NSP SHERBURNE COUNTY GENERATING PLANT

BOTTOM ASH POND REVISIONS

BECKER, MINNESOTA

LABORATORY #9-1357

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN. 55114
PHONE 612/645-3601

CHARLES W. BRITZIUS, P.E.
Chairman of the Board
NORMAN E. HENNING, P.E.
President
CLINTON R. EUE
Executive Vice-President
Treasurer
ALBERT C. HOLLER, F.A.I.C.
Vice-President Chemistry

December 22, 1982

Northern States Power Company
Attn: Roger B Anderson
414 Nicollet Mall
7th Floor - Plant Eng & Const
Minneapolis, MN 55401

Gentlemen:

Subj: NSP Sherburne County Generating Plant
Bottom Ash Pond Revisions
Becker, Minnesota
Laboratory #9-1357

We have completed our testing work for the Bottom Ash Pond Revisions. Our final report is attached. Copies of the report are being sent as noted below. This work was performed under your Purchase Order #A82926CT.

We appreciate having had the opportunity to work with you on this project. If you have any questions, please contact us.

Very truly yours,

Dale Britzius

Dale Britzius,
Civil Engineer

Thomas B Flick

Thomas B Flick, P.E.
Manager, Soils & Geology Dept

DB/TBF/fm
cc: 1-Black & Veatch Consulting Eng
Attn: Larry Almaleh

OBSERVATIONS AND TEST PROGRAM

BOTTOM ASH POND REVISION

SHERBURNE COUNTY GENERATING PLANT

BECKER, MINNESOTA

LABORATORY #9-1357

INTRODUCTION

This report concerns the observations and testing we performed during the recent revisions to the bottom ash pond at Northern States Power Company's Sherburne County Generating Plant in Becker, Minnesota. Our work was performed in accordance with your Purchase Order No A82926CT.

The scope of our recent involvement consisted of:

1. Performing field observations at the borrow area and laboratory testing to judge if the imported cohesive fill materials were in compliance with the project specifications.

2. Performing field observations and compaction testing to document that the embankment and clay core fill materials were placed in accordance with the project specifications.

3. Performing laboratory testing to determine the permeability of undisturbed samples removed from the compacted clay core.

4. Performing laboratory testing to determine if the Type I filter material was in compliance with the project specifications.

PROJECT INFORMATION

The recent construction consisted of completing the northeast portion of the dike around the existing bottom ash pond. This portion of the dike was originally left at a lower elevation than the remainder of the dike around the pond. Final top of dike elevation in this area will be at elevation 1000'. The lowest portion of the existing dike was approximately elevation 975' prior to the start of the recent construction.

The central core of the dike extension will consist of an impervious clay core having a minimum thickness of 10'. The project specifications require that the material used to construct the clay core consist of a material classified as either a CL, CL-SC or an SC-CL. The cohesive material is to be compacted to at least 90% of ASTM:D1557 (Modified Proctor). The moisture content of the cohesive fill at the time of placement must be in the range of 0-5% over optimum moisture content. The clay is to be obtained from an off-site borrow source designated by Northern States Power Company.

The remainder of the dike is to consist primarily of on-site granular fill materials. These sand fill materials are to be compacted to at least 95% of ASTM:D1557 (Modified Proctor).

There is an existing filter blanket present beneath the outer half of the existing dike. Since the revisions in the northeast portion of the dike will include increasing the width of the dike base, the filter blanket will also be extended outward to the toe of the new embankment. The filter blanket material is to consist of Type I material with a minimum thickness of 1 1/2'. The filter material present at the very toe of the embankment is to consist of Type II filter material.

Parallel to the toe of the new embankment, a drainage ditch is to be constructed. This ditch is to be lined with an 18" impervious blanket consisting of material similar to that used for the clay core, although an SC material could also be used in this area. The impervious blanket in the drainage ditch is to be compacted to at least 100% of the Modified Proctor density.

OBSERVATION METHODS AND RESULTS

Initial Preparation

Between August 13 and October 15, 1982, we were present at the site on a full-time basis to observe and monitor construction operations during the dike revision. Initially, we documented that the contractor removed all surficial vegetation from the embankment, and also all granular materials and the remains of a roadway from above the existing impervious clay core. The surface of the existing clay core was subsequently scarified and re-compacted using a large sheepsfoot compactor. Listed below are the elevations at which the impervious clay core was exposed at representative locations prior to the start of recent fill placement:

Location	Top of Existing Clay Core
East dike-coordinate 865, 700	Elevation 985'
East dike-coordinate 865, 600	Elevation 993'
East dike-coordinate 865, 800	Elevation 974'
North dike-coordinate 2, 028, 900	Elevation 978'
North dike-coordinate 2, 028, 800	Elevation 984'
North dike-coordinate 2, 028, 700	Elevation 991'

After completion of the preparatory operations, we observed that the width of the existing clay core was approximately 13' to 15'. The existing core was generally centered along the centerline of the dike. However, on the east dike near coordinate 865, 700, the existing clay core was off-set about 3 1/2' east from the centerline of the dike.

Cohesive Fill Importation

The contractor elected to import and construct an on-site stockpile of the clay fill material needed for the impervious clay core early in the job. During excavation of cohesive material, we provided an engineer at the borrow pit to visually and manually classify the soil and provide judgements regarding the material's suitability. Those materials classified as either CL, SC-CL, or CL-SC were approved for importation to the site.

OBSERVATION METHODS AND RESULTS
(Cont.)

To assist NSP's field engineers in their determination of material quantities, we performed random field density tests of the undisturbed clay borrow materials. The densities averaged 100 pcf. In addition, we performed field density tests in the materials stockpiled at the project site to obtain data regarding the field density in a loose stockpiled condition, similar to the density the soil would have in a truck. The densities of the material in the loose condition averaged 77 pcf. We have attached a data sheet summarizing our field density tests in the borrow and stockpile areas.

Impervious Core Construction

During placement of the cohesive fill materials within the impervious core, we performed observations and documented that no granular fill materials became trapped within the new clay core. We also documented that those portions of the cohesive fill which became unacceptably dry were removed from the core area prior to placement of the succeeding lifts of cohesive fill. We observed that the cohesive fill was placed in maximum 8" thick layers, and that a large sheepsfoot compactor was utilized to thoroughly compact these materials prior to placement of additional fill. We documented that the width of the new core was at least 10'-12'.

During compaction of the cohesive fill materials, a series of field density tests were performed. These tests were performed at about 2' vertical intervals at representative locations within the new construction. The tests were performed utilizing the sand cone method, and the field density results were evaluated on the basis of ASTM:D1557 (Modified Proctor). Attached to this report are data sheets regarding each of the field compaction tests, as well as summary sheets including pertinent information about these density tests.

Based on the results of our recent testing, it is our opinion the clay core fill materials were placed and compacted in compliance with the project specifications.

OBSERVATION METHODS AND RESULTS
(Cont.)

Embankment Fill Construction

We were also present at the site on a full-time basis during the compaction and placement of the embankment fill materials adjacent to the clay core. Prior to fill placement, we observed that all surficial vegetation was removed from the existing embankments, and that the exposed granular materials were surface compacted. The existing embankment consisted primarily of sands and silty sands which would be classified as either SM or SP-SM. During placement of the new fill materials, we documented that the exisitng embankment face was terraced so that the new fill materials could be placed in relatively horizontal lifts.

During placement of the embankment fill materials, we performed a series of field density tests to document the effectiveness of the compaction procedures. Again, the compaction tests were evaluated on the basis of ASTM:D1557. Most of the on-site sands were very dry. It was necessary for the contractor to wet down these soils prior to compacting them in order to obtain the specified density.

Data sheets regarding each of the field density tests as well as a summary sheet indicating pertinent information regarding our tests of the granular embankment fill materials are attached. Based on this data, it is our opinion the embankment fill materials were placed and compacted in general compliance with the project specifications.

Permeability Testing

During placement and compaction of the impervious clay core, we obtained four undisturbed samples of the compacted cohesive fill materials. As indicated by the project specifications, two of these undisturbed samples were obtained after approximately 15% of the cohesive fill material had been placed. The remaining two samples were obtained after approximately 80-85% of the fill materials had been placed. The remaining two samples were obtained in accordance with ASTM procedure D1587. The 3" diameter thinwall tube samples were

OBSERVATION METHODS AND RESULTS
(Cont.)

then submitted to the laboratory, where they were extruded, and subjected to Falling Head permeability tests.

The samples were subjected to a maximum test head of 10', with a confining pressure 2 psi greater than the test head. In addition, the density and plasticity index of each of the samples were determined in the laboratory. The laboratory test results are indicated on the attached data sheet.

A review of the data suggests the permeability rates vary from 10^{-6} to about 10^{-8} cm/sec. The initial two samples, which consisted of CL type material, had permeability rates of 10^{-8} range. The final tube samples, obtained from the upper portions of the clay core, consisted of a mixture of sandy clay and clayey sand. The permeability of this material was considerably faster, in the range of 10^{-6}.

Filter Blanket Material

During our involvement, we also observed that the existing filter blanket beneath the outer portions of the existing embankment was extended to the toe of the new embankment prior to the placement of the embankment fill materials. The results of our laboratory gradation indicated the filter material was in compliance with the specified Type I material.

Drainage Ditch Line

At the time of our involvement terminated this fall, the drainage ditch at the toe of the embankment had not been completed and the Type II filter materials had not been placed in the specified area near the toe of the new embankment. We have observed the cohesive fill materials imported into the drainage ditch area, and it is our opinion these materials comply with the project specifications. Based on our recent conversations with Roger Anderson of NSP, we understand that no additional testing will be required in this area.

COMPACTION TESTS

CLAY CORE

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-1	C-2	C-3	C-4
DATE TAKEN:	August 17, 1982	August 17, 1982	August 17, 1982	August 17, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, trace of gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2
LOCATION:	East dike, existing clay core, coordinate N 866,120	East dike, existing clay core, coordinate N 866,000	East dike, existing clay core, coordinate N 865,800	North dike, existing clay core, coordinate E 2,028,810
ELEVATION OF TEST:	976'	973'	974'	984'
DEPTH BELOW EXISTING GRADE:	6"	6"	6"	6"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	119	124	124
Moisture Content	(%)	11.1	14.3	11.7	11.1
Plus #4 Material	(%)	5	9	5	8

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	126.0	126.0	126.0	126.0
Optimum Moisture	(%)	11.3	11.3	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	91	94.5	99	99
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Jones

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-5	C-6	C-7
DATE TAKEN:	August 18, 1982	August 18, 1982	August 18, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, a little gravel, brown (SC-CL)-2	Sandy clay, trace of gravel, brown (SC-CL)-2
LOCATION:	East dike, clay core, coordinate N 866,100	East dike, clay core, coordinate N 866,000	East dike, clay core, coordinate N 865,850
ELEVATION OF TEST:	977.5'	975'	975.5'
DEPTH BELOW EXISTING GRADE:	6"	6"	6"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density	(pcf)	115	115	115
Moisture Content	(%)	14.0	12.4	13.0
Plus #4 Material	(%)	8	6	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)		
Maximum Dry Density	(pcf)	126.0	126.0	126.0
Optimum Moisture	(%)	11.3	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	91	91	91
Specified Compaction	(%)	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Simons

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-8	C-9	C-10	C-11
DATE TAKEN:	August 19, 1982	August 19, 1982	August 19, 1982	August 19, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4	Sandy clay, trace of gravel, brown (SC)-4
LOCATION:	East dike, clay core, coordinate N 866,130	East dike, clay core, coordinate N 866,050	East dike, clay core, coordinate N 865,850	East dike, clay core, coordinate N 865,700
ELEVATION OF TEST:	979'	979'	976.5'	988.5'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	123	123	117
Moisture Content	(%)	14.3	12.4	12.3	13.3
Plus #4 Material	(%)	5	4	3	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	93.5	99	99	94.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Jus

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	C-12	C-13
DATE TAKEN:	August 19, 1982	August 19, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC)-4	Sandy clay, a little gravel, brown (SC)-4
LOCATION:	North dike, clay core, coordinate E 2,028,950	North dike, clay core, coordinate E 028,800
ELEVATION OF TEST:	979'	985'
DEPTH BELOW EXISTING GRADE:	10"	10"

FIELD DENSITY DETERMINATION:

Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density	(pcf)	120	123
Moisture Content	(%)	11.7	11.7
Plus #4 Material	(%)	7	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	123.9	123.9
Optimum Moisture	(%)	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	97	99
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Jun

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:		C-14	C-15	C-16	C-17
DATE TAKEN:		August 26, 1982	August 26, 1982	August 26, 1982	August 26, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:		East dike, clay core, coordinate N865,900	East dike, clay core, coordinate N866,000	North dike, clay core, coordinate E2,028,900	North dike, clay core, coordinate E2,028,800
ELEVATION OF TEST:		980'	980.5'	981.5'	984'
DEPTH BELOW EXISTING GRADE:		8"	8"	8"	8"
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	124	113.5	125.5	123
Moisture Content	(%)	10.8	10.8	12.0	12.0
Plus #4 Material	(%)	5	9	4	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	100	91.5	101	99
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. [illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	C-18	C-19	C-20	C-21
DATE TAKEN:	August 30, 1982	August 30, 1982	August 30, 1982	August 30, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:	East dike, clay core, coordinate N865,900	East dike, clay core, coordinate N865,750	North dike, clay core, coordinate E2,028,900	North dike, clay core, coordinate E2,028,800
ELEVATION OF TEST:	982.0'	983.5'	982.5'	985.5'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	117	122	115
Moisture Content	(%)	13.0	12.7	13.0	12.7
Plus #4 Material	(%)	9	4	10	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	94	95	99	93
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Zimmer

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	C-22	C-23	C-24	C-25
DATE TAKEN:	Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:	East dike coofdinate N865,850	East dike coordinate N866,000	North dike coordinate E2,029,010	North dike coordinate E2,028,700
ELEVATION OF TEST:	984.5'	985.5'	986'	987'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	123	117	128	128
Moisture Content	(%)	12.4	13.0	14.3	14.3
Plus #4 Material	(%)	5	4	7	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	128.3	128.3
Optimum Moisture	(%)	11.2	11.2	11.0	11.0

COMPACTION TEST RESULTS:

Compaction	(%)	99	94.5	99.5	99.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jurs

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		C-26	C-27	C-28	C-29
TEST NUMBER:					
DATE TAKEN:		Sept 16,1982	Sept 16,1982	Sept 16,1982	Sept 17,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865,850	East dike coordinate N866,000	East dike coordinate N865,900	East dike coordinate N866,050
ELEVATION OF TEST:		987'	988'	989'	990'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	124	112.5	124	115
Moisture Content	(%)	12.4	11.1	12.4	11.7
Plus #4 Material	(%)	4	5	7	4
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	100	91	100	93
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale Ryan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	C-30	C-31	C-32	C-33
DATE TAKEN:	Sept 17,1982	Sept 17,1982	Sept 20,1982	Sept 20,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (CL)-1	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:	North dike coordinate E2,028,800	North dike coordinate E2,029,000	East dike coordinate N865,700	East dike coordinate N866,050
ELEVATION OF TEST:	987'	988'	991'	992'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116	125	116	123
Moisture Content	(%)	14.5	14.5	13.3	14.3
Plus #4 Material	(%)	9	8	9	7

