PERMAFROST TECHNOLOGY FOUNDATION

FINAL REPORT

FOUNDATION STABILITY RESEARCH AT 1417 JONES ROAD FAIRBANKS, ALASKA

JUNE 1998

Final Report
on
Foundation Stabilization Research
Studies on
House and Garage

1417 Jones Rd.
Fairbanks, Alaska

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Introduction

The house at 1417 Jones Road is a small wood frame house that was constructed on short wood piles set into, or on, the permafrost. By the late 1980's there had been significant settlement of the foundation and some cosmetic, if not structural distress. Stutzmann Engineering was contracted to do a series of studies on the house. Their reports are summarized below and reproduced in their entirety in Appendix D.

Stutzmann Engineering's first study, dated April 7, 1988, did not include any kind of foundation exploration. The assumption was made that the structure was on permafrost and that future settlement would occur. It was concluded that it would be prohibitively expensive to take steps to reduce the amount of future settlement, and that the pile foundation was appropriate for the conditions. They concluded that it would be best to adopt a plan of continued maintenance on the existing foundation system and recommended several structural modifications.

Their second report, dated May 13, 1988, addressed the progress on the structural rehabilitation recommended in the first report.

Their third report, dated July 8, 1988, recommended that the structure be releveled and that a foundation exploration be conducted.

Their fourth report, dated July 25, 1988, described a backhoe test pit dug on July 16 adjacent to the center piling on the west side of the house to determine the depth of the piles and the subsurface soil conditions. The backhoe was stopped at a depth of 4 feet by frozen ground. Stutzmann Engineering evaluated the conditions and stated that this was permafrost. The test pit revealed that the piles were set on a rough poured concrete pad, roughly 7 inches thick and 2-1/2 feet in diameter[1] that was sitting on top of the frozen ground. A hand-dug pit on the south side of the structure found a similar situation at a depth of 3-1/2 feet. This report concludes that, due to clearing around the site, future settlement is inevitable. The report goes on to suggest that the structure could be placed on deeper piles or on posts and pads placed on an insulated gravel fill.

Stutzmann Engineering's fifth report, dated September 1, 1988, presented the results of three borings drilled on August 9, 1988. Their summary description indicates wet to

[1] The report shows a 2-1/2" concrete footing. We suspect this is an error and it is really 2-1/2 feet.

saturated, frost-susceptible silts and clays with pockets of permafrost containing free ice. This information caused a rethinking of the conditions with the conclusion that there will be future settlement regardless of what foundation changes are made. The report discusses the possibilities of using deep piles or moving the structure to another location to gain more stability. According to the boring logs, the permafrost was over 40 feet deep at the southeast corner of the house, 30 feet deep along the west side, and 17 feet deep on the northeast corner.

Stutzmann Engineering's last report, dated May 30, 1989, presents recommendations for putting the house on a deep pile foundation.

None of the recommendations for improving foundation conditions was followed and the house was deeded to the Permafrost Technology Foundation (PTF) in 1991 to use in a study of house foundations on permafrost terrain. This study consisted of drilling two additional borings, releveling the house, and monitoring settlement and temperature. The house was taken off the pile foundation and placed on a Triodetic foundation in the summer of 1994. This is the final report for the Permafrost Technology Foundation study.

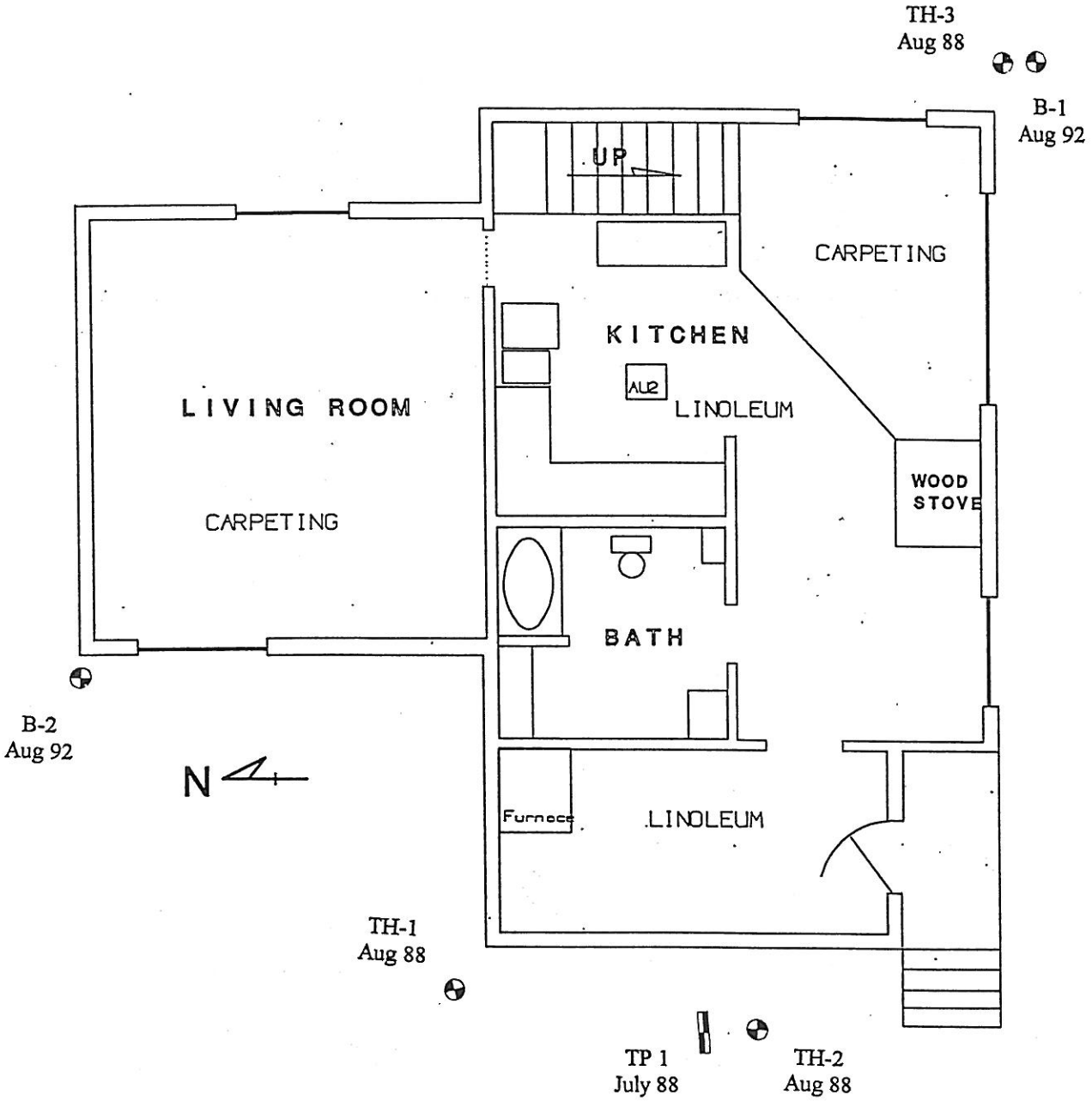
Structure Description

The house is two stories with the living quarters downstairs and the bedrooms upstairs. The downstairs floor plan is shown on Figure 1. The house was elevated about 3 feet on a pile foundation, and it is currently elevated about the same amount on a Triodetic Foundation. It has a separate two-car garage which is founded on slab on grade. It had a small wood stove in the northeast corner prior to 1991. The house is maintained level by releveling the foundation when necessary. The garage has not been releveled and is far enough out of level to be of marginal use.

Geotechnical Exploration

In order to determine the condition of the soils near the structure at the start of our study, two boreholes were drilled and samples of the soil were taken as shown on the Boring Logs, Figures B-1 and B-2. Samples of the unfrozen soil were collected by driving a split spoon sampler out the bottom of a hollow stem auger using a 300-pound hammer and a 30 inch drop. The number of hammer blows required to drive the core barrel gives information on the competency of the soil at each sample depth. These samples are considered "disturbed samples." However, since they are retrieved essentially intact in their natural state they provide useful information about the soil. This method of sampling was continued until frozen ground was encountered.

The frozen soils were sampled with a dry core barrel. The 3-inch diameter core barrel was drilled into the frozen ground about 5 feet below the auger. The sampler was then brought up to the surface and the soil pushed out of the tube. The soil was classified and representative samples were saved in their frozen state.



Legend: B – Hollow stem auger boring, drilled for the Permafrost Technology Foundation
TH – Solid stem auger boring, drilled for Stutzmann Engineering
TP - Shallow test pit, excavated for Stutzmann Engineering

FIGURE 1 – FLOOR PLAN OF HOUSE AT 1411 JONES RD
SHOWING LOCATIONS OF SUBSURFACE EXPLORATIONS

Both borings show soft brown clayey Silt to a depth of about 10 feet underlain by gray clayey Silt to the top of the permafrost. Permafrost was encountered at a depth of 14.5 feet in Boring B-1 and at a depth of 15.2 feet in Boring B-2. Below the top of the permafrost the clayey Silt was interspersed with lenses of ice and massive ice layers.

Level Measurements

Background

Level measurements were taken to determine the relative elevation of the floor. The level measurements were made using a small precise telescopic level (sometime referred to as a "contractor's level") mounted on a tripod, and a surveyor's rod calibrated in millimeters. The millimeter rod was used instead of a standard surveyor's rod to give more precision to the measurements. Since the distance from the level to the rod was rarely over 15 feet, the rod could easily be read to the nearest millimeter (0.04 inch).

It should be noted, however, that when level measurements are this precise, perturbations can, and do, occur. These small changes are due to the placement of the rod from one measurement set to the next. Often the rod had to be placed behind furniture and it was impossible to determine if it was sitting on the same spot under the same conditions as the previous measurement. If the location was slightly different or an electrical cord or something else happened to be under the rod, the readings would be different. Even the thickness of a few sheets of paper will show up at this precision. Many of the areas are carpeted, which makes it particularly difficult to get consistent readings.

There was also the possibility for a gross error in reading the rod. The level had the standard three cross hairs (center, upper, and lower) used for measuring distances in surveying. If the operator was careless or inexperienced (student labor was used for these measurements), a reading could be made using either the upper or lower cross hair instead of the center one. This would cause an error of tens of millimeters. These errors are readily identifiable when the data is plotted as a function of time. They have been included in the raw data but have been eliminated in the analyses presented herein.

Level data was collected several times a year and accumulated for a period of five years. Each measurement location is designated on the floor plan by a letter, as shown on the floor plans, Figures B1 and B2. The settlement data are presented in Table B1. The data from different groups of letters were plotted together to show relevant comparisons such as along the south wall or along the diagonal across the structure. These charts are shown on Figures B3 through B9. Table B1 and Figures B3 through B9 show all the data collected.

All level data discussed thus far are referenced to Point A. The difference between curves representing two points is the relative difference in elevation of those two points but neither curve represents the true elevation or even relative changes in actual elevation.

Determining absolute elevations requires a stable surveyor's benchmark or other stable reference outside the structure. No such reference or benchmark was available at this location. Nevertheless, the relative elevations allow differential settlement to be observed. Relative differential movement between points in the structure is the most important information for this study.

The discussion of the data has been broken down into logical segments below. In these discussions, some data is not presented because it was taken during times when the house was being releveled and the data is meaningless in terms of ground settlement. In addition, some data points were eliminated because it was obvious they were not correct.

House on Pile Foundation

There were about two and one half years of data between the time the house was initially releveled by PTF and the time the Triodetic foundation was installed. Figure 2 shows all the data from this period on one graph using Point AB and September 2, 1992, as reference points. Point AB was chosen because, when that is done, most of the other data all show relative heave in the winter. Had another point been chosen, the conclusions would have been the same, but it would be harder to see the relationships. September 2, 1992, was chosen because that is first time when the seasonal frost is gone, and the relative elevations between various points should be a minimum. This does not mean that the house was level on that day. We are using that day to determine relative movement at other times of the year.

From this figure, it is obvious that there is a very significant seasonal differential movement, but not much long-term differential movement. How one chooses to present the data changes the graphical picture of the performance, but it does not affect the overall conclusions presented here. There was about 120 to 150 mm of differential movement caused by the freeze thaw cycles.

The differential movements from summer to summer seem to be relatively small. The total remaining differential movement from summer to summer seems to be less than 10 mm. Ten mm of differential movement is very small in comparison to the 150mm seasonal fluctuation, however it is not insignificant when you consider that it may be accumulative. That is, the next year there could have been an additional 10mm and, after 10 years, the structure may have had a total of 100 mm of permanent summertime differential movement.

Since the house is no longer on a pile foundation, there is no need in this report to analyze the data further or to make predictions regarding the future behavior.

House on a Triodetic Foundation

There are just over two years of data after the Triodetic foundation was installed and leveled. Figure 3 shows all the data using Point P and July 15, 1995, as reference points. Point P was chosen because this representation seems to show the seasonal differential

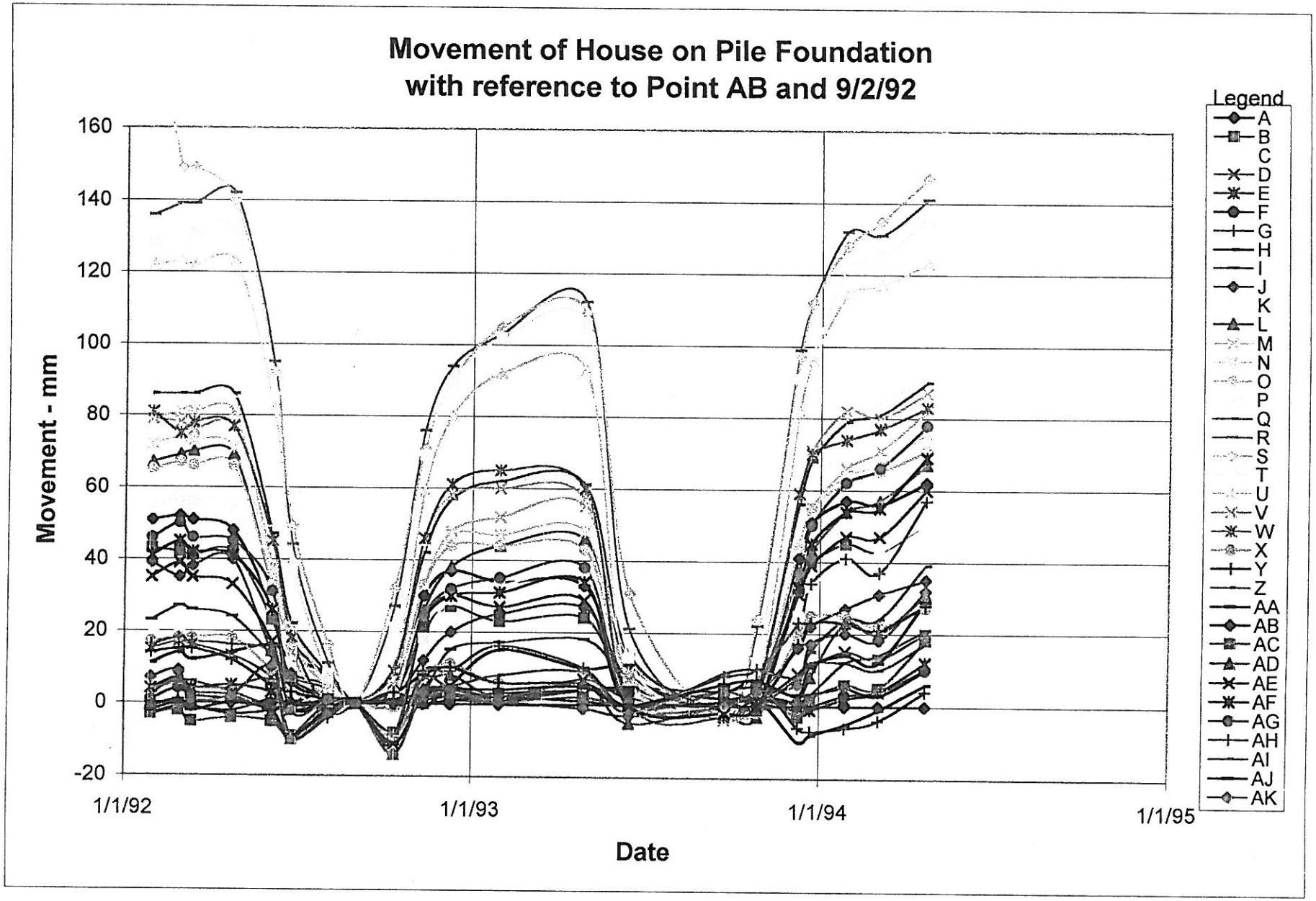

Movement of House on Pile Foundation
with reference to Point AB and 9/2/92
Movement - mm
160
140
120
100
80
60
40
20
0
-20
1/1/92
1/1/93
1/1/94
1/1/95
Date
Legend
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
AA
AB
AC
AD
AE
AF
AG
AH
AI
AJ
AK

FIGURE 2

movement the best. Had another point been chosen, the conclusions would have been the same. July 15, 1995, was chosen because that is first time when the seasonal frost is gone, and the relative elevations between various points should be a minimum. This does not mean that the house was level on that day. We are using that day to determine relative movement at other times of the year.

From Figure 3, it appears that there was on the order of 20 mm of seasonal differential movement but that there is a progressive differential movement on the order of 50 mm per year. This is an entirely different trend than was observed when the house was on the pile foundation.

The Triodetic foundation was installed by first placing a leveling layer of sand and gravel under the house and then lifting the house, building the foundation, and then putting the house back down on the foundation. This was accomplished in August of 1994. The leveling course varied in thickness from about 6 inches to over 12 inches. The initial installation was in excess of 6 inches out of level. PTF releveled the house in September of 1994 by placing wooden blocks under the low points. AHFC asked PTF to remove the wood to give the foundation a chance to react more naturally to the environment. The wood blocks were removed and the area under the feet of the Triodetic foundation was filled with sand and gravel later that fall.

It is possible that the gravel pad reduced the frost heave by consolidating the frost susceptible soils, adding load to the frost susceptible soils, and creating better drainage. It is also possible that the addition of the gravel accelerated thawing of the underlying permafrost by reducing the water content of the surficial soils and increasing the surface temperature in the summer.

Regardless of the causes, it is obvious that there is very significant ongoing differential settlement that will require periodic releveling of the house. We see no reason that this trend should change substantially in the near future.

Figure 4 shows contour intervals of differential movement based on data between December 23, 1994 and February 13, 1997. The largest movement was between points AI and S. Point AI was the highest and Point S was the lowest. This total relative differential was considered 100%. The percent of relative movement was calculated for all points considering 0% to be the high point and 100% to be the low point. The contours show that there is a relatively uniform pattern of settlement across the house, i.e., the differential movement is roughly in a plane. A structure can withstand a much higher differential movement if that movement is in a plane than it can if it is not in a plane.

Garage

Figure 5 shows all the elevation data relative to Point GA. This shows graphically that the garage is over 600 mm out of level and that it is becoming more out of level year by year. It is not obvious from this figure that there is any significant seasonal fluctuation.

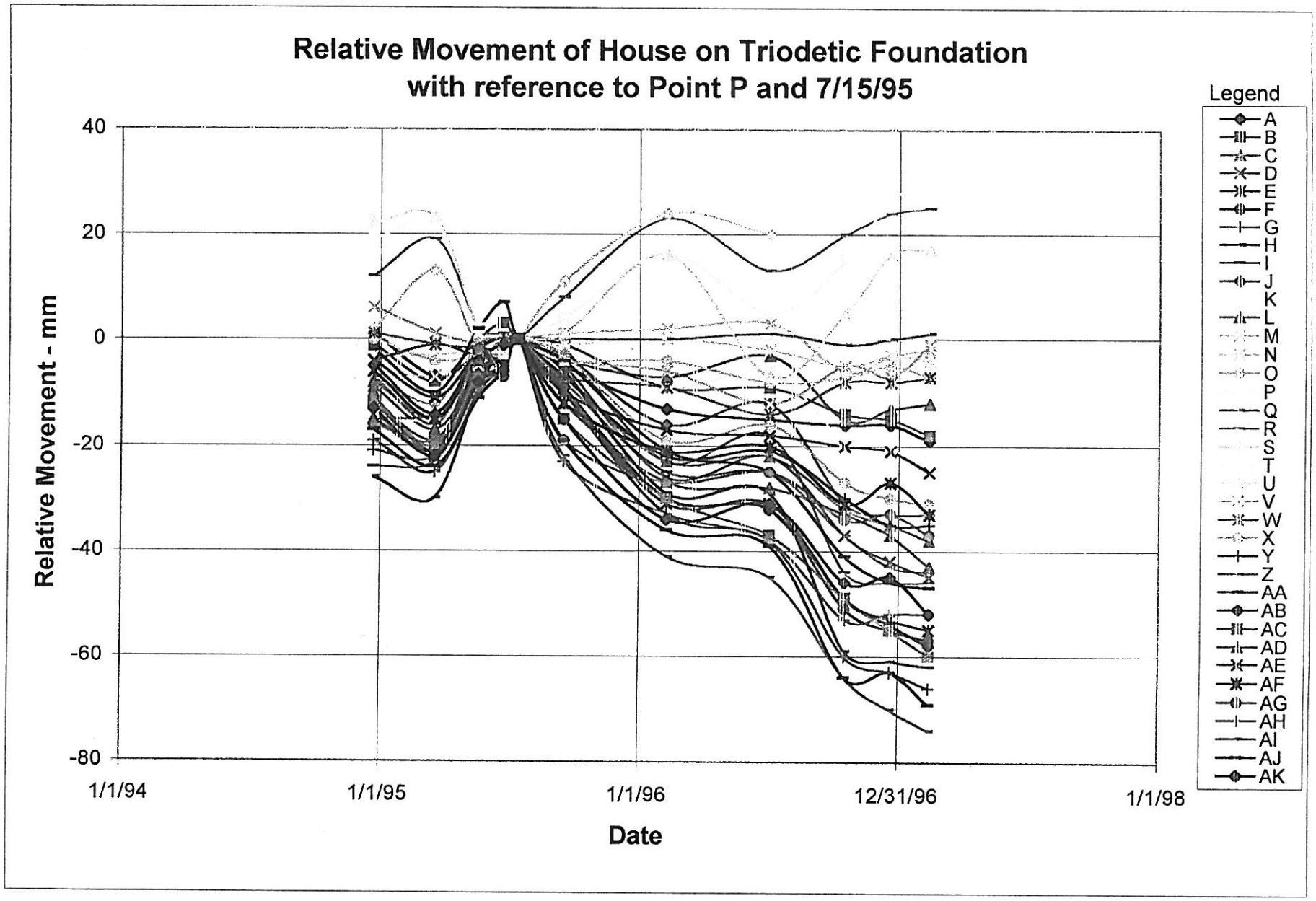
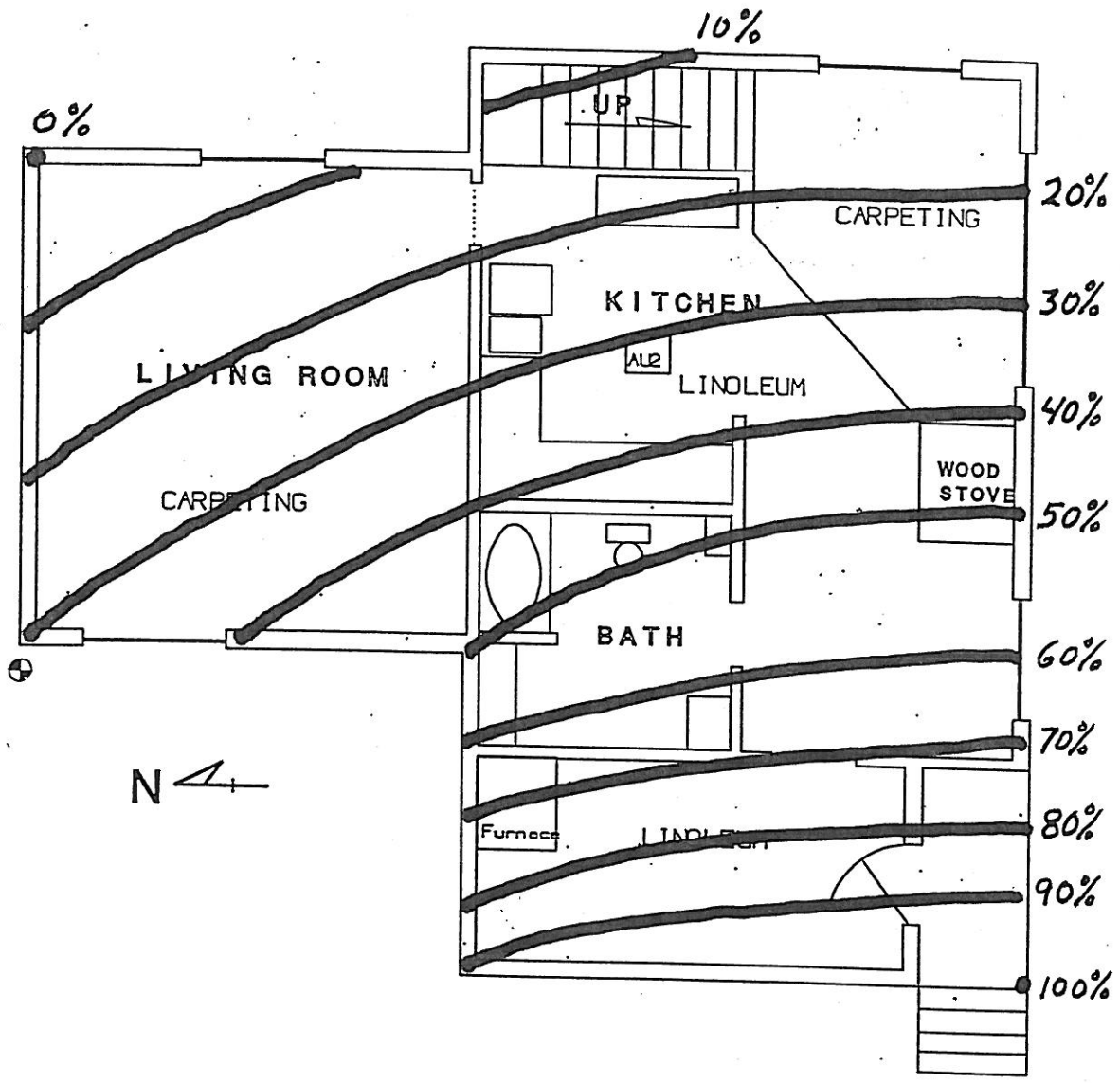

Relative Movement of House on Triodetic Foundation
with reference to Point P and 7/15/95
Relative Movement - mm
40
20
0
-20
-40
-60
-80
1/1/94
1/1/95
1/1/96
12/31/96
1/1/98
Date
Legend
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
AA
AB
AC
AD
AE
AF
AG
AH
AI
AJ
AK

FIGURE 3



Note: The percentages shown refer to the percentage of the total differential movement between the high and the low point on the foundation. The contours were developed from data collected between 10/16/94 and 2/13/97.

FIGURE 4 – CONTOURS OF DIFFERENTIAL SETTLEMENT OF HOUSE AT 1417 JONES ROAD BETWEEN 10/16/94 AND 2/13/97

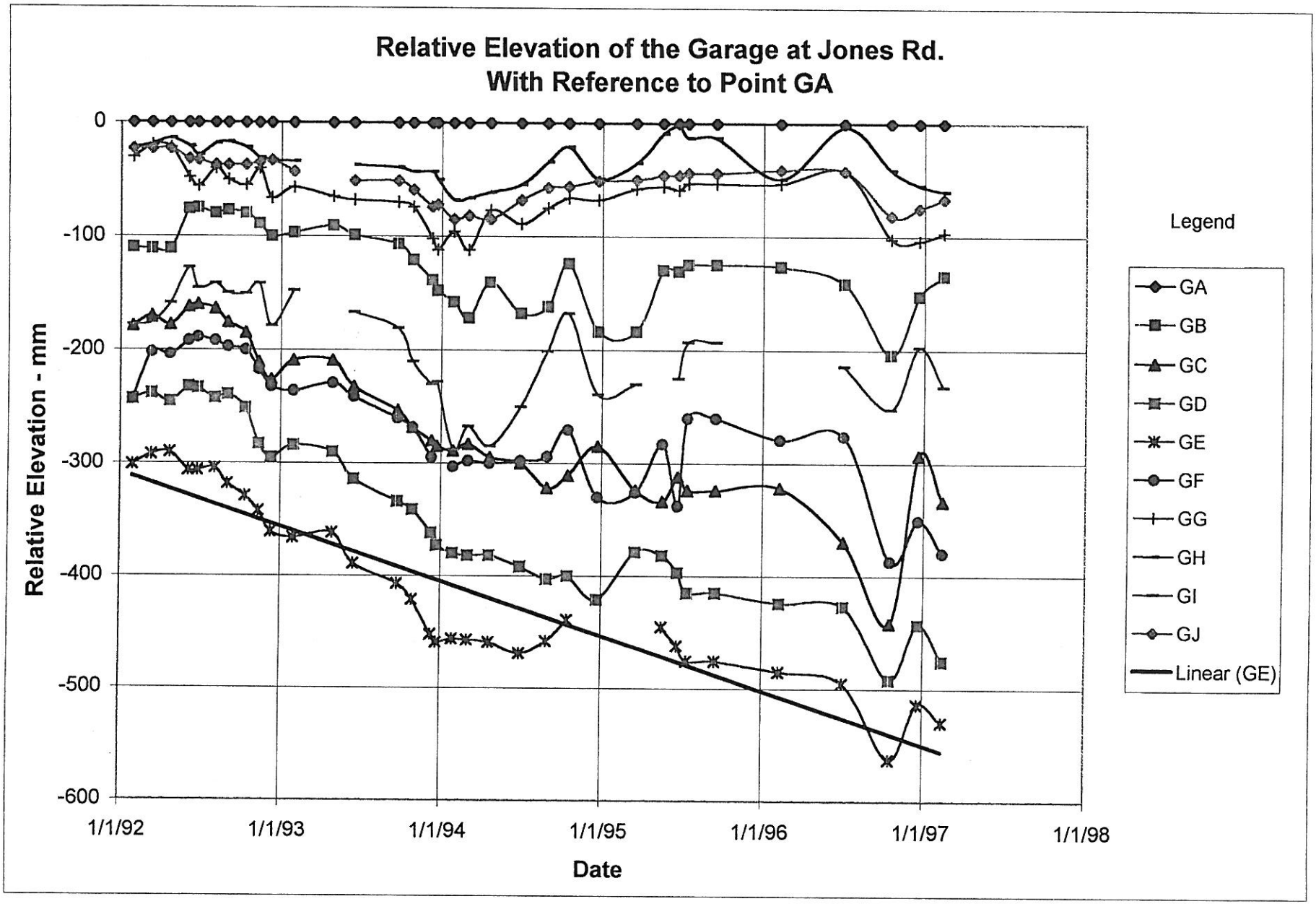

Relative Elevation of the Garage at Jones Rd.
With Reference to Point GA
Relative Elevation - mm
0
-100
-200
-300
-400
-500
-600
1/1/92
1/1/93
1/1/94
1/1/95
1/1/96
1/1/97
1/1/98
Date
Legend
GA
GB
GC
GD
GE
GF
GG
GH
GI
GJ
Linear (GE)

FIGURE 5

Instead, there seems to be very significant different movement occurring which is somewhat variable from point to point as time progresses.

Figure 6 shows the relative movements of the garage with Point GA and August 4, 1992 as reference points. The conclusions from this figure are the same.

In conclusion, the garage was over 550 mm out of level, and that is increasing at a rate of 60 to 70 mm per year. There may be some seasonal differential movement, but it is masked by the large continuing overall movements. There seems to be quite a bit of variability in differential movement from time to time, indicating that, either the rate of thawing, or the subsurface conditions, or both, are not uniform. It is unlikely that the garage is going to reach stability in the near future, indicating that if it is to be saved, remedial action must be done soon.

Earthquakes and Other Dynamic Events

The presence of loose soils indicates concern for settlement during a dynamic event such, as an earthquake. During the period over which the level measurements were made, there were 15 earthquakes over a Richter Magnitude of 4.0. The two largest were a Magnitude 5.0 on November 1, 1992, and a Richter Magnitude 6.2 on October 6, 1995. The last one was the most significant, not only because it was the largest, but also because it was the shallowest at only 9 km below the surface. It was felt very strongly by residents of Fairbanks, however, reviewing our settlement data we can not see any settlement that can be attributed to an earthquake. This suggests that significant settlement will not be caused by future earthquakes producing the same intensity. This does not preclude the possibility of settlement during a more severe earthquake or other type of dynamic event. Even the same magnitude earthquake either closer or shallower may produce a higher intensity.

Temperature Measurements

Temperature measurements were made with thermistors, which were read with a datalogger and converted, automatically to temperature.

When the test borings were drilled, thermistor strings with twelve thermistors each were placed in the holes prior to backfilling. The locations of the thermistor strings are shown on Figure C-1. The depths of the thermistors are shown on the data sheets, Table C-1 and on the boring logs, Figures A-1 and A-2. These thermistor strings were installed to evaluate the performance of the house.

In addition, several thermistor strings were installed specifically for research purposes. String 3 consisted of two thermistors placed in the air, one under the building and the other outside. String 4 was installed to evaluate the temperatures above and below the ground surface for thermal modeling. String 5 included a single thermistor, which was read for a very short period. The data from these three strings are presented in Table C-1

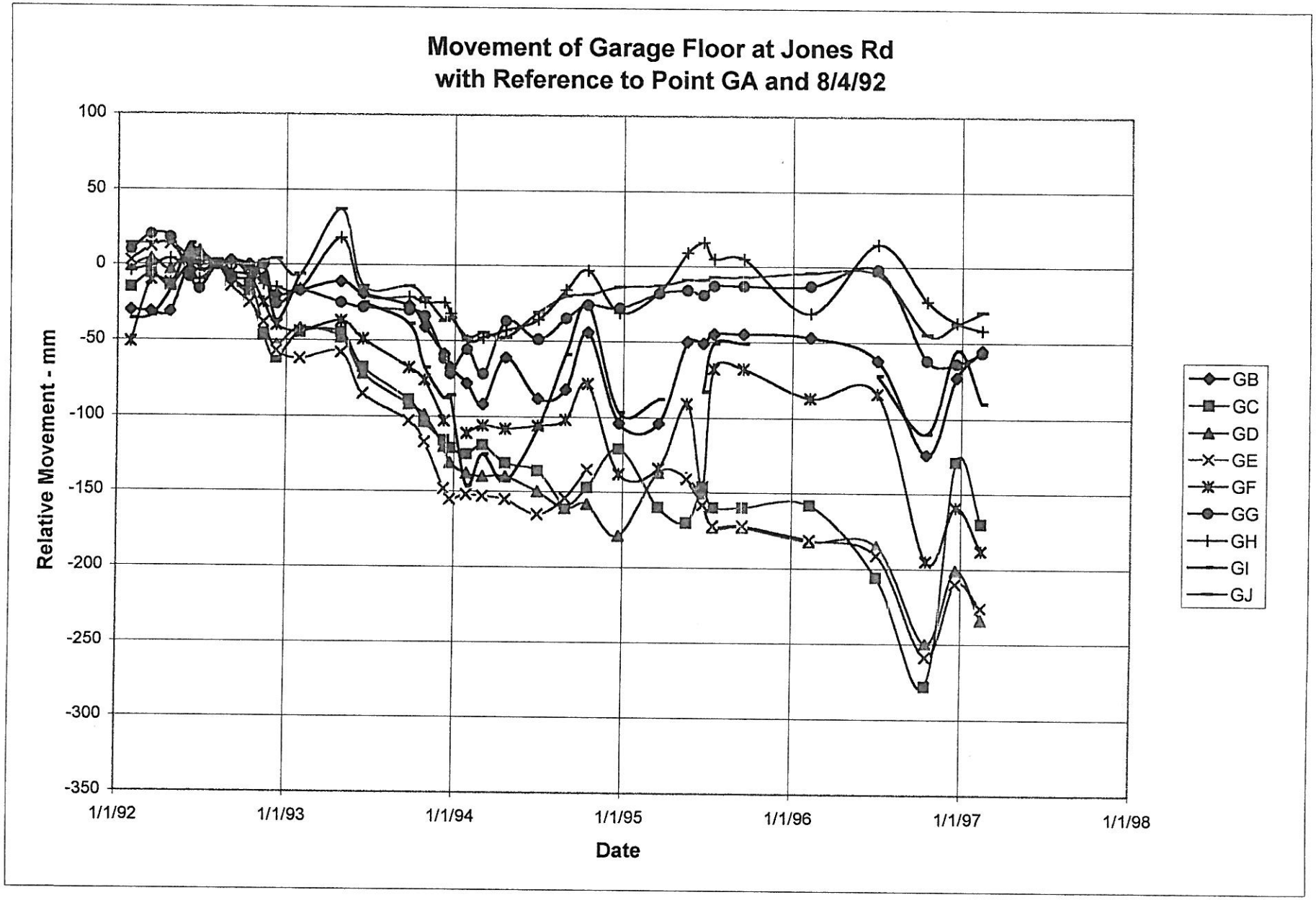

Movement of Garage Floor at Jones Rd
with Reference to Point GA and 8/4/92
Relative Movement - mm
100
50
0
-50
-100
-150
-200
-250
-300
-350
1/1/92
1/1/93
1/1/94
1/1/95
1/1/96
1/1/97
1/1/98
Date
GB
GC
GD
GE
GF
GG
GH
GI
GJ

FIGURE 6

for completeness in the disclosure statement for the sale of the house. The data has not been analyzed and no other discussion of the data will be made in this report.

The two strings discussed herein, were monitored periodically for nearly four years. The raw data is shown in Table C-1. The temperature data was plotted with respect to time on charts to give a graphic indication of the trends over the duration of the study. These charts are shown on Figures C-2 through C-21. All data collected are shown in Table C-1 and Figures C-2 through C-21.

