Patzig Testing Laboratories Co., Inc.

3922 DELAWARE AVENUE DES MOINES, IOWA 50313 (515) 266-5101

November 18, 1980

City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Re: Ames Lagoons
Ames Power Plant
Lab No. 199869

Attn: Merlin Hove

Gentlemen:

This letter summarizes the test results and conversation pertaining to the above project to date.

Construction commenced October 31, 1980, and a representative of this firm visited the site as requested by Jim Townsend of Lutz, Daily & Brain. The lime pond basin and dike fill areas had been stripped prior to the visit. Jim Townsend verified that stripping and discing was performed prior to fill placement on the south, west and north dikes. The east dike area was stripped; however, discing and filling had not commenced. The stripping material was used for the toe slope fill of the west dike exterior, and for the centerline fill of the south dike. This material had been accepted as suitable random fill.

The major portion of the lime pond dike was constructed from October 31 thru November 6, 1980, and in-place density and moisture content was determined at 51 locations throughout this interval, with some additional testing at later dates. In-place densities were approximately 95 percent relative compaction or greater in all cases. Moisture content in the south dike random fill (strippings) was relatively high as determined by the nuclear gauge, however. Samples were submitted to the laboratory to evaluate oven-dry moisture of this material, and the high moisture content was confirmed. Lutz, Daily & Brain considered this material acceptable, however, as a suitable density had been obtained. High and low moisture contents at other locations were also accepted by Lutz, Daily & Brain through Jim Townsend where adequate density was achieved.

On November 3, 1980, three samples of fill material were submitted to the laboratory to determine plasticity indexes. The sample locations are shown on the site plan, and test results are enclosed.

The ash pond dikes were primarily constructed from November 5 thru November 10, 1980. In-place density and moisture content was evaluated at 20 locations during this interval. The number of random fill density tests in relation to liner density tests was decreased on the basis of job history and construction observations. Densities were 95 percent relative compaction or greater in all cases.

-continued-

On November 7, 1980, nine soil samples were obtained at locations shown on the site plan to evaluate gradation and plasticity indexes. The samples were selected primarily from marginal areas to define the limits of suitable liner materials. Results of these tests are enclosed.

On November 17, 1980, construction of the lagoon bottom liner, and our acceptance testing, is continuing. Also, sampling for as-built liner permeability is underway. We will submit a record of further field and laboratory test results as they are developed.

If you have questions concerning this report, please contact us at your convenience.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Craig A. Carradus

Craig A. Carradus, E.I.T.

CAC/dkb

2 cc above
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

I hereby certify that this plan, specification or report was prepared by me or under my direct personal supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa.

Signed Date

Byron A. Marks 11-18 1980

Byron A. Marks, P.E., Iowa Reg. No. 4928

PROJECT Ames Lagoon
Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

LAB. NO. 199869-A

DATE November 15, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Maximum Density-Optimum Moisture Determination
SUBMITTED BY sampled by lab rep @ site
SENDER'S NO. _____ MARKED _____
DATE RECEIVED 10/31/80 DATE TESTED 10/31/80 BY CC/BAM

MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION
(ASTM D698)

Borrow Area	On Site
Reference No.	01101A
Soil Color	Gray
Textural Classification, visual	Silty Sand
Maximum Dry Density, pcf	112.6
Optimum Moisture, percent	15.0

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

FORM 100

PROJECT Ames Lagoon
Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

LAB. NO. 199869-B

DATE November 15, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Maximum Density-Optimum Moisture Determination
SUBMITTED BY sampled by lab rep @ site
SENDER'S NO. _____ MARKED _____
DATE RECEIVED 10/31/80 DATE TESTED 10/31/80 BY CC/RES/BAM

MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION
(ASTM D698)

Borrow Area	On Site
Reference No.	01101B
Soil Color	Gray
Textural Classification, visual	Very Silty Sand
Maximum Dry Density, pcf	111.7
Optimum Moisture, percent	15.6

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

FORM 100

PROJECT Ames Lagoon
Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE

DES MOINES, IOWA 50313

LAB. NO. 199869-C

DATE November 15, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Maximum Density-Optimum Moisture Determination
SUBMITTED BY sampled by lab rep @ site
SENDER'S NO. _____ MARKED _____
DATE RECEIVED 10/31/80 DATE TESTED 11/3/80 BY BC/BAM

MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION
(ASTM D698)

Borrow Area	Lime Pond
Reference No.	01104B
Soil Color	Black
Textural Classification, visual	Silty Clay w/Organics
Maximum Dry Density, pcf	94.0
Optimum Moisture, percent	25.0

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

FORM 100

PROJECT Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

LAB. NO. 199869-D

DATE November 15, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Relative Density of Cohesionless Soil
SUBMITTED BY
SENDER'S NO. MARKED
DATE RECEIVED 11/6/80 DATE TESTED 11/7/80 BY CAC/BAM

RELATIVE DENSITY OF COHESIONLESS SOIL
(ASTM D2049)

Borrow Area	On Site
Reference No.	-
Soil Color	Brown
Textural Classification, Visual	Fine to Medium Sand
Maximum Density, pcf	115.0
Minimum Density, pcf	96.0

