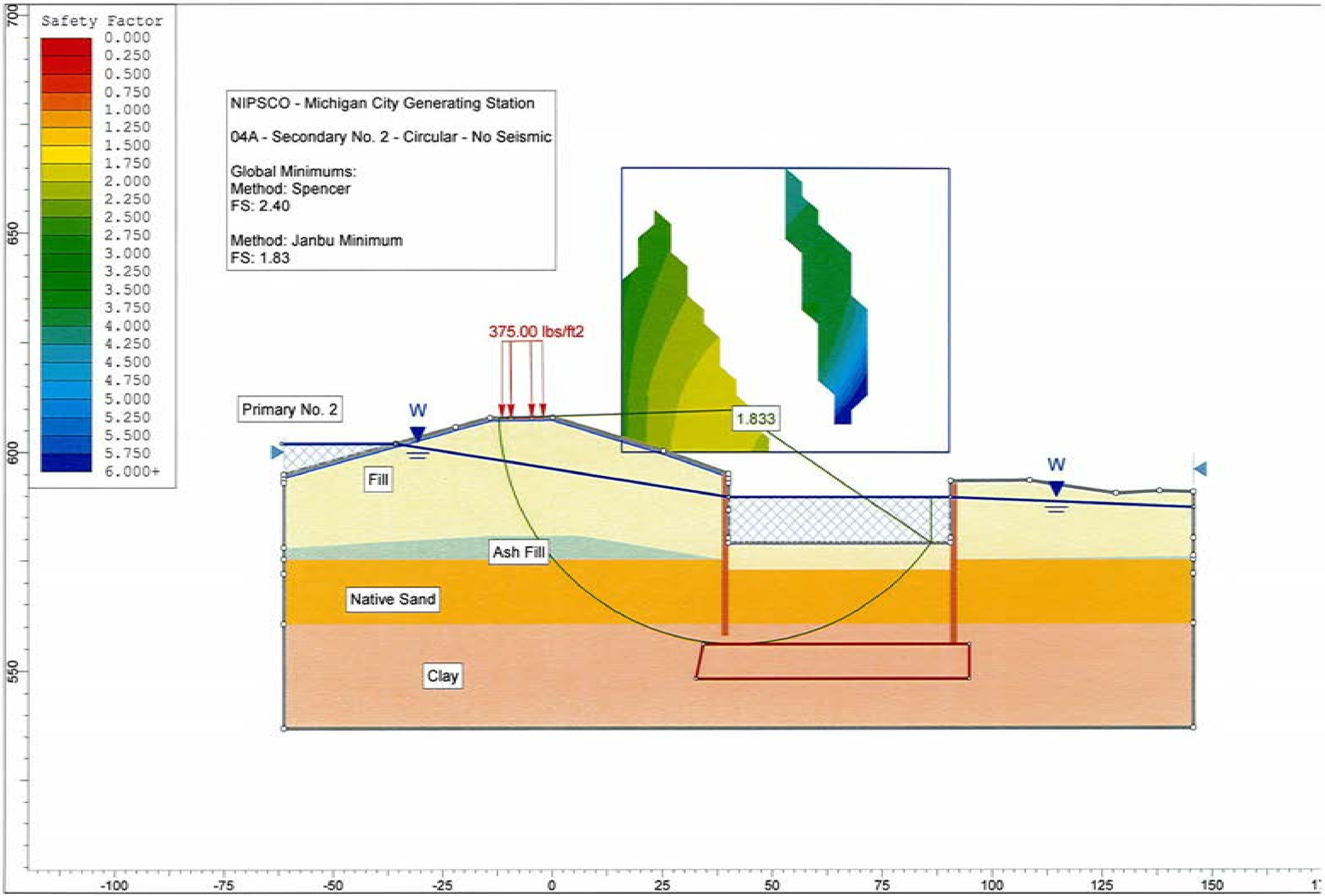
03D - Secondary No. 1 - Circular - Seismic

Global Minimums:
Method: Spencer
FS: 1.56

Method: Janbu Minimum
FS: 1.49

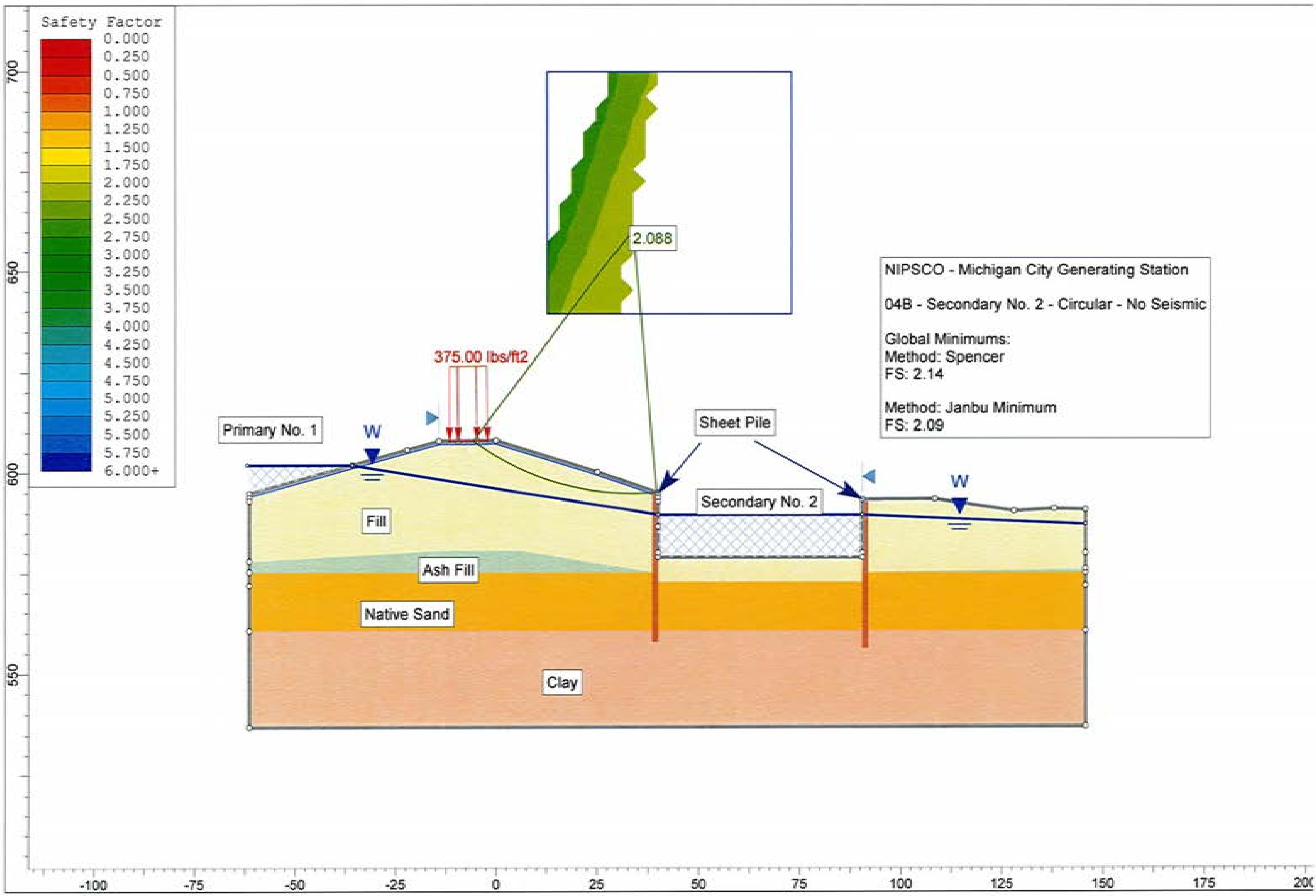
Secondary No.1.slim

7/10/2012, 10:58:47 AM



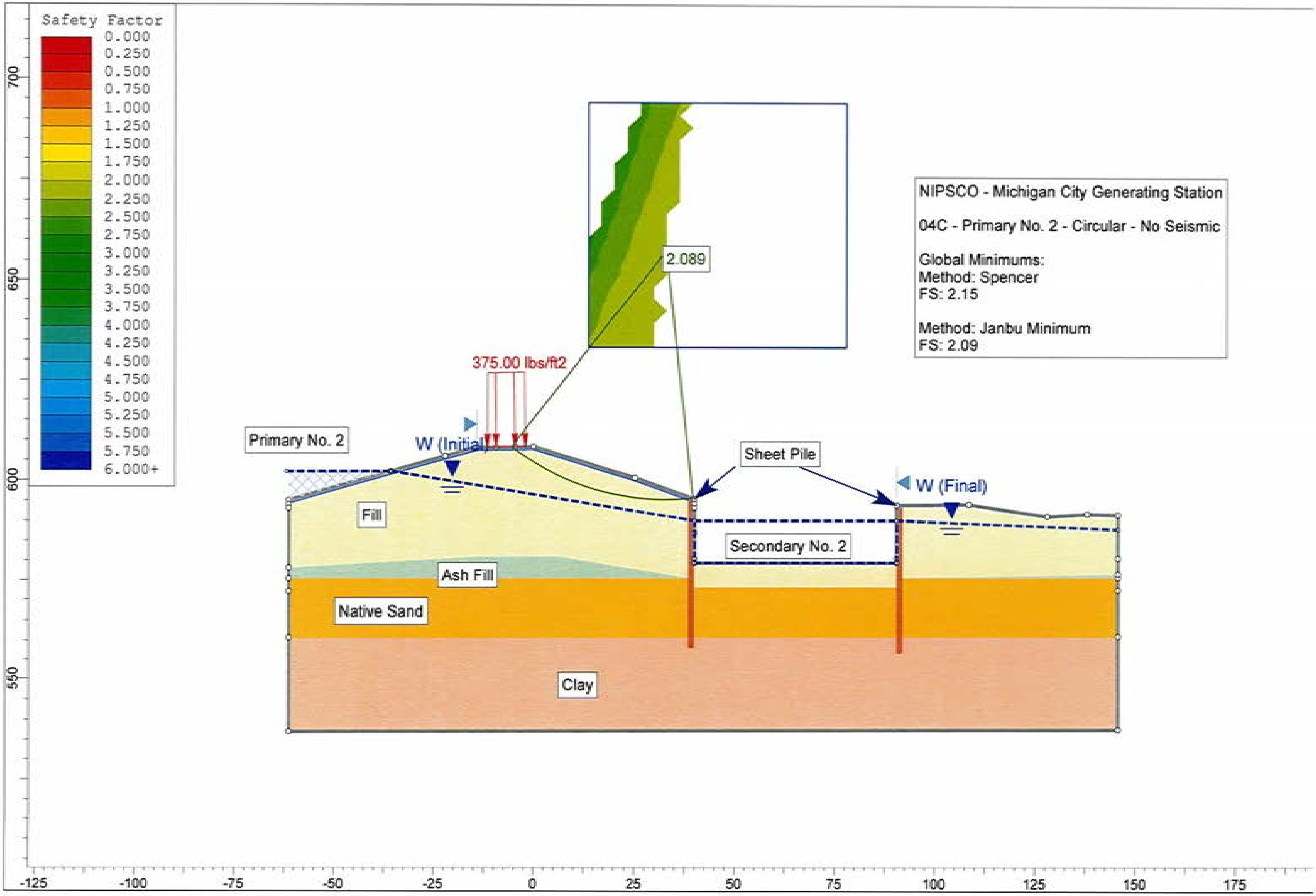
Secondary No. 2.slim

7/16/2012, 10:31:52 AM



Secondary No. 2.slim

7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

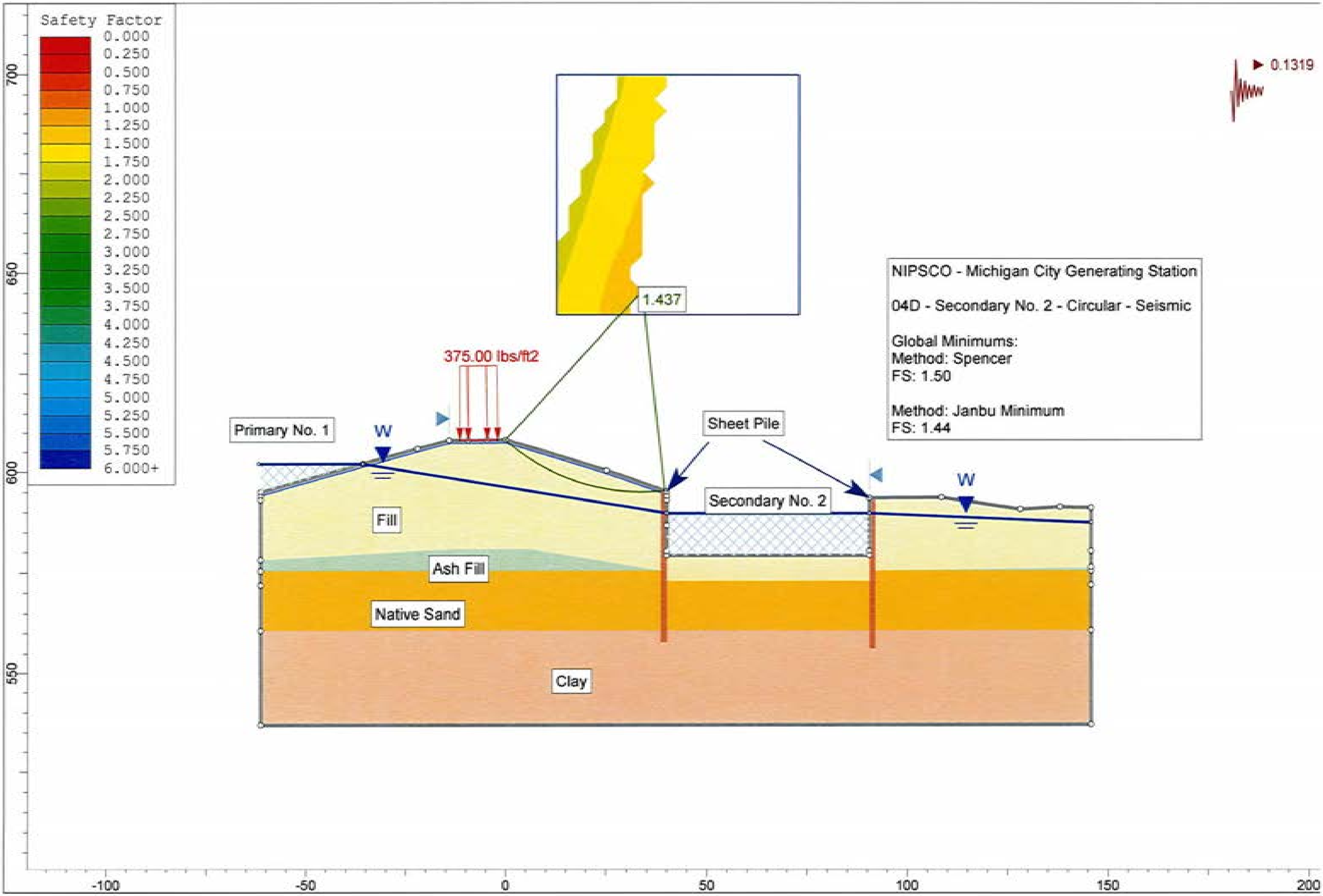
04C - Primary No. 2 - Circular - No Seismic

Global Minimums:
Method: Spencer
FS: 2.15

Method: Janbu Minimum
FS: 2.09

Secondary No. 2-rapid.slim

7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

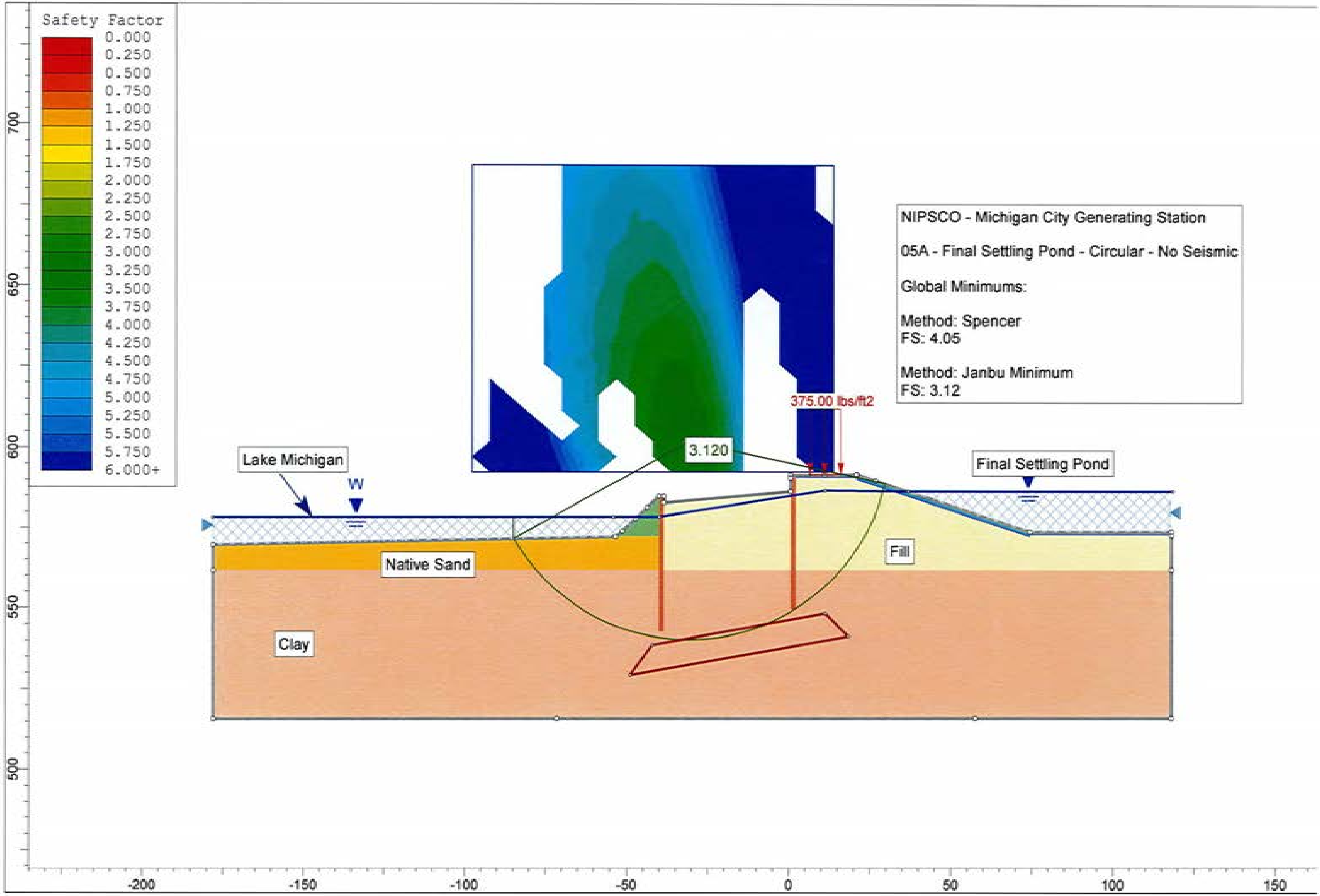
04D - Secondary No. 2 - Circular - Seismic