Thermistors are capable of measuring temperature to the nearest one thousandth of a degree Centigrade. However, the nearest one tenth of a degree is probably satisfactory for our purposes for everything except the location of the actual freezing front. Thermistors were used because they are more accurate and easier to read than thermocouples; however, they have the disadvantage of being more fragile, and they can drift a few thousands of a degree over time. To obtain the maximum accuracy, the strings must be calibrated in a reference bath both before and after their use. These thermistor strings were calibrated before placing them in the hole, but since they are buried after installation, it is impractical to remove them without destroying them. Therefore, the secondary calibration cannot be made. Since the calibration could not be completed the temperatures cannot be relied upon to more than about a tenth of a degree.

Figures 7 and 8 show all the data within the range of –0.6 to 1.0 degree C for Strings 1 and 2, respectively. Several pieces of data were considered to be in error and were eliminated prior to making the plots shown. Both figures show the same trends as follows:

- Every thermistor reached a temperature below freezing during the late winter or early spring. This indicates that the active layer touches the permafrost each year.
- Every point above a depth of 14 feet in String 1 and 12.5 feet in String 2 was above freezing in the late summer or fall and below freezing in the late winter. This suggests that the active layer is about 12 to 14 feet deep around the perimeter of the house.
- Temperatures in the permafrost seem to be increasing very slowly, perhaps 0.01 to 0.02 degrees per year. This can be seen in the figures by drawing a line through the data points in late winter for any thermeistor. This translates to a slow but steady thawing of the permafrost, perhaps on the order of 75 to 150mm (3 to 6 inches) per year.

Results and Conclusions

The borings indicate that the structure is underlain by a thin layer of sand and gravel fill overlying soft silt to the top of the permafrost. Permafrost was found in the borings at a depth of about 15 feet. Below the top of the permafrost ice lenses and massive ice were found.

The combination of the temperature measurements and the settlement measurements indicate that the active layer reaches the top of the permafrost every year. However, the

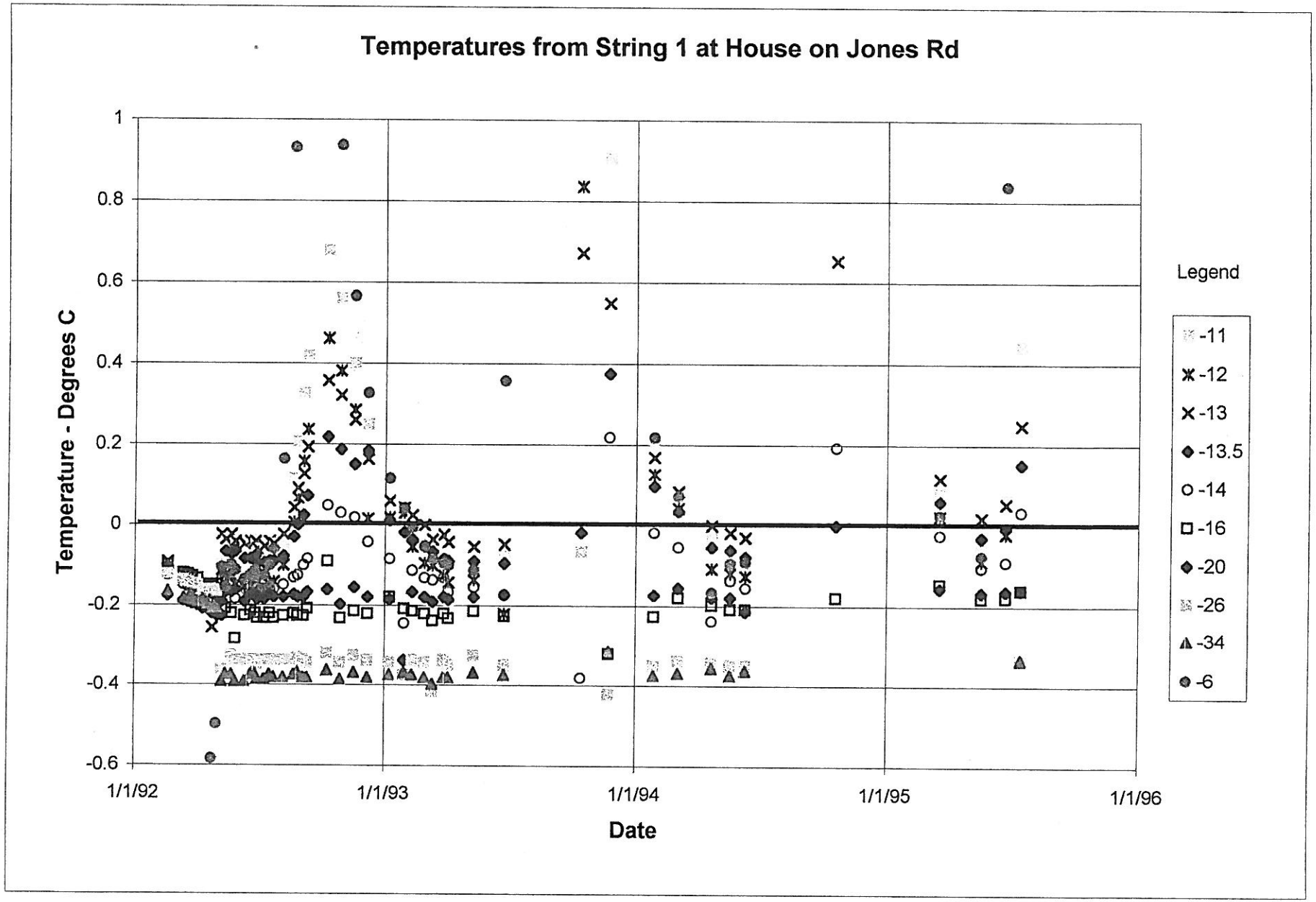

Temperatures from String 1 at House on Jones Rd
Temperature - Degrees C
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1/1/92
1/1/93
1/1/94
1/1/95
1/1/96
Date
Legend
-11
-12
-13
-13.5
-14
-16
-20
-26
-34
-6

FIGURE 7

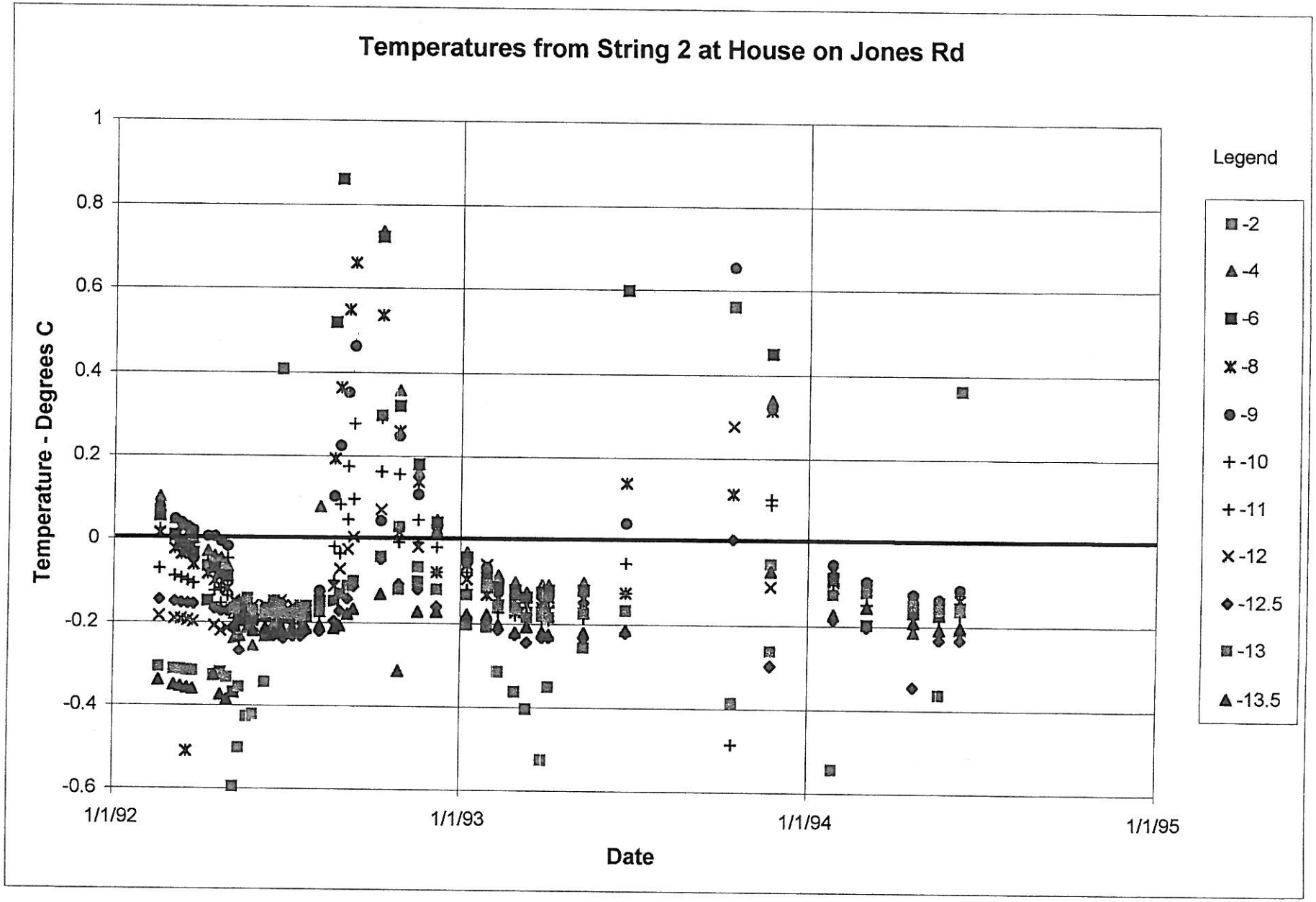

Temperatures from String 2 at House on Jones Rd
Temperature - Degrees C
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1/1/92
1/1/93
1/1/94
1/1/95
Date
Legend
-2
-4
-6
-8
-9
-10
-11
-12
-12.5
-13
-13.5

FIGURE 8

deep ground temperatures are warming slowly and the permafrost is thawing slowly. These trends have continued for many years and should be expected to continue in the future.

The settlement data indicate that the Triodetic foundation is settling differentially at a rate on the order of 50mm (2 inches) per year. The contour map of differential movement across the house shows that it is nearly a plane. This would indicate that a fairly high differential movement could be tolerated before the house must be releveled from a structural standpoint. However, from a functional standpoint the owner may well wish to relevel the house long before it is necessary from a structural standpoint. Assuming the trends observed during the study period continue, it is likely that the house should be releveled for functionality every two to three years.

Releveling will require lifting each of the base plates and putting shims or soil under them before lowering them again. It may be possible to lift at key points and shim several points at once. However, if this is done, the resulting foundation will not be level. Cosmetic remedial measures should not be taken without releveling first. If doors or windows are reset, molding is redone, cracks in walls are patched, etc. without releveling, this work will make it more difficult to relevel and be more costly.

Bibliography of References

Alkire, B.D., W.M. Haas and T.J. Kaderabek 1975. "Improving Low Temperature Compaction of Granular Soils," *Canadian Geotechnical Journal*, Vol. 12, No. 4, pp. 527-530.

ASHRAE 1989. *Handbook of Fundamentals*, American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta GA.

Buska, J.S. and J.B. Johnson 1988. "Frost Heave Forces on H and Pipe Foundation Piles." *Proceedings of the Fifth International Permafrost Conference, Trondheim, Norway*, pp. 1039-1044.

Chamberlain, E.J. 1988. "A New Freezing Test for Determining Frost Susceptibility," *Proceedings of the Fifth International Permafrost Conference, Trondheim, Norway*, pp. 1045-1050.

Danyluk, L.S. 1986. *Stabilization of Fine-Grained Soil for Road and Airfield Construction*, AKDOT/PF Report AKÄRDÄ86-30.

Esch D.C. 1986. "Insulation Performance Beneath Roads and Airfields in Alaska," *Proceedings of the 4th Intl Cold Regions Specialty Conference*, Anchorage, AK. ASCE, 345 E. 47th. St. New York City, NY 10017-2398.

Esch D.C. 1988. "Embankment Case Histories on Permafrost," *Embankment Design and Construction in Cold Regions*. American Society of Civil Engineers, 345 East 47th St., New York, NY 10017-2398.

Farouki, O.T. 1985. "Ground Thermal Properties" *Thermal Design Considerations in Frozen Ground Engineering,* ASCE, pp. 186-203.

Forland K.S., T. Førland and S.K. Ratkje 1988, "Frost Heave," *Proceedings of the Fifth International Permafrost Conference, Trondheim, Norway*, pp. 344 -348.

Freitag D. and T. McFadden 1997. *Introduction to Cold Regions Engineering.* ASCE Press. American Society for Civil Engineers New York City, NY. ISBN 0-7844-0006-7

Hartman, C.W. and P.R. Johnson 1978, *Environmental Atlas of Alaska,* Univ. of Alaska Fairbanks, Fairbanks, AK.

Johnson, P.R. 1971. *Empirical Heat Transfer Rates of Small Long and Balch Thermal Piles and Thermal Convective Loops*, Institute of Arctic Environmental Engineering, University of Alaska Fairbanks. Report 7102. Johnston G.H., Editor 1981. *Permafrost Engineering Design and Construction,* John Wiley and Sons, New York.

Kersten M.S. 1949. *Thermal Properties of Soils.* University of Minn., Engineering Experiment Station, Bull. 28.

Kinney T.C. and K.A. Troost, 1984, "Thaw Strain of Laboratory Compacted Frozen Gravel," *Proceedings: 3rd Internation Specialty Conf. on Cold Regions Engineering.* Canadian Society for Civil Engineering, Edmonton, Alberta, Canada.

Krzewinski T.G., T.A. Hammer and G.G. Booth 1988. "Foundation Considerations for Siting and Designing the Red Dog Mine Mill Facilities on Permafrost." *Proceedings of the Fifth International Permafrost Conference, Trondheim, Norway.* pp. 955-960.

Linell, K.A. and C.W. Kaplar, 1966. "Description and Classification of Frozen Soils." Proc. International Conference on Permafrost (1963) Lafayette IN. U.S. National Academy of Sciences, Publ. 1287. pp. 481-487.

Lovell C.W. 1983. "Frost Susceptibility of Soils" *Proceedings of the Fourth International Permafrost Conference, Fairbanks, Alaska.* pp. 735-739.

Maksimjak R.V., S.S. Vyalov and A.A. Chapaev 1983. "Methods for Determining the Long-Term Strength of Frozen Soils," *Proceedings of the Fourth International Permafrost Conference, Fairbanks, Alaska*, pp. 783-786.

McFadden, T. and F.L. Bennett 1991. *Construction in Cold Regions.* John Wiley and Sons Inc, New York City, NY. 615 Pgs. ISBN 0-471-52503-0.

Nixon, J.F. 1986. "Pipeline Frost Heave Predictions Using a 2-D Thermal Model." in Andersland, O.B. and F.H. Sayles, eds., Research on Transportation Facilities in Cold Regions, Proceedings, American Society of Civil Engineers, Boston, October 27, 1986, pp. 67-82.

Penner, E. and C.B. Crawford 1983. *Frost Action and Foundations.* National Research Council of Canada, Div. of Building Research. DBR No. 1090, Ottawa, Canada.

Rice, E.F. 1982. *Building in the North.* University of Alaska Fairbanks, Fairbanks, AK.

Rice, E.F. and K.E. Walker 1983. "Introduction to Cold Regions Engineering." U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH. Internal Report #808.

Smith, D.W. Editor 1986. *Cold Climate Utilities Manual.* Canadian Society for Civil Engineering, 2050 Mansfield St. Montreal, Quebec, Canada, H3A 1Z2.

Appendices

Appendix A
Bore Hole Logs

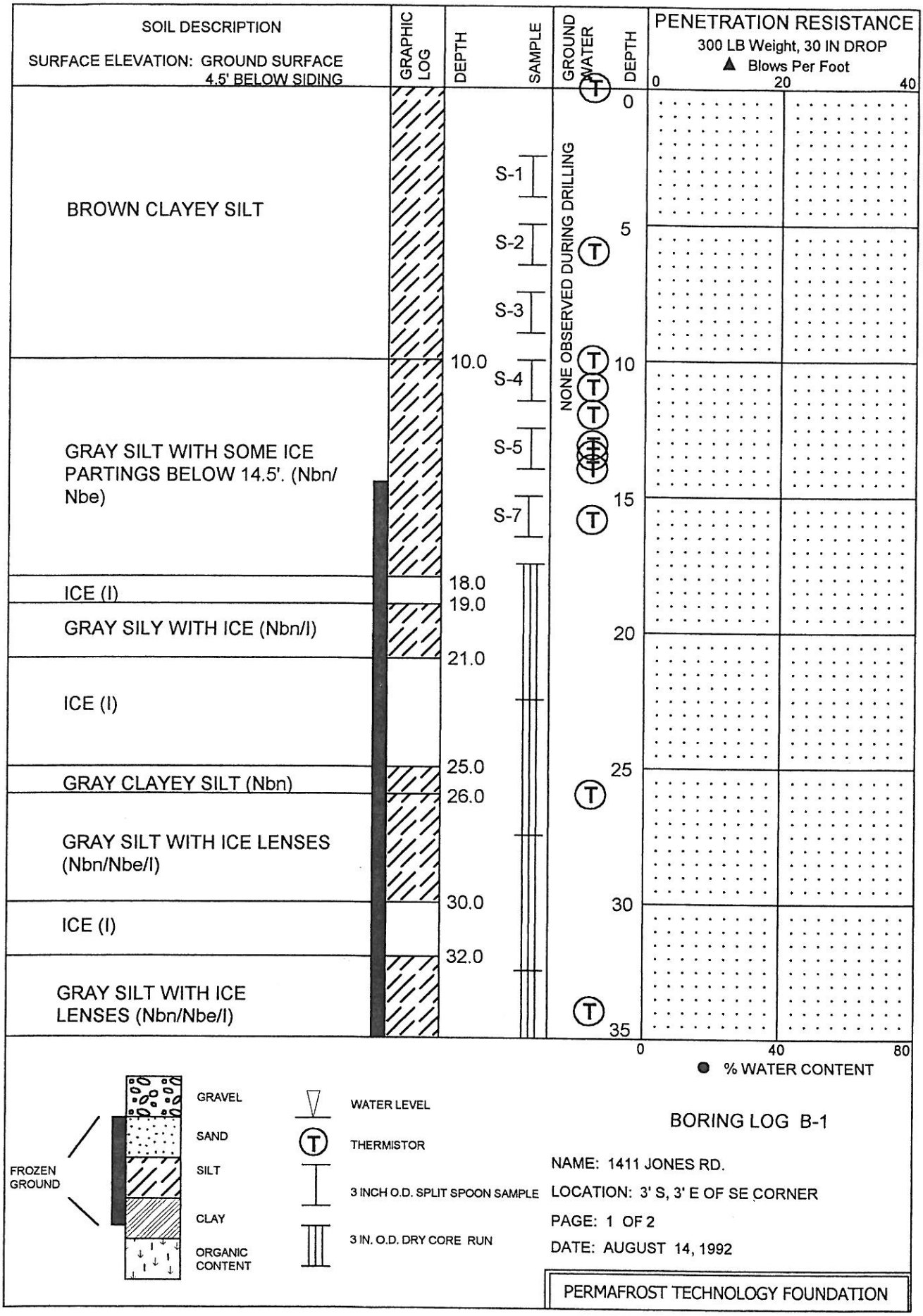
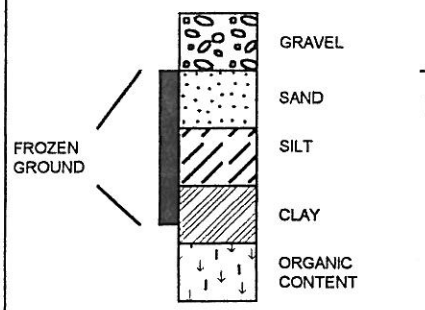

SOIL DESCRIPTION
SURFACE ELEVATION: GROUND SURFACE
4.5' BELOW SIDING
GRAPHIC LOG
DEPTH
SAMPLE
GROUND WATER
DEPTH
PENETRATION RESISTANCE
300 LB Weight, 30 IN DROP
▲ Blows Per Foot
0
20
40
BROWN CLAYEY SILT
S-1
S-2
S-3
S-4
S-5
S-7
NONE OBSERVED DURING DRILLING
0
5
10
15
20
25
30
35
10.0
GRAY SILT WITH SOME ICE PARTINGS BELOW 14.5'. (Nbn/Nbe)
18.0
ICE (I)
19.0
GRAY SILY WITH ICE (Nbn/I)
21.0
ICE (I)
25.0
GRAY CLAYEY SILT (Nbn)
26.0
GRAY SILT WITH ICE LENSES (Nbn/Nbe/I)
30.0
ICE (I)
32.0
GRAY SILT WITH ICE LENSES (Nbn/Nbe/I)
0
40
80
% WATER CONTENT
GRAVEL
SAND
SILT
CLAY
ORGANIC CONTENT
FROZEN GROUND
WATER LEVEL
THERMISTOR
3 INCH O.D. SPLIT SPOON SAMPLE
3 IN. O.D. DRY CORE RUN
BORING LOG B-1
NAME: 1411 JONES RD.
LOCATION: 3' S, 3' E OF SE CORNER
PAGE: 1 OF 2
DATE: AUGUST 14, 1992
PERMAFROST TECHNOLOGY FOUNDATION

FIGURE A-1a

SOIL DESCRIPTION SURFACE ELEVATION:	GRAPHIC LOG	DEPTH	SAMPLE	GROUND WATER	DEPTH	PENETRATION RESISTANCE 300 LB Weight, 30 IN DROP ▲ Blows Per Foot 0 20 40
GRAY SILT WITH ICE LENSES (Nbn/Nbe)		36.5			35	
Bottom of Boring @ 36.5 feet 8/14/92					40	
					45	
					50	
					55	
					60	
					65	
					70	

0 40 80

● % WATER CONTENT



WATER LEVEL

THERMISTOR

3 INCH O.D. SPLIT SPOON SAMPLE

3 IN. O.D. DRY CORE RUN

BORING LOG B-1 (cont.)

NAME: 1411 JONES RD.

LOCATION:

PAGE: 2 OF 2

DATE:

PERMAFROST TECHNOLOGY FOUNDATION

FIGURE A1b

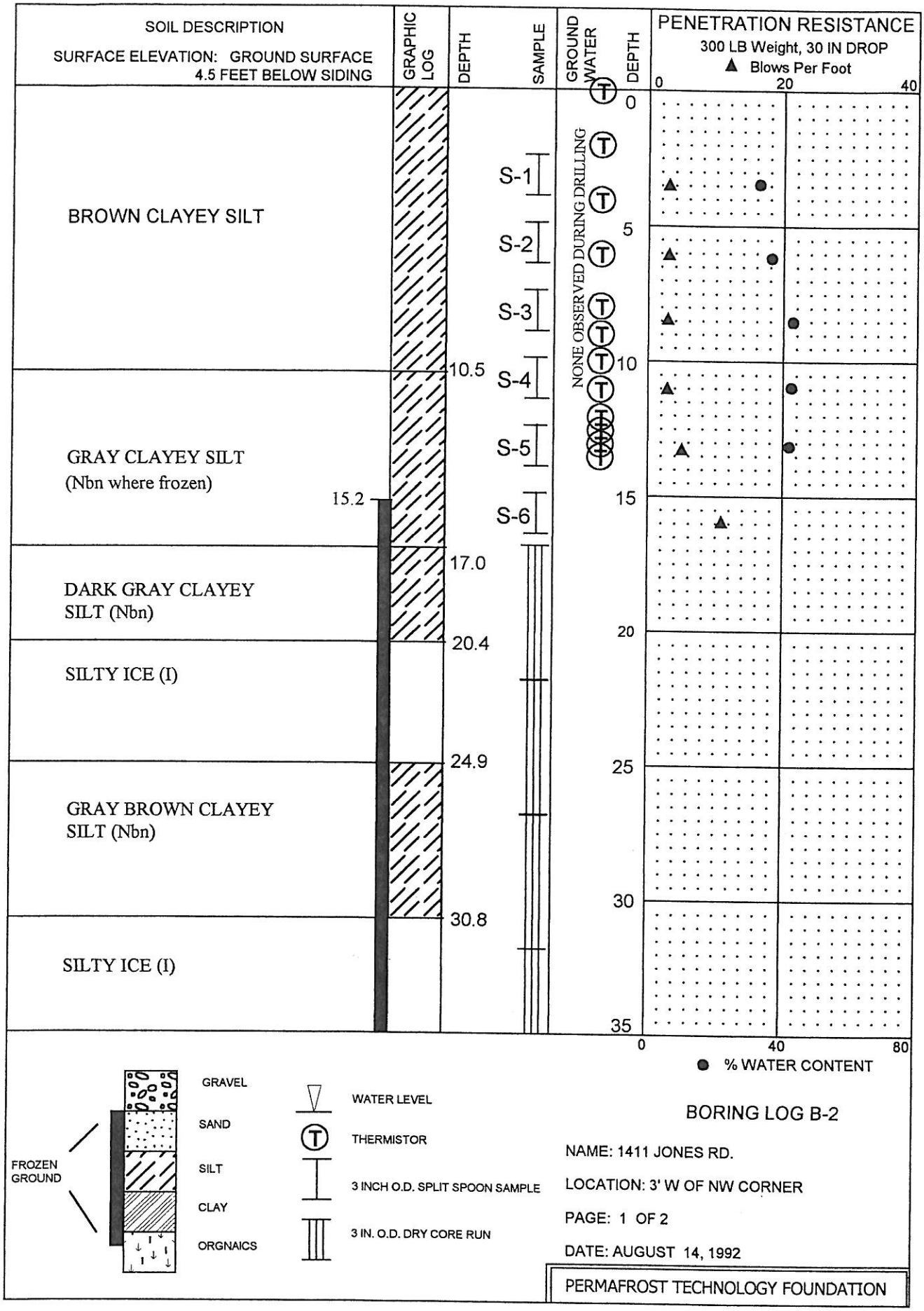
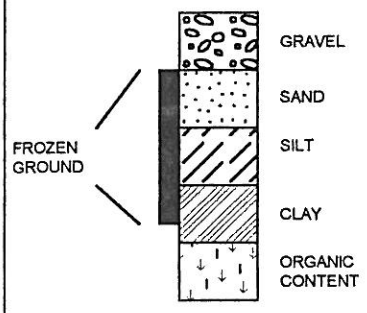

SOIL DESCRIPTION
SURFACE ELEVATION: GROUND SURFACE
4.5 FEET BELOW SIDING
GRAPHIC LOG
DEPTH
SAMPLE
GROUND WATER
DEPTH
PENETRATION RESISTANCE
300 LB Weight, 30 IN DROP
Blows Per Foot
0
20
40
BROWN CLAYEY SILT
GRAY CLAYEY SILT
(Nbn where frozen)
DARK GRAY CLAYEY SILT (Nbn)
SILTY ICE (I)
GRAY BROWN CLAYEY SILT (Nbn)
SILTY ICE (I)
10.5
15.2
17.0
20.4
24.9
30.8
S-1
S-2
S-3
S-4
S-5
S-6
NONE OBSERVED DURING DRILLING
0
5
10
15
20
25
30
35
0
40
80
% WATER CONTENT
GRAVEL
SAND
SILT
CLAY
ORGNAICS
FROZEN GROUND
WATER LEVEL
THERMISTOR
3 INCH O.D. SPLIT SPOON SAMPLE
3 IN. O.D. DRY CORE RUN
BORING LOG B-2
NAME: 1411 JONES RD.
LOCATION: 3' W OF NW CORNER
PAGE: 1 OF 2
DATE: AUGUST 14, 1992
PERMAFROST TECHNOLOGY FOUNDATION

FIGURE A-2a

SOIL DESCRIPTION SURFACE ELEVATION:	GRAPHIC LOG	DEPTH	SAMPLE	GROUND WATER	DEPTH	PENETRATION RESISTANCE 300 LB Weight, 30 IN DROP ▲ Blows Per Foot 0 20 40
Silty ICE (I) continued		37.5			35	
Bottom of Boring @37.5' 8/14/92					40	
					45	
					50	
					55	
					60	
					65	
					70	

0 40 80

● % WATER CONTENT



WATER LEVEL

THERMISTOR

3 INCH O.D. SPLIT SPOON SAMPLE

3 IN. O.D. DRY CORE RUN

BORING LOG B-2

NAME: 1411 JONES RD.

LOCATION:

PAGE: 2 OF 2

DATE:

PERMAFROST TECHNOLOGY FOUNDATION

FIGURE A2b

Appendix B
Level Measurements

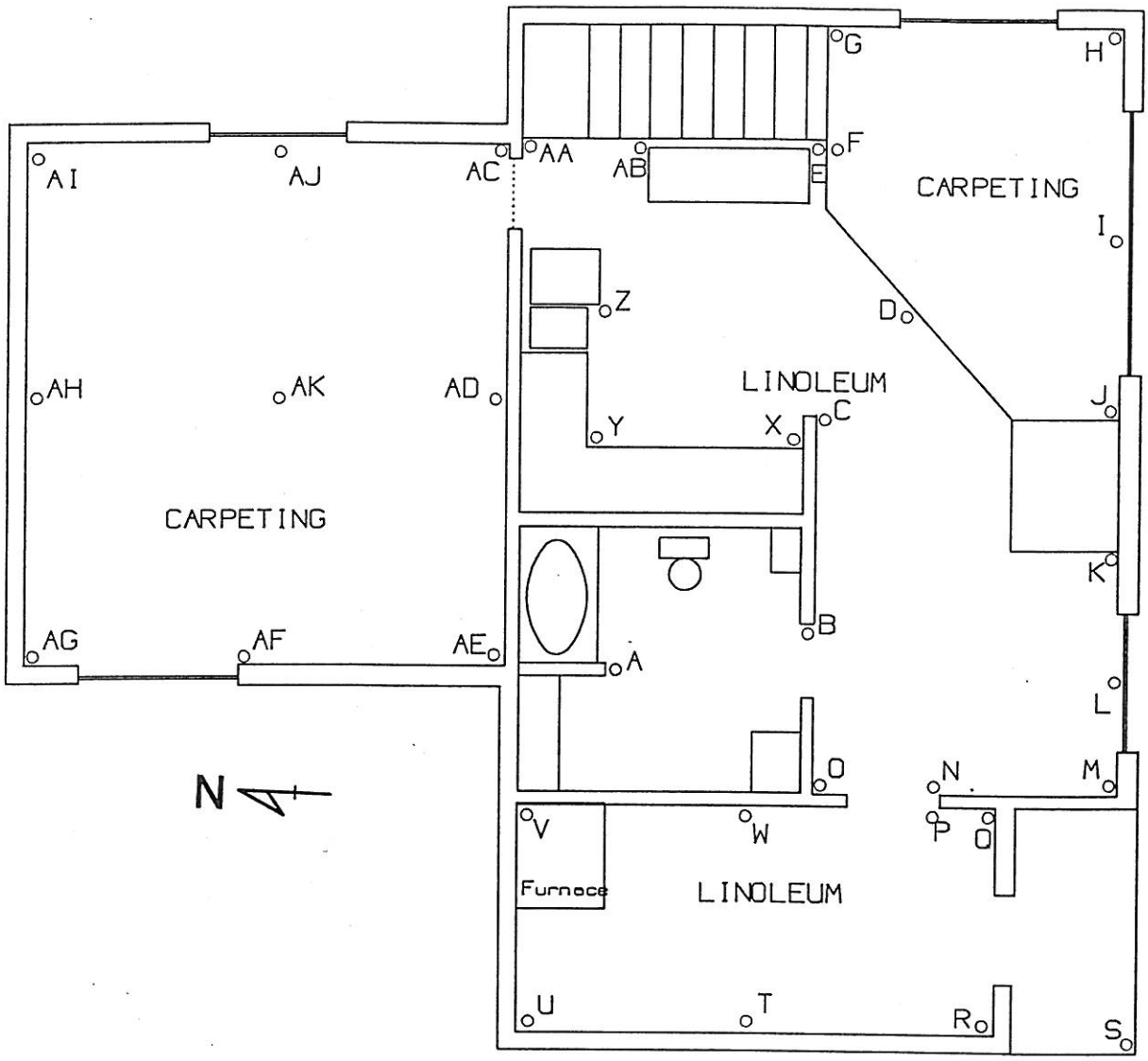


FIGURE B-1 – FLOOR PLAN OF HOUSE ON JONES RD.
SHOWING LOCATIONS OF LEVEL MEASUREMENTS

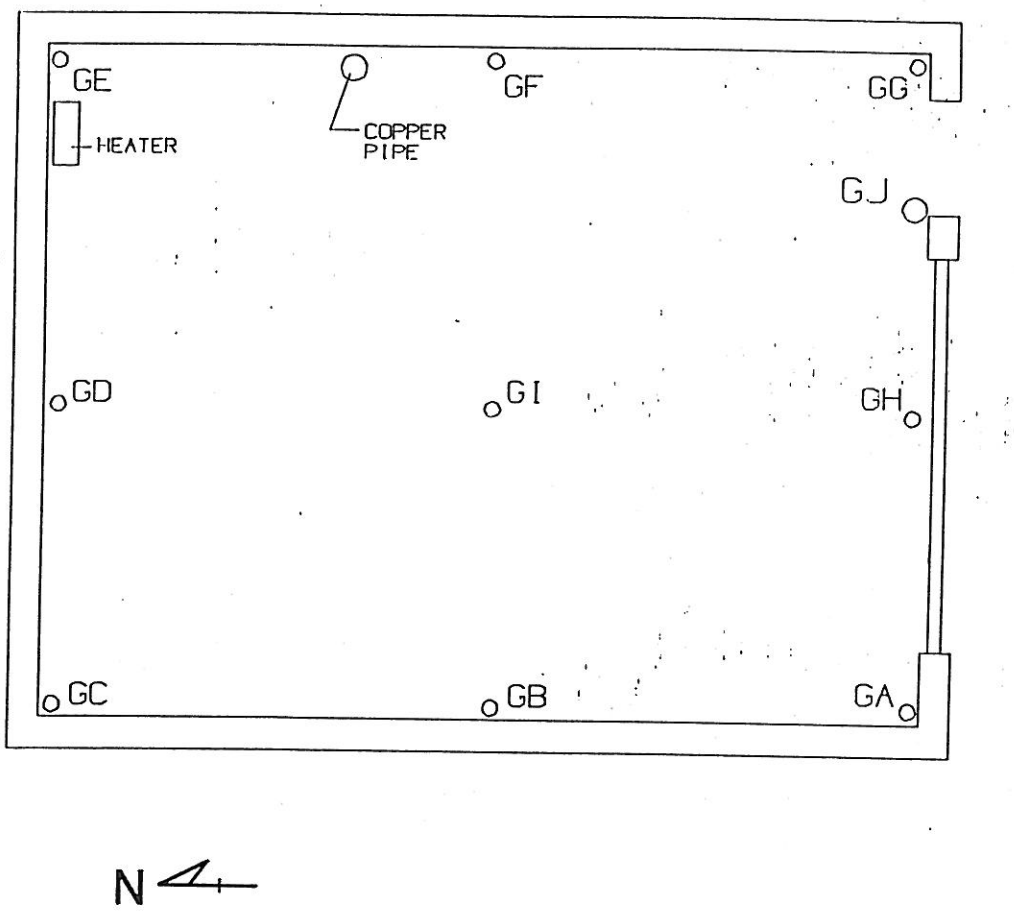


FIGURE B-2 – FLOOR PLAN OF GARAGE ON JONES RD.
SHOWING LOCATIONS OF LEVEL MEASUREMENTS

Level measurements of house on piles using point A as the reference

	6/26/91	1/30/92	2/28/92	3/13/92	4/24/92	6/5/92	6/26/92	8/4/92	9/2/92	10/12/92	11/12/92	12/10/92	1/30/93
A	0	0	0	0	0	0	0	0	0	0	0	0	0
B	-31	4	2	2	6	9	13	12	12	10	2	2	1
C	-40	-18	-18	-20	-16	-3	4	11	13	9	-8	-14	-19
D	-58	-33	-32	-32	-32	-16	-5	2	3	0	-24	-29	-29
E	-61	-43	-41	-43	-39	-19	-3	3	4	0	-25	-31	-28
F	-47	-47	-45	-46	-44	-24	-5	0	3	-2	-25	-32	-28
G	-58	-56	-55	-56	-54	-29	-10	-3	-4	-5	-34	-40	-37
H	-62	-35	-33	-34	-29	-5	11	11	5	3	-26	-27	-14
I	-59	-24	-21	-21	-20	-9	5	6	4	2	-23	-18	-13
J	-55	-10	-15	-11	-6	-10	4	5	2	0	-16	-15	-7
K	-68	3	5	5	6	0	7	4	0	-3	-12	-8	-1
L	-59	19	20	22	24	9	14	8	3	0	-1	4	13
M	-58	31	32	33	36	15	18	6	3	0	6	14	21
N	-56	22	23	23	24	12	12	3	1	-2	4	11	14
O	-36	28	29	29	32	21	24	16	14	13	17	21	24
P	-167	-67	-68	-68	-64	-78	-85	-95	-101	-96	-87	-81	-74
Q	-169	-67	-68	-67	-64	-81	-86	-96	-102	-96	-90	-82	-74
R	-190	-32	-30	-29	-23	-48	-79	-108	-117	-94	-71	-60	-48
S	-206		-40	-39	-45	-71	-94	-123	-137	-109	-96	-84	-66
T	-198	-36	-42	-33	-29	-54	-82	-107	-113	-96	-74	-60	-45
U	-186	-42	-42	-42	-38	-57	-79	-108	-113	-108	-84	-70	-55
V	-176	-87	-89	-90	-86	-96	-107	-116	-115	-114	-99	-94	-89
W	-162	-67	-74	-70	-68	-78	-85	-101	-97	-92	-81	-73	-66
X	-41	-19	-19	-18	-15	-2	12	12	15	10	-7	-11	-13
Y	-51	-32	-32	-31	-31	-16	2	4	5	4	-17	-22	-23
Z	-55	-42	-41	-40	-40	-22	-2	2	5	2	-23	-29	-29
AA	-56	-45	-44	-43	-42	-19	2	7	9	6	-21	-27	-23
AB	-63	-50	-51	-50	-47	-25	-5	-1	1	-3	-29	-36	-33
AC	-42	-40	-40	-42	-38	-17	-1	12	14	2	-14	-20	-19
AD	-35	-29	-25	-28	-26	-9	4	16	20	2	-6	-9	-12
AE	-32	0	3	0	1	7	9	14	16	1	10	9	9
AF	-31	6	9	7	9	16	9	15	16	2	9	9	13
AG	-38	6	9	6	8	16	3	10	11	-2	5	6	12
AH	-38	-21	-20	-20	-18	1	-1	8	14	1	-7	-14	-4
AI	-44	-37	-37	-37	-34	-10	-6	7	10	-3	-13	-22	-16
AJ	-42	-40	-39	-40	-35	-15	-2	9	13	-2	-15	-20	-17
AK	-20	-17	-16	-23	-19	11	11	22	27	9	0	-6	-6

