# Lincoln-Lancaster County Health Department

ENVIRONMENTAL HEALTH DIVISION
3140 N STREET · LINCOLN, NE 68510-1514 (402) 441-8000

Permit

SEWAGE INSTALLATION
SEPTIC SYSTEM

Permit # 00380218501

Issued 05/08/00
Expires 11/08/00
Revenue Code 3157

Establishment

CATHOLIC BISHOP OF LINCOLN INC
T12N R5E SEC 10 QTR SW
9300 W AGNEW RD-AGNEW

FEES: $150.00

TOTAL: $150.00

Permitee

MSGR TIMOTHY J SHOEBURN VP
CATHOLIC BISHOP OF LINCOLN INC
BOX 0080328
LINCOLN NE 68501-0328

Leon F. Vinci, MPH, Health Director

• POST IN A PROMINENT PLACE • NOT TRANSFERABLE

013076

**Lincoln-Lancaster County Health Department**
Environmental Health Division
3140 "N" Street • Lincoln, NE 68510-1514
Phone: 402-441-8022

**A**

Permit Number: 00380218501

# Sewage Disposal System

## Request for Site Clearance and Permit

**Include Form B, Form C and Applicable Fees with this Application.**

☒ Septic System ☐ Lagoon ☐ Other (Refer to Form C)

The undersigned hereby requests site clearance and permit to construct a Sewage Disposal System in conformance with appropriate resolution or ordinance, as described herein:

**PLEASE PRINT OR TYPE**

## A. System Location (Indicate correct number and street)

Address 9300 W. Agnew Road (no rural route) City Agnew NE, Zip 68428

Legal Description SW (1/4) 10 (Section) 12N (Township) 5E (Range) Subdivision Addition Block Lot

Geographical Location (if known): Longitude _____ Latitude _____

☐ Check if system mail address is not the same as the owner's address

## B. Owner

Name CATHOLIC BISHOP OF LINCOLN, INC. Signature Msgr Timothy J. Thurburn, Vice President

Address P.O. BOX 80328 City/State/Zip LINCOLN, NE 68501-0328

☐ Check if owner designed system Home Phone 464-8342 Work Phone 488-0921

## C. Contractor

Name David Cavlovic Company Name Sampson Construction Company

Address 3730 S. 14th St. City/State/Zip Lincoln, NE 68502

☐ Check if contractor designed system Work Phone (402) 434-5455

## D. Engineer/Installer ☐ Check and complete if engineer designed system

Designer Name Gary Virdi, PE Firm HWS Consulting Work Phone (402) 479-2200

## E. This System Will Serve a

☐ Residential Dwelling Number of Bedrooms _____ Is there a Whirlpool Bathtub YES NO

☒ Commercial Establishment/Other Facility Specify New Monastery

Design flow in gallons per day 2,000 Type of Wastewater: ☒ Domestic ☐ Non-Domestic.

***DO NOT WRITE BELOW THIS LINE***

## Approval Process ☐ Municipal Code 24.38 ☒ County Resolution No. 2832

Received 5/31/00 V.C.H. Pending NDEQ Approval

| | | | | | |
|---|---|---|---|---|---|
| 1. **Health Department** | Date rec'd 5-3-00 | **ACTION** | ☒ Approved | ☐ Disapproved | |
| | Date frwd _____ | Signature John F Manes | | | |
| 2. **Supt. Bldg. Insp. or Village Clerk** | Date rec'd 5.31.00 | **ACTION** | ☒ Approved | ☐ Disapproved | |
| | Date frwd 5.31.00 | Signature | | | |
| 3. **City or County Engineer** | Date rec'd _____ | **ACTION** | ☒ Approved | ☐ Disapproved | |
| | Date frwd _____ | Signature Jim Plough | | | |

## Installation Final Written Approval

By _____

Date _____

***Business Office Use Only***

Date Rec'd 05/04/00

Amt Paid 150 cc

Rec'd By LO Cash/Check No. 22972

FORM 23-100 10-96 White - Health Dept. Yellow - Engineer Pink - Bldg. Inspector

Lincoln-Lancaster County Health Department
Environmental Health Division
3140 "N" Street • Lincoln, NE 68510-1514
Phone: 402-441-8022

**B**

Permit Number: 00380285

# Sewage Disposal System

## Soil Absorption Test Data Report
## Annex to Application

PLEASE PRINT OR TYPE

### System Location (Indicate correct number and street)

Address 9300 W. Agnew Road (no rural route) City Agnew NE, Zip 68302

Owner Msgr. T. J. Thorburn Addresss P.O. Box 80328 Lincoln, NE 68501

Soil Type (SCS): Silty Clay Loam Percolation Rate: 41.1 min./inch

Date of Tests 2-17-00 to 5-2-00 Weather: Precipitation None Temperature 35-50°F

## Percolation Test Data Table

| A. | B. | C. D. E. F. Pre-Saturation Period | | | | G. H. I. J. K. Percolation Readings | | | | | L. M. N. Results | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Start | | End | | Start | | | End | | | | |
| Hole No. | Hole Depth (in) | Date (Mo/Da) | Time (Hr/Min) | Date (Mo/Da) | Time (Hr/Min) | Date (Mo/Da) | Time (Hr/Min) | Water Lev (in.) | Date (Mo/Da) | Time (Hr/Min) | Elapsed Time (Min) | Water Level Drop (in) | Percolation Rates (Min/in) |
| P-4 | 48 | 2/16 | 16/00 | 2/17 | 10/00 | 2/17 | 10/05 | 4.50 | 2/17 | 10/35 | 30 | 0.50 | 60.0 |
| P-5 | 48 | 2/16 | 16/05 | 2/17 | 10/00 | 2/17 | 10/07 | 14.00 | 2/17 | 10/37 | 30 | 0.50 | 60.0 |
| P-6 | 48 | 2/16 | 16/10 | 2/17 | 10/00 | 2/17 | 10/08 | 8.0 | 2/17 | 10/38 | 30 | 0.50 | 60.0 |
| P-7 | 48 | 4/27 | 16/10 | 4/28 | 9/45 | 4/28 | 9/58 | 20.16 | 4/28 | 10/28 | 30 | 1.68 | 17.9 |
| P-8 | 48 | 4/27 | 16/05 | 4/28 | 9/45 | 4/28 | 9/56 | 29.16 | 4/28 | 10/26 | 30 | 1.08 | 27.8 |
| P-9 | 60 | 5/1 | 15/05 | 5/2 | 8/30 | 5/2 | 8/42 | 33.60 | 5/2 | 9/12 | 30 | 1.44 | 20.8 |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

### Person Conducting Percolation Tests

Name: Josh Letts
Phone: 479-2200
Address 825 J Street
Lincoln, NE

Sum of Percolation Rates: 246.5
Average of Rates: 41.1
Rate Used for Calculation: 60.0

DO NOT WRITE BELOW THIS LINE

### Reviewing Action

Remarks – UTILIZE 60 MIN/INCH FOR SIZING CALCULATION.
– GRANULAR FILLER MATERIAL MUST COVER 2" ABOVE PIPE IN TRENCHES
– DESIGN IS FOR TRENCHES OR BEDS ?

Signature of Reviewing Official John E Manis Date 5-4-00

FORM 23-101 10-96

| FOR NDEQ USE ONLY |
|---|
| PERMIT NUMBER: |
| APPROVED BY: |
| DATE APPROVED: |

# FORM B

# APPLICATION FOR CONSTRUCTION / OPERATING PERMIT FOR A SEPTIC SYSTEM

(PLEASE PRINT OR TYPE)

## A. Owner Information:

☐ Check here if owner designed system

Owner: CARMELITE MONASTERY (Name) _____ (Street, P.O. Box, or Route) _____ (City)

Owner: _____ (Signature) _____ (State) _____ (Zip) _____ (Phone (Home)) _____ (Work)

## B. Contractor Information: -NA-

☐ Check here if contractor designed system

Contractor: _____ (Name) _____ (Company Name)

_____ (Street, P.O. Box, or Route) _____ (City) _____ (State) _____ (Zip) _____ (Phone (Work))

## C. Engineer Information:

☐ Check and complete if engineer designed system

Designer: GARY VIRDI, PE (Name) HWS CONSULTING GROUP INC. (Firm) 402-479-2215 (Phone (Work))

## D. System Location:

Legal Description: _____ (1/4) SW 1/4 (of 1/4) 10 (Section) 12N (Township) SE (Range) _____ (Subdivision) _____ (Block) _____ (Lot#)

County: LANCASTER Is a County Permit Required: ☒ Yes ☐ No

☒ Check here if system mailing address is not the same as the owners and complete mailing information

System mailing Address: BERNARD P. REMPE CLARK ENERSEN PARTNERS, 600 NBC CENTER (Street, P.O. Box, or Route) LINCOLN (City) NE (State) 68508-1478 (Zip)

## E. This System Will Serve A:

☐ Dwelling

Number of Bedrooms: _____

Is There a Whirlpool Bathtub: ☐ Yes ☐ No

☒ Establishment (name) CARMELITE MONASTERY

Design Flow in Gallons per day: 2,000

Type of Wastewater: ☒ Domestic ☐ Non-Domestic

## F. Septic Tanks:

Number of Tanks in Series: 2 Tank Size (gallons) 1500 (1st) 1500 (2nd) _____ (3rd) _____ (4th) _____ (5th)

Tank Material: ☒ Concrete ☐ Plastic ☐ Other _____

## G. Absorption system: (See Attachment C for Percolation Information)

Percolation Rate: 60 (min. per inch) Soil Type: PEORIA LEAN AND SILTY CLAY Land Slope: 5 %

Type of Absorption System: ☐ Trench ☒ Bed ☐ Gravelless ☐ Other _____

Total Square Feet of Field Required: 3,000 (ft. sq.)

Type of Lateral: ☐ Half-Moon ☒ Perforated Pipe ☐ Other Lateral Material: _____

Number of Trenches: _____ Number of Absorption Beds: 1

Trench Width: _____ Number of Distribution Laterals per Bed: 6

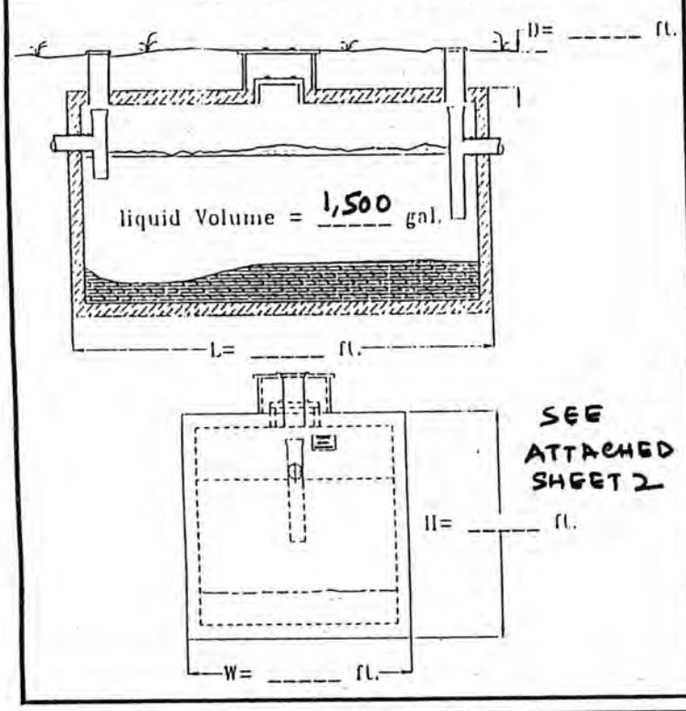
## H. Setbacks: Check the Boxes Below If the Required Setback Has Been Satisfied:

| Distance From | Private Well | Public Well | Surface Water | Ground Water | Pressure Water lines | Property Lines | Foundations Yours | Foundations Neighbors | All Other Setbacks |
|---|---|---|---|---|---|---|---|---|---|
| Tank (ft) | 50 ☑ | 500 ☒ | 50 ☒ | NA ☐ | 10 ☒ | 10 ☒ | 15 ☒ | 25 ☒ | ☑ |
| Field (ft) | 100 ☒ | 500 ☒ | 50 ☒ | 4 ☒ | 25 ☒ | 10 ☒ | 30 ☒ | 40 ☒ | ☒ |

(OVER)

# COMPLETE SECTIONS I & J AND IF NECESSARY SECTION K FOR SUBDIVISIONS

## I. SEPTIC TANK DIMENSIONS



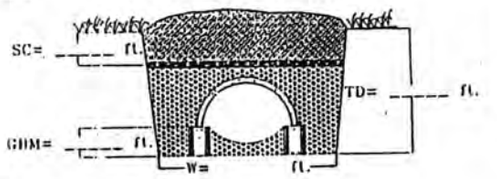

SEE ATTACHED SHEET 2

**KEY**

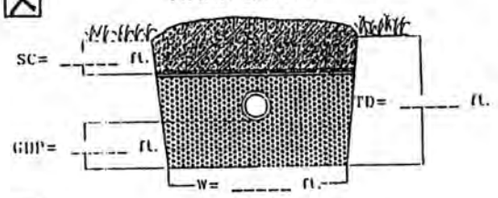
SC= SOIL COVER, TD= TRENCH DEPTH, W= WIDTH
GBM= GRAVEL BELOW HALF MOON, L= TANK DEPTH
GBP = GRAVEL BELOW PIPE, H= TANK HEIGHT,
D= DEPTH OF COVER

## J. CHECK THE BOX FOR THE APPROPRAITE ABSORPTION FIELD AND COMPLETE THE BLANKS

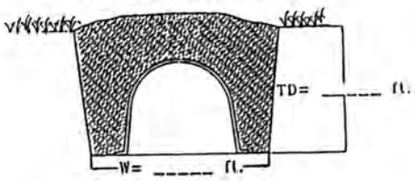
☐ HALF-MOON IN GRAVEL



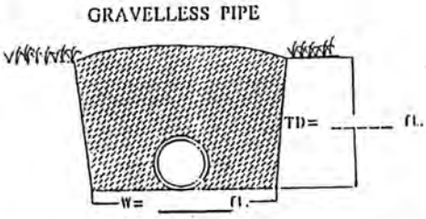

☒ PIPE IN GRAVEL




☐ GRAVELLESS HALF MOON




☐ GRAVELLESS PIPE

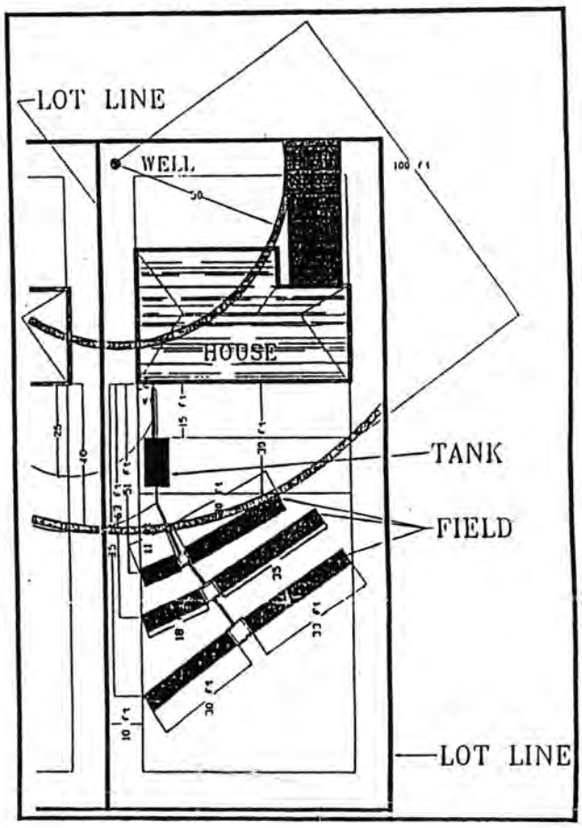



☐ OTHER: Include Drawing

## K. Complete Adjacent Lot Worksheet for All Wells and Water Lines Within The Reporting Distance in Chapter 5

| NORTHWEST | NORTH | NORTHEAST |
|---|---|---|
| DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ | DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ | DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ |
| **WEST**<br>DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ | PROPOSED SEPTIC SYSTEM INSTALLATION | **EAST**<br>DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ |
| **SOUTHWEST**<br>DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ | **SOUTH**<br>DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ | **SOUTHEAST**<br>DISTANCE IN FEET FROM: TANK FIELD<br>WELL: ____ ____<br>WATER LINES: ____ ____ |

## EXAMPLE PLOT PLAN




Documents Required:

* Completed Form B application
* Directions to the lot with site map
* Dimensioned plot plan ( See Example)
* Completed percolation test data (see attachment C)
* Dimensioned drawing showing profile view of septic system and slope of terrain
* All information must be submitted to the Department of Environmental Quality. Show applicant's name, address and phone number on each submitted page

* Send Documents to:

Department of Environmental Quality
Ground Water Section
1200 N Street, Suite 400
P.O. Box 98922
Lincoln, Nebraska 68509-8922

HWS Consulting Group Inc.

LINCOLN OFFICE
825 J Street, Box 80358
Lincoln, NE 68501-0358
402/479-2200
FAX 402/479-2276
hwsinfo@hws-con.com

Solutions Through Service
Over 55 Years

May 2, 2000

Mr. Steve Goans, P.E
Ground Water Section
Department of Environmental Quality
Suite 400, The Atrium
1200 "N" Street, P.O. Box 98922
Lincoln, NE 68509-8922

REFERENCE: **Carmelite Monastery – Septic Tank System**
2 Miles West of Agnew, Nebraska

Dear Steve,

Attached find the operating permit application for your review and approval. Additional project information is as follows:

**Project Background**

The Mother Theresa of Jesus O.C.D. Prioress plans to construct a new monastery 2 miles west of Agnew, Nebraska. The monastery will have approximately 20 inhabitants. A wastewater treatment system is required for the monastery. HWS conducted a detailed geotechnical evaluation of the site (Geotechnical Report is Attached). Based on the results of the geotechnical evaluation, an on-site septic tank and lateral system is proposed to treat the wastewater discharge from the monastery.

**Site Location**

The project site is located on the west 500 feet of the east ½ of the SW ¼ of Section 10, Township 12 North, Range 5 East in Lancaster County, Nebraska (1 3/4 miles west of Agnew on West Agnew Road).

**Soil Conditions**

The town of Agnew lies in the Dissected Till Plains section of Nebraska, a part of the Central Lowland province of the Interior Plains physiographic division . The project site is situated upon loess capped uplands. The uplands were formed by the dissection of a glacial drift plain that was later covered by various depths of Illinoian-age clayey or sandy material (Loveland formation) or Loveland loess. Much of the Loveland materials were removed by erosion prior to the deposition of Wisconsinan-age Peoria loess. Peoria Loess covers much of the area and is the parent material of the surficial soils.

In the area of the proposed laterals (borings 12 and 13 – see attached map and boring logs), Peoria lean and silty clays were encountered from the surface to depths of 8.0 to 8.5 feet below the surface.

Sangamon, Loveland and Glacial Till lean to fat clays were found below the Peoria in descending order to the depth of borings. Groundwater was encountered at an elevation of 1415.0 (7.0 feet below the existing grade) in the proposed laterals area.

**Percolation Tests**

Six field percolation tests were performed in the proposed laterals area (see attached map) in accordance with Chapter 6 (Soil Percolation Tests) of Title 124 produced by The Nebraska Department of Environmental Quality. The results of the field percolation tests are summarized in Table 1.

**TABLE 1 - Field Percolation Data**

| Location | Depth ft | Percolation Rate (min/in) |
|---|---|---|
| P-4 | 4.0 | 60.0 |
| P-5 | 4.0 | 60.0 |
| P-6 | 4.0 | 60.0 |
| P-7 | 4.0 | 27.8 |
| P-8 | 4.0 | 17.9 |
| P-9 | 5.0 | 20.8 |

An application rate of 0.65 gallon/sq.ft./day is used for the design of laterals and absorption beds.