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	128.3	123.9	123.9
Optimum Moisture	(%)	11.2	11.0	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	94	95	94	99
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		C-34	C-35	C-36	C-37
DATE TAKEN:		Sept 20,1982	Sept 20,1982	Sept 21,1982	Sept 21,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865,800	East dike coordinate N866,000	East dike coordinate N865,850	East dike coordinate N866,000
ELEVATION OF TEST:		993'	994'	994.5'	995'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	122	115	121.5	114
Moisture Content	(%)	13.0	11.1	13.3	13.0
Plus #4 Material	(%)	8	6	8	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	98.5	93	98	92.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Jones

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	C-38	C-39
DATE TAKEN:	Sept 21,1982	Sept 21,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (CL)-2	Sandy clay, a little gravel, brown (CL)-2
LOCATION:	North dike coordinate E2,028,880	North dike coordinate E2,029,000
ELEVATION OF TEST:	989.5'	991'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	124	120.5
Moisture Content	(%)	12.7	12.4
Plus #4 Material	(%)	6	9

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	126.0	126.0
Optimum Moisture	(%)	11.3	11.3

COMPACTION TEST RESULTS:

Compaction	(%)	98.5	96
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. [illegible]

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		C-40	C-41	C-42	C-43
TEST NUMBER:					
DATE TAKEN:		Sept 22,1982	Sept 22,1982	Sept 22,1982	Sept 23,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, trace of gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N866,120	East dike coordinate N866,000	East dike coordinate N865,850	East dike coordinate N865,800
ELEVATION OF TEST:		994'	994'	995'	996'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	112.5	112	123	122
Moisture Content	(%)	13.0	12.7	12.4	12.7
Plus #4 Material	(%)	5	6	5	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	91	90.5	99	98.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Zimm

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		C-44	C-45	C-46	C-47
DATE TAKEN:		Sept 23,1982	Sept 23,1982	Sept 23,1982	Sept 24,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:		East dike coordinate N865, 750	East dike coordinate N865,950	East dike coordinate N866,180	North dike coordinate E2,028, 950
ELEVATION OF TEST:		997'	997'	995'	993'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	120	119	117	112
Moisture Content	(%)	12.4	12.4	11.1	12.4
Plus #4 Material	(%)	6	10	9	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	123.9	123.9	123.9	123.9
Optimum Moisture	(%)	11.2	11.2	11.2	11.2
COMPACTION TEST RESULTS:					
Compaction	(%)	97	96	94.5	90.5
Specified Compaction	(%)	90	90	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jamison

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	C-48	C-49
DATE TAKEN:	Sept 24,1982	Sept 24,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sandy clay, a little gravel, brown (SC-CL)-4	Sandy clay, a little gravel, brown (SC-CL)-4
LOCATION:	North dike coordinate E2,029,000	North dike coordinate E2,028,800
ELEVATION OF TEST:	994.5'	996'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	118.5	120.5
Moisture Content	(%)	14.3	13.0
Plus #4 Material	(%)	7	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	123.9	123.9
Optimum Moisture	(%)	11.2	11.2

COMPACTION TEST RESULTS:

Compaction	(%)	96	97.7
Specified Compaction	(%)	90	90

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By _____

SG-225 (81-A)

COMPACTION TESTS

EMBANKMENT

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-1	E-2	E-3	E-4
DATE TAKEN:	August 20, 1982	August 20, 1982	August 20, 1982	August 20, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5
LOCATION:	East dike, W embankment, coordinate N 865,900	East dike, W embankment, coordinate N 865,900	East dike, E embankment, coordinate N 865,900	East dike, E embankment, coordinate N 865,900
ELEVATION OF TEST:	976.5'	979'	976.5'	979'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	119	111	122	112
Moisture Content	(%)	7.0	8.7	8.1	5.3
Plus #4 Material	(%)	3	15	9	6

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	125.0	125.0
Optimum Moisture	(%)	11.1	11.1	11.1	11.1

COMPACTION TEST RESULTS:

Compaction	(%)	95.5	89	97.5	90
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Sun

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645 3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	E-5	E-6
DATE TAKEN:	August 20, 1982	August 20, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, a little gravel, brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, brown (SM)-5
LOCATION:	North dike, N embankment, coordinate E2, 029, 010	East dike, E embankment, corrdinate N866, 090
ELEVATION OF TEST:	975'	978'
DEPTH BELOW EXISTING GRADE:	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)	
Dry Density	(pcf)	125	118.5
Moisture Content	(%)	4.3	4.7
Plus #4 Material	(%)	7	2

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)	
Maximum Dry Density	(pcf)	125.0	125.0
Optimum Moisture	(%)	11.1	11.1

COMPACTION TEST RESULTS:

Compaction	(%)	100	95
Specified Compaction	(%)	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing and Engineering Laboratory Inc.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Ayers

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-7	E-8	E-9	E-10
DATE TAKEN:	August 23, 1982	August 23, 1982	August 23, 1982	August 23, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, dark brown (SM)-5	Silty sand, mostly fine grained, dark brown (SM)-5
LOCATION:	East dike, E embankment, coordinate N865,900 (retest of #E-4)	East dike, W embankment, coordinate N865,900 (retest of #E-2)	East dike, W embankment, coordinate N866,065	East dike, W embankment, coordinate N865,950
ELEVATION OF TEST:	977.5'	977.5'	980'	980'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'
FIELD DENSITY DETERMINATION:				
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density (pcf)	128	125.5	117	110
Moisture Content (%)	7.2	7.0	6.4	7.0
Plus #4 Material (%)	6	4	0	0
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:				
Method	ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density (pcf)	125.0	125.0	125.0	125.0
Optimum Moisture (%)	11.1	11.1	11	11
COMPACTION TEST RESULTS:				
Compaction (%)	102.5	100.5	93.5	88
Specified Compaction (%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Lyn

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:		E-11	E-12	E-13	E-14
DATE TAKEN:		August 24, 1982	August 24, 1982	August 24, 1982	August 24, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:		East dike, W embankment, coordinate N866,065 (retest of E-9)	East dike, W embankment, coordinate N865,950 (retest of E-10)	East dike, toe ditch fill area, coordinate N865,900	East dike, toe ditch fill area, coordinateN866,100
ELEVATION OF TEST:		980'	980'	960'	960'
DEPTH BELOW EXISTING GRADE:		1'	1'	10"	10"
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	121	118.5	111	119
Moisture Content	(%)	7.2	7.5	2.0	2.8
Plus #4 Material	(%)	1	1	3	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	115.2	115.2
Optimum Moisture	(%)	11.1	11.1	11.9	11.9
COMPACTION TEST RESULTS:					
Compaction	(%)	97	95	96	103
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1292

TEST NUMBER:	E-15	E-16	E-17	E-18
DATE TAKEN:	August 24, 1982	August 24, 1982	August 25, 1982	August 25, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Silty sand, mostly fine grained, a little gravel, dark brown (SM)-5	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:	North dike, S embankment, coordinate E2,028,750	North dike, N embankment, coordinate E2,028,750	East dike, E embankment, coordinate N865,750	East dike, W embankment, coordinate N865,750
ELEVATION OF TEST:	986'	986'	979'	981'
DEPTH BELOW EXISTING GRADE:	10"	10"	8"	8"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	114	119	111	114
Moisture Content	(%)	3.6	6.4	2.8	3.4
Plus #4 Material	(%)	1	10	5	2

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	125.0	115.2	120.0
Optimum Moisture	(%)	10.5	11.1	11.9	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	95	95.5	96.5	95
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Lam

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:		E-19	E-20	E-21	E-22
DATE TAKEN:		August 25, 1982	August 25, 1982	August 25, 1982	August 25, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Silty sand, mostly fine grained, trace of gravel, dark brown (SM)-5	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:		North dike, S embankment, coordinate E2,028,900	North dike, N embankment, coordinate E2,028,900	Toe of east dike, E embankment, coordinate N865,800	Toe of east dike, E embankment, coordinate 866,000
ELEVATION OF TEST:		979.5'	980.5'	961'	961'
DEPTH BELOW EXISTING GRADE:		10"	10"	8"	8"
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111.5	125	118.5	118
Moisture Content	(%)	5.8	9.3	4.2	3.4
Plus #4 Material	(%)	2	3	11	4
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	125.0	125.0	120.0	120.0
Optimum Moisture	(%)	11.1	11.1	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	89.5	100	98.5	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-23	E-24	E-25	E-26
DATE TAKEN:	August 25, 1982	August 25, 1982	August 26, 1982	August 26, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, brown (SP)-8
LOCATION:	East dike, W embankment, coordinate N866,000	East dike, E embankment, coordinate N866,000	North dike, S embankment, coordinate E2,028,900	East dike, E embankment, coordinate N866,090
ELEVATION OF TEST:	979.5'	978.5'	979.5'	978'
DEPTH BELOW EXISTING GRADE:	10"	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111.5	114.5	116.5	104.5
Moisture Content	(%)	2.8	4.2	5.8	4.7
Plus #4 Material	(%)	8	4	2	0

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	115.2	120.0	109.8
Optimum Moisture	(%)	11.9	11.9	10.5	13.8

COMPACTION TEST RESULTS:

Compaction	(%)	97	99.5	97	95
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:		E-27	E-28	E-29	E-30
DATE TAKEN:		August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Silty sand, mostly fine grained, a little gravel, dark brown (SM-5)	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP)-8
LOCATION:		East dike, E embankment, coordinate N865,800	East dike, W embankment, coordinate N865,750	East dike, E embankment, coordinate N866,050	East dike, E embankment, coordinate N865,900
ELEVATION OF TEST:		982.5'	984'	969'	971.5'
DEPTH BELOW EXISTING GRADE:		10"	10"	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	120.5	124	120	114
Moisture Content	(%)	6.7	7.2	5.5	3.6
Plus #4 Material	(%)	2	7	5	2
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	125.0	115.2	109.8
Optimum Moisture	(%)	10.5	11.1	11.9	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	100.5	99	104	104
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-31	E-32	E-33	E-34
DATE TAKEN:	August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:	North dike, N embankment, coordinate E2,028,800	North dike, S embankment, coordinate E2,028,800	East dike, E embankment, coordinate N866,000	East dike, E embankment, coordinate N865,800
ELEVATION OF TEST:	987'	987.5'	971.5'	973'
DEPTH BELOW EXISTING GRADE:	10'	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	111	121	115.5	117
Moisture Content	(%)	5.0	6.4	3.4	3.6
Plus #4 Material	(%)	4	4	5	5

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	120.0	120.0	120.0
Optimum Moisture	(%)	11.9	10.5	10.5	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	96.5	101	96	97.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B Gus

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY No. 9-1292

TEST NUMBER:	E-35	E-36	E-37	E-38
DATE TAKEN:	August 27, 1982	August 27, 1982	August 27, 1982	August 27, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:	East dike, E embankment, coordinate N865,950	East dike, W embankment, coordinate N865,950	East dike, W embankment, coordinate N866,050	East dike, E embankment, coordinate N866,050
ELEVATION OF TEST:	982'	982.5'	982'	981'
DEPTH BELOW EXISTING GRADE:	10"	10"	10"	10"

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	116.5	116.5	119	115
Moisture Content	(%)	8.7	5.3	5.8	6.1
Plus #4 Material	(%)	1	2	3	3

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	115.2	115.2	115.2
Optimum Moisture	(%)	10.5	11.9	11.9	11.9

COMPACTION TEST RESULTS:

Compaction	(%)	97	101	103	100
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale Bolton

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-39	E-40	E-41	E-42
DATE TAKEN:	Sept 1, 1982	Sept 1, 1982	Sept 1, 1982	Sept 1, 1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, mostly fine grained trace of gravel, brown (SP-SM)-7
LOCATION:	East dike west embankment coordinate N865,800	East dike west embankment coordinate N865,950	East dike west embankment coordinate N866,050	East dike east embankment coordinate N866,100
ELEVATION OF TEST:	985'	985'	986'	981'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	122.5	115.5	112.5	123.0
Moisture Content	(%)	9.9	8.7	9.3	10.2
Plus #4 Material	(%)	4	4	7	3

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	115.2	115.2	120.0
Optimum Moisture	(%)	10.5	11.9	11.9	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	102	100.5	97.5	102.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing & Engineering Laboratory.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-43	E-44	E-45
DATE TAKEN:	Sept 1,1982	Sept 1,1982	Sept 1,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, brown (SP-SM)-6	Sand, mostly fine grained, brown (SP)-7	Sand, fine to medium grained, brown (SP-SM)-6
LOCATION:	East dike east embankment coordinate N866,000	East dike east embankment coordinate N865,800	East dike east embankment coordinate N866,000 (Retest #E43)
ELEVATION OF TEST:	982'	983'	982'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'
FIELD DENSITY DETERMINATION:			
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)		
Dry Density (pcf)	101.5	118	109
Moisture Content (%)	10.2	8.1	10.2
Plus #4 Material (%)	6	3	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:			
Method	ASTM:D1557-78, Method "A", (-#4 Basis)		
Maximum Dry Density (pcf)	115.2	120.0	115.2
Optimum Moisture (%)	11.9	10.5	11.9
COMPACTION TEST RESULTS:			
Compaction (%)	88.5	98.5	95
Specified Compaction (%)	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested. The test locations and number of tests were selected by Twin City Testing & Engineering Laboratory

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E46	E47	E48	E49
DATE TAKEN:	Sept 2,1982	Sept 2,1982	Sept 2,1982	Sept 2,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, grown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:	East dike east embankment coordinate N865750	East dike east embankment coordinate N865,880	East dike east embankment coordinate N866,000 access road	East dike east embankment coordinate N866,120 access road
ELEVATION OF TEST:	976'	975'	973'	975'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	109	119	119	111
Moisture Content	(%)	5.3	5.8	6.4	5.8
Plus #4 Material	(%)	5	4	3	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	115.2	115.2	115.2	115.2
Optimum Moisture	(%)	11.9	11.9	11.9	11.9

COMPACTION TEST RESULTS:

Compaction	(%)	95	103	103	96.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R. Fass

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E50	E51	E52	E53
DATE TAKEN:		Sept 2,1982	Sept 2,1982	Sept 2,1982	Sept 2,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7
LOCATION:		East dike east embankment coordinate N865,800	East dike east embankment coordinate N865,950 access road	East dike east embankment coordinate N866,050 access road	East dike east embankment coordinate N866,120
ELEVATION OF TEST:		978'	977'	975'	976'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	121	119	118	122.5
Moisture Content	(%)	7.2	6.7	6.1	9.9
Plus #4 Material	(%)	5	4	4	5
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	120.0
Optimum Moisture	(%)	10.5	10.5	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	101	99	98.5	102
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B. Simonson