Global Minimums:
Method: Spencer
FS: 1.50

Method: Janbu Minimum
FS: 1.44

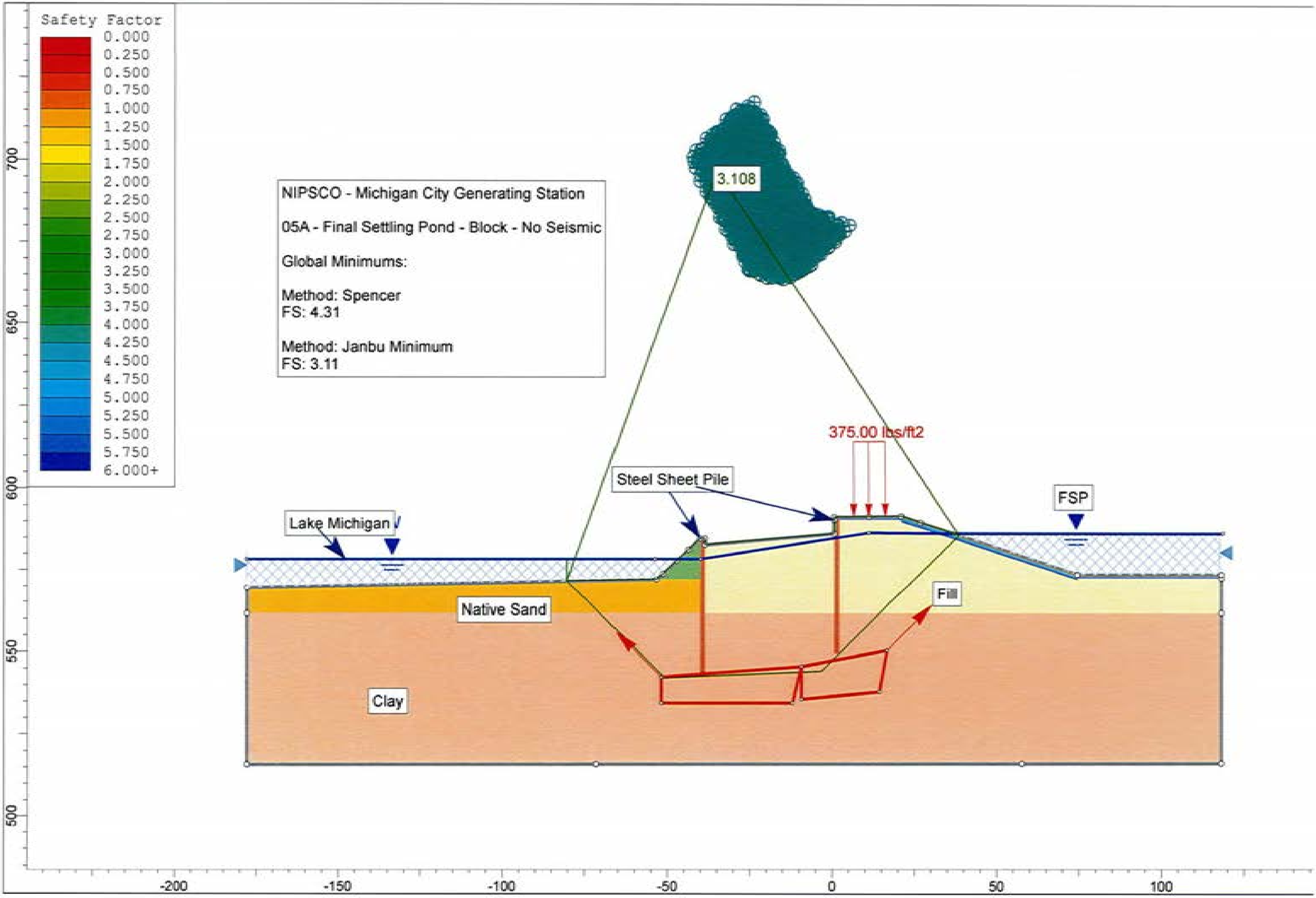
Secondary No. 2.slim

7/16/2012, 10:31:52 A



FSP-Global.slim

7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

05A - Final Settling Pond - Block - No Seismic

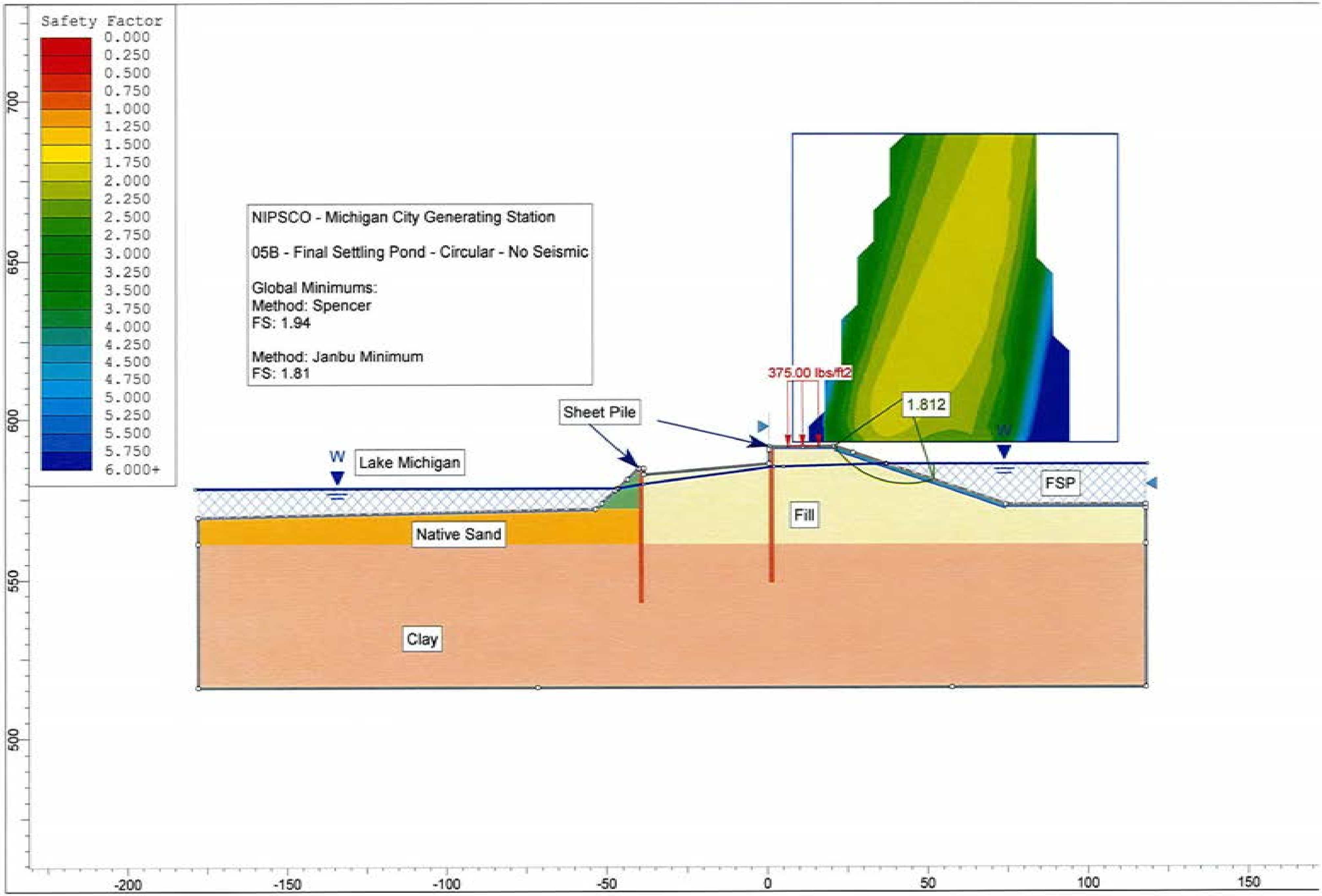
Global Minimums:

Method: Spencer
FS: 4.31

Method: Janbu Minimum
FS: 3.11

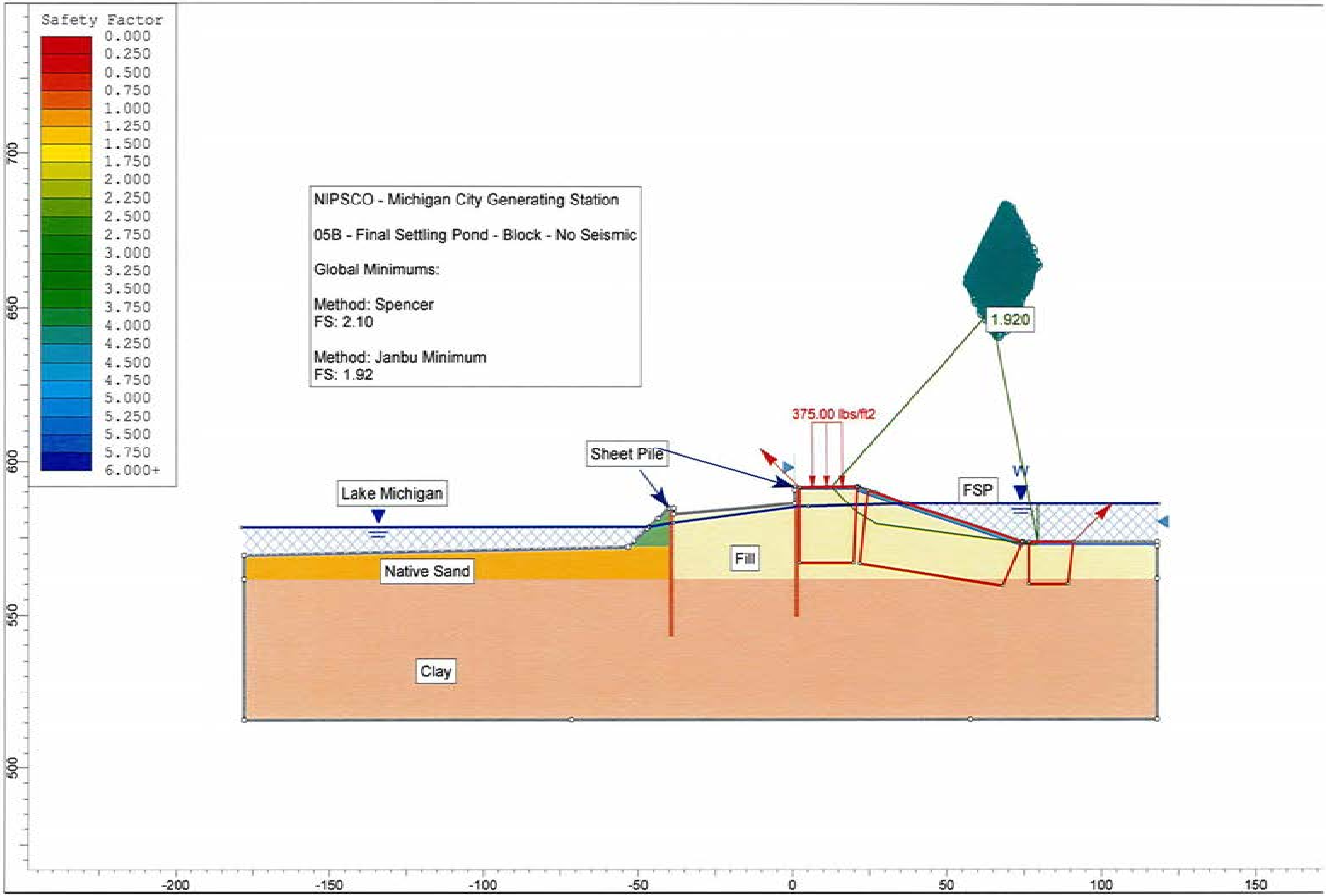
FSP-Global BLOCK.slim

Golder Associates Inc. 7/16/2012, 10:31:52 A



FSP-Local.slim

7/16/2012, 10:31:52 A



NIPSCO - Michigan City Generating Station

05B - Final Settling Pond - Block - No Seismic

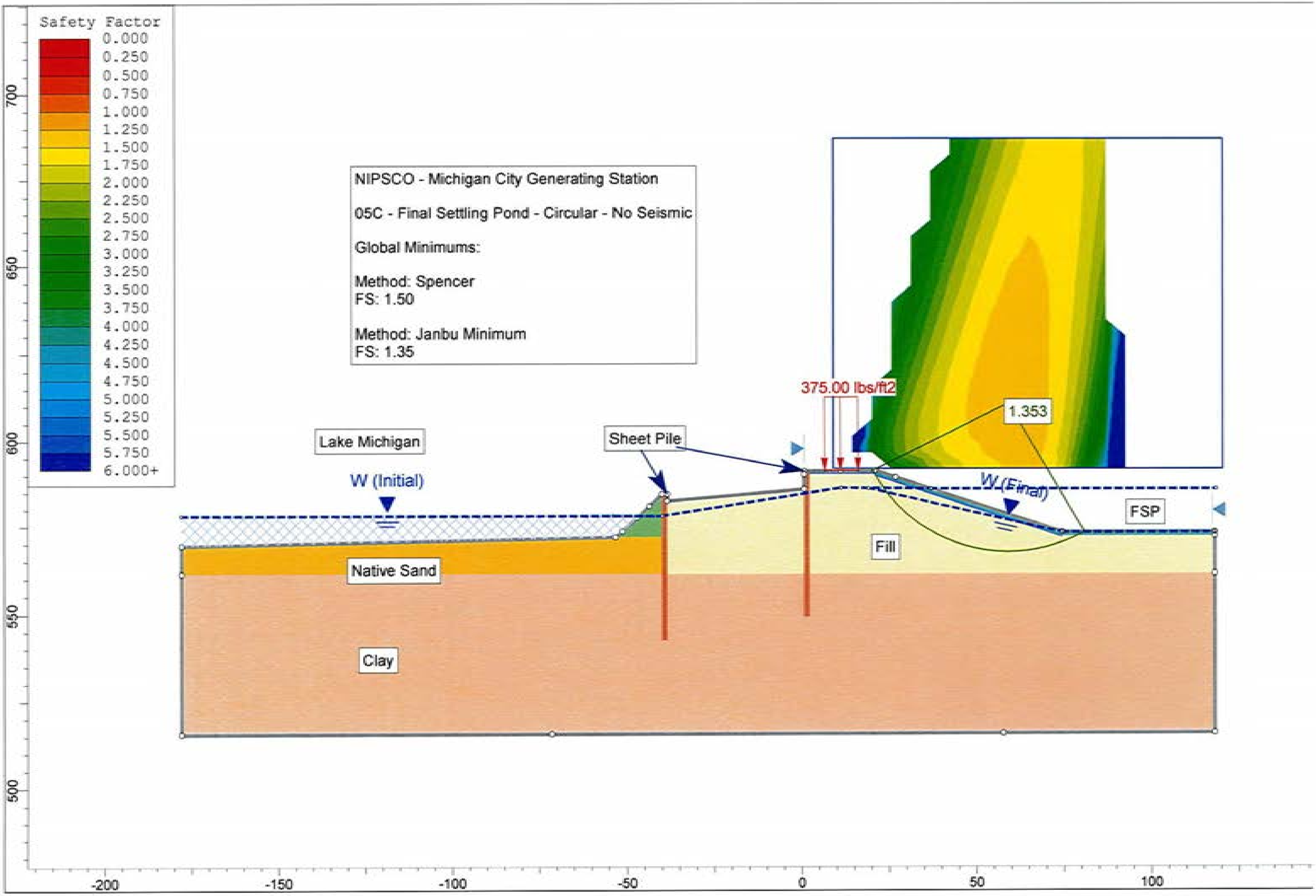
Global Minimums:

Method: Spencer
FS: 2.10

Method: Janbu Minimum
FS: 1.92

FSP-Local-Block.slim

7/16/2012, 10:31:52 AM



NIPSCO - Michigan City Generating Station

05C - Final Settling Pond - Circular - No Seismic

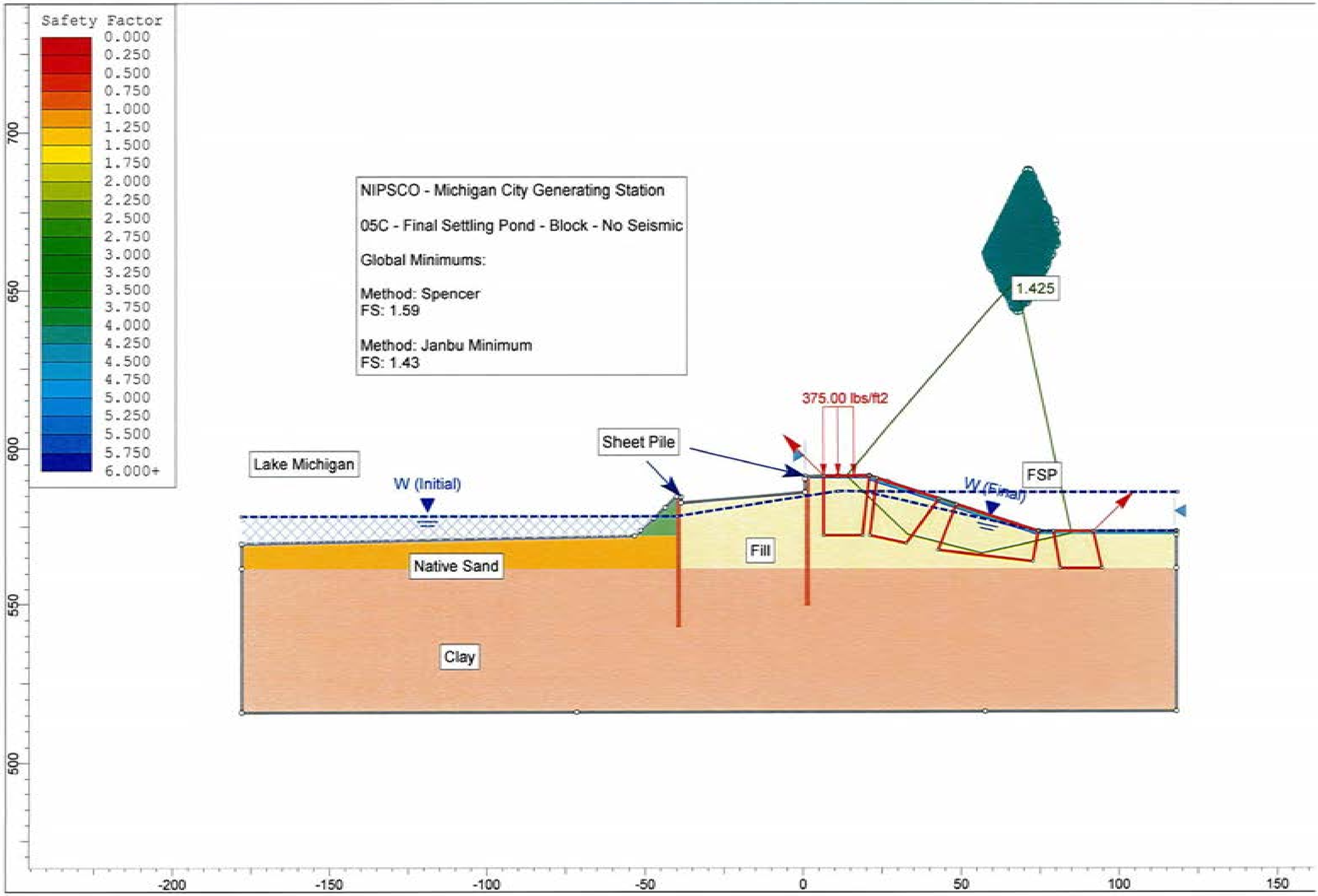
Global Minimums:

Method: Spencer
FS: 1.50

Method: Janbu Minimum
FS: 1.35

FSP-rapid.slim

7/16/2012, 10:31:52 A



NIPSCO - Michigan City Generating Station

05C - Final Settling Pond - Block - No Seismic

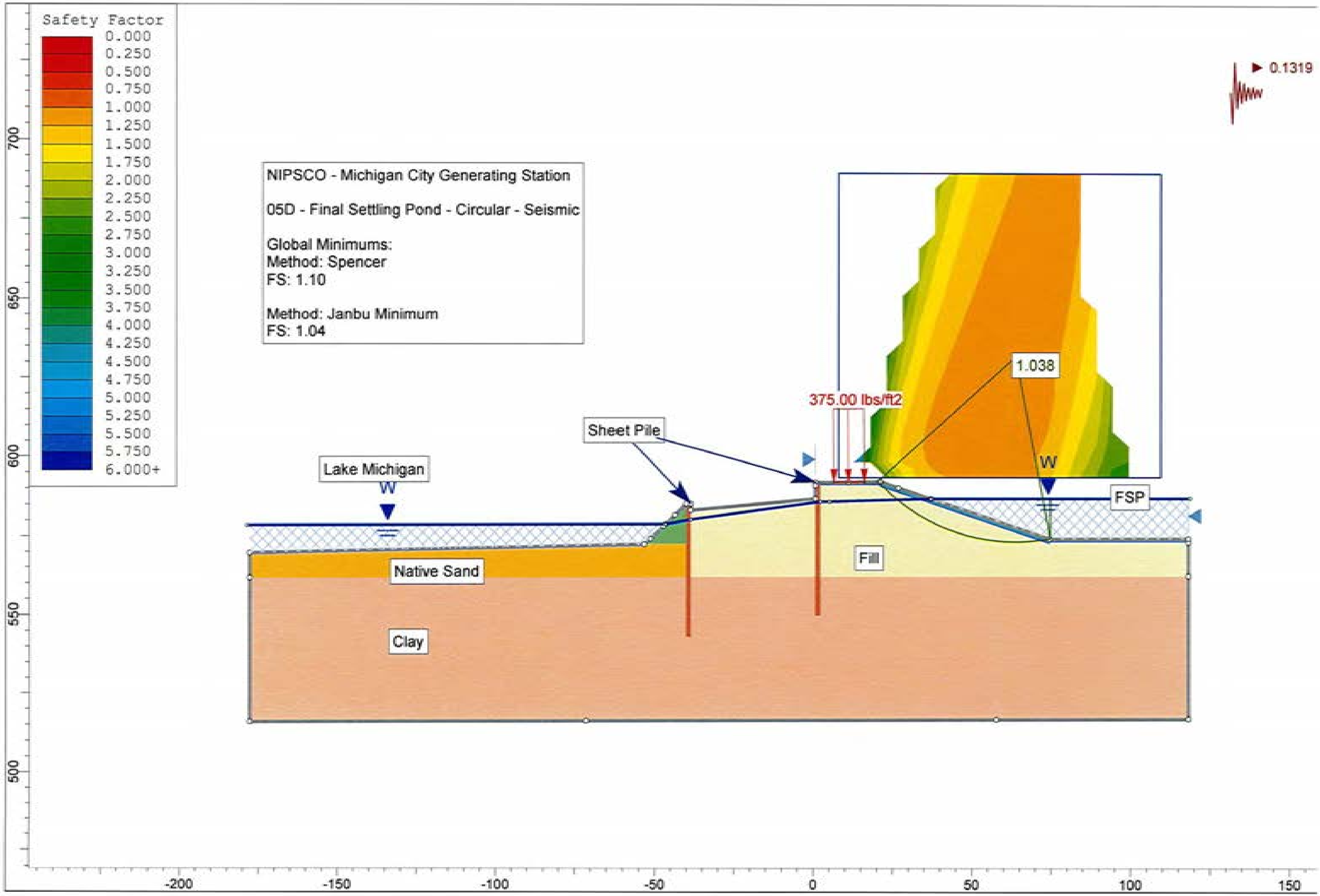
Global Minimums:

Method: Spencer
FS: 1.59

Method: Janbu Minimum
FS: 1.43

FSP-rapid-BLOCK.slim

7/16/2012, 10:31:52 AI



NIPSCO - Michigan City Generating Station

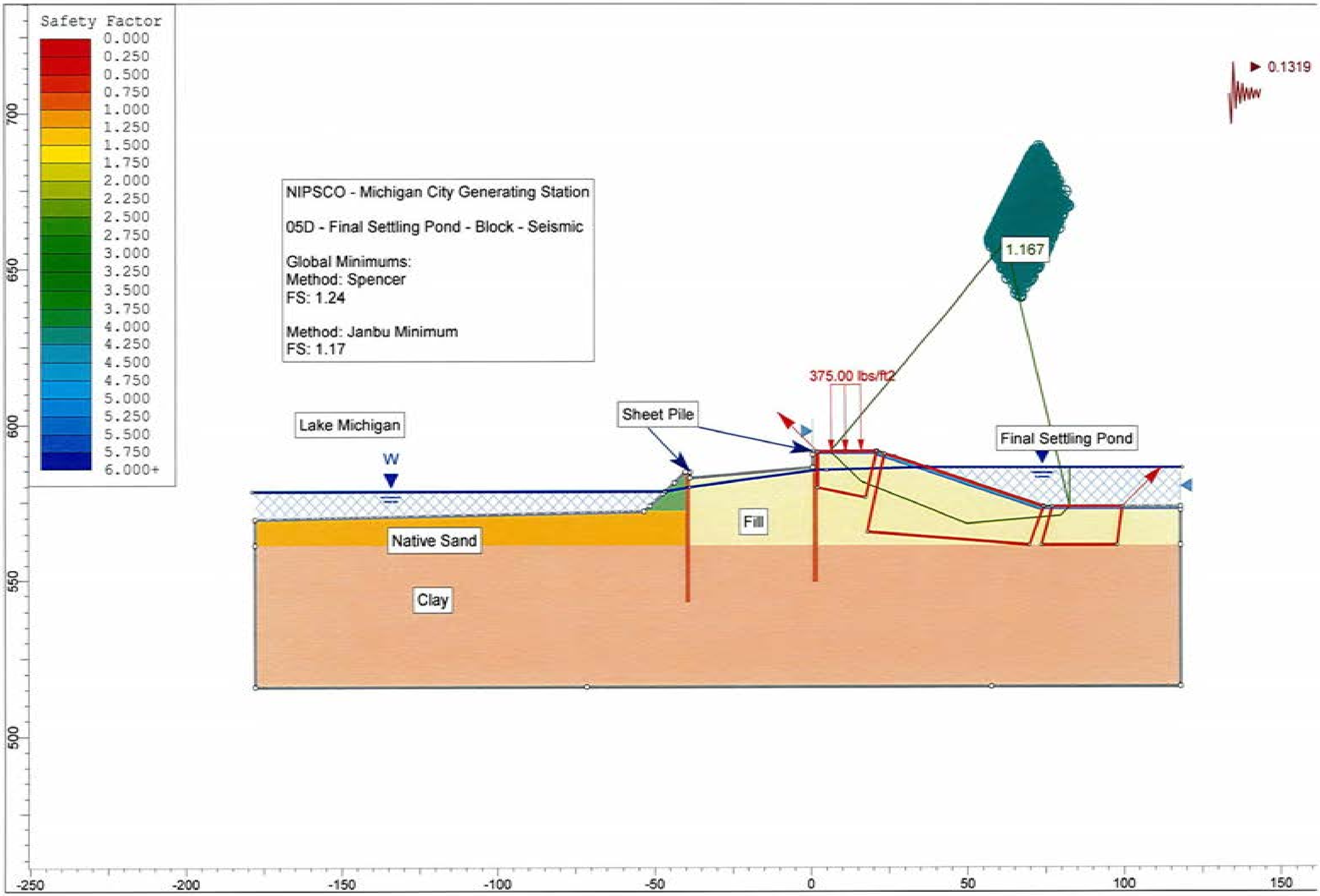
05D - Final Settling Pond - Circular - Seismic

Global Minimums:
Method: Spencer
FS: 1.10

Method: Janbu Minimum
FS: 1.04

FSP-Local SEISMIC.slim

7/16/2012, 10:31:52 AM



FSP-Local-BLOCK SEISMIC.slim

7/16/2012, 10:31:52 A

APPENDIX F

Sheet Piles Analyses

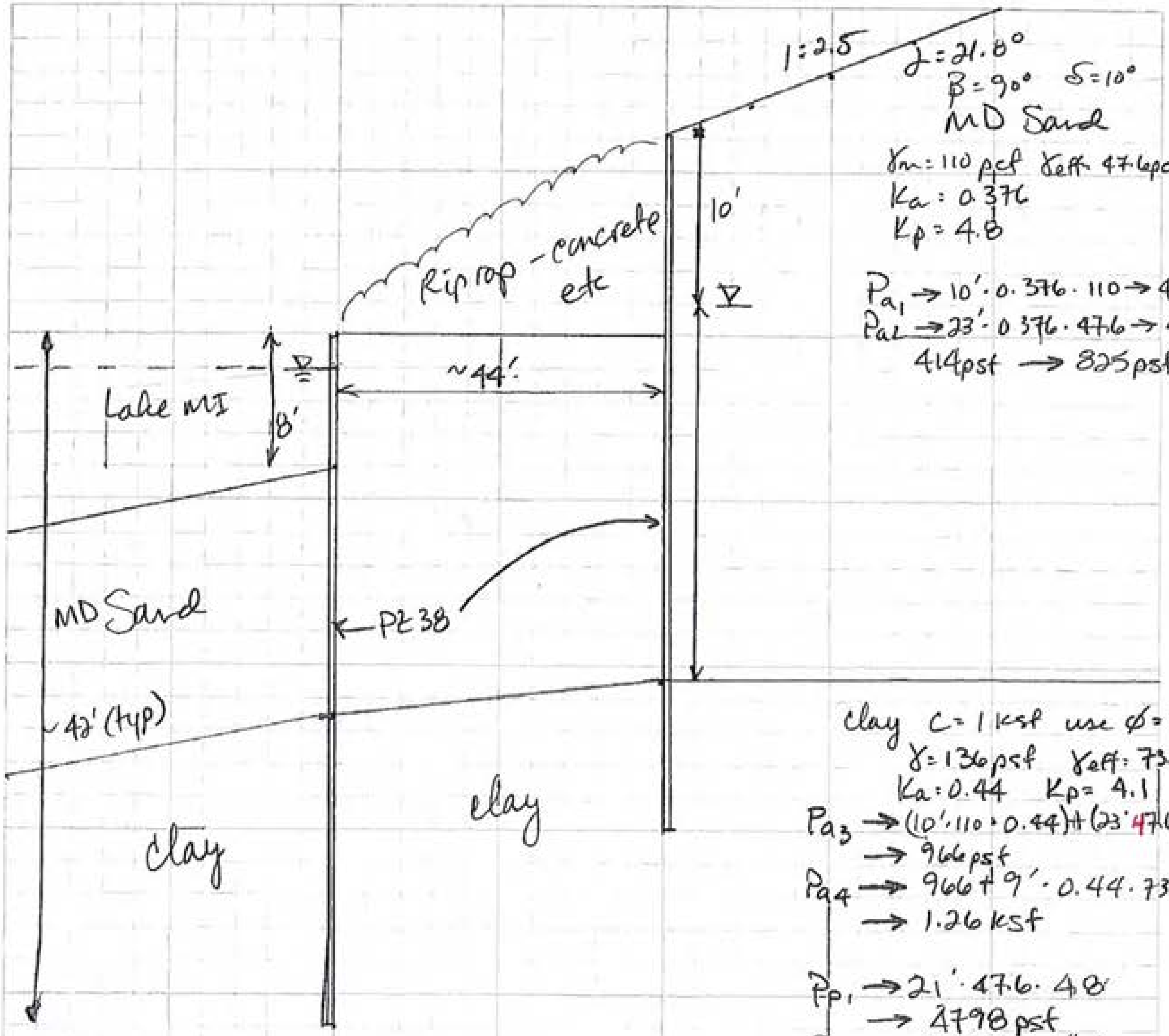
Golder Associates

SUBJECT NIPSCO Section C-C

Job No. 12388898
Ref.

Made by WSD
Checked JRR
Reviewed

Date 24 July 12
Sheet of



$\lambda = 21.8°$
$\beta = 90°$ $\delta = 10°$
MD Sand
$\gamma_m = 110$ pcf γ_{eff} 47.6pcf
$K_a : 0.376$
$K_p = 4.8$

$P_{a_1} \rightarrow 10' \cdot 0.376 \cdot 110 \rightarrow 414$psf
$P_{a_2} \rightarrow 23' \cdot 0.376 \cdot 47.6 \rightarrow 411$psf +
414psf → 825psf

clay C = 1 ksf use $\phi = 30°$
$\gamma = 136$psf $\gamma_{eff} = 73.6$ pcf
$K_a : 0.44$ $K_p = 4.1$
$P_{a_3} \rightarrow (10' \cdot 110 \cdot 0.44) + (23' \cdot 47.6 \cdot 0.44)$
→ 966psf
$P_{a_4} \rightarrow 966 + 9' \cdot 0.44 \cdot 73.6$
→ 1.26 ksf

$P_{p_1} \rightarrow 21' \cdot 47.6 \cdot 4.8$
→ 4798 psf
$P_{p_2} \rightarrow 9' \cdot 73.6 \cdot 4.1$
4100 + 2716 → 6816psf

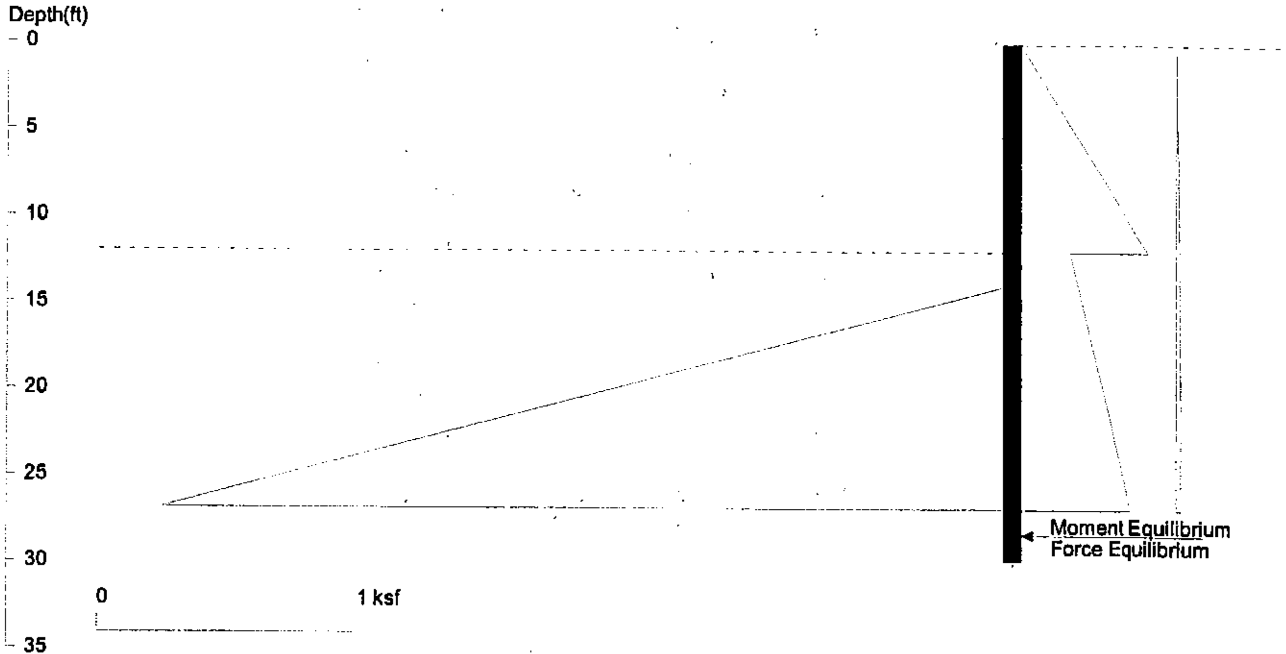
Wall 2 – $P_{a_1} \rightarrow 23' \cdot 0.376 \cdot 47.6$
→ 412 psf
$P_a \rightarrow 482 + 19' \cdot 0.44 \cdot 73.6$
→ 1098 psf

$P_{p_1} \rightarrow 15' \cdot 4.8 \cdot 47.6$
→ 3.43
$P_{p_2} \rightarrow 293 + 19' \cdot 73.6 \cdot 41$
→ 8.66 psf

note in program neglected top 2' of passive resistance due to potential for scouring.

NIPSCO secondary ponds

Two Wall Case, Step 1: Wall 1 Analysis



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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File: C:\Shoring8\SepWallF1.sh8

Upper Wall

Wall Height=12.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=17.80 Min. Pile Length=29.80 (in graphics and analysis)
User inputted Embedment=30.00, Pile Length=42.00
MOMENT IN PILE: Max. Moment=35.67 per Pile Spacing=1.0 at Depth=20.53

SYSTEM FACTOR OF SAFETY (Approximate)=1.69
The request embedment is 17.8, the user input fixed embedment = 30.