**Flow Conditions**

The monastery is expected to have a maximum of 20 inhabitants. The anticipated wastewater discharge from the monastery is 2000 gallons per day @ 100 gallons/day/inhabitant. All wastewater discharge is expected to be domestic.

**Septic Tank and Lateral System**

Two 1500 gallon septic tanks, connected in series, are proposed. The wastewater will flow out of the septic tanks and flow into two absorption beds. The absorption beds will be 100' long and 25' wide and will have five laterals at 5' spacing. The absorption bed will provided a total of 5000 sq. feet of absorption area. Drawings for the septic tank and laterals are attached.

If you have any questions or need additional information, please contact me at 402-479-2215.

Sincerely,

HWS CONSULTING GROUP INC.

Ted J. McIntyre, PE
52-80-2568/2300
cc: Bernard Rempe – Clark Enersen

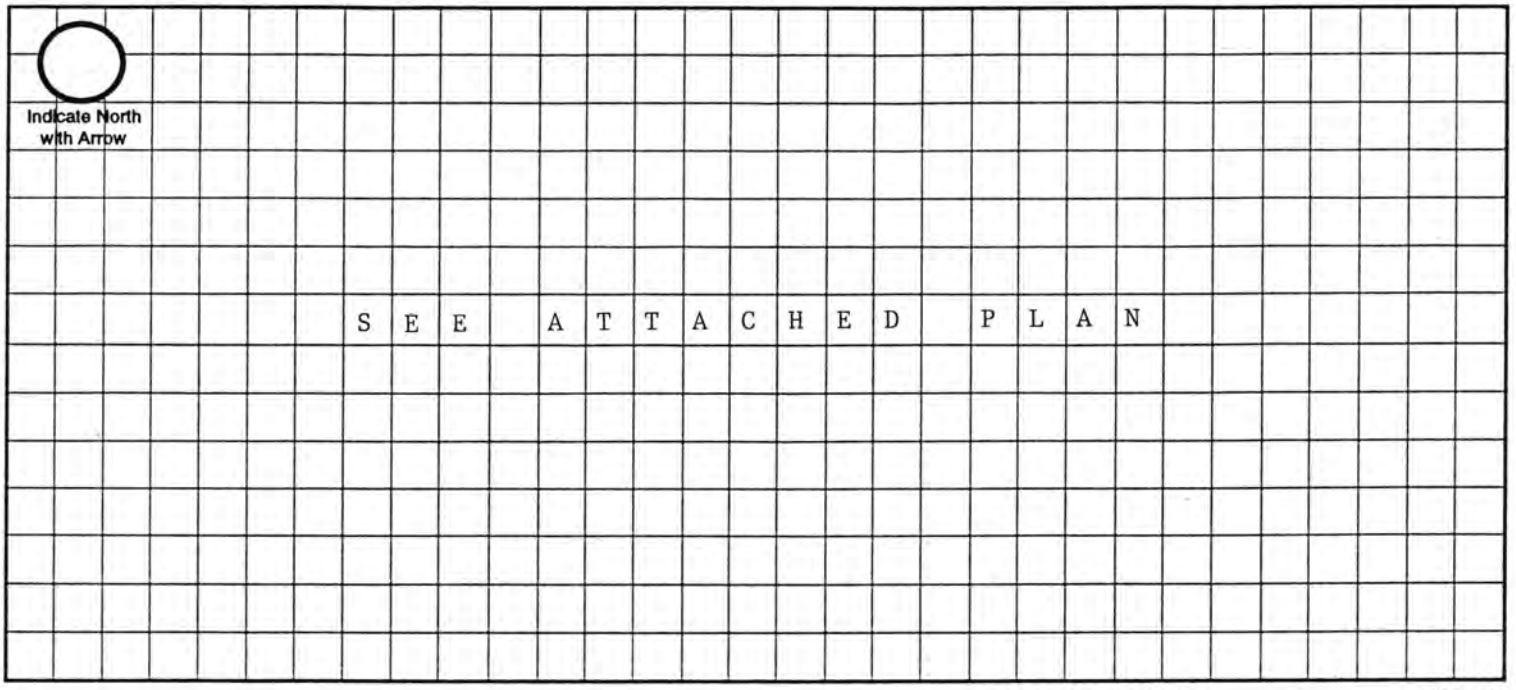
**Lincoln-Lancaster County Health Department**
Environmental Health Division
3140 "N" Street • Lincoln, NE 68510-1514
Phone: 402-441-8022

C

Permit Number: 00380218501

# Sewage Disposal System
## Preliminary Plan Specifications

Draw a plot plan showing system location, lines, distribution box, tank and laterals, percolation test hole locations, well, residence, compass direction and property lines. Indicate on drawing if residence and well are existing or proposed.




**Approximate Scale:** _____ ft. = _____ grid line/s

## A. System Location (Indicate correct number and street)

Address (no rural route) 9300 W. Agnew Road City Agnew NE, Zip 68428

## B. Proposed Septic Tank/s

Tank Material: ☒ Concrete ☐ Plastic ☐ Other _____

## C. Proposed Absorption System (See Form B for Percolation Information)

Percolation Rate 60 (min. per inch) Soil Type: Silty Clay Land Slope: _____ %

Type of Absorption System: ☐ Trench ☒ Bed ☐ Other _____

Total Square Feet of Field Required: 5,000 sq. ft.

Type of Lateral: ☐ Half-Moon ☒ Perforated Pipe ☐ Other Lateral Material: _____

Capacity of Septic Tank 3,000 gals Number of Absorption Beds: 2 Number of Distribution Laterals per Bed 4

Total Length of Laterals 800 ft. Number of Trenches (LINES) 8 Trench Width 8"

## D. Setbacks Check the Boxes Below if the Required Setback has been Satisfied

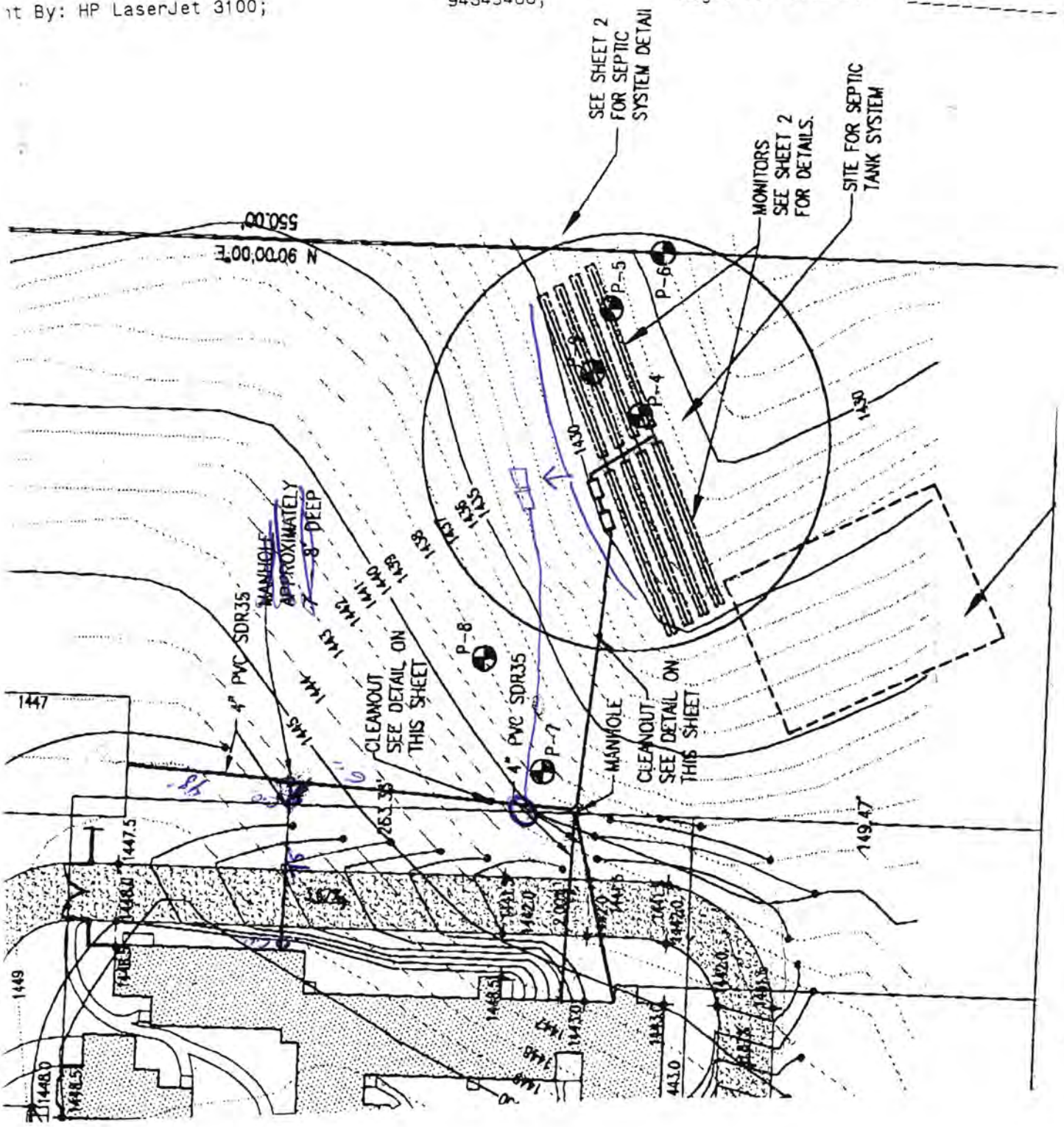
| Distance From | Private Well | Public Well | Surface Water | Gound Water | Pressure Water Lines | Property Lines | Foundations Yours | Foundations Neighbors | All Other Setbacks |
|---|---|---|---|---|---|---|---|---|---|
| Tank (ft) | 50 ☒ | 500 ☒ | 50 ☒ | NA ☐ | 25 ☒ | 20 ☒ | 15 ☒ | 25 ☒ | ☒ |
| Field (ft) | 100 ☒ | 500 ☒ | 50 ☒ | 4 ☒ | 30 ☒ | 20 ☒ | 30 ☒ | 40 ☒ | ☒ |
| Lagoon (ft) | 100 ☐ | 500 ☐ | 50 ☐ | N/A ☐ | 30 ☐ | 50 ☐ | 100 ☐ | 200 ☐ | ☐ |

## E. Required Signatures

Home Building Contractor Sampson G.C. _____ Date 5-3-00

Installer _____ Date _____

FORM 23-102 10-96


SEE SHEET 2 FOR SEPTIC SYSTEM DETAIL
MONITORS SEE SHEET 2 FOR DETAILS.
SITE FOR SEPTIC TANK SYSTEM
550.00'
N 00°00'06" E
P-5
P-6
P-4
P-8
P-7
1430
1435
1440
1445
1447
1447.5
1448
1448.5
1449
1442.0
1443.0
4" PVC SDR35
MANHOLE APPROXIMATELY 8' DEEP
CLEANOUT SEE DETAIL ON THIS SHEET
MANHOLE
CLEANOUT SEE DETAIL ON THIS SHEET
149.47
263.38'

| FOR AGENCY USE ONLY | APPLICATION NUMBER | | |
|---|---|---|---|
| | NE | | |
| | DATE RECEIVED | | |
| | | | |
| | YEAR | MO. | DAY |

# NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY
# APPLICATION FOR CLASS V INJECTION WELL AUTHORIZATION

**PLEASE ANSWER EVERY ITEM TO THE BEST OF YOUR KNOWLEDGE. AN INCOMPLETE APPLICATION MAY BE RETURNED. IF YOU HAVE QUESTIONS WHILE FILLING OUT THIS APPLICATION, PLEASE CALL 402-471-4982.**

**(1) Facility Information:**

Contact Name/Title Bernie Rempel Architect

Name of Facility A New Monastery for Carmel of Jesus, Mary & Joseph

Street Address 9300 W. Agnew Road

Mailing Address 600 NBC Center

City/Zip Lincoln NE 68508-1478 Telephone No. ( 402 ) 488-0921

**(2) Owner or Principal Officer Information:**

Name/Title Msgr. T.J. Thorburn

Mailing Address P.O. Box 80328 Telephone No. (402 ) 488-0921

City/State/Zip Lincoln, NE 68501

**!! IMPORTANT !! ITEMS 3 - 5 MUST BE COMPLETED OR THIS APPLICATION CANNOT BE PROCESSED.**

**(3) Legal Description of the property on which the well is located:**

This information is available at the County Register of Deeds or at the Natural Resources Conservation Service (NRCS) in your area.

____ Quarter, SW Quarter, Section 10, Township 12N, Range 5 (East)/West (circle one),

Lancaster County. (example: SE1/4, NW1/4, Sec. 3, T8N, R20W, Grant County)

**(4) Map of well location on the property:**

Sketch a map on a separate sheet of paper ($8^1/_2$ x 11 or larger) showing the location of the following features: injection wells, production wells, septic systems, and any water supply wells on your property. This map should include such features as houses, buildings, streets, roads, and property lines or fences. The map should indicate distances between features and which direction is north.

**(5) Map showing all water wells within $^1/_2$ mile of the injection well:**

An aerial photograph of the Section can be obtained from the local NRCS. Using this map, locate the injection well and **all** water wells including irrigation and domestic wells within a $^1/_2$ mile radius of the injection well. Registered well information can be obtained through the Nebraska Department of Water Resources (402-471-2363). The city or county engineer may know locations of some of the private wells. However, a visual inspection or telephone call to the property owner may be necessary to provide this information.

No water wells within 1/2 mile.

(MORE ON BACK)

**(6) Description of type of business using the injection well (i.e. car dealer, private residence):**

Monastery (Private)

**(7) Description of activity which generates the fluid or injection (i.e. septic field, heat pump):**

Septic Field

**(8) Code number of Class V well for this application (choose from one below):** 5W32

CODE NUMBERS AND WELL DEFINITIONS

DRAINAGE WELLS
- 5F1 Agricultural Drainage Wells
- 5D2 Storm Water Drainage Wells
- 5D3 Improved Sinkholes
- 5D4 Industrial Drainage Wells
- 5G30 Special Drainage Wells

GEOTHERMAL REINJECTION WELLS
- 5A5 Electric Power Reinjection Wells
- 5A6 Direct Heat Reinjection Wells
- 5A7 Heat Pump/Air Conditioning Return Flow Wells
- 5A8 Groundwater Aquaculture Return Flow Wells

DOMESTIC WASTEWATER DISPOSAL WELLS
- 5W9 Untreated Sewage Waste Disposal Wells
- 5W10 Cesspools, serving > 20 persons
- 5W11 Septic Systems (undifferentiated disposal method), serving > 20 persons
- 5W31 Septic Systems (well disposal method), serving > 20 persons
- 5W32 Septic Systems (drainfield disposal method), serving > 20 persons
- 5W12 Domestic Wastewater Treatment Plant Effluent Disposal Wells

MINERAL AND FOSSIL FUEL RECOVERY RELATED WELLS
- 5X13 Mining Wells (sand or other backfill)
- 5X14 Solution Mining Wells
- 5X15 In-situ Fossil Fuel Recovery Wells
- 5X16 Spent-Brine Return Flow Wells (after extraction of halogens)

OIL FIELD PRODUCTION WASTE DISPOSAL WELLS
- 5X17 Air Scrubber Waste Disposal Wells
- 5X18 Water Softener Regeneration Brine Disposal Wells

INDUSTRIAL/COMMERCIAL/UTILITY DISPOSAL WELLS
- 5A19 Cooling Water Return Flow Wells
- 5W20 Industrial Process Water and Waste Disposal Wells
- 5X28 Automobile Service Station Disposal Wells

RECHARGE WELLS
- 5R21 Aquifer Recharge Wells
- 5B22 Saline Water Intrusion Barrier Wells
- 5S23 Subsidence Control Wells

MISCELLANEOUS WELLS
- 5N24 Radioactive Waste Disposal Wells
- 5X25 Experimental Technology Wells
- 5X26 Aquifer Remediation Related Wells
- 5X29 Abandoned Drinking Water Wells Used for Disposal of Waste
- 5X27 Other Wells (well type/purpose and injection fluid must be specified)

**THE FOLLOWING INFORMATION (9 - 16) CAN BE OBTAINED FROM THE INSTALLER OF THE SYSTEM.**

**(9) Material receiving injection fluid (i.e. sand, clay):** silty clay

**(10) If this is a heat pump return flow well (5A7), is it open or closed loop?** N/A

**(11) Daily flow to injection well:** 2,000 **gallons per day.**

**(12) Depth of injection well:** 2 **feet.**

**(13) Depth of production well:** 261 **feet.**

**(14) Does the injection fluid come into contact with the air at any point?** No

**(15) Has the injection fluid been analyzed by a lab?** No **If yes, please include analysis.**

**(16) What is the status of the well (i.e. being planned, in use, abandoned)?** being planned

**(17) Name and signature of person filling out application:**

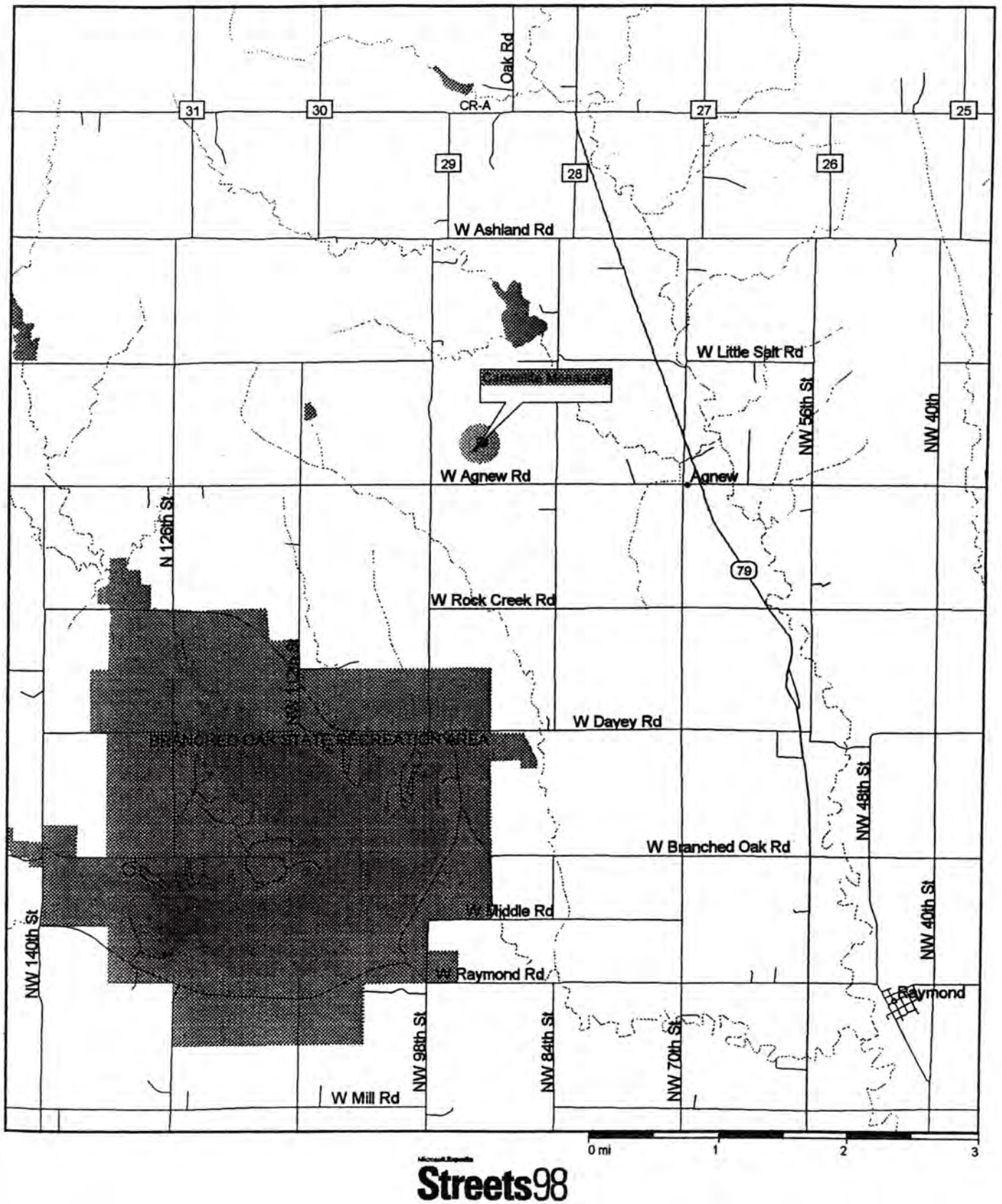
| Matthew D. Goeller | Matthew D. Goeller | 5-3-00 |
|---|---|---|
| Print Name | Sign Name | Date |

**Return Completed Application to:**

**Nebraska Department of Environmental Quality**
**Ground Water Section/UIC Program**
**P.O. Box 98922**
**Lincoln, Nebraska 68509-8922**

# Vicinity Map

## Carmelite Monastery




Streets98

Copyright © 1988-1997, Microsoft Corporation and/or its suppliers. All rights reserved. Please visit our web site at http://maps.expedia.com.