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E-54	E-55	E-56	E-57
TEST NUMBER:					
DATE TAKEN:		Sept 7,1982	Sept 7,1982	Sept 7,1982	Sept 7,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9
LOCATION:		East dike west embankment coordinate N865,790	East dike west embankment coordinate N865,900	East dike west embankment coordinate N866,090	East dike east embankment coordinate N866,000
ELEVATION OF TEST:		987'	987'	987'	988'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method	Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)				
Dry Density	(pcf)	124	120	114	118.5
Moisture Content	(%)	6.4	6.4	5.3	5.3
Plus #4 Material	(%)	6	6	10	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	105	102	97	101
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:		E-58	E-59	E-60	E-61
DATE TAKEN:		Sept 7,1982	Sept 7,1982	Sept 7,1982	Sept 7,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, trace of gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, a little gravel, brown (SP)-6	Sand, fine to medium grained, trace of gravel, brown (SP)-6
LOCATION:		East dike east embankment coordinate N865,800	East dike east embankment coordinate N865,950	East dike east embankment coordinate N866,150	East dike east embankment coordinate N866,000
ELEVATION OF TEST		984	983	978.5	980
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	125	117	114	112
Moisture Content	(%)	7.0	6.7	5.5	5.3
Plus #4 Material	(%)	4	6	8	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	115.2	115.2
Optimum Moisture	(%)	10.5	10.5	11.9	11.9
COMPACTION TEST RESULTS:					
Compaction	(%)	104.5	98	97	97
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale B [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E62	E63	E64	E65
TEST NUMBER:					
DATE TAKEN:		Sept 8,1982	Sept 8,1982	Sept 8,1982	Sept 8,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7
LOCATION:		East dike east embankment coordinate N865,850	East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,950	East dike east embankment coordinate N865,800
ELEVATION OF TEST:		985'	981'	984'	916.5
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	115	116.5	115
Moisture Content	(%)	5.0	5.3	5.0	6.1
Plus #4 Material	(%)	6	8	7	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	120.0	120.0
Optimum Moisture	(%)	13.9	13.9	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	98	98	97	96
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Tan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

LABORATORY No. 9-1357

TEST NUMBER:	E-66	E-67	E-68	E-69
DATE TAKEN:	Sept 9,1982	Sept 9,1982	Sept 9,1982	Sept 9,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:	East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,950	East dike east embankment coordinate N865,800	North dike north embankment coordinate E2,028,800
ELEVATION OF TEST:	982'	985'	985.5'	983'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	115	117	120	115
Moisture Content	(%)	4.7	5.0	4.7	4.7
Plus #4 Material	(%)	4	3	6	7

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9

COMPACTION TEST RESULTS:

Compaction	(%)	98	99	102	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-70	E-71	E-72	E-73
DATE TAKEN:		Sept 9,1982	Sept 9,1982	Sept 9,1982	Sept 9,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP)-8
LOCATION:		North dike north embankment coordinate E2,028,950	North dike north embankment coordinate E2,028,980	North dike north embankment coordinate E2,029,610	North dike north embankment coordinate E2,029,100
ELEVATION FO TEST:		981'	989'	982'	883'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	122	125	116	107
Moisture Content	(%)	6.1	5.5	6.4	6.4
Plus #4 Material	(%)	8	6	6	7
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	109.8
Optimum Moisture	(%)	10.5	10.5	10.5	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	101.5	104	96.5	98
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Lyn

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

		E-74	E-75	E-76	E-77
TEST NUMBER:					
DATE TAKEN:		Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:		North dike north embankment coordinate E2,028,620	North dike north embankment coordinate E2,028,800	North dike north embankment coordinate E2,029,000	North dike north embankment coordinate E2,028,900
ELEVATION OF TEST:		993'	992'	990'	991'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	123	112	114	112
Moisture Content	(%)	5.0	5.3	5.5	5.0
Plus #4 Material	(%)	5	3	4	5
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	114	95.5	97	95.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-78	E-79	E-80	E-81
DATE TAKEN:	Sept 10,1982	Sept 10,1982	Sept 10,1982	Sept 10,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP)-8	Sand, mostly, fine grained, a little gravel, brown (SP-SM)-7
LOCATION:	North dike north embankment coordinate E2,028,700	North dike north embankment coordinate E2,028,950	North dike south embankment coordinate E2,028,850	North dike south embankment coordinate E2,028,940
ELEVATION OF TEST:	996'	994'	991.5'	992'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	117	122	110	120
Moisture Content	(%)	5.0	6.1	5.0	5.5
Plus #4 Material	(%)	8	6	5	5

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	117.7	119.8	120.0
Optimum Moisture	(%)	10.5	13.9	13.8	10.5

COMPACTION TEST RESULTS:

Compaction	(%)	97	103.5	100	100
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale R Jan

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-82	E-83	E-84	E-85
DATE TAKEN:		Sept 13,1982	Sept 13,1982	Sept 13,1982	Sept 13,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, mostly fine grained, a little gravel, brown)SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7
LOCATION:		North dike north embankment coordinate E2,029,000	North dike north embankment coordinate E2,028,940	North dike south embankment coordinate E2,028,850	North dike south embankment coordinate E2,029,980
ELEVATION OF TEST:		995'	995'	993.5'	994.5'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	124	125	122	125
Moisture Content	(%)	5.5	5.0	6.1	5.8
Plus #4 Material	(%)	8	6	10	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	120.0	120.0	120.0	120.0
Optimum Moisture	(%)	10.5	10.5	10.5	10.5
COMPACTION TEST RESULTS:					
Compaction	(%)	103	104	101.5	104
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-86	E-87	E-88	E-89
DATE TAKEN:		Sept 14,1982	Sept 14,1982	Sept 14,1982	Sept 14,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, mostly fine grained, a little gravel, brown (SP-SM)-7	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:		East dike east embankment coordinate N866,100	East dike east embankment coordinate N865,900	East dike east embankment coordinate N865,800	East dike west embankment coordinate N865,850
ELEVATION OF TEST:		984'	984.5'	988'	987'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	119	121	121.5	121
Moisture Content	(%)	6.1	7.0	6.7	6.1
Plus #4 Material	(%)	6	6	7	3
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	120.0	120.0	117.7
Optimum Moisture	(%)	13.9	10.5	10.5	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	101	101	101.5	103
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By [signature]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-90	E-91	E-92	E-93
DATE TAKEN:		Sept 14,1982	Sept 14,1982	Sept 14,1982	Sept 14,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, mostly fine grained, a little gravel, brown (SP)-8	Sand, mostly fine grained, a little gravel, brown (SP)-8
LOCATION:		East dike west embankment coordinate N866,000	East dike west embankment coordinate N865,800	East dike west embankment coordinate N866,100	East dike east embankment coordinate N865,850
ELEVATION OF TEST:		987.5'	988.5'	989'	990'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	124	112	105	114
Moisture Content	(%)	5.5	5.0	5.0	6.1
Plus #4 Material	(%)	7	7	8	8
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	109.8	109.8
Optimum Moisture	(%)	13.9	13.9	13.8	13.8
COMPACTION TEST RESULTS:					
Compaction	(%)	105	95	95.5	104.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:		E-94	E-95	E-96	E-97
DATE TAKEN:		Sept 16,1982	Sept 16,1982	Sept 16,1982	Sept 16,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)		Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9
LOCATION:		East dike east embankment coordinate N866,050	East dike east embankment coordinate N865,800	East dike west embankment coordinate 865, 700	East dike west embankment coordinate N866,000
ELEVATION OF TEST:		991'	992'	990'	991'
DEPTH BELOW EXISTING GRADE:		1'	1'	1'	1'
FIELD DENSITY DETERMINATION:					
Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	120	114.5	115	116
Moisture Content	(%)	5.5	5.0	5.5	5.8
Plus #4 Material	(%)	10	6	7	6
LABORATORY MOISTURE-DENSITY RELATION OF SOIL:					
Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9
COMPACTION TEST RESULTS:					
Compaction	(%)	102	97.5	98.5	98.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By Dale Ba[illegible]

SG-225 (81-A)

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: DENSITY TESTS OF COMPACTED FILL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY No. 9-1357

TEST NUMBER:	E-98	E-99	E-100	E-101
DATE TAKEN:	Sept 17,1982	Sept 17,1982	Sept 17,1982	Sept 17,1982
UNIFIED SOIL CLASSIFICATION: (Moisture-Density Sample Number)	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, a little gravel, brown (SP-SM)-9	Sand, fine to medium grained, trace of gravel, brown (SP-SM)-9
LOCATION:	East dike east embankment coordinate N865,800	East dike east embankment coordinate N866,000	East dike west embankment coordinate N865,900	East dike west embankment coordinate N866,100
ELEVATION OF TEST:	993'	994'	992'	993'
DEPTH BELOW EXISTING GRADE:	1'	1'	1'	1'

FIELD DENSITY DETERMINATION:

Method		Density in Place by Sand-Cone Method, ASTM: D1556-64 (- #4 Basis)			
Dry Density	(pcf)	118	112	112	114
Moisture Content	(%)	5.0	4.2	5.0	5.5
Plus #4 Material	(%)	3	6	6	4

LABORATORY MOISTURE-DENSITY RELATION OF SOIL:

Method		ASTM:D1557-78, Method "A", (-#4 Basis)			
Maximum Dry Density	(pcf)	117.7	117.7	117.7	117.7
Optimum Moisture	(%)	13.9	13.9	13.9	13.9

COMPACTION TEST RESULTS:

Compaction	(%)	100	95	95	96.5
Specified Compaction	(%)	95	95	95	95

ATTENTION: Density tests are valid at the location and elevation of the test only. No representation is made as to the adequacy of fill and compaction at locations and elevations other than those tested.

Twin City Testing and Engineering Laboratory, Inc.

By _____

SG-225 (81-A)

MOISTURE-DENSITY RELATIONSHIPS

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 1

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co

DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

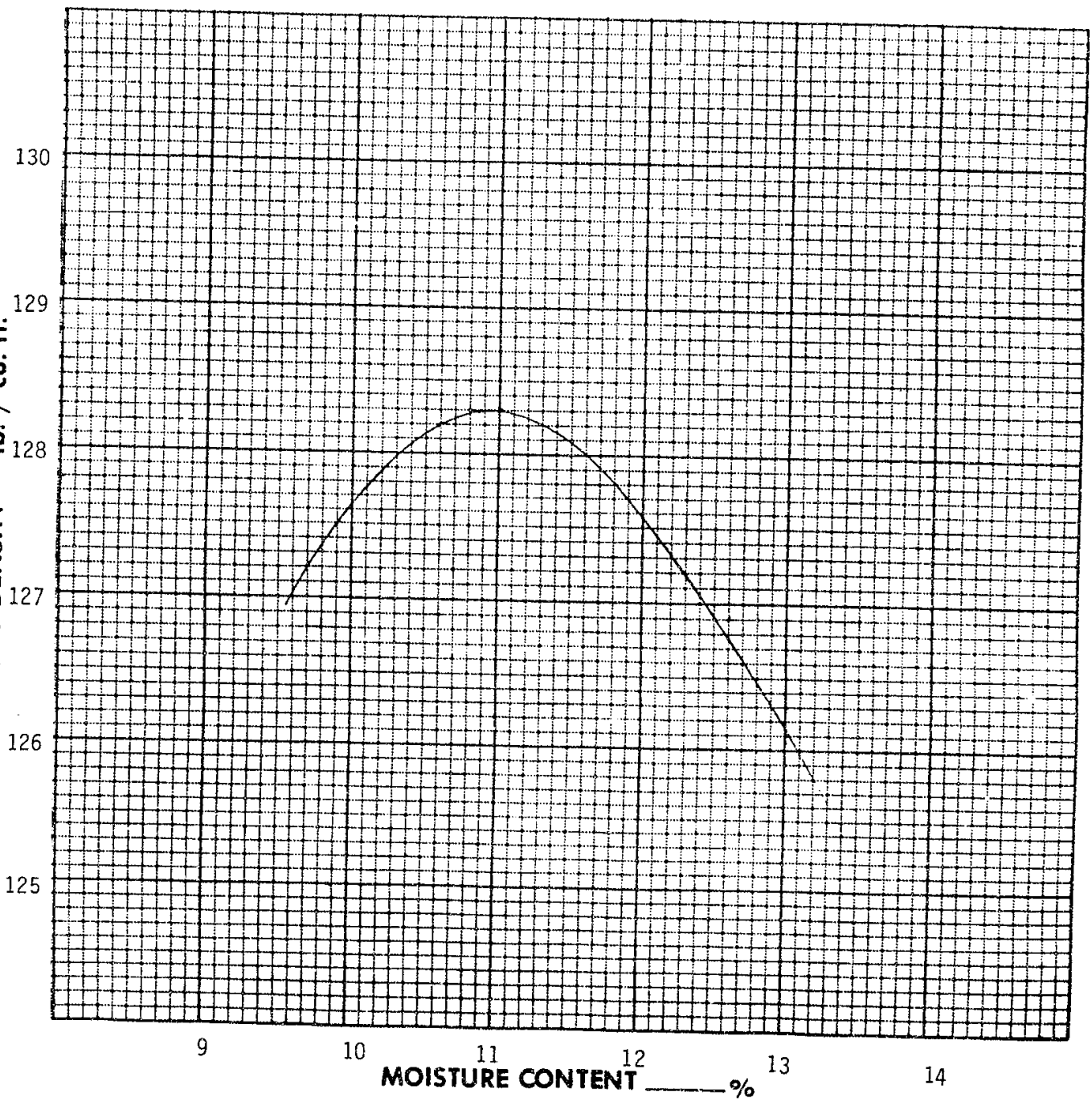
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay, brown (CL)

MAXIMUM DENSITY: 128.3 lb./cu. ft.

OPTIMUM MOISTURE 11.0 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 2

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

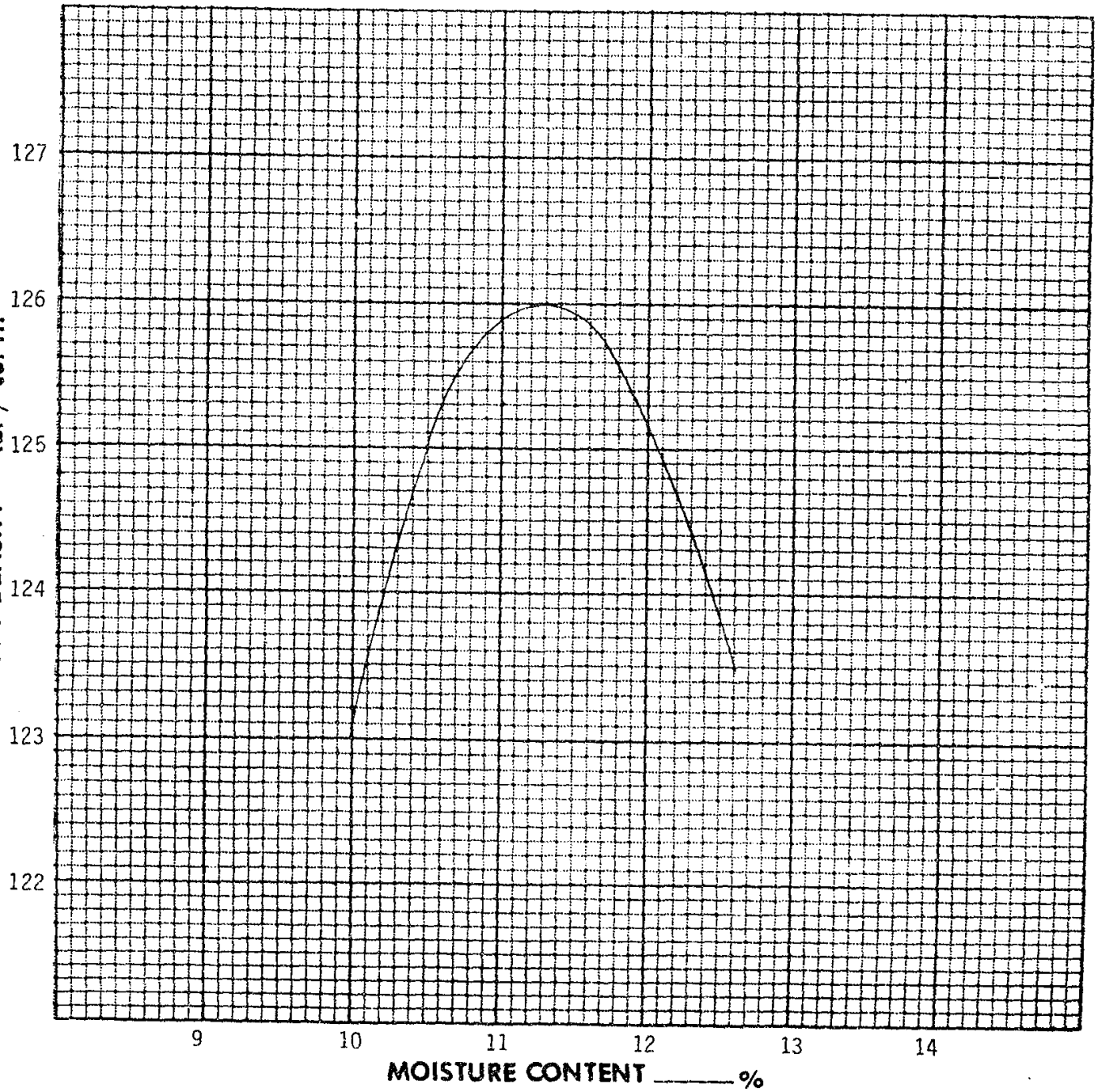
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay, brown (CL)

MAXIMUM DENSITY: 126.0 lb./cu. ft.