TABLE B-1

Level measurements of house on piles using point A as the reference

	4/29/93	6/16/93	9/24/93	10/28/93	12/10/93	12/23/93	1/28/94	3/4/94	4/22/94
A	0	0	0	0	0	0	0	0	0
B	3	13	12	12	3	1	0	-1	1
C	-15	8	13	12	-10	-14	-20	-21	-20
D	-23	0	4	1	-29	-37	-39	-40	-39
E	-25	3	8	2	-38	-48	-51	-48	-46
F	-26	2	7	3	-37	-48	-51	-49	-49
G	-33	-4	2	0	-51	-62	-67	-64	-62
H	-18	10	4	4	-46	-54	-57	-52	-51
I	-11	7	3	2	-36	-44	-41	-38	-37
J	-4	5	2	2	-23	-27	-28	-23	-25
K	2	3	-1	-3	-16	-18	-17	-13	-11
L	16	10	3	-3	-4	-5	0	4	8
M	25	11	3	3	6	7	12	18	23
N	16	5	-1	0	5	5	8	12	15
O	24	17	13	12	17	18	19	23	23
P	-74	-93	-100	-99	-84	-83	-79	-73	-71
Q	-74	-93	-101	-100	-87	-85	-80	-77	-74
R	-38	-101	-119	-98	-59	-56	-42	-42	-38
S	-61	-111	-139	-116	-81	-76	-66	-58	-52
T	-40	-105	-113	-104	-63	-66	-48	-44	-39
U	-53	-111	-111	-113	-72	-68	-56	-52	-52
V	-91	-113	-117	-117	-97	-95	-90	-91	-90
W	-70	-101	-98	-97	-79	-78	-80	-76	-76
X	-13	9	15	10	-6	-11	-17	-19	-20
Y	-22	0	8	2	-19	-23	-29	-30	-29
Z	-28	0	7	2	-28	-34	-40	-41	-40
AA	-23	4	12	8	-31	-39	-43	-44	-43
AB	-32	-4	3	-2	-40	-50	-56	-55	-61
AC	-17	9	20	16	-30	-35	-37	-37	-30
AD	-7	10	22	16	-19	-23	-14	-16	-11
AE	12	11	16	13	6	4	6	7	14
AF	17	11	16	13	8	10	13	15	23
AG	16	7	17	12	7	10	16	21	27
AH	-9	9	24	21	-4	-3	-2	-5	9
AI	-14	3	21	17	-23	-26	-23	-22	-13
AJ	-15	8	21	17	-25	-27	-30	-31	-20
AK	-7	19	29	28	-8	-7	-10	-11	-3

TABLE B-1

Level measurements of house on Triodetic Foundation using point A as the reference

	10/16/94	12/23/94	3/19/95	5/19/95	6/23/95	7/15/95	9/17/95	2/9/96	7/3/96	10/17/96	12/20/96	2/13/97
A	0	0	0	0	0	0	0	0	0	0	0	0
B	5	7	8	12	13	9	13	13	15	11	10	10
C	6	3	3	10	12	13	11	3	6	-3	-6	-6
D	1	-7	-6	6	7	8	8	-5	1	-13	-18	-18
E	8	-11	-9	0	4	5	0	-13	-11	-28	-32	-31
F	4	-6	-7	3	6	7	3	-10	-10	-28	-32	-31
G	-6	-19	-17	-6	-3	1	-4	-19	-22	-43	-46	-46
H	4	-9	-5	12	17	18	17	2	4	-25	-27	-25
I	9	-6	3	13	14	19	22	9	16	-9	-11	-8
J	7	5	10	19	23	22	24	19	25	7	5	8
K	9	4	11	17	19	19	22	23	28	16	14	16
L	12	8	17	22	24	24	25	30	36	25	27	31
M	11	14	21	19	21	21	27	36	39	31	34	38
N	0	3	11	8	7	7	11	20	20	18	20	22
O	9	14	18	15	14	15	16	24	22	24	26	27
P	-95	-92	-84	-88	-90	-91	-86	-78	-76	-75	-75	-72
Q	-93	-93	-82	-88	-87	-88	-83	-75	-72	-73	-72	-68
R	-94	-74	-59	-80	-83	-85	-72	-49	-57	-49	-45	-41
S	-98	-90	-71	-90	-93	-91	-75	-54	-56	-226	-220	-219
T	-84	-81	-70	-94	-101	-99	-90	-70	-79	-68	-56	-52
U	-87	-75	-66	-92	-98	-96	-90	-67	-88	-75	-64	-60
V	-98	-104	-101	-107	-109	-109	-108	-102	-106	-98	-100	-91
W	-99	-96	-90	-95	-100	-96	-98	-92	-95	-88	-88	-84
X	3	0	3	10	9	8	10	2	7	-3	-6	-4
Y	-2	-7	-8	0	0	-1	-3	-10	-7	-15	-20	-17
Z	0	-9	-10	0	0	-1	-4	-13	-11	-22	-28	-26
AA	4	-7	-7	1	4	-4	-3	-12	-14	-29	-34	-32
AB	-3	-16	-16	-4	-3	-3	-8	-20	-20	-36	-41	-42
AC	21	-1	0	7	8	12	2	-5	-10	-21	-27	-29
AD	23	2	3	10	7	11	4	-3	-2	-6	-10	-13
AE	21	5	6	10	5	10	5	6	7	6	5	4
AF	22	1	0	8	4	8	1	0	3	-7	-3	-6
AG	15	-8	-9	5	-2	4	-10	-10	-6	-14	-13	-14
AH	18	-18	-11	0	-1	4	-14	-16	-19	-33	-32	-29
AI	22	-13	-11	1	2	7	-10	-21	-23	-41	-47	-48
AJ	24	-7	-6	3	6	11	-3	-12	-13	-37	-36	-39
AK	24	-2	-3	7	7	12	2	-9	-4	-18	-17	-21

TABLE B-1

Level measurements of garage using point GA as the reference

	1/30/92	3/13/92	4/24/92	6/5/92	6/26/92	8/4/92	9/2/92	10/12/92	11/12/92	12/10/92	1/30/93	4/29/93	6/16/93
GA	0	0	0	0	0	0	0	0	0	0	0	0	0
GB	-110	-111	-111	-76	-75	-80	-77	-80	-89	-100	-97	-91	-99
GC	-179	-170	-178	-162	-160	-164	-176	-185	-211	-226	-209	-209	-232
GD	-243	-238	-245	-232	-233	-242	-239	-251	-283	-295	-284	-290	-314
GE	-301	-292	-290	-306	-306	-304	-318	-329	-342	-361	-366	-362	-389
GF	-243	-202	-204	-192	-189	-192	-197	-200	-217	-232	-236	-229	-241
GG	-30	-20	-22	-48	-56	-40	-50	-55	-40	-66	-57	-65	-68
GH	-22	-19	-14	-21	-28	-18	-17	-22	-31	-33	-34		-37
GI	-178	-176	-159	-128	-146	-142	-150	-151	-142	-179	-148		-167
GJ	-23	-23	-23	-32	-33	-37	-37	-37	-35	-33	-43		-51

	9/24/93	10/28/93	12/10/93	12/23/93	1/28/94	3/4/94	4/22/94	7/1/94	8/30/94	10/16/94	12/23/94	3/19/95	5/19/95
GA	0	0	0	0	0	0	0	0	0	0	0	0	0
GB	-107	-121	-139	-148	-158	-172	-141	-168	-162	-124	-184	-184	-130
GC	-253	-268	-280	-285	-289	-283	-295	-300	-322	-311	-285	-324	-334
GD	-334	-341	-362	-373	-380	-382	-382	-392	-403	-400	-421	-379	-382
GE	-407	-421	-452	-459	-456	-457	-459	-469	-458	-439			-445
GF	-260	-268	-295		-303	-298	-300	-298	-294	-270	-330	-326	-283
GG	-70	-74	-102	-112	-96	-112	-77	-89	-75	-66	-68	-58	-56
GH	-39	-43	-43	-50	-68	-66	-61	-54	-34	-21	-49	-35	-9
GI	-181	-210	-230	-228	-288	-267	-285	-250	-201	-168	-239	-230	
GJ	-51	-59	-74	-72	-85	-82	-85	-68	-57	-56	-51	-50	-46

	6/23/95	7/15/95	9/17/95	2/9/96	7/3/96	10/17/96	12/20/96	2/13/97
GA	0	0	0	0	0	0	0	0
GB	-131	-125	-125	-127	-142	-204	-153	-135
GC	-312	-324	-324	-322	-370	-442	-293	-334
GD	-397	-415	-415	-424	-427	-492	-443	-476
GE	-462	-476	-476	-485	-495	-563	-514	-530
GF	-338	-260	-260	-279	-276	-387	-351	-380
GG	-59	-53	-53	-53	-42	-102	-104	-97
GH	-2	-13	-13	-49	-3	-41	-55	-60
GI	-225	-193	-193		-214	-252	-197	-232
GJ	-46	-44	-44	-41	-42	-82	-75	-67

TABLE B-1

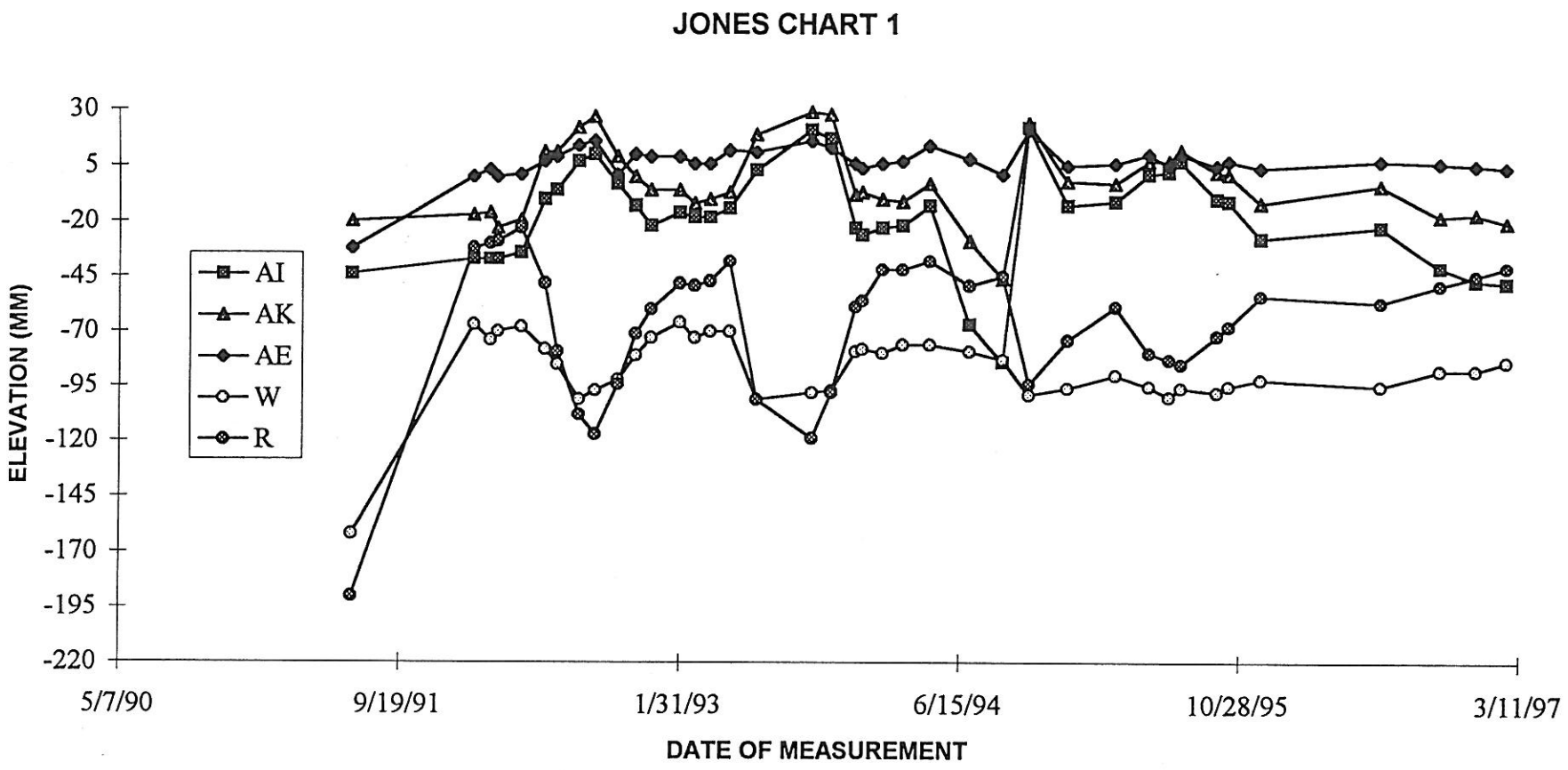

JONES CHART 1
30
5
-20
-45
-70
-95
-120
-145
-170
-195
-220
ELEVATION (MM)
AI
AK
AE
W
R
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
DATE OF MEASUREMENT

FIGURE B-3

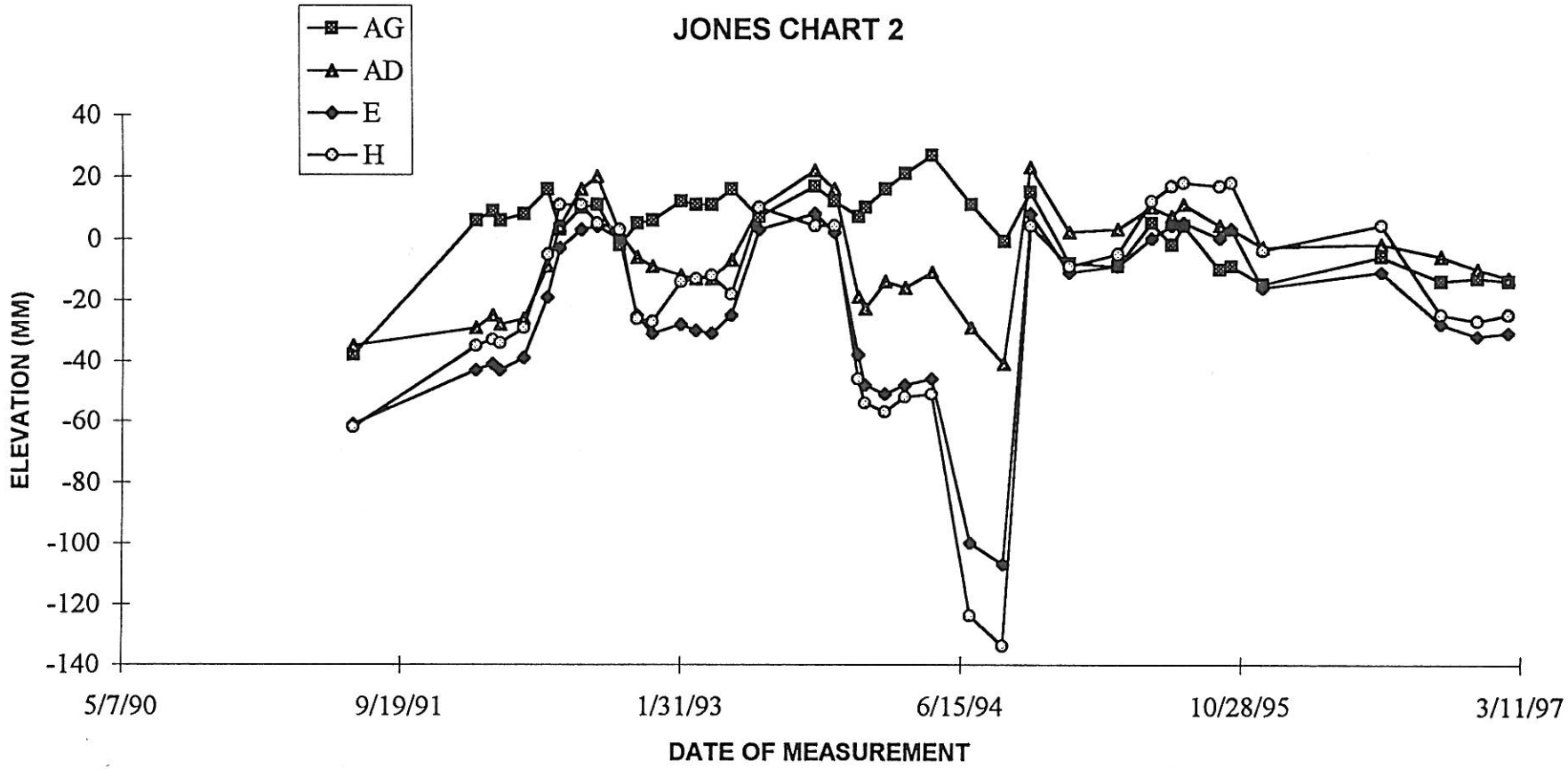

JONES CHART 2
AG
AD
E
H
40
20
0
-20
-40
-60
-80
-100
-120
-140
ELEVATION (MM)
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
DATE OF MEASUREMENT

FIGURE B-4

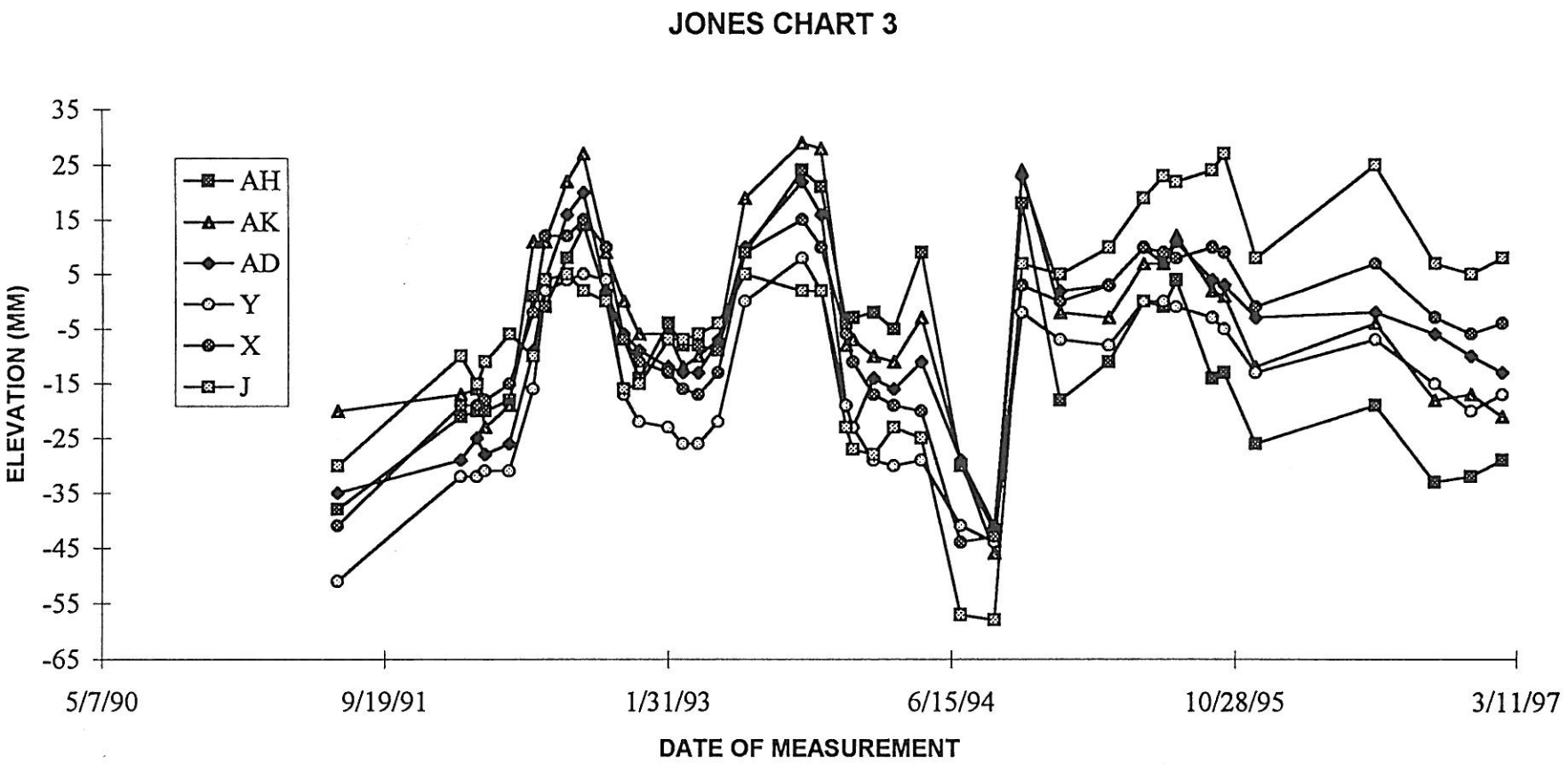

JONES CHART 3
35
25
15
5
-5
-15
-25
-35
-45
-55
-65
ELEVATION (MM)
AH
AK
AD
Y
X
J
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
DATE OF MEASUREMENT

FIGURE B-5

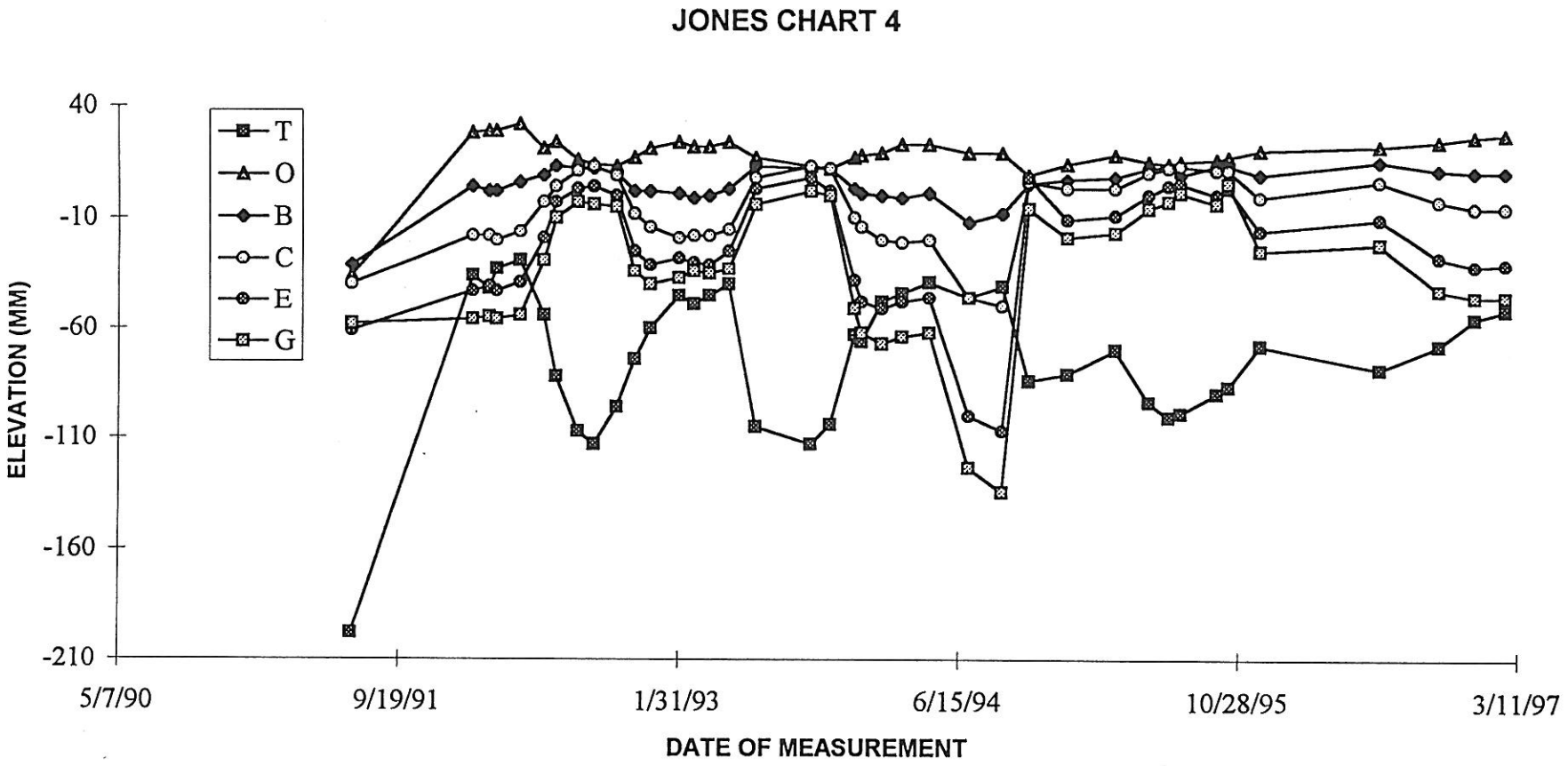

JONES CHART 4
40
-10
-60
-110
-160
-210
ELEVATION (MM)
T
O
B
C
E
G
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
DATE OF MEASUREMENT

FIGURE B-6

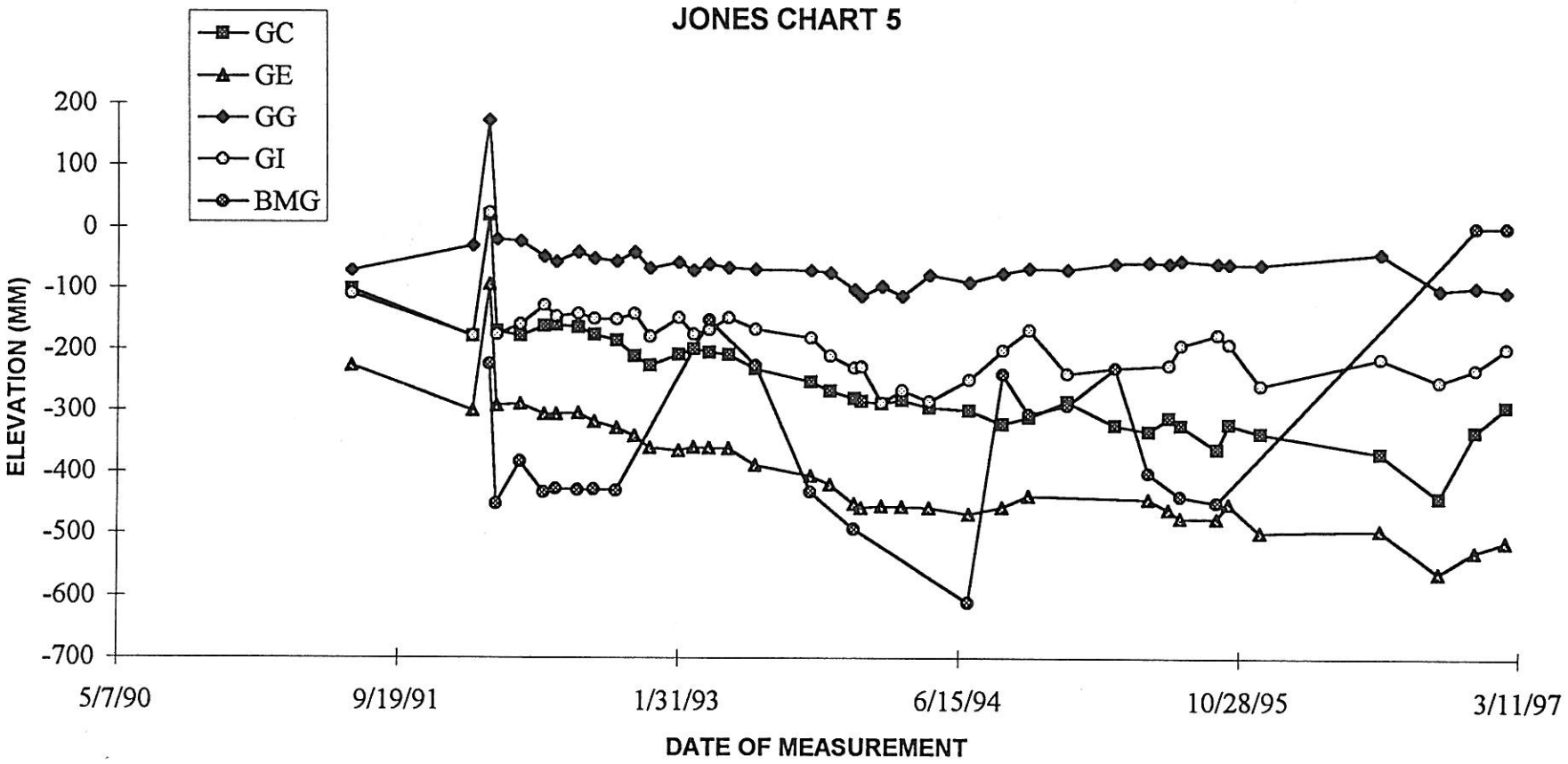

JONES CHART 5
GC
GE
GG
GI
BMG
200
100
0
-100
-200
-300
-400
-500
-600
-700
ELEVATION (MM)
5/7/90
9/19/91
1/31/93
6/15/94
10/28/95
3/11/97
DATE OF MEASUREMENT

FIGURE B-7

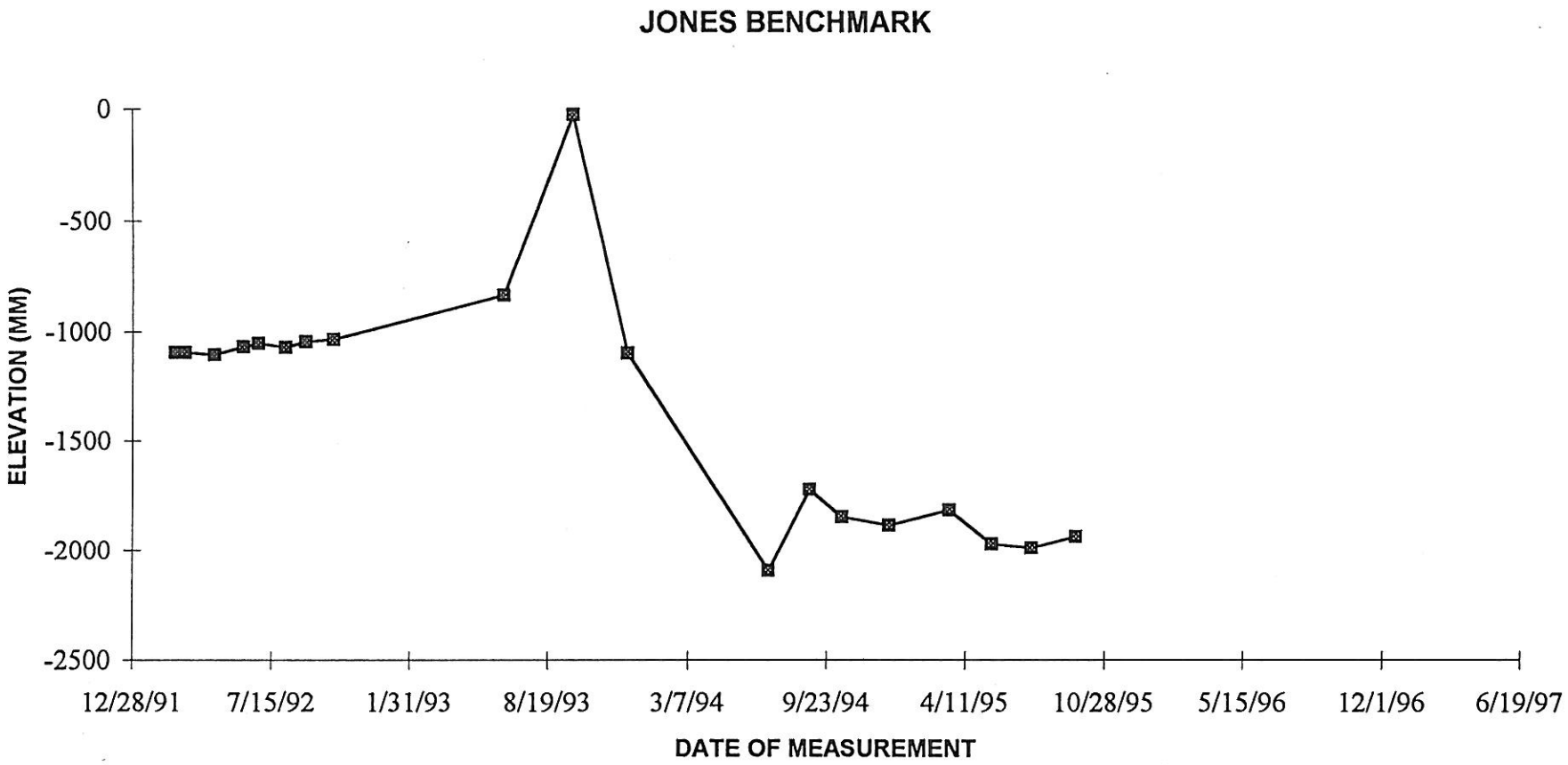

JONES BENCHMARK
0
-500
-1000
-1500
-2000
-2500
ELEVATION (MM)
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE B-8

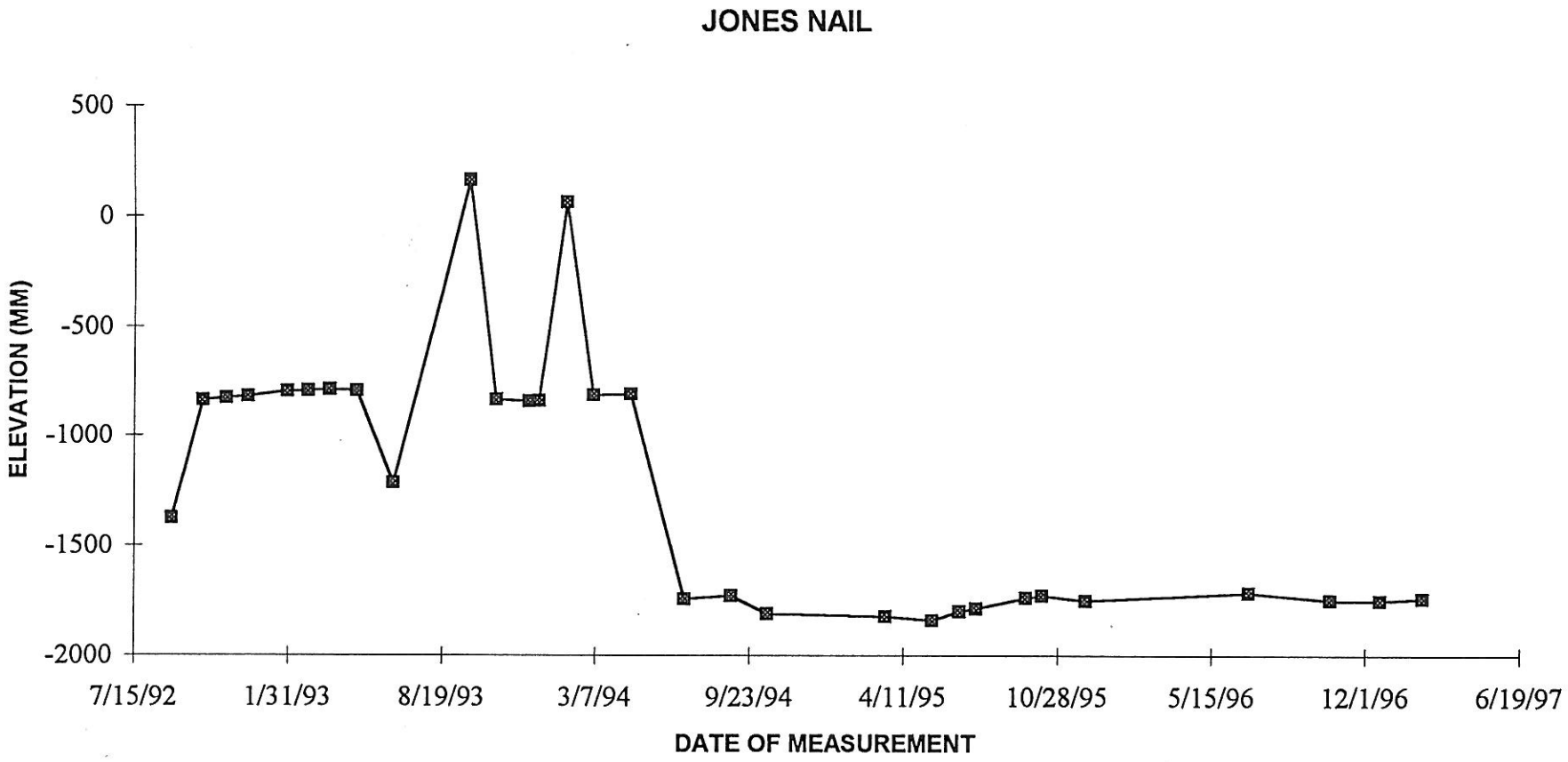

JONES NAIL
500
0
-500
-1000
-1500
-2000
ELEVATION (MM)
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE B-9

Appendix C
Temperature Measurements

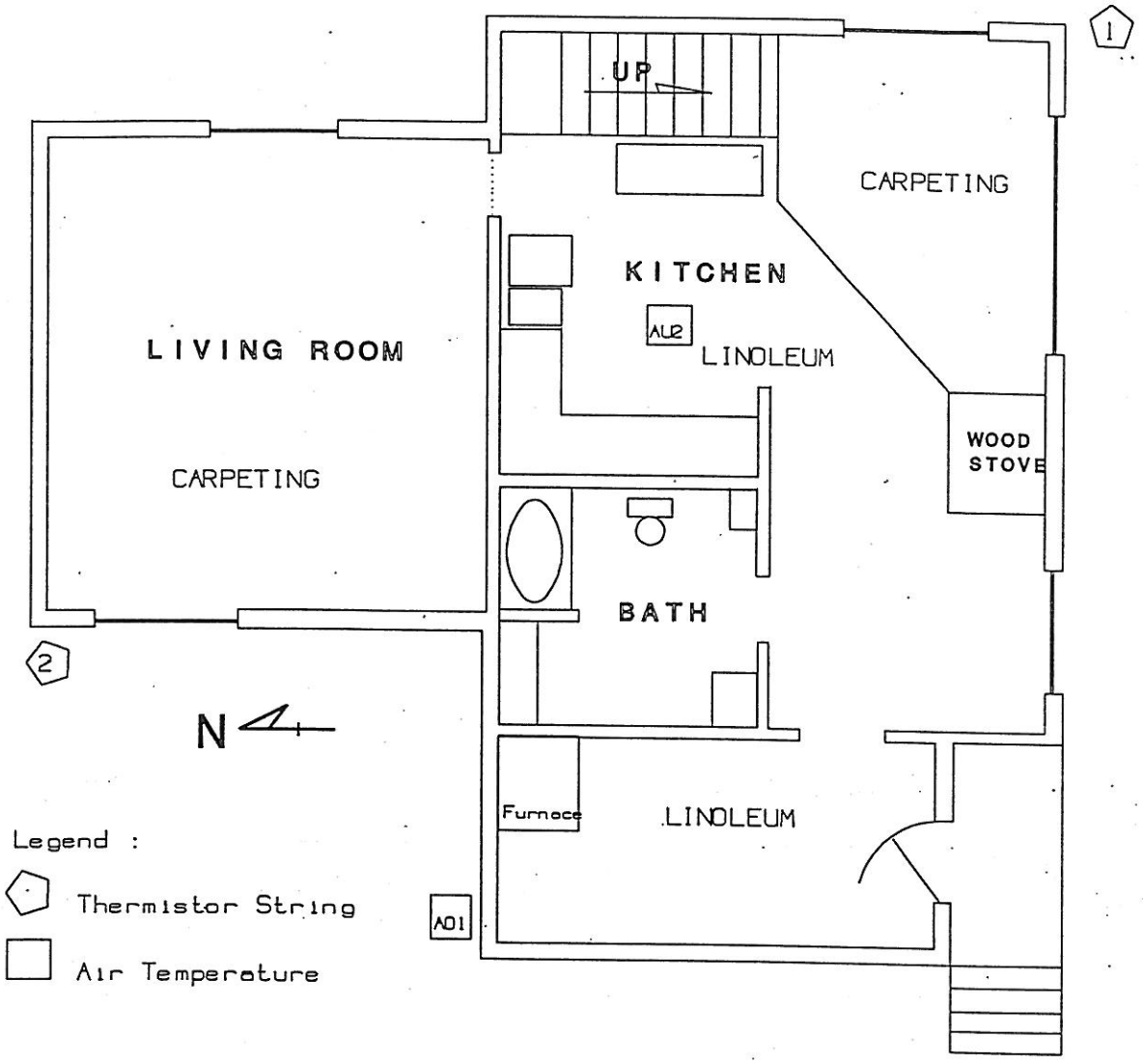


FIGURE C-1 – FLOOR PLAN OF HOUSE ON JONES RD.
SHOWING LOCATIONS OF THERMISTOR STRINGS

Temperature Measurements at 1411 Jones Rd.