# GEOTECHNICAL ENGINEERING REPORT

## CARMELITE MONASTERY

**2 MILES WEST OF AGNEW, NEBRASKA**

**PREPARED FOR**

## THE CLARK ENERSEN PARTNERS

**600 NBC CENTER**

**LINCOLN, NEBRASKA 68508-1478**

**February 28, 2000**

**PREPARED BY**

HWS Consulting Group Inc.

May 2, 2000

Mr. Bernard P. Rempe
The Clark Enersen Partners
600 NBC Center
Lincoln, Nebraska 68508-1478

REFERENCE: Addendum to Geotechnical Engineering Report
Carmelite Monastery
2 Miles West of Agnew, Nebraska

Dear Mr. Rempe:

To satisfy the requirements of the Lancaster County Department of Health, three (3) additional field percolation tests were performed in the area of the planned leach field wastewater treatment system. A total of six (6) field percolation tests were performed in this area, P-4 through P-9. The average percolation rate of the six tests is **41.1** min/in. The locations of these tests are shown in the attached Figure 1. The results of P-4 through P-6 have been reported in the Geotechnical Engineering Report for this project, and the results of P-7 through P-9 are provided in Table 1 below.

**TABLE 1**
**Field Percolation Data**

| Location | Depth ft | Percolation Rate (min/in) |
|---|---|---|
| P-7 | 4.0 | 27.8 |
| P-8 | 4.0 | 17.9 |
| P-9 | 5.0 | 20.8 |

If any questions arise concerning this addendum, please contact HWS for assistance.

Sincerely,

HWS CONSULTING GROUP INC.

Matthew D. Goeller

Matthew D. Goeller, E.I.T.

MDG\mdg
52-80-2568.0105
GEOTECH\CARMADD

Orig. & 2 pc.: The Clark Enersen Partners

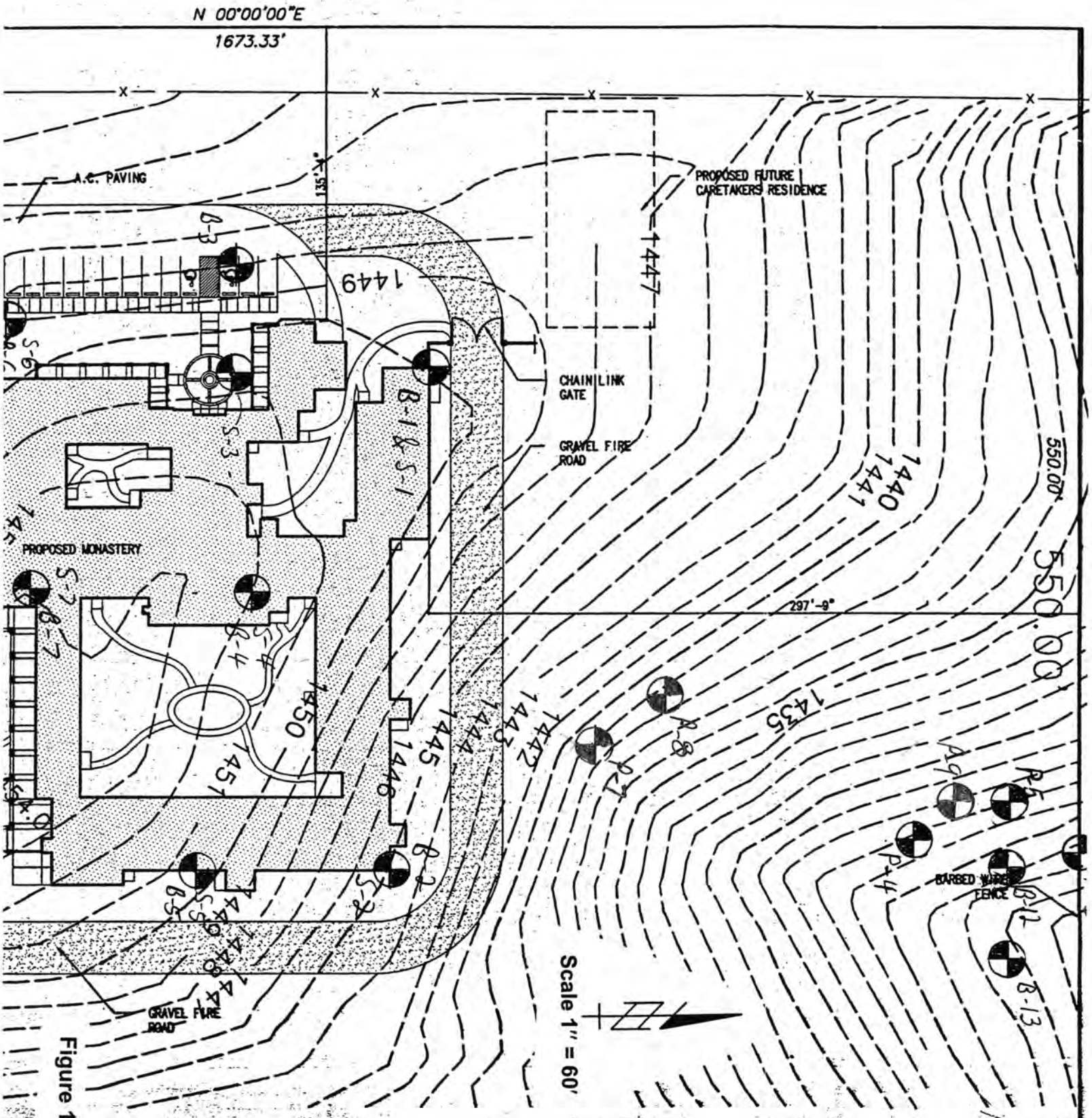

N 00°00'00"E
1673.33'
A.C. PAVING
PROPOSED FUTURE CARETAKERS RESIDENCE
CHAIN LINK GATE
GRAVEL FIRE ROAD
PROPOSED MONASTERY
GRAVEL FIRE ROAD
BARBED WIRE FENCE
BARBED WIRE FENCE
297'-9"
550.00'
1449
1447
1441
1435
1450
1451
1446
1445
1444
1443
1442
1440
B-1 & S-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-13
S-2
S-3
S-4
S-5
S-6
S-7
P-1
P-2
P-3
P-4
Scale 1" = 60'

Figure 1

HWS Consulting Group Inc.

LINCOLN OFFICE
825 J Street, Box 80358
Lincoln, NE 68501-0358
402/479-2200
FAX 402/479-2276
hwsinfo@hws-con.com

Solutions Through Service

Over 55 Years

February 28, 2000

Mr. Bernard P. Rempe
The Clark Enersen Partners
600 NBC Center
Lincoln, Nebraska 68508-1478

REFERENCE: Carmelite Monastery
2 Miles West of Agnew, Nebraska

Dear Mr. Rempe:

HWS Consulting Group Inc. (HWS) is pleased to submit the enclosed report that summarizes the findings of a soil and foundation engineering study and provides recommendations related to the design and construction of the foundation and wastewater treatment system for the referenced project.

If any questions arise concerning this report or if additional information is needed about soil conditions at this site, please contact HWS for assistance.

Sincerely,

HWS CONSULTING GROUP INC.

Matthew D. Goeller

Matthew D. Goeller, E.I.T.

MDG\ljn
52-80-2568.0105
GEOTECH\CARMrpt

Orig. & 2 cc.: The Clark Enersen Partners
Enclosures

# GEOTECHNICAL ENGINEERING REPORT

## CARMELITE MONASTERY
## 2 MILES WEST OF AGNEW, NEBRASKA

**Prepared**
**for**

## THE CLARK ENERSEN PARTNERS
**600 NBC CENTER**
**LINCOLN, NEBRASKA 68508-1478**

**February 28, 2000**

**Prepared**
**by**

## HWS CONSULTING GROUP INC.
**825 "J" Street**
**Lincoln, Nebraska 68508**

## CONTENTS


| | | Page |
|---|---|---|
| I. | INTRODUCTION | 1 |
| II. | SUBSURFACE EXPLORATION | 3 |
| III. | LABORATORY ANALYSES | 6 |
| IV. | GEOLOGY AND SITE CONDITIONS | 8 |
| V. | DISCUSSION AND RECOMMENDATIONS | 10 |
| VI. | CONCLUSIONS | 22 |

APPENDIX A. VICINITY MAP AND BORING LOCATION PLAN

APPENDIX B. DUTCH FRICTION-CONE PENETRATION DIAGRAMS

APPENDIX C. BORING LOGS

APPENDIX D. CRITERIA USED FOR VISUAL CLASSIFICATION

- Table D-1. Soil Classification Chart
- Table D-2. Criteria for Describing Moisture Condition of Clay Soil
- Table D-3. Criteria for Describing Moisture Condition of Granular Soil
- Table D-4. Criteria for Describing Consistency of Clay Soil
- Table D-5. Criteria for Describing Density of Coarse- Grained Soil
- Table D-6. Criteria for Describing Strength of Rock

APPENDIX E. SWELL TEST REPORT

# I. INTRODUCTION

The Mother Theresa of Jesus O.C.D. Prioress plans to construct a new monastery 2 miles west of Agnew, Nebraska. It is HWS' understanding that the proposed building will be a slab-on-grade, single story structure with masonry bearing walls, a wood-framed truss roof with a possible basement in the northeast section of the building. The building area is approximately 300 feet x 250 feet in plan dimension with 2 interior courtyards. A 20-stall parking lot is planned to be constructed west of the buildings. The tentative finished floor elevation will be 1450 feet (USGS datum) according to the Clark Enersen Partners. A maximum of 3 to 4 feet of cut and fill is expected during site grading. A maximum of 23 permanent residents are expected to be living in the monastery after completion. HWS Consulting Group Inc. (HWS) has prepared this report to present: (a) the findings of an exploration of the soils in the proposed building and wastewater treatment system areas at the project site, (b) the results obtained from laboratory tests, and (c) recommendations concerning the design and construction of the wastewater treatment system and the foundation for the proposed buildings.

Field and laboratory work consisted of: (a) making auger borings and Dutch friction-cone soundings to determine the depth, thickness, and composition of each soil formation encountered to the depths of the borings, (b) performing field tests to determine the approximate strength and permeability of the on site soils, (c) performing a geologic study to determine the origin of the deposits underlying the site, and (d) performing standard tests to determine the engineering properties of the soil strata that would affect the performance of the proposed structures.

An engineering evaluation has been made of subsurface conditions with respect to design and construction of the proposed building and wastewater treatment system. Recommendations are provided for the type of foundation, the allowable bearing pressure on the foundation soil, the minimum depth of footings, the lateral earth pressure exerted by backfill against restrained

and unrestrained walls, the design of retaining walls, the modulus of subgrade reaction to be used in the design of footings and pavement structures, the design of foundation and retaining-wall drains, the protective slopes around the building, the type of wastewater treatment facility, the types of soils to be used as fill and backfill, and the placement of fill and backfill.

## II. SUBSURFACE EXPLORATION

A program of Dutch friction-cone soundings, test borings, field percolation tests, and soil sampling was performed at the project site on January 20, 21, 26, 27 and February 16 and 17, 2000.

Eleven (11) Dutch friction-cone soundings were made at the site. The results of the soundings were used to determine the depths for obtaining undisturbed soil samples from an exploratory boring made immediately adjacent to each sounding, with the exception of soundings S-3, S-10, and S-11 that did not have adjacent borings. Nine (9) exploratory borings were taken to depths of ten (10) to twenty (20) feet below the existing grade to establish the general subsurface conditions of the area under consideration for the buildings and parking area. Two (2) exploratory borings were taken to depths of fifteen (15) feet below the existing grade and three (3) field percolation tests were performed at the proposed wastewater treatment system area to determine the suitability of the natural soils for a leach field or lagoon wastewater treatment system. The wastewater treatment area will be located approximately 300 feet north of the north edge of the planned buildings in the northeast corner of the property. This wastewater treatment area was shifted from its previous location approximately 1200-1300 feet north of the north edge of the planned building during the time this report was being prepared. Two (2) exploratory borings and three (3) field percolation tests were made at the previous location. This previous wastewater treatment area has been excluded from the project property in an exchange for additional property to the south of the buildings. The information from these borings and field percolation tests made at the previous treatment site is included in this report for added understanding about the surrounding geology.

The Dutch friction-cone soundings were performed with a mechanical penetrometer in accordance with ASTM D 3441-94, Standard Method for Deep, Quasi-Static, Cone, and Friction Cone Penetration Tests of Soil. The mechanical penetrometer operates incrementally,

using a set of inner rods to operate a telescoping penetrometer tip and to transmit the components of penetration resistance (cone bearing and friction sleeve resistance) to the surface for measurement. The plot of the test data identifies the relative positions and thicknesses of hard and soft layers.

The field percolation tests were performed in accordance with Chapter 6 (Soil Percolation Tests) of Title 124 produced by The Nebraska Department of Environmental Quality. The results of the field percolation tests are summarized in Table 1.

**TABLE 1**
**Field Percolation Data**

| Location | Depth ft | Percolation Rate (min/in) |
|---|---|---|
| P-1 | 3.0 | 83.3 |
| P-2 | 3.0 | 234.4 |
| P-3 | 3.0 | 250.0 |
| P-4 | 4.0 | 60.0 |
| P-5 | 4.0 | 60.0 |
| P-6 | 4.0 | 60.0 |

The borings were made in accordance with ASTM D 1452-80 (Reapproved 1995), Standard Practice for Soil Investigation and Sampling by Auger Borings. A machine-driven, continuous-flight auger having a diameter of six inches was used to advance the holes for split-barrel and thin-walled tube sampling. The bore holes were stable and casing was not required.

Twelve (12) relatively undisturbed soil samples were recovered for visual observation and laboratory testing. This sampling was performed in accordance with ASTM D 1587-94, Standard Method for Thin-Walled Tube Sampling of Soil, utilizing an open-tube sampler having an outside diameter of 3.0 inches.

The vicinity map and the boring and percolation test location plan are presented in Appendix A. The penetration diagrams (see Appendix B) present the results of the Dutch friction-cone soundings. The boring logs (refer to Appendix C) present the data obtained in the subsurface exploration. The logs include the surface elevations, the approximate depths and

elevations of major changes in the character of the subsurface materials, visual descriptions of the materials in accordance with the criteria presented in Appendix D, groundwater data, and the locations of undisturbed samples of soil. The locations of the soundings and borings were determined by tape measurements from the centerline of West Agnew Road and the fence lines bordering the property. Elevations (approximate) at the sounding and boring locations were determined by survey with reference to a bench mark previously set by Allied Surveying and Mapping, Inc. (steel spike marked with a lath) in the building area. Allied Surveying and Mapping, Inc. indicated that the elevation of this benchmark is 1454.03 feet (USGS datum). Water level readings were made in the auger borings at times and under conditions stated on the boring logs.

## III. LABORATORY ANALYSES

The undisturbed soil samples obtained during the subsurface exploration were examined in the laboratory by a member of HWS' professional engineering staff to supplement the field identification. Standard tests were performed on selected samples to determine the engineering properties of the foundation materials.

The moisture content and dry density of selected undisturbed soil samples are presented in the boring logs opposite the respective sample location. These data correlate with the strength and compressibility of the soil. High moisture content and low density usually indicates low strength and high compressibility.

The unconfined compressive strengths of several undisturbed samples were estimated in the laboratory with a calibrated hand penetrometer. These strengths are presented on the boring logs and are estimates only. Actual values are generally lower than the estimated values indicated on the boring logs.

The plasticity characteristics of an air-dried sample of the subsurface soils was determined in accordance with ASTM Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (D 4318-95a). These limits of consistency (Atterberg limits) are used in the Unified Soil Classification System as a basis for laboratory differentiation between materials of appreciable plasticity (clays) and slightly plastic or nonplastic materials (silts). The test results are presented in Table 2.

**TABLE 2**
**Atterberg Limits**

| Boring No. | Depth ft | Liquid Limit, % | Plastic Limit, % | Plasticity Index | Group Symbol |
|---|---|---|---|---|---|
| 9 | 1.7-2.0 | 60 | 21 | 39 | CH |

A swell test was performed on a sample of the foundation soils in accordance with Method "C" of ASTM D 4546-96, Standard Test Methods for One-Dimensional Swell or Settlement Potential of Cohesive Soils, except that time-rate readings were not obtained. A brief summary of the test data is presented in Table 3, and the complete test reports are presented in Appendix E.

**TABLE 3**
**Swell Test Data**

| Boring No. | Depth ft | Overburden Pressure tons/ft$^2$ | Swell Index | Swell Pressure tons/ft$^2$ | Soil Layer Thickness feet |
|---|---|---|---|---|---|
| B-9 | 1.7-2.0 | 0.1 | 0.035 | 1.1 | 2.0 |

## IV. GEOLOGY AND SITE CONDITIONS

The town of Agnew lies in the Dissected Till Plains section of Nebraska, a part of the Central Lowland province of the Interior Plains physiographic division[1]. The project site is located on the west 500 feet of the east ½ of the SW ¼ of Section 10, Township 12 North, Range 5 East in Lancaster County, Nebraska (1 3/4 miles west of Agnew on West Agnew Road) and is situated upon loess capped uplands. The uplands were formed by the dissection of a glacial drift plain that was later covered by various depths of Illinoian-age clayey or sandy material (Loveland formation) or Loveland loess. Much of the Loveland materials were removed by erosion prior to the deposition of Wisconsinan-age Peoria loess. Peoria Loess covers much of the area and is the parent material of the surficial soils.