OPTIMUM MOISTURE 11.3 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 3

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

REPORTED TO: Northern States Power Co

LABORATORY NO. 9-1292

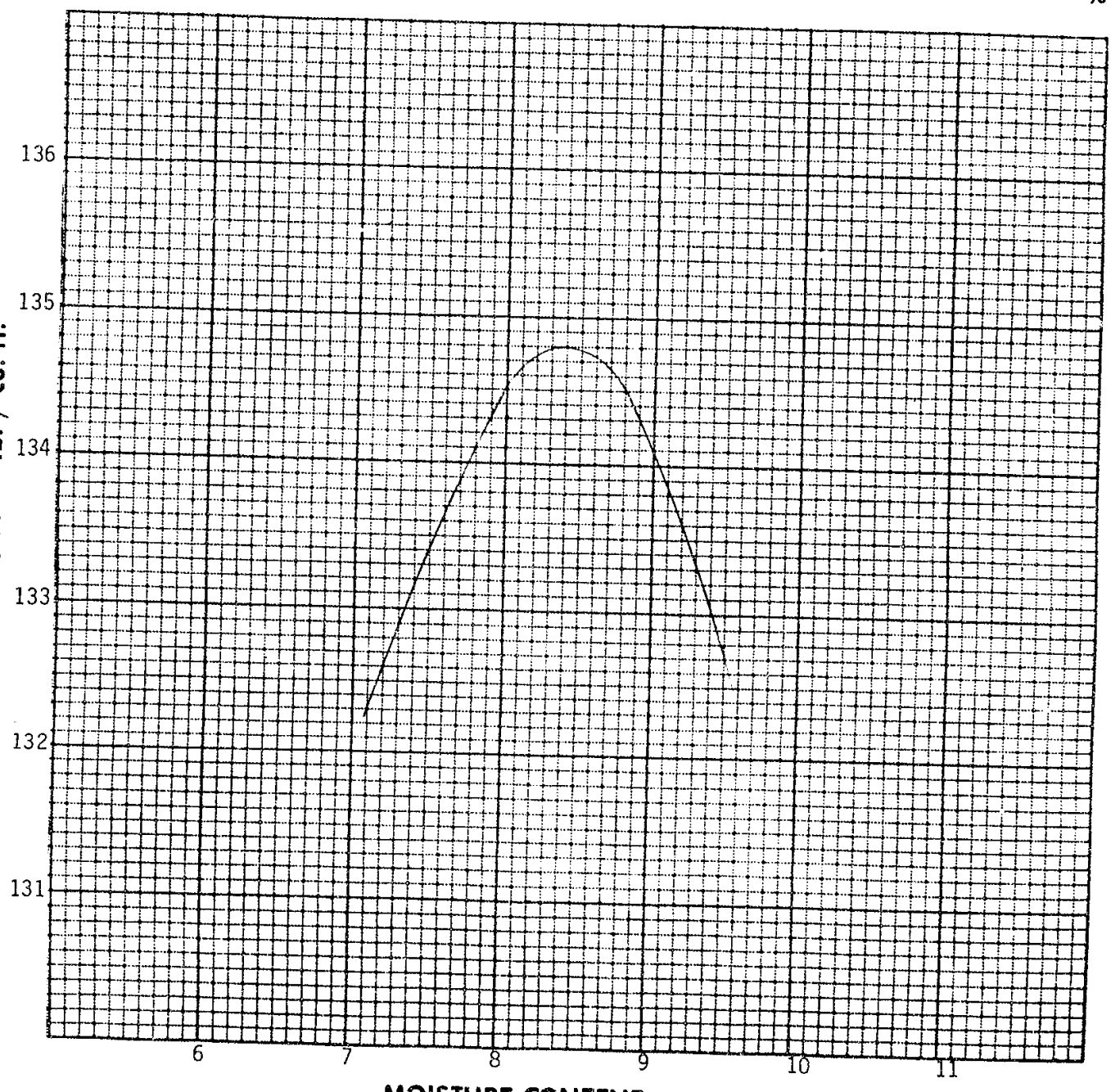
DATE: August 24, 1982

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Clayey sand, mostly fine grained, reddish brown (SC)

MAXIMUM DENSITY: 134.8 lb./cu. ft. **OPTIMUM MOISTURE** 8.4 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612-645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 4

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

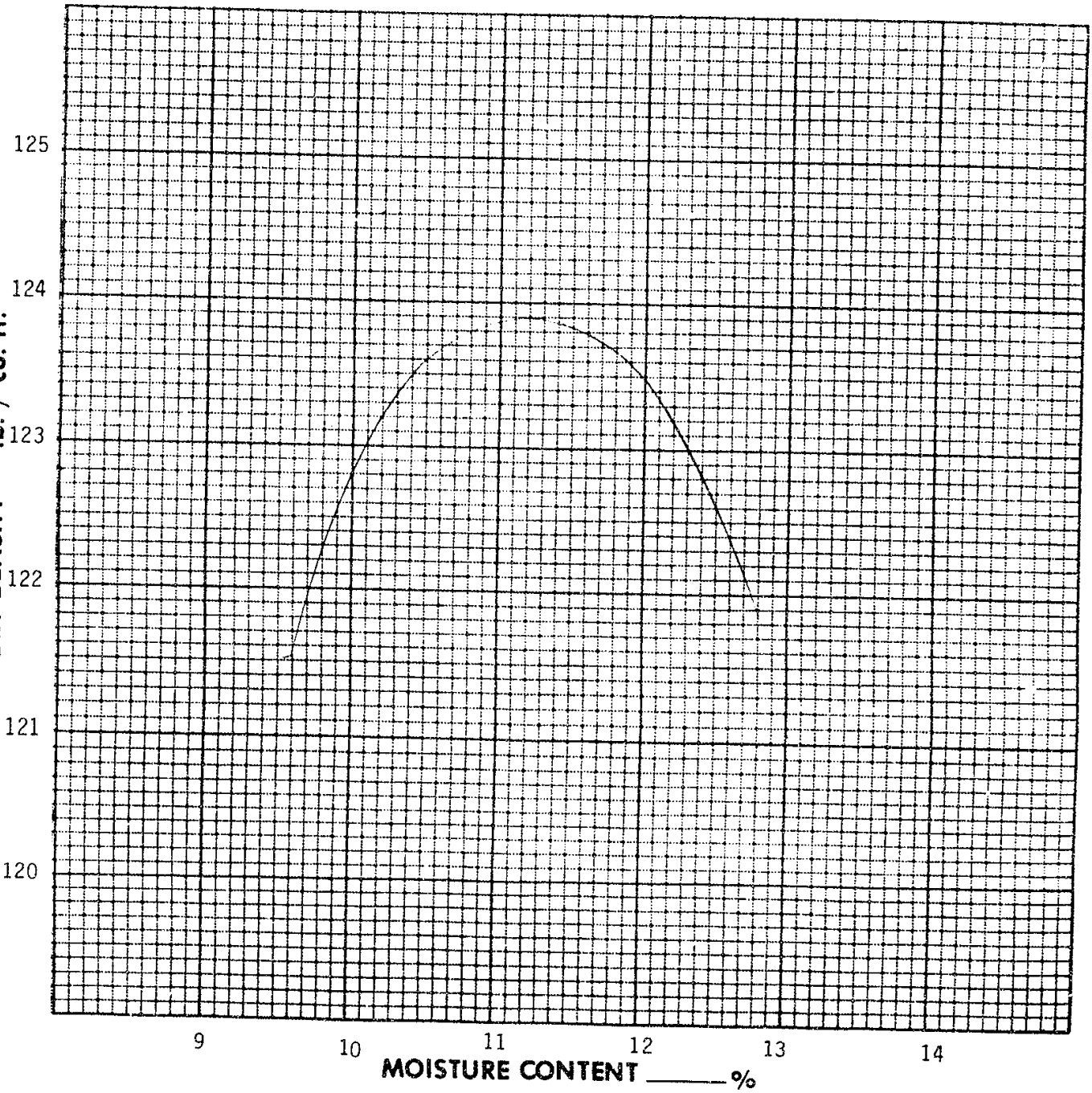
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sandy clay brown (SC-CL)

MAXIMUM DENSITY: 123.9 lb./cu. ft.

OPTIMUM MOISTURE 11.2 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612-645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 5

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

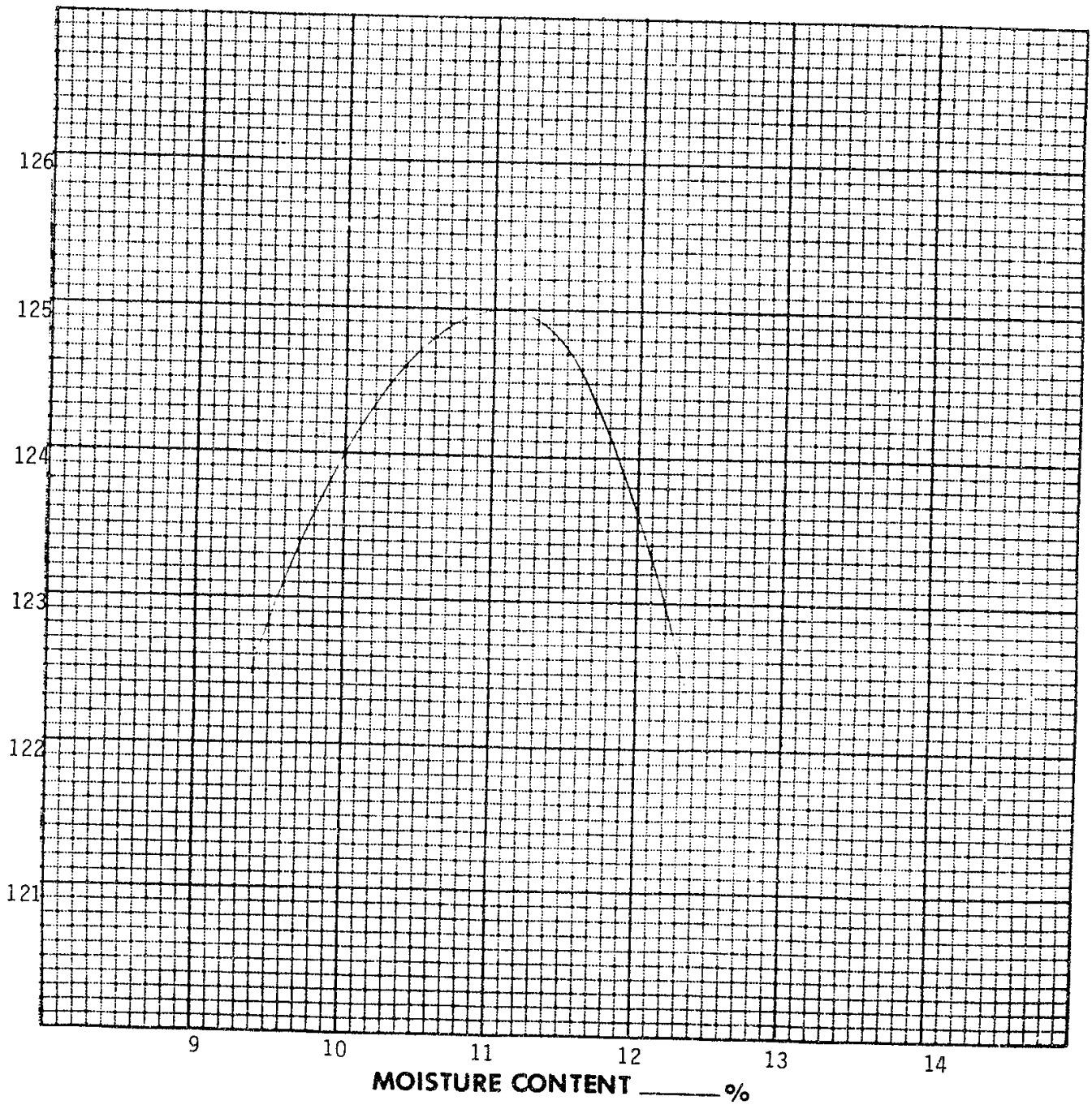
LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Silty sand, mostly fine grained, dark brown (SM)

MAXIMUM DENSITY: 125.0 lb./cu. ft.