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Grain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

FORM 100

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Lagoon
Ames Power Plant
Ash Lagoon

Lab No. 199869-E

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

18 In-Place Density Determinations
Method: Nuclear ASTM D 2922 Date Tested 11/1/80 By CCA/BAM
Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
1	125' N. of S. End in Liner, W. Dike	00825C	16.6	106.3	100.5	-8'
2	250' N. of S. End in Liner, W. Dike	01101A	16.9	112.8	100.2	-7'
3	350' N. of S. End CL of Dike, W. Dike	01101A	15.7	112.4	99.8	-6'
4	150' E. of W. End in Liner, S. Dike	00825B	26.7	98.4	100.4	-10'
5	275' E. of W. End in Liner, S. Dike	00825C	12.9	110.1	104.0	-11'
6	525' N. of S. End, 10' W. of CL, W. Dike	01101A	7.0	111.5	99.0	-5'
7	325' E. of W. End in Liner, S. Dike	00825C	21.3	101.5	95.9	-9'
8	350' E. of W. End in Liner, S. Dike	00825C	17.1	105.7	99.9	-8'
9	250' E. of W. End on CL, S. Dike	01104B	31.0	89.7	95.4	-6'
10	260' E. of W. End, S. Dike	01104B	32.2	89.9	95.6	-5'
11	200' E. of W. End in Liner, N. Dike	00825B	24.0	94.0	95.9	-7½'
12	190' E. of W. End in Liner, N. Dike	00825C	18.9	108.0	102.1	-6½'
13	190' E. of W. End CL N. Dike	01101A	7.9	113.9	101.1	-7'
14	450' E. of W. End in Liner, N. Dike	00825C	16.3	103.6	97.9	-7½'

-continued-

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type

Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
15	650' E. of W. End CL S. Dike	01104B	31.3	90.0	95.7	-7½'
16	380' N. of S. End in Liner, W. Dike	00825B	27.8	90.0	91.8	-4'
17	275' N. of S. End, 10' W. of CL Dike	01101A	7.3	113.9	101.1	-3'
18	Rework & Retest of #16, 325' N. of S. End in Liner, W. Dike	00826A	19.1	99.5	95.7	-4'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thomspon & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
01101A	112.6	15.0	Brown-Gray	Sand
00825B	98.0	22.2	Black	Silty Clay
01104B	94.0	25.0	Black	Silty Clay t/Organics
00826A	104.0	19.0	Dk. Brown	Silty Clay

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-F

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

12 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/3/80 By CCA/BAM

Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
19	275' E. of W. End on CL, N. Dike	01101A	9.6	117.2	104.1	-5½'
20	380' E. of W. End in Liner, N. Dike	00825C	20.3	106.2	100.4	-6'
21	100' E. of W. End in Liner, N. Dike	00825C	17.4	112.0	105.9	-6'
22	250' N. of S. End in Liner, W. Dike	00825C	17.4	103.0	97.4	-3'
23	Retest #9, S. Dike	01104B	31.3	89.1	94.8	-6'
24	125' E. of W. End in Liner, S. Dike	00825C	22.3	101.3	95.7	-6'
25	400' E. of W. End in Liner, N. Dike	00825B	21.9	96.8	98.8	-5'
26	150' E. of W. End on CL, N. Dike	01117A	11.3	119.7	98.9	-4½'
27	550' N. of S. End in Liner, W. Dike	00825C	17.5	107.7	101.8	-0'
28	150' N. of S. End in Liner, W. Dike	00825B	29.4	94.8	96.7	-2'
29	200' N. of S. End in Liner, W. Dike	00825B	26.7	94.6	96.5	-1'

-continued-

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type

LAB. NO. 199869-F

Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
30	600' E. of W. End in Liner, S. Dike	00825B	27.0	95.6	97.6	-10½'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
01101A	112.6	15.0	Brown & Gray	Silty Sand
00825C	105.8	18.1	Dk. Brown	Silty Clay †/Sand
01104B	94.0	25.0	Black	Silty Clay †/Organics
00825B	98.0	22.2	Black	Silty Clay
01117A	121.0	12.0		Very Silty Clay Sand

PROJECT Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE

DES MOINES, IOWA 50313

LAB. NO. 199869-G

DATE November 15, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Maximum Density-Optimum Moisture Determination

SUBMITTED BY sampled by lab rep @ site

SENDER'S NO. MARKED

DATE RECEIVED 11/3/80 DATE TESTED 11/10/80 BY BC/BAM

MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION
(ASTM D698)

Borrow Area	On Site
Reference No.	01113A
Soil Color	Brown-Gray
Textural Classification, visual	Very Silty Sand
Maximum Dry Density, pcf	120.5
Optimum Moisture, percent	11.9