The subsurface materials encountered at the boring locations in the area of the proposed buildings are briefly described below in descending order of occurrence. Detailed descriptions are provided in the boring logs, which are presented in Appendix C.

| **Soil Zone** | **Description** |
|---|---|
| Subsoil | Fat clay; moist; very stiff; encountered from the surface to a depth of 1.5 feet below the existing ground surface at boring location 9. |
| Subsoil/Peoria Transition | Fat clay; wet; very stiff; encountered immediately below the subsoil from 1.5 to 2.0 feet below the existing ground surface at boring location 9. |
| Peoria | Lean clay; wet; medium stiff to very stiff; encountered from the surface to the depths of all the boring locations except at boring location 9; encountered from 2.0 to 10.0 feet below the existing ground surface at boring location 9. |
| Loveland | Lean clay with sand; wet; stiff; encountered from 10.0 feet below the surface to the depth of boring 9. |
| Glacial Till | Lean clay with sand; wet, stiff to very stiff; encountered from 6.5 to 14.5 feet below the ground surface to the depth of borings 10, 11 and 12. |

[1] Physiographic Provinces of North America, Map by A. K. Lobeck, 1948; The Geographical Press; Columbia University, New York

In the area of the proposed wastewater treatment system (borings 12 and 13), Peoria lean and silty clays were encountered from the surface to depths of 8.0 to 8.5 feet below the surface. Sangamon, Loveland and Glacial Till lean to fat clays were found below the Peoria in descending order to the depth of borings. More detail may be found in the boring logs in Appencix C.

Groundwater was encountered at elevations ranging from 1,443.5 to1,434.6 feet (7.5 to 12.0 feet below the existing grade) in the building area and at an elevation of 1415.0 (7.0 feet below the existing grade) in the proposed wastewater system area. The water table could be expected to fluctuate several feet depending on surface drainage, rainfall, vegetation, temperature, and other factors.

## V. DISCUSSION AND RECOMMENDATIONS

Four basic requirements for a satisfactory foundation of a structure are as follows:

a. The base of the foundation must be located below the depth to which the soil is subject to frost action and seasonal volume change caused by alternate wetting and drying.

b. The foundation (including the earth beneath it) must be stable or safe from failure.

c. The foundation must not settle or deflect enough to disfigure or damage the structure.

d. The foundation structure must be properly located with respect to any future influence that could adversely affect its performance.

The discussion and recommendations related to the proposed wastewater treatment system are based on the following:

a. Site conditions.

b. Subsurface soil percolation rates and other engineering properties for the subsurface materials

c. State of Nebraska requirements of a maximum allowable seepage rate of 1/8 inch per day in open municipal lagoons.

The following recommendations for design and construction of the foundation for the proposed Carmelite Monastery and its wastewater treatment system are based upon site conditions, the engineering properties of the subsurface materials, and the requirements of the proposed structure.

1. **Suitable Floor and Pavement Subgrade Material.** The upper 0.5 feet of existing soils should not be used to support the pavement structure, or new fill. This soil is loose, dry soil that has been tilled for farming purposes and contains many roots and other organic matter. Appreciable settlement may occur if any permanent structures were constructed upon the upper 0.5 feet of soil. This material should be stripped from the building area and areas to be paved and stockpiled for later use as top dressing in areas that will be vegetated.

The underlying natural soils may be left in the building area and areas to be paved if these soils are "wet" and prove stable under a loaded dump truck or similar piece of equipment. By HWS' definition, a "wet" cohesive soil contains sufficient moisture to be rolled into a 1/8-inch-diameter thread without crumbling. A "moist" cohesive soil would crumble when being rolled to form a 1/8-inch-diameter thread. At the time of the subsurface exploration, portions of the fat clay subsoil and fat clay subsoil/Peoria transition materials encountered at boring location 9 were "moist." The natural soils are capable of safely supporting the new fill, pavement slabs, and the proposed pavement loads.

These moist, fat clay subsoil and subsoil/Peoria transition materials have a slight to moderate volume-change potential and will swell as its moisture content increases. The estimated heave of a floor slab or pavement structure constructed atop these moist, fat clays is 0.7 inches as the fat clays become wetter. The magnitude of potential heave is difficult to estimate and should only be used as a rough approximation. If this amount of heave is unacceptable, the potential swell may be minimized by one of the following methods: Any moist soil located within 4.0 feet of proposed finished subgrade elevation within the building or within 2.0 feet of the pavement subgrade elevation should be either removed and replaced with controlled earth fill or "cured" to raise the moisture content of the soils. Controlled earth fill is defined as earth fill that is designed, compacted, and tested in accordance with generally accepted good practice and placed with observation by the Soils Engineer.

Curing of a soil that is low in moisture content consists of uniformly wetting the soil until the moisture content has increased to a level at least equal to its plastic limit (approximately 21%). The time required to uniformly cure the moist soil is dependent on several factors including the thickness of the dry materials, the variability of the subsurface material types, and weather conditions. The curing process could take from several days to two or more weeks to occur. Serious consideration should be given to starting the curing operations prior to beginning the subsequent construction activities. A moisture content at least equal to

the plastic limit of the soil should be maintained until the floor slab or pavement structure is constructed. The Soils Engineer should inspect areas that have been "cured" to verify that the moisture content of the subgrade soil has been increased to sufficient depth prior to the commencement of the construction activities.

2. **Suitable Foundation Material.** The upper 0.5 feet of existing soils should not be used to support foundations or new fill. As discussed above, this material has been tilled for farming purposes and has a large amount of organics. It is loose and dry in its current state. Appreciable settlement may occur if this soil was used to support floor slabs or foundations. .

3. **Preparation of the Building Area and Areas to be Paved.** All vegetation and the upper 0.5 feet of existing soils should be removed from the building area and areas to be paved. All moist, fat clay subsoil and subsoil/Peoria transition materials encountered within the building area and areas to be paved should be removed and replaced or cured by irrigation as discussed in Recommendation 1. Thereafter, the exposed ground located in areas that have been "cut" to the proposed subgrade elevations and areas to be filled should be proofrolled with a loaded dump truck or similar piece of equipment (in the presence of the Soils Engineer) to locate unstable materials. Any unstable material should be either removed and replaced with controlled earth fill or reworked to conform to the moisture content and compaction recommendations presented in Table 5. Upon approval of the site by the Soils Engineer, any exposed ground surface that has not been previously reworked should be scarified to a minimum depth of six inches and reworked to conform to the moisture content and compaction recommendations presented in Table 5. Areas to be filled should then be raised to the desired elevation with controlled earth fill. Immediately prior to placement of the pavement structure, the subgrade in cut and fill sections should be scarified to a minimum depth of six inches and reworked to a uniform condition conforming to the moisture content and compaction recommendations presented in Table 5. The Soils Engineer should observe the

foundation excavations to verify that the footings will be seated in suitable natural foundation material or controlled earth fill.

**4. OSHA Excavation Requirements.** Excavations that will be occupied by personnel should be made in accordance with the Occupational Safety and Health Administration (OSHA) Construction Standards-29 CFR Part 1926, Subpart P-Excavations as published in the Federal Register, Vol. 54, 209, Tuesday, October 31, 1989, Rules and Regulations. The fat clay subsoil, fat clay subsoil/Peoria transition soil and the lean clay Peoria materials that HWS anticipates will be exposed during excavating operations are classified as Type B soils (maximum allowable slope of 1.0[H]:1.0[V]). OSHA states that a soil should be reclassified if the properties, factors, or conditions affecting the soil's classification change in any way. Sheet piling and/or shoring will be necessary if the sides of the excavations can not be sloped to meet OSHA regulations.

**5. Allowable Bearing Pressure.** The allowable net bearing pressure on the natural materials located beneath the proposed building or on controlled earth fill is 3,000 $lbf/ft^2$. The net bearing pressure is the contact pressure at the base of the foundation in excess of the pressure at the same level due to the surrounding surcharge. The contact pressure at the base of the foundation is the result of (a) all direct loads on the foundation, (b) the weight of the concrete foundation, (c) the weight of the backfill (120 $lbf/ft^3$) located directly above the foundation, and (d) the weight of the concrete floor slab located directly above the foundation. The surcharge pressure is equal to the total weight of a column of soil that extends from the lowest immediately adjacent ground surface to the bottom of the foundation divided by the soil column's area.

**6. Settlement.** Settlement of the proposed building is expected to be negligible (less than 1/4 inch) if the fill materials are properly placed (see Recommendation 15) and the recommendations in this report are carried out.

**7. Minimum Depth of Footings.** The bottoms of all exterior footings should be placed at a minimum depth of 40 inches below finished grade to provide reasonable protection against frost action and seasonal volume change. In addition, the bottom of a proposed footing should be constructed so that either (a) the elevation of the proposed footing and an existing footing are the same or (b) the horizontal distance between the nearest edge of the proposed footing and nearest edge of the existing footing is equal to or greater than the difference in elevation between the footings.

**8. Lateral Earth Pressure.** Any basement-type wall or retaining wall should be designed to withstand the pressure from the backfill. The pressure exerted by the backfill against the walls should be computed on the basis of the equivalent-fluid theory, by which the lateral pressure is considered to be caused by a fluid having a unit weight such that the total pressure of the soil and the so-called equivalent fluid are the same. The equivalent-fluid unit weights of the various recommended backfill materials, placed in accordance with Recommendation 15, are shown in Table 4. In order for the unit weights of sand to be applicable, the sand should occupy the area presented in Figure 1.

**TABLE 4**
**Recommended Equivalent-Fluid Unit Weights**

| Soil Type | Equivalent-Fluid Unit Weight, $lbf/ft^3$ | |
|---|---|---|
| | Restrained Wall | Unrestrained Wall |
| Clay | 70 | 60 |
| Sand | 40 | 30 |

The values presented in the above table assume drained (non-saturated) foundation or retaining wall backfill.

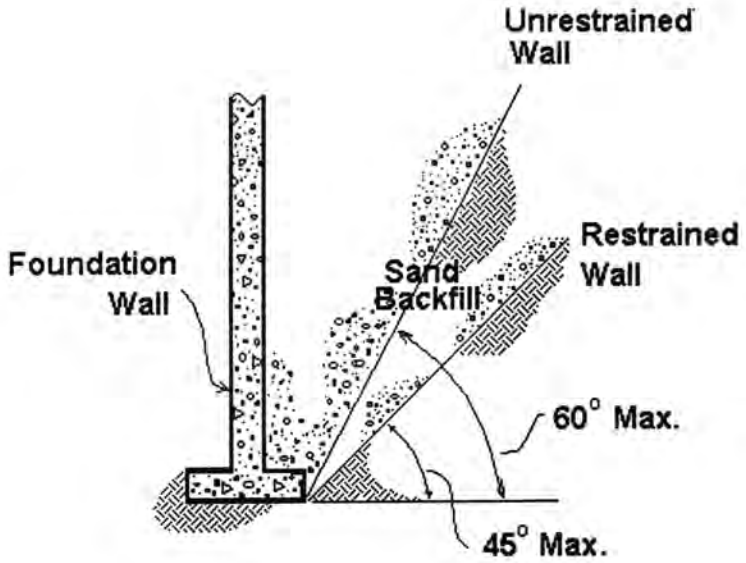



**Figure 1. Required Area for Sand Placed Behind Basement-Type and Retaining Walls**

9. **Retaining Wall Design.** A retaining wall must provide adequate stability against horizontal movement. The soil in front of the wall will provide passive-earth-pressure resistance as the wall tends to slide into the soil. In calculating the passive-earth-pressure resistance, the upper 40 inches (from finished grade) should not be assumed to contribute resistance against horizontal movement due to frost action and seasonal volume change of the soil. The suggested equivalent-fluid unit weight for calculating the passive-earth-pressure resistance is 170 $lbf/ft^3$ for non-saturated soil conditions and 120 $lbf/ft^3$ for saturated soil conditions. Additional resistance to horizontal movement will be provided by frictional resistance between the base of the footing and the foundation soil. At this project site, a retaining-wall footing would be seated in cohesive soil; therefore, the frictional resistance should be based on the cohesion of the soil. The suggested frictional resistance of the foundation soil is 1000 $lbf/ft^2$. The backfill above a retaining wall footing will help resist

overturning of the wall. Wet unit weights of 120 and 115 lbf/ft$^3$ should be used in calculating the weights of cohesive and granular backfill, respectively, above a retaining-wall footing. A minimum factor of safety of 1.5 should be applied to the overall retaining-wall design. The maximum soil pressure beneath a retaining-wall footing should not exceed the bearing pressure presented in Recommendation 4.

**10. Vertical Modulus of Subgrade Reaction.** The suggested value of the vertical modulus of subgrade reaction to be used in the design of footings and pavement structure is 100 lbf/in$^3$.

**11. Foundation and Retaining-Wall Drains.** A drainage system (consisting of a slotted drainpipe encased in granular filter material) should be installed around any floor slab that will be below finished grade and behind any retaining wall to intercept surface water that might enter the backfill. The drainpipes (with 3/32-in. slots) should be backfilled with fine aggregate for State of Nebraska "47B" concrete (hereinafter referred to as "sand-gravel"). The pipes should have a minimum of 4 inches of sand-gravel encasing the bottoms and sides, and the sand-gravel should extend to within 2.0 feet of finished grade. The drainage lines around the floor slab should be installed on the outside of the foundation walls and should be located below the floor elevation, but the bottoms of the lines should be at least four inches above the bottom level of the footings.

**12. Protective Slopes around the Building.** The site should be graded in a manner that will divert water away from the building. The protective slopes around the building should meet the following requirements:

a. Slope downward from the building to lower areas or drainage swales.

b. Minimum horizontal length of 10 feet, minimum vertical fall of 6 inches (5 percent).

c. Minimum gradient (beyond 10 feet from building):

(1) Impervious surface; 1/8 inch per foot (1 percent).

(2) Pervious surface; 1/4 inch per foot (2 percent).

**13. Wastewater Treatment System.** HWS recommends considering either a leach field or a lagoon type wastewater treatment system for this project. The results of the field percolation tests performed in the proposed area for this system indicate that the soil would be permeable enough for a leach field system at the depths that the tests were run. The results were, however, at the minimum allowable percolation rate for this type of system. HWS recommends using a larger area than would otherwise be required for this type of system to account for the relatively slow percolation rate of the soils.

If it is decided to use a lagoon system, HWS has collected 3 relatively undisturbed soil samples at the proposed location that may be used to perform hydraulic conductivity testing on the natural soils at various depths if requested. In addition, HWS may provide further recommendations for the compaction and moisture content used during the construction of the lagoon.

More details pertaining to the design of a leach field or lagoon system for this project will be found in the forthcoming Preliminary Wastewater Design Memorandum for Carmelite Monastery.

**14. Types of Soils to be used as Fill and Backfill.** Controlled earth fill placed within the building area, areas to be paved, and in lagoon dikes should be constructed of clean inorganic SM[2], SC[3], ML[4] or CL[5] materials (with a liquid limits less than 50 and a plasticity index less than 30). The lean clay Peoria and Loveland materials encountered at the project site are considered suitable for use as fill within the building area, areas to be paved and within

[2] Silty sand
[3] Clayey sand
[4] Silt, silt with sand and sandy silt.
[5] Lean clay, lean clay with sand and sandy lean clay

lagoon dike area. A majority of the Peoria lean clay materials encountered at the site were high in moisture content and would require manipulation (drying) to achieve the moisture content necessary for proper compaction.

The materials used as fill and backfill outside the building, and areas to be paved and outside of the lagoon dikes may consist of ML, CL, SC, SM, and CH (fat clay, fat clay with sand and/or sandy fat clay). It should be noted, however, that the upper 2.0 feet of the subsoil and subsoil/Peoria transition materials at boring location 9 were low in moisture content and would require the addition of water to achieve a moisture content necessary for proper placement. As previously discussed, any foundation or retaining-wall drain should be either embedded in sand-gravel or wrapped with a geotextile and bedded in fine sand. Any granular backfill should be capped with at least two feet of clay. Proposed fill and backfill materials should be subject to approval by the Soils Engineer. Representative samples of the proposed fill and backfill materials should be submitted to the Soils Engineer at least three days prior to placement so the necessary laboratory tests can be performed.

**15. Placement of Fill and Backfill.** The suggested basis for controlling the placement of fill and backfill on the site, excluding free-draining granular materials, are the "optimum moisture content" and "maximum dry density" as determined by ASTM D 698-91, Procedure A, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$) (600 kN-m/m$^3$). The recommended acceptable values of moisture content and degree of compaction are given in Table 5.

**TABLE 5**
**Compaction Recommendations of Controlled Earth Fill and Backfill**

| Location | Soil Type | Minimum Moisture Content | Minimum Compaction* |
|---|---|---|---|
| Below top-of-interior-footing elevations in the building area. | Silts and Clays | 2% Below Optimum | 98% |
| | Silty and Clayey Sands | ** | 100% |
| From 0.0 to 1.0 foot below pavement subgrade elevations outside the building area. | Silts and Clays | 2% Below Optimum | 100% |
| | Silty and Clayey Sands | ** | 100% |
| (a) Above top-of-interior-footing elevation in the building area and (b) greater than 1.0 foot below pavement subgrade elevation outside the building area. | Silts and Clays | 2% Below Optimum | 95% |
| | Silty and Clayey Sands | ** | 95% |
| Backfill of footings and utility trenches outside the building area and outside of areas to be paved. | Silts and Clays | 2% Below Optimum | 92% |

* Percent of Maximum Dry Density (ASTM D 698-91, Procedure A)
** Moisture as necessary to obtain density (near Optimum)

Clean free-draining sand used as backfill should be consolidated by means of a vibratory compactor to at least 60% "relative density", as determined in accordance with ASTM D 4253-93 (Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table) and D 4254-91 (Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density).

**16. Grading Observation.** Observation and frequent testing by the Soils Engineering Firm during compaction of fill and backfill are necessary to verify proper moisture

content and degree of compaction. A professional opinion should be obtained from the Soils Engineer that the site has been properly prepared, that all footings will be seated on suitable foundation materials, and that all fill, backfill, and subgrade materials conform to the moisture content and compaction recommendations presented above. If these testing and observation services are not performed, the allowable bearing pressure stated in Recommendation 5 may be invalid. As the Soils Engineer for this project, HWS has interpreted the results of the subsurface exploration and laboratory tests to arrive at the recommendations presented in this report. Consequently, HWS is in the best position to relate actual observed conditions to those assumed for this report and to provide revised recommendations if differences are found during grading operations and construction of the foundation for the referenced project.

**17. Subgrade Observation.** The floor subgrade, pavement subgrade, and foundation materials should be observed by the Soils Engineer immediately prior to placement of the concrete or paving components. Severe changes in the condition of these materials can occur after initial preparation as the result of rain, drying, freezing, and construction activities. Any subgrade or foundation material that becomes disturbed, desiccated, or does not conform to the moisture content and compaction recommendations previously presented should either be removed and replaced or reworked to meet these recommendations.

**18. Applicability of Recommendations.** The recommendations presented in this report are based in part upon HWS' analyses of the data from the Dutch friction-cone soundings and soil borings. The penetration diagrams, boring logs, and related information depict subsurface conditions only at the specific sounding and boring locations and at the time of the subsurface exploration. Soil conditions may differ between the soundings and exploratory borings and might change with the passage of time. The nature and extent of any variations between the sounding and boring locations or of any changes in soil conditions (e.g., drying of soil) might not become evident until grading operations and construction of the foundation for

the referenced project have begun. If variations and changes in the soil conditions then appear, it will be necessary to re-evaluate the recommendations stated in this report.

## VI. CONCLUSIONS

HWS concludes, on the basis of the findings of the subsurface exploration at the project site and the evaluation of the engineering properties of samples of the foundation materials, that the proposed Carmelite Monastery can be safely supported by spread footings seated on either firm natural materials or controlled earth fill. Satisfactory performance of the foundation system used to support the new structure is to be expected if the foregoing recommendations are carried out.