PILE SELECTION:
Request Min. Section Modulus = 13.0 in3/ft=697.40 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
PZ38 has Section Modulus = 46.8 in3/ft=2515.97 cm3/m. It is greater than Min. Requirements! OK
Top Deflection = 0.59(in) based on E (ksi)=29000.00 and I (in4)/foot=280.8

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	12	0.496	0.041333
*	Below	Base		
12.00	0.190	15.00	0.237	0.015818
15.00	0.237	18.00	0.285	0.015818
18.00	0.285	21.00	0.332	0.015818
21.00	0.332	24.00	0.380	0.015818
24.00	0.380	27.00	0.427	0.015818
27.00	0.427	30.00	0.475	0.015818
*	Sur-	charg		
0.000	0.000	0.600	0.001	0.001193
0.600	0.001	1.200	0.001	0.001191
1.200	0.001	1.800	0.002	0.001185
1.800	0.002	2.400	0.003	0.001178

2.400	0.003	3.000	0.004	0.001167
3.000	0.004	3.600	0.004	0.001154
3.600	0.004	4.200	0.005	0.001139
4.200	0.005	4.800	0.006	0.001122
4.800	0.006	5.400	0.006	0.001102
5.400	0.006	6.000	0.007	0.001080
6.000	0.007	6.600	0.008	0.001056
6.600	0.008	7.200	0.008	0.001030
7.200	0.008	7.800	0.009	0.001003
7.800	0.009	8.400	0.009	0.000974
8.400	0.009	9.000	0.010	0.000943
9.000	0.010	9.600	0.010	0.000911
9.600	0.010	10.20	0.011	0.000878
10.20	0.011	10.80	0.011	0.000844
10.80	0.011	11.40	0.012	0.000809
11.40	0.012	12.00	0.012	0.000773
12.00	0.012	13.20	0.013	0.000718
13.20	0.013	14.40	0.014	0.000644
14.40	0.014	15.60	0.015	0.000569
15.60	0.015	16.80	0.015	0.000494
16.80	0.015	18.00	0.016	0.000421
18.00	0.016	19.20	0.016	0.000351
19.20	0.016	20.40	0.017	0.000283
20.40	0.017	21.60	0.017	0.000218
21.60	0.017	22.80	0.017	0.000157
22.80	0.017	24.00	0.017	0.000100
24.00	0.017	26.40	0.017	0.000023
26.40	0.017	28.80	0.017	-0.00006
28.80	0.017	31.20	0.017	-0.00013

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
14	0.000	33.00	4.783	0.2517

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	12.00	1.00

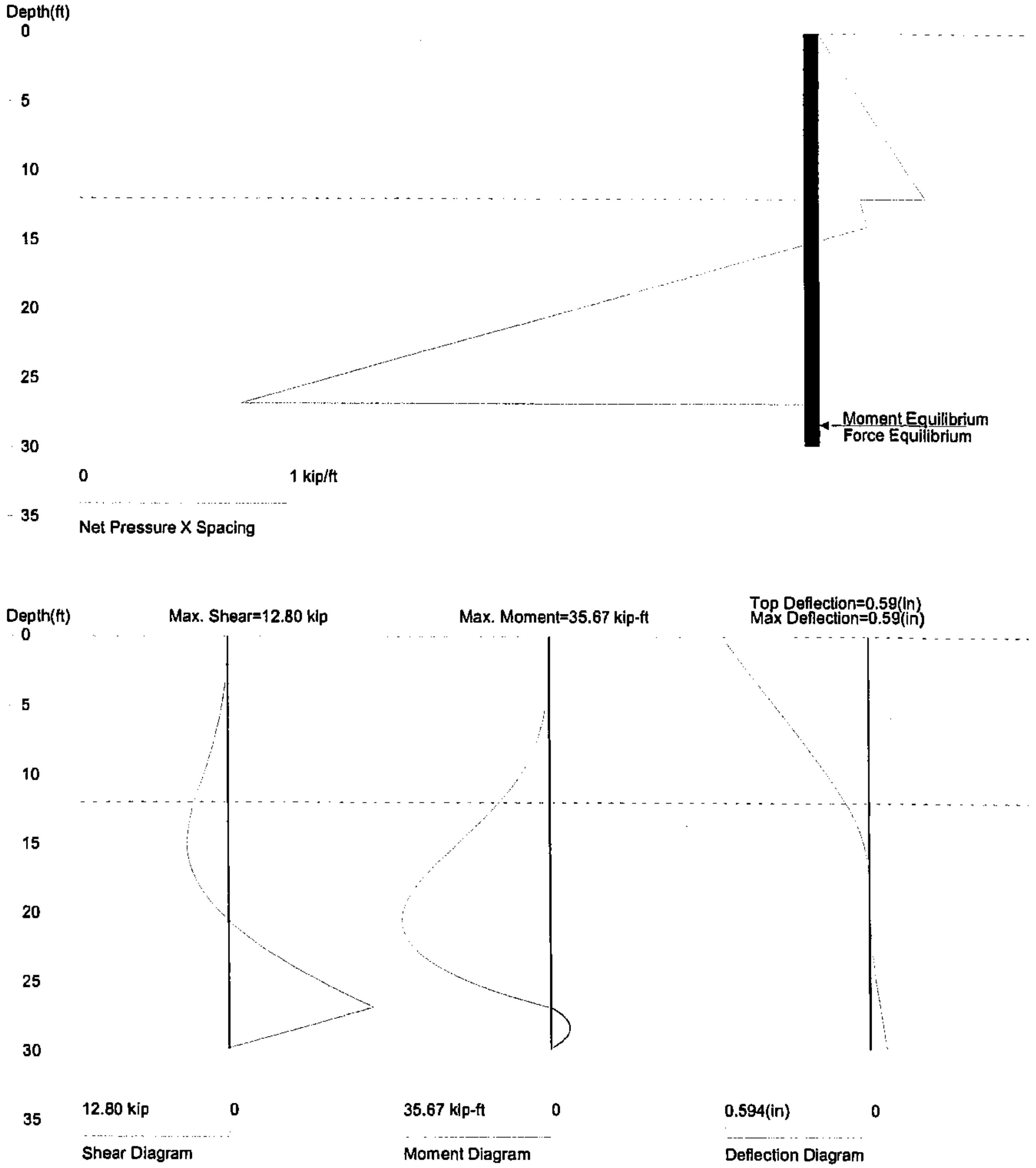
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

NIPSCO secondary ponds

Two Wall Case, Step 1: Wall 1 Analysis



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input Pile, pz38: E (ksi)=29000.0, I (in4)/foot=280.8

File: C:\Shoring8\SepWallF1.sh8

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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

                         SHORING WALL CALCULATION SUMMARY
                  The leading shoring design and calculation software
                       Software Copyright by CivilTech Software
                                www.civiltech.com

********************************************************************************
ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:
    1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
    2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
    3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
    4. TRENCHING AND SHORING MANUAL Revision 12, California Department of
       Transportation, January 2000
    6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
    5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
    7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
    8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS:  Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft,
Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in
-------------------------------------------------------------------------------
Licensed to   WZ     Golder Assocaites
Date: 7/27/2012  File: C:\Shoring8\SepWallF1.sh8

Title: NIPSCO secondary ponds
Subtitle: Two Wall Case, Step 1: Wall 1 Analysis

*********************************INPUT DATA**********************************
Wall Type: 1. Sheet Pile
        Wall Height: 12.00
        Pile Diameter: 1.00
        Pile Spacing: 1.00
        Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
        Top Brace Increase (Multi-Bracing): Add 15%*
Embedment Option: 3. Fixed
        Fixed Embedment: 30.00
        Friction at Pile Tip: No
Pile Properties:
        Steel Strength, Fy:  50 ksi = 345 MPa
        Allowable Fb/Fy: 0.66
        Elastic Module, E: 29000.00
        Moment of Inertia, I: 184.20
        User Input Pile: pz38

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
 No.    Z1 top          Top Pres.       Z2 bottom       Bottom Pres.    Slope
-------------------------------------------------------------------------------
 1      *               Above           Base
 2      0.000           0.000           12              0.496           0.041333
 3      *               Below           Base
 4      12.00           0.190           15.00           0.237           0.015818
 5      15.00           0.237           18.00           0.285           0.015818
 6      18.00           0.285           21.00           0.332           0.015818
 7      21.00           0.332           24.00           0.380           0.015818
 8      24.00           0.380           27.00           0.427           0.015818
 9      27.00           0.427           30.00           0.475           0.015818
 10     30.00           0.475           33.00           0.522           0.015818
 11     33.00           0.548           36.00           0.625           0.025685
 12     36.00           0.625           39.00           0.702           0.025685
 13     39.00           0.702           42.00           0.779           0.025685
 14     42.00           0.779           45.00           0.856           0.025685
 15     45.00           0.856           48.00           0.933           0.025685
 16     48.00           0.933           51.00           1.010           0.025685
 17     51.00           1.010           54.00           1.088           0.025685
 18     54.00           1.088           57.00           1.165           0.025685
 19     57.00           1.165           60.00           1.242           0.025685
 20     60.00           1.242           63.00           1.319           0.025685
 21     63.00           1.319           66.00           1.396           0.025685
 22     66.00           1.396           69.00           1.473           0.025685
 23     69.00           1.473           72.00           1.550           0.025685
 24     72.00           1.550           75.00           1.627           0.025685
 25     75.00           1.627           78.00           1.704           0.025685
 26     78.00           1.704           81.00           1.781           0.025685
 27     81.00           1.781           84.00           1.858           0.025685
 28     84.00           1.858           87.00           1.935           0.025685
 29     87.00           1.935           90.00           2.012           0.025685
 30     90.00           2.012           93.00           2.089           0.025685
 31     93.00           2.089           96.00           2.166           0.025685
 32     96.00           2.166           99.00           2.243           0.025685
 33     99.00           2.243           102.0           2.320           0.025685
 34     102.0           2.320           105.0           2.397           0.025685
```

```
35      105.0          2.397          108.0          2.475          0.025685
36      108.0          2.475          111.0          2.552          0.025685
37      111.0          2.552          114.0          2.629          0.025685
38      114.0          2.629          117.0          2.706          0.025685
39      117.0          2.706          120.0          2.783          0.025685
40      *              sur-           charg
41      0.000          0.000          0.600          0.001          0.001193
42      0.600          0.001          1.200          0.001          0.001191
43      1.200          0.001          1.800          0.002          0.001185
44      1.800          0.002          2.400          0.003          0.001178
45      2.400          0.003          3.000          0.004          0.001167
46      3.000          0.004          3.600          0.004          0.001154
47      3.600          0.004          4.200          0.005          0.001139
48      4.200          0.005          4.800          0.006          0.001122
49      4.800          0.006          5.400          0.006          0.001102
50      5.400          0.006          6.000          0.007          0.001080
51      6.000          0.007          6.600          0.008          0.001056
52      6.600          0.008          7.200          0.008          0.001030
53      7.200          0.008          7.800          0.009          0.001003
54      7.800          0.009          8.400          0.009          0.000974
55      8.400          0.009          9.000          0.010          0.000943
56      9.000          0.010          9.600          0.010          0.000911
57      9.600          0.010          10.20          0.011          0.000878
58      10.20          0.011          10.80          0.011          0.000844
59      10.80          0.011          11.40          0.012          0.000809
60      11.40          0.012          12.00          0.012          0.000773
61      12.00          0.012          13.20          0.013          0.000718
62      13.20          0.013          14.40          0.014          0.000644
63      14.40          0.014          15.60          0.015          0.000569
64      15.60          0.015          16.80          0.015          0.000494
65      16.80          0.015          18.00          0.016          0.000421
66      18.00          0.016          19.20          0.016          0.000351
67      19.20          0.016          20.40          0.017          0.000283
68      20.40          0.017          21.60          0.017          0.000218
69      21.60          0.017          22.80          0.017          0.000157
70      22.80          0.017          24.00          0.017          0.000100
71      24.00          0.017          26.40          0.017          0.000023
72      26.40          0.017          28.80          0.017          -0.00006
73      28.80          0.017          31.20          0.017          -0.00013
74      31.20          0.017          33.60          0.016          -0.00019
75      33.60          0.016          36.00          0.016          -0.00023
76      36.00          0.016          38.40          0.015          -0.00026
77      38.40          0.015          40.80          0.014          -0.00028
78      40.80          0.014          43.20          0.014          -0.00029
79      43.20          0.014          45.60          0.013          -0.00029
80      45.60          0.013          48.00          0.000          -0.00543
-------------------------------------------------------------------------------

* PASSIVE PRESSURE *
 No.    Z1 top         Top Pres.      Z2 bottom      Bottom Pres.   Slope
-------------------------------------------------------------------------------
 1      *              Below          Base
 2      14             0.000          33.00          4.783          0.2517
 3      33.00          4.537          120.0          33.60          0.334092
-------------------------------------------------------------------------------

* ACTIVE SPACE *
 No.    Z depth        Spacing
-------------------------------------------------------------------------------
 1      0.00           1.00
 2      12.00          1.00
-------------------------------------------------------------------------------

* PASSIVE SPACE *
 No.    Z depth        Spacing
-------------------------------------------------------------------------------
 1      0.00           1.00
-------------------------------------------------------------------------------
*For Tieback:  Input1 = Diameter;  Input2 = Bond Strength
*For Plate:  Input1 = Diameter;  Input2 = Allowable Pressure
*For Deadman:  Input1 = Horz. Width;  Input2 = Allowable Pressure; Angle = 0


********************************CALCULATION*********************************

   The calculated moment and shear are per pile spacing.  Sheet piles are per one foot or meter; Soldier
piles are per pile.

   Top Pressures start at depth =  0.00

*  CALCULATE REQUEST EMBEDMENT  *
     The Request Embedment, Yend = 17.80
     The user input fixed embedment = 30.0
```

```
----------------------------CANTILEVER CASE---------------------
** Approximate Factor of Safety based on fixed embedment, FS = 1.69
Note:
   User input fixed embedment is 30, which is deeper than calculated embedment. Use calculated embedment
= 17.8 for graphics and analysis.

            |      D1=0.00
            |
            |
            |
        ==|==      D2=12.00
            |
            |
            |      D3=29.80

          D1 - TOP DEPTH
          D2 - EXCAVATION BASE
          D3 - PILE TIP (20% increased, see EMBEDMENT Notes below)

   MOMENT BALANCE: M=0.00   AT DEPTH=26.84  WITH EMBEDMENT OF 14.84
   FORCE BALANCE: F=0.00   AT DEPTH=29.80  WITH EMBEDMENT OF 17.80

   The program calculates an embedment for moment equilibrium, then increase the embedment by 20% to
reach force equilibrium.
   A Balance Force=12.90 is developed from depth=26.84 to depth=29.80
   Total Passive Pressure = Total Active Pressure,    OK!


**********************************RESULTS*****************************************

* EMBEDMENT Notes *
Based on USS Design Manual, first calculate embedment for moment equilibrium, then increased by 20 to 40
% to reach force equilibrium.
The embedment for moment equilibrium is 14.84
* The 20% increased embedment for force equilibrium is 17.80 (Used by Program)
The 30% increased embedment for force equilibrium is 19.29
The 40% increased embedment for force equilibrium is 20.77

Based on AASHTO 2002 Standard Specifications, first calculate embedment for moment equilibrium, then add
safety factor of 30% for temporary shoring; add safety factor of 50% for permanent shoring.
The embedment for moment equilibrium is 14.84
Add 30% embedment for temporary shoring is 19.29
Add 50% embedment for permanent shoring is 22.25

* BASED ON USS DESIGN MANUAL (20% increased), PROGRAM CALCULATED MINIMUM EMBEDMENT = 17.80
TOTAL MINIMUM PILE LENGTH = 29.80

* MOMENT IN PILE (per pile spacing)*
Pile Spacing:  sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 35.67 at 20.53
Maximum Shear = 12.80
Moment and Shear are per pile spacing: 1.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00


******************************SPECIFIED PILE ************************************

   Overall Maximum Moment = 35.67 at 20.53
   The pile selection is based on the magnitude of the moment only. Axial force is neglected.

   Request Min. Section Modulus = 12.97 in3/ft = 697.40 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

   PZ38 has been found in Sheet Pile list!
   PZ38(English):    Sx= 46.80 in3/ft  Ix= 280.80 in4/ft   Weight= 38.00 lb/ft
   PZ38(Metrics):    Sx= 2515.97 cm3/m  Ix= 383.46 x100cm4/m   Weight= 0.555 kN/m

   * Note: All the pile dimensions are in English Units per one foot width.


   PZ38 is capable to support the shoring!
   I (in4)/foot=280.80
   Top deflection = 0.594(in)
   Max. deflection = 0.594(in)

********PRESSURE, LOAD, SHEAR, MOMENT, AND DEFLECTION V.S. DEPTH************

The shear and moment are per single soldier pile (secant/tangent pile) or one foot
of sheet pile (concrete wall). The deflection is based on users input pile below:
        User Input Pile: pz38
        Elastic Module,  E (ksi)= 29000.00
```

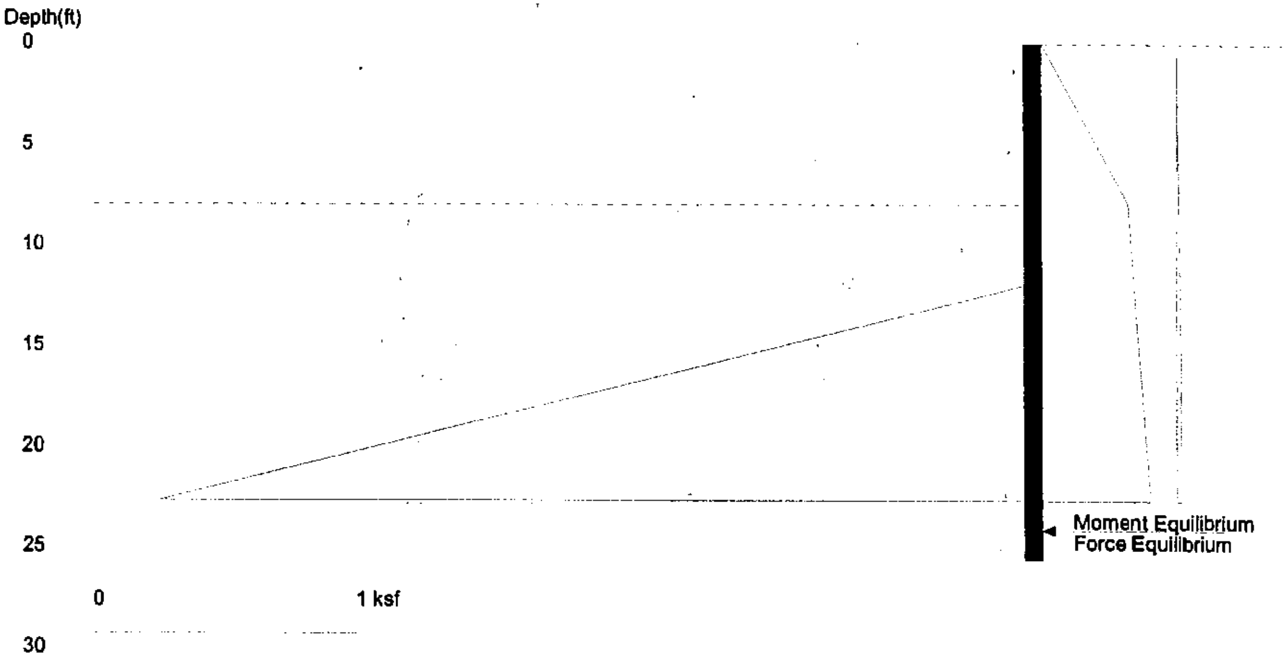
```
Moment of Inertia,  I (in4)/foot= 280.8

PRESS. - Sum of all pressures (Net pressure). (Active) direction is positive
LOAD - Liner load (force per unit depth) = Pressures multiply by acting space