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

FORM 100

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-H

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

13 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/4/80 By BC/BAM

Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
31	30' W. & 50' N. of SW Corner of Lime Pond on Access Road	00825C	20.9	101.5	95.9	-2'
32	300' E. of W. End, N. Dike Lime Pond	00825C	18.4	104.6	98.9	-1'
33	550' E. of W. End, N. Dike Lime Pond	00825C	18.9	104.0	98.2	-3'
34	500' E. of W. End, N. Dike Lime Pond	00825C	19.7	101.7	96.1	-5'
35	450' E. of W. End, S. Dike Lime Pond	00825C	19.4	103.0	97.4	-10'
36	475' E. of W. End, S. Dike Lime Pond	00825C	18.0	106.2	100.4	-8'
37	425' E. of W. End, S. Dike Lime Pond	01101B	16.3	111.5	99.9	-5'
38	575' E. of W. End, S. Dike Lime Pond	00825C	18.7	101.7	96.2	-4'
39	425' E. of W. End, N. Dike Lime Pond	00825C	19.9	101.3	95.7	-2'
40	125' E. of W. End, N. Dike Lime Pond	00825C	19.4	101.7	96.1	-0'
41	375' E. of W. End, S. Dike Lime Pond	00825C	20.0	100.8	95.3	-2'
42	100' E. of W. End, S. Dike Lime Pond	00825C	18.0	104.6	98.9	-1'

-continued-

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type

LAB. NO. 199869-H

Location Reference Lime Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
43	200' S. of N. End, E. Dike Lime Pond	00825C	19.2	102.8	97.2	-12'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay †/Sand
01101B	111.7	15.6	Gray	Very Silty Sand

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-1

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

6 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/5/80 By BC/BAM

Location Reference Lime and Ash Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
44	500' S. of N. End, E. Dike Lime Pond	00825C	16.5	106.4	100.6	-11'
45	450' S. of N. End, E. Dike Lime Pond	00825B	21.0	95.0	96.9	-10'
46	100' S. of N. End, E. Dike Lime Pond	00825B	21.9	93.8	95.7	-9'
47	325' S. of N. End, E. Dike Lime Pond	00826A	17.7	99.0	95.2	-8'
48	500' W. of E. End, N. Dike Ash Pond	00825C	16.7	104.4	98.7	-11'
49	500' S. of N. End, E. Dike Lime Pond	00825C	18.6	103.5	97.8	-7'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb

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1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00825B	98.0	22.2	Dk. Brown	Silty Clay
00826A	104.0	19.0	Dk. Brown	Silty Clay

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-J

Date November 15, 1980

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

6 In-Place Density Determinations

Method: Nuclear ASTM Date Tested 11/6/80 By BC/BAM

Location Reference Lime Pond or Ash Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
50	100' S. of N. End, E. Dike Lime Pond	00826A	18.8	100.5	96.6	-6'
51	325' S. of N. End, E. Dike Lime Pond	00826A	18.9	102.8	98.8	-5'
52	550' S. of N. End, E. Dike Lime Pond	00826A	18.2	99.5	95.7	-4'
53	525' E. of W. End, S. Dike Ash Pond	00825B	20.8	94.5	96.4	-11'
54	350' E. of W. End, S. Dike Ash Pond	00825B	21.5	96.8	98.8	-10'
55	150' E. of W. End, S. Dike Ash Pond	00825B	21.0	94.6	96.5	-9'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
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1 cc McAninch Corp.
1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00826A	104.0	19.0	Dk. Brown	Silty Clay
00825B	98.0	22.2	Dk. Brown	Silty Clay

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-K

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

8 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/7/80 By BC/BAM

Location Reference Ash Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
56	50' W. of E. End, N. Dike Ash Pond	00825C	19.2	104.5	98.8	-7'
57	100' E. of W. End, S. Dike Ash Pond	00826A	19.9	100.5	96.6	-6'
58	250' W. of E. End, N. Dike Ash Pond	00826A	20.5	99.2	95.4	-6'
59	500' W. of E. End, N. Dike Ash Pond	00826A	20.1	100.0	96.2	-5'
60	25' W. of E. End, N. Dike Ash Pond	00826A	21.1	99.7	95.9	-4'
61	350' W. of E. End, N. Dike Ash Pond	00826A	19.9	100.9	97.0	-3'
62	100' N. of S. End, E. Dike Ash Pond	00826A	20.9	100.5	96.6	-12'
63	250' N. of S. End, E. Dike Ash Pond	00826A	19.8	101.7	97.8	-11'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,
PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

BAM/dkb
2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp. 1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00826A	104.0	19.0	Dk. Brown	Silty Clay

PATZIG TESTING LABORATORIES CO., INC.
515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-L

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 15, 1980

10 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/8/80 By BC/BAM

Location Reference Lime or Ash Pond As Below Elevation Reference Top of Dike

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
64	150' S. of N. End, E. Dike Lime Pond	00825C	20.0	104.0	98.3	-3'
65	125' N. of S. End, E. Dike Ash Pond	00825C	18.4	105.6	99.8	-10'
66	175' S. of N. End, E. Dike Lime Pond	00826A	20.5	101.5	97.6	-0'
67	75' W. of E. End, N. Dike Ash Pond	00826A	18.1	101.7	97.8	-2'
68	275' W. of E. End, N. Dike Ash Pond	00826A	18.3	102.2	98.3	-1'
69	475' N. of S. End, E. Dike Ash Pond	00825C	18.0	105.7	99.9	-9'
70	325' N. of S. End, E. Dike Ash Pond	00826A	20.5	99.5	95.7	-8'
71	100' N. of S. End, E. Dike Ash Pond	00826A	20.3	100.5	96.6	-7'
72	525' N. of S. End, E. Dike Ash Pond	00825C	19.0	104.3	98.6	-6'
73	350' E. of W. End, S. Dike Ash Pond	00826A	19.9	100.5	96.6	-5'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,
PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