At the time of the exploration, portions of the fat clay subsoil and subsoil/Peoria transition materials (encountered at boring location 9) had a low moisture content. Theses soils have slight to moderate volume-change potential and will swell as their moisture content increases. The estimated heave of a floor slab or pavement structure is 0.7 inches. The magnitude of potential heave is difficult to estimate and should only be used as a rough approximation. To minimize the potential swell, any moist soil located in the building area or areas to be paved should be removed and replaced with controlled earth fill or "cured" to raise the moisture content of the soils in accordance with Recommendation 1.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices for exclusive use by The Clark Enersen Partners, JVC Associates, Mother Theresa of Jesus O.C.D. Prioress, their representatives, and the contractor for specific application to the proposed Carmelite Monastery. The recommendations of this report are not valid for any other purpose.

HWS should be contacted if any questions arise concerning this report or if changes in the nature, design, or location of the structure are planned. If any such changes are made, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by HWS and the conclusions of this report are modified or verified in

writing. This report shall not be reproduced, except in full, without the written approval of HWS Consulting Group Inc.

Submitted By

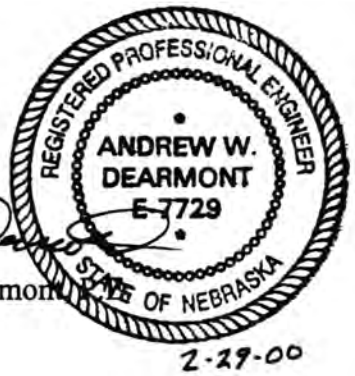
HWS CONSULTING GROUP INC.

Prepared By

Matthew D. Goeller, E.I.T.

Reviewed By

Andrew W. Dearmont

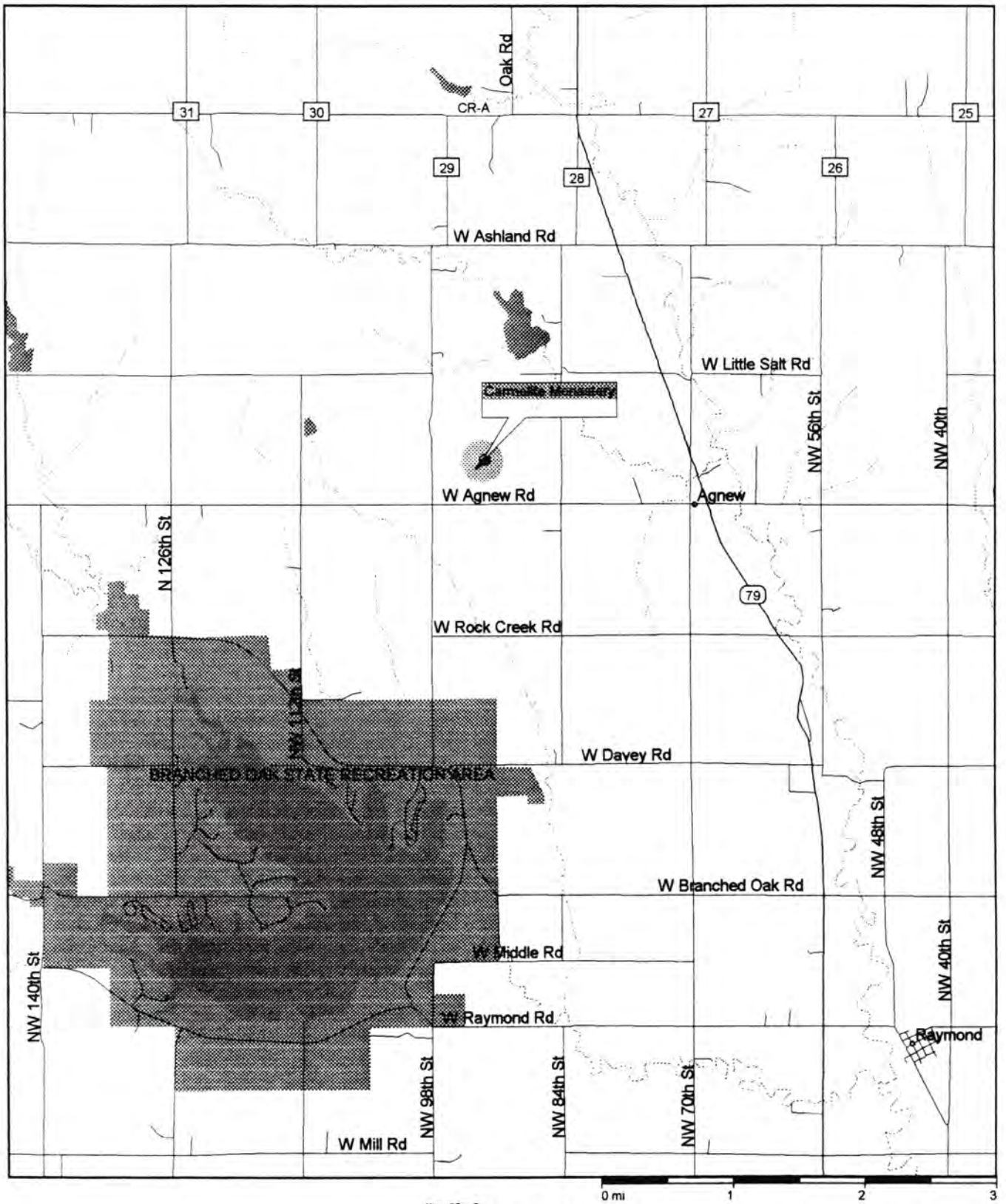



2-29-00

# APPENDIX A. VICINITY MAP AND BORING LOCATION PLAN

# Vicinity Map

Carmelite Monastery




Streets98

Copyright © 1988-1997, Microsoft Corporation and/or its suppliers. All rights reserved. Please visit our web site at http://maps.expedia.com.