String 1

Depth	Date 2/19/92	3/6/92	3/13/92	3/20/92	3/26/92	4/3/92	4/10/92	4/17/92	4/24/92	5/1/92	5/8/92	5/14/92
0	-9.244		-3.025	-2.236	-0.942	-4.93	-1.961	-0.792	-0.084	-0.291	-0.297	-0.179
-6	-2.099		-1.773	-1.461	-1.139	-1.374	-1.494	-1.244	-0.584	-0.497	-0.107	-0.155
-10	-0.076		-0.174	-0.201	-0.22	-0.232	-0.291	-0.327	-0.291	-0.256	-0.226	-0.078
11	-0.101		-0.134	-0.143	-0.15	-0.157	-0.143	-0.167	-0.173	-0.173	-0.101	-0.107
-12	-0.097		-0.131	-0.14	-0.149	-0.159	-0.197	-0.155	-0.161	-0.191	-0.113	-0.125
-13	-0.092		-0.123	-0.13	-0.138	-0.147	-0.191	-0.149	-0.256	-0.161	-0.024	-0.036
-13.5	-0.104		-0.131	-0.138	-0.146	-0.154	-0.149	-0.161	-0.173	-0.173	-0.226	-0.066
-14	-0.125		-0.149	-0.154	-0.16	-0.167	-0.161	-0.173	-0.185	-0.185	-0.137	-0.131
-16	-0.101		-0.121	-0.124	-0.128	-0.134	-0.149	-0.149	-0.155	-0.149	-0.208	-0.208
-20	-0.176		-0.188	-0.192	-0.195	-0.199	-0.208	-0.208	-0.22	-0.226	-0.191	-0.167
-26	-0.123		-0.136	-0.142	-0.146	-0.149	-0.167	-0.161	-0.161	-0.167	-0.362	-0.607
-34	-0.165		-0.182	-0.185	-0.187	-0.192	-0.185	-0.197	-0.208	-0.208	-0.391	-0.374

String 2

Depth	Date 2/19/92	3/6/92	3/13/92	3/20/92	3/26/92	4/3/92	4/10/92	4/17/92	4/24/92	5/1/92	5/8/92	5/14/92
0	-5.735	-5.091	-1.803	-1.585	-1.211		-1.821	-1.008	-0.403	-0.185	-0.415	-0.119
-2	0.056	0.005	-0.013	-0.029	-0.04		-0.066	-0.072	-0.078	-0.095	-0.595	-0.502
-4	0.101	0.048	0.03	0.013	-0.001		-0.03	-0.042	-0.048	-0.066	-0.238	-0.232
-6	0.055	0.009	-0.007	-0.023	-0.035		-0.149	-0.072	-0.321	-0.09	-0.368	-0.161
-8	0.015	-0.025	-0.038	-0.51	-0.062		-0.084	-0.101	-0.09	-0.119	-0.173	-0.173
-9	0.076	0.047	0.038	0.028	0.019		0.006	0.006	-0.006	-0.018	-0.167	-0.155
-10	0.023	-0.001	-0.008	-0.017	-0.023		-0.042	-0.042	-0.155	-0.048	-0.173	-0.167
-11	-0.072	-0.09	-0.095	-0.101	-0.107			-0.125	-0.119	-0.137	-0.191	-0.244
-12	-0.185	-0.191	-0.192	-0.195	-0.198			-0.208	-0.22	-0.214	-0.149	-0.191
-12.5	-0.146	-0.151	-0.153	-0.155	-0.156			-0.167	-0.173	-0.173	-0.214	-0.268
-13	-0.308	-0.313	-0.314	-0.316	-0.317			-0.327	-0.327	-0.333	-0.167	-0.356
-13.5	-0.339	-0.35	-0.354	-0.357	-0.36			-0.327	-0.374	-0.385	-0.208	-0.197

String 3

Depth	Date 2/19/92	3/6/92	3/13/92	3/20/92	3/26/92	4/3/92	4/10/92	4/17/92	4/24/92	5/1/92	5/8/92	5/14/92
AO1				-4.057		-3.609	-7.195	1.536		0.193		5.521
AU2				-1.227	3.032		-6.239	5.628	8.458	1.064		7.731

String 4

Depth	Date 2/19/92	3/6/92	3/13/92	3/20/92	3/26/92	4/3/92	4/10/92	4/17/92	4/24/92	5/1/92	5/8/92	5/14/92
8.5												
2.5												
2												
1												
0												
-1												
-2												
-4												
-6												
-7												
-7.5												
-7.75												

String 5

Date 2/19/92	3/6/92	3/13/92	3/20/92	3/26/92	4/3/92	4/10/92	4/17/92	4/24/92	5/1/92	5/8/92	5/14/92

TABLE C-1

Temperature Measurements at 1411 Jones Rd.

String 1

Depth	5/22/92	5/28/92	6/10/92	6/19/92	6/26/92	6/29/92	7/9/92	7/17/92	7/23/92	8/6/92	8/21/92	8/27/92
0	0.236	1.141	3.413	4.862	5.777	8.916	9.235	9.508	10.752	10.905	8.946	8.181
-6	-0.101	-0.113	-0.137	-0.125	-0.113	-0.131	-0.125	-0.101	-0.06	0.163	0.931	1.218
-10	-0.084	-0.101	-0.137	-0.113	-0.101	-0.125	-0.113	-0.101	-0.09	0.006	0.236	0.358
11	-0.113	-0.119	-0.143	-0.131	-0.125	-0.143	-0.143	-0.137	-0.113	-0.054	0.115	0.205
-12	-0.131	-0.149	-0.155	-0.149	-0.149	-0.161	-0.161	-0.149	-0.143	-0.101	0.006	0.066
-13	-0.024	-0.042	-0.048	-0.042	-0.042	-0.06	-0.054	-0.042	-0.048	-0.024	0.042	0.09
-13.5	-0.072	-0.066	-0.084	-0.084	-0.078	-0.095	-0.095	-0.09	-0.09	-0.078	-0.03	0
-14	-0.143	-0.185	-0.161	-0.149	-0.149	-0.161	-0.161	-0.155	-0.161	-0.149	-0.131	-0.125
-16	-0.22	-0.285	-0.226	-0.214	-0.22	-0.232	-0.232	-0.22	-0.232	-0.226	-0.22	-0.226
-20	-0.167	-0.161	-0.191	-0.173	-0.173	-0.185	-0.185	-0.173	-0.179	-0.179	-0.173	-0.179
-26	-0.327	-0.338	-0.338	-0.338	-0.338	-0.35	-0.338	-0.338	-0.338	-0.338	-0.338	-0.333
-34	-0.374	-0.391	-0.391	-0.374	-0.374	-0.385	-0.385	-0.374	-0.38	-0.38	-0.374	-0.368

String 2

Depth	5/22/92	5/28/92	6/10/92	6/19/92	6/26/92	6/29/92	7/9/92	7/17/92	7/23/92	8/6/92	8/21/92	8/27/92
0	0.849	3.678	12.475	11.395	11.271	18.036	18.49	14.586	17.609	15.589	14.374	8.632
-2	-0.426	-0.421	-0.344	-0.161	0.407	1.68	2.714	3.901	4.432	5.22	4.791	5.212
-4	-0.214	-0.256	-0.232	-0.203	-0.214	-0.22	-0.208	-0.197	-0.179	0.078	1.72	2.34
-6	-0.167	-0.185	-0.185	-0.179	-0.173	-0.191	-0.185	-0.173	-0.173	-0.149	0.518	0.861
-8	-0.179	-0.197	-0.179	-0.179	-0.173	-0.191	-0.185	-0.179	-0.173	-0.137	0.193	0.364
-9	-0.155	-0.185	-0.167	-0.149	-0.155	-0.173	-0.173	-0.167	-0.167	-0.125	0.103	0.224
-10	-0.161	-0.191	-0.173	-0.173	-0.173	-0.191	-0.185	-0.185	-0.173	-0.155	-0.018	0.084
-11	-0.179	-0.203	-0.197	-0.185	-0.185	-0.197	-0.203	-0.191	-0.197	-0.185	-0.101	-0.036
-12	-0.143	-0.161	-0.161	-0.149	-0.149	-0.161	-0.161	-0.161	-0.161	-0.155	-0.113	-0.072
-12.5	-0.203	-0.22	-0.232	-0.232	-0.232	-0.238	-0.232	-0.232	-0.22	-0.22	-0.197	-0.173
-13	-0.143	-0.173	-0.179	-0.179	-0.161	-0.179	-0.179	-0.185	-0.161	-0.173	-0.149	-0.131
-13.5	-0.191	-0.22	-0.214	-0.226	-0.214	-0.226	-0.22	-0.22	-0.214	-0.208	-0.214	-0.208

String 3

Depth	5/22/92	5/28/92	6/10/92	6/19/92	6/26/92	6/29/92	7/9/92	7/17/92	7/23/92	8/6/92	8/21/92	8/27/92
AO1		18.754	21.573		18.213	25.981	21.766	20.166	21.612	18.871		8.7
AU2		14.493	16.932		15.462	22.237	18.457	17.468	17.671	15.56		9.416

String 4

Depth	5/22/92	5/28/92	6/10/92	6/19/92	6/26/92	6/29/92	7/9/92	7/17/92	7/23/92	8/6/92	8/21/92	8/27/92
8.5												
2.5												
2												
1												
0												
-1												
-2												
-4												
-6												
-7												
-7.5												
-7.75												

String 5

	5/22/92	5/28/92	6/10/92	6/19/92	6/26/92	6/29/92	7/9/92	7/17/92	7/23/92	8/6/92	8/21/92	8/27/92

TABLE C-1

Temperature Measurements at 1411 Jones Rd.

String 1

Depth	9/4/92	9/10/92	10/9/92	10/28/92	11/17/92	12/7/92	1/8/93	1/29/93	2/10/93	2/28/93	3/12/93	3/28/93
0	6.019	4.119	0.432	0.042	-0.911	-0.537	-0.843	-2.28	-2.29	-1.014	-1.267	-1.188
-6	1.674	1.88	1.49	0.937	0.567	0.327	0.115	0.042	-0.006	-0.054	-0.084	-0.095
-10	0.536	0.654	0.918	0.717	0.518	0.321	0.151	0.066	0.042	-0.012	-0.036	-0.072
11	0.327	0.419	0.679	0.561	0.401	0.248	0.06	0.024	-0.012	-0.048	-0.054	-0.084
-12	0.157	0.236	0.462	0.382	0.285	0.0151	0.018	0.03	-0.054	-0.095	-0.101	-0.125
-13	0.127	0.193	0.358	0.321	0.26	0.163	0.06	0.042	0.024	0	-0.036	-0.024
-13.5	0.024	0.072	0.218	0.187	0.151	0.184	0.012	-0.018	-0.036	-0.054	-0.066	-0.084
-14	-0.101	-0.084	0.048	0.03	0.018	-0.042	-0.084	-0.244	-0.113	-0.131	-0.137	-0.131
-16	-0.226	-0.208	-0.09	-0.232	-0.214	-0.22	-0.179	-0.208	-0.214	-0.22	-0.238	-0.22
-20	-0.179	-0.167	-0.161	-0.197	-0.155	-0.179	-0.185	-0.338	-0.167	-0.179	-0.191	-0.179
-26	-0.338	-0.344	-0.321	-0.344	-0.327	-0.338	-0.344	-0.374	-0.338	-0.344	-0.415	-0.338
-34	-0.38	-0.38	-0.362	-0.385	-0.368	-0.38	-0.374	-0.368	-0.374	-0.38	-0.397	-0.38

String 2

Depth	9/4/92	9/10/92	10/9/92	10/28/92	11/17/92	12/7/92	1/8/93	1/29/93	2/10/93	2/28/93	3/12/93	3/28/93
0	6.688	0.623	-0.143	-1.076	-3.943	-2.762	-1.428	-2.253	-2.348	-1.328	-1.278	-1.211
-2	4.525	3.953	0.297	0.03	-0.066	-0.119	-0.203	-0.208	-0.315	-0.362	-0.403	-0.526
-4	2.651	2.616	0.736	0.358	0.163	0.048	-0.03	-0.066	-0.084	-0.101	-0.125	-0.107
-6	1.231	1.373	0.723	0.321	0.181	0.042	-0.042	-0.09	-0.113	-0.119	-0.137	-0.125
-8	0.549	0.661	0.536	0.26	0.139	0.018	-0.06	-0.131	-0.137	-0.131	-0.155	-0.149
-9	0.352	0.462	0.045	0.248	0.109	0.012	-0.054	-0.066	-0.125	-0.131	-0.137	-0.131
-10	0.175	0.278	0.291	0.157	0.048	-0.018	-0.078	-0.101	-0.143	-0.137	-0.161	-0.161
-11	0.048	0.097	0.163	-0.006	-0.006	-0.078	-0.119	-0.125	-0.173	-0.179	-0.179	-0.191
-12	-0.024	0.006	0.072	0.018	-0.018	-0.078	-0.095	-0.06	-0.137	-0.173	-0.155	-0.161
-12.5	-0.143	-0.113	-0.048	-0.107	-0.119	-0.161	-0.185	-0.191	-0.214	-0.226	-0.244	-0.232
-13	-0.113	-0.101	-0.042	-0.119	-0.101	-0.119	-0.131	-0.107	-0.155	-0.161	-0.185	-0.179
-13.5	-0.179	-0.167	-0.131	-0.315	-0.173	-0.173	-0.179	-0.179	-0.203	-0.22	-0.208	-0.22

String 3

Depth	9/4/92	9/10/92	10/9/92	10/28/92	11/17/92	12/7/92	1/8/93	1/29/93	2/10/93	2/28/93	3/12/93	3/28/93
AO1	11.98	-0.356	-0.659	-3.986	-14.658	-13.48	-4.483	-14.888	-13.028	-4.786	-3.046	1.953
AU2	8.887	0.905	-0.52	-3.498	-15.466	-15.248	-4.589		-9.706	-4.854	-1.3	6.723

String 4

Depth	9/4/92	9/10/92	10/9/92	10/28/92	11/17/92	12/7/92	1/8/93	1/29/93	2/10/93	2/28/93	3/12/93	3/28/93
8.5			-0.786	-3.962	-15.248	-14.376	-4.772	-15.652	-13.534	-4.867	-3.001	1.549
2.5			-0.543	-3.591	-14.685	-13.37	-4.617	-14.565	-13.432	-4.69	-3.021	1.49
2			-0.711	-3.814	-15.123	-14.086	-4.731	-15.291	-13.568	-4.836	-3.076	1.536
1			-0.883	-4.01	-15.272	-14.449	-4.858	-15.701	-13.765	-5.029	-3.326	0.95
0			-0.338	-1.762	-8.943	-8.883	-5.996	-14.633	-14.785	-6.76	-6.004	-4.349
-1			-0.191	-0.653	-4.976	-5.619	-6.268	-13.852	-14.04	-7.005	-6.264	-5.45
-2			-0.048	-0.362	-1.422	-2.706	-5.907	-12.221	-12.449	-6.496	-5.83	-5.15
-4			-0.208	-0.25	-0.226	-0.256	-4.029	-7.013	-8.487	-5.532	-4.913	-4.213
-6			-0.502	-0.572	-0.426	-0.426	-2.176	-3.741	-5.589	-4.58	-4.01	-3.513
-7			-0.537	-0.883	-0.508	-0.467	-1.356	-2.556	-4.297	-4.019	-3.532	-3.136
-7.5			-0.7	-0.688	-0.624	-0.619	-1.25	-2.337	-3.976	-3.924	-3.498	-3.141
-7.75			-0.561	-0.526	-0.508	-0.467	-0.974	-2.052	-3.707	-3.659	-3.281	-3.206

String 5

	9/4/92	9/10/92	10/9/92	10/28/92	11/17/92	12/7/92	1/8/93	1/29/93	2/10/93	2/28/93	3/12/93	3/28/93

TABLE C-1

Temperature Measurements at 1411 Jones Rd.

String 1

Depth	4/4/93	5/11/93	6/24/93	10/14/93	11/23/93	1/28/94	3/4/94	4/22/94	5/19/94	6/10/94	10/19/94	11/8/94
0	-0.191	0.729	8.574	2.505	-0.09	-0.728	-2.478	-0.048	1.134	5.456		
-6	-0.101	-0.113	0.358	2.574	1.192	0.218	0.072	-0.167	-0.095	-0.09	2.63	1.641
-10	-0.078	-0.09	-0.006	1.621	0.943	0.272	0.151	-0.018	-0.054	-0.066	1.601	-2.747
11	-0.203	-0.113	-0.072	-0.066	0.905	0.205	0.024	-0.03	-0.078	-0.095	1.347	1.147
-12	-0.143	-0.137	-0.22	0.836	-4.232	0.127	0.042	-0.107	-0.119	-0.125	-2.237	-0.197
-13	-0.042	-0.054	-0.048	0.673	0.549	0.169	0.084	0	-0.018	-0.03	0.654	-0.238
-13.5	-0.09	-0.09	-0.095	-0.018	0.376	0.097	0.036	-0.054	-0.06	-0.078	6.05	-0.462
-14	-0.167	-0.155	-0.173	-0.38	0.218	-0.018	-0.054	-0.238	-0.137	-0.155	0.193	-0.309
-16	-0.232	-0.214	-0.226	-1.729	-0.321	-0.226	-0.179	-0.197	-0.208	-0.208	-0.179	-0.107
-20	-0.185	-0.179	-0.173	-1.081	-0.894	-0.173	-0.155	-0.179	-0.179	-0.214	-0.757	-6.143
-26	-0.35	-0.327	-0.35	-0.985	-0.421	-0.35	-0.338	-0.344	-0.35	-0.35	-4.265	-0.473
-34	-0.38	-0.368	-0.374	-2.535	-0.315	-0.374	-0.368	-0.356	-0.374	-0.362	-5.096	-8.407

String 2

Depth	4/4/93	5/11/93	6/24/93	10/14/93	11/23/93	1/28/94	3/4/94	4/22/94	5/19/94	6/10/94	10/19/94	11/8/94
0	-0.191	1.873	12.716	3.283	-3.63	-3.4	-9.123	2.278	15.392	21.844		
-2	-0.35	-0.256	4.241	0.561	-0.054	-0.543	-2.269	-0.974	-0.362	0.364		
-4	-0.107	-0.101	1.575	-6.467	0.34	-0.072	-0.113	-0.214	-0.208	-0.208		
-6	-0.119	-0.119	0.598	-1.036	0.45	-0.09	-0.197	-0.167	-0.173	-0.161		
-8	-0.137	-0.137	0.139	0.115	0.315	-0.084	-0.101	-0.155	-0.155	-0.137		
-9	-0.137	-0.125	0.042	0.654	0.321	-0.054	-0.095	-0.125	-0.137	-0.113		
-10	-0.161	-0.149	-0.054	-1.875	0.09	-0.078	-0.125	-0.155	-0.161	-0.143		
-11	-0.191	-0.185	-0.125	-0.485	0.103	-0.119	-0.149	-0.179	-0.185	-0.173		
-12	-0.167	-0.161	-0.125	0.278	-0.107	-0.095	-0.113	-0.131	-0.143	-0.137		
-12.5	-0.232	-0.232	-0.22	0.006	-0.297	-0.185	-0.203	-0.344	-0.232	-0.232		
-13	-0.185	-0.173	-0.167	-0.385	-0.262	-0.125	-0.119	-0.149	-0.161	-0.161		
-13.5	-0.226	-0.22	-0.214	-1.609	-0.072	-0.173	-0.155	-0.191	-0.208	-0.203		

String 3

Depth	4/4/93	5/11/93	6/24/93	10/14/93	11/23/93	1/28/94	3/4/94	4/22/94	5/19/94	6/10/94	10/19/94	11/8/94
AO1	4.618	10.427	13.762	3.334	-7.108	-7.254	-20.373	13.685	15.448	18.854	-17.218	
AU2	9.796											

String 4

Depth	4/4/93	5/11/93	6/24/93	10/14/93	11/23/93	1/28/94	3/4/94	4/22/94	5/19/94	6/10/94	10/19/94	11/8/94
8.5	4.271	8.086	13.775	3.297	-7.017	-7.36	-20.467	13.407	15.406	19.883		
2.5	4.081	7.593	13.584	1.86	-6.397	-7.081	-19.981	12.692	14.815	19.362	-17.763	
2	4.157	7.768	13.66	-4.681	-6.845	-9.412	-20.265	12.728	15.267	19.953	-17.554	-9.777
1	3.737	7.639	13.558	3.146	-7.313	-7.426	-20.185	12.499	14.992	19.83	-15.584	-8.805
0	-1.4	1.536	9.325	-1.322	-17.724	-6.268	-13.933	-0.636	2.693	7.283	-6.181	-5.092
-1	-2.711	-0.415	4.279	-1.483	-1.455	-5.154	-11.104	-2.566	-0.438	1.019	-0.619	-2.363
-2	-3.061	-0.653	1.16	-2.736	-0.648	-3.561	-8.787	-3.036	-0.711	-0.38	-2.894	-0.22
-4	-3.513	-1.267	-0.7	-9.446	-0.155	-0.746	-5.079	-3.176	-1.205	-0.854	-0.274	-10.248
-6	-3.226	-1.472	-0.917	-0.797	-0.403	-0.362	-2.258	-2.374	-1.333	-0.997	-0.426	-8.758
-7	-2.945	-1.466	-0.94	-7.684	-0.45	-0.397	-1.216	-2.03	-1.3	-0.997	-6.925	-3.405
-7.5	-2.975	-1.615	-1.098	-0.676		-0.561	-1.065	-2.052	-1.428	-1.138	-9.384	-9.214
-7.75	-2.798	-1.439	-0.934	-0.7	-0.485	-0.403	-0.803	-1.907	-1.25	-0.974	-1.019	-1.127

String 5

	4/4/93	5/11/93	6/24/93	10/14/93	11/23/93	1/28/94	3/4/94	4/22/94	5/19/94	6/10/94	10/19/94	11/8/94
					-7.569	-7.286	-19.329	15.744	19.242	23.402		

TABLE C-1

Temperature Measurements at 1411 Jones Rd.

String 1

Depth	3/19/95	5/19/95	6/23/95	7/15/95	10/17/96	11/15/96	12/20/96	2/13/97
0								
-6	0.025	-0.076	0.837	2.448				
-10	0.107	-0.02	0.159	0.678				
11	0.08	-0.045	0.063	0.443				
-12	0.023	-0.088	-0.02					
-13	0.116	0.019	0.054	0.247				
-13.5	0.06	-0.03	-0.005	0.152				
-14	-0.024	-0.104	-0.09	0.034				
-16	-0.146	-0.18	-0.179	-0.16				
-20	-0.156	-0.167	-0.163	-0.16				
-26				-0.337				
-34				-0.334				

String 2

Depth	3/19/95	5/19/95	6/23/95	7/15/95	10/17/96	11/15/96	12/20/96	2/13/97
0								
-2								
-4								
-6								
-8								
-9								
-10								
-11								
-12								
-12.5								
-13								
-13.5								

String 3

Depth	3/19/95	5/19/95	6/23/95	7/15/95	10/17/96	11/15/96	12/20/96	2/13/97
AO1				-0.81	-8.456			-10.67
AU2								

String 4

Depth	3/19/95	5/19/95	6/23/95	7/15/95	10/17/96	11/15/96	12/20/96	2/13/97
8.5					-8.342			-10.993
2.5		14.111	15.437		-7.86			-10.801
2		13.688	15.137	12.554	-7			-10.616
1		10.565	14.022	12.37	-7.465			-10.968
0		4.922	10.978	11.908	-4.701	-11.734		-10.561
-1		0.277	5.838	10.787	-1.059	-8.074	-10.874	-9.915
-2	-11.21	-0.536	1.624	7.947	-0.081	-4.04	-8.273	-9.452
-4	-7.746	-1.186	-0.689	4.385	-0.174	-0.187	-4.615	-8.292
-6	-5.089	-1.431	-0.924	-0.462	-0.438	-0.398	-1.688	-6.815
-7	-4.043	-1.452	-0.965	-0.762	-0.512	-0.464	-0.787	-6.023
-7.5				-0.808	-0.681	-0.637	-0.751	-5.849
-7.75				-0.965	-0.535			-5.572

String 5

	3/19/95	5/19/95	6/23/95	7/15/95	10/17/96	11/15/96	12/20/96	2/13/97

TABLE C-1

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.

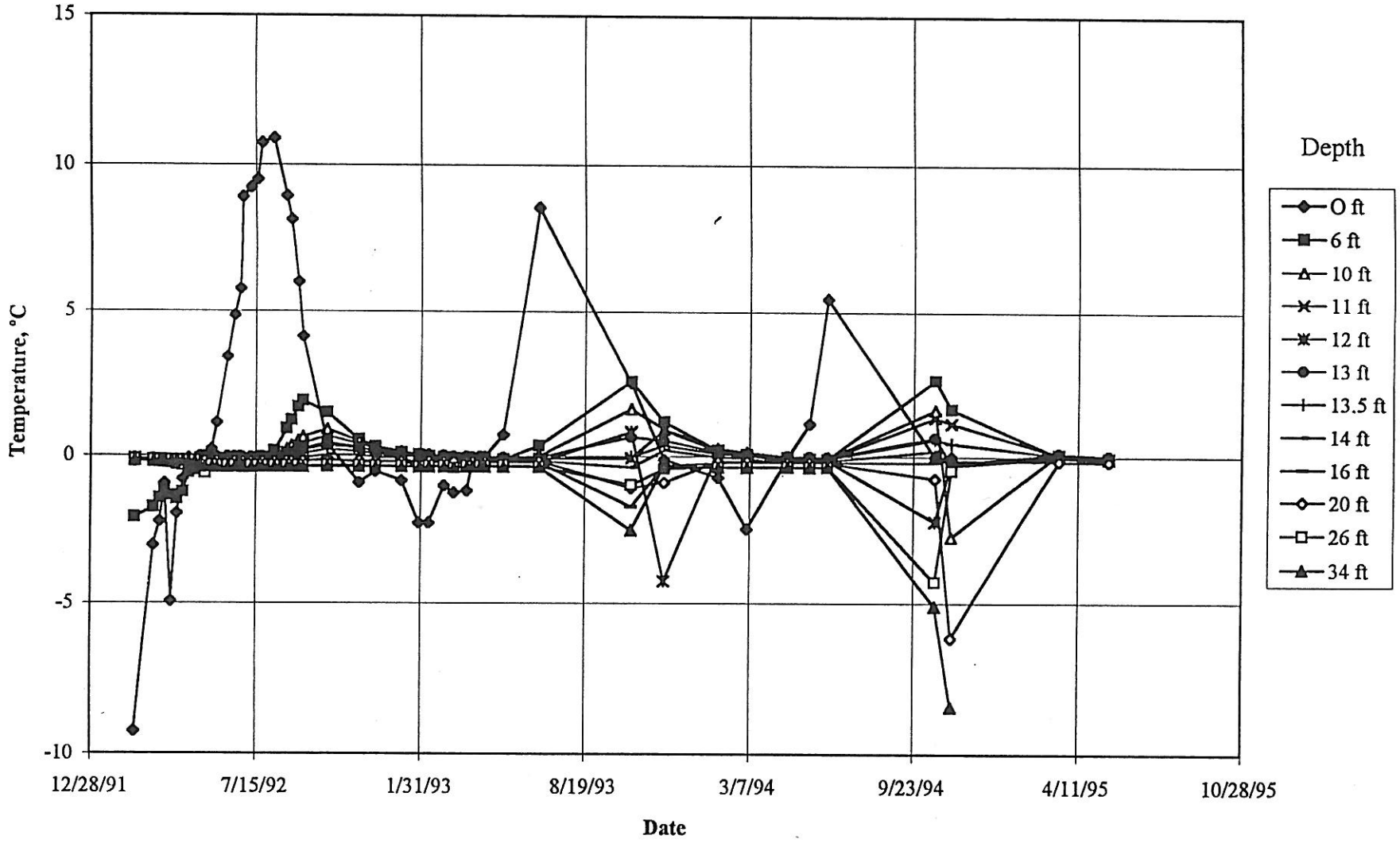


FIGURE C-2

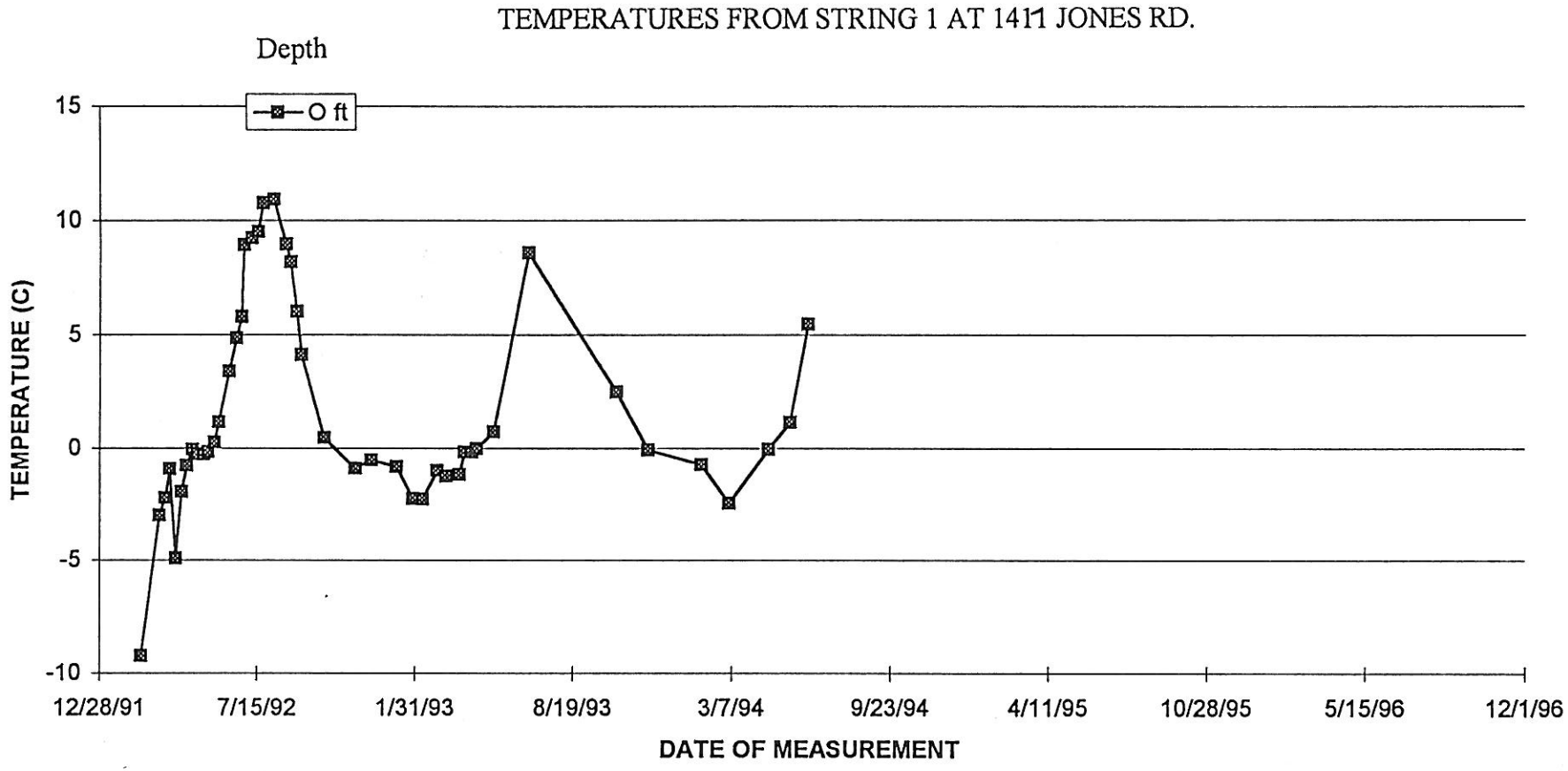

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.
Depth
O ft
15
10
5
0
-5
-10
TEMPERATURE (C)
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
DATE OF MEASUREMENT

FIGURE C-3

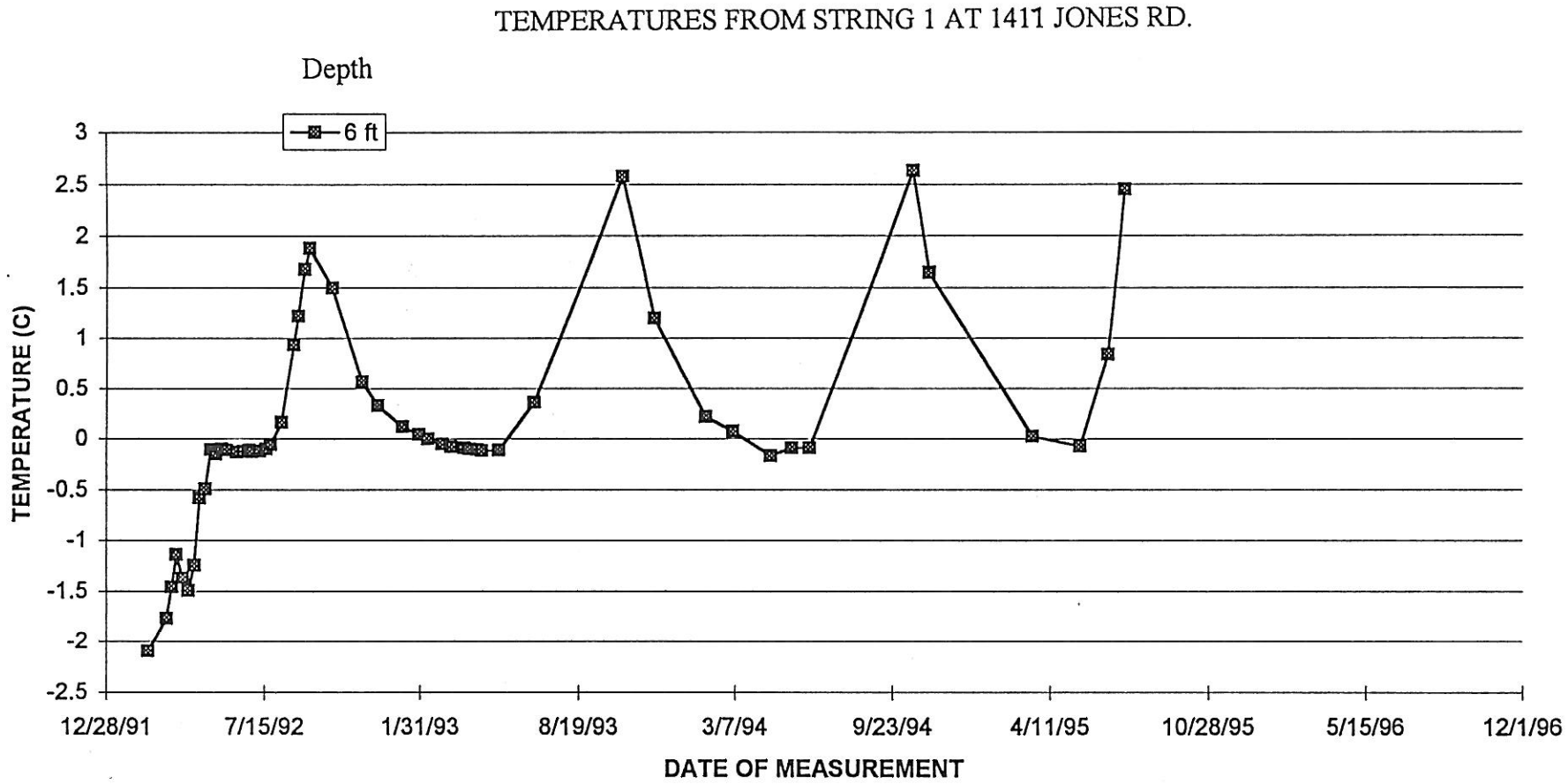

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.
Depth
6 ft
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
TEMPERATURE (C)
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
DATE OF MEASUREMENT

FIGURE C-4

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.