NO      DEPTH   PRESS.  LOAD    SHEAR   MOMENT  DEFLECTION
        ft      ksf     kip/ft  kip     kip-ft  in
--------------------------------------------------------------
1       0.00    0.00    0.00    0.00    0.00    0.594
2       0.04    0.00    0.00    0.00    0.00    0.593
3       0.07    0.00    0.00    0.00    0.00    0.591
4       0.11    0.00    0.00    0.00    0.00    0.589
5       0.15    0.01    0.01    0.00    0.00    0.588
6       0.19    0.01    0.01    0.00    0.00    0.586
7       0.22    0.01    0.01    0.00    0.00    0.585
8       0.26    0.01    0.01    0.00    0.00    0.583
9       0.30    0.01    0.01    0.00    0.00    0.581
10      0.34    0.01    0.01    0.00    0.00    0.580
11      0.37    0.02    0.02    0.00    0.00    0.578
12      0.41    0.02    0.02    0.00    0.00    0.577
13      0.45    0.02    0.02    0.00    0.00    0.575
14      0.49    0.02    0.02    0.01    0.00    0.573
15      0.52    0.02    0.02    0.01    0.00    0.572
16      0.56    0.02    0.02    0.01    0.00    0.570
17      0.60    0.03    0.03    0.01    0.00    0.569
18      0.63    0.03    0.03    0.01    0.00    0.567
19      0.67    0.03    0.03    0.01    0.00    0.565
20      0.71    0.03    0.03    0.01    0.00    0.564
21      0.75    0.03    0.03    0.01    0.00    0.562
22      0.78    0.03    0.03    0.01    0.00    0.561
23      0.82    0.04    0.04    0.01    0.00    0.559
24      0.86    0.04    0.04    0.02    0.00    0.557
25      0.90    0.04    0.04    0.02    0.01    0.556
26      0.93    0.04    0.04    0.02    0.01    0.554
27      0.97    0.04    0.04    0.02    0.01    0.553
28      1.01    0.04    0.04    0.02    0.01    0.551
29      1.05    0.04    0.04    0.02    0.01    0.549
30      1.08    0.05    0.05    0.03    0.01    0.548
31      1.12    0.05    0.05    0.03    0.01    0.546
32      1.16    0.05    0.05    0.03    0.01    0.544
33      1.19    0.05    0.05    0.03    0.01    0.543
34      1.23    0.05    0.05    0.03    0.01    0.541
35      1.27    0.05    0.05    0.03    0.01    0.540
36      1.31    0.06    0.06    0.04    0.02    0.538
37      1.34    0.06    0.06    0.04    0.02    0.536
38      1.38    0.06    0.06    0.04    0.02    0.535
39      1.42    0.06    0.06    0.04    0.02    0.533
40      1.46    0.06    0.06    0.05    0.02    0.532
41      1.49    0.06    0.06    0.05    0.02    0.530
42      1.53    0.06    0.06    0.05    0.03    0.528
43      1.57    0.07    0.07    0.05    0.03    0.527
44      1.61    0.07    0.07    0.05    0.03    0.525
45      1.64    0.07    0.07    0.06    0.03    0.524
46      1.68    0.07    0.07    0.06    0.03    0.522
47      1.72    0.07    0.07    0.06    0.04    0.520
48      1.75    0.07    0.07    0.07    0.04    0.519
49      1.79    0.08    0.08    0.07    0.04    0.517
50      1.83    0.08    0.08    0.07    0.04    0.516
```

NIPSCO secondary ponds

Two Wall Case, Step 2: Wall 2 Analysis



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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Lower Wall

Wall Height=8.0 Pile Diemeter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=17.64 Min. Pile Length=25.64 (in graphics and analysis)
User inputted Embedment=30.00, Pile Length=38.00
MOMENT IN PILE: Max. Moment=24.15 per Pile Spacing=1.0 at Depth=17.63

SYSTEM FACTOR OF SAFETY (Approximate)=1.70
The request embedment is 17.6, the user input fixed embedment = 30.

PILE SELECTION:
Request Min. Section Modulus = 8.8 in3/ft=472.17 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
PZ38 has Section Modulus = 46.8 in3/ft=2515.97 cm3/m. It is greater than Min. Requirements! OK
Top Deflection = 0.36(in) based on E (ksi)=29000.00 and I (in4)/foot=280.8

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	8	0.331	0.041375
*	Below	Base		
8	0.331	23	0.412	0.005400
23	0.482	42	1.1	0.032526
*	Sur-	charg		
0.000	0.000	0.600	0.001	0.001193
0.600	0.001	1.200	0.001	0.001191
1.200	0.001	1.800	0.002	0.001185
1.800	0.002	2.400	0.003	0.001178
2.400	0.003	3.000	0.004	0.001167
3.000	0.004	3.600	0.004	0.001154
3.600	0.004	4.200	0.005	0.001139
4.200	0.005	4.800	0.006	0.001122

4.800	0.006	5.400	0.006	0.001102
5.400	0.006	6.000	0.007	0.001080
6.000	0.007	6.600	0.008	0.001056
6.600	0.008	7.200	0.008	0.001030
7.200	0.008	7.800	0.009	0.001003
7.800	0.009	8.400	0.009	0.000974
8.400	0.009	9.000	0.010	0.000943
9.000	0.010	9.600	0.010	0.000911
9.600	0.010	10.20	0.011	0.000878
10.20	0.011	10.80	0.011	0.000844
10.80	0.011	11.40	0.012	0.000809
11.40	0.012	12.00	0.012	0.000773
12.00	0.012	13.20	0.013	0.000718
13.20	0.013	14.40	0.014	0.000644
14.40	0.014	15.60	0.015	0.000569
15.60	0.015	16.80	0.015	0.000494
16.80	0.015	18.00	0.016	0.000421
18.00	0.016	19.20	0.016	0.000351
19.20	0.016	20.40	0.017	0.000283
20.40	0.017	21.60	0.017	0.000218
21.60	0.017	22.80	0.017	0.000157
22.80	0.017	24.00	0.017	0.000100
24.00	0.017	26.40	0.017	0.000023

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
12	0.000	23	3.43	0.3118
23	2.93	42	8.66	0.3016

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	8.00	1.00

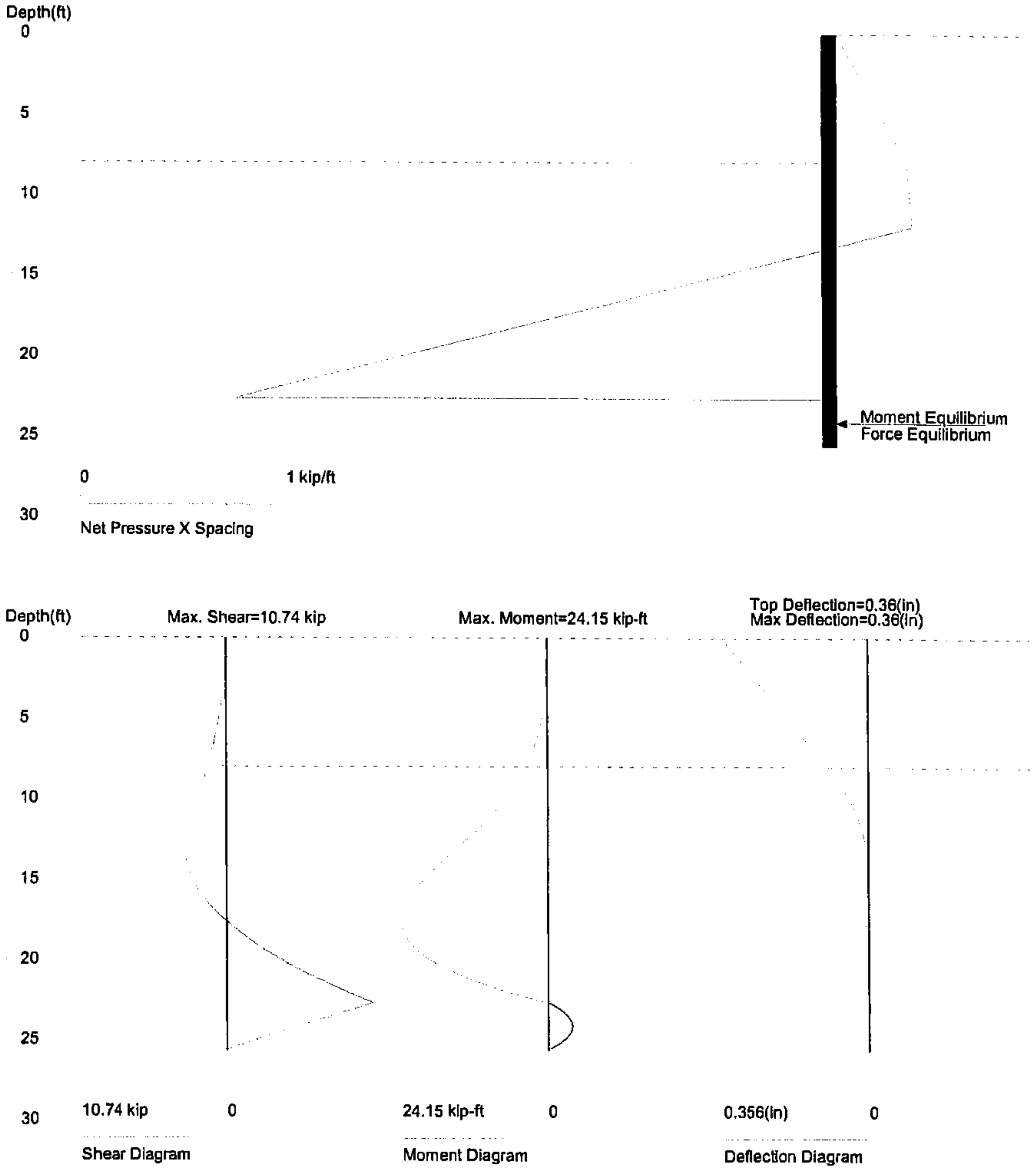
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

NIPSCO secondary ponds

Two Wall Case, Step 2: Wall 2 Analysis



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input Pile, pz38: E (ksi)=29000.0, I (in4)/foot=280.8

File: C:\Shoring8\SepWallF2.sh8

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                    SHORING WALL CALCULATION SUMMARY
             The leading shoring design and calculation software
                  Software Copyright by CivilTech Software
                            www.civiltech.com

*******************************************************************************
ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:
    1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
    2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
    3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
    4. TRENCHING AND SHORING MANUAL Revision 12, California Department of
       Transportation, January 2000
    6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
    5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
    7. EARTH RETENTION SYSTEMS HANDBDOK, Alan Macnab, McGraw-Hill. 2002
    8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS:   Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft,
Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in
------------------------------------------------------------------------------
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Date: 7/27/2012  File: C:\Shoring8\SepWallF2.sh8

Title: NIPSCO secondary ponds
Subtitle: Two Wall Case, Step 2: Wall 2 Analysis

*********************************INPUT DATA***********************************
Wall Type: 1. Sheet Pile
        Wall Height: 8.00
        Pile Diameter: 1.00
        Pile Spacing: 1.00
        Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
        Top Brace Increase (Multi-Bracing): Add 15%*
Embedment Option: 3. Fixed
        Fixed Embedment: 30.00
        Friction at Pile Tip: No
Pile Properties:
        Steel Strength, Fy:  50 ksi = 345 MPa
        Allowable Fb/Fy: 0.66
        Elastic Module, E: 29000.00
        Moment of Inertia, I: 280.80
        User Input Pile: pz38

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
 NO.    Z1 top          Top Pres.       Z2 bottom        Bottom Pres.    Slope
------------------------------------------------------------------------------
  1     *               Above           Base
  2     0.000           0.000           8                0.331           0.041375
  3     *               Below           Base
  4     8               0.331           23               0.412           0.005400
  5     23              0.482           42               1.1             0.032526
  6     *               Sur-            charg
  7     0.000           0.000           0.600            0.001           0.001193
  8     0.600           0.001           1.200            0.001           0.001191
  9     1.200           0.001           1.800            0.002           0.001185
 10     1.800           0.002           2.400            0.003           0.001178
 11     2.400           0.003           3.000            0.004           0.001167
 12     3.000           0.004           3.600            0.004           0.001154
 13     3.600           0.004           4.200            0.005           0.001139
 14     4.200           0.005           4.800            0.006           0.001122
 15     4.800           0.006           5.400            0.006           0.001102
 16     5.400           0.006           6.000            0.007           0.001080
 17     6.000           0.007           6.600            0.008           0.001056
 18     6.600           0.008           7.200            0.008           0.001030
 19     7.200           0.008           7.800            0.009           0.001003
 20     7.800           0.009           8.400            0.009           0.000974
 21     8.400           0.009           9.000            0.010           0.000943
 22     9.000           0.010           9.600            0.010           0.000911
 23     9.600           0.010           10.20            0.011           0.000878
 24     10.20           0.011           10.80            0.011           0.000844
 25     10.80           0.011           11.40            0.012           0.000809
 26     11.40           0.012           12.00            0.012           0.000773
 27     12.00           0.012           13.20            0.013           0.000718
 28     13.20           0.013           14.40            0.014           0.000644
 29     14.40           0.014           15.60            0.015           0.000569
 30     15.60           0.015           16.80            0.015           0.000494
 31     16.80           0.015           18.00            0.016           0.000421
 32     18.00           0.016           19.20            0.016           0.000351
 33     19.20           0.016           20.40            0.017           0.000283
 34     20.40           0.017           21.60            0.017           0.000218
```

```
 35     21.60          0.017          22.80          0.017          0.000157
 36     22.80          0.017          24.00          0.017          0.000100
 37     24.00          0.017          26.40          0.017          0.000023
 38     26.40          0.017          28.80          0.017          -0.00006
 39     28.80          0.017          31.20          0.017          -0.00013
 40     31.20          0.017          33.60          0.016          -0.00019
 41     33.60          0.016          36.00          0.016          -0.00023
 42     36.00          0.016          38.40          0.015          -0.00026
 43     38.40          0.015          40.80          0.014          -0.00028
 44     40.80          0.014          43.20          0.014          -0.00029
 45     43.20          0.014          45.60          0.013          -0.00029
 46     45.60          0.013          48.00          0.000          -0.00543
-----------------------------------------------------------------------------

* PASSIVE PRESSURE *
 No.    Z1 top         Top Pres.      Z2 bottom      Bottom Pres.   Slope
-----------------------------------------------------------------------------
 1      *              Below          Base
 2      12             0.000          23             3.43           0.3118
 3      23             2.93           42             8.66           0.3016
-----------------------------------------------------------------------------

* ACTIVE SPACE *
 No.    Z depth        Spacing
-----------------------------------------------------------------------------
 1      0.00           1.00
 2      8.00           1.00
-----------------------------------------------------------------------------

* PASSIVE SPACE *
 No.    Z depth        Spacing
-----------------------------------------------------------------------------
 1      0.00           1.00
-----------------------------------------------------------------------------
*For Tieback:  Input1 = Diameter;  Input2 = Bond Strength
*For Plate:  Input1 = Diameter;  Input2 = Allowable Pressure
*For Deadman:  Input1 = Horz. Width;  Input2 = Allowable Pressure; Angle = 0

*********************************CALCULATION***********************************

   The calculated moment and shear are per pile spacing.  Sheet piles are per one foot or meter; Soldier
piles are per pile.

   Top Pressures start at depth =  0.00

*  CALCULATE REQUEST EMBEDMENT  *
     The Request Embedment, Yend = 17.64
     The user input fixed embedment = 30.0

---------------------------CANTILEVER CASE---------------------
** Approximate Factor of Safety based on fixed embedment, FS = 1.70
Note:
   User input fixed embedment is 30, which is deeper than calculated embedment. Use calculated embedment
= 17.6 for graphics and analysis.

         |      D1=0.00
         |
         |
         |
       ==|==    D2=8.00
         |
         |
         |      D3=25.64

         D1 - TOP DEPTH
         D2 - EXCAVATION BASE
         D3 - PILE TIP (20% increased, see EMBEDMENT Notes below)

   MOMENT BALANCE: M=0.00   AT DEPTH=22.70  WITH EMBEDMENT OF 14.70
   FORCE BALANCE: F=0.00   AT DEPTH=25.64  WITH EMBEDMENT OF 17.64

   The program calculates an embedment for moment equilibrium, then increase the embedment by 20% to
reach force equilibrium.
   A Balance Force=10.89 is developed from depth=22.70 to depth=25.64
   Total Passive Pressure = Total Active Pressure,    OK!

*********************************RESULTS*****************************************

* EMBEDMENT Notes *
Based on USS Design Manual, first calculate embedment for moment equilibrium, then increased by 20 to 40
% to reach force equilibrium.
The embedment for moment equilibrium is 14.70
```

```
* The 20% increased embedment for force equilibrium is 17.64 (Used by Program)
The 30% increased embedment for force equilibrium is 19.11
The 40% increased embedment for force equilibrium is 20.58

Based on AASHTO 2002 Standard Specifications, first calculate embedment for moment equilibrium, then add
safety factor of 30% for temporary shoring; add safety factor of 50% for permanent shoring.
The embedment for moment equilibrium is 14.70
Add 30% embedment for temporary shoring is 19.11
Add 50% embedment for permanent shoring is 22.04

* BASED ON USS DESIGN MANUAL (20% increased), PROGRAM CALCULATED MINIMUM EMBEDMENT = 17.64
TOTAL MINIMUM PILE LENGTH = 25.64

* MOMENT IN PILE (per pile spacing)*
Pile Spacing:  sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 24.15 at 17.63
Maximum Shear = 10.74
Moment and Shear are per pile spacing: 1.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00


*****************************SPECIFIED PILE ***********************************

   Overall Maximum Moment = 24.15 at 17.63
   The pile selection is based on the magnitude of the moment only. Axial force is neglected.

   Request Min. Section Modulus = 8.78 in3/ft = 472.17 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

   PZ38 has been found in Sheet Pile list!
   PZ38(English):    Sx= 46.80 in3/ft  Ix= 280.80 in4/ft   Weight= 38.00 lb/ft
   PZ38(Metrics):    Sx= 2515.97 cm3/m  Ix= 383.46 x100cm4/m   Weight= 0.555 kN/m

   * Note: All the pile dimensions are in English Units per one foot width.


   PZ38 is capable to support the shoring!
   I (in4)/foot=280.80
   Top deflection = 0.356(in)
   Max. deflection = 0.356(in)

********PRESSURE, LOAD, SHEAR, MOMENT, AND DEFLECTION V.S. DEPTH************

The shear and moment are per single soldier pile (secant/tangent pile) or one foot
of sheet pile (concrete wall). The deflection is based on users input pile below:
        User Input Pile: pz38
        Elastic Module,  E (ksi)= 29000.00
        Moment of Inertia,  I (in4)/foot= 280.8

        PRESS. - Sum of all pressures (Net pressure). (Active) direction is positive
        LOAD - Liner load (force per unit depth) = Pressures multiply by acting space

        NO      DEPTH   PRESS.  LOAD    SHEAR   MOMENT  DEFLECTION
                ft      ksf     kip/ft  kip     kip-ft  in
        ------------------------------------------------------------
        1       0.00    0.00    0.00    0.00    0.00    0.356
        2       0.03    0.00    0.00    0.00    0.00    0.355
        3       0.06    0.00    0.00    0.00    0.00    0.354
        4       0.10    0.00    0.00    0.00    0.00    0.353
        5       0.13    0.01    0.01    0.00    0.00    0.352
        6       0.16    0.01    0.01    0.00    0.00    0.351
        7       0.19    0.01    0.01    0.00    0.00    0.350
        8       0.22    0.01    0.01    0.00    0.00    0.349
        9       0.26    0.01    0.01    0.00    0.00    0.348
        10      0.29    0.01    0.01    0.00    0.00    0.347
        11      0.32    0.01    0.01    0.00    0.00    0.346
        12      0.35    0.02    0.02    0.00    0.00    0.345
        13      0.39    0.02    0.02    0.00    0.00    0.344
        14      0.42    0.02    0.02    0.00    0.00    0.343
        15      0.45    0.02    0.02    0.00    0.00    0.342
        16      0.48    0.02    0.02    0.00    0.00    0.341
        17      0.51    0.02    0.02    0.01    0.00    0.340
        18      0.55    0.02    0.02    0.01    0.00    0.339
        19      0.58    0.02    0.02    0.01    0.00    0.338
        20      0.61    0.03    0.03    0.01    0.00    0.336
        21      0.64    0.03    0.03    0.01    0.00    0.335
        22      0.67    0.03    0.03    0.01    0.00    0.334
        23      0.71    0.03    0.03    0.01    0.00    0.333
        24      0.74    0.03    0.03    0.01    0.00    0.332
        25      0.77    0.03    0.03    0.01    0.00    0.331
        26      0.80    0.03    0.03    0.01    0.00    0.330
```

```
27        0.83      0.04      0.04      0.01      0.00      0.329
28        0.87      0.04      0.04      0.02      0.00      0.328
29        0.90      0.04      0.04      0.02      0.01      0.327
30        0.93      0.04      0.04      0.02      0.01      0.326
31        0.96      0.04      0.04      0.02      0.01      0.325
32        1.00      0.04      0.04      0.02      0.01      0.324
33        1.03      0.04      0.04      0.02      0.01      0.323
34        1.06      0.05      0.05      0.02      0.01      0.322
35        1.09      0.05      0.05      0.03      0.01      0.321
36        1.12      0.05      0.05      0.03      0.01      0.320
37        1.16      0.05      0.05      0.03      0.01      0.319
38        1.19      0.05      0.05      0.03      0.01      0.318
39        1.22      0.05      0.05      0.03      0.01      0.317
40        1.25      0.05      0.05      0.03      0.01      0.316
41        1.28      0.05      0.05      0.04      0.02      0.315
42        1.32      0.06      0.06      0.04      0.02      0.314
43        1.35      0.06      0.06      0.04      0.02      0.313
44        1.38      0.06      0.06      0.04      0.02      0.312
45        1.41      0.06      0.06      0.04      0.02      0.310
46        1.44      0.06      0.06      0.04      0.02      0.309
47        1.48      0.06      0.06      0.05      0.02      0.308
48        1.51      0.06      0.06      0.05      0.02      0.307
49        1.54      0.07      0.07      0.05      0.03      0.306
50        1.57      0.07      0.07      0.05      0.03      0.305
51        1.61      0.07      0.07      0.05      0.03      0.304
52        1.64      0.07      0.07      0.06      0.03      0.303
53        1.67      0.07      0.07      0.06      0.03      0.302
54        1.70      0.07      0.07      0.06      0.04      0.301
55        1.73      0.07      0.07      0.06      0.04      0.300
56        1.77      0.07      0.07      0.07      0.04      0.299
57        1.80      0.08      0.08      0.07      0.04      0.298
58        1.83      0.08      0.08      0.07      0.04      0.297
59        1.86      0.08      0.08      0.07      0.05      0.296
60        1.89      0.08      0.08      0.08      0.05      0.295
61        1.93      0.08      0.08      0.08      0.05      0.294
62        1.96      0.08      0.08      0.08      0.05      0.293
63        1.99      0.08      0.08      0.08      0.06      0.292
64        2.02      0.09      0.09      0.09      0.06      0.291
65        2.06      0.09      0.09      0.09      0.06      0.290
66        2.09      0.09      0.09      0.09      0.06      0.289
67        2.12      0.09      0.09      0.10      0.07      0.288
68        2.15      0.09      0.09      0.10      0.07      0.287
69        2.18      0.09      0.09      0.10      0.07      0.285
70        2.22      0.09      0.09      0.10      0.08      0.284
71        2.25      0.10      0.10      0.11      0.08      0.283
72        2.28      0.10      0.10      0.11      0.08      0.282
73        2.31      0.10      0.10      0.11      0.09      0.281
74        2.34      0.10      0.10      0.12      0.09      0.280
75        2.38      0.10      0.10      0.12      0.10      0.279
76        2.41      0.10      0.10      0.12      0.10      0.278
77        2.44      0.10      0.10      0.13      0.10      0.277
78        2.47      0.11      0.11      0.13      0.11      0.276
79        2.50      0.11      0.11      0.13      0.11      0.275
80        2.54      0.11      0.11      0.14      0.12      0.274
81        2.57      0.11      0.11      0.14      0.12      0.273
82        2.60      0.11      0.11      0.14      0.12      0.272
83        2.63      0.11      0.11      0.15      0.13      0.271
84        2.67      0.11      0.11      0.15      0.13      0.270
85        2.70      0.11      0.11      0.15      0.14      0.269
86        2.73      0.12      0.12      0.16      0.14      0.268
87        2.76      0.12      0.12      0.16      0.15      0.267
88        2.79      0.12      0.12      0.17      0.15      0.266
89        2.83      0.12      0.12      0.17      0.16      0.265
90        2.86      0.12      0.12      0.17      0.17      0.264
91        2.89      0.12      0.12      0.18      0.17      0.263
92        2.92      0.12      0.12      0.18      0.18      0.262
93        2.95      0.13      0.13      0.19      0.18      0.261
94        2.99      0.13      0.13      0.19      0.19      0.259
95        3.02      0.13      0.13      0.19      0.19      0.258
96        3.05      0.13      0.13      0.20      0.20      0.257
97        3.08      0.13      0.13      0.20      0.21      0.256
98        3.11      0.13      0.13      0.21      0.21      0.255
99        3.15      0.13      0.13      0.21      0.22      0.254
100       3.18      0.14      0.14      0.22      0.23      0.253
101       3.21      0.14      0.14      0.22      0.23      0.252
102       3.24      0.14      0.14      0.22      0.24      0.251
103       3.28      0.14      0.14      0.23      0.25      0.250
104       3.31      0.14      0.14      0.23      0.26      0.249
105       3.34      0.14      0.14      0.24      0.26      0.248
106       3.37      0.14      0.14      0.24      0.27      0.247
107       3.40      0.15      0.15      0.25      0.28      0.246
108       3.44      0.15      0.15      0.25      0.29      0.245
109       3.47      0.15      0.15      0.26      0.30      0.244
110       3.50      0.15      0.15      0.26      0.30      0.243
```