OPTIMUM MOISTURE 11.1 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL MN 55114
PHONE 612 645 3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 6

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 24, 1982

REPORTED TO: Northern States Power Co

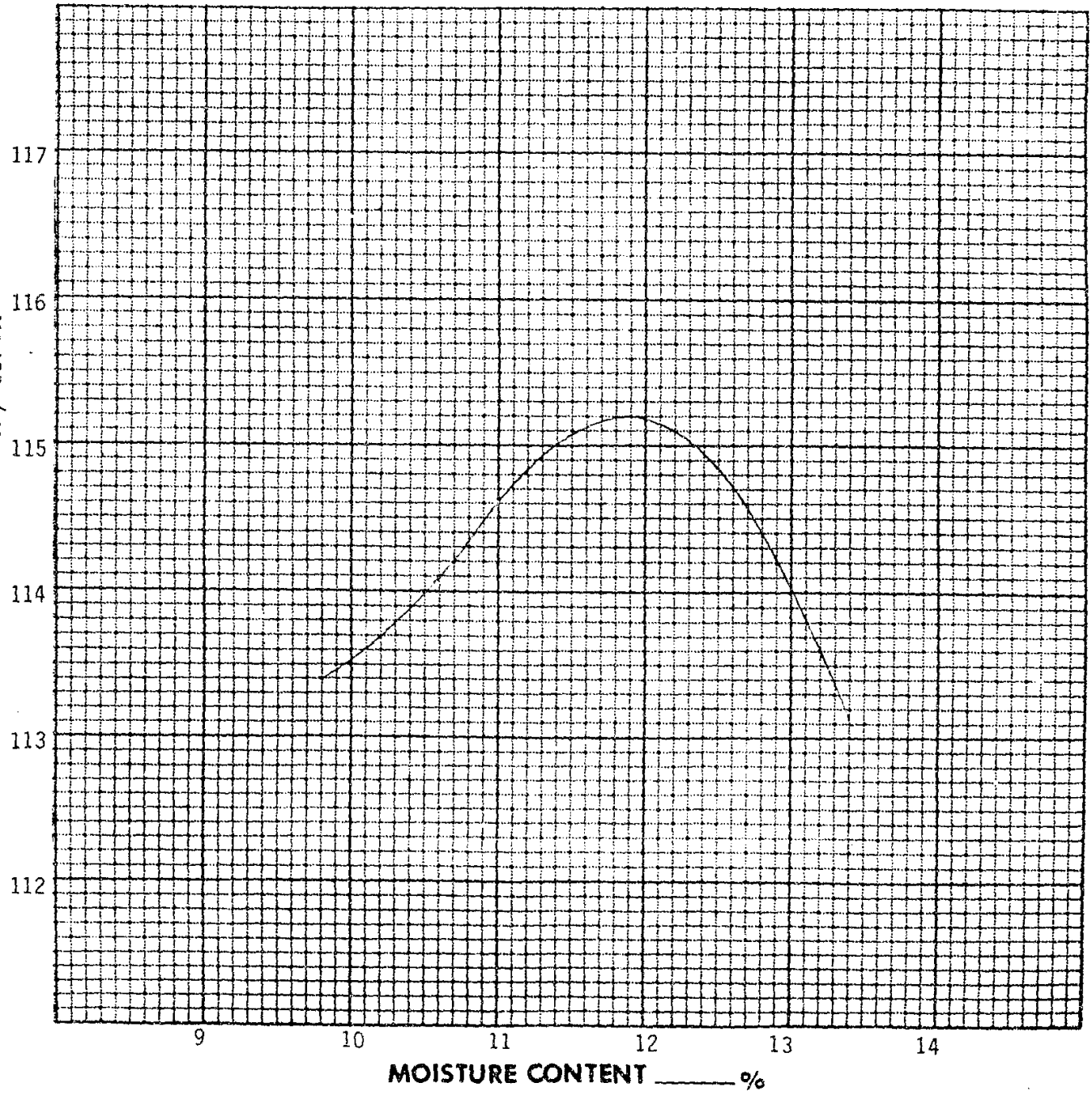
COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A".

TYPE OF MATERIAL: Sand, fine to medium grained, brown (SP)

MAXIMUM DENSITY: 115.2 lb./cu. ft. **OPTIMUM MOISTURE** 11.9 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645 3601

MOISTURE - DENSITY CURVE

SAMPLE NO. 7

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: September 2, 1982

REPORTED TO: Northern States Power Co

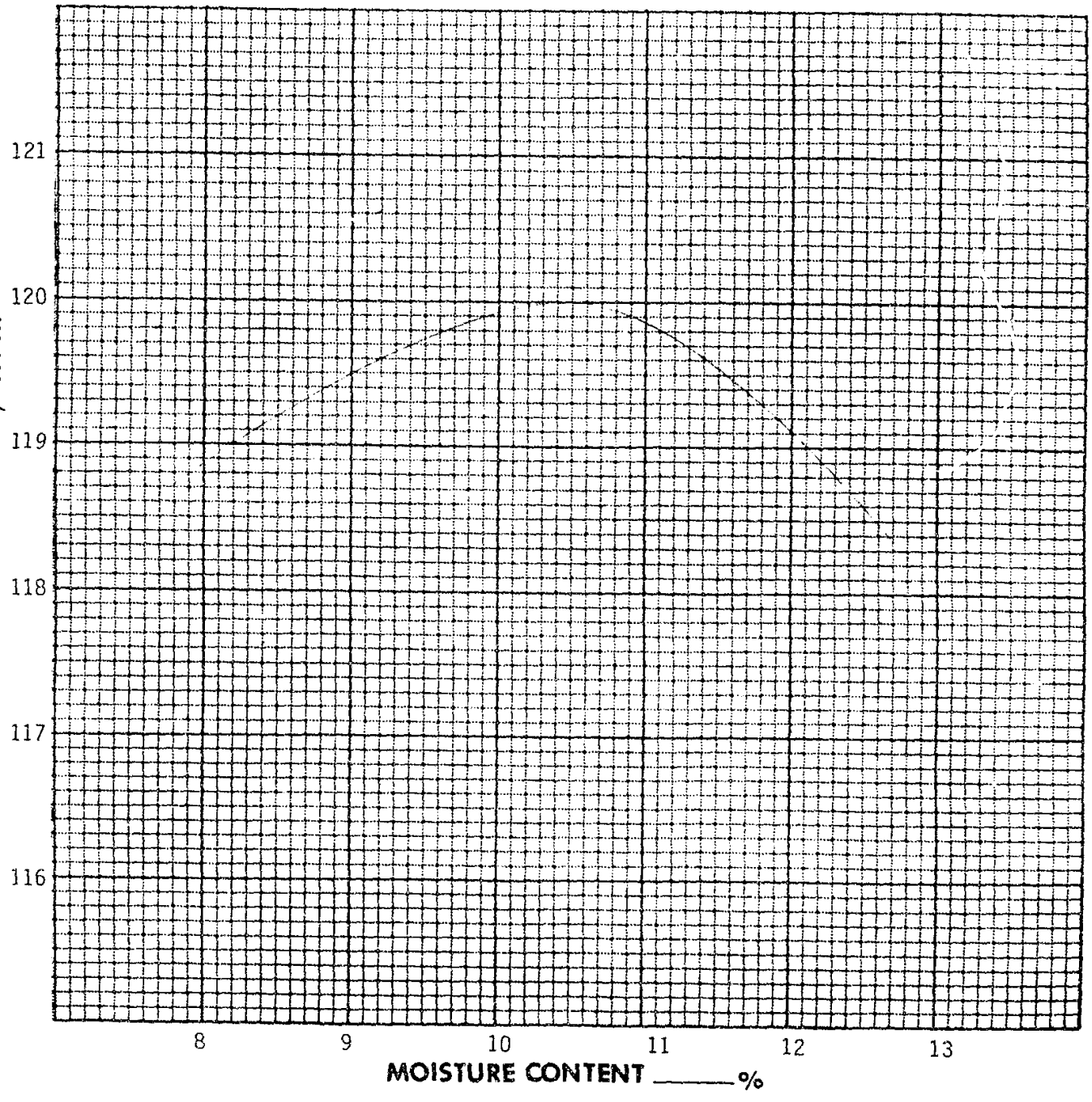
COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sand, mostly fine grained, brown (SP-SM)

MAXIMUM DENSITY: 120.0 lb./cu. ft. **OPTIMUM MOISTURE** 10.5 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612 645-0601

MOISTURE - DENSITY CURVE

SAMPLE NO. 8

PROJECT: SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MN

DATE: August 31, 1982

REPORTED TO: Northern States Power Co

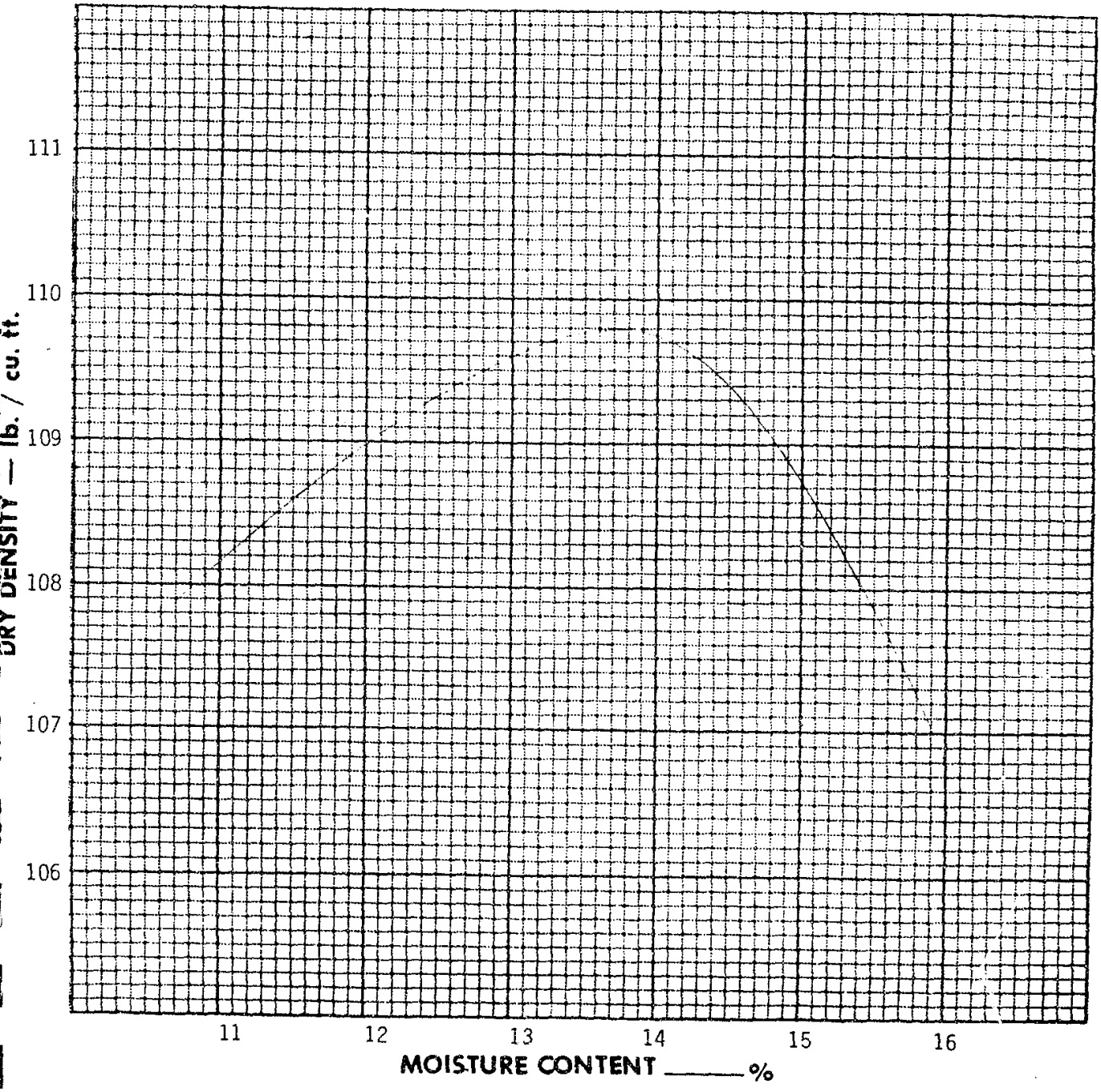
COPIES TO: 1-C S McCrossan Inc
1-Black & Veatch Consulting Engr
Attn: Larry Almalch
P O Box 8405
Kansas City, MO 64114

LABORATORY NO. 9-1292

METHOD OF TEST: ASTM:D1557-78, Method "A".

TYPE OF MATERIAL: Sand, mostly fine grained, brown (SP)

MAXIMUM DENSITY: 109.8 lb./cu. ft. **OPTIMUM MOISTURE** 13.8 %



twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

MOISTURE-DENSITY CURVE

SAMPLE NO. 9

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT BOTTOM ASH POND REVISIONS BECKER, MINNESOTA

DATE: October 11, 1982

REPORTED TO: Northern States Power Co

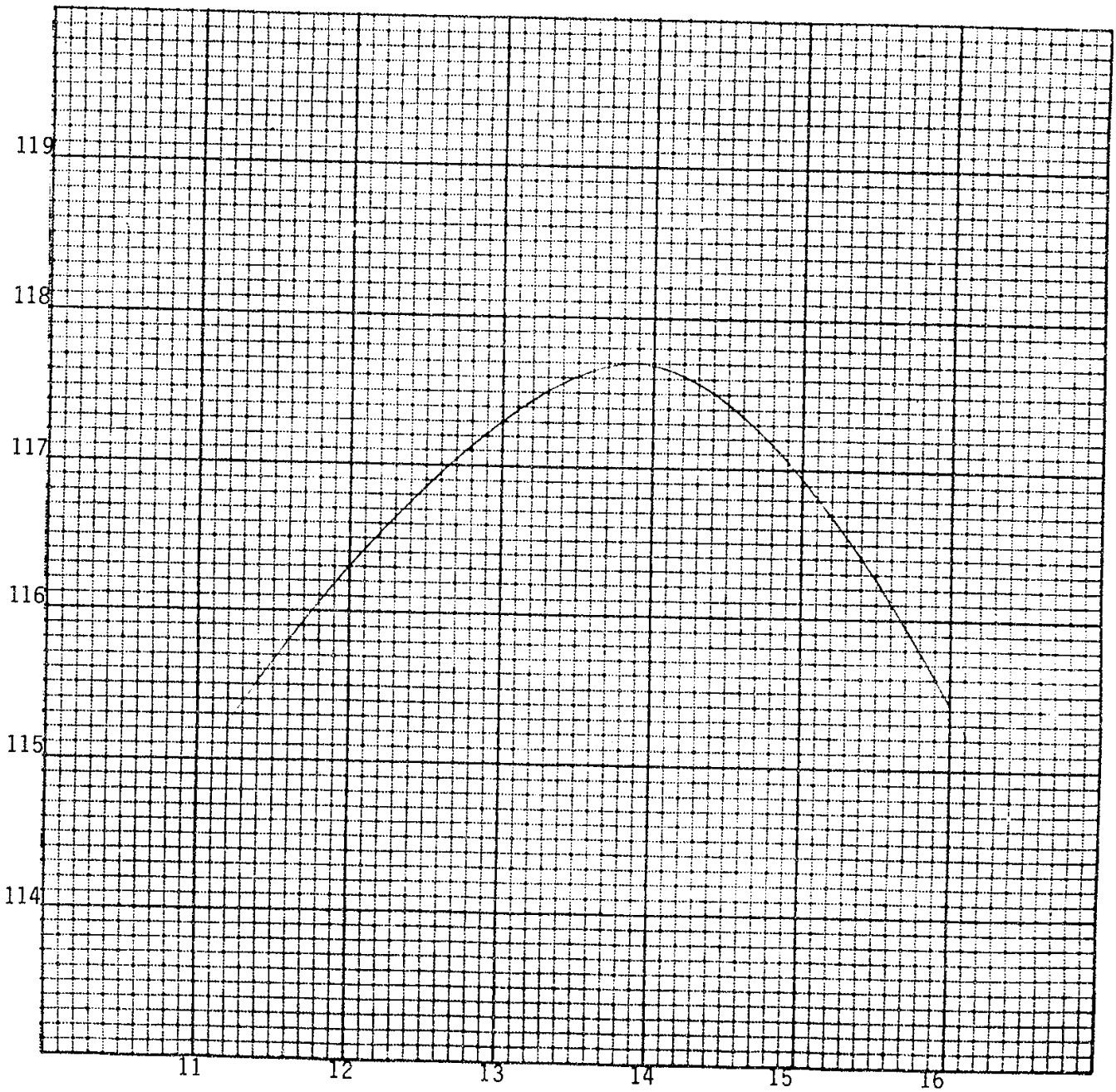
COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almalch