# APPENDIX B.
# DUTCH FRICTION-CONE PENETRATION DIAGRAMS

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–1**

BY: **JL & BJ**

SURFACE ELEVATION: **1451.0** ft. LOCATION: **B–1**

PAGE: **1 of 1**

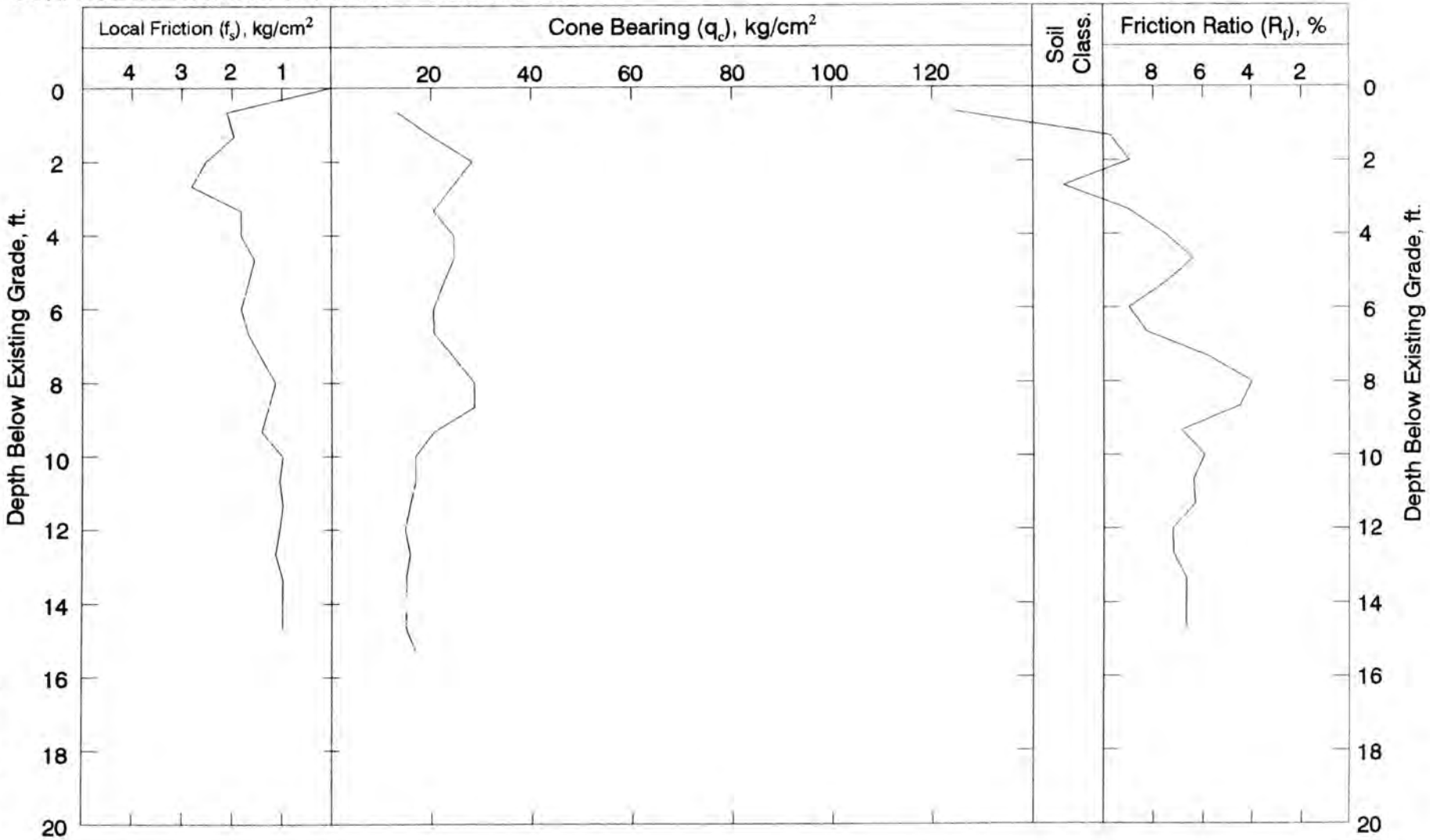



Figure B–1a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–2**

BY: **JL & BJ**

SURFACE ELEVATION: **1446.6** ft. LOCATION: **B–2**

PAGE: **1 of 1**

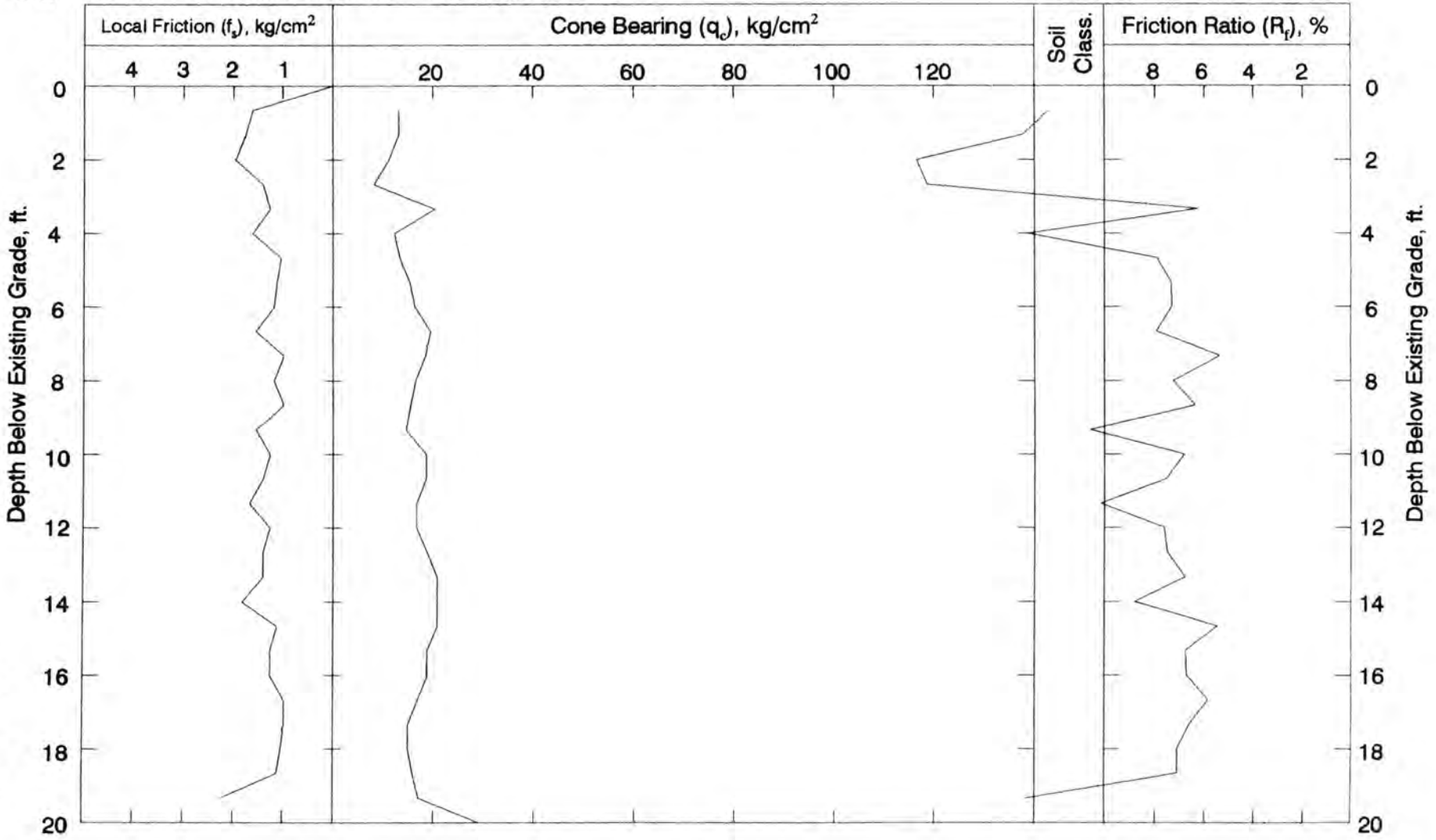



Figure B–2aa

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–3**

BY: **JL & BJ**

SURFACE ELEVATION: **1447.8** ft. LOCATION: **B–3**

PAGE: **1 of 1**

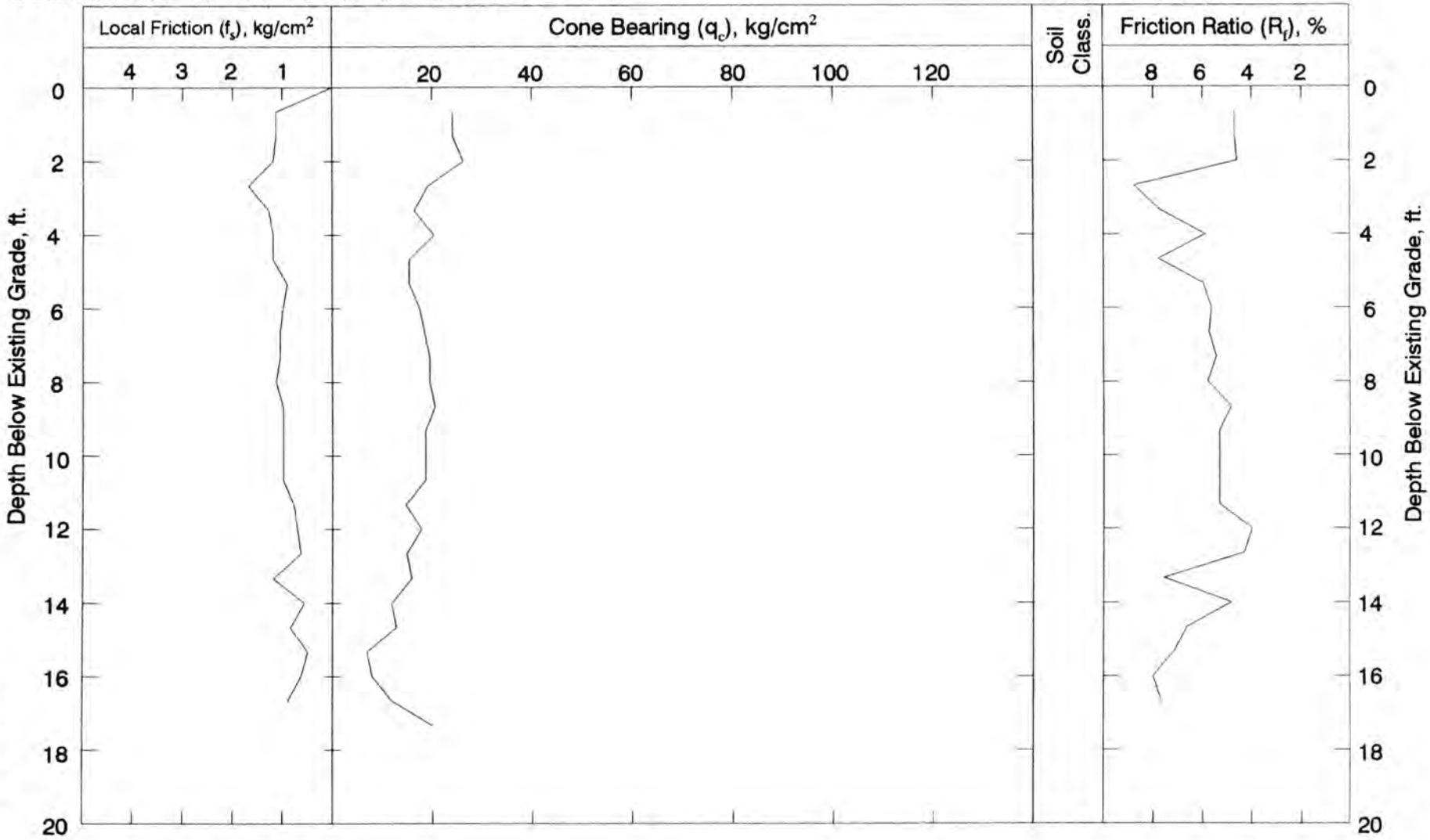



Figure B–3a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–4**

BY: **JL & BJ**

SURFACE ELEVATION: **1452.3** ft. LOCATION: **B–4**

PAGE: **1 of 1**

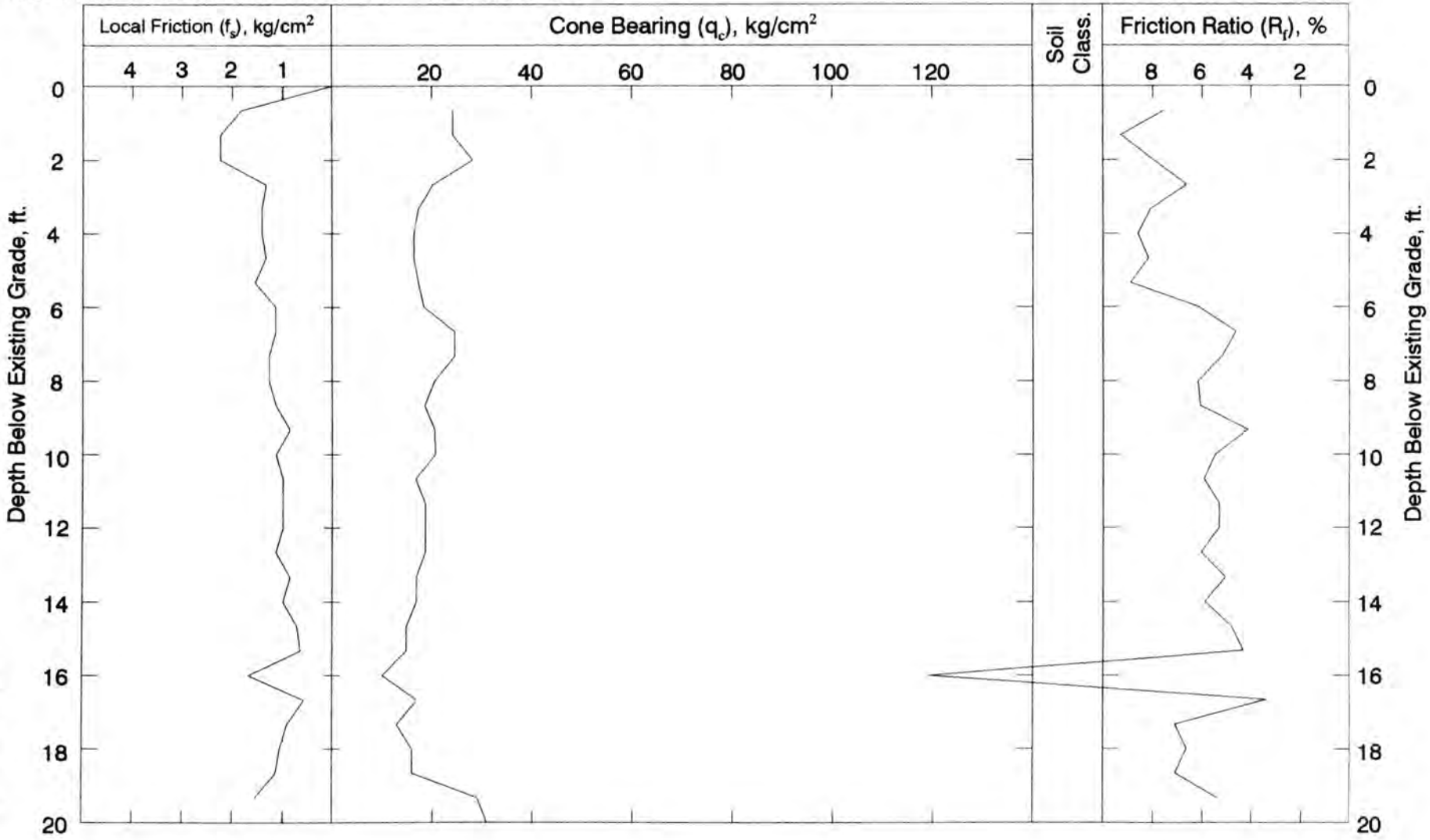



Figure B–4a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–5**

BY: **JL & BJ**

SURFACE ELEVATION: **1451.0** ft. LOCATION: **B–5**

PAGE: **1 of 1**

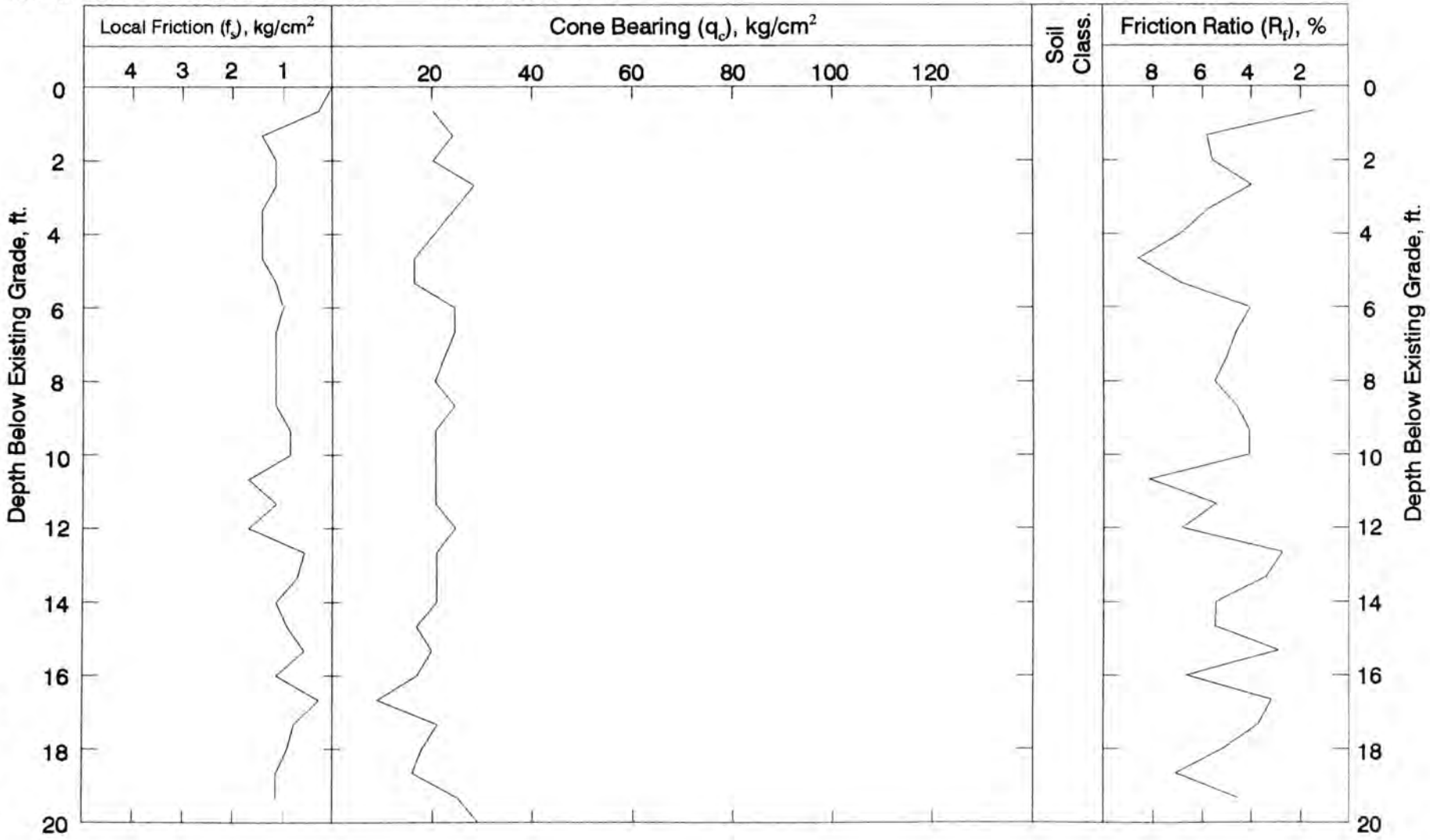



Figure B–5a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–6**

BY: **JL & BJ**

SURFACE ELEVATION: **1446.5** ft. LOCATION: **B–6**

PAGE: **1 of 1**

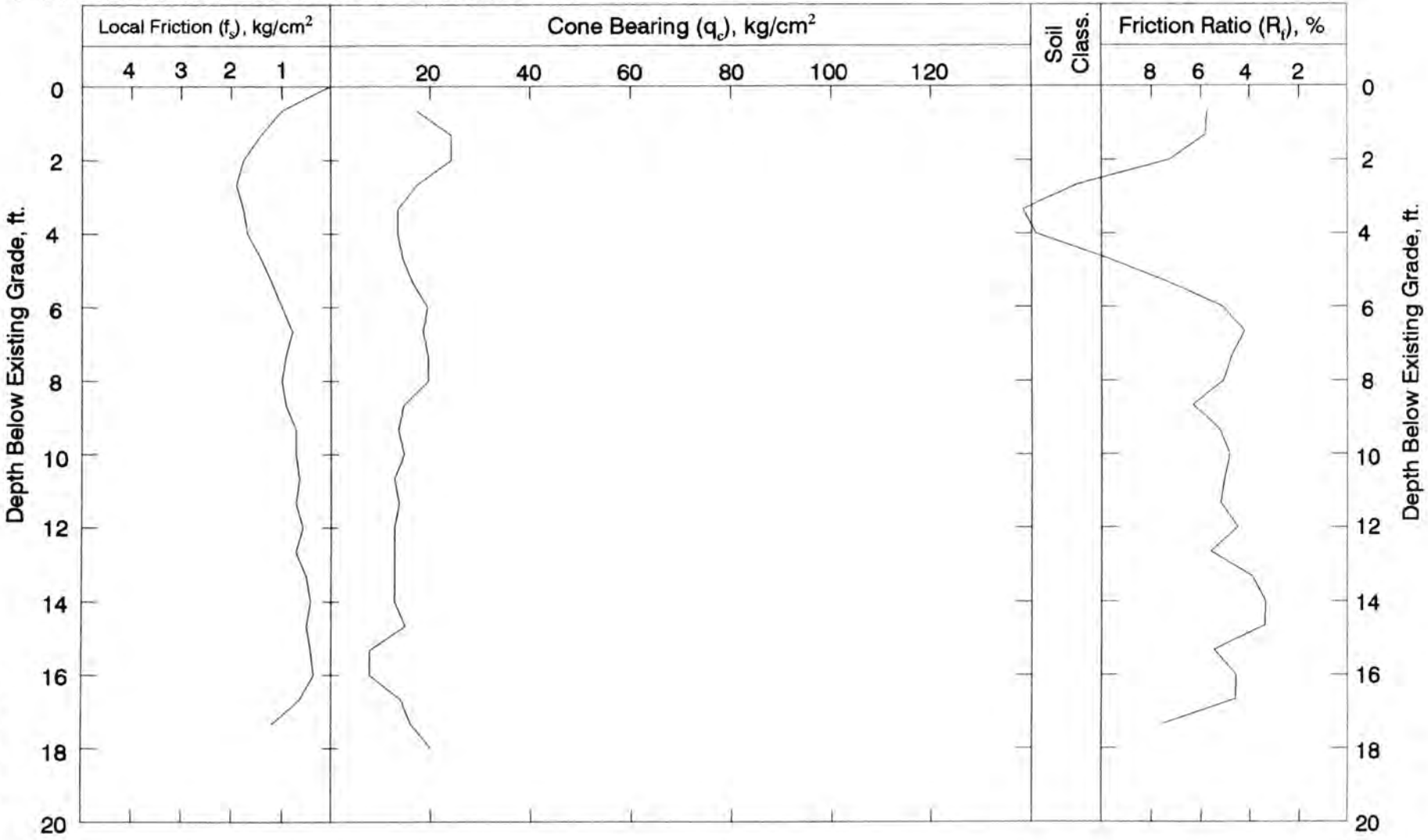



Figure B–6a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–7**

BY: **JL & BJ**

SURFACE ELEVATION: **1451.4** ft. LOCATION: **B–7**

PAGE: **1 of 1**

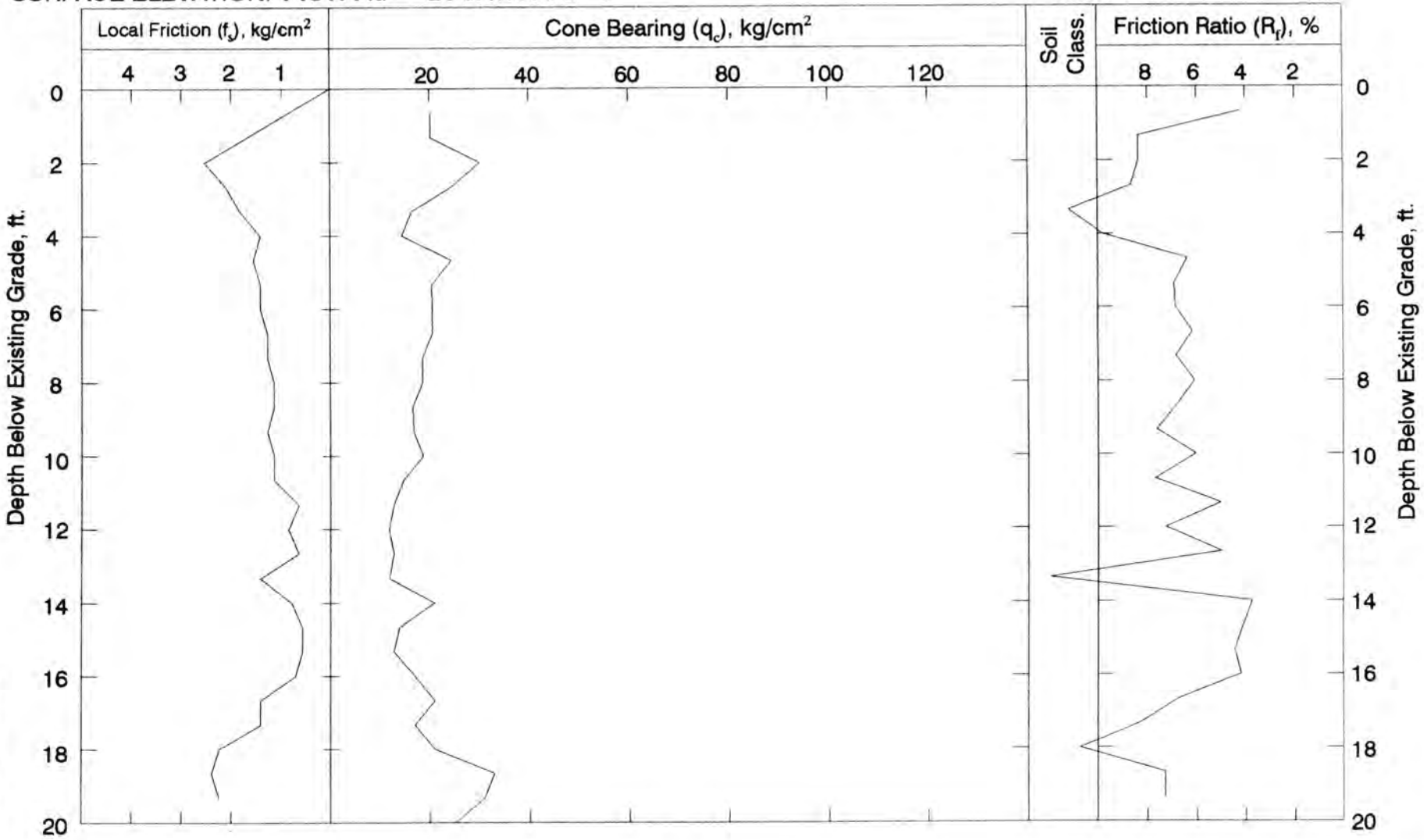



Figure B–7a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–8**

BY: **JL & BJ**

SURFACE ELEVATION: **1447.8** ft. LOCATION: **B–8**

PAGE: **1 of 1**

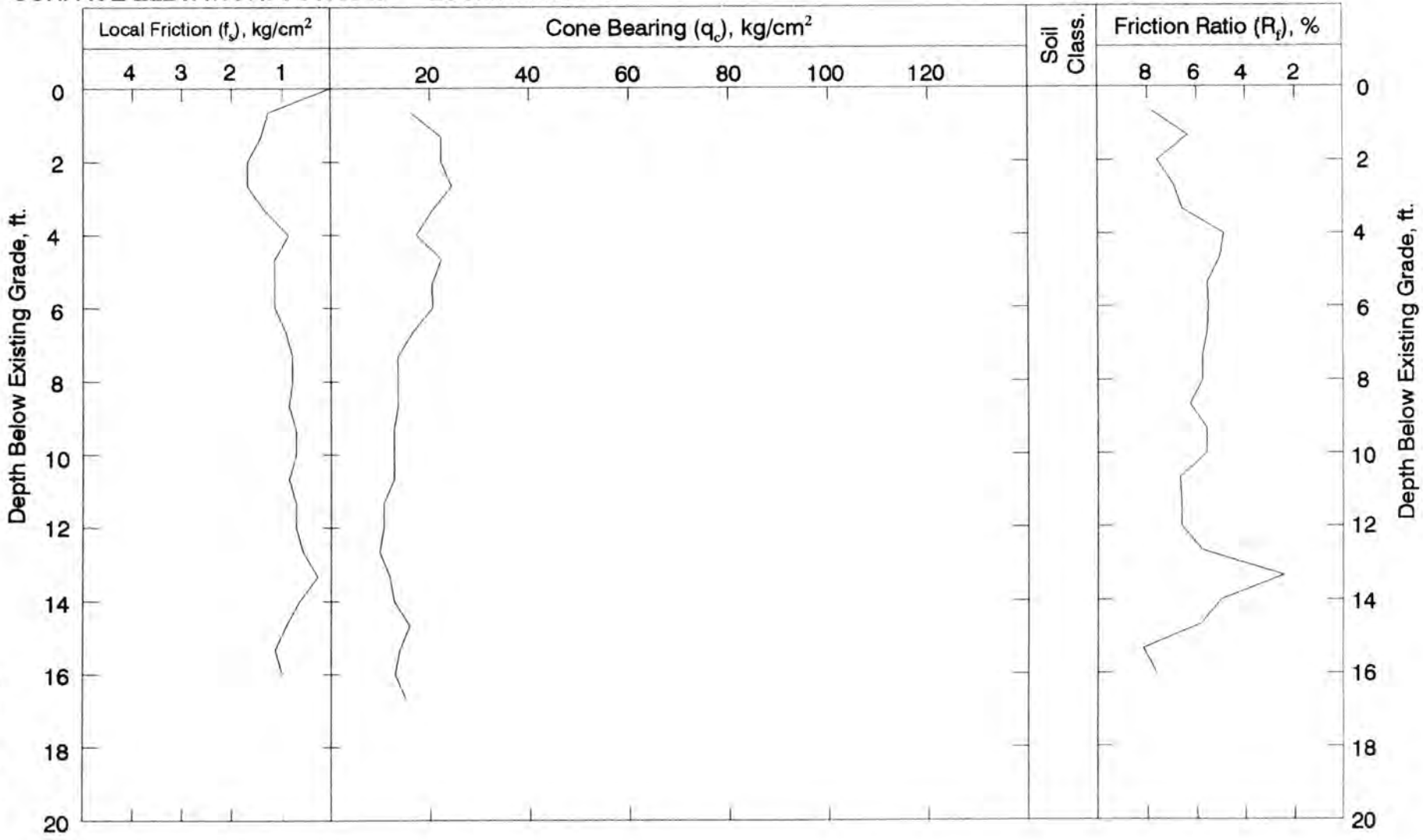



Figure B–8a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–9**

BY: **JL & BJ**

SURFACE ELEVATION: **1451.2** ft. LOCATION: **B–9**

PAGE: **1 of 1**

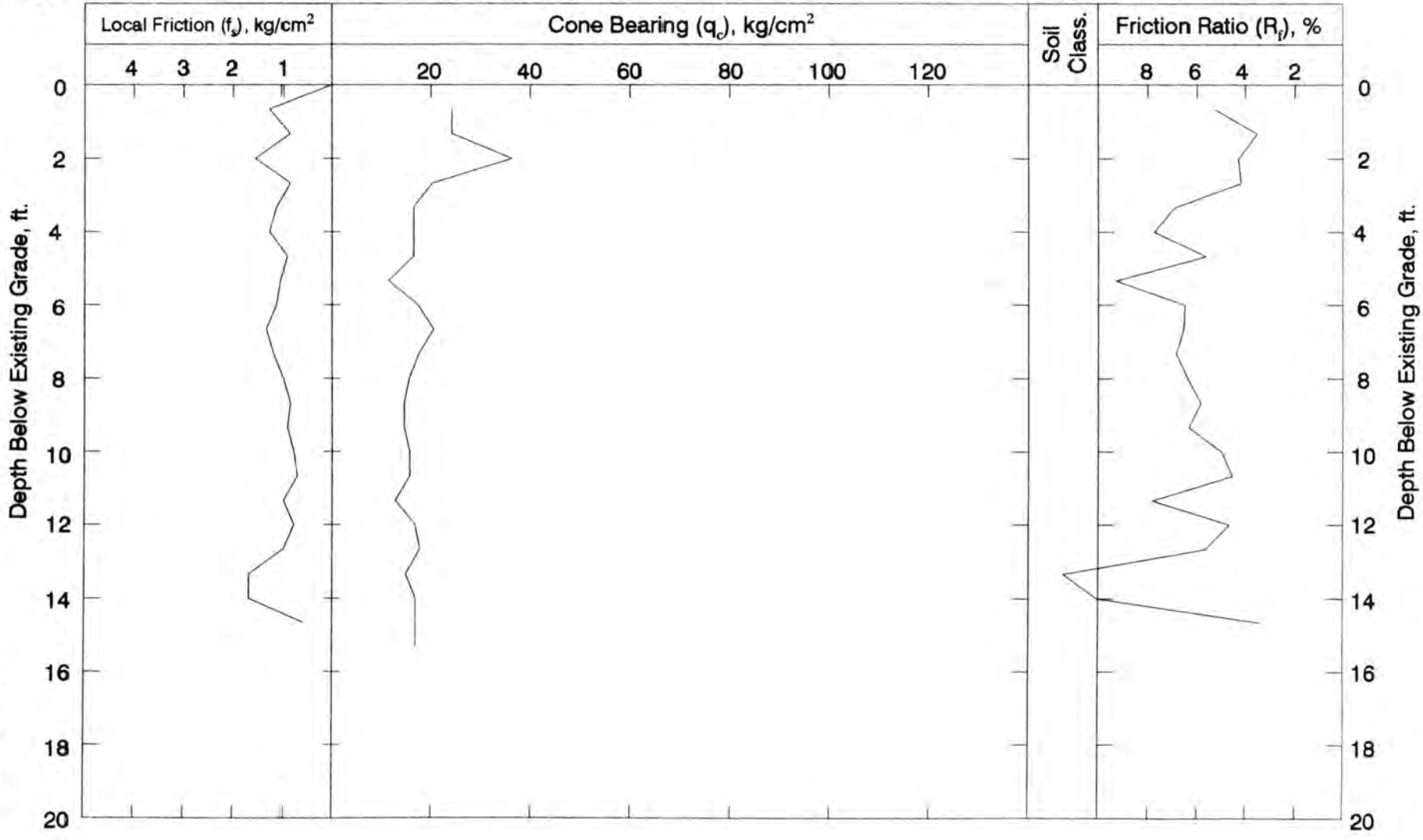



Figure B–9a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–10**

BY: **JL & BJ**

SURFACE ELEVATION: **1438.0** ft. LOCATION: **S–10**

PAGE: **1 of 1**

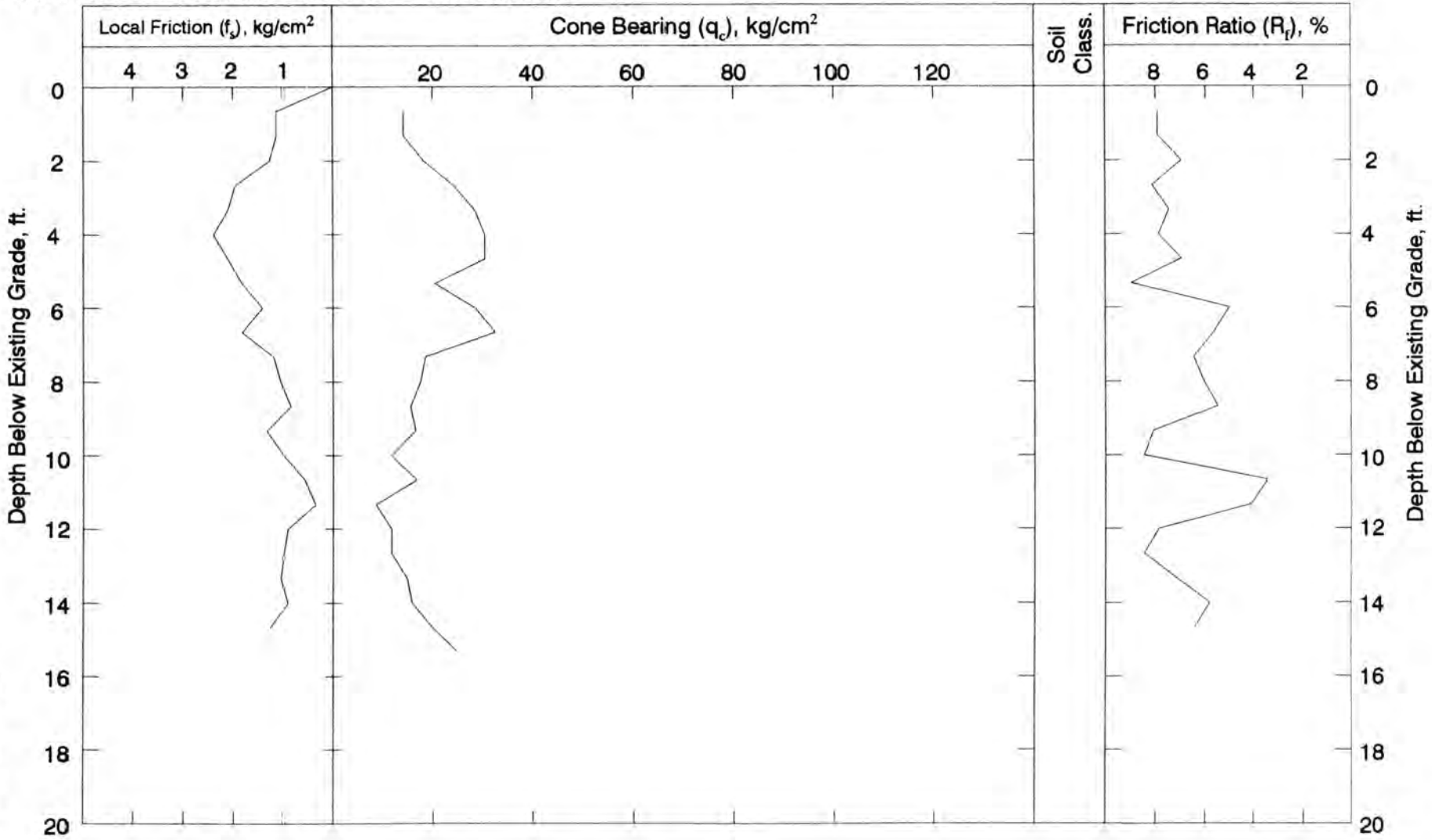



Figure B–10a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# PENETRATION DIAGRAM OF DUTCH FRICTION–CONE PENETROMETER

PROJECT: **Carmelite Monastery**
**2 Miles West of Agnew, Nebraska**

DATE: **1–20–00**

SOUNDING NO.: **S–11**

BY: **JL & BJ**

SURFACE ELEVATION: **1448.0** ft. LOCATION: **S–11**

PAGE: **1 of 1**

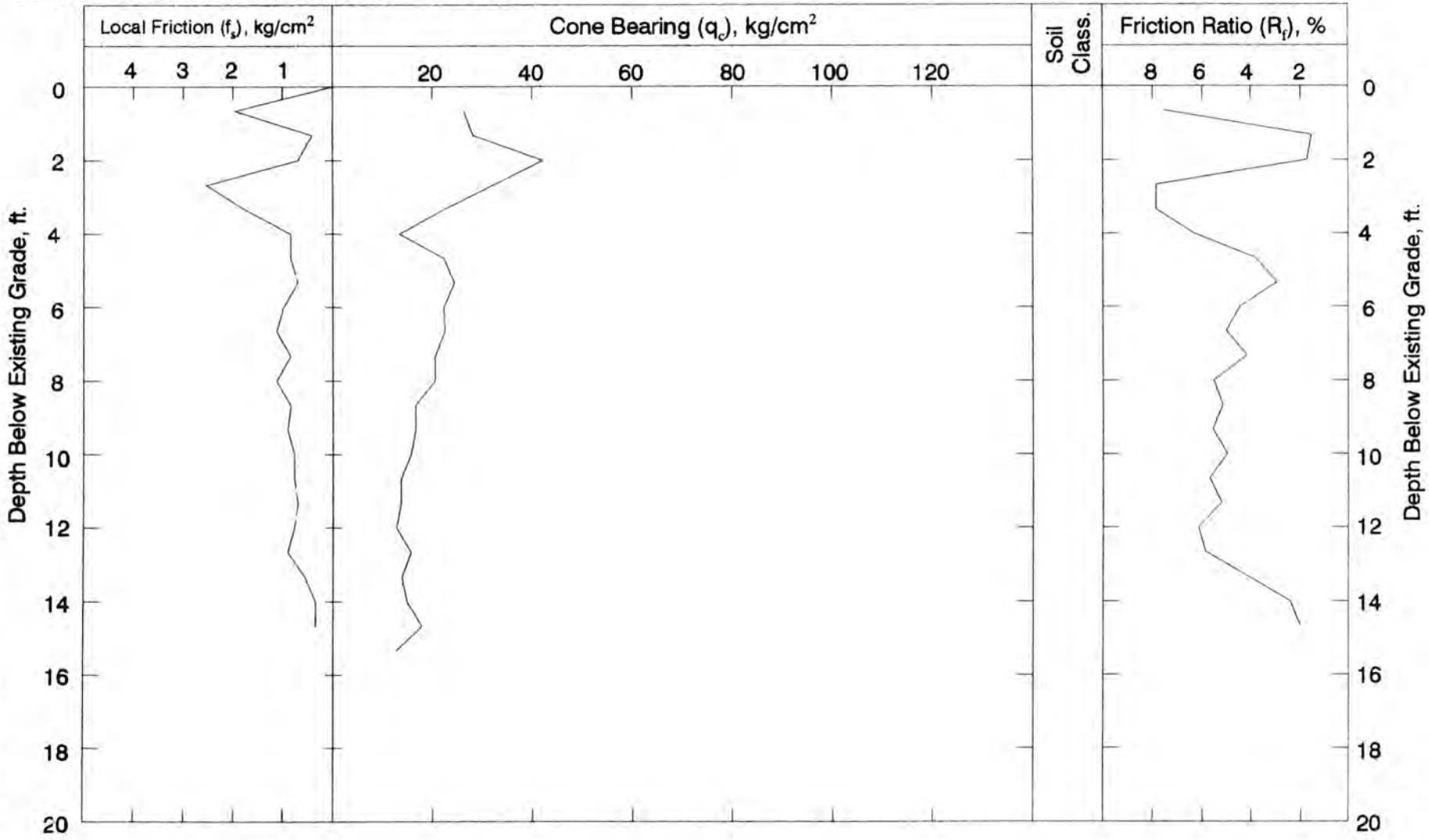



Figure B–11a

# APPENDIX C. BORING LOGS

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Carmelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 1
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|
| 1451.0 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown; wet; stiff. (Peoria) | | | | | | 0 |
| | | | | | | | | | 1 |
| | | | | | | | | | 2 |
| | | | | | | | | | 3 |
| | | | | | | | | | 4 |
| | | | | | | | | | 5 |
| | | | | | | | | | 6 |
| | | | | | | | | | 7 |
| | | | | | | | | | 8 |
| | | | | | | | | | 9 |
| 1441.0 | 10.0 | | | | | | | | 10 |
| | | | | | | | | | 11 |
| | | | | | | | | | 12 |
| | | | | | | | | | 13 |
| | | | | | | | | | 14 |
| | | | | | | | | | 15 |

Groundwater was not encountered to the depth of the boring.

Figure C-1a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 2
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1446.6 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with yellowish red; wet; medium stiff. (Peoria) | | | | | | | 0 |
| | | | | | | | | | | 1 |
| | | | | | | | | | | 2 |
| 1443.6 | 3.0 | CL | Same as above except stiff. (Peoria) | | | | | | | 3 |
| | | | | | | | | | | 4 |
| | | | | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| 1439.1 | 7.5 | CL | Same as above except mottled with grey, red, and black. (Peoria) | | | | | | | 8 |
| | | | | 1.8 | | | 1 | 90.4 | 30.3 | 9 |
| | | | | | | | | | | 10 |
| | | | | | | | | | | 11 |
| 1434.6 | 12.0 | CL | Same as above except saturated. (Peoria) | | | | | | | 12 |
| | | | | Groundwater was encountered at 12.0' feet on 1-21-00. | | | | | | 13 |
| | | | | | | | | | | 14 |
| 1431.6 | 15.0 | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-2a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 3
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|
| 1447.8 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with yellowish red; wet; stiff. (Peoria) | | | | | | 0 |
| | | | | | | | | | 1 |
| | | | | | | | | | 2 |
| | | | | | | | | | 3 |
| | | | | | | | | | 4 |
| | | | | | | | | | 5 |
| | | | | | | | | | 6 |
| | | | | | | | | | 7 |
| | | | | | | | | | 8 |
| | | | | | | | | | 9 |
| 1437.8 | 10.0 | | | | | | | | 10 |
| | | | | | | | | | 11 |
| | | | | | | | | | 12 |
| | | | | | | | | | 13 |
| | | | | | | | | | 14 |
| | | | | | | | | | 15 |

Groundwater was not encountered to the depth of the boring.

Figure C-3a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 4
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1452.3 | 0.0 | CL | LEAN CLAY; medium plasticity; dark yellowish brown; wet; stiff. (Peoria) | | | | | | | 0 |
| | | | | | | | | | | 1 |
| | | | | | | | | | | 2 |
| | | | | | | | | | | 3 |
| | | | | | | | | | | 4 |
| | | | | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| | | | | | | | | | | 8 |
| | | | | | | | | | | 9 |
| 1442.3 | 10.0 | CL | Same as above; mottled with grey and black. (Peoria) | 1.8 | | | 2A | 88.9 | 31.0 | 10 |
| 1441.3 | 11.0 | CL | Same as above; mottled with grey; saturated; medium stiff. (Peoria) | 0.8 | | | 2B | 89.4 | 31.4 | 11 |