Golder Associates

SUBJECT Section D-D Pond 1 - Secondary

Job No.

Ref.

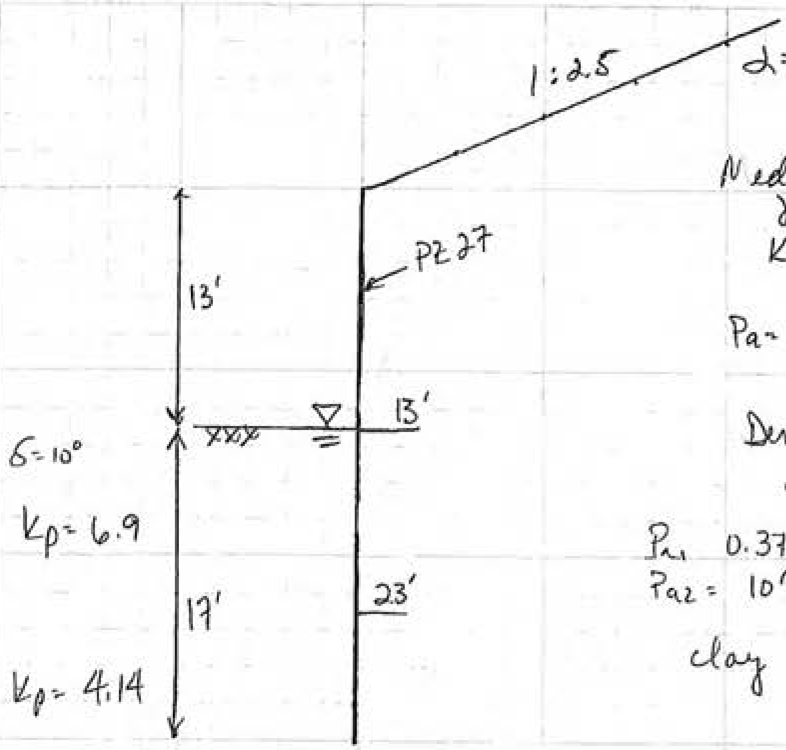
Made by WJ

Checked JRR

Reviewed

Date 20 July 12

Sheet of



α = 21.8°

B = 90° wall angle

Medium Dense Sand ϕ = 33°

γ_m = 110 pcf δ = 10° wall friction ϕ

Ka = 0.376 γ_{eff} = 47.6 pcf

Pa = 13' · 0.376 · 110 → 538 psf → 0.54 ksf

Dense Sand ϕ = 40°

γ_{sat} = 120 pcf δ = 10°

Ka = 0.26 γ_{eff} = 57.6 pcf

P_{a_1} 0.372 ksf

P_{a_2} = 10' 57.6 · 0.26 → 150 psf → 0.522 ksf

clay c = 1 ksf - use ϕ = 30°

c = 0.1 ksf

γ = 36 pcf γ_{eff} = 73.6 pcf

Ka = 0.44

P_{a_1} → (13' · 110 · 0.44) + (10' · 57.6 · 0.44) →

0.88 ksf

P_{a_2} → 7' · 73.6 · 0.44 → 1.11 ksf

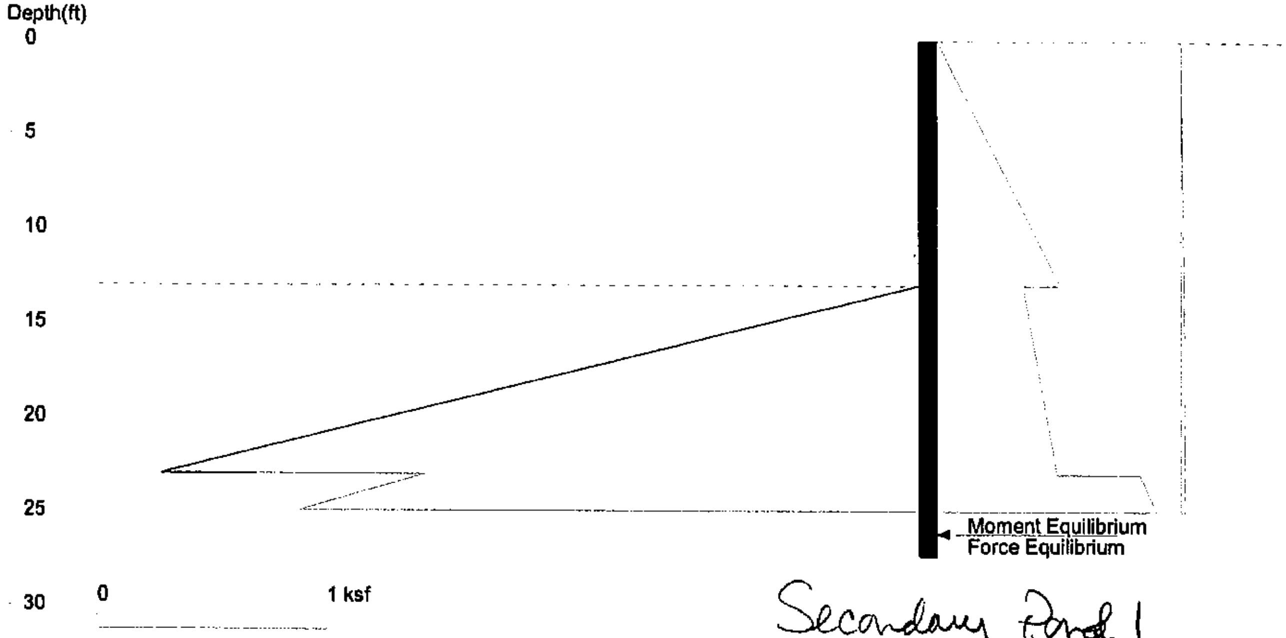
P_p = 10' · 6.90 · 47.6 pcf → 3.28 ksf

P_{a_2} → 0' · 47.6 · 4.14 → 1.97

P_{a_3} → 2.13 ksf + 1.97 ksf → 4.1 ksf

NIPSCO Section D-D

Section D-D



Secondary Pond 1

<ShoringSuite> **CIVILTECH SOFTWARE USA** **www.civiltech.com**

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File: C:\work directory\Nipsco work\calcs\earth pressure section d-d.ep8.sh8

Wall Height=13.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=14.34 Min. Pile Length=27.34 (in graphics and analysis)
User inputted Embedment=17.00, Pile Length=30.00
MOMENT IN PILE: Max. Moment=32.83 per Pile Spacing=1.0 at Depth=19.17

SYSTEM FACTOR OF SAFETY (Approximate)=1.19
The request embedment is 14.3, the user input fixed embedment = 17.

PILE SELECTION:
Request Min. Section Modulus = 11.9 in3/ft=641.71 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
PZ27 has Section Modulus = 30.2 in3/ft=1623.55 cm3/m. It is greater than Min. Requirements! Ok
Top Deflection = 0.83(in) based on E (ksi)=29000.00 and I (in4)/foot=184.2

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0	0.000	13	0.538	0.041385
*	below	base		
13	0.372	23	0.522	0.015000
23	0.88	30	1.11	0.032857
*	Sur-	charge		
0.000	0.000	0.650	0.001	0.001193
0.650	0.001	1.300	0.002	0.001190
1.300	0.002	1.950	0.002	0.001184
1.950	0.002	2.600	0.003	0.001175
2.600	0.003	3.250	0.004	0.001163
3.250	0.004	3.900	0.005	0.001148
3.900	0.005	4.550	0.005	0.001130
4.550	0.005	5.200	0.006	0.001110

5.200	0.006	5.850	0.007	0.001087
5.850	0.007	6.500	0.007	0.001061
6.500	0.007	7.150	0.008	0.001034
7.150	0.008	7.800	0.009	0.001004
7.800	0.009	8.450	0.009	0.000972
8.450	0.009	9.100	0.010	0.000939
9.100	0.010	9.750	0.011	0.000904
9.750	0.011	10.400	0.011	0.000868
10.400	0.011	11.050	0.012	0.000831
11.050	0.012	11.700	0.012	0.000792
11.700	0.012	12.350	0.013	0.000753
12.350	0.013	13.000	0.013	0.000713
13.000	0.013	14.300	0.014	0.000653
14.300	0.014	15.600	0.015	0.000572
15.600	0.015	16.900	0.015	0.000491
16.900	0.015	18.200	0.016	0.000412
18.200	0.016	19.500	0.016	0.000336
19.500	0.016	20.800	0.017	0.000263
20.800	0.017	22.100	0.017	0.000195
22.100	0.017	23.400	0.017	0.000130
23.400	0.017	24.700	0.017	0.000071
24.700	0.017	26.000	0.017	0.000017
26.000	0.017	28.600	0.017	-0.000055

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
13.000	0.000	23	3.28	0.3280
23	2.13	30	4.1	0.2814

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00
2	13.00	1.00

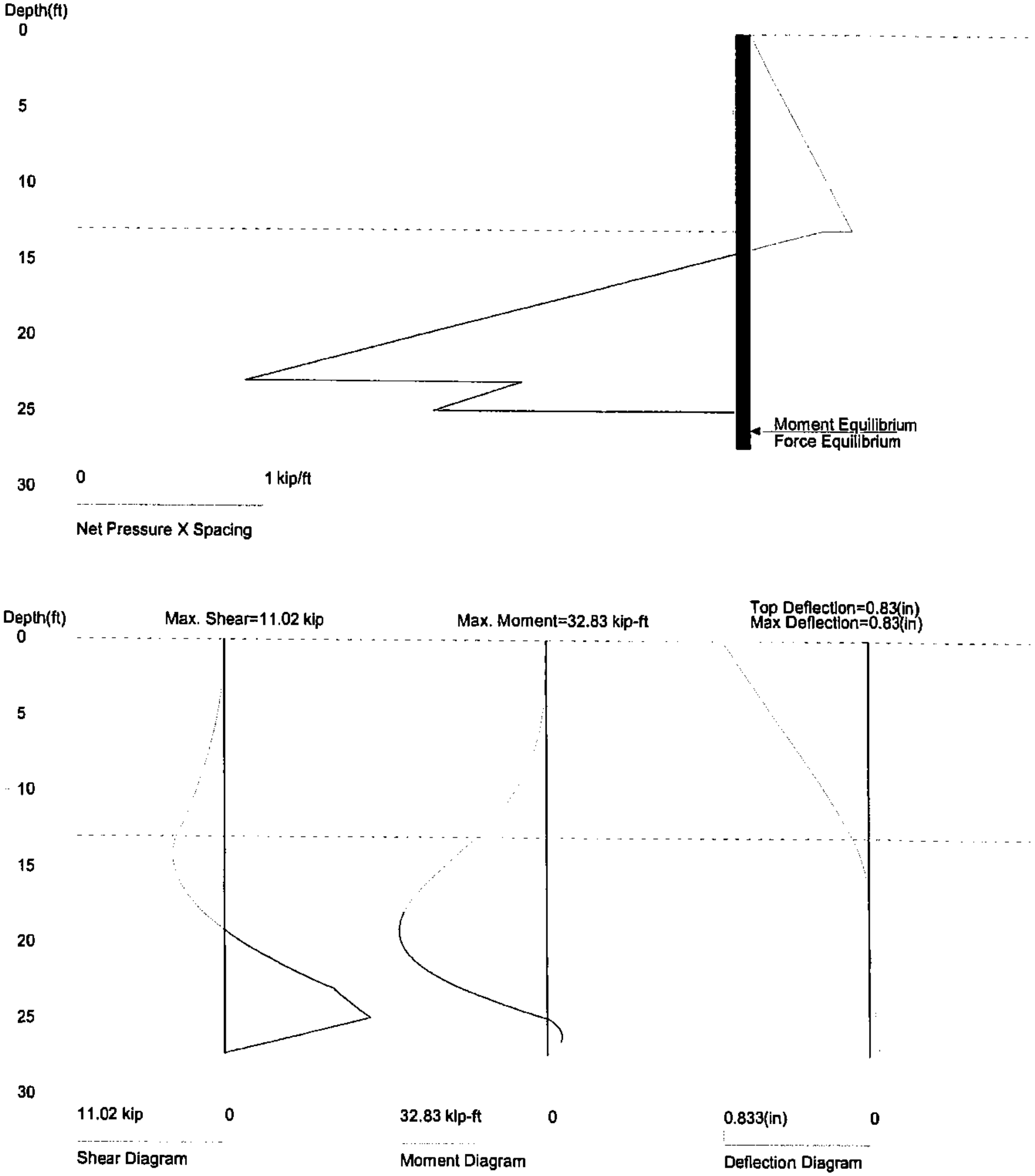
PASSIVE SPACING:

No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

NIPSCO Section D-D

Section D-D



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input Pile, PZ27: E (ksi)=29000.0, I (in4)/foot=184.2

File: C:\work directory\Nipsco work\calcs\earth pressure section d-d.ep8.sh8

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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                    SHORING WALL CALCULATION SUMMARY
           The leading shoring design and calculation software
                  Software Copyright by CivilTech Software
                          www.civiltech.com

*******************************************************************************
ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:
    1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
    2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
    3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
    4. TRENCHING ANO SHORING MANUAL Revision 12, California Department of
       Transportation, January 2000
    6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
    5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
    7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
    8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS:   Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft,
Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in
-------------------------------------------------------------------------------
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Date: 7/20/2012  File: C:\work directory\Nipsco work\calcs\earth pressure section d-d.ep8.sh8

Title: NIPSCO Section D-D
Subtitle: Section D-D

**********************************INPUT DATA***********************************
Wall Type: 1. Sheet Pile
        Wall Height: 13.00
        Pile Diameter: 1.00
        Pile Spacing: 1.00
        Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
        Top Brace Increase (Multi-Bracing): Add 15%*
Embedment Option: 3. Fixed
        Fixed Embedment: 17.00
        Friction at Pile Tip: No
Pile Properties:
        Steel Strength, Fy:  50 ksi = 345 MPa
        Allowable Fb/Fy: 0.66
        Elastic Module, E: 29000.00
        Moment of Inertia, I: 184.20
        User Input Pile: PZ27

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
 No.    Z1 top          Top Pres.       Z2 bottom       Bottom Pres.    Slope
-------------------------------------------------------------------------------
 1      *               Above           Base
 2      0               0.000           13              0.538           0.041385
 3      *               below           base
 4      13              0.372           23              0.522           0.015000
 5      23              0.88            30              1.11            0.032857
 6      *               Sur-            charg
 7      0.000           0.000           0.650           0.001           0.001193
 8      0.650           0.001           1.300           0.002           0.001190
 9      1.300           0.002           1.950           0.002           0.001184
 10     1.950           0.002           2.600           0.003           0.001175
 11     2.600           0.003           3.250           0.004           0.001163
 12     3.250           0.004           3.900           0.005           0.001148
 13     3.900           0.005           4.550           0.005           0.001130
 14     4.550           0.005           5.200           0.006           0.001110
 15     5.200           0.006           5.850           0.007           0.001087
 16     5.850           0.007           6.500           0.007           0.001061
 17     6.500           0.007           7.150           0.008           0.001034
 18     7.150           0.008           7.800           0.009           0.001004
 19     7.800           0.009           8.450           0.009           0.000972
 20     8.450           0.009           9.100           0.010           0.000939
 21     9.100           0.010           9.750           0.011           0.000904
 22     9.750           0.011           10.40           0.011           0.000868
 23     10.40           0.011           11.05           0.012           0.000831
 24     11.05           0.012           11.70           0.012           0.000792
 25     11.70           0.012           12.35           0.013           0.000753
 26     12.35           0.013           13.00           0.013           0.000713
 27     13.00           0.013           14.30           0.014           0.000653
 28     14.30           0.014           15.60           0.015           0.000572
 29     15.60           0.015           16.90           0.015           0.000491
 30     16.90           0.015           18.20           0.016           0.000412
 31     18.20           0.016           19.50           0.016           0.000336
 32     19.50           0.016           20.80           0.017           0.000263
 33     20.80           0.017           22.10           0.017           0.000195
 34     22.10           0.017           23.40           0.017           0.000130
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 35     23.40          0.017          24.70          0.017          0.000071
 36     24.70          0.017          26.00          0.017          0.000017
 37     26.00          0.017          28.60          0.017          -0.00005
 38     28.60          0.017          31.20          0.017          -0.00013
 39     31.20          0.017          33.80          0.016          -0.00019
 40     33.80          0.016          36.40          0.016          -0.00023
 41     36.40          0.016          39.00          0.015          -0.00026
 42     39.00          0.015          41.60          0.014          -0.00028
 43     41.60          0.014          44.20          0.013          -0.00029
 44     44.20          0.013          46.80          0.013          -0.00029
 45     46.80          0.013          49.40          0.012          -0.00029
 46     49.40          0.012          52.00          0.000          -0.00458
---------------------------------------------------------------------------

* PASSIVE PRESSURE *
 No.    Z1 top         Top Pres.      Z2 bottom      Bottom Pres.   Slope
---------------------------------------------------------------------------
 1      *              Below          Base
 2      13.00          0.000          23             3.28           0.3280
 3      23             2.13           30             4.1            0.2814
---------------------------------------------------------------------------

* ACTIVE SPACE *
 No.    Z depth        Spacing
---------------------------------------------------------------------------
 1      0.00           1.00
 2      13.00          1.00
---------------------------------------------------------------------------

* PASSIVE SPACE *
 No.    Z depth        Spacing
---------------------------------------------------------------------------
 1      0.00           1.00
---------------------------------------------------------------------------
*For Tieback:  Input1 = Diameter;  Input2 = Bond Strength
*For Plate:  Input1 = Diameter;  Input2 = Allowable Pressure
*For Deadman:  Input1 = Horz. Width;  Input2 = Allowable Pressure; Angle = 0

********************************CALCULATION*********************************

   The calculated moment and shear are per pile spacing.  Sheet piles are per one foot or meter; Soldier
piles are per pile.