LABORATORY NO. 9-1357

METHOD OF TEST: ASTM:D1557-78, Method "A"

TYPE OF MATERIAL: Sand, fine to medium grained, brown (SP-SM)-9

MAXIMUM DENSITY: 117.7 lb./cu. ft. **OPTIMUM MOISTURE** 13.9 %



COMPACTION SUMMARY SHEET

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Impervious Clay Core

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-1	8-17-82	East Dike, Coordinate N 866, 120 (Existing Clay Core)	976'	11.1	11.3	-0.2	115.0	126.0	91	90	
C-2	8-17-82	East Dike, Coordinate N 866, 000 (Existing Clay Core)	973'	14.3	11.3	+3.0	119.0	126.0	94.5	90	
C-3	8-17-82	East Dike, Coordinate N 865, 800 (Existing Clay Core)	974'	11.7	11.3	+0.4	124.0	126.0	99	90	
C-4	8-17-82	North Dike, Coordinate E 2, 028, 810 (Existing Clay Core)	984'	11.1	11.3	-0.2	124.0	126.0	99	90	
C-5	8-18-82	East Dike, Coordinate N 866, 100	977.5'	14.0	11.3	+2.7	115.0	126.0	91	90	
C-6	8-18-82	East Dike, Coordinate N 866, 000	975'	12.4	11.3	+1.1	115.0	126.0	91	90	
C-7	8-18-82	East Dike, Coordinate N 865, 850	975.5'	13.0	11.3	+1.7	115.0	126.0	91	90	
C-8	8-19-82	East Dike, Coordinate N 866, 130	979'	14.3	11.2	+3.1	116.0	123.9	93.5	90	
C-9	8-19-82	East Dike, Coordinate N 855, 050	979'	12.4	11.2	+1.2	123.0	123.9	99	90	
C-10	8-19-82	East Dike, Coordinate N 865, 850	976.5'	12.3	11.2	+1.1	123.0	123.9	99	90	
C-11	8-19-82	East Dike, Coordinate N 865, 700	988.5'	13.3	11.2	+2.1	117.0	123.9	94.5	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

Impervious Clay Core

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-12	8-19-82	North Dike, Coordinate E 2, 028, 950	979'	11.7	11.2	+0.5	120.0	123.9	97	90	
C-13	8-19-82	North Dike, Coordinate E 2, 028, 800	985'	11.7	11.2	+0.5	123	123.9	99	90	
C-14	8-26-82	East Dike, Coordinate N 865, 900	980'	10.8	11.2	-0.4	124	123.9	100	90	
C-15	8-26-82	East Dike Coordinate N 866, 000	980.5'	10.8	11.2	-0.4	113.5	123.9	91.5	90	
C-16	8-26-82	North Dike Coordinate E 2, 028, 900	981.5'	12.0	11.2	+0.8	125.5	123.9	101	90	
C-17	8-26-82	North Dike Coordinate E 2, 028, 800	984'	12.0	11.2	+0.8	123	123.9	99	90	
C-18	8-30-82	East Dike Coordinate N 869, 900	982'	13.0	11.2	+1.8	116.0	123.9	94	90	
C-19	8-30-82	East Dike Coordinate N 865, 750	983.5'	12.7	11.2	+1.5	117.0	123.9	95	90	
C-20	8-30-82	North Dike Coordinate E 2, 028, 900	982.5'	13.0	11.2	+1.8	122.0	123.9	99	90	
C-21	8-30-82	North Dike Coordinate E 2, 028, 800	985.5'	12.7	11.2	+1.5	115.0	123.9	93	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

PROJECT: Northern States Power Co — Bottom Ash Pond Revision — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-22	9-10-82	East Dike Coordinate, N 865, 850	984.5'	12.4	11.2	+1.2	123	123.9	99	96	
C-23	9-10-82	East Dike Coordinate, N 866, 000	985.5'	13.0	11.2	+1.8	117	123.9	94.5	90	
C-24	9-14-82	North Dike, Coordinate E 2 029 010	986'	14.3	11.0	+3.3	128	128.3	99.5	90	
C-25	9-14-82	North Dike Coordinate E 2, 028 700	987'	14.3	11.0	+3.3	128	128.3	99.5	90	
C-26	9-16-82	East Dike, Coordinate N 865 850	987'	12.4	11.2	+2.2	124	123.9	100	90	
C-27	9-16-82	East Dike, Coordinate N 866, 000	988'	11.1	11.2	-0.1	112.5	123.9	91	90	
C-28	9-16-82	East Dike Coordinate N 865 900	989'	12.4	11.2	+2.2	124	123.9	100	90	
C-29	9-17-82	East Dike Coordinate N 866 050	990'	11.7	11.2	+0.5	115	123.9	93	90	
C-30	9-17-82	North Dike Coordinate E 2 028 800	987'	14.5	11.2	+3.3	116	123.9	94	90	
C-31	9-17-82	North Dike Coordinate E 2 029 000	988'	14.5	11.0	+3.5	125	128.3	95	90	
C-32	9-20-82	East Dike Coordinate N 865 900	991'	13.3	11.2	+2.1	116	123.9	94	90	
C-33	9-20-82	East Dike Coordinate N 866 050	992'	14.3	11.2	+3.1	123	123.9	99	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-34	9-20-82	East Dike Coordinate N 865 800	993'	13.0	11.2	+1.8	122	123.9	98.5	90	
C-35	9-20-82	East Dike Coordinate N 866 000	994'	11.1	11.2	-0.1	115	123.9	93	90	
C-36	9-21-82	East Dike Coordinate N 865 850	994.5'	13.3	11.2	+2.1	121.5	123.9	98	90	
C-37	9-21-82	East Dike Coordinate N 866 000	995'	13.0	11.2	+1.8	114	123.9	92.5	90	
C-38	9-21-82	North Dike Coordinate E 2 028 880	989.5'	12.7	11.3	+1.4	124	126.0	98.5	90	
C-39	9-21-82	North Dike Coordinate E 2 029 000	991'	12.4	11.3	+1.1	120.5	126.0	96	90	
C-40	9-22-82	East Dike Coordinate N 866 120	994'	13.0	11.2	+1.8	112.5	123.9	91	90	
C-41	9-22-82	East Dike Coordinate N 866 000	994'	12.7	11.2	+1.5	112	123.9	90.5	90	
C-42	9-22-82	East Dike Coordinate N 865 850	995'	12.4	11.2	+1.2	123	123.9	99	90	
C-43	9-23-82	East Dike Coordinate N 865 800	996'	12.7	11.2	+1.5	122	123.9	98.5	90	
C-44	9-23-82	East Dike Coordinate N 865 750	997'	12.4	11.2	+1.2	120	123.9	97	90	
C-45	9-23-82	East Dike Coordinate N 865 950	997'	12.4	11.2	+1.2	119	123.9	96	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Bottom Ash Pond Revision

PROJECT: Northern States Power Co — Impervious Clay Core — Date:

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
C-46	9-23-82	East Dike Coordinate N 866 100	995'	11.1	11.2	-0.1	117	123.9	94.5	90	
C-47s	9-24-82	North Dike Coordinate N 2 028 950	993'	12.4	11.2	+1.1	112	123.9	90.5	90	
C-48	9-24-82	North Dike Coordinate N 2 029 000	994.5'	14.3	11.2	+3.1	118.5	123.9	96	90	
C-49	9-24-82	North Dike Coordinate E 2 028 000	996'	13.0	12.2	+1.8	120.5	123.9	97.5	90	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests
Embankment

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-1	8-20-82	East Dike, West Embankment, Coordinate N 865, 900	976.5'	7.0	11.1	-4.0	119	125.0	95.5	95	
E-3	8-20-82	East Dike, East Embankment Coordinate N 865, 900	976.5'	8.1	11.1	-3.0	122	125.0	97.5	95	
E-5	8-20-82	North Dike, North Embankment Coordinate E 2,029,010	975'	4.3	11.1	-6.8	125	125.0	100	95	
E-6	8-20-82	East Dike, East Embankment Coordinate N 866, 090	978'	4.7	111	-6.4	118.5	125.0	95	95	
E-7	8-23-82	East Dike, East Embankment Coordinate N 865, 900	977.5'	7.2	11.1	-3.9	128	125.0	102.5	95	Retest of #E-4
E-8	8-23-82	East Dike, West Embankment Coordinate N 865, 900	977.5'	7.0	11.1	-4.1	125.5	125.0	100.5	95	Retest of #E-2
E-11	8-24-82	East Dike, West Embankment Coordinate N 866, 065	980'	7.2	11.1	-3.9	125.0	125.0	97	95	Retest of #E-9
E-12	8-24-82	East Dike, West Embankment Coordinate N 865, 950	980'	7.5	11.1	-3.6	118.5	125.0	95	95	Retest of #E-10
E-13	8-24-82	Old toe ditch area, East Dike, East Embankment Coordinate N 865, 900	960'	2.0	11.9	-9.9	111	115.2	96	95	
E-14	8-24-82	Old toe ditch area, East Dike, East Embankment Coordinate N 866, 100	960'	2.8	11.9	-9.1	119	115.2	103	95	
E-15	8-24-82	North Dike, South Embankment Coordinate E 2, 028, 750	986'	3.6	10.5	-6.9	114	120.0	95	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-16	8-24-82	North Dike, North Embankment, Coordinate E 2, 028, 750	986'	6.4	11.1	-4.7	119	125.0	95.5	95	
E-17	8-25-82	East Dike, East Embankment Coordinate N 865, 750	979'	2.8	11.9	-9.1	111	115.2	96.5	95	
E-18	8-25-82	East Dike, West Embankment Coordinate N 865, 750	981'	3.4	10.5	-7.1	114	120.0	95	95	
E-20	8-25-82	North Dike, North Embankment Coordinate E 2, 028, 900	980.5	9.3	11.1	-1.8	125	125.0	100	95	
E-21	8-25-82	Toe of East Dike, East Embankment Coordinate N 865, 800	961'	4.2	10.5	-6.3	118.5	120.0	98.5	95	
E-22	8-25-82	Toe of East Dike, East Embankment Coordinate N 866, 000	961'	3.4	10.5	-7.1	118	120.0	98	95	
E-23	8-25-82	East Dike, West Embankment Coordinate N 866, 000	979.5'	2.8	11.9	-9.1	111.5	115.2	97	95	
E-24	8-25-82	East Dike, East Embankment Coordinate N 866, 000	978.5'	4.2	11.9	-7.7	114.5	115.2	99.5	95	
E-25	8-26-82	North Dike, South Embankment Coordinate E 2, 028, 900	979.5'	5.8	10.5	-4.7	116.5	120.0	97	95	Retest of #E-19
E-26	8-26-82	East Dike, East Embankment Coordinate N 866, 090	978'	4.7	13.8	-9.1	104.5	109.8	95	95	
E-27	8-27-82	East Dike, East Embankment Coordinate N 365, 800	982.5	6.7	10.5	-3.8	120.5	120.0	100.5	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Passing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab #9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-28	8-27-82	East Dike, West Embankment Coordinate N 865, 750	984'	7.2	11.1	-3.9	124	125.5	99	95	
E-29	8-27-82	East Dike, East Embankment Coordinate N 866, 050	969'	5.5	11.9	-6.4	120	115.2	104	95	
E-30	8-27-82	East Dike, East Embankment Coordinate N 865, 900	971.5'	3.6	13.8	-10.2	114	109.8	104	95	
E-31	8-27-82	North Dike, North Embankment Coordinate E 2, 028, 800	987'	5.0	11.9	-6.9	111	115.2	96.5	95	
E-32	8-27-82	North Dike, South Embankment Coordinate E 2, 028, 800	987.5'	6.4	10.5	-4.1	121	120.0	101	95	
E-33	8-27-82	East Dike, East Embankment Coordinate N 866, 000	971.5'	3.4	10.5	-2.1	115.5	120.0	96	95	
E-34	8-27-82	East Dike, East Embankment Coordinate N 865, 800	973'	3.6	10.5	-6.9	117	120.0	97.5	95	
E-35	8-27-82	East Dike, East Embankment Coordinate N 865, 950	982'	8.7	10.5	-1.8	116.5	120.0	97	95	
E-36	8-27-82	East Dike, West Embankment Coordinate N 865, 950	982.5'	5.3	11.9	-6.6	116.5	115.2	101	95	
E-37	8-27-82	East Dike, West Embankment Coordinate N 866, 050	982'	5.8	11.9	-6.1	119	115.2	103	95	
E-38	8-27-82	East Dike, East Embankment Coordinate N 866, 050	981'	6.1	11.9	-5.8	115	115.2	100	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-39	9-1-82	East Dike, West Embankment Coordinate N 865, 800	985'	9.9	10.5	-0.6	122.5	120.0	102	95	
E-40	9-1-82	East Dike, West Embankment Coordinate N 865 950	985'	8.7	11.9	-3.2	115.5	115.2	100.5	95	
E-41	9-1-82	East Dike, West Embankment Coordinate N 866 050	986'	9.3	11.9	-2.6	112.5	115.2	97.5	95	
E-42	9-1-82	East Dike, East Embankment Coordinate N 866 100	981'	10.2	10.5	-0.3	123.0	120.0	102.5	95	
E-44	9-1-82	East Dike, East Embankment Coordinate N 865, 800	983'	8.1	10.5	-2.4	118	120.0	98.5	95	
E-45	9-1-82	East Dike, East Embankment Coordinate N 866 000	982'	10.2	11.9	-1.7	109	115.2	95	95	Retest of #43
E-46	9-2-82	East Dike, East Embankment Coordinate N 865 750	976'	5.3	11.9	-6.6	109	115.2	95	95	
E-47	9-2-82	East Dike, East Embankment Coordinate N 865 880	975'	5.8	11.9	-6.1	119	115.2	103	95	
E-48	9-2-82	East Dike, East Embankment, Coordinate N 866 000, Access Road	973'	6.4	11.9	-5.5	119	115.2	103	95	
E-49	9-2-82	East Dike, East Embankment, Coordinate N 866 120, Access Road	975'	5.8	11.9	-6.1	111	115.2	96.5	95	
E-50	9-2-82	East Dike, East Embankment, Coordinate N 865 800	978'	7.2	10.5	-2.7	121	120.0	101	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-51	9-1-82	East Dike, East Embankment Coordinate N 865 950	977'	6.7	10.5	-3.8	119	120.0	99	95	
E-52	9-1-82	East Dike, East Embankment Coordinate N 866 050	975'	6.1	10.5	-4.4	118	120.0	98.5	95	
E-53	9-1-82	East Dike, East Embankment Coordinate N 866 120	976'	9.9	10.5	-0.6	122.5	120.0	102	95	
E-54	9-7-82	East Dike, West Embankment Coordinate N 865 790	987'	6.4	13.9	-7.5	124	117.7	105	95	
E-55	9-7-82	East Dike, West Embankment Coordinate N 865 900	987'	6.4	13.9	-7.5	120	117.7	102	95	
E-56	9-7-82	East Dike, West Embankment Coordinate N 866 090	987'	5.3	13.9	-8.6	114	117.7	97	95	
E-57	9-7-82	East Dike, East Embankment Coordinate N 866 000	988'	5.3	13.9	-8.6	118.5	117.7	101	95	
E-58	9-7-82	East Dike, East Embankment Coordinate N 865 800	984'	7.0	10.5	-3.5	125	120.0	104.5	95	
E-59	9-7-82	East Dike, East Embankment, Coordinate N 865 950, Access Road	983'	6.7	10.5	-3.8	117	120.5	98	95	
E-60	9-7-82	East Dike, East Embankment, Coordinate N 866 150	978.5'	5.5	11.9	-5.4	114	115.2	97	95	
E-61	9-7-82	East Dike, East Embankment, Coordinate N 866 000	980'	5.3	11.9	-6.6	112	115.2	97	95	
E-62	9-8-82	East Dike, East Embankment, Coordinate	985'	5.0	12.9	-8.9	115	117.7	98	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E- 63	9-8-82	East Dike, East Embankment, Coordinate N 866 100	981'	5.3	13.9	-8.6	115	117.7	98	95	
E-64	9-8-82	East Dike, East Embankment, Coordinate N 865 950	984'	5.0	10.5	-5.5	116.5	120.0	97	95	
E-65	9-8-82	East Dike, East Embankment, Coordinate N 865 800	986.5'	6.1	10.5	-4.4	115	120.0	96	95	
E-66	9-9-82	East Dike, East Embankment, Coordinate N 866 100	982'	4.7	13.9	-9.2	115	117.7	98	95	
E-67	9-9-82	East Dike, East Embankment, Coordinate N 865 950, Access Road	985'	5.0	13.9	-8.9	117	117.7	99	95	
E-68	9-9-82	East Dike, East Embankment, Coordinate N 865 800	985.5'	4.7	13.9	-9.2	120	117.7	102	95	
E-69	9-9-82	North Dike, North Embankment, Coordinate E 2 028 800	983'	4.7	13.9	-9.2	115	117.7	98	95	
E-70	9-9-82	North Dike, North Embankment, Coordinate, E 2 028 950	981'	6.1	10.5	-4.4	122	120.0	101.5	95	
E-71	9-9-82	North Dike, North Embankment, Coordinate E 2 028 980	989'	5.5	10.5	-5.0	125	120.0	104	95	
E-72	9-9-82	North Dike, North Embankment, Coordinate, E 2 029 010	982'	6.4	10.5	-4.1	116	120.0	96.5	95	
E-73	9-9-82	North Dike, North Embankment, Coordinate, E 2 029 100	983'	6.4	13.8	-7.4	107	109.8	98	95	
E-74	9-10-82	North Dike, North Embankment, Coordinate E 2 028 620	982'	5.0	13.9	-8.9	122	117.7	104	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E- 75	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 800	992'	5.3	13.9	-8.6	112	117.7	95.5	95	
E-76	9-10-82	North Dike, North Embankment, Coordinate, E 2 029 000	990'	5.5	13.9	-8.4	114	117.7	97	95	
E-77	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 900	991'	5.0	13.9	-8.9	112	117.7	95.5	95	
E-78	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 700	996'	5.0	10.5	-5.5	117	120	97	95	
E-79	9-10-82	North Dike, North Embankment, Coordinate, E 2 028 950	994'	6.1	13.9	-7.8	122	117.7	103.5	95	
E-80	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 850	991.5'	5.0	13.8	-8.8	110	119.8	100	95	
E-81	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 940	992'	5.5	10.5	-5.5	120	120.0	100	95	
E-82	9-13-82	North Dike, North Embankment, Coordinate, E 2 029 000	995'	5.5	10.5	-5.5	124	120.0	103	95	
E-83	9-13-82	North Dike, North Embankment Coordinate, E 2 028 940	995'	5.0	10.5	-5.5	125	120.0	104	95	
E-84	9-13-82	North Dike, North Embankment, Coordinate, E 2 028 850	993.5'	6.1	10.5	-4.4	122	120.0	101.5	95	
E-85	9-13-82	North Dike, North Embankment Coordinate, E 2 028 980	994.5'	5.8	10.5	-4.3	125	120.0	104	95	
E-86	9-14-82	East Dike, East Embankment	986'	6.1	13.0	-7.8	110	117.7	101	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-87	9-14-82	East Dike, East Embankment, Coordinate N 865 900, Access Road	986.5'	7.0	10.5	-3.5	121	120.0	101	95	
E-88	9-14-82	East Dike, East Embankment, Coordinate, 865 800	988'	6.7	10.5	-3.8	121.5	120.0	101.5	95	
E-89	9-14-82	East Dike, West Embankment, Coordinate, N 865 850	989'	6.1	13.9	-7.8	121	117.7	103	95	
E-90	9-14-82	East Dike, West Embankment, Coordinate, N 866 000	989.5'	5.5	13.9	-8.4	124	117.7	105	95	
E-91	9-14-82	East Dike, West Embankment Coordinate, N 865 800	990'	5.0	13.9	-8.9	112	117.7	95	95	
E-92	9-16-82	East Dike, West Embankment Coordinate, N 866 100	991'	5.0	13.8	-8.8	105	109.8	95.5	95	
E-93	9-16-82	East Dike, East Embankment Coordinate, N 865 850	990'	6.1	13.8	-7.7	114	109.8	104.5	95	
E-94	9-16-82	East Dike, East Embankment Coordinate N 866, 050	991'	5.5	13.9	-8.4	120	117.7	102	95	
E-95	9-16-82	East Dike, East Embankment Coordinate, N 865, 800	992'	5.0	13.9	-8.9	114.5	117.7	97.5	95	
E-96	9-16-82	East Dike, West Embankment Coordinate, N 865, 700	992'	5.5	13.9	-8.4	115	117.7	98.5	95	
E-97	9-16-82	East Dike, West Embankment Coordinate, N 866, 000	993'	5.8	13.9	-8.1	116	117.7	98.5	95	
E-98	9-17-82	East Dike, East Embankment Coordinate N 865 800	993'	5.0	13.9	-8.9	118	117.7	100	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY, INC.