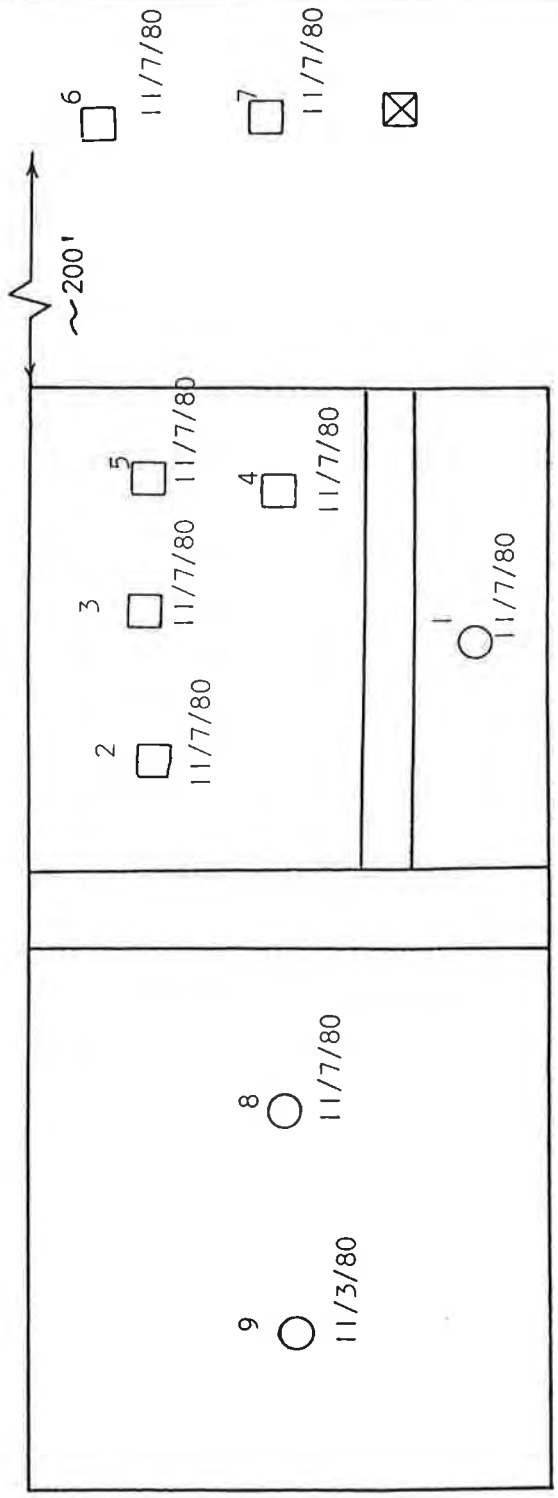
2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert 1 cc McAninch Corp. 1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00826A	104.0	19.0	Dk. Brown	Silty Clay