   Top Pressures Start at depth =  0.00

*  CALCULATE REQUEST EMBEDMENT  *
     The Request Embedment, Yend = 14.34
     The user input fixed embedment = 17.0

----------------------------CANTILEVER CASE---------------------
** Approximate Factor of Safety based on fixed embedment, FS = 1.19
Note:
   User input fixed embedment is 17, which is deeper than calculated embedment. Use calculated embedment
= 14.3 for graphics and analysis.

             |      D1=0.00
             |
             |
             |
          ==|==     D2=13.00
             |
             |
             |      D3=27.34

        D1 - TOP DEPTH
        D2 - EXCAVATION BASE
        D3 - PILE TIP (20% increased, see EMBEDMENT Notes below)

   MOMENT BALANCE: M=0.00   AT DEPTH=24.95  WITH EMBEDMENT OF 11.95
   FORCE BALANCE: F=0.00   AT DEPTH=27.34  WITH EMBEDMENT OF 14.34

   The program calculates an embedment for moment equilibrium, then increase the embedment by 20% to
reach force equilibrium.
   A Balance Force=11.08 is developed from depth=24.95 to depth=27.34
   Total Passive Pressure = Total Active Pressure,     OK!

*********************************RESULTS*******************************************

* EMBEDMENT Notes *
Based on USS Design Manual, first calculate embedment for moment equilibrium, then increased by 20 to 40
% to reach force equilibrium.
The embedment for moment equilibrium is 11.95
```

```
* The 20% increased embedment for force equilibrium is 14.34 (Used by Program)
The 30% increased embedment for force equilibrium is 15.54
The 40% increased embedment for force equilibrium is 16.74

Based on AASHTO 2002 Standard Specifications, first calculate embedment for moment equilibrium, then add
safety factor of 30% for temporary shoring; add safety factor of 50% for permanent shoring.
The embedment for moment equilibrium is 11.95
Add 30% embedment for temporary shoring is 15.54
Add 50% embedment for permanent shoring is 17.93

* BASED ON USS DESIGN MANUAL (20% increased), PROGRAM CALCULATED MINIMUM EMBEDMENT = 14.34
TOTAL MINIMUM PILE LENGTH = 27.34

* MOMENT IN PILE (per pile spacing)*
Pile Spacing:  Sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 32.83 at 19.17
Maximum Shear = 11.02
Moment and Shear are per pile spacing: 1.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00


*****************************SPECIFIED PILE ***********************************

   Overall Maximum Moment = 32.83 at 19.17
   The pile selection is based on the magnitude of the moment only. Axial force is neglected.

   Request Min. Section Modulus = 11.94 in3/ft = 641.71 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

   PZ27 has been found in Sheet Pile list!
   PZ27(English):    Sx= 30.20 in3/ft  Ix= 184.20 in4/ft   Weight= 27.00 lb/ft
   PZ27(Metrics):    Sx= 1623.55 cm3/m  Ix= 251.54 x100cm4/m   Weight= 0.394 kN/m

   * Note: All the pile dimensions are in English Units per one foot width.


   PZ27 is capable to support the shoring!
   I (in4)/foot=184.20
   Top deflection = 0.833(in)
   Max. deflection = 0.833(in)

********PRESSURE, LOAD, SHEAR, MOMENT, AND DEFLECTION V.S. DEPTH************

The shear and moment are per single soldier pile (secant/tangent pile) or one foot
of sheet pile (concrete wall). The deflection is based on users input pile below:
        User Input Pile: PZ27
        Elastic Module,  E (ksi)= 29000.00
        Moment of Inertia,  I (in4)/foot= 184.2

        PRESS. - Sum of all pressures (Net pressure). (Active) direction is positive
        LOAD - Liner load (force per unit depth) = Pressures multiply by acting space

        NO      DEPTH   PRESS.  LOAD    SHEAR   MOMENT  DEFLECTION
                ft      ksf     kip/ft  kip     kip-ft  in
        -------------------------------------------------------------
        1       0.00    0.00    0.00    0.00    0.00    0.833
        2       0.03    0.00    0.00    0.00    0.00    0.831
        3       0.07    0.00    0.00    0.00    0.00    0.829
        4       0.10    0.00    0.00    0.00    0.00    0.827
        5       0.14    0.01    0.01    0.00    0.00    0.825
        6       0.17    0.01    0.01    0.00    0.00    0.823
        7       0.21    0.01    0.01    0.00    0.00    0.821
        8       0.24    0.01    0.01    0.00    0.00    0.819
        9       0.27    0.01    0.01    0.00    0.00    0.817
        10      0.31    0.01    0.01    0.00    0.00    0.815
        11      0.34    0.01    0.01    0.00    0.00    0.813
        12      0.38    0.02    0.02    0.00    0.00    0.811
        13      0.41    0.02    0.02    0.00    0.00    0.809
        14      0.45    0.02    0.02    0.00    0.00    0.807
        15      0.48    0.02    0.02    0.00    0.00    0.804
        16      0.51    0.02    0.02    0.01    0.00    0.802
        17      0.55    0.02    0.02    0.01    0.00    0.800
        18      0.58    0.02    0.02    0.01    0.00    0.798
        19      0.62    0.03    0.03    0.01    0.00    0.796
        20      0.65    0.03    0.03    0.01    0.00    0.794
        21      0.68    0.03    0.03    0.01    0.00    0.792
        22      0.72    0.03    0.03    0.01    0.00    0.790
        23      0.75    0.03    0.03    0.01    0.00    0.788
        24      0.79    0.03    0.03    0.01    0.00    0.786
        25      0.82    0.04    0.04    0.01    0.00    0.784
        26      0.86    0.04    0.04    0.02    0.00    0.782
```