Summary of Passing Soil Density Tests

Date:

Bottom Ash Pond Revisions

PROJECT: Northern States Power Co — Embankment

Sherburne County Generating Plant

Test No.	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-99	9-17-82	East Dike, East Embankment, Coordinate, N 866 000	994'	4.2	13.9	-9.7	112	117.7	95	95	
E-100	9-17-82	East Dike, West Embankment, Coordinate, N 865 900	994'	5.0	13.9	-8.9	112	117.7	95	95	
E-101	9-17-82	East Dike, West Embankment, Coordinate, N 866 100	995'	5.5	13.9	-8.4	114	117.7	96.5	95	

TWIN CITY TESTING AND ENGINEERING LABORATORY INC

Summary of Failing Soil Density Tests

PROJECT: Bottom Ash Pond Revisions
Northern States Power Co
Sherburne County Generating Plant

Embankment

Date: Sept 2, 1982
Lab # 9-1292

Test No	Date	Location of Test	Elev.	Field Moist. (%)	Opt. Moist. (%)	Moisture Variance From Optimum	Field Density (pcf)	Max. Density (pcf)	Comp-action (%)	Comp. Spec. (%)	Remarks
E-2	8-20-82	East Dike, West Embankment Coordinate N865, 900	979'	8.7	11.1	-2.4	111.0	125.0	89	95	Passed by #E-8
E-4	8-20-82	East Dike, East Embankment Coordinate N 865, 900	979'	5.3	11.1	-5.8	112.0	125.0	90	95	Passed by #E-7
E-9	8-23-82	East Dike, West Embankment Coordinate N 866, 065	980'	6.4	11.1	-4.7	117	125.0	93.5	95	Passed by #E-11
E-10	8-23-82	East Dike, West Embankment Coordinate N 865, 950	980'	7.0	11.1	-4.1	110	125.0	88	95	Passed by #E-12
E-19	8-25-82	North Dike, South Embankment Coordinate E 2, 028, 900	979.5'	5.8	11.1	-5.3	111.5	125.0	89.5	95	Passed by #E-25
E-43	9-1-82	East Pile, East Embankment Coordinate N 866,000	982'	10.2	11.9	-1.7	101.5	115.2	88.5	95	Passed by E-45

FIELD DENSITY TESTS

BORROW AREA

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: TESTS OF SOIL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS

DATE: August 25, 1982

REPORTED TO: BECKER, MINNESOTA
Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black &Veatch Consulting Eng

LABORATORY No. 9-1292

SAMPLE NUMBER:	1	2
SAMPLE IDENTIFICATION:	Proposed Clay Core Fill	Proposed Clay Core Fill
LOCATION SAMPLED:	Borrow Area	Borrow Area
UNIFIED SOIL CLASSIFICATION:	Sandy Clay. a little gravel, brown (CL)	Sandy Clay a little gravel, brown (SC-CL)

MECHANICAL ANALYSIS:

Passing	3/8"	100%	100%
	#4	98	95
	#10	96	92
	#40	84	79
	#100	62	59
	#200	57	48

LABORATORY MOISTURE-DENSITY RELATION OF SOIL: (see attached curve)

Method -	ASTM:D1557 Modified	ASTM:D1557 Modified
Maximum Dry Density (pcf)	128.3	126.0
Optimum Moisture (%)	11.0	11.3
LL	44	26
PL	16	13
PI	28	13
Undisturbed Field Density (pcf)	94	-

Twin City Testing and Engineering Laboratory, Inc.

By _____

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST. PAUL, MN 55114
PHONE 612/645-3601

REPORT OF: TESTS OF SOIL

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POINT REVISIONS

REPORTED TO: BECKER, MINNESOTA
Northern States Power Co
Attn: Roger Anderson
414 Nicollet Mall
Minneapolis, MN 55401

DATE: August 25, 1982

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting
Attn: Larry Almalch Eng

LABORATORY No. 9-1292

SAMPLE NUMBER:		3	4
SAMPLE IDENTIFICATION:		Proposed Clay Core Fill	Proposed Clay Core Fill
LOCATION SAMPLED:		Borrow Area	Borrow Area
UNIFIED SOIL CLASSIFICATION:		Clayey Sand, trace of gravel, reddish brown (SC)	Sandy Clay, a little gravel, brown (SC-CL)
MECHANICAL ANALYSIS:			
Passing	3/8"	100%	100%
	#4	96	92
	#10	92.8	91
	#40	80.9	76
	#100	59.4	53
	#200	49.6	41
LABORATORY MOISTURE-DENSITY RELATION OF SOIL: (see attached curve)			
	Method	ASTM:D1557 Modified	ASTM:D1557 Modified
	Maximum Dry Density (pcf)	134.8	123.9
	Optimum Moisture (%)	8.4%	11.2%
	LL	16	29
	PL	13	14
	PI	3	15
	Undisturbed Field Density (pcf)	114.5	107

Twin City Testing and Engineering Laboratory, Inc.

By _____

FILTER MATERIAL GRADATION

twin city testing
and engineering laboratory, inc.
662 CROMWELL AVENUE
ST PAUL MN 55114
PHONE 612/645-3601

REPORT OF: TEST OF BASE AGGREGATE

PROJECT: NSP SHERBURNE COUNTY GENERATING PLANT
BOTTOM ASH POND REVISIONS
BECKER, MINNESOTA

DATE: November 29, 1982

REPORTED TO: Northern States Power Company
Attn: Roger B Anderson
414 Nicollet Mall, 7th Floor
Minneapolis, Minnesota 55401

FURNISHED BY:

COPIES TO: 1-C S McCrossan
1-Black & Veatch Consulting Eng
Attn: Larry Almaleh

LABORATORY No. 9-1357

SAMPLE NUMBER:		1	SPECIFICATIONS
TYPE OF AGGREGATE:		Filter Material - Type 1	Type I Filter Material
LOCATION SAMPLED:		East Embankment Coordinant 866, 150N	
MECHANICAL ANALYSIS:			
Passing	3"	100	100
	2"	100	85-100
	1 1/2"	85	72-90
	3/4"	58	50-70
	1/2"	50	35-50
	3/8"	27	-
	#3	22	22-32
	#6	16	12-20
	#10	12	0-12

REMARKS:

The above sample meets the project specification for a Type I Filter material.

PERMEABILITY TESTS

LABORATORY TEST DATA

PROJECT: N.S.P. Sherburne County Generating Plant
Bottom Ash Pond Revisions, Becker, Minnesota