AMES ASH POND

ATTERBERG AND GRAIN SIZE SAMPLES



○ Sample Location

□ Test Pit Location and Sample

⊠ Test Pit without Sampling

SUPERSCRIPT INDICATES SAMPLE NUMBER

SUBSCRIPT INDICATES SAMPLING DATE

NOT TO SCALE

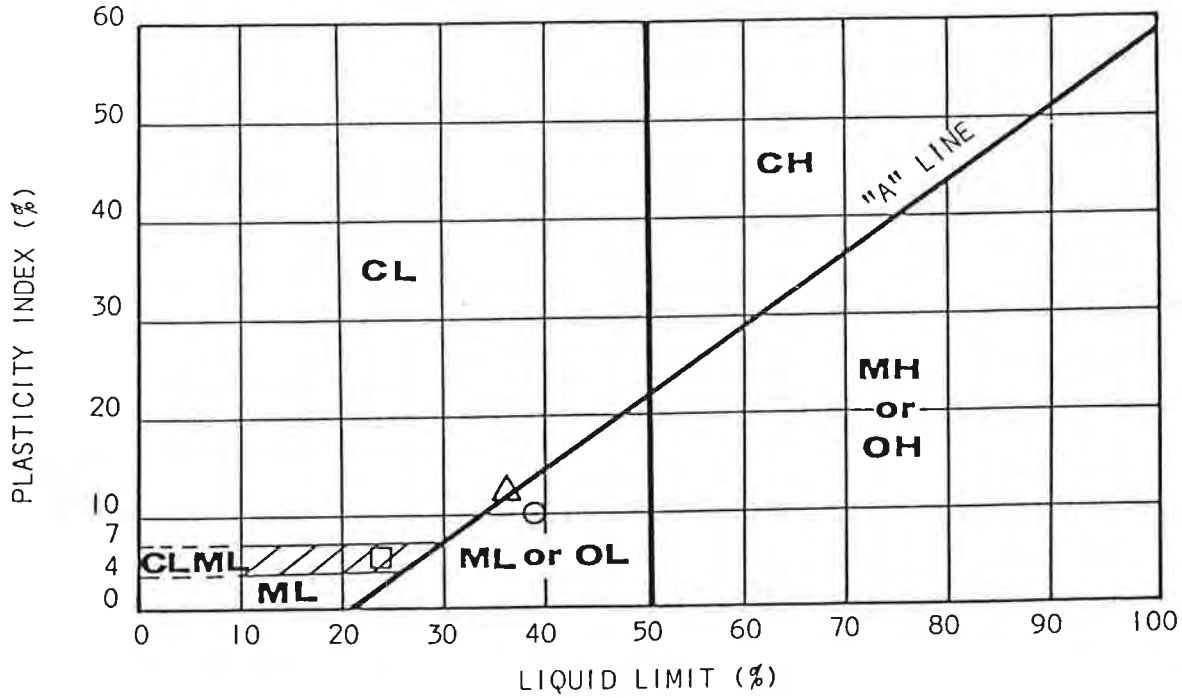
SAMPLED: NOVEMBER 3, 1980
TESTED : NOVEMBER 7, 1970

AMES LAGOONS

UNIFIED SOIL CLASSIFICATION (ASTM D2487)

Key Symbol	Test Boring No.	Sample Depth, ft	Natural Moisture	Atterberg LL	Atterberg PL	Atterberg PI	% Pass No. 200	Unified Class
○	9	1 BNG		39	29	10		ML
△	9	2 BNG		37	25	12		CL-ML
□	9	3 BNG		24	19	5		CL-ML

BNG: Below natural grade



LAB. NO. 199869-M

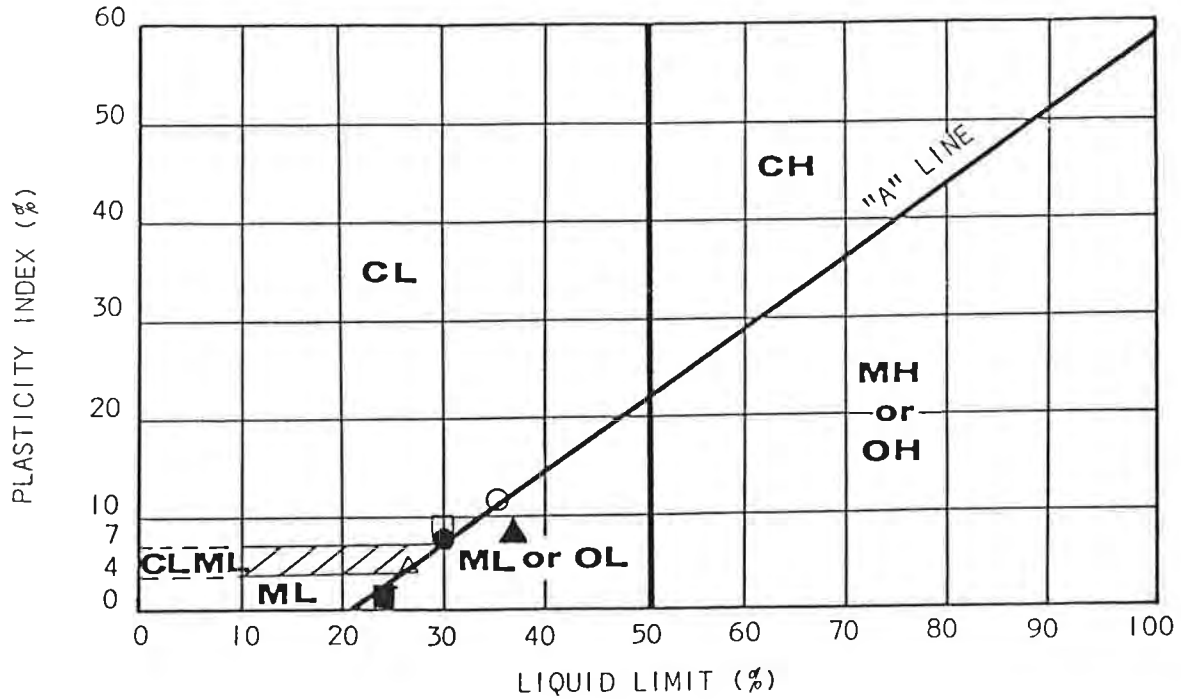
SAMPLED: NOVEMBER 7, 1980
TESTED: NOVEMBER 10, 1980

AMES LAGOONS

UNIFIED SOIL CLASSIFICATION (ASTM D2487)