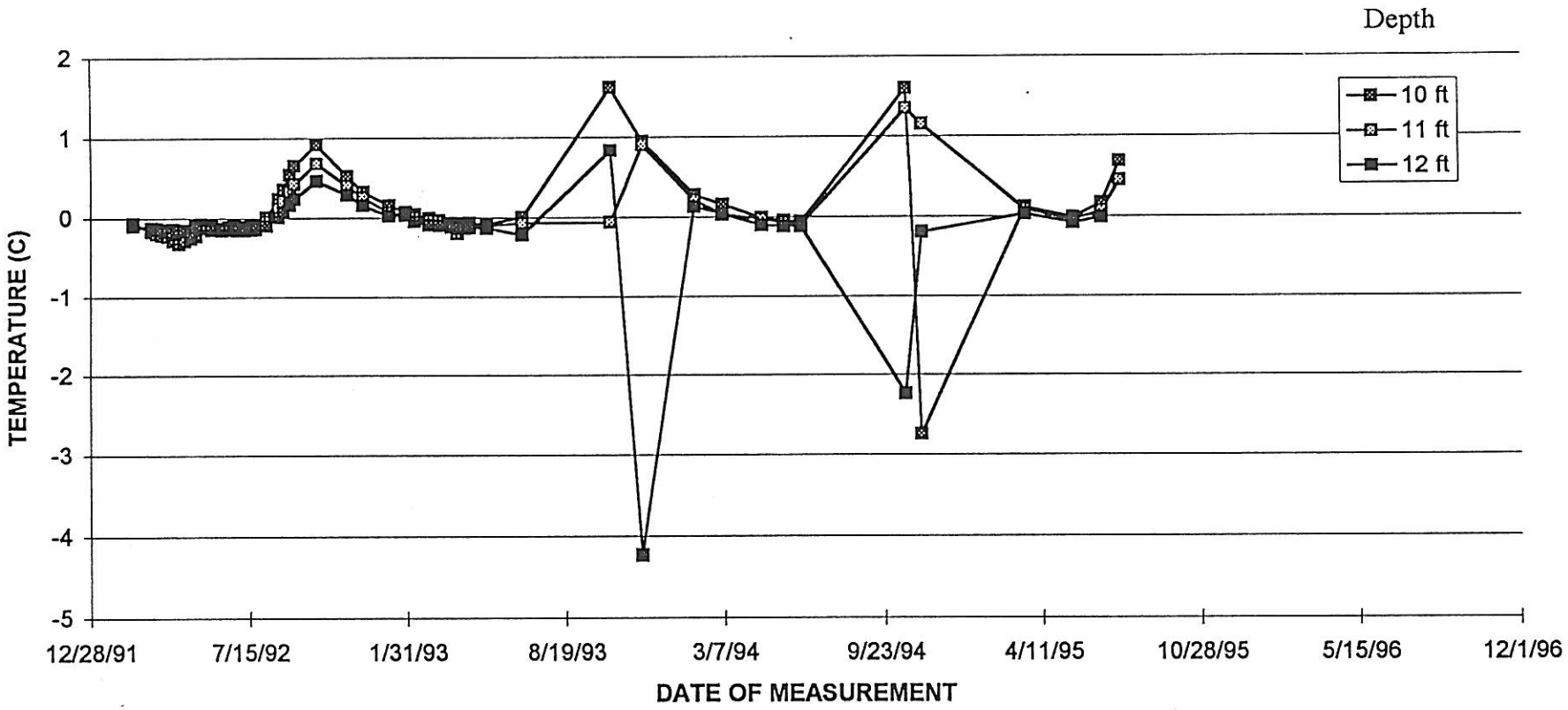


FIGURE C-5

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.

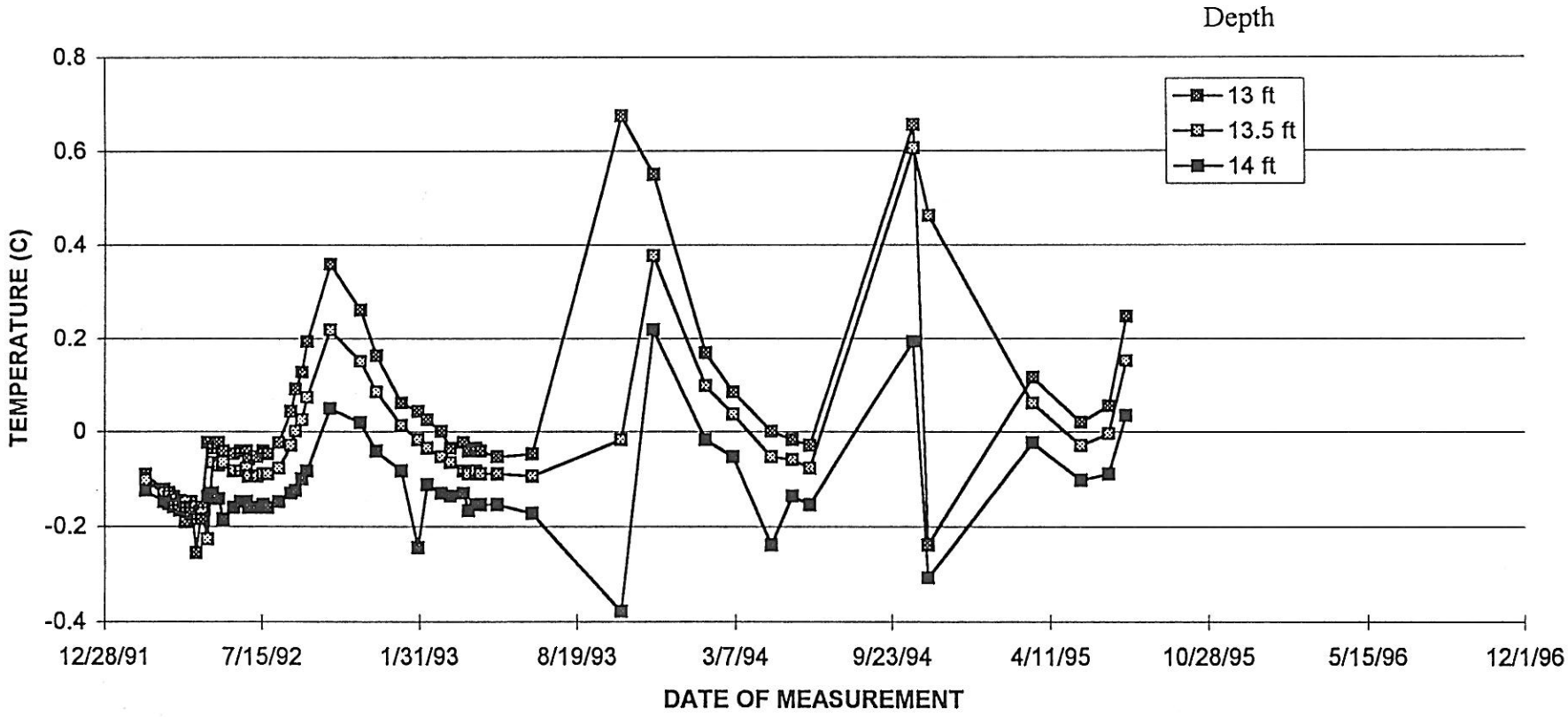


FIGURE C-6

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.

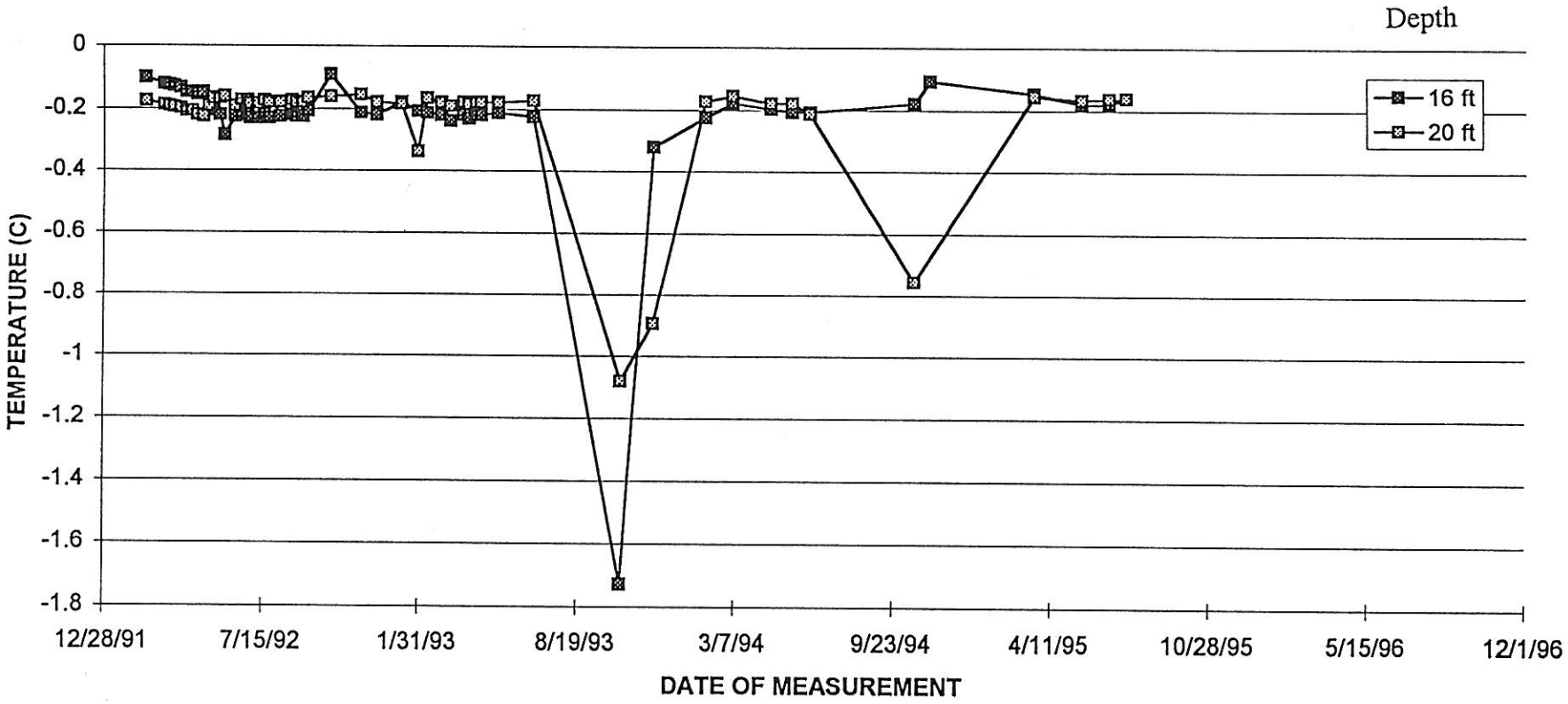


FIGURE C-7

TEMPERATURES FROM STRING 1 AT 1411 JONES RD.

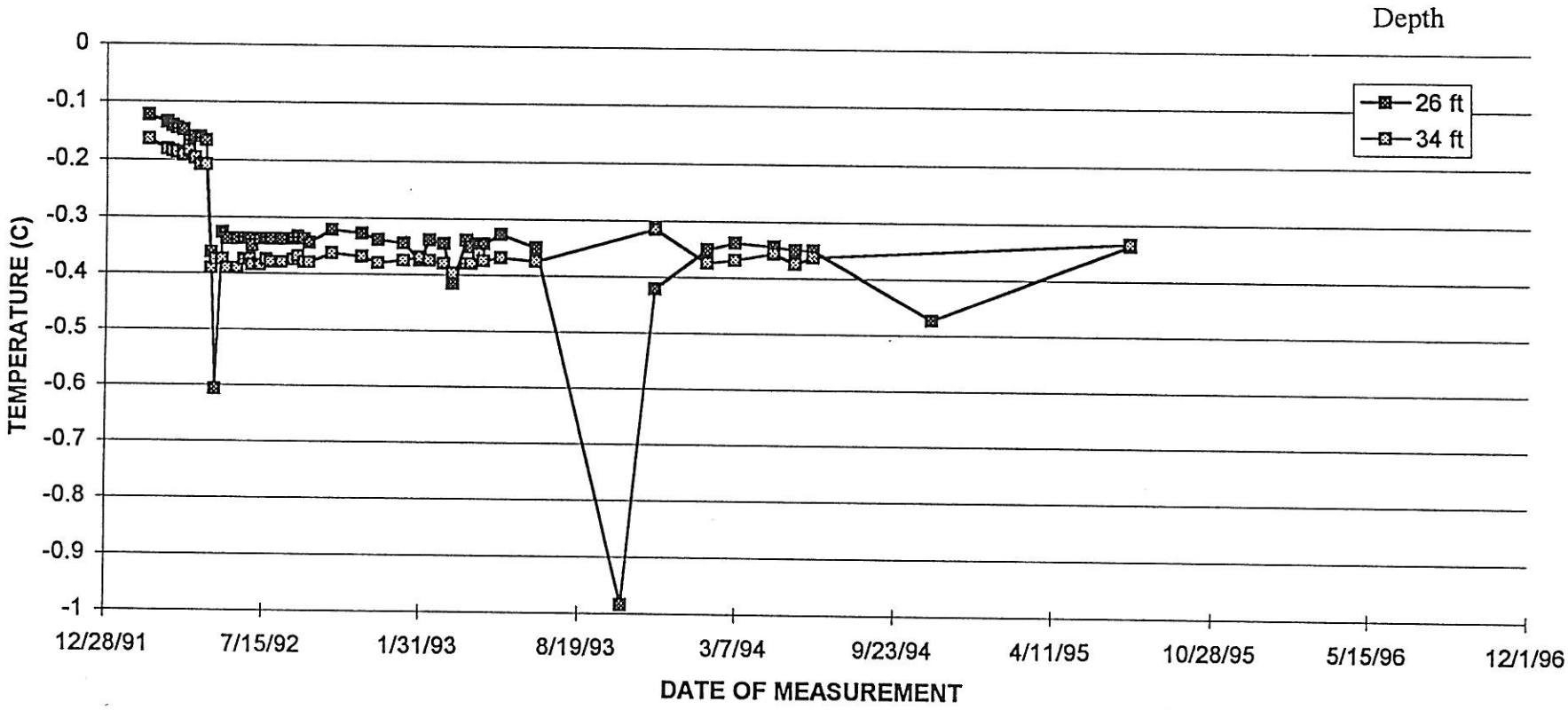


FIGURE C-8

TEMPERATURES FROM STRING 2 AT 1411 JONES RD.

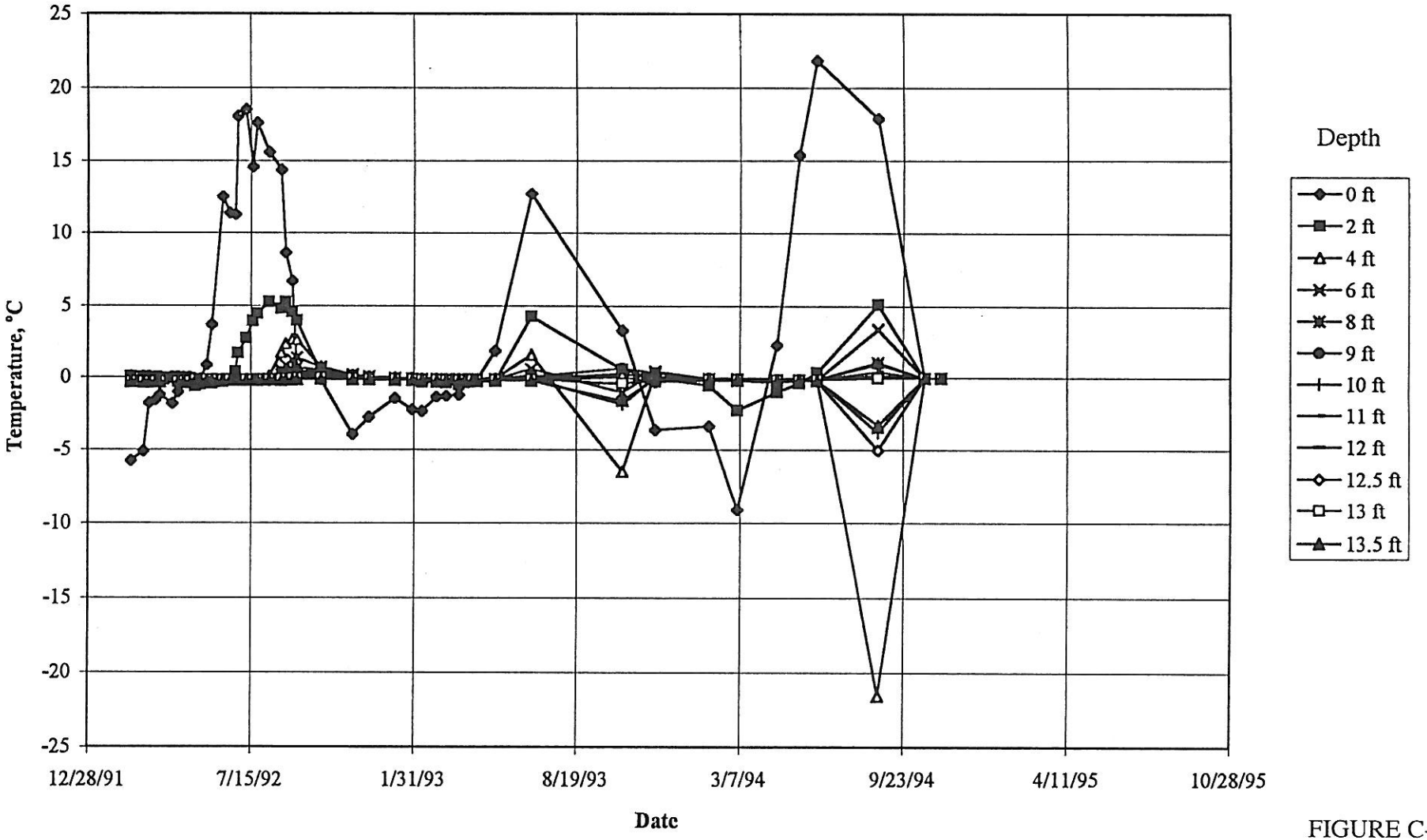


FIGURE C-9

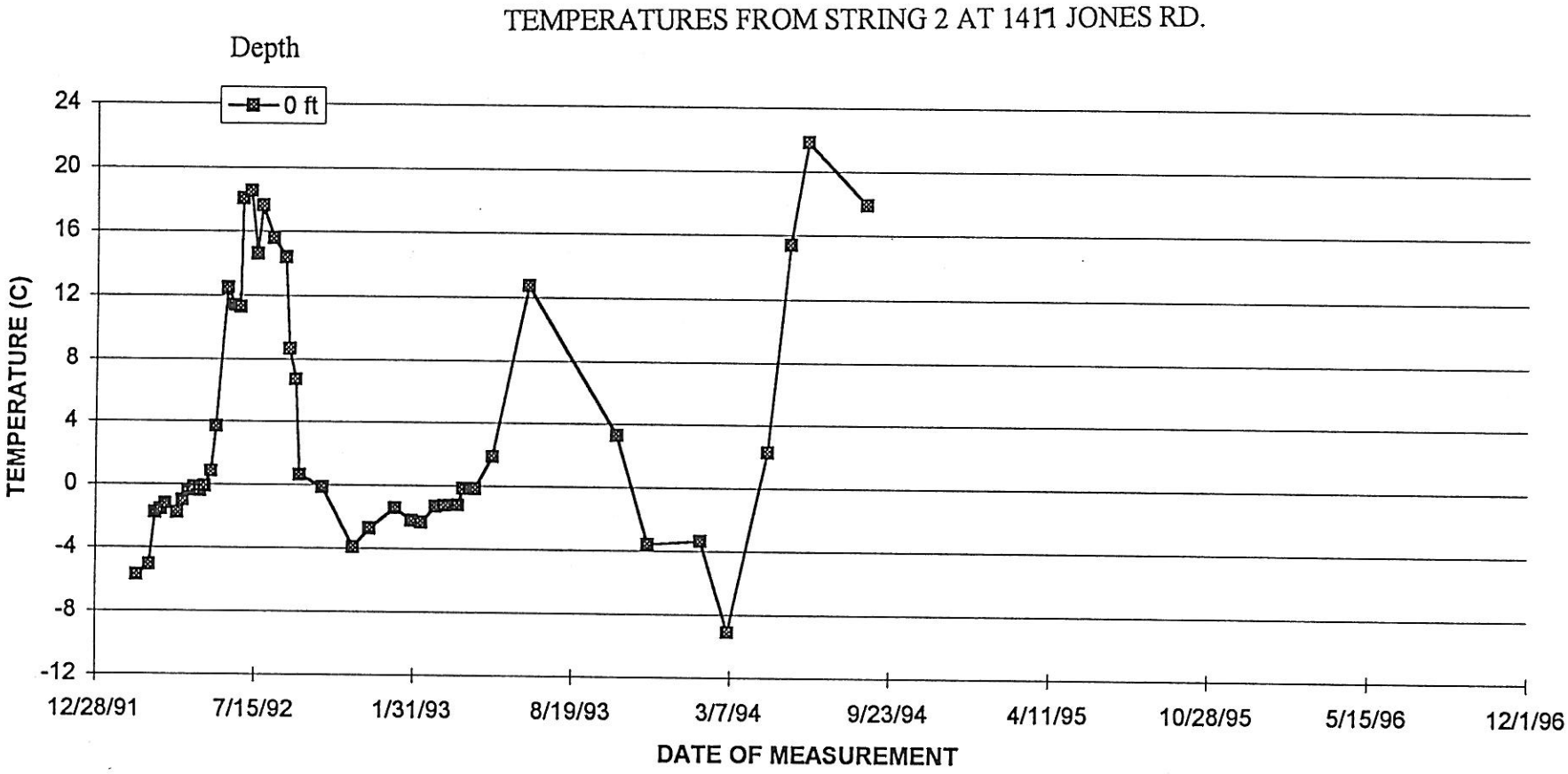

TEMPERATURES FROM STRING 2 AT 1411 JONES RD.
Depth
0 ft
24
20
16
12
8
4
0
-4
-8
-12
TEMPERATURE (C)
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
DATE OF MEASUREMENT

FIGURE C-10

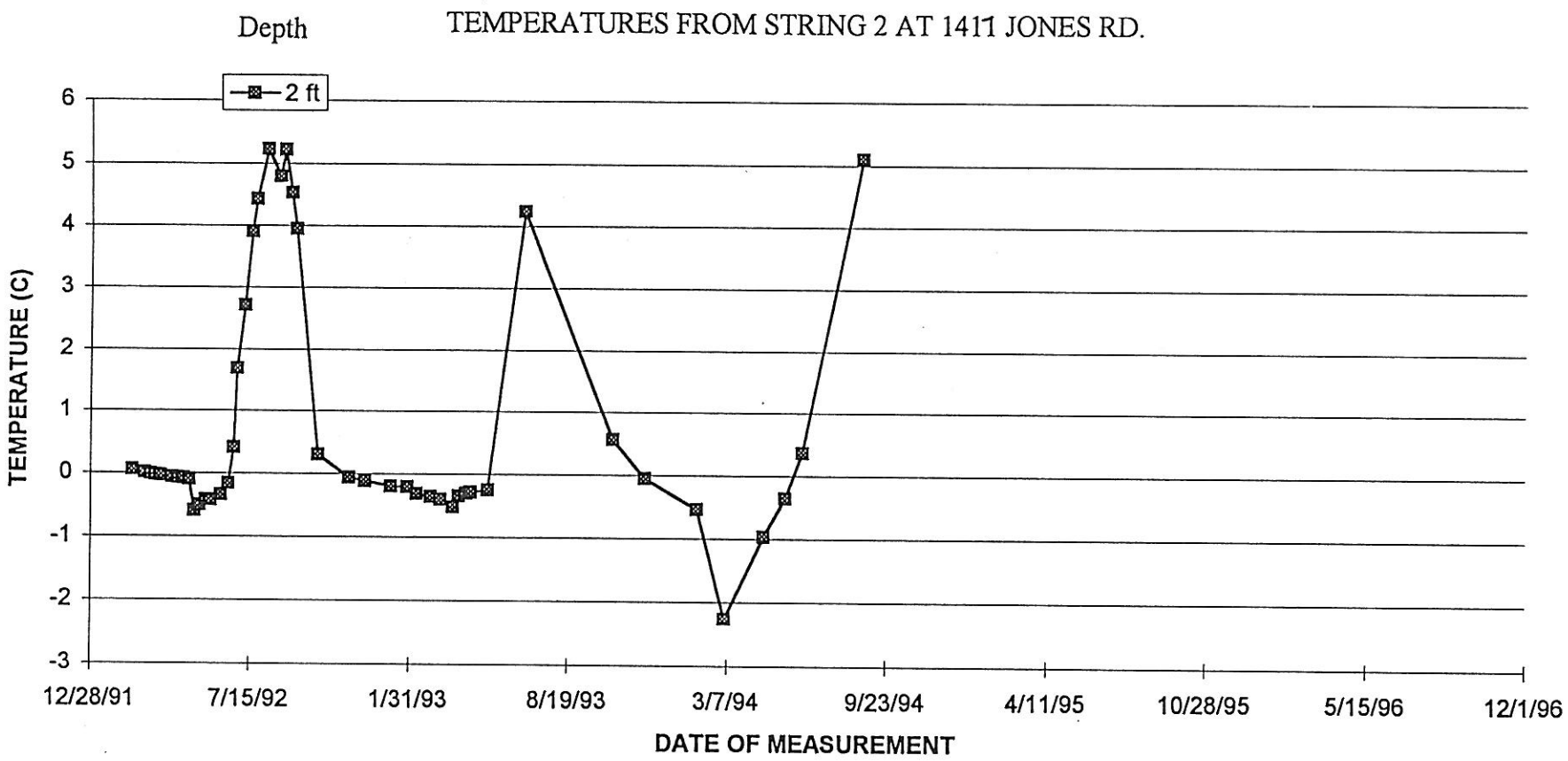

Depth
TEMPERATURES FROM STRING 2 AT 1411 JONES RD.
2 ft
6
5
4
3
2
1
0
-1
-2
-3
TEMPERATURE (C)
12/28/91
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
DATE OF MEASUREMENT

FIGURE C-11

TEMPERATURES FROM STRING 2 AT 1411 JONES RD.

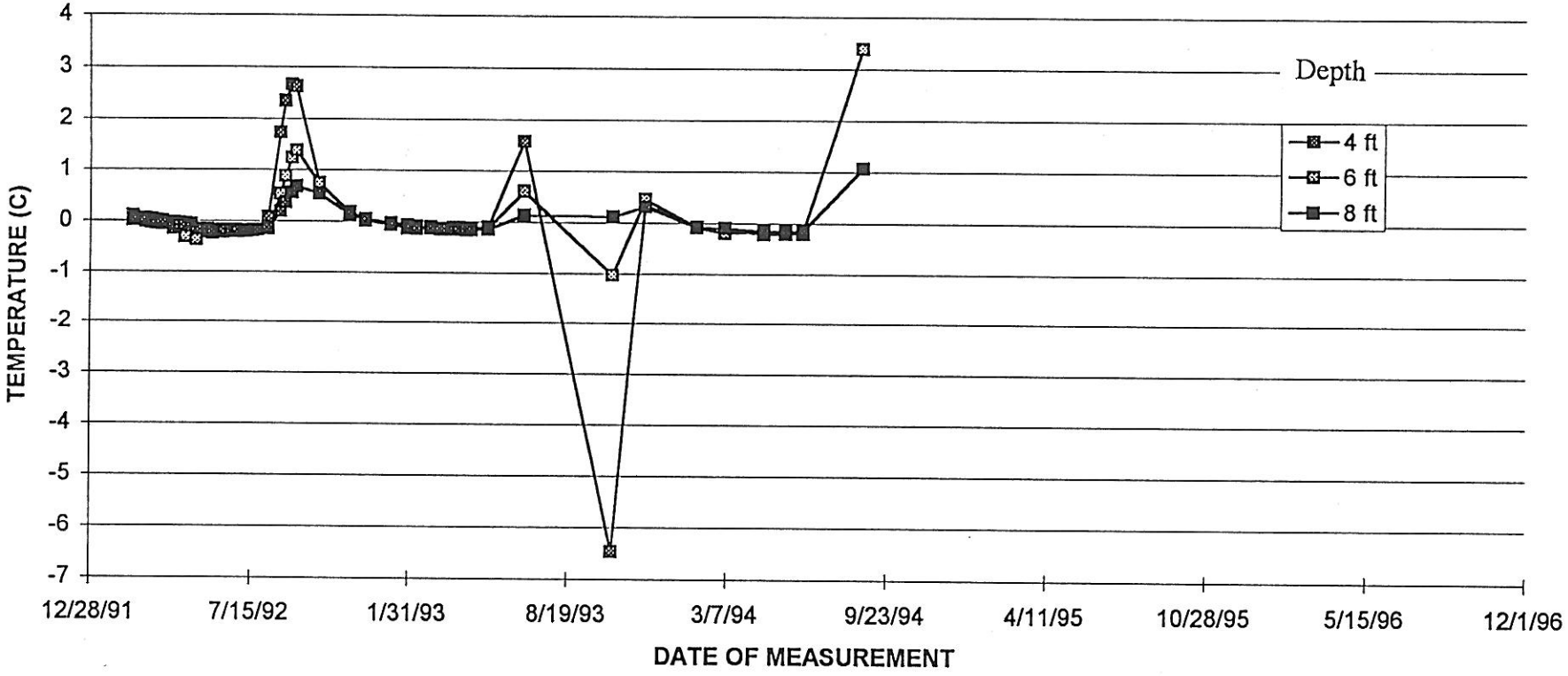


FIGURE C-12

TEMPERATURES FROM STRING 2 AT 1411 JONES RD.

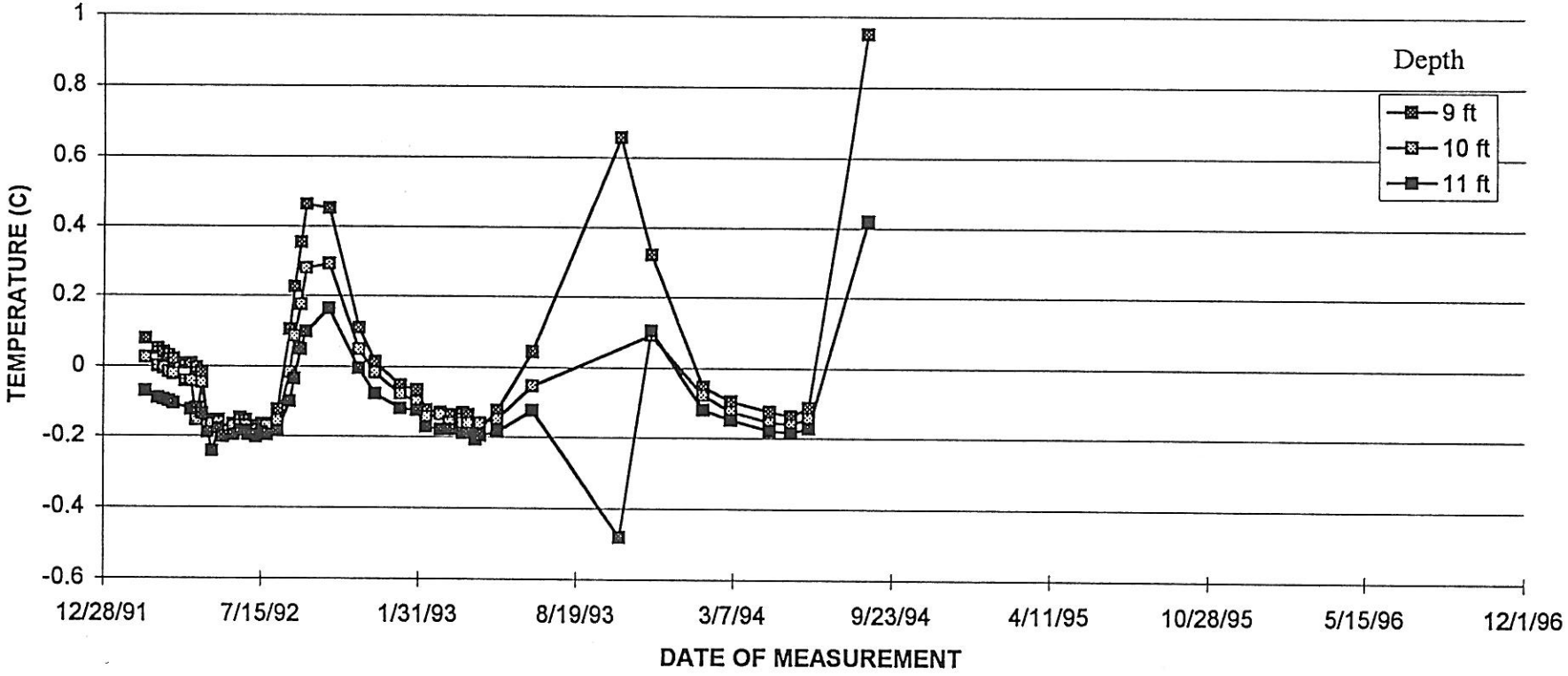


FIGURE C-13

TEMPERATURES FROM STRING 2 AT 141 JONES RD.

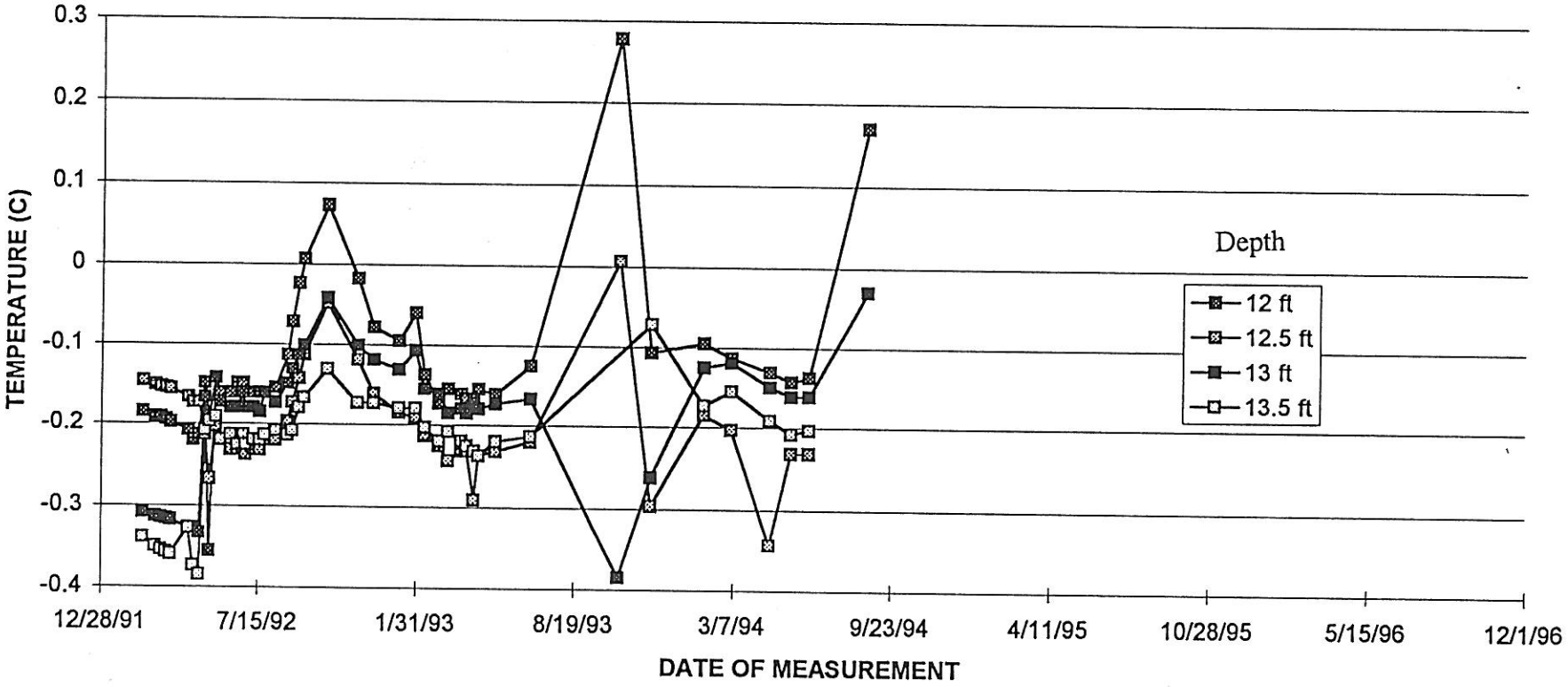


FIGURE C-14

TEMPERATURES FROM STRING 3 AT 1411 JONES RD.