| | | | Groundwater was encountered at 11.0' feet on 1-21-00. | | | | | | | 12 |
| | | | | | | | | | | 13 |
| | | | | | | | | | | 14 |
| 1437.3 | 15.0 | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-4a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 5
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1451.0 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with light gray; wet; stiff. (Peoria) | | | | | | | 0 |
| | | | | | | | | | | 1 |
| | | | | | | | | | | 2 |
| | | | | | | | | | | 3 |
| | | | | | | | | | | 4 |
| | | | | | | | | | | 5 |
| 1445.5 | 5.5 | CL | Same as above; mottled with yellowish red and black. (Peoria) | | | | | | | 6 |
| | | | | 1.7 | | | 3 | 88.4 | 29.9 | 7 |
| 1443.5 | 7.5 | CL | Same as above except saturated. (Peoria) | | | | | | | 8 |
| | | | | Groundwater was encountered at 7.5' feet on 1-21-00. | | | | | | 9 |
| | | | | | | | | | | 10 |
| | | | | | | | | | | 11 |
| | | | | | | | | | | 12 |
| | | | | | | | | | | 13 |
| | | | | | | | | | | 14 |
| 1436.0 | 15.0 | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-5a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 6
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|
| 1446.5 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with gray and yellowish red; wet; stiff. (Peoria) | | | | | | 0 |
| 1443.5 | 3.0 | CL | Same as above except medium stiff to stiff. (Peoria) | | | | | | 3 |
| 1442.5 | 4.0 | CL | Same as above except stiff. (Peoria) | | | | | | 4 |
| 1437.5 | 9.0 | CL | Same as above except medium stiff to stiff. (Peoria) | | | | | | 9 |
| 1436.5 | 10.0 | | | | | | | | 10 |

Groundwater was not encountered to the depth of the boring.

Figure C-6a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 7
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1451.4 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish red mottled with gray and yellowish brown; wet; stiff. (Peoria) | | | | | | | 0 |
| | | | | | | | | | | 1 |
| | | | | | | | | | | 2 |
| | | | | | | | | | | 3 |
| | | | | | | | | | | 4 |
| 1446.4 | 5.0 | CL | Same as above except grayish brown. (Peoria) | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| | | | | | | | | | | 8 |
| | | | | | | | | | | 9 |
| | | | | | | | | | | 10 |
| | | | | | | | | | | 11 |
| 1439.9 | 11.5 | CL | LEAN CLAY; medium plasticity; grayish brown mottled with yellowish red; wet; medium stiff to stiff. (Peoria) | | | | | | | 12 |
| 1439.4 | 12.0 | CL | Same as above except saturated. (Peoria) | 1.0 | | | 4 | 89.8 | 30.8 | |
| | | | Groundwater was encountered at 12.0' feet on 1-21-00. | | | | | | | 13 |
| | | | | | | | | | | 14 |
| 1436.4 | 15.0 | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-7a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 8
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1447.8 | 0.0 | CL | LEAN CLAY; medium plasticity; dark yellowish brown mottled with yellowish red and very dark grayish brown; wet; stiff. (Peoria) | Groundwater was not encountered to the depth of the boring. | | | | | 19.2 | 0 |
| 1444.8 | 3.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with yellowish red and gray; wet; stiff. (Peoria) | 1.8 | | | 5 | 91.7 | 24.4 | 3 |
| 1440.8 | 7.0 | CL | Same as above except medium stiff to stiff. (Peoria) | | | | | | | 7 |
| 1437.8 | 10.0 | | | | | | | | | 10 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-8a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Camelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 9
Sheet: 1 of 1
Date: 1-21-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1451.2 | 0.0 | CL | LEAN CLAY; medium plasticity; dark grayish brown mottled with dark yellowish red; moist; very stiff. (Subsoil) | | | | | | 21.1 | 0 |
| 1449.7 | 1.5 | CL | LEAN CLAY; medium plasticity; brown mottled with yellowish brown and black; wet; very stiff. (Subsoil/Peoria Transition) | 3.5 | | | 6 | 98.6 | 24.2 | 1 |
| 1448.7 | 2.5 | CL | Same as above except stiff. (Peoria) | | | | | | | 2 |
| 1447.7 | 3.5 | CL | Same as above except grayish brown. (Peoria) | | | | | | | 3 |
| | | | | | | | | | | 4 |
| | | | | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | | | | | | | 7 |
| | | | | | | | | | | 8 |
| | | | | | | | | | | 9 |
| 1441.2 | 10.0 | CL | LEAN CLAY WITH SAND; 15-20% fine to coarse sand; medium plasticity; yellowish red; saturated; stiff. (Loveland) | Groundwater was encountered at 10.0' feet on 1-21-00. | | | | | | 10 |
| | | | | | | | | | | 11 |
| | | | | | | | | | | 12 |
| | | | | | | | | | | 13 |
| | | | | | | | | | | 14 |
| 1436.2 | 15.0 | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-9a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Carmelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 10
Sheet: 1 of 1
Date: 1-27-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|
| 1387.3 | 0.0 | CL | LEAN CLAY; 5-15% fine to medium sand; medium plasticity; dark brown; moist; stiff. (Subsoil) | | | | | | 0 |
| 1384.8 | 2.5 | CL | LEAN CLAY; trace of fine sand; medium plasticity; dark brown mottled with olive gray and yellowish red; wet; stiff. (Peoria) | | | | | | 3 |
| 1380.8 | 6.5 | CL | LEAN CLAY; 10-20% fine to coarse sand; medium plasticity; light yellowish brown mottled with yellowish red, black and white; wet; stiff. (Glacial Till) | | | | | | 7 |
| 1372.3 | 15.0 | | | | | | | | 15 |

Groundwater was not encountered to the depth of the boring.