Key Symbol	Test No.	Sample Depth, ft	Natural Moisture	Atterberg LL	Atterberg PL	Atterberg PI	% Pass No. 200	Unified Class
○	2	4BLT		35	24	11	77	CL
□	4	3BLT		30	21	9	63	CL
△	5	3BLT		27	22	5	66	CL-ML
●	6	4.5BNG		30	22	8	60	CL
■	7	4BNG		24	22	2	46	SM
▲	7A	1BNG		37	29	8	74	ML
	1(4)	2± BLT						
	3(5)	3± BLT						
	8(6)	---						

BLT: BELOW DESIGN LINER TOP
BNG: BELOW NATURAL GRADE



NOTE: 1 CORRELATED TO 4 BY VISUAL EXAMINATION
3 CORRELATED TO 5 BY VISUAL EXAMINATION
8 CORRELATED TO 6 BY VISUAL EXAMINATION

PROJECT Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

LAB. NO. 199869-N

DATE November 18, 1980

TO Attn: Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

TESTS ON Maximum Density-Optimum Moisture Determination
SUBMITTED BY sampled by lab rep @ site
SENDER'S NO. MARKED
DATE RECEIVED 11/3/80 DATE TESTED 11/17/80 BY CC/BAM

MAXIMUM DENSITY-OPTIMUM MOISTURE DETERMINATION
(ASTM D698)

Borrow Area	On Site
Reference No.	01117A
Soil Color	
Textural Classification, visual	Very silty clay sand
Maximum Dry Density, pcf	121.0
Optimum Moisture, percent	12.0

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above, Attn: Merlin Hove
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain
1 cc McAninch Corp.
1 cc James Thompson & Son

Project Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE

DES MOINES, IOWA 50313

Lab No. 199869-0

Attn: Mr. Merlin Hove

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Date November 20, 1980

10 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/10/80 By BC/BAM

Location Reference As Below Elevation Reference Berm Wall

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
74	N. Dike Ash Pond, 475' W. of E. End	00826A	17.6	102.3	98.4	-0'
75	E. Dike Ash Pond, 75' S. of N. End	00826A	18.0	101.4	97.5	-3'
76	E. Dike Ash Pond, 250' S. of N. End	00826A	19.4	102.8	98.8	-4'
77	E. Dike Ash Pond, 425' S. of N. End	00825C	20.0	102.3	96.7	-3'
78	S. Dike Ash Pond, 375' E. of W. End	00825C	20.0	103.3	97.6	-8'
79	S. Dike Ash Pond, 500' E. of W. End	00825C	19.4	103.9	98.2	-7'
80	S. Dike Ash Pond, 175' E. of W. End	00826A	20.8	99.4	95.6	-4'
81	E. Dike Lime Pond, 175' S. of N. End	00825C	18.8	102.1	96.5	-0'
82	S. Dike Ash Pond, 475' E. of W. End	00825C	19.5	101.6	96.0	-3'
83	S. Dike Ash Pond, 225' E. of W. End	00825C	19.3	101.4	95.8	-2'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

By for A. Marks, P.E.

2cc Above
1cc Above, Attn: Jim Townsend
1cc Lutz, Daily & Brain, Attn: Lee Seybert
1cc McAninch Corp.
1cc James Thompson & Son

BAM:vlb

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00826A	104.0	19.0	Dk. Brown	Silty Clay

Project Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Lab No. 199869-P

To Attn: Mr. Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Date November 20, 1980

6 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/11/80 By BC/BAM

Location Reference As Below Elevation Reference Berm Wall

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
84	Clear Water Dike, 100' E. of W. End	00825B	21.8	93.2	95.1	-11'
85	Clear Water Dike, 400' E. of W. End	00825B	22.0	95.6	97.6	-10'
86	Clear Water Dike, 250' E. of W. End	00825B	20.5	94.6	96.5	-9'
87	Clear Water Dike, 450' E. of W. End	00826A	18.1	102.8	98.8	-8'
88	100' E. & 150' S. of N.W. Corner of Ash Pond on Lagoon Floor	00825C	20.1	101.8	96.2	-2'
89	E. Dike Ash Pond, 175' N. of S. End	00825C	19.0	103.5	97.8	-2'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

2cc Above
1cc Above, Attn: Jim Townsend
1cc Lutz, Daily & Brain, Attn: Lee Seybert
1cc McAninch Corp.
1cc James Thompson & Son
BAM:vlb

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00825B	98.0	22.2	Dk. Brown	Silty Clay
00826A	104.0	19.0	Dk. Brown	Silty Clay

Project Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Lab No. 199869-Q

To Attn: Mr. Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Date November 20, 1980

4 In-Place Density Determinations
Method: Nuclear ASTM D 2922 Date Tested 11/12/80 By BC/BAM
Location Reference As Below Elevation Reference Berm Wall & Lagoon Floor

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
90	Clear Water Dike, 50' E. of W. End	00826A	20.4	100.2	96.3	-7'
91	Ash Pond on Lagoon Floor, 20' W. and 50' N. of S.E. corner	00825C	19.2	103.4	97.7	-2'
92	Ash Pond on Lagoon Floor, 150' E. and 225' S. of N.W. Corner	00826A	20.1	100.3	96.4	-1'
93	Clear Water Dike, 250' E. of W. End	00825C	19.5	101.5	95.9	-6'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