DATE: Sept 10, 1982

REPORTED TO: Northern States Power Company

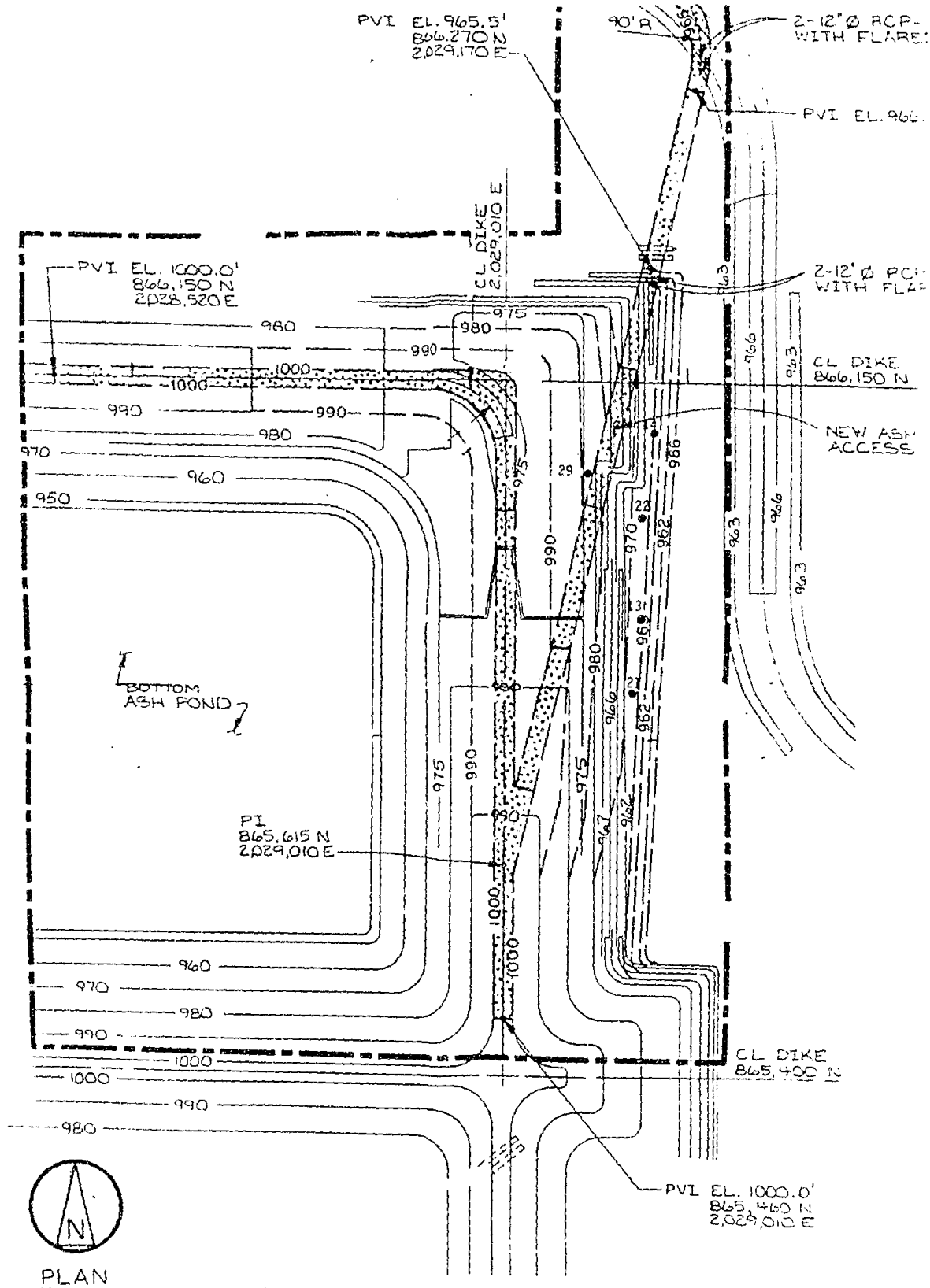
JOB NO.: 9-1357

Permeability Sample Number	1	2	3	4
Sample Location	Impermeable Clay Core, East Dike, Coordinate N865, 950	Impermeable Clay Core, East Dike, Coordinate N866, 075,	Impermeable Clay Core East Dike, Coordinate N866, 000	Impermeable Clay Core North Dike, Coordinate E2, 029, 925
Elevation	984'	984'	994	994
Soil Classification (ASTM:D2487)	Fill, mostly Sandy Clay (CL)	Fill, mostly Sandy Clay (CL)	Fill, Mixture of Sandy Clay and Clayey Sand, Brown (SC-CL)	Fill, Mixture of Sandy Clay and Clayey Sand, Brown (SC-CL)
Type of Sample	3T	3T	3T	3T
Moisture-Density Relation of Soil (ASTM:D698) 1557-78, Method "A" Modified Proctor	Proctor #1	Proctor #2	Proctor #4	Proctor #4
Max. Dry Density (PCF)	128.3	126.0	123.9	123.9
Optimum Moisture Content (%)	11.0	11.3	11.2	11.2
Permeability Test				
Trial No.	6-9	6-9	6-9	6-9
Type of Test	Falling Head	Falling Head	Falling Head	Falling Head
Type of Specimen	In-Situ (Clay Core)	In-Situ (Clay Core)	In-Situ (Clay Core)	In-Situ (Clay Core)
Specimen Height (inches)	2.33	2.58	2.12	2.45
Specimen Diameter (inches)	2.84	2.81	2.83	2.89
Dry Density (PCF)	120.0	113.8	114.2	112.1
Percent of Max. Density	93.5%	90.5%	92%	90.5%
Moisture Content (%)	12.0	14.4	11.9	12.5
Max. Head Differential (ft)	10.0	10.0	10.0	10.0
Confining Pressure (effective - PSI)	2.0	2.0	2.0	2.0
Water Temperature (^{o}C)	23	23	22	22
Coefficient of Permeability K @ 20^{o}C (cm/sec)	$1X10^{-8}$	$2X10^{-8}$	$1x10^{-6}$	4×10^{-6}
K @ 20^{o}C (ft/min)	$2X10^{-8}$	$4X10^{-8}$	2×10^{-6}	8×10^{-6}
Atterberg Limits				
Liquid Limits (%)	22.3	20.7	25.0	22.6
Plastic Limit (%)	12.4	13.5	11.9	12.5
Plasticity Index	9.9	7.2	13.1	10.1

SKETCHES OF

COMPACTION TEST

LOCATIONS



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

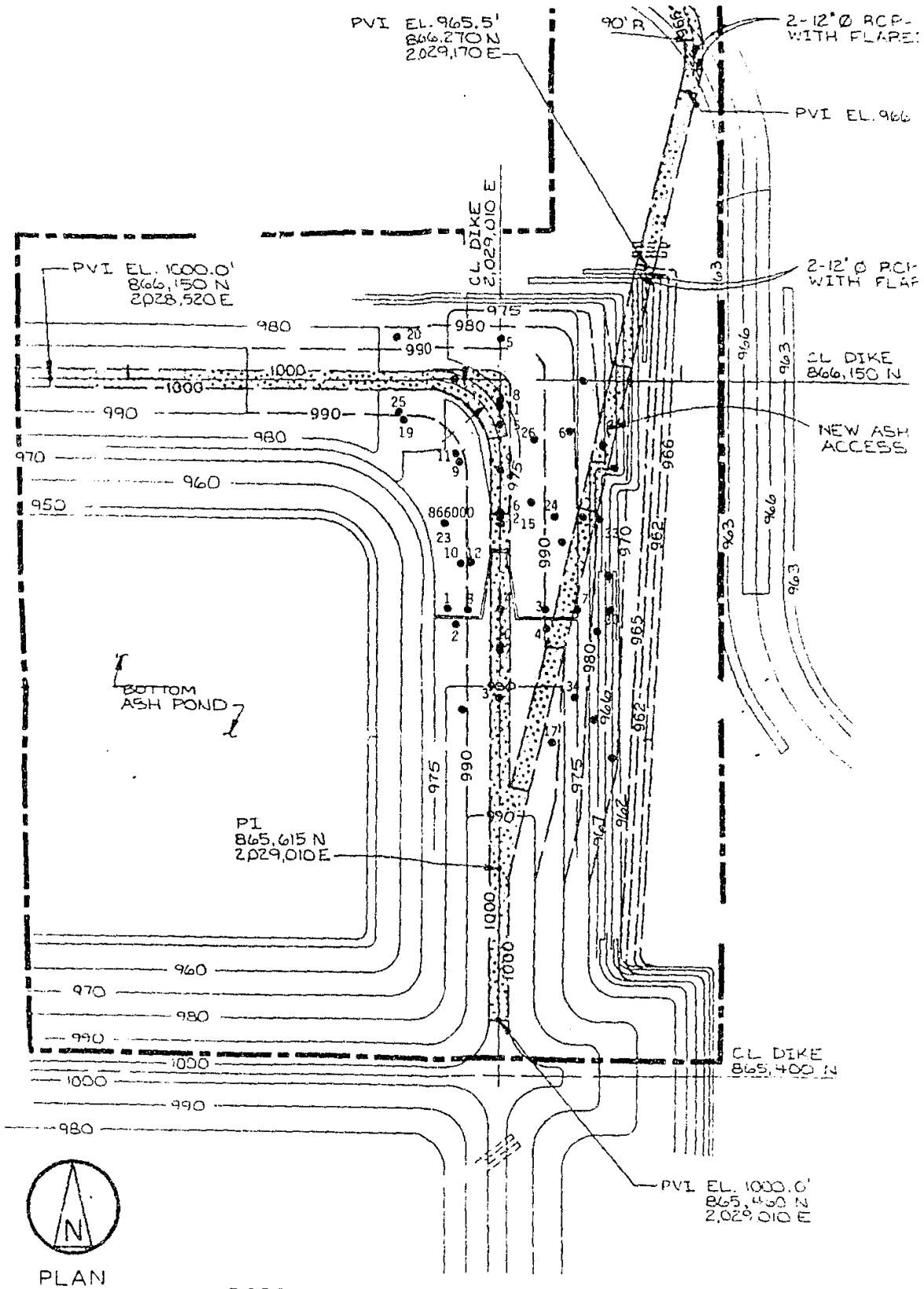
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TESTING LOCATIONS

BETWEEN ELEVATIONS 960'-970'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

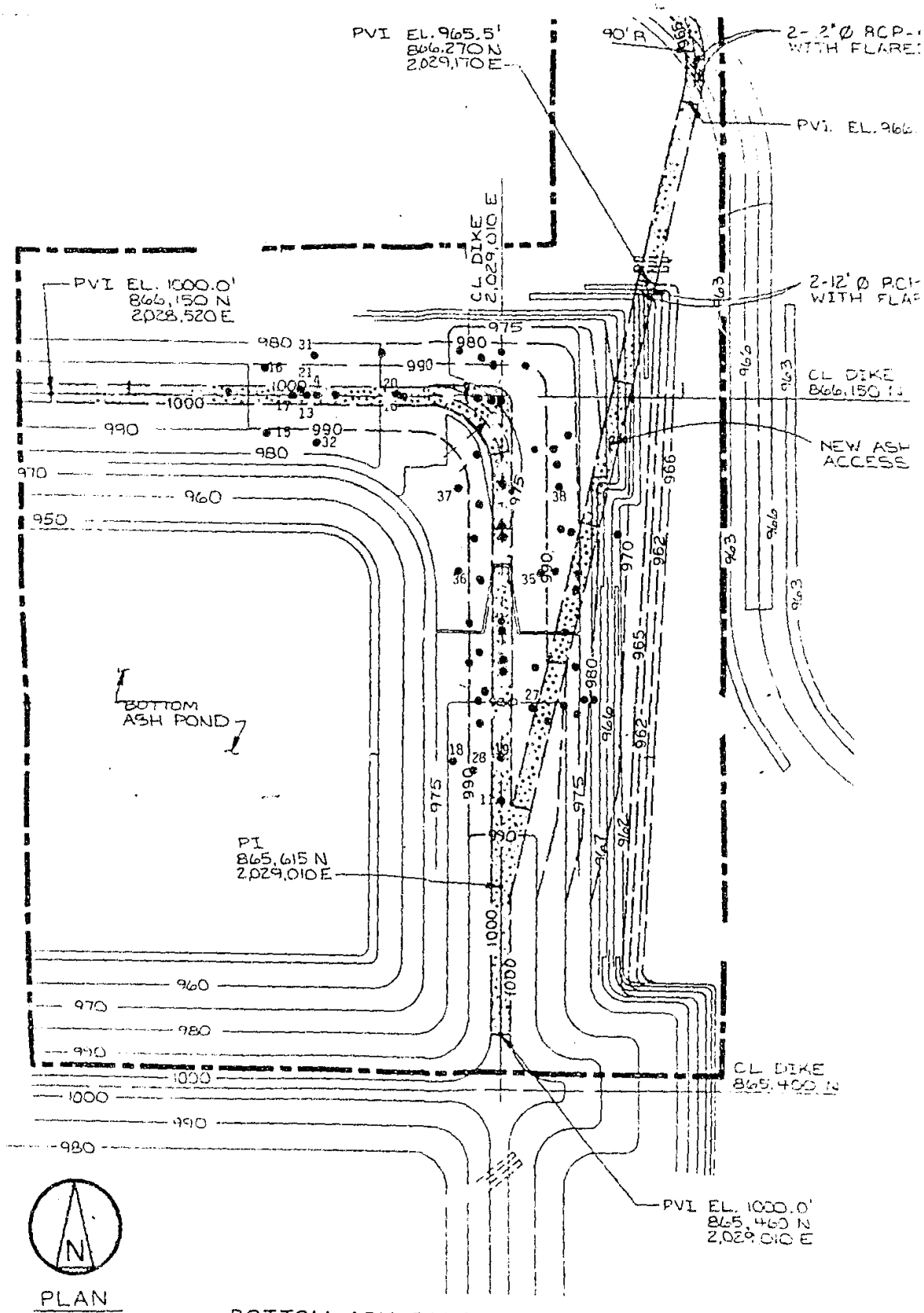
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TESTING LOCATIONS

BETWEEN ELEVATIONS 971'-980'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

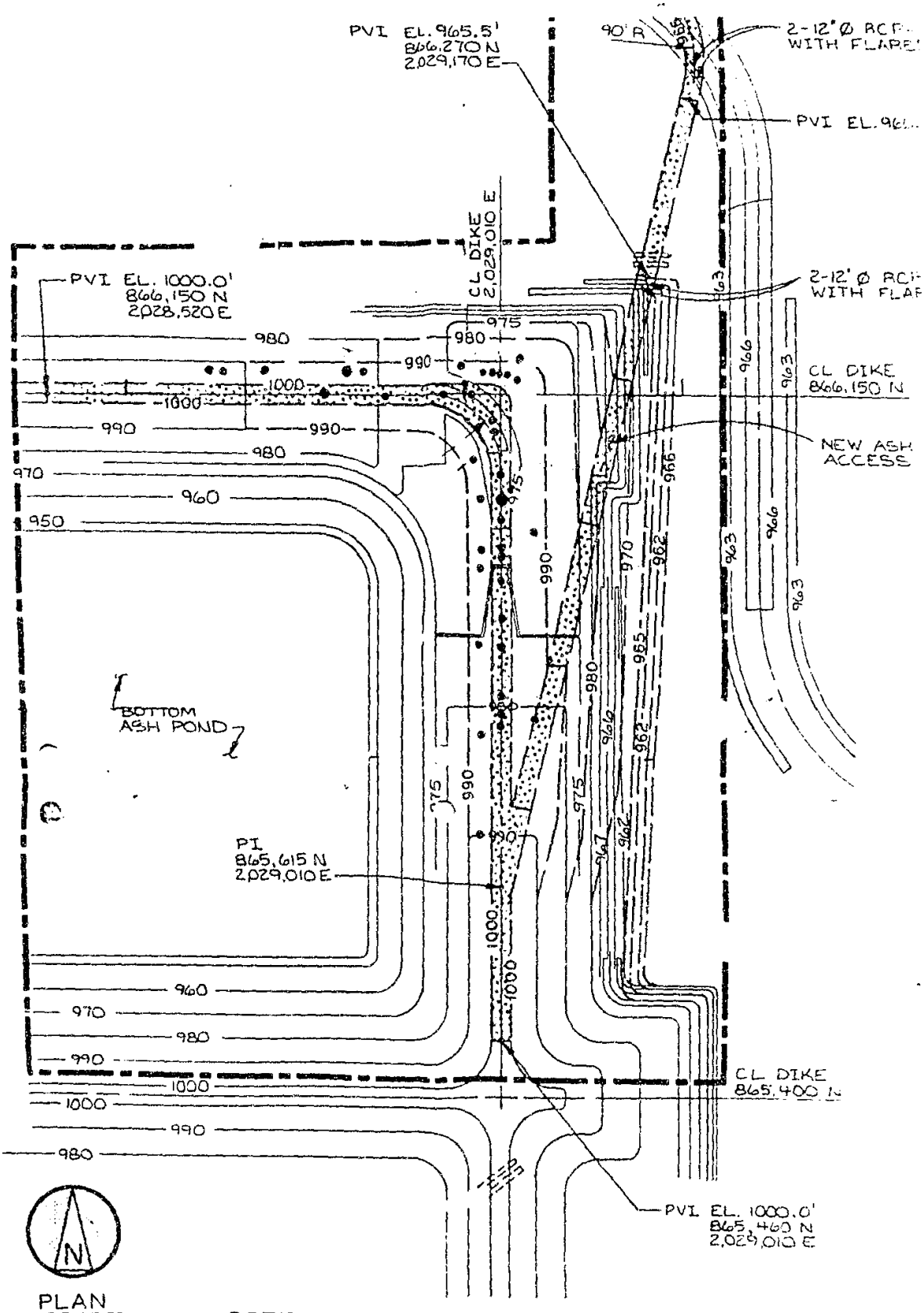
MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TEST LOCATIONS

BETWEEN ELEVATION 981' - 990'

TWIN CITY TESTING LABORATORY #9-1292



PLAN

SCALE: 1" = 100'-0"

BOTTOM ASH POND MODIFICATION

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA

SHERBURNE COUNTY GENERATING PLANT

COMPACTION TEST LOCATIONS

BETWEEN ELEVATIONS 991' - 1000'

TWIN CITY TESTING LABORATORY #9-1292