Figure C-10a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Carmelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 11
Sheet: 1 of 1
Date: 1-27-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1388.0 | 0.0 | CL | LEAN CLAY WITH SAND; 15-25% fine to coarse sand; medium plasticity; dark brown mottled with yellowish red and light brown; wet; stiff. (Subsoil/Peoria Transition) | Groundwater was not encountered to the depth of the boring. | | | | | | 0 |
| | | | | | | | | | | 1 |
| | | | | | | | | | | 2 |
| 1385.0 | 3.0 | CL | LEAN CLAY; medium plasticity; grayish brown mottled with black and yellowish red; wet; very stiff. (Peoria) | 3.3 | | | 7 | 100.9 | 22.2 | 3 |
| | | | | | | | | | | 4 |
| 1383.0 | 5.0 | CL | LEAN CLAY; 5-15% fine to medium sand; medium plasticity; light reddish brown mottled with dark brown, olive gray and yellowish red; wet; medium to stiff. (Peoria) | | | | | | | 5 |
| | | | | | | | | | | 6 |
| 1381.5 | 6.5 | CL | LEAN CLAY; medium plasticity; grayish brown mottled with black slightly mottled with yellowish red; wet; very stiff. (Peoria) | 2.3 | | | 8 | 98.8 | 25.7 | 7 |
| 1380.8 | 7.2 | CL | LEAN CLAY; medium plasticity; yellowish red heavily mottled with grayish brown mottled with black; wet; stiff to very stiff. (Peoria) | 2.0 | | | | | | |
| 1380.5 | 7.5 | CL/CH | LEAN TO FAT CLAY; medium to high plasticity; dark brown mottled with yellowish red and black; wet; stiff to very stiff. (Glacial Till) | 1.8 | | | | | | 8 |
| 1379.5 | 8.5 | CL/CH | | | | | 9 | 101.2 | 23.6 | 9 |
| 1379.1 | 8.9 | CL/CH | LEAN TO FAT CLAY; medium to high plasticity; grayish brown heavily mottled with yellowish red and dark grayish brown; wet; very stiff. (Glacial Till) | 2.8 | | | | | | |
| 1378.0 | 10.0 | | Same as above except 10-20% fine to medium sand; very stiff. (Glacial Till) | | | | | | | 10 |
| | | | | | | | | | | 11 |
| | | | | | | | | | | 12 |
| | | | | | | | | | | 13 |
| | | | | | | | | | | 14 |
| | | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-11a

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Carmelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. 12
Sheet: 1 of 1
Date: 2-16-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|
| 1423.2 | 0.0 | CL | LEAN CLAY; medium plasticity; yellowish brown mottled with gray; wet; stiff to very stiff. (Peoria) | | | | | | 0 |
| 1418.2 | 5.0 | CL/ML | SILTY CLAY; low plasticity; yellowish brown; wet; medium stiff. (Peoria) | | | | | | 5 |
| 1414.7 | 8.5 | CH | FAT CLAY; high plasticity; dark brown mottled with reddish brown and black; wet; very stiff. (Loveland) | | | | | | 9 |
| 1411.7 | 11.5 | CL/CH | LEAN TO FAT CLAY; 5-15% medium sand; medium to high plasticity; dark reddish brown mottled with yellowish red and black; wet; very stiff. (Loveland) | | | | | | 12 |
| 1408.7 | 14.5 | CL/CH | LEAN TO FAT CLAY; 10-20% fine to medium sand; medium to high plasticity; dark brown mottled with yellowish red; wet; very stiff. (Glacila Till) | | | | | | 15 |
| 1408.2 | 15.0 | | | | | | | | |

Groundwater was not encountered to the depth of the boring.

Figure C-12a

HWS
LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# BORING LOG

Carmelite Monastery
2 Miles west of Agnew, Nebraska

Boring No. B-13
Sheet: 1 of 1
Date: 2-17-00

| ELEV. ft. | DEPTH ft. | GROUP SYMBOL | SOIL DESCRIPTION | *$q_u$ tsf | SPT | N | SAMPLE NO. | Dry Dens. pcf | MOIST % | DEPTH ft. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1422.1 | 0.0 | CL/CH | LEAN TO FAT CLAY; medium to high plasticity; very dark grayish brown; wet; medium stiff. (Subsoil) | | | | | | | 0 |
| | | | | | | | | | | 1 |
| 1420.1 | 2.0 | CL | LEAN CLAY; medium plasticity; dark grayish brown mottled with very dark grayish brown; wet; stiff. (Peoria) | | | | | | | 2 |
| 1419.1 | 3.0 | CL | LEAN CLAY; medium plasticity; grayish brown mottled yellowish red; wet; very stiff. (Peoria) | 2.3 | | | 10 | 91.4 | 29.1 | 3 |
| | | | | | | | | | | 4 |
| 1417.1 | 5.0 | CL | Same as above except stiff. (Peoria) | | | | | | | 5 |
| | | | | | | | | | | 6 |
| | | | | 1.5 | | | 11 | 99.6 | 24.0 | |
| 1415.1 | 7.0 | CL | Same as above except saturated; stiff. (Peoria) | | | | | | | 7 |
| | | | Groundwater was encountered at 7.0 feet on 2-17-00. | | | | | | | |
| 1414.1 | 8.0 | CH | FAT CLAY; high plasticity; dark reddish brown mottled gray; saturated; very stiff. (Sangamon) | | | | | | | 8 |
| 1413.1 | 9.0 | CH | FAT CLAY; 5-15% fine to medium sand; high plasticity; dark brown mottled with yellowish red and black; saturated; very stiff to hard. (Loveland) | 4.0 | | | 12 | 95.3 | 30.5 | 9 |
| | | | | | | | | | | 10 |
| 1411.8 | 10.3 | | | | | | | | | 11 |
| | | | | | | | | | | 12 |
| | | | | | | | | | | 13 |
| | | | | | | | | | | 14 |
| | | | | | | | | | | 15 |

* Unconfined Compressive Strength as measured by a calibrated hand penetrometer.

Figure C-13a

# APPENDIX D.
# CRITERIA USED FOR VISUAL SOIL CLASSIFICATION

TABLE D-1

**Soil Classification Chart**

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A] | | | Group | Soil Classification | |
|---|---|---|---|---|---|
| | | | | Group Symbol | Group Name[B] |
| Coarse-Grained Soils<br>More than 50% retained on No. 200 sieve | Gravels<br>More than 50% of coarse fraction retained on No. 4 sieve | Clean Gravels<br>Less than 5% fines[C] | Cu·4 and 1 μCcμ3[E] | GW | Well-graded gravel[F] |
| | | | Cu<4 and/or 1 >Cc>3[E] | GP | Poorly graded gravel[F] |
| | | Gravels with Fines<br>More than 12% fines[C] | Fines classify as ML or MH | GM | Silty gravel[F,G,H] |
| | | | Fines classify as CL or CH | GC | Clayey gravel[F,G,H] |
| | Sands<br>50% or more of coarse fraction passes No. 4 sieve | Clean Sands<br>Less than 5% fines[D] | Cu·6 and 1μCcμ3[E] | SW | Well-graded sand[1] |
| | | | Cu<6 and/or 1>Cc>3[E] | SP | Poorly graded sand[1] |
| | | Sands with Fines<br>More than 12% fines[D] | Fines classify as ML or MH | SM | Silty sand[G,H,I] |
| | | | Fines classify as CL or CH | SC | Clayey sand[G,H,I] |
| Fine-Grained Soils<br>50% or more passes the No. 200 sieve | Silts and Clays<br>Liquid limit less than 50 | inorganic | PI>7 and plots on or above "A" line[J] | CL | Lean clay[K,L,M] |
| | | | PI<4 or plots below "A" line[J] | ML | Silt[K,L,M] |
| | | organic | Liquid limit - oven dried / Liquid limit - not dried <0.75 | OL | Organic clay[K,L,M]<br>Organic silt[K,L,M,O] |
| | Silts and Clays<br>Liquid limit 50 or more | inorganic | PI plots on or above "A" line | CH | Fat clay[K,L,M] |
| | | | PI plots below "A" line | MH | Elastic silt[K,L,M] |
| | | organic | Liquid limit - oven dried / Liquid limit - not dried <0.75 | OH | Organic clay[K,L,M,P]<br>Organic silt[K,L,M,Q] |
| Highly organic soils | Primarily organic matter, dark in color, and organic odor | | PT | Peat | |

[A] Based on the material passing the 3-in. (77-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded with silt
GP-GC poorly graded gravel with clay
[D] Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
[H] If fines are organic, add "with organic fines' to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
[L] If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.
[M] If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥4 and plots on or above "A" line.
[O] PI <4 or plots below "A" line.
[P] PI plots on or above "A" line
[Q] PI plots below "A" line.

**TABLE D-2**

| CRITERIA FOR DESCRIBING MOISTURE CONDITION OF CLAY SOIL | |
|---|---|
| **Description** | **Criteria** |
| Dry | Absence of moisture, dusty, dry to the touch. |
| Moist | Damp, slightly wet, moisture content below plastic limit. |
| Wet | Moisture content above the plastic limit. |
| Saturated | Very wet. Usually soil is below water table. |

**TABLE D-3**

| CRITERIA FOR DESCRIBING MOISTURE CONDITION OF GRANULAR SOIL | |
|---|---|
| **Description** | **Criteria** |
| Dry | Absence of moisture, dry to the touch. |
| Moist | Damp but no visible free water. |
| Wet | Visible free water. |
| Saturated | Usually soil is below water table. |

**TABLE D-4**

| CRITERIA FOR DESCRIBING CONSISTENCY OF CLAY SOIL | |
|---|---|
| **Density** | **Penetration Resistance, N Blows per 12 in.** |
| Very Soft | Less Than 2 |
| Soft | 2-4 |
| Medium | 4-8 |
| Stiff | 8-15 |
| Very Stiff | 15-30 |
| Hard | Greater Than 30 |

**TABLE D-5**

**CRITERIA FOR DESCRIBING DENSITY OF COARSE-GRAINED SOIL**

| Density | Penetration Resistance, N Blows per 12 in. |
|---|---|
| Loose | Less Than 10 |
| Medium | 10-30 |
| Dense | 30-50 |
| Very Dense | Greater Than 50 |

**TABLE D-6**

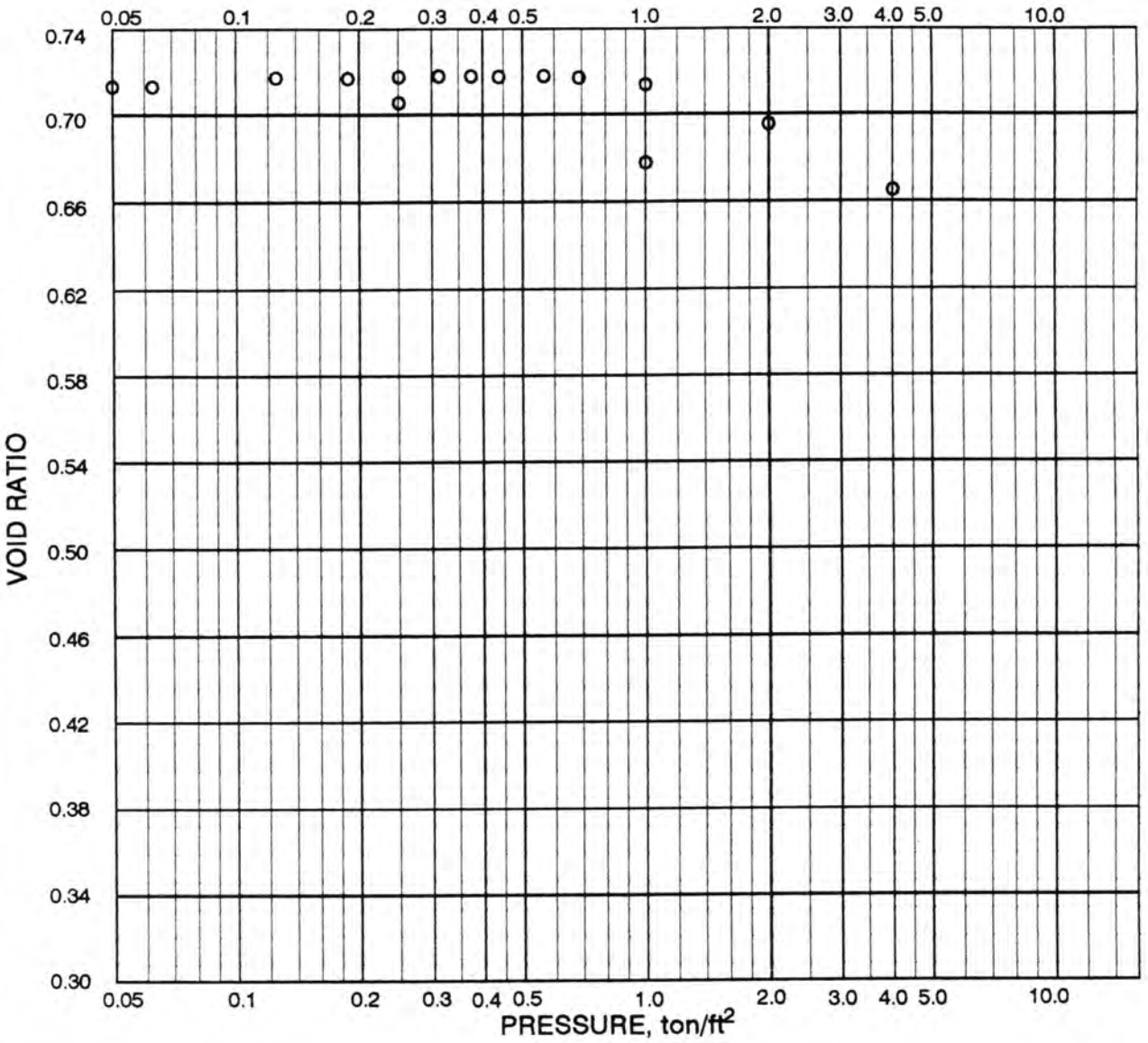
**CRITERIA FOR DESCRIBING STRENGTH OF ROCK**

| Description | Criteria |
|---|---|
| Very soft | Permits denting by moderate pressure of the fingers. |
| Soft | Resists denting by the fingers, but can be abraded and pierced to a shallow depth by a pencil point. |
| Moderately soft | Resists a pencil point, but can be scratched and cut with a knife blade. |
| Moderately hard | Resistant to abrasion or cutting by a knife blade, but can be easily dented or broken by light blows of a hammer. |
| Hard | Can be deformed or broken by repeated moderate hammer blows. |
| Very hard | Can be broken only by heavy, and in some rocks, repeated hammer blows. |

# APPENDIX E. SWELL TEST REPORT

LINCOLN OFFICE
825 J St., Box 80358
Lincoln, NE 68501

# SWELL TEST REPORT




| | | | | | |
|---|---|---|---|---|---|
| Initial Ht. | **1.00 in.** | Diameter | **2.50 in.** | Type of Specimen | **Undisturbed** |
| Initial Saturation | | | **95.1 %** | Overburden Pressure | **0.1** ton/ft² |
| Final Saturation | | | **100+ %** | Swelling Pressure | **1.1** ton/ft² |
| Initial Dry Density | | | **98.3** lb/ft³ | Swell Index | **0.035** |
| Initial Water Content | | | **25.1 %** | | |

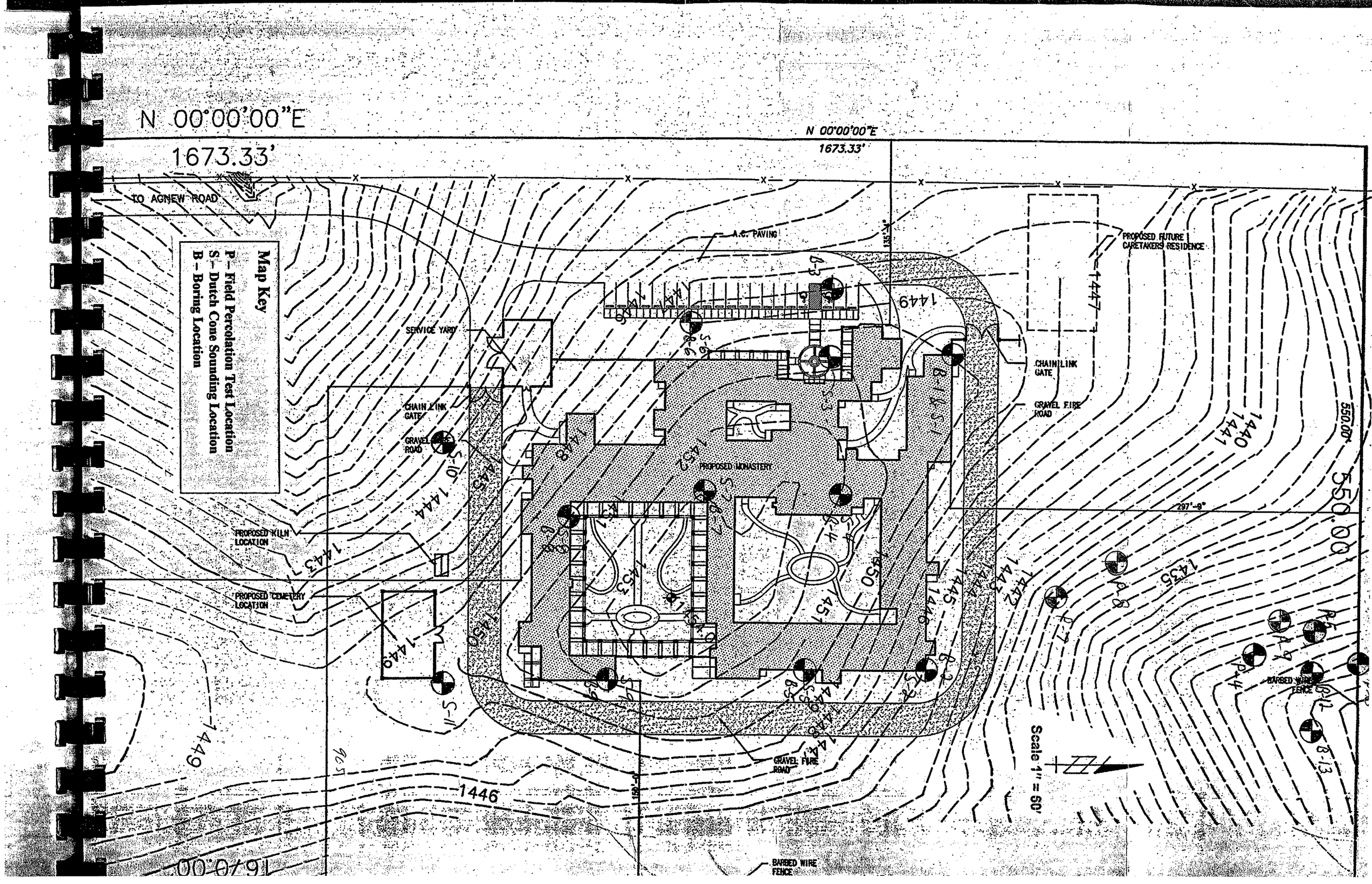
| | | | |
|---|---|---|---|
| Remarks | | Project | **Carmelite Monastery** |
| | | | **2 Miles West of Agnew, Nebraska** |
| Classification | **CH** | | |
| | | | |
| LL **60.1** | G | Boring No. **9** | Sample No. **6** |
| PL **21.2** | $D_{10}$ | Depth **1.7–2.0** | Date **1–25–00** |

# BORING AND PERCOLATION TEST LOCATION PLAN
## CARMELITE MONASTERY
## 2 MILES WEST OF AGNEW, NEBRASKA

Scale 1" = 60'

**Map Key**

P – Field Percolation Test Location
S – Dutch Cone Sounding Location
B – Boring Location


N 00°00'00"E
1673.33'
TO AGNEW ROAD
Map Key
P – Field Percolation Test Location
S – Dutch Cone Sounding Location
B – Boring Location
A.C. PAVING
SERVICE YARD
CHAIN LINK GATE
GRAVEL ROAD
PROPOSED KILN LOCATION
PROPOSED CEMETERY LOCATION
PROPOSED MONASTERY
PROPOSED FUTURE CARETAKERS RESIDENCE
CHAIN LINK GATE
GRAVEL FIRE ROAD
297'-9"
550.00'
BARBED WIRE FENCE
GRAVEL FIRE ROAD
BARBED WIRE FENCE
Scale 1" = 50'
1670.00'
1446
1449
1447
1441
1440
1435
1443
1444
1445
1450
1452
1453
1454
1448
1440
1444
1443
1445
1450
1449