2 CC Above
1 CC Above, Attn: Jim Townsend
1 CC Lutz, Daily & Brain, Attn: Lee Seybert
1 CC McAninch Corp.
1 CC James Thompson & Son

BAM:vlb

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00826A	104.0	19.0	Dk. Brown	Silty Clay
00825C	105.8	18.1	Dk. Brown	Silty Clay f/Sand

Project Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Lab No. 199869-R

To Attn: Mr. Merlin Hove
City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Date November 20, 1980

3 In-Place Density Determinations

Method: Nuclear ASTM D2922 Date Tested 11/17/80 By CCA/BAM

Location Reference As Below Elevation Reference Bottom of Cell

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
94	200' N. and 300' E. of S.W. Corner	50% 00825A 50% 00825B	19.6	98.2	96.7	-2'
95	200' N. and 300' E. of S.W. Corner	00825C	19.6	108.0	102.1	-1'
96	400' N. and 200' W. of S.E. Corner	00825C	11.4	110.9	104.8	-2'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks, P.E.

2 CC Above
1 CC Above, Attn: Jim Townsend
1 CC Lutz, Daily & Brain, Attn: Lee Seybert
1 CC McAninch Corp.
1 CC James Thompson & Son

BAM:vlb

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825A	105.0	18.5	Black	silty clay trace sand
00825B	98.0	22.2	Black	silty clay
00825C	105.8	18.5	Dk.Brown	silty clay trace sand

Project Ames Power Plant
Ash Lagoon

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE
DES MOINES, IOWA 50313

Lab No. 199869-S

To Attn: Mr. Merlin Hove
City of Ames
Carroll & E 5th
Ames, Iowa 50010

Date November 24, 1980

9 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/20/80 By CCA/BAM

Location Reference As below Elevation Reference Finish subgrade (other) lagoon bottom-liner

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
106	130' E & 30' N. of SW Corner of clear water pond	00825A	18.2	99.9	95.1	-0'
107	130' E & 30' N. of SW Corner of clear water pond	00825A	15.7	104.0	99.0	-0'
108	130' E & 30' N. of SW Corner of clear water pond	00825A	23.9	96.4	98.4	-0'
109	450' E and 100' S of N.W. Corner of Ash Pond	00825A	23.1	93.4	95.3	-0'
110	450' E and 100' S of NW Corner of Ash Pond	00825A	21.6	97.0	98.9	-0'
111	450' E and 100' S of NW Corner of Ash Pond	00825A	28.9	94.0	95.9	-0'
112	475' E and 80' N of SW Corner of Ash Pond	00825A	16.9	97.7	99.7	-0'
113	475' E and 80' N of SW Corner of Ash Pond	00825A	23.8	94.6	96.5	-0'

-continue-

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type

LAB. NO. 199869-S

Location Reference As below Elevation Reference Finish subgrade (other) lagoon bottom-liner

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
114	475' E and 80' N of SW Corner of Ash Pond	00825A	20.1	91.1	93.0	-2'

Test results available to job personnel on site immediately following completion.

Corrective measures, if needed, and scheduling of retests left to discretion of contractor.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

2cc above
1cc above, Attn: Jim Townsend
1cc Lutz, Daily & Brain, Attn: Lee Seybert
1cc McAninch Corporation
1cc James Thompson & Son

BAM/mrp

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00825A	105.0	18.5	Dark brown	Very Silty Clay

PATZIG TESTING LABORATORIES CO., INC.

515/266-5101 3922 DELAWARE AVENUE

DES MOINES, IOWA 50313

Project Ames Power Plant
Ash Lagoon

Lab No. 199869-T

To City of Ames
Carroll & E. 5th
Ames, Iowa 50010
Attn: Merlin Hove

Date November 28, 1980

9 In-Place Density Determinations

Method: Nuclear ASTM D 2922 Date Tested 11/18/80 By BC/BAM

Location Reference As below Elevation Reference Berm & Lagoon

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
97	Sta. 5+50, Clear Water Dike	00826A	20.3	100.5	96.6	-5'
98	Sta. 4+00, Clear Water Dike	00825C	19.0	101.5	95.9	-4'
99	400' E. & 100' S. of NW Corner Ash Pond	00826A	19.5	100.9	97.0	-1'
100	350' E. & 125' N. of SW Corner Ash Pond	00826A	18.9	100.7	96.8	-0'
101	125' N. of S. End of E. Berm of Ash Pond at Junction of Berm & Floor	00825B	29.2	93.2	95.1	-0'
102	50' W. of E. End of Clear Water Dike at Junction of Berm & Floor	00825B	22.4	96.6	98.6	-1'
103	50' W. of E. End of N. Berm of Ash Pond	00825C	17.6	105.7	99.9	-2'
104	250' E. of N. End of N. Berm Ash Pond	00825C	18.9	104.0	98.3	-1'

-continued-

Location Reference As Below Elevation Reference Berm & Lagoon

Test No.	Test Location	Ref. No.	Moisture Content, Percent	In-Place Density Dry Soil lbs/c.f.	Percent Compaction (% of Max Density)	Test Elev
105	50' W. & 50' S. of NE Corner Ash Pond	00825C	18.9	101.7	96.1	-0'

Test results available to job personnel on site immediately following completion.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Byron A. Marks

Byron A. Marks, P.E.