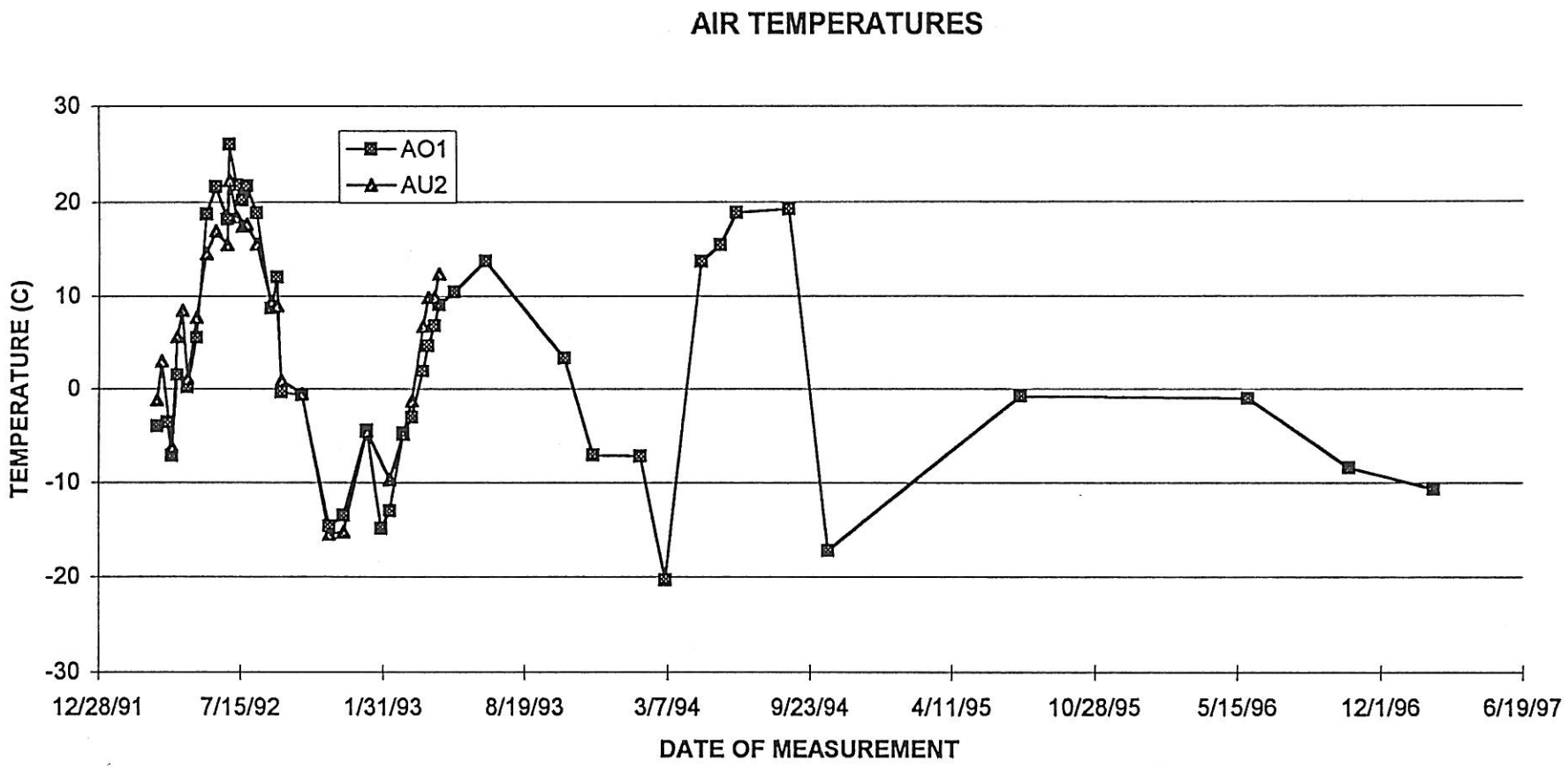


FIGURE C-15

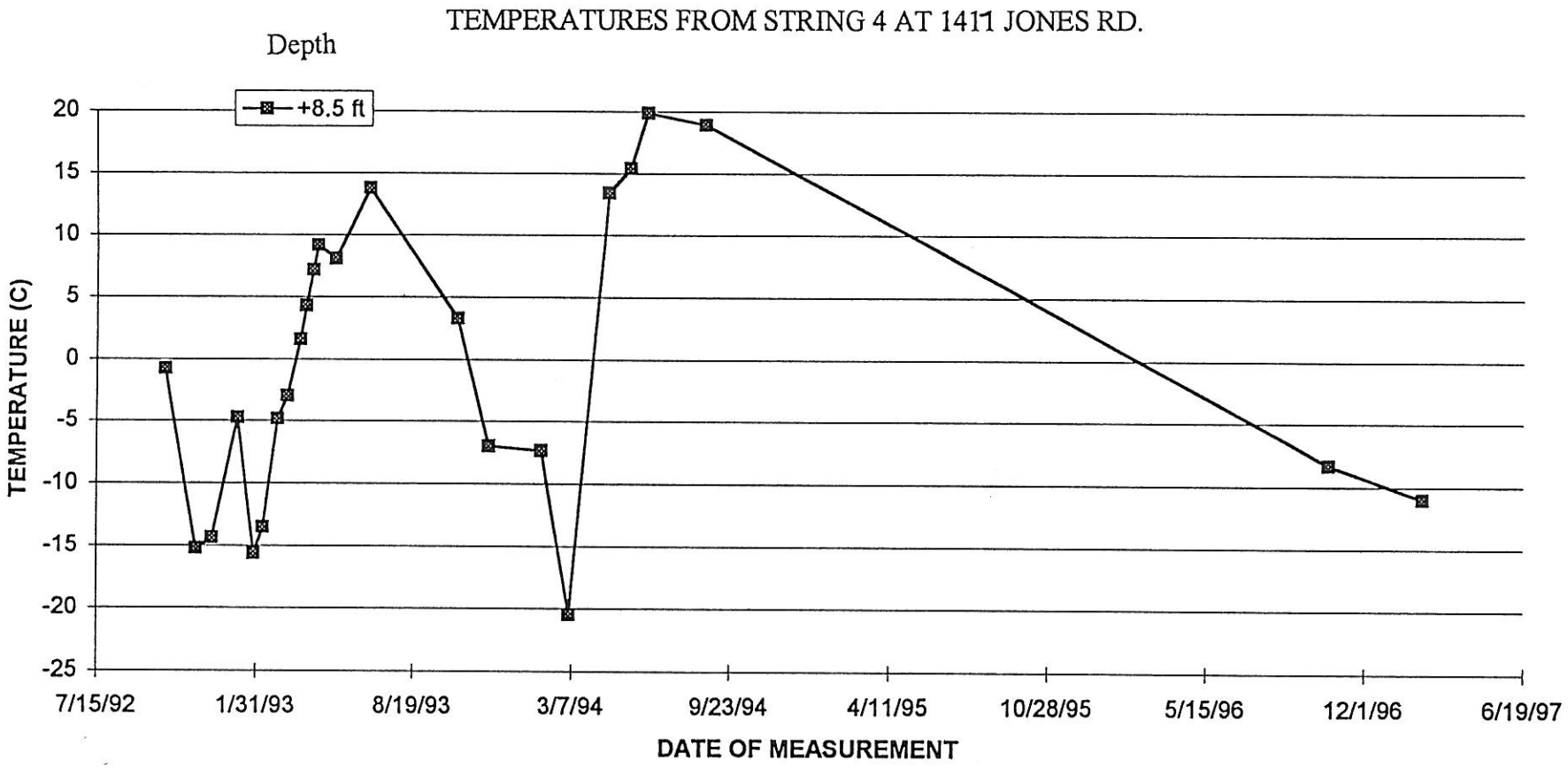

TEMPERATURES FROM STRING 4 AT 1411 JONES RD.
Depth
+8.5 ft
20
15
10
5
0
-5
-10
-15
-20
-25
TEMPERATURE (C)
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE C-16

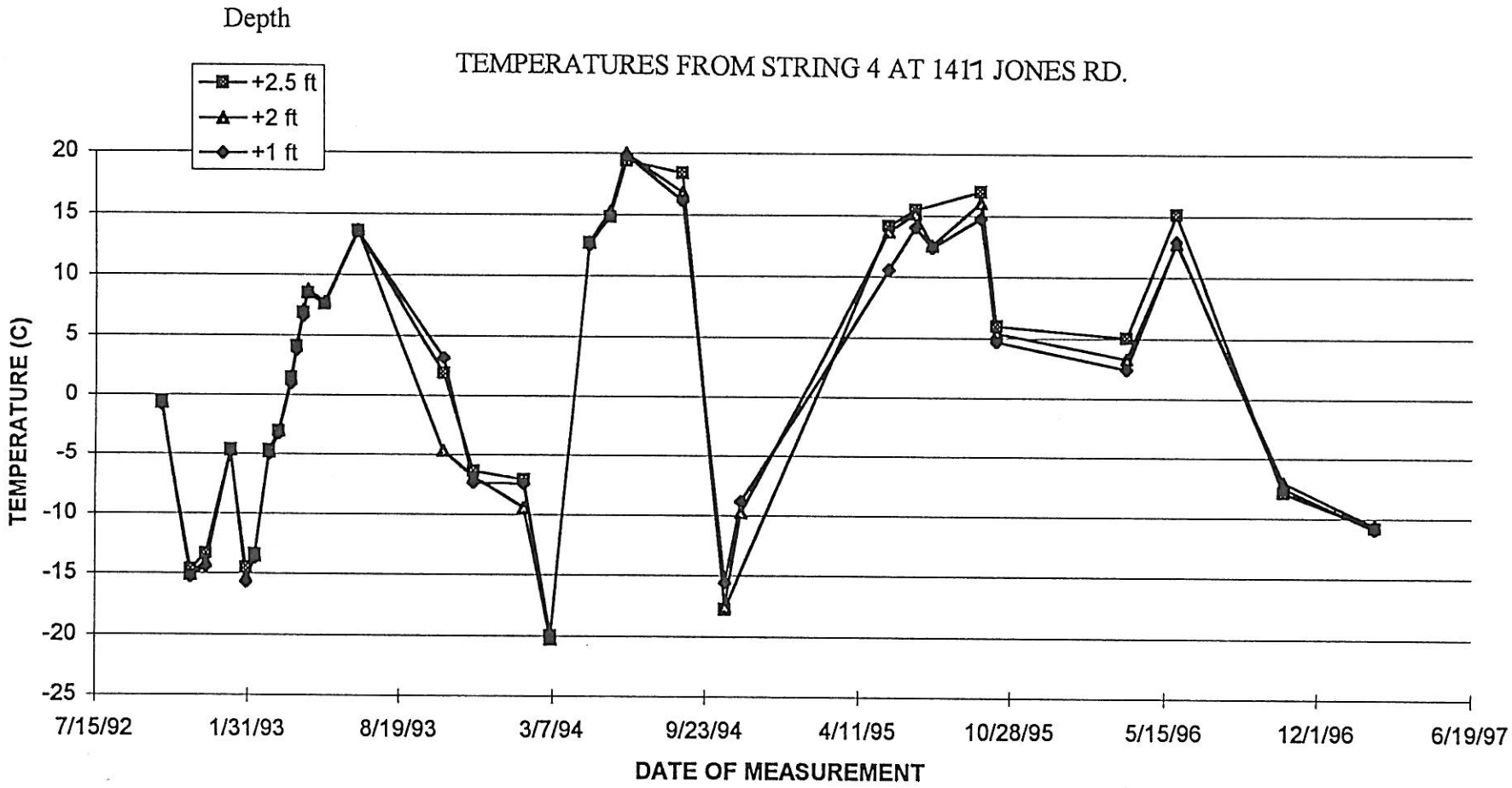

Depth
TEMPERATURES FROM STRING 4 AT 1411 JONES RD.
+2.5 ft
+2 ft
+1 ft
20
15
10
5
0
-5
-10
-15
-20
-25
TEMPERATURE (C)
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE C-17

TEMPERATURES FROM STRING 4 AT 1411 JONES RD.

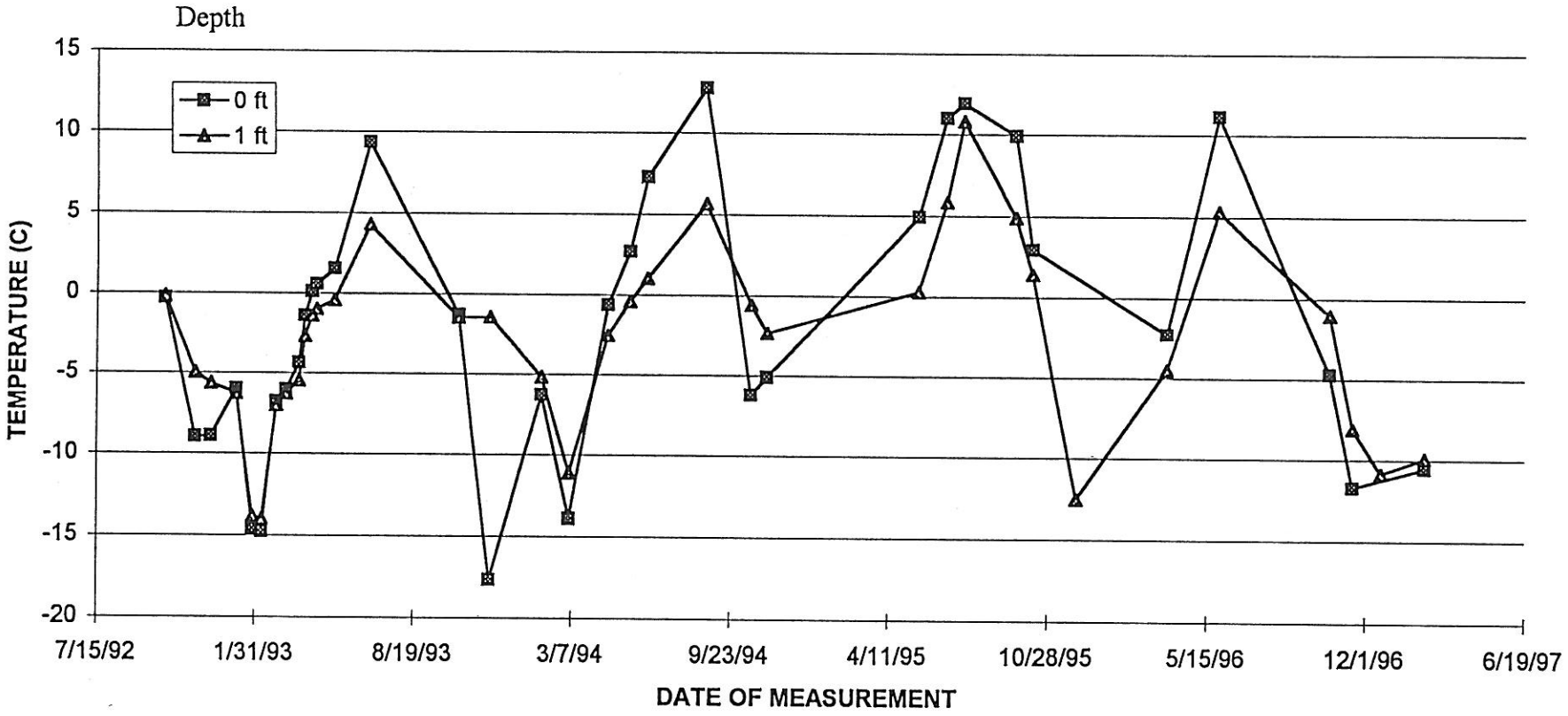


FIGURE C-18

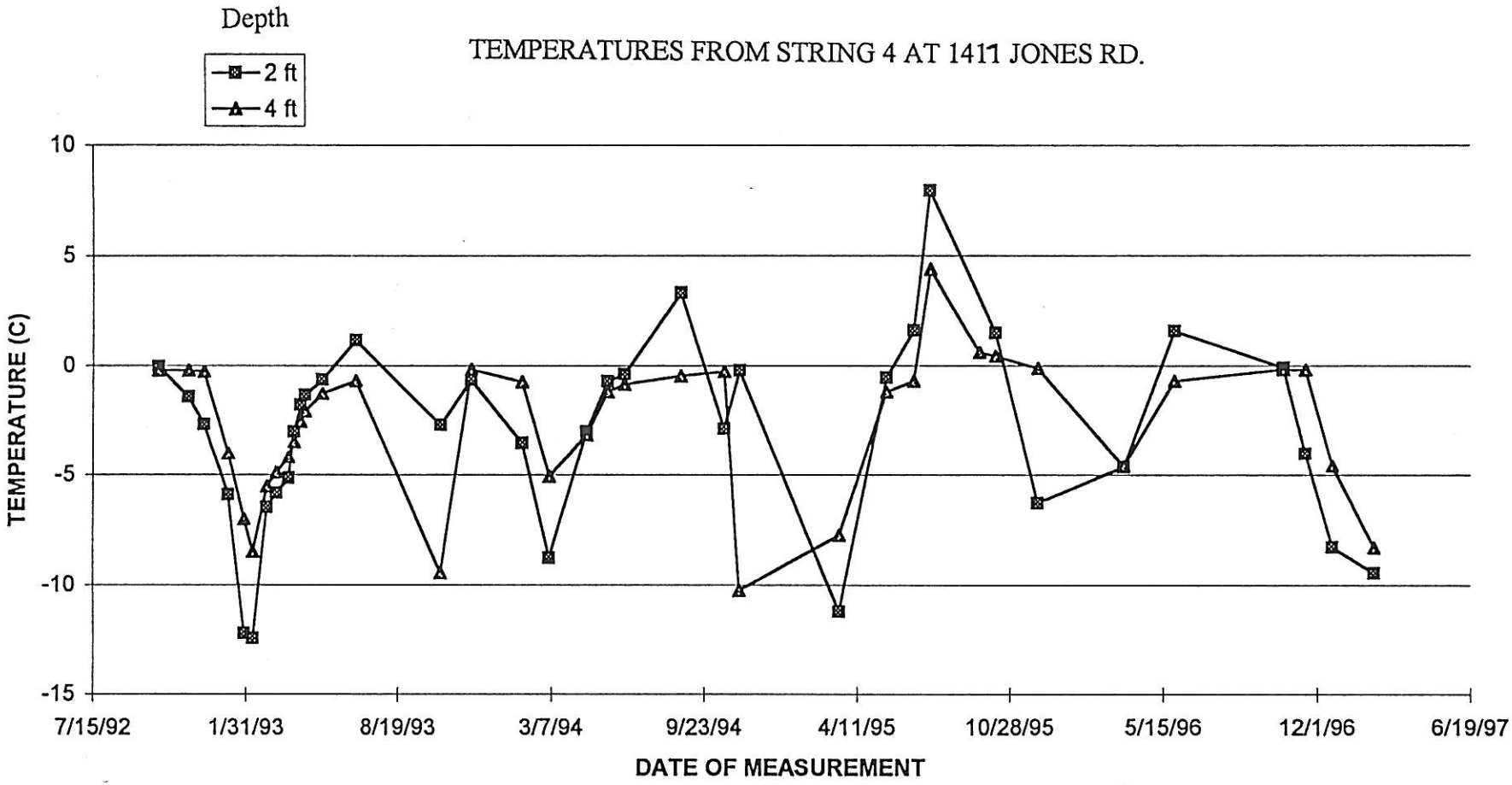

Depth
2 ft
4 ft
TEMPERATURES FROM STRING 4 AT 1411 JONES RD.
10
5
0
-5
-10
-15
TEMPERATURE (C)
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE C-19

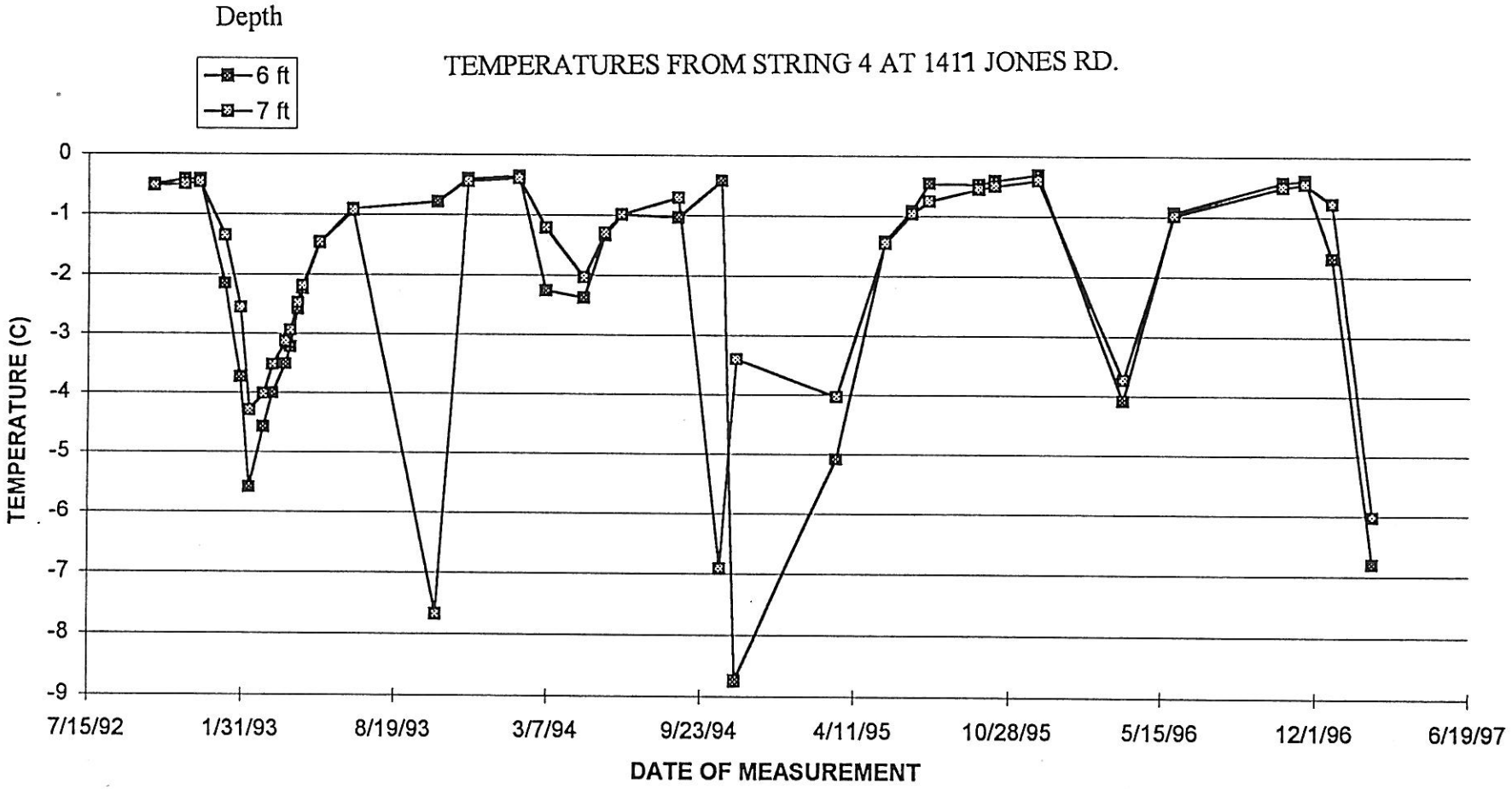

Depth
6 ft
7 ft
TEMPERATURES FROM STRING 4 AT 1411 JONES RD.
TEMPERATURE (C)
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE C-20

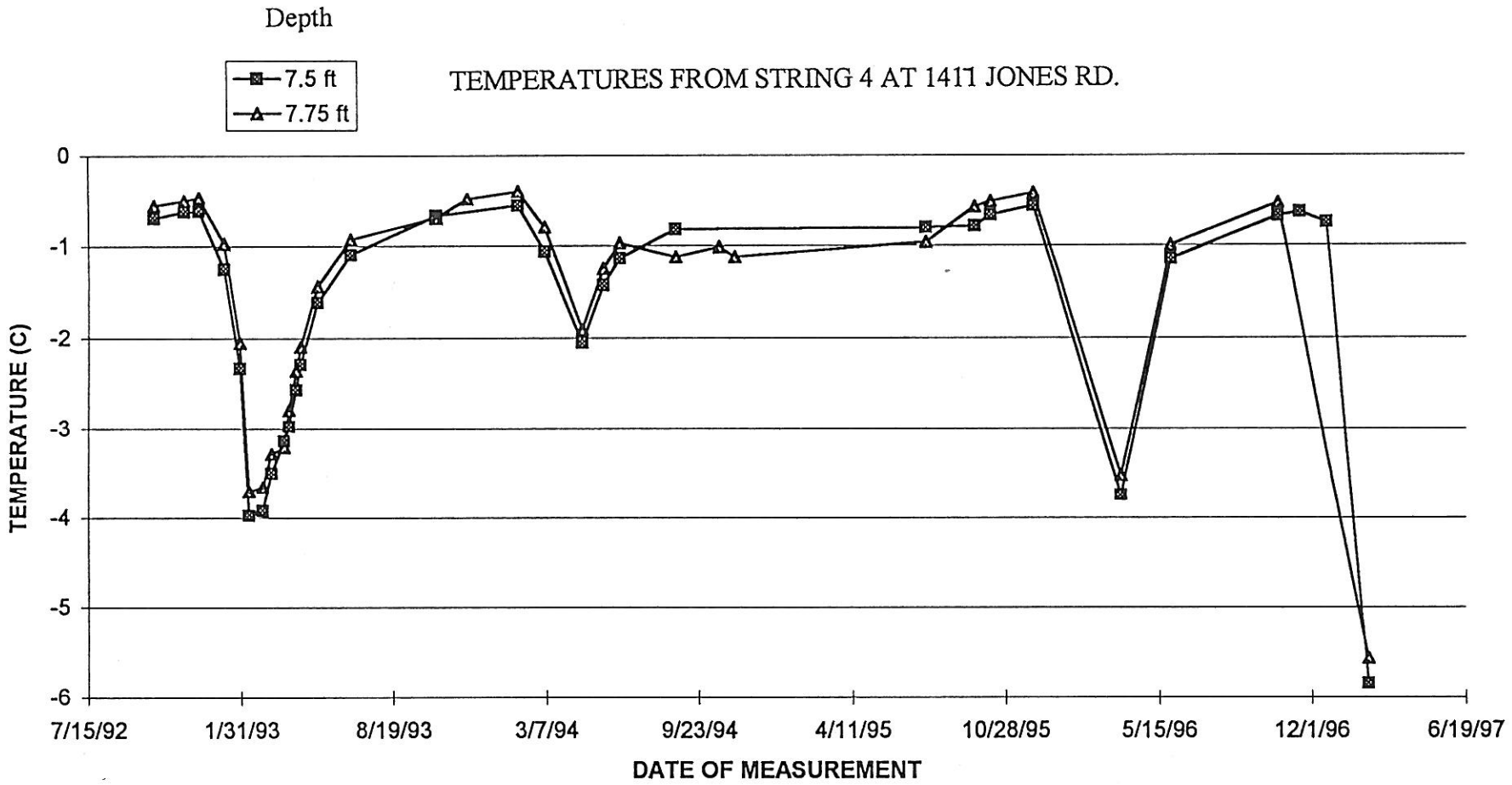

Depth
7.5 ft
7.75 ft
TEMPERATURES FROM STRING 4 AT 1411 JONES RD.
0
-1
-2
-3
-4
-5
-6
TEMPERATURE (C)
7/15/92
1/31/93
8/19/93
3/7/94
9/23/94
4/11/95
10/28/95
5/15/96
12/1/96
6/19/97
DATE OF MEASUREMENT

FIGURE C-21

Appendix D
Engineering Reports

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

April 7, 1988

Coldwell Banker
105 Adak
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838 Inspection
Located at 1411 Jones Road
East 330 ft. of $N\frac{1}{2}S\frac{1}{2}SW\frac{1}{4}SW\frac{1}{4}$, Sec. 11, T1N, R2W, F.M., Alaska

Gentlemen:

Per your request, we inspected the subject property, making note of structural defects or inadequacies. This report presents the findings of our investigation and recommendations for correcting any structural problems where noted. Our report is limited to the main dwelling on the lot, a two story, wood frame, single family home.

PILING AND SUPPORTING BEAMS

As mentioned, the structure is a two story, three bedroom, one bath, frame construction, single family home. The North two bedrooms are additions to the original building. The foundation is a treated wooden pile foundation.

No soil investigation (soil boring) was made at this time. Due to the seasonal, frozen conditions no measurement were taken to determine the length and condition of the piling below grade. The soils are classified as Minto Soils, as shown in the "S.C.S. Fairbanks Soils Survey Series 1959, No. 25." Minto Soils can contain permafrost soils. No attempt was made to determine if the piling foundation should be altered and it was assumed to be appropriate for the soils conditions; however, measurements made on the finish floor indicate differential settlement has occurred. Our approach to this problem would be to retain the piling foundation and to continue leveling the building as necessary. It may be very difficult and expensive to reduce or prevent further thaw settlement considering the thermal changes that have already taken place.

The beams that rest on top of the pilings support the house and are overstressed, do not have lateral support and in places, do not have sufficient bearing area. They are built-up beams consisting of three 2"x10"s spanning 12'-6". The beams under the bedroom addition are not overstressed but do need lateral support and increased bearing surfaces.

Some type of added support at mid-span for the overstressed beams would only add to the differential settling and periodic leveling problems; therefore, we recommend replacing the beams under the main living area with three 1-3/4"x11-7/8"s microlams continuous from support to support. Lateral support shall be provided with the installation of five 2'x12"s installed from beam to beam. The bedroom addition would need four 2"x10"s installed from beam to beam. See the attached drawing showing the minimum bearing areas for each load point. Uplift restraint should be provided by 3/4" plywood nailed to the joist, rim joists and the beam for the entire length. Replace the existing beam-piling ties with a flat steel plate 1/8"thick. Each plate should be bolted with ½" bolts, a total of 4 per connection. Only the main living area and the bedroom addition need this connection (19 connections). Notch the piling as necessary for this connection.

The center beam connection for the bedroom, where it bolts into the main building, needs the lag bolts removed and replaced with through bolts.

SECOND STORY FLOOR JOIST FRAMING

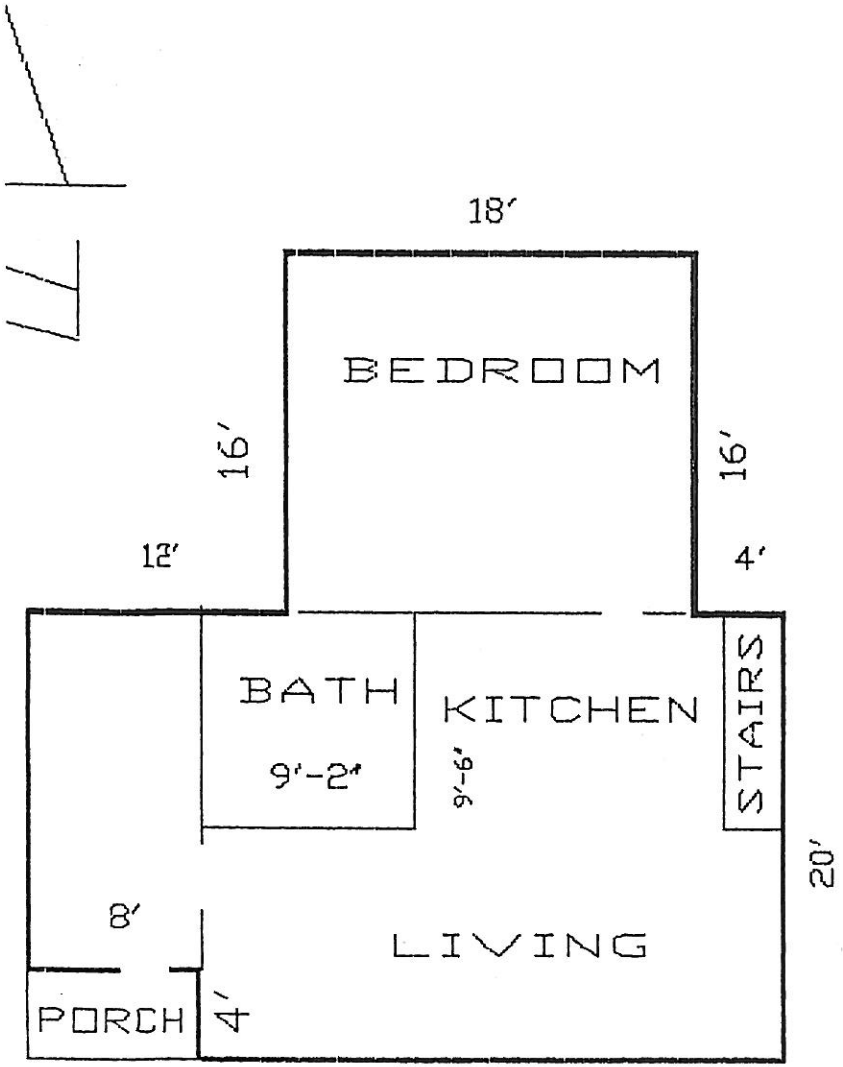
The second story of the main living area is supported by 2"x8"s on 24" centers spanning 10 feet. These joists are supported by a 4"x6"s beam. This beam is supported on the West end by two 2"x4"s nailed to a partition wall.

This beam is overstressed, improperly supported and not transferring the load directly onto a piling. The beam should be replaced with a 3"x12" glulam or two 1-3/4" x 11-7/8" microlam beams. A 4"x4" column should be placed at both ends and over the piling located approximately 12'-6" from the East side of the building.

The second story floor joists for the bedroom addition on the North side of the building are 2"x6"s on 24" c-c spanning 18'. These joists are heavily overstressed. A 3"x12" glulam beam of three 1-3/4"x11-7/8" microlam beams should be installed under the joists at the center span in a North-South direction. They should extend into the wall framing and be supported by a 4"x4" column. If the pulldown stairs are not removed, the beam should be centered as close as possible to the center span and no further than 1'-0" from center span.

The above should correct the structural deficiencies observed. This investigation and report is limited to an analysis of the items specifically addressed and are not a certification of the structural inadequacies of other elements of the building.

The corrections to the structural deficiencies should be made as mentioned above or as approved by an engineer. Any other structural deficiencies uncovered should be brought to the attention of the engineer.