```
27          0.89      0.04      0.04      0.02      0.01      0.780
28          0.92      0.04      0.04      0.02      0.01      0.778
29          0.96      0.04      0.04      0.02      0.01      0.776
30          0.99      0.04      0.04      0.02      0.01      0.774
31          1.03      0.04      0.04      0.02      0.01      0.771
32          1.06      0.05      0.05      0.02      0.01      0.769
33          1.10      0.05      0.05      0.03      0.01      0.767
34          1.13      0.05      0.05      0.03      0.01      0.765
35          1.16      0.05      0.05      0.03      0.01      0.763
36          1.20      0.05      0.05      0.03      0.01      0.761
37          1.23      0.05      0.05      0.03      0.01      0.759
38          1.27      0.05      0.05      0.03      0.01      0.757
39          1.30      0.06      0.06      0.04      0.02      0.755
40          1.34      0.06      0.06      0.04      0.02      0.753
41          1.37      0.06      0.06      0.04      0.02      0.751
42          1.40      0.06      0.06      0.04      0.02      0.749
43          1.44      0.06      0.06      0.04      0.02      0.747
44          1.47      0.06      0.06      0.05      0.02      0.745
45          1.51      0.06      0.06      0.05      0.02      0.743
46          1.54      0.07      0.07      0.05      0.03      0.741
47          1.57      0.07      0.07      0.05      0.03      0.738
48          1.61      0.07      0.07      0.06      0.03      0.736
49          1.64      0.07      0.07      0.06      0.03      0.734
50          1.68      0.07      0.07      0.06      0.03      0.732
51          1.71      0.07      0.07      0.06      0.04      0.730
52          1.75      0.07      0.07      0.07      0.04      0.728
53          1.78      0.08      0.08      0.07      0.04      0.726
54          1.81      0.08      0.08      0.07      0.04      0.724
55          1.85      0.08      0.08      0.07      0.05      0.722
56          1.88      0.08      0.08      0.08      0.05      0.720
57          1.92      0.08      0.08      0.08      0.05      0.718
58          1.95      0.08      0.08      0.08      0.05      0.716
59          1.99      0.08      0.08      0.08      0.06      0.714
60          2.02      0.09      0.09      0.09      0.06      0.712
61          2.05      0.09      0.09      0.09      0.06      0.710
62          2.09      0.09      0.09      0.09      0.06      0.708
63          2.12      0.09      0.09      0.10      0.07      0.705
64          2.16      0.09      0.09      0.10      0.07      0.703
65          2.19      0.09      0.09      0.10      0.07      0.701
66          2.23      0.09      0.09      0.11      0.08      0.699
67          2.26      0.10      0.10      0.11      0.08      0.697
68          2.29      0.10      0.10      0.11      0.09      0.695
69          2.33      0.10      0.10      0.12      0.09      0.693
70          2.36      0.10      0.10      0.12      0.09      0.691
71          2.40      0.10      0.10      0.12      0.10      0.689
72          2.43      0.10      0.10      0.13      0.10      0.687
73          2.47      0.10      0.10      0.13      0.11      0.685
74          2.50      0.11      0.11      0.13      0.11      0.683
75          2.53      0.11      0.11      0.14      0.12      0.681
76          2.57      0.11      0.11      0.14      0.12      0.679
77          2.60      0.11      0.11      0.14      0.13      0.677
78          2.64      0.11      0.11      0.15      0.13      0.675
79          2.67      0.11      0.11      0.15      0.14      0.672
80          2.70      0.12      0.12      0.16      0.14      0.670
81          2.74      0.12      0.12      0.16      0.15      0.668
82          2.77      0.12      0.12      0.16      0.15      0.666
83          2.81      0.12      0.12      0.17      0.16      0.664
84          2.84      0.12      0.12      0.17      0.16      0.662
85          2.88      0.12      0.12      0.18      0.17      0.660
86          2.91      0.12      0.12      0.18      0.18      0.658
87          2.94      0.13      0.13      0.18      0.18      0.656
88          2.98      0.13      0.13      0.19      0.19      0.654
89          3.01      0.13      0.13      0.19      0.19      0.652
90          3.05      0.13      0.13      0.20      0.20      0.650
91          3.08      0.13      0.13      0.20      0.21      0.648
92          3.12      0.13      0.13      0.21      0.22      0.646
93          3.15      0.13      0.13      0.21      0.22      0.644
94          3.18      0.14      0.14      0.22      0.23      0.642
95          3.22      0.14      0.14      0.22      0.24      0.640
96          3.25      0.14      0.14      0.23      0.24      0.637
97          3.29      0.14      0.14      0.23      0.25      0.635
98          3.32      0.14      0.14      0.23      0.26      0.633
99          3.36      0.14      0.14      0.24      0.27      0.631
100         3.39      0.14      0.14      0.24      0.28      0.629
101         3.42      0.15      0.15      0.25      0.29      0.627
102         3.46      0.15      0.15      0.25      0.29      0.625
103         3.49      0.15      0.15      0.26      0.30      0.623
104         3.53      0.15      0.15      0.26      0.31      0.621
105         3.56      0.15      0.15      0.27      0.32      0.619
106         3.59      0.15      0.15      0.28      0.33      0.617
107         3.63      0.15      0.15      0.28      0.34      0.615
108         3.66      0.16      0.16      0.29      0.35      0.613
109         3.70      0.16      0.16      0.29      0.36      0.611
110         3.73      0.16      0.16      0.30      0.37      0.609
```

Golder Associates

SUBJECT Section B-B Pond 2 - Secondary

Job No. 12388898

Ref.

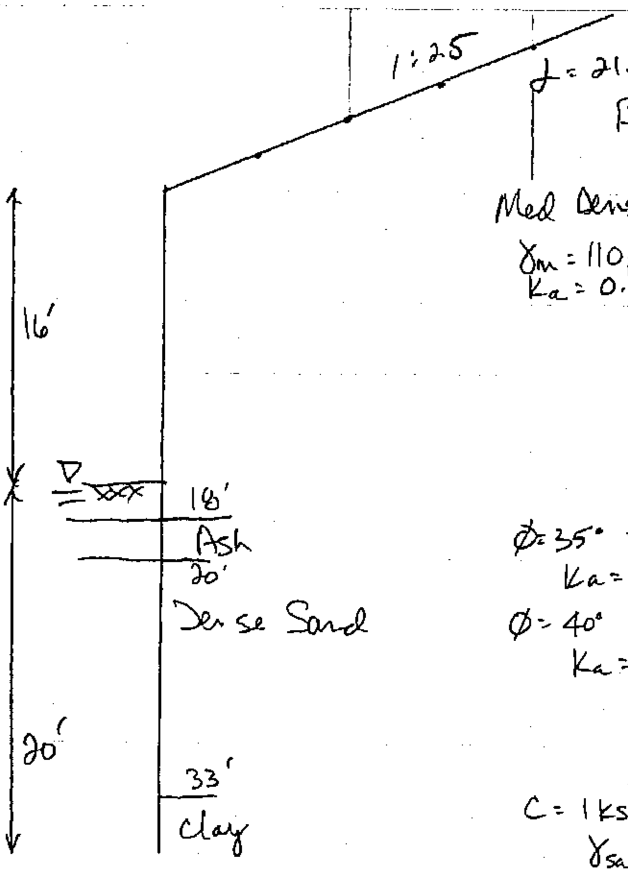
Made by WB

Checked JRR

Reviewed

Date 20 July 12

Sheet of



∠ = 21.8°

β = 90° Wall ∠

Med Dense Sand Ø = 33°

γ_m = 110pcf δ = 10° Wall Fric ∠

Ka = 0.376 γ_{eff} = 47.6pcf

Kp = 4.8

kp = 5.3

Ø = 35° γ_{sat} = 110 pcf δ = 10°

Ka = 0.33 γ_{eff} = 47.6pcf

Ø = 40° γ_{sat} = 120 pcf δ = 10°

Ka = 0.26 γ_{eff} = 57.6pcf

Kp = 6.9

Kp = 4.1

C = 1ksf - use ϕ = 30°

γ_{sat} = 136pcf γ_{eff} = 73.6pcf

Ka = 0.44

P_{p1} → 2'·47.6·4.8 → 0.457ksf

P_{p2} → 0.5 → 2'·47.6·5.3 → 1.0ksf

P_{p3} → 1.3 → 13'·57.6·6.9 → 6.4ksf

P_{p4} → 3.85 → 3'·73.6·4.1 → 4.76ksf

P_{a1} → 16'·110·0.376 + 2'·47.6·0.376

→ 0.662ksf 0.036 → 0.698ksf

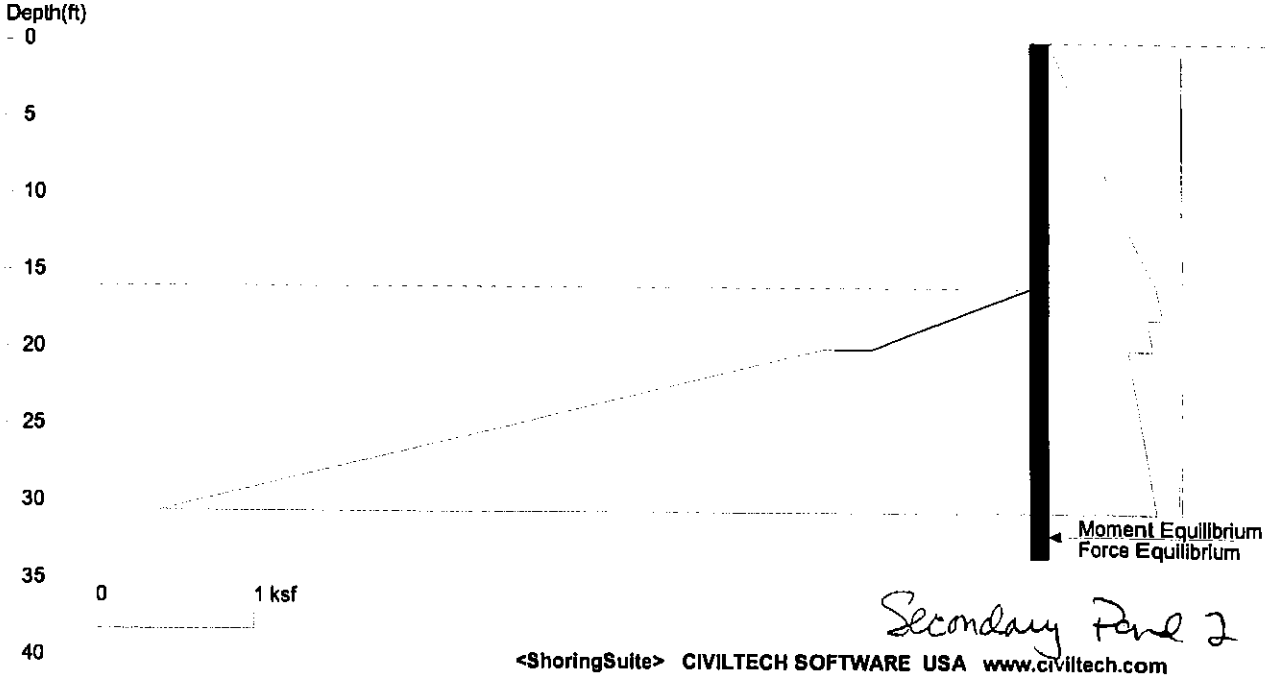
P_{a2} → 0.612 → 2'·47.6 0.33 → 0.643 ksf

P_{a3} → 0.507 → 13'·57.6·0.26 → 0.702 ksf

P_a → 1.19 → 3'·73.6·0.44 → 1.29ksf

NIPSCO secondary ponds

Section B - B



Secondary Pond 2

<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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File: C:\work directory\Nipsco work\calcs\section b-b.sh8

Wall Height=16.0 Pile Diameter=1.0 Pile Spacing=1.0 Wall Type: 1. Sheet Pile

PILE LENGTH: Min. Embedment=17.51 Min. Pile Length=33.51 (in graphics and analysis)
User inputted Embedment=20.00, Pile Length=36.00
MOMENT IN PILE: Max. Moment=67.71 per Pile Spacing=1.0 at Depth=24.01

SYSTEM FACTOR OF SAFETY (Approximate)=1.14
The request embedment is 17.5, the user input fixed embedment = 20.

PILE SELECTION:
Request Min. Section Modulus = 24.6 in3/ft=1323.65 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
PZ27 has Section Modulus = 30.2 in3/ft=1623.55 cm3/m. It is greater than Min. Requirements! OK
Top Deflection = 2.21(in) based on E (ksi)=29000.00 and I (in4)/foot=184.2

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
*	Above	Base		
0.000	0.000	16	0.662	0.041375
*	below	base		
16	0.662	18	0.698	0.018000
18	0.612	20	0.643	0.015500
20	0.507	33	0.702	0.015000
33	1.19	36	1.29	0.033333
*	Sur-	charge		
0.000	0.000	0.800	0.001	0.001193
0.800	0.001	1.600	0.002	0.001188
1.600	0.002	2.400	0.003	0.001179
2.400	0.003	3.200	0.004	0.001165
3.200	0.004	4.000	0.005	0.001147
4.000	0.005	4.800	0.006	0.001125

4.800	0.006	5.600	0.006	0.001098
5.600	0.006	6.400	0.007	0.001068
6.400	0.007	7.200	0.008	0.001035
7.200	0.008	8.000	0.009	0.000998
8.000	0.009	8.800	0.010	0.000959
8.800	0.010	9.600	0.010	0.000917
9.600	0.010	10.400	0.011	0.000872
10.400	0.011	11.200	0.012	0.000826
11.200	0.012	12.000	0.012	0.000779
12.000	0.012	12.800	0.013	0.000730
12.800	0.013	13.600	0.014	0.000681
13.600	0.014	14.400	0.014	0.000631
14.400	0.014	15.200	0.015	0.000581
15.200	0.015	16.000	0.015	0.000531
16.000	0.015	17.600	0.016	0.000458
17.600	0.016	19.200	0.016	0.000362
19.200	0.016	20.800	0.017	0.000272
20.800	0.017	22.400	0.017	0.000187
22.400	0.017	24.000	0.017	0.000109
24.000	0.017	25.600	0.017	0.000039
25.600	0.017	27.200	0.017	-0.000024
27.200	0.017	28.800	0.017	-0.000078
28.800	0.017	30.400	0.017	-0.000126
30.400	0.017	32.000	0.017	-0.000166
32.000	0.017	35.200	0.016	-0.000213

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
*	Below	Base		
16.000	0.000	18.000	0.5	0.2500
18.000	0.5	20.000	1.0	0.2500
20.000	1.3	33	6.4	0.3923
33	3.85	36	4.76	0.3033

ACTIVE SPACING:

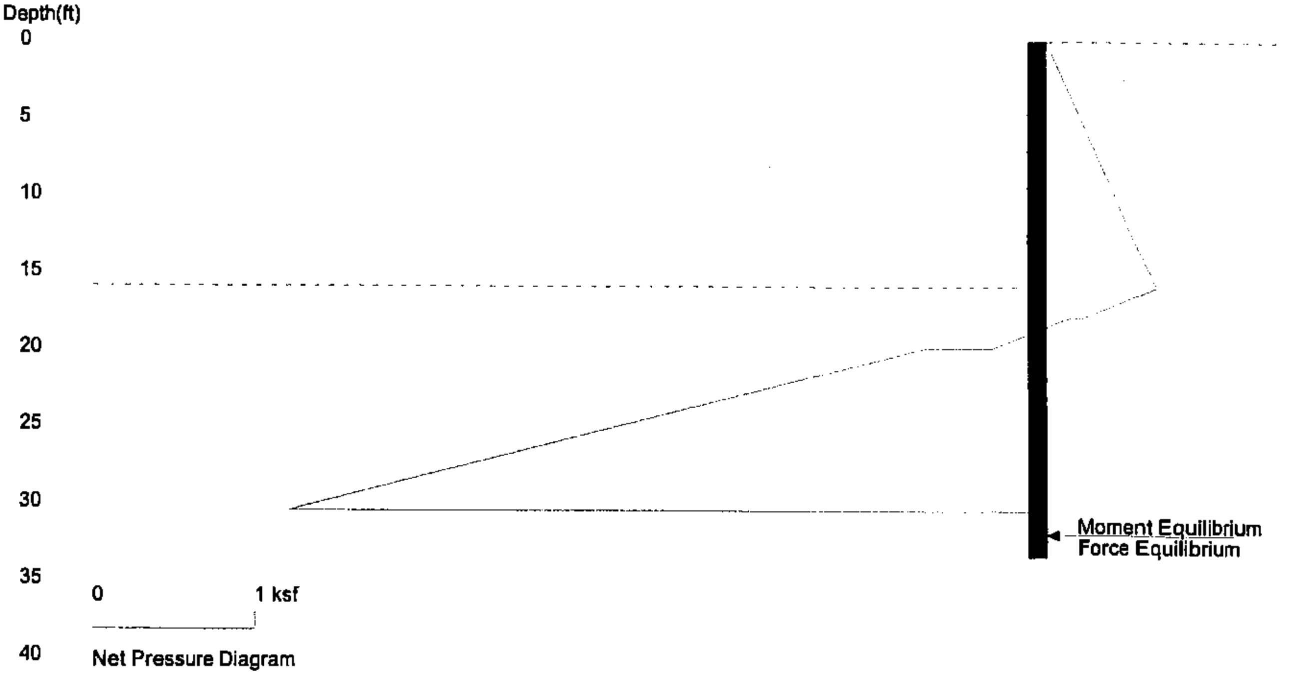
No.	Z depth	Spacing
1	0.00	1.00
2	16.00	1.00

PASSIVE SPACING:

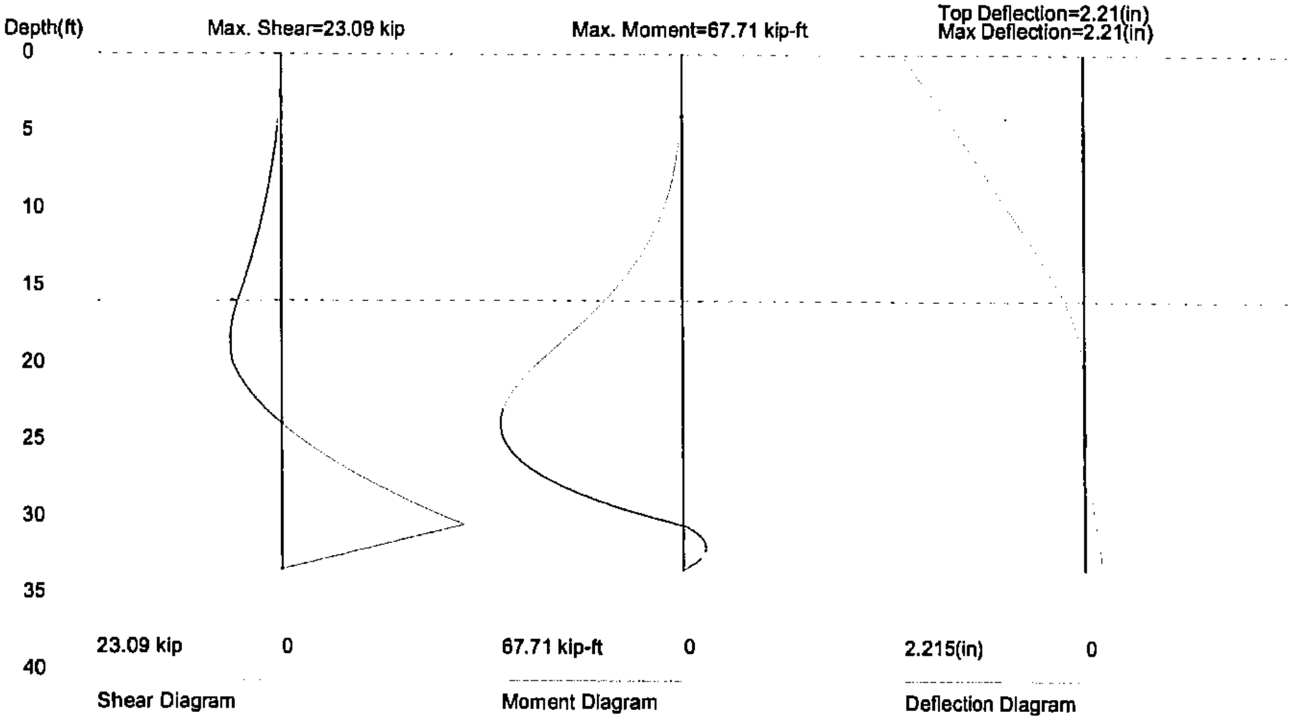
No.	Z depth	Spacing
1	0.00	1.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

NIPSCO secondary ponds
Section B - B



Net Pressure Diagram



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 1.0 foot or meter

User Input Pile, pz27: E (ksi)=29000.0, I (in4)/foot=184.2

File: C:\work directory\Nipsco work\calcs\section b-b.sh8

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********************************************************************************

                            SHORING WALL CALCULATION SUMMARY
                 The leading shoring design and calculation software
                       Software Copyright by CivilTech Software
                             www.civiltech.com

********************************************************************************
ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
The calculation method is based on the following references:
    1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
    2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
    3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
    4. TRENCHING AND SHORING MANUAL Revision 12, California Department of
       Transportation, January 2000
    6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
    5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
    7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002
    8. AASHTO HB-17, American Association of State and Highway Transportation Officials, 2 September 2002

UNITS:   Width/Spacing/Diameter/Length/Depth - ft, Force - kip, Moment - kip-ft,
Friction/Bearing/Pressure - ksf, Pres. Slope - kip/ft3, Deflection - in
--------------------------------------------------------------------------------
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Date: 7/20/2012  File: C:\work directory\Nipsco work\calcs\section b-b.sh8

Title: NIPSCO secondary ponds
Subtitle: Section B - B

*********************************INPUT DATA*************************************
Wall Type: 1. Sheet Pile
        Wall Height: 16.00
        Pile Diameter: 1.00
        Pile Spacing: 1.00
        Factor of Safety (F.S.): 1.00
Lateral Support Type (Braces): 1. No
        Top Brace Increase (Multi-Bracing): Add 15%*
Embedment Option: 3. Fixed
        Fixed Embedment: 20.00
        Friction at Pile Tip: No
Pile Properties:
        Steel Strength, Fy:  50 ksi = 345 MPa
        Allowable Fb/Fy: 0.66
        Elastic Module, E: 29000.00
        Moment of Inertia, I: 184.20
        User Input Pile: pz27

* DRIVING PRESSURE (ACTIVE, WATER, & SURCHARGE) *
 No.    Z1 top          Top Pres.        Z2 bottom       Bottom Pres.    Slope
--------------------------------------------------------------------------------
 1      *               Above            Base
 2      0.000           0.000            16              0.662           0.041375
 3      *               below            base
 4      16              0.662            18              0.698           0.018000
 5      18              0.612            20              0.643           0.015500
 6      20              0.507            33              0.702           0.015000
 7      33              1.19             36              1.29            0.033333
 8      *               Sur-             charge
 9      0.000           0.000            0.800           0.001           0.001193
 10     0.800           0.001            1.600           0.002           0.001188
 11     1.600           0.002            2.400           0.003           0.001179
 12     2.400           0.003            3.200           0.004           0.001165
 13     3.200           0.004            4.000           0.005           0.001147
 14     4.000           0.005            4.800           0.006           0.001125
 15     4.800           0.006            5.600           0.006           0.001098
 16     5.600           0.006            6.400           0.007           0.001068
 17     6.400           0.007            7.200           0.008           0.001035
 18     7.200           0.008            8.000           0.009           0.000998
 19     8.000           0.009            8.800           0.010           0.000959
 20     8.800           0.010            9.600           0.010           0.000917
 21     9.600           0.010            10.400          0.011           0.000872
 22     10.400          0.011            11.200          0.012           0.000826
 23     11.200          0.012            12.000          0.012           0.000779
 24     12.000          0.012            12.800          0.013           0.000730
 25     12.800          0.013            13.600          0.014           0.000681
 26     13.600          0.014            14.400          0.014           0.000631
 27     14.400          0.014            15.200          0.015           0.000581
 28     15.200          0.015            16.000          0.015           0.000531
 29     16.000          0.015            17.600          0.016           0.000458
 30     17.600          0.016            19.200          0.016           0.000362
 31     19.200          0.016            20.800          0.017           0.000272
 32     20.800          0.017            22.400          0.017           0.000187
 33     22.400          0.017            24.000          0.017           0.000109
 34     24.000          0.017            25.600          0.017           0.000039
```

```
35      25.600          0.017           27.200          0.017           -0.000024
36      27.200          0.017           28.800          0.017           -0.000078
37      28.800          0.017           30.400          0.017           -0.000126
38      30.400          0.017           32.000          0.017           -0.000166
39      32.000          0.017           35.200          0.016           -0.000213
40      35.200          0.016           38.400          0.015           -0.000257
41      38.400          0.015           41.600          0.014           -0.000283
42      41.600          0.014           44.800          0.013           -0.000293
43      44.800          0.013           48.000          0.012           -0.000293
44      48.000          0.012           51.200          0.011           -0.000286
45      51.200          0.011           54.400          0.011           -0.000274
46      54.400          0.011           57.600          0.010           -0.000258
47      57.600          0.010           60.800          0.009           -0.000241
48      60.800          0.009           64.000          0.000           -0.002794
----------------------------------------------------------------------------

* PASSIVE PRESSURE *
 No.    Z1 top          Top Pres.       Z2 bottom       Bottom Pres.    Slope
----------------------------------------------------------------------------
 1      *               Below           Base
 2      16.000          0.000           18.000          0.5             0.2500
 3      18.000          0.5             20.000          1.0             0.2500
 4      20.000          1.3             33              6.4             0.3923
 5      33              3.85            36              4.76            0.3033
----------------------------------------------------------------------------

* ACTIVE SPACE *
 No.    Z depth         Spacing
----------------------------------------------------------------------------
 1      0.00            1.00
 2      16.00           1.00
----------------------------------------------------------------------------

* PASSIVE SPACE *
 No.    Z depth         Spacing
----------------------------------------------------------------------------
 1      0.00            1.00
----------------------------------------------------------------------------
*For Tieback:  Input1 = Diameter;  Input2 = Bond Strength
*For Plate:  Input1 = Diameter;  Input2 = Allowable Pressure
*For Deadman:  Input1 = Horz. Width;  Input2 = Allowable Pressure; Angle = 0


********************************CALCULATION*********************************

   The calculated moment and shear are per pile spacing.  Sheet piles are per one foot or meter; Soldier
piles are per pile.

   Top Pressures start at depth =  0.00

*  CALCULATE REQUEST EMBEDMENT  *
     The Request Embedment, Yend = 17.51
     The user input fixed embedment = 20.0

---------------------------CANTILEVER CASE----------------------
** Approximate Factor of Safety based on fixed embedment, FS = 1.14
Note:
   User input fixed embedment is 20, which is deeper than calculated embedment. Use calculated embedment
= 17.5 for graphics and analysis.

          |      D1=0.00
          |
          |
          |
        ==|==    D2=16.00
          |
          |
          |      D3=33.51

          D1 - TOP DEPTH
          D2 - EXCAVATION BASE
          D3 - PILE TIP (20% increased, see EMBEDMENT Notes below)

   MOMENT BALANCE: M=0.00   AT DEPTH=30.59  WITH EMBEDMENT OF 14.59
   FORCE BALANCE: F=0.00   AT DEPTH=33.51  WITH EMBEDMENT OF 17.51

   The program calculates an embedment for moment equilibrium, then increase the embedment by 20% to
reach force equilibrium.
   A Balance Force=23.38 is developed from depth=30.59 to depth=33.51
   Total Passive Pressure = Total Active Pressure,     OK!


*********************************RESULTS*********************************
```

```
* EMBEDMENT Notes *
Based on USS Design Manual, first calculate embedment for moment equilibrium, then increased by 20 to 40
% to reach force equilibrium.
The embedment for moment equilibrium is 14.59
* The 20% increased embedment for force equilibrium is 17.51 (Used by Program)
The 30% increased embedment for force equilibrium is 18.97
The 40% increased embedment for force equilibrium is 20.43

Based on AASHTO 2002 Standard Specifications, first calculate embedment for moment equilibrium, then add
safety factor of 30% for temporary shoring; add safety factor of 50% for permanent shoring.
The embedment for moment equilibrium is 14.59
Add 30% embedment for temporary shoring is 18.97
Add 50% embedment for permanent shoring is 21.89

* BASED ON USS DESIGN MANUAL (20% increased), PROGRAM CALCULATED MINIMUM EMBEDMENT = 17.51
TOTAL MINIMUM PILE LENGTH = 33.51

* MOMENT IN PILE (per pile spacing)*
Pile Spacing:  sheet piles are one foot or one meter; soldier piles are one pile.
Overall Maximum Moment = 67.71 at 24.01
Maximum Shear = 23.09
Moment and Shear are per pile spacing: 1.0 foot or meter

* VERTICAL LOADING *
Vertical Loading from Braces = 0.00
Vertical Loading from External Load = 0.00
Total Vertical Loading = 0.00


*****************************SPECIFIED PILE ************************************

   Overall Maximum Moment = 67.71 at 24.01
   The pile selection is based on the magnitude of the moment only. Axial force is neglected.

   Request Min. Section Modulus = 24.62 in3/ft = 1323.65 cm3/m, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

   PZ27 has been found in Sheet Pile list!
   PZ27(English):     Sx= 30.20 in3/ft  Ix= 184.20 in4/ft   Weight= 27.00 lb/ft
   PZ27(Metrics):     Sx= 1623.55 cm3/m  Ix= 251.54 x100cm4/m   Weight= 0.394 kN/m

   * Note: All the pile dimensions are in English Units per one foot width.


   PZ27 is capable to support the shoring!
   I (in4)/foot=184.20
   Top deflection = 2.215(in)
   Max. deflection = 2.215(in)
```

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Appendix G

References

NIPSCO –MICHIGAN CITY GENERATING STATION
REFERENCE LIST

1. NPDES Permit No. IN0000116 issued to NIPSCO Michigan City Generating Station, dated March 15, 2011.

2. October 4, 2010 response by NIPSCO to EPA (5306P) Request for Information regarding the Michigan City Generating Station.

3. May 8, 2012 memorandum from EPA to GZA regarding EPA Comments on Northern Indiana Pub Serv Co – Michigan City Generating Station, Michigan City, IN, Round 10 Draft Assessment Report

4. July 31, 2012 response by NIPSCO to EPA regarding NIPSCO's review of the March 29, 2012 Draft Report.

5. August 27, 2012 Technical Memorandum and Calculations by Golder Associates, Inc. entitled *FINAL REPORT – SUMMARY OF HYDRAULIC EVALUATION OF IMPOUNDMENTS* for the Michigan City Generating Station.

6. August 27, 2012 Technical Report by Golder Associates, Inc. entitled *2012 GEOTECHNICAL INVESTIGATION AND EMBANKMENT STABILITY ANALYSES, NIPSCO Michigan City Generating Station, Michigan City, Indiana*.