BAM/dkb

2 cc above
1 cc above, Attn: Jim Townsend
1 cc Lutz, Daily & Brain, Attn: Lee Seybert
1 cc McAninch Corp.
1 cc James Thompson & Son

Maximum Densities Used to Determine Percent Compaction

Ref. No.	Max Dens	% Opt Moist	Soil Color	Soil Type
00826A	104.0	19.0	Dk. Brown	Silty Clay t/Sand
00825C	105.8	18.1	Dk. Brown	Silty Clay t/Sand
00825B	98.0	22.2	Dk. Brown	Silty Clay

Patzig Testing Laboratories Co., Inc.

3922 DELAWARE AVENUE DES MOINES, IOWA 50313 (515) 266-5101

December 11, 1980

City of Ames
Carroll & E. 5th
Ames, Iowa 50010

Re: Ames Lagoons
Ames Power Plant
Lab No. 199869-T

Attn: Merlin Hove

Gentlemen:

This letter presents the results of the lagoon seal tests for the above project. Nine tests were conducted on undisturbed samples, 3-inch diameter Shelby tubes, collected in essential compliance with ASTM D1587.

The coefficient of permeability (hydraulic conductivity) for each sample was evaluated using a falling head permeameter. Sample permeabilities calculated from the test results appear on the enclosed table.

The most permeable sample has been selected to calculate the maximum seepage rate that may occur under both 6 and 20 foot lagoon water levels. The calculations, using Darcy's law, are shown on the enclosed computation sheet, and the calculated maximum seepage does not exceed the IDEQ limitation of 1/16-inch per day.

Respectfully submitted,

PATZIG TESTING LABORATORIES CO., INC.

Craig A. Carradus

Craig A. Carradus, E.I.T.

CAC/dkb

1 cc above
2 cc Lutz, Daily & Brain
Attn: Lee Seybert

Encls.

Lagoons
s Power Plant
b No. 199869-T

PERMEABILITY TESTS

Sample No.	Grid Location	Cell Designation	Permeability Feet/Day X 10^{-5}	Permeability Cm/Sec X 10^{-9}
1	100' W. 200' N. of SE Corner	Ash Pond	0.9	3.2
2	100' S. 25' E. of NW Corner	Ash Pond	0.5	1.9
3	200' N. 200' E. of SW Corner	Ash Pond	2.1	7.3
4	100' W. 100' S. of NE Corner	Ash Pond	1.9	7.0
5	330' E. 200' N. of SW Corner	Ash Pond	0.1	0.4
6	400' E. of NW Corner-45' Up Dike	Ash Pond	1.1	3.9
7	200' E. 50' N. of SW Corner	Ash Pond	0.4	1.5
8	300' E. 10' N. of SW Corner	Clearwater Basin	6.4	23
9	125' E. 35' N. of SW Corner	Clearwater Basin	8.5	30

Lagoons
Power Plant
No. 199869-T

LINER SEEPAGE CALCULATION

$Q = KiA$

Where: Q = the amount or volume of water that passes an interface during some period of time ($ft^3/day/ft^2$)
Maximum Q = 1/16-in./day = 0.005 $ft^3/day/ft^2$
T = thickness of lining = 3'
H = Difference in Head (Water depth) + T
K = the coefficient of permeability (ft/day)
A = the cross-sectional area of the interface (ft^2/ft^2)
i = the difference in head (H) divided by the thickness of the lining (T)

SIX FOOT WATER LEVEL

H = 6 + 3 = 9'

$$Q = KiA = \frac{KHA}{T} = \frac{(8.5\times10^{-5})\ (9)}{3} = 2.6\times10^{-4}\ ft^3/day/ft^2$$
$$= 1/326\text{-in./day}$$

20-FOOT WATER LEVEL

H = 20 + 3 = 23'

$$Q = KiA = \frac{KHA}{T} = \frac{(8.5\times10^{-5})\ (23)}{3} = 6.5\times10^{-4}\ ft^3/day/ft^2$$
$$= 1/128\text{-in./day}$$

LUTZ, DAILY & BRAIN
CONSULTING ENGINEERS

MEMORANDUM

DATE: December 4, 1980

JOB: Ames, Iowa 60MW
JOB NUMBER: 76-11

TO: JFD, FJL, SCB, WEH, LAS, FBF
FROM: JRP

RE: Contract No. 76-11-32, Item 2
Lime Pond

The lime pond has been completed essentially in accordance with the plans and specifications except for the seeding of the pond levees. Sterilization work for the inside of the lime pond was completed on Friday, November 28, 1980, according to James Thompson & Sons, the general Contractor. I was not advised ahead of time when the sterilization work was going to be done, therefore, no representative of the City was on site to observe the work.

cad
cc: Resident File