EXISTING

BEDROOM FLOOR JOISTS 2"X8"-24" C-C
CEILING JOISTS 2"X6"-24" C-C

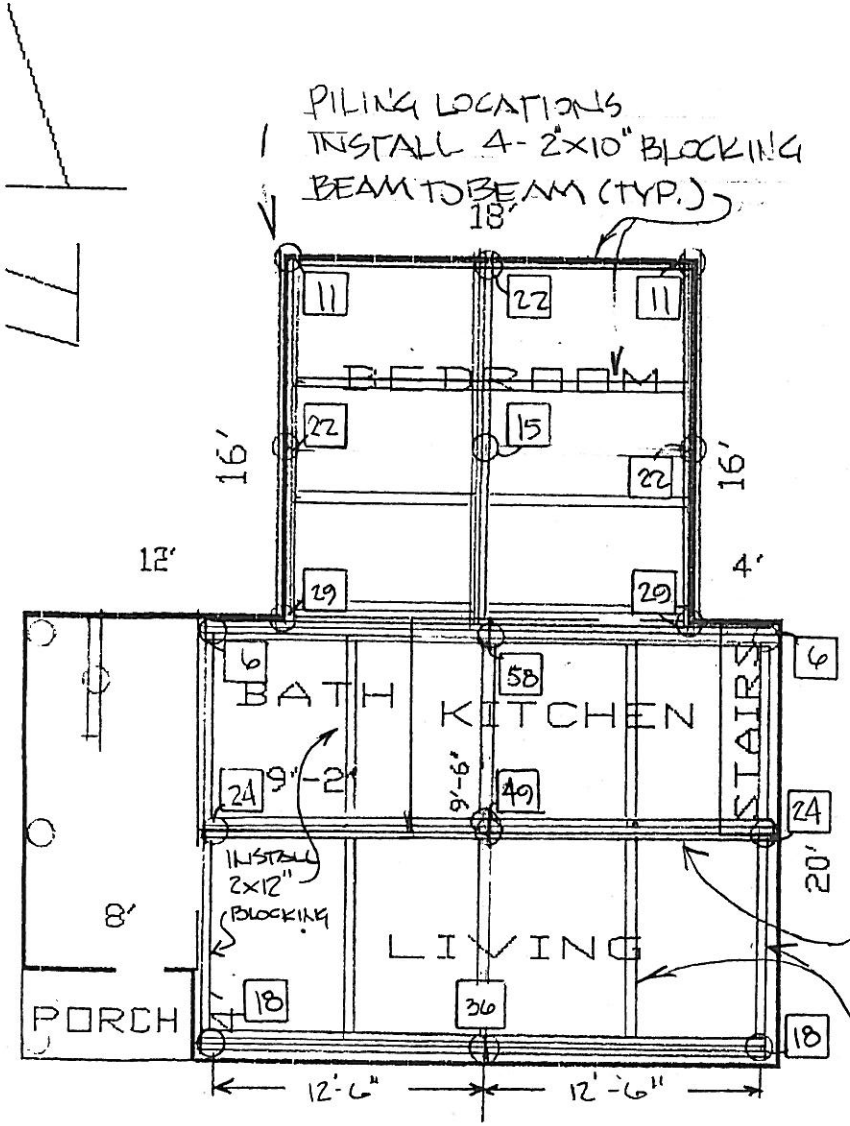
LIVING ROOM FLOOR JOISTS 2"X8"-16" C-C
CEILING JOISTS 2"X8"-24" C-C

1411 Jones Rd. AHFC#91838

Two Story Frame Bldg.

on a Piling Foundation

36 MINIMUM REQUIRED BEARING AREAS IN SQ. IN. (TYPICAL)



EXISTING

BEDROOM FLOOR JOISTS 2"X8"-24" C-C
CEILING JOISTS 2"X6"-24" C-C

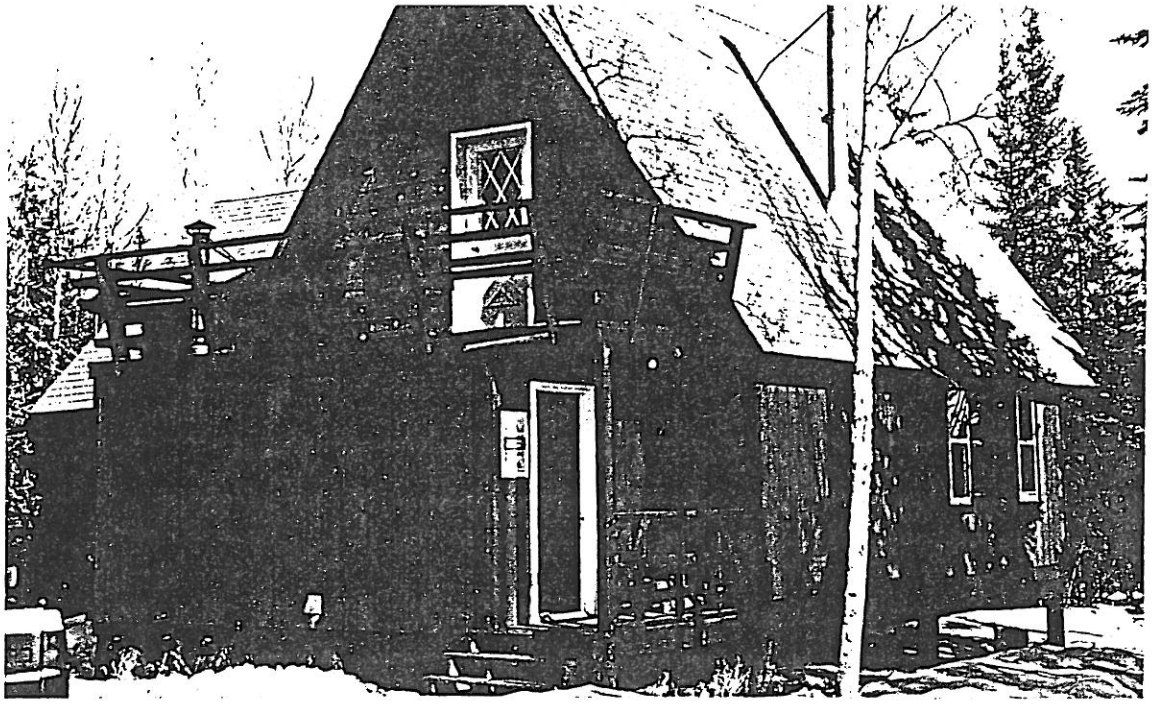
LIVING ROOM FLOOR JOISTS 2"X8"-16" C-C
CEILING JOISTS 2"X8"-24" C-C

1411 Jones Rd. AHFC#91838

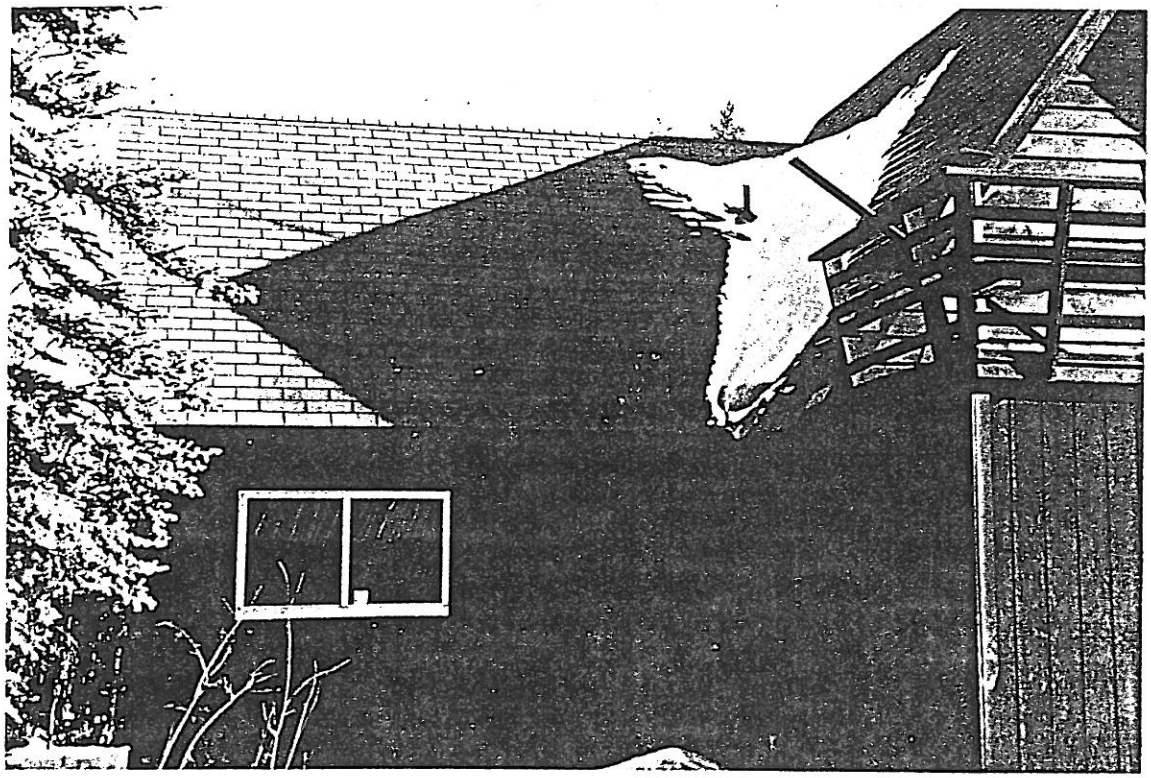
Two Story Frame Bldg.

on a Piling Foundation

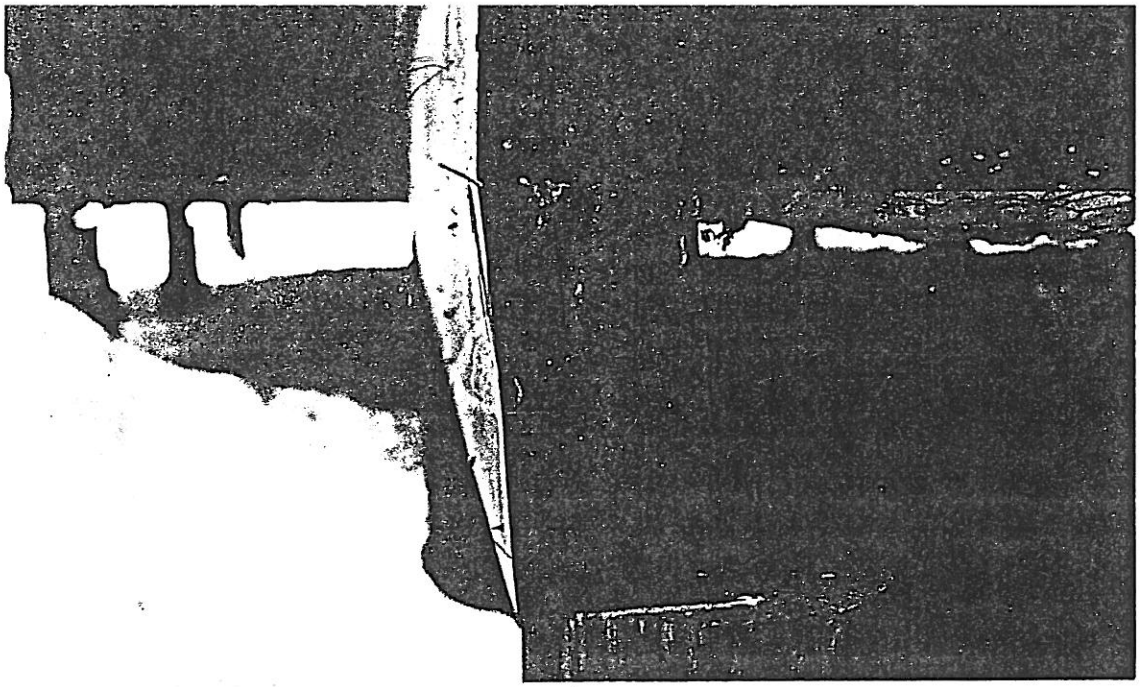
EXISTING SUPPORTING BEAMS
3-2"X10" (TYP.)
INSTALL 5-2"X12" BLOCKING
BEAM TO BEAM (TYP.)



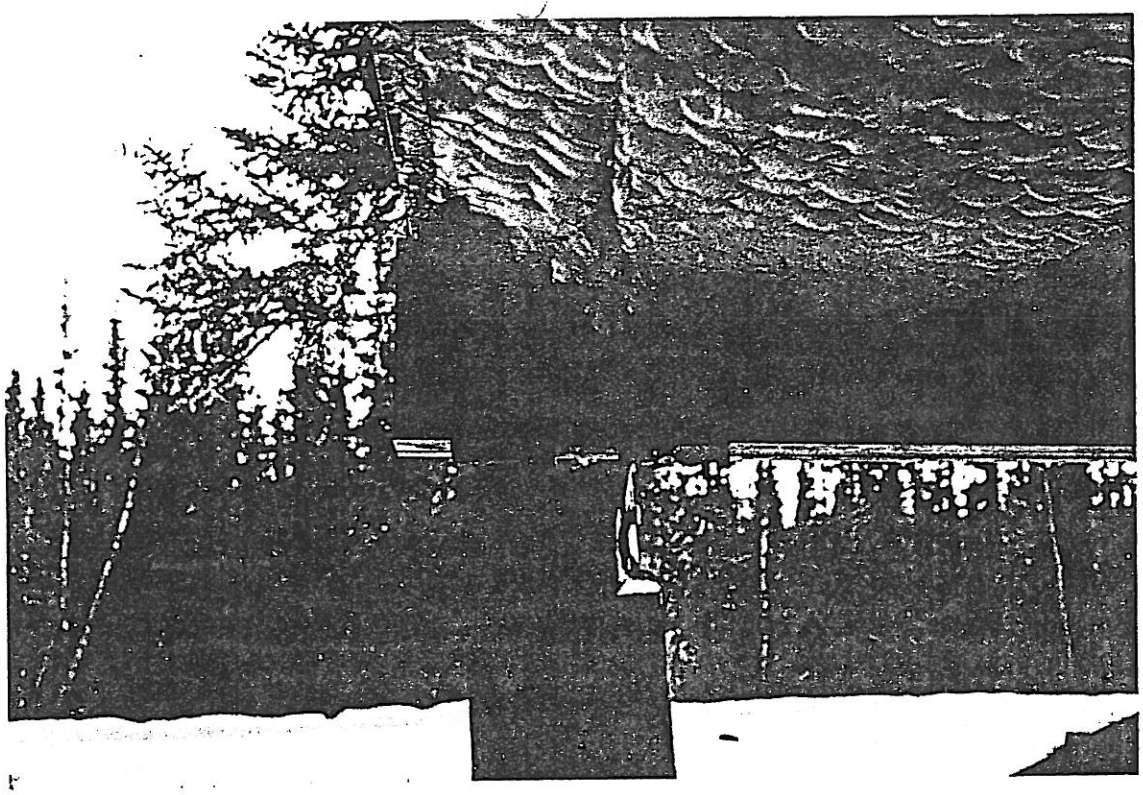
VIEW SHOWING ORIGINAL BUILDING WITH PORCH ADDITION.



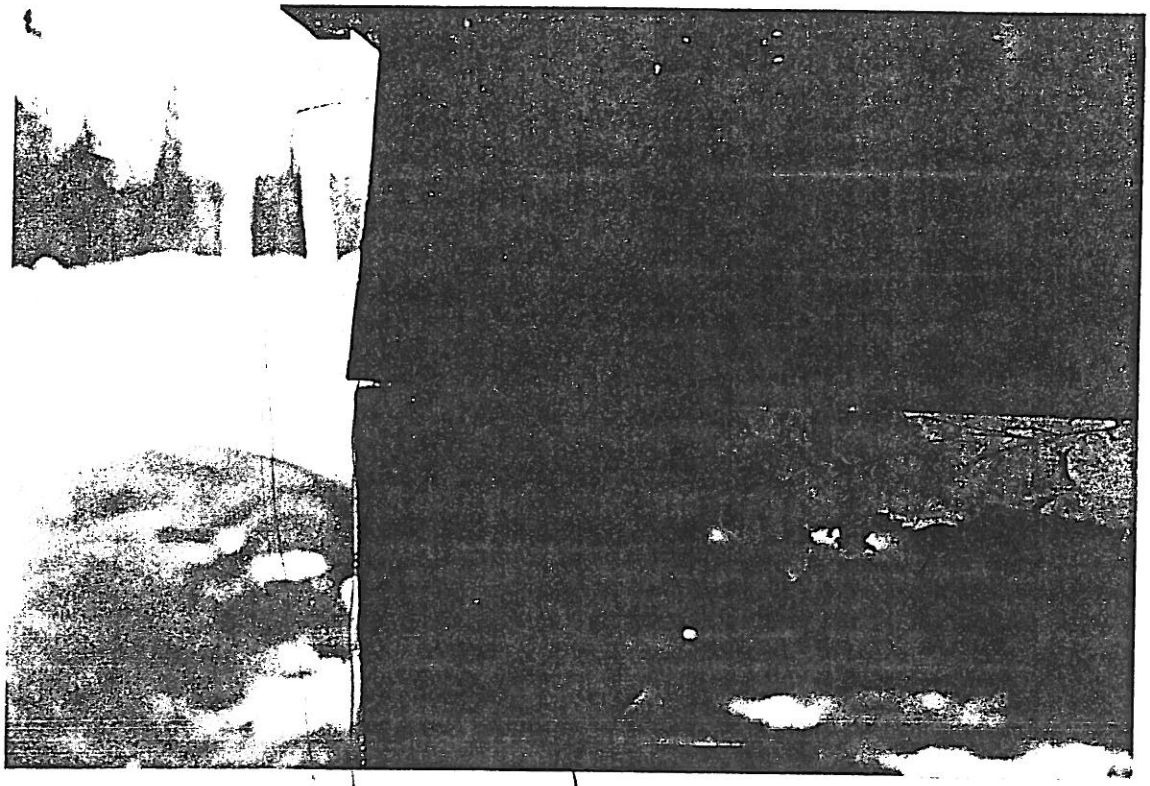
TWO STORY BEDROOM ADDITION ON THE NORTH SIDE OF BUILDING.



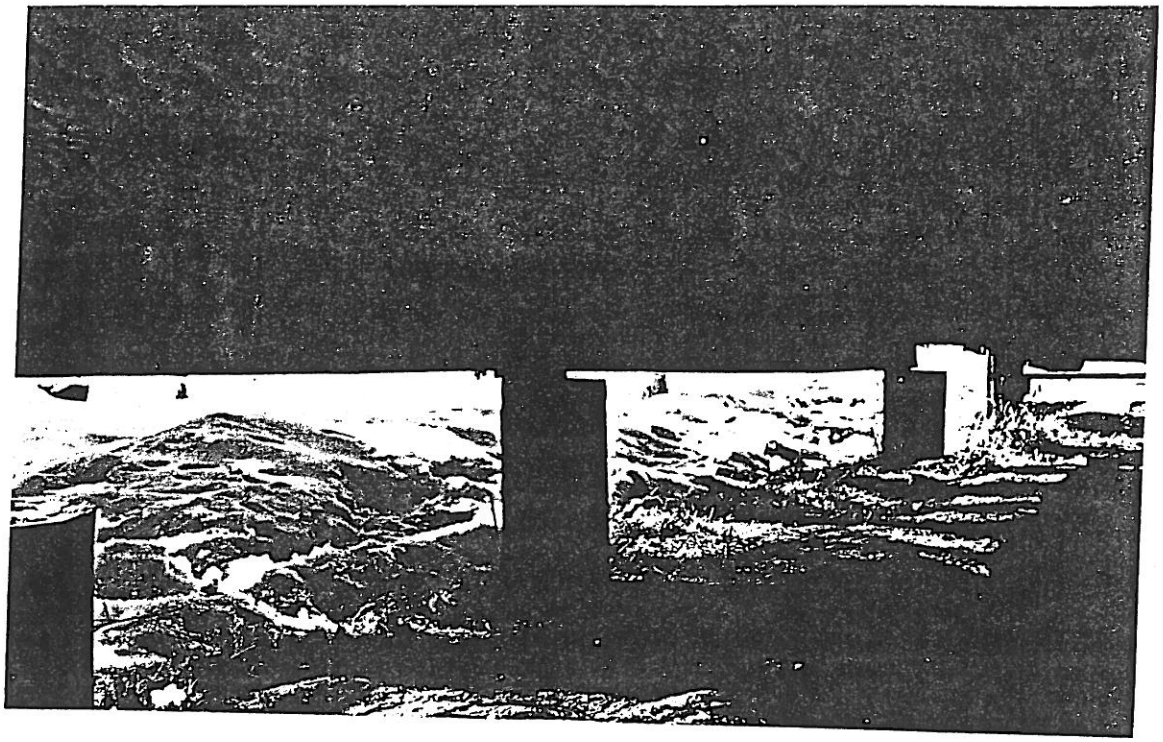
N.E. CORNER OF THE ADDITION OF THE NORTH SIDE OF THE ORIGINAL STRUCTURE.



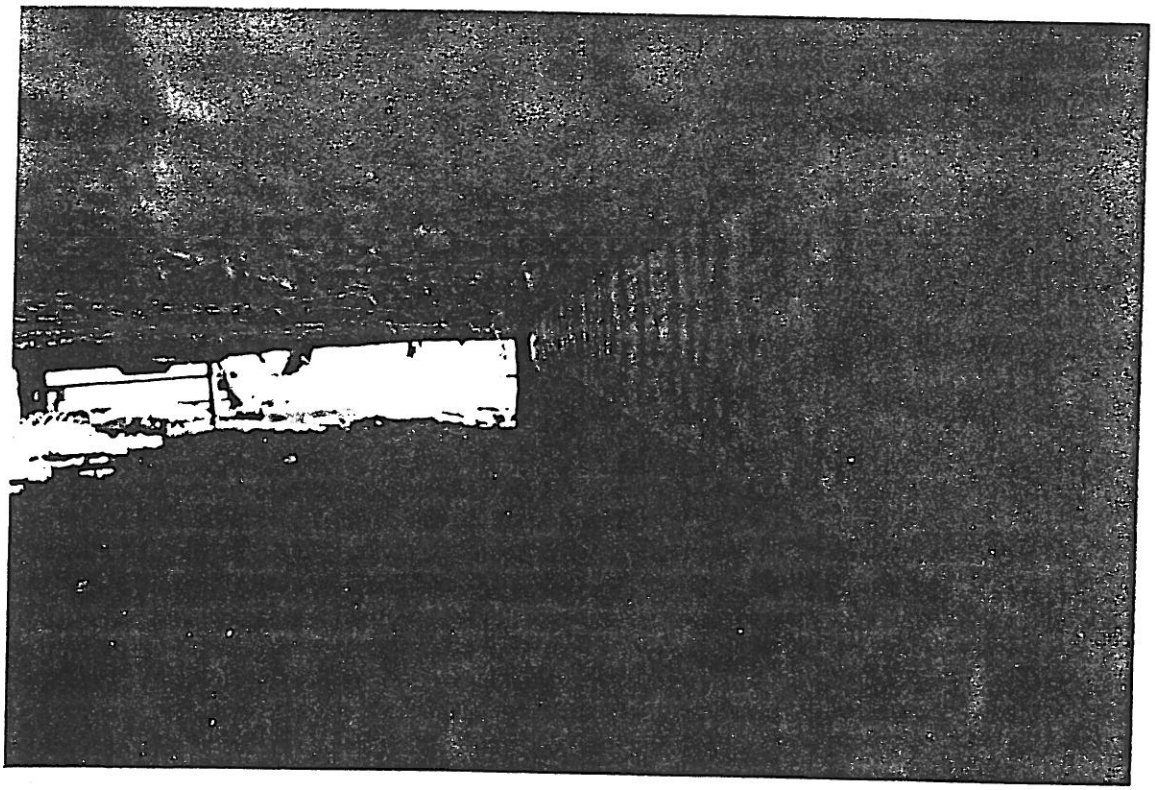
S.E. CORNER OF BUILDING.



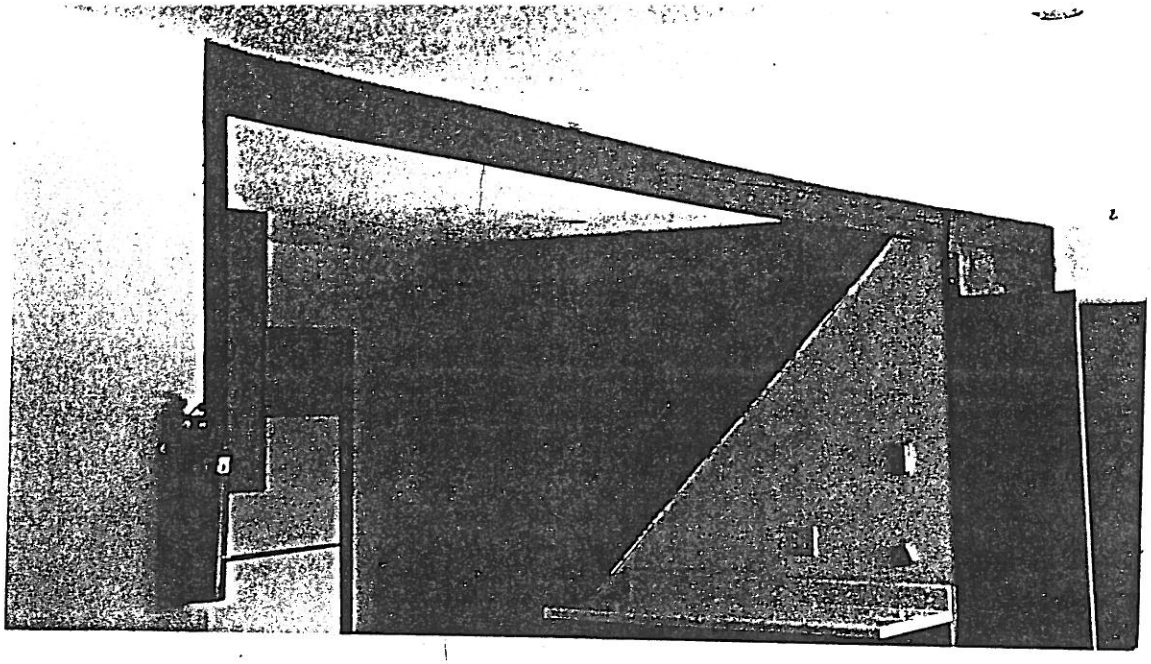
BEAM, JOIST AND RIM JOIST AT THE S.E. CORNER OF THE BUILDING.
JOIST SHOWS CRUSHING DUE TO INSUFFICIENT BEARING AREA.



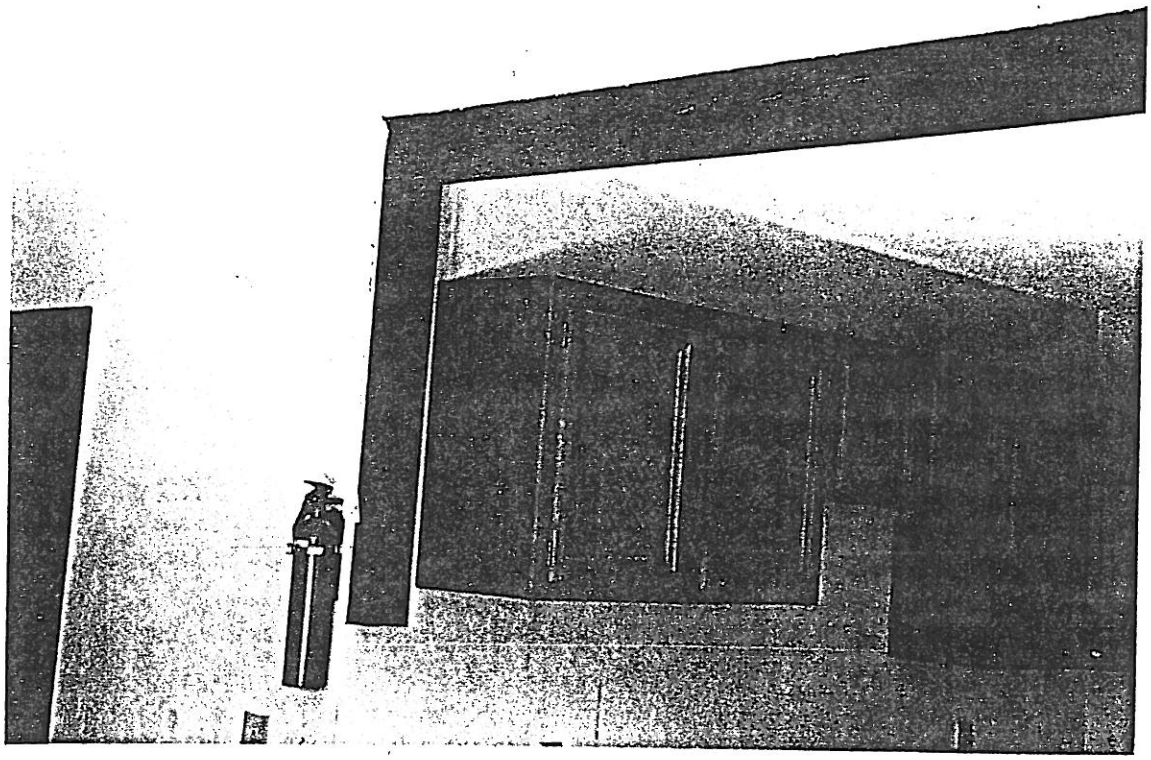
SOUTH WALL BEAM AND POSTS

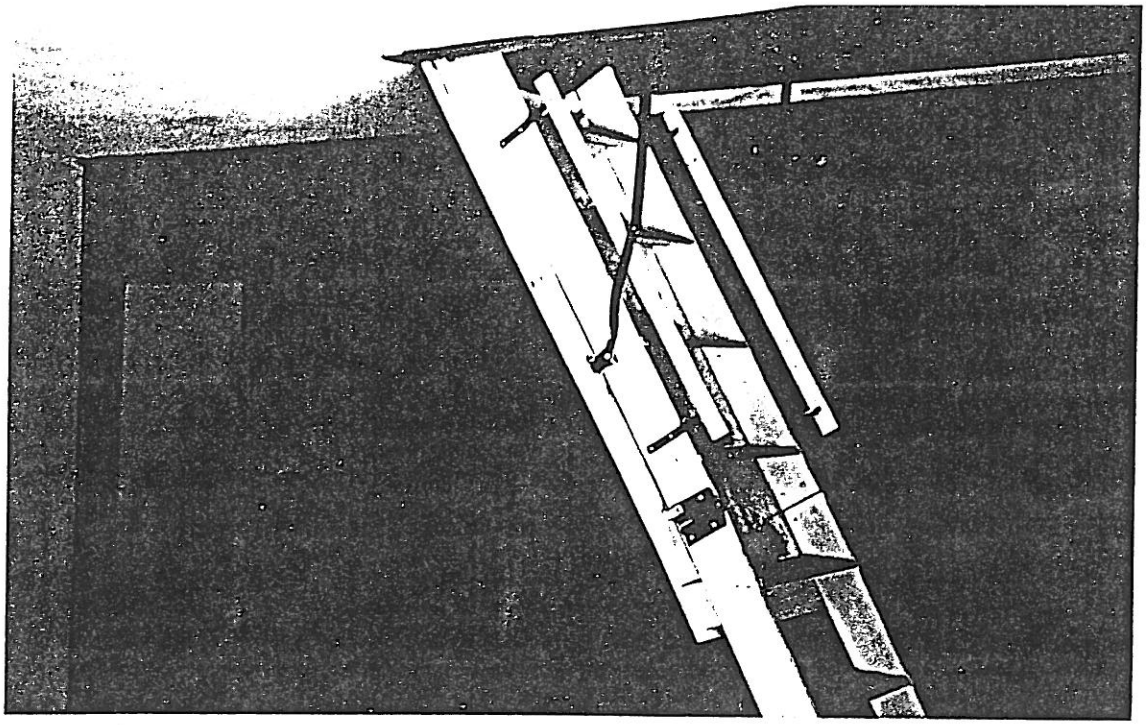


CENTER BEAM UNDER THE MAIN LIVING AREA

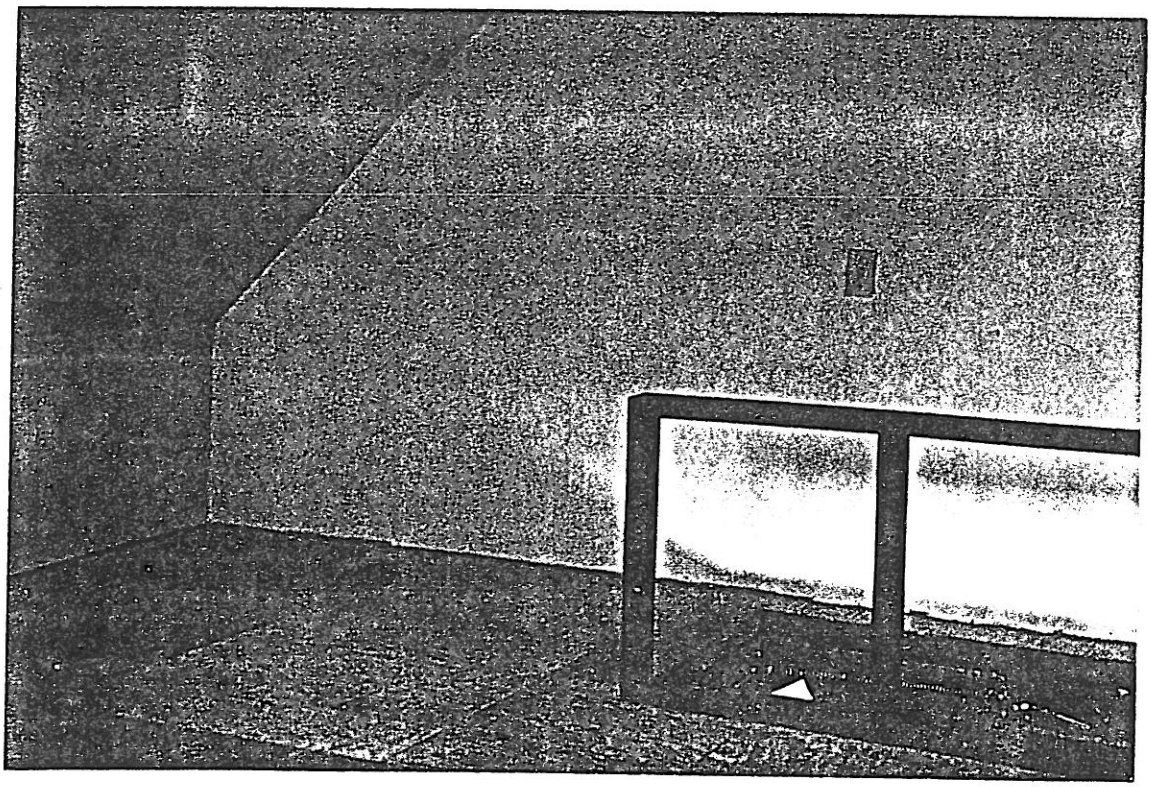


OVERLOADED BEAM IN THE MAIN AREA

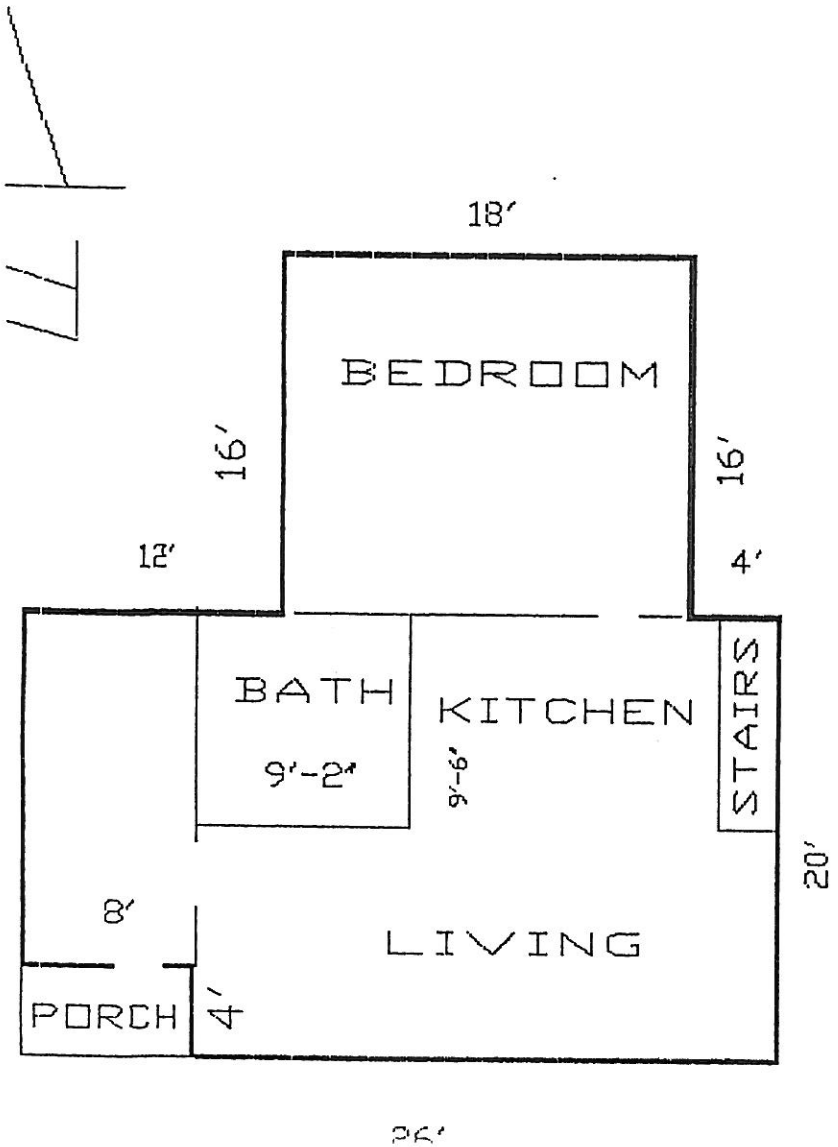




THE ONLY ACCESS TO THE SECOND STORY BEDROOM IN THE ADDITION, AS SHOWN FROM THE FIRST FLOOR. SECOND FLOOR JOISTS ARE 2"x6" 24" cc 18 ft.



SECOND STORY BEDROOM ACCESS. THE WINDOW OPENING IN THIS ROOM MEASURES 1'-4" x 3'4".



EXISTING

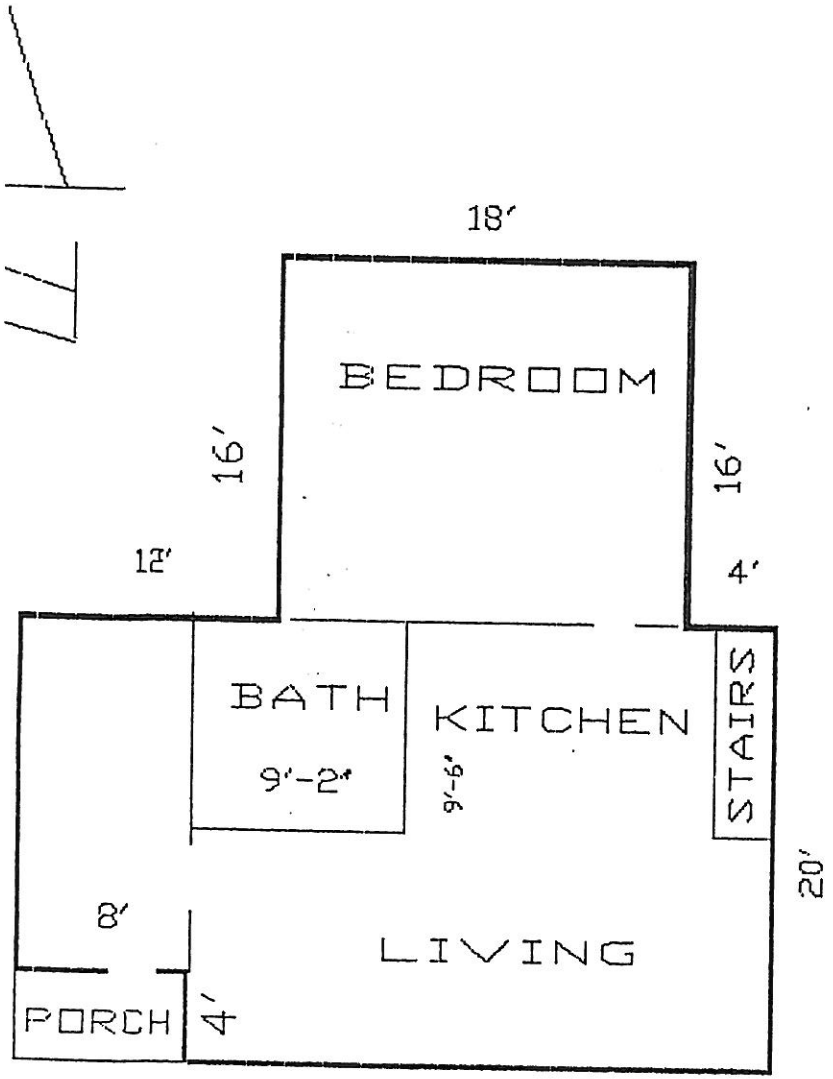
BEDROOM FLOOR JOISTS 2"X8"-24" C-C
CEILING JOISTS 2"X6"-24" C-C

LIVING ROOM FLOOR JOISTS 2"X8"-16" C-C
CEILING JOISTS 2"X8"-24" C-C

1411 Jones Rd. AHFC#91838

Two Story Frame Bldg.

on a Piling Foundation



EXISTING

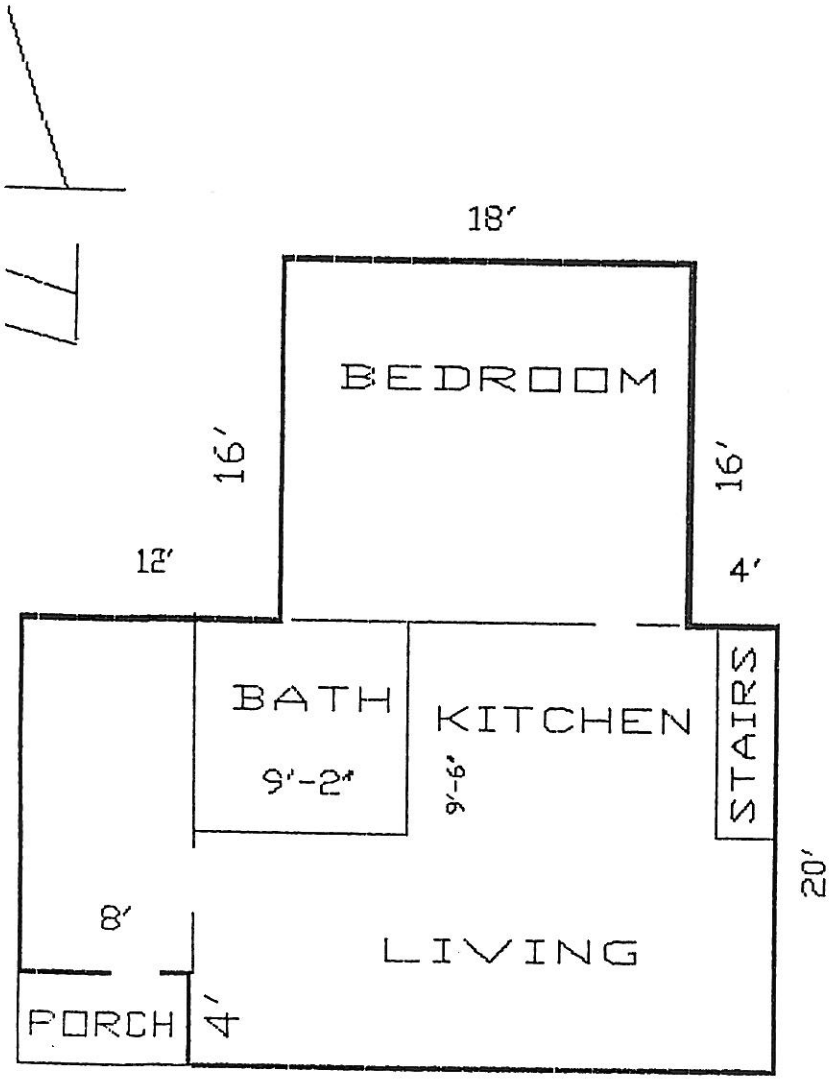
BEDROOM FLOOR JOISTS 2"X8"-24" C-C
CEILING JOISTS 2"X6"-24" C-C

LIVING ROOM FLOOR JOISTS 2"X8"-16" C-C
CEILING JOISTS 2"X8"-24" C-C

1411 Jones Rd. AHFC#91838

Two Story Frame Bldg.

on a Piling Foundation



EXISTING

BEDROOM FLOOR JOISTS 2"X8"-24" C-C
CEILING JOISTS 2"X6"-24" C-C

LIVING ROOM FLOOR JOISTS 2"X8"-16" C-C
CEILING JOISTS 2"X8"-24" C-C

1411 Jones Rd. AHFC#91838

Two Story Frame Bldg.

on a Piling Foundation

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

May 13, 1988

Coldwell Banker
105 Adak
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838/Thompson
1411 Jones Road, Fairbanks

Gentlemen:

I have inspected the progress of the recommended structural repairs on the above referenced house. In accordance with my recommendations, the repairs appear to be proceeding in a satisfactory manner, and are about 88% complete.

The placement of the load bearing column in the kitchen area prevents the diswasher door from opening. The column is located directly above a piling below. This location is necessary to transfer the upper floor loads directly to the piling below; therefore the diswasher should be moved to another location.

Please contact our office if you have any questions.

Very truly yours,

Scott E. Wortman, P.E.

38/CB9

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

July 8, 1988

Coldwell Banker
105 Adak
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838 Inspection
Located at 1411 Jones Road
East 330 ft. of N½S½SW¼SW¼, Sec. 11
T1N, R2W, F.M., Alaska

Gentlemen:

On July 5, 1988, I inspected the structural repairs which were made to the above mentioned property. In my letter of April 7, 1988, I made several recommendations for structural repairs. I have found these repairs appear to have been made satisfactorily. In fact, I was pleased with the quality of the work that had been performed.

During this inspection it was noted that the entrance/furnace room area , which is not part of the main structure but is attached, recently has had some settlement on the West side. The settlement has caused the entrance door to become very difficult to open and close. My letter of April 7, 1988, addressed the fact that no drilling was performed to determine exact soils conditions below ground and the length of piling is unknown.

My recommendation at this point is that due to the fact that excessive settlement has not occurred thus far, periodic leveling of the building would be the appropriate solution to the foundation differential settlement problems; however in my opinion a soils investigation should be performed to at least provide any potential buyer with more information regarding the foundation.

If we can be of further assistance, please contact our office.

Sincerely,

STUTZMANN ENGINEERING ASSOC., INC.

Scott Wortman, P.E.

39/c3

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

July 25, 1988

Coldwell Banker
105 Adak Avenue
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838 (Thompson)
1411 Jones Road, Fairbanks

Gentlemen:

On July 16, 1988 a soils test hole was dug with a backhoe on the above referenced location. The test hole was dug next to the center piling on the West side of the house (furnace room portion). The purpose of this test hole wa to determine the depth of piling and subsurface soil conditions.

Moist to saturated silt was found from the surface to a depth of 4 feet when frozen silt was encountered. The digging was terminated at this point due to the difficulty of digging frozen ground with a backhoe. Soil moisture contents were taken at 3½' and 4' (frozen sample) and are noted on the soils log.

It is our opinion that the frozen soil is permafrost. This opinion is based on type of soil, location, depth of frost, time of year of digging and past experience.

It was found that the existing wood piling is setting on top of a rough poured, concrete footing, approximately 7" thick by 2½" diameter. This concrete footing is setting on top of the frozen ground. The portion of house supported by this piling is presently indicating some settlement. Other portions of the house also indicate some prior settlement, as noted in our previous report dated April 7, 1988.

A concrete footing was also found to be supporting the center piling support on the South side of the structure. This was verified by hand digging. The top of the concrete footing was at 3½ feet below ground surface.

Based on the finding of these two concrete footings, we, therefore, assume that all the pilings have concrete footings at approximately 4 foot depth. These footings are being supported by high moisture content, frozen silt.

It is our opinion that continual settlement of the structure will occur as the underlying permafrost thaws. Considerable clearing of trees has already been done around the perimeter of the structure so continual thawing of the permafrost is inevitable.

There are several ways of possibly correcting or alleviating the potential problem of differential settlement of the building.

One method would be to replace the existing piles with new piles at a much greater depth. This would require moving the structure and considerable expense.

Another method would be to replace the existing piling foundation with a post and pad foundation built upon a gravel pad with rigid foam insulation below. Some leveling of the structure may still be needed as thawing occurs.

This would probably be the method we would have recommended for any new construction on this property.

Under the present circumstances, we recommend placing 3 inches of extruded polystyrene foam (DOW Styrofoam SM or equivalent) under the entire structure and around all sides a distance of 8 feet from the structure. The insulation around the perimeter of the structure should be sloped away from the building. Some excavation will be necessary around the perimeter of the building to prevent a low spot from being created beneath the structure due to the difference of recommended ground cover over the insulation. These items are indicated on the two drawings enclosed with this report.

We feel this insulation will slow the thawing of the permafrost beneath the structure but it will not stop it. Movement of the building should be less and thus require less frequent leveling. The insulation should also allow the surrounding ground to thaw more quickly than that below the structure. This may permit escapage of some of the soil moisture below the structure as it thaws.

The placement of this insulation will also allow for future construction of post and pad foundation if unacceptable settlement continues to occur.

If you have any questions regarding this matter, please contact our office.

Very truly yours,

STUTZMANN ENGINEERING ASSOC., INC.

Scott Wortman, P.E.

Enc.
39/C4

STUTZMANN ENGINEERING ASSOC., INC.

P.O. BOX 1429, FAIRBANKS, ALASKA 99707 — (907) 452-4094

CLIENT: [illegible]

HOLE No.: [illegible]

LOCATION: [illegible]

JOB No. [illegible]

DATE 7/[illegible]/84

DRILLER: JVP CONSTRUCTION

LOGGED BY: [illegible]

SHEET No. 1 OF 1

SAMPLE LOCA. FROZEN

SOIL DESCRIPTION

0'

MOIST

FINE, BROWN, SILT

SATURATED

5'

NOTE:

THIS TEST HOLE WAS DUG WITH A BACKHOE TO A DEPTH OF 4 FEET AT WHICH FROZEN SOIL WAS ENCOUNTERED.

DIGGING WAS TERMINATED AT THIS A [illegible] DEPTH.

10'

15'

20'

25'

30'

35'

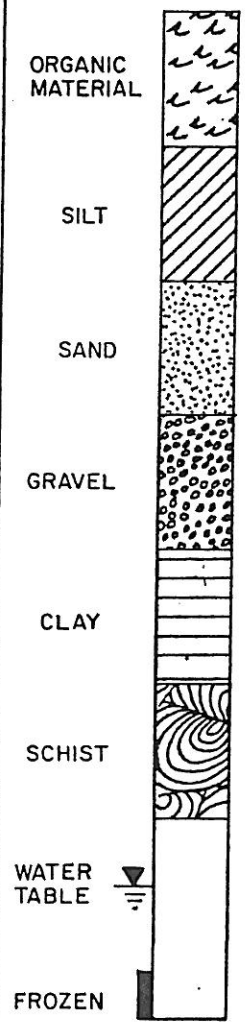
40'

SAMPLE DATA

3½' W=[illegible]%

4' W=36.3%

LEGEND



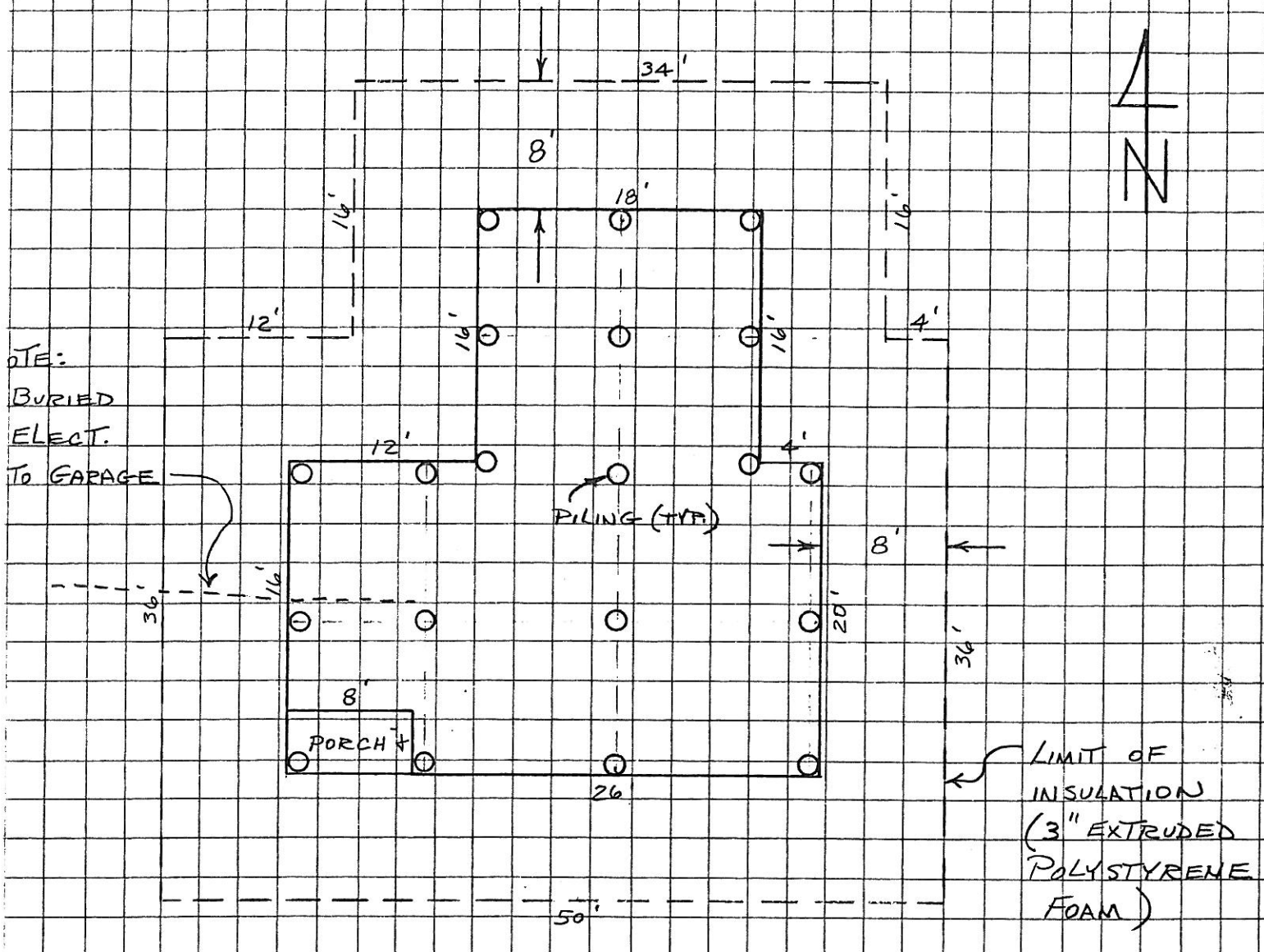
N = SPT blows/ft.
3" O.D. spoon
300#, 30" drop

W = % Moisture

GSS = % Gravel/ Silt/Sand

STUTZMANN ENGINEERING ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
P.O. BOX 1429, FAIRBANKS, ALASKA 99707 (907) 452-4094

PROJECT: AHFC# 91838	SHEET NO. 1 OF 2
CLIENT: COLDWELL BANKER	JOB NO.
LOCATION: 1411 JONES RD.	DATE: 7/21/88
FIELD BOOK:	SCALE: 1" = 10'
CALCULATED BY: J.H.A.	DISC:



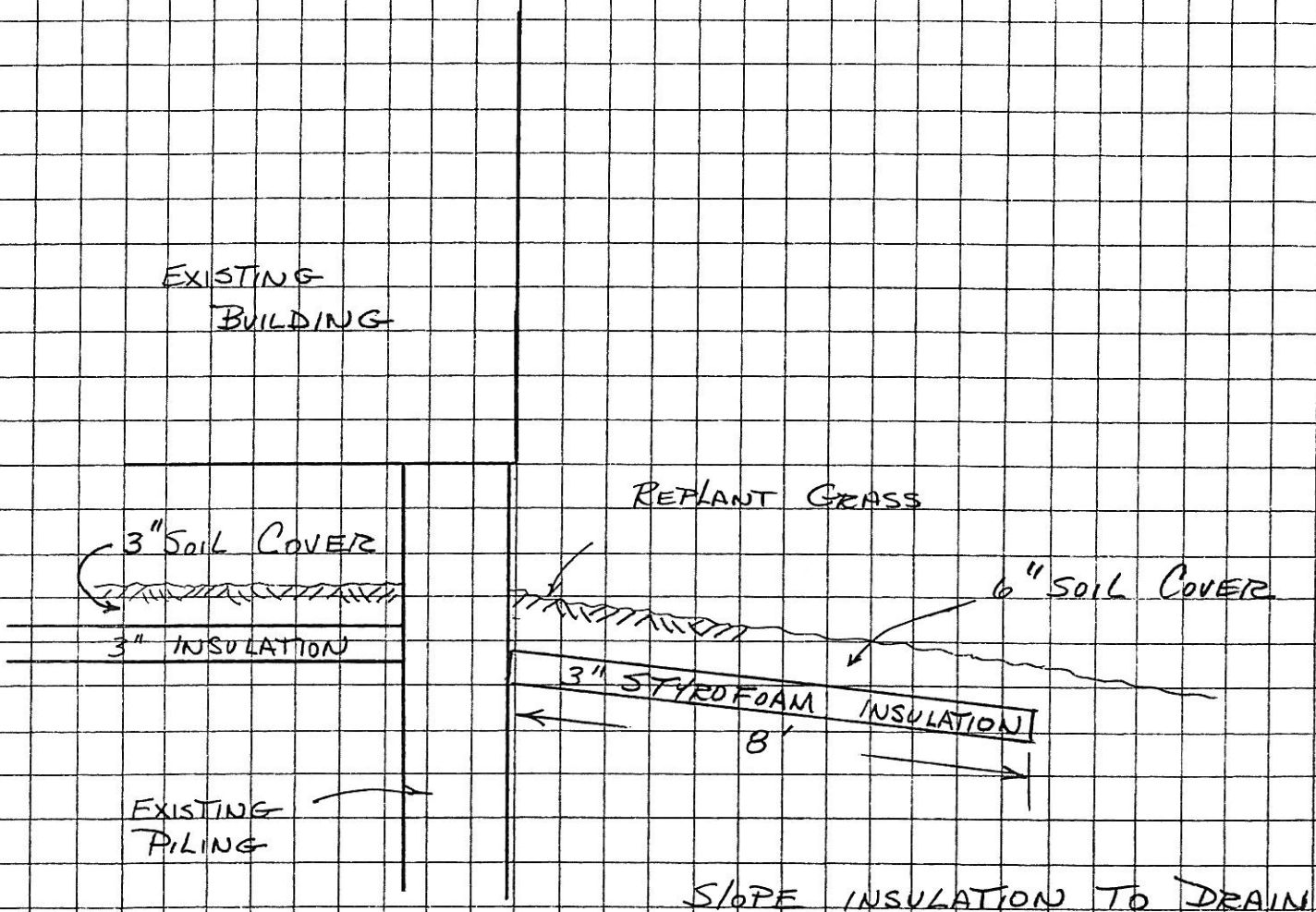
NOTE:
BURIED ELECT. TO GARAGE

TOTAL AREA OF INSULATION = 2344 SQ. FT.

COMMENTS:

STUTZMANN ENGINEERING ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
P.O. BOX 1429, FAIRBANKS, ALASKA 99707 (907) 452-4094

PROJECT: AHFC #9183B	SHEET NO. 2 OF 2
CLIENT: COLDWELL BANKER	JOB NO.
LOCATION: 1411 JONES RD.	DATE: 7/21/88
FIELD BOOK:	SCALE: N.T.S.
CALCULATED BY: J.H.A.	DISC:



SLOPE INSULATION TO DRAIN AWAY FROM BUILDING.

COMMENTS:

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

September 1, 1988

Coldwell Banker
105 Adak
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838 (Thompson)
1411 Jones Road, Fairbanks

Gentlemen:

On August 9, 1988 we drilled three test holes to determine the condition of the underlying soils at a residence located at 1411 Jones Road (see copies of attached bore logs). The underlying soils consisted of wet to saturated frost susceptible silts and clays, with pockets of permafrost containing free ice. The permafrost appears to be in a thaw cycle.

The above information changes the situation as presented in my letter of July 25, 1988. This building will most likely experience some differential settlement for many years, possibly stabilizing after 20 to 30 years. Most likely this settlement will occur regardless of the type of foundation installed; however, there are some methods that can be used to reduce or almost eliminate the settlement.

Some of the current movement in the existing structure is caused by seasonal frost heaving. This movement can be eliminated.

Two methods of foundation repair, along with their estimates and probable construction costs, are listed below. Both methods would eliminate seasonal frost heaving and reduce differential settlement due to thawing permafrost. They would also provide for fairly simple methods of adjustments should that become necessary.

FOUNDATION NO. 1 - See attached Drawing No. 1

I would recommend moving the building about 50 feet to an area that has not been disturbed.

Estimate of probable construction costs:

Construct gravel pad 180 c.y. @ 10.00 c.y.	$1,800.00
Hand clear new site	200.00
Insulation	471.00
Move Building	7,000.00
Construct & connect posts, pads & braces	1,500.00
Reconnect sewer. water & electricty	1,500.00
Miscellaneous & contingencies	1,000.00
	$13,471.00

FOUNDATION NO. 2 - See attached Drawing No. 2

The piling could be placed without moving the building. Nine piles and six glulam beams would be required to support the building.

Estimate of probable construction costs:

9 piles @ 60' depth @ $25.00 ft.	$13,500.00
6 glulam beams	3,012.00
Beam for connections & miscellaneous materials	1,000.00
Labor for installation, etc.	8,000.00
	$25,512.00

Although foundation No. 2 cannot be guaranteed against settlement because of underlying permafrost containing free ice which is in a thaw cycle, from a practical standpoint, in all likelihood this foundation will remain stable. And if a piling were to subside it could be easily added onto and driven deeper. This is due to the fact that the piling will be outside the building wall rather than underneath the building.

Foundation No. 1 is less expensive but will most likely require more periodic maintenance, leveling the building, etc. It also involves moving to another location.

In conclusion, permafrost conditions in this area eliminate the possibility of a totally stable structure. Foundation No. 2 provides the most stable foundation of the options considered.

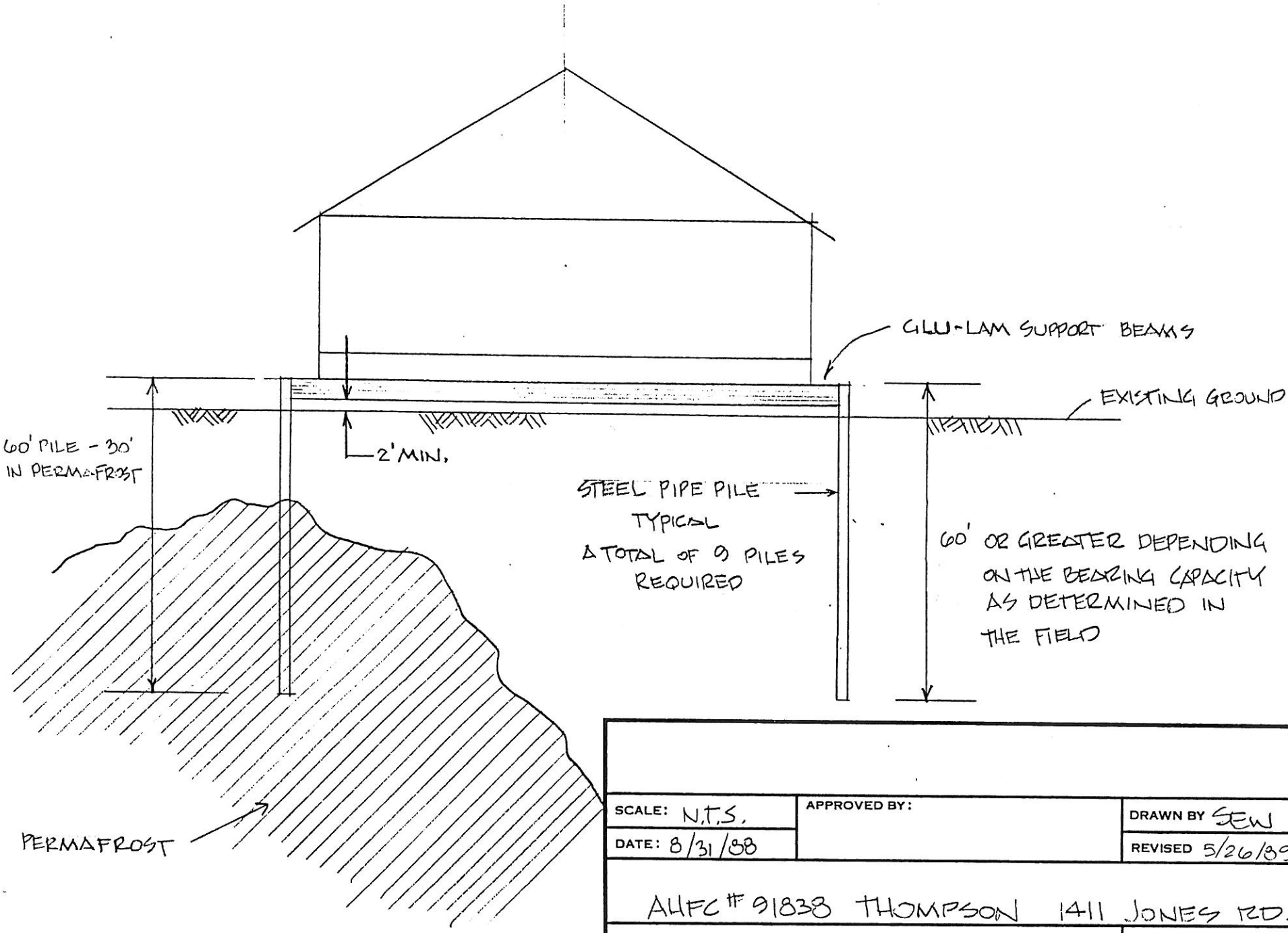
If we can be of further assistance please contact our office.

Very truly yours,

STUTZMANN ENGINEERING ASSOC., INC.

Scott Wortman, P.E.

Enc.
40-C2

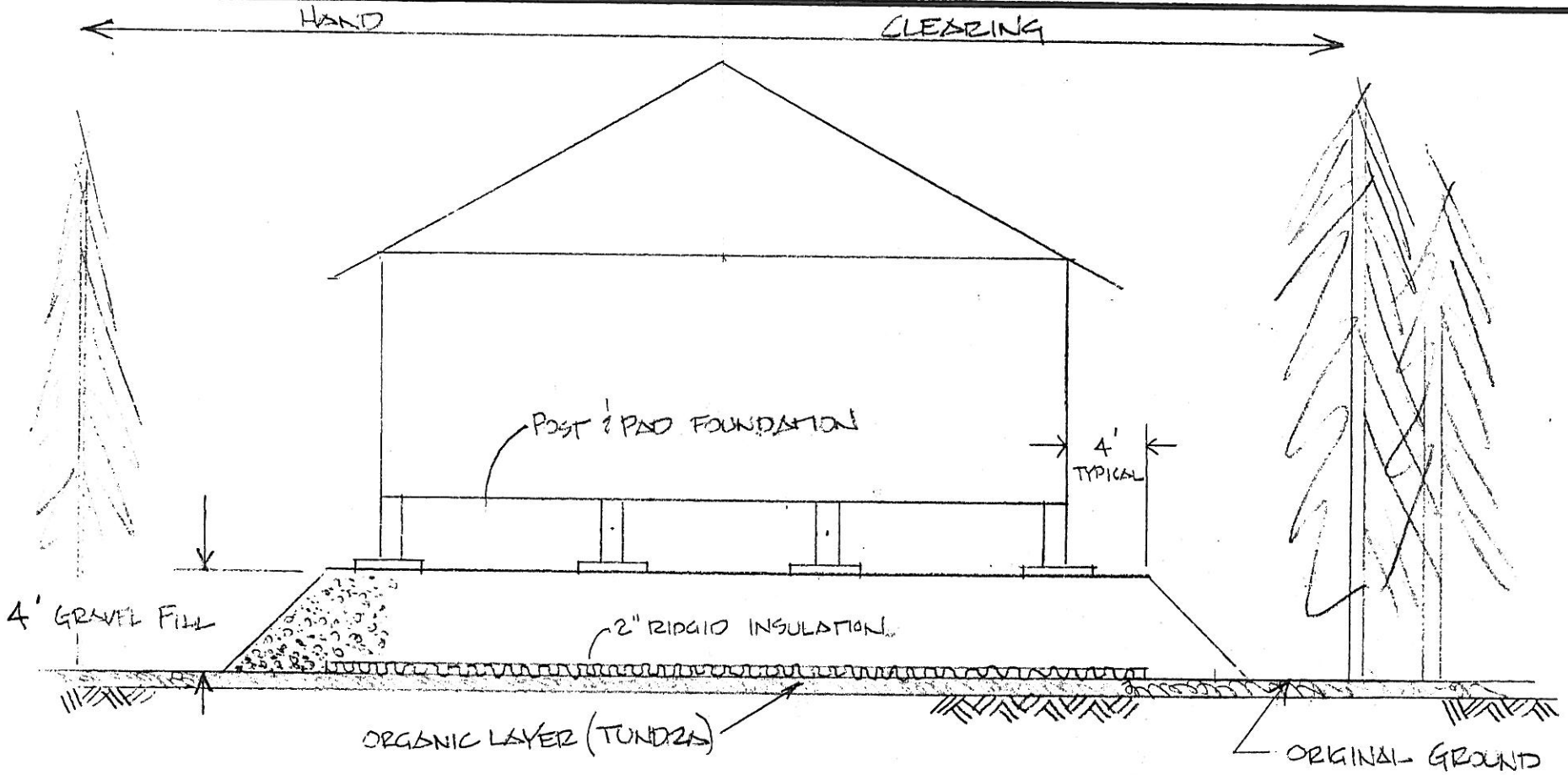


SCALE: N.T.S.	APPROVED BY:	DRAWN BY SEW
DATE: 8/31/88		REVISED 5/26/89

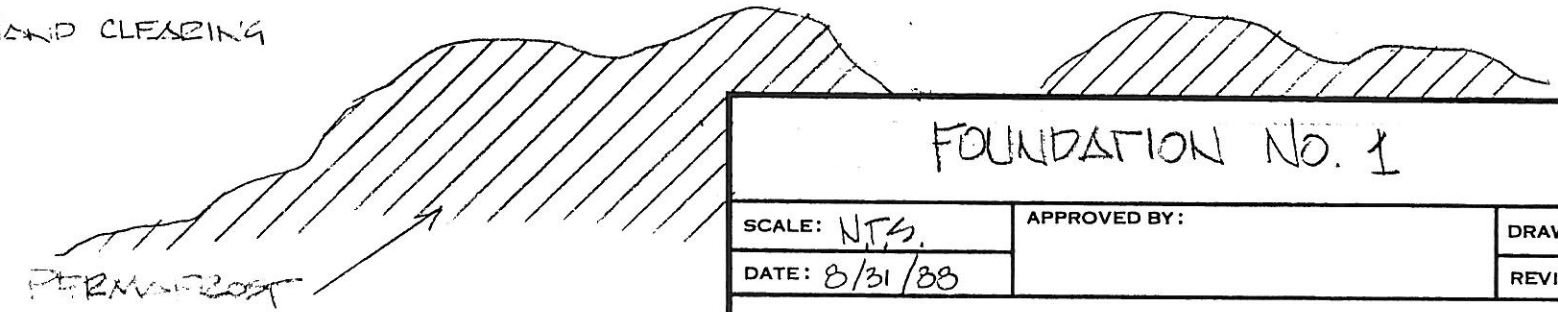
AHFC # 91838 THOMPSON 1411 JONES RD.

FOR COLDWELL BANKER

DRAWING NUMBER 2



NOTE: CUT STUMPS FLUSH WHEN HAND CLEARING



FOUNDATION NO. 1

SCALE: N.T.S.	APPROVED BY:	DRAWN BY SEW
DATE: 8/31/88		REVISED

AHFC # 91838 (THOMPSON) 1411 JONES RD

DRAWING NUMBER 1

STUTZMANN ENGINEERING ASSOC., INC.

P.O. BOX 1429, FAIRBANKS, ALASKA 99707 — (907) 452-4094

CLIENT: COLDWELL BANKER

JOB No. AWFC 31838

HOLE No.: 3

DATE 8/9/88

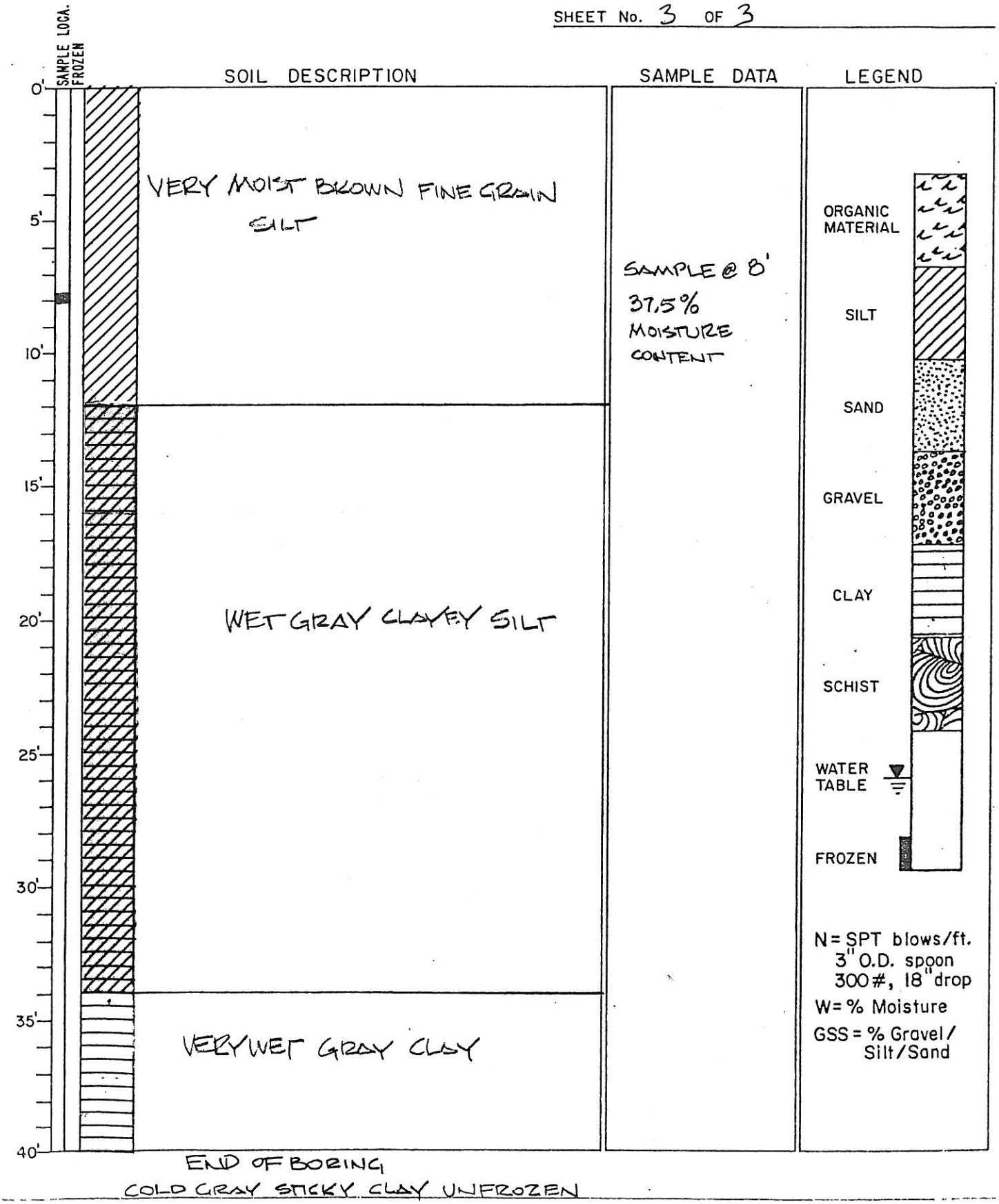
LOCATION: 1411 JONES RD

DRILLER: ALSINCO

4' OFF SE. CORNER OF HOUSE

LOGGED BY: SEW

SHEET No. 3 OF 3



END OF BORING

COLD GRAY STICKY CLAY UNFROZEN

STUTZMANN ENGINEERING ASSOC., INC.

P.O. BOX 1429, FAIRBANKS, ALASKA 99707 — (907) 452-4094

CLIENT: COLDWELL BANKER

JOB No. AHFC 91838

HOLE No.: 2

DATE 8/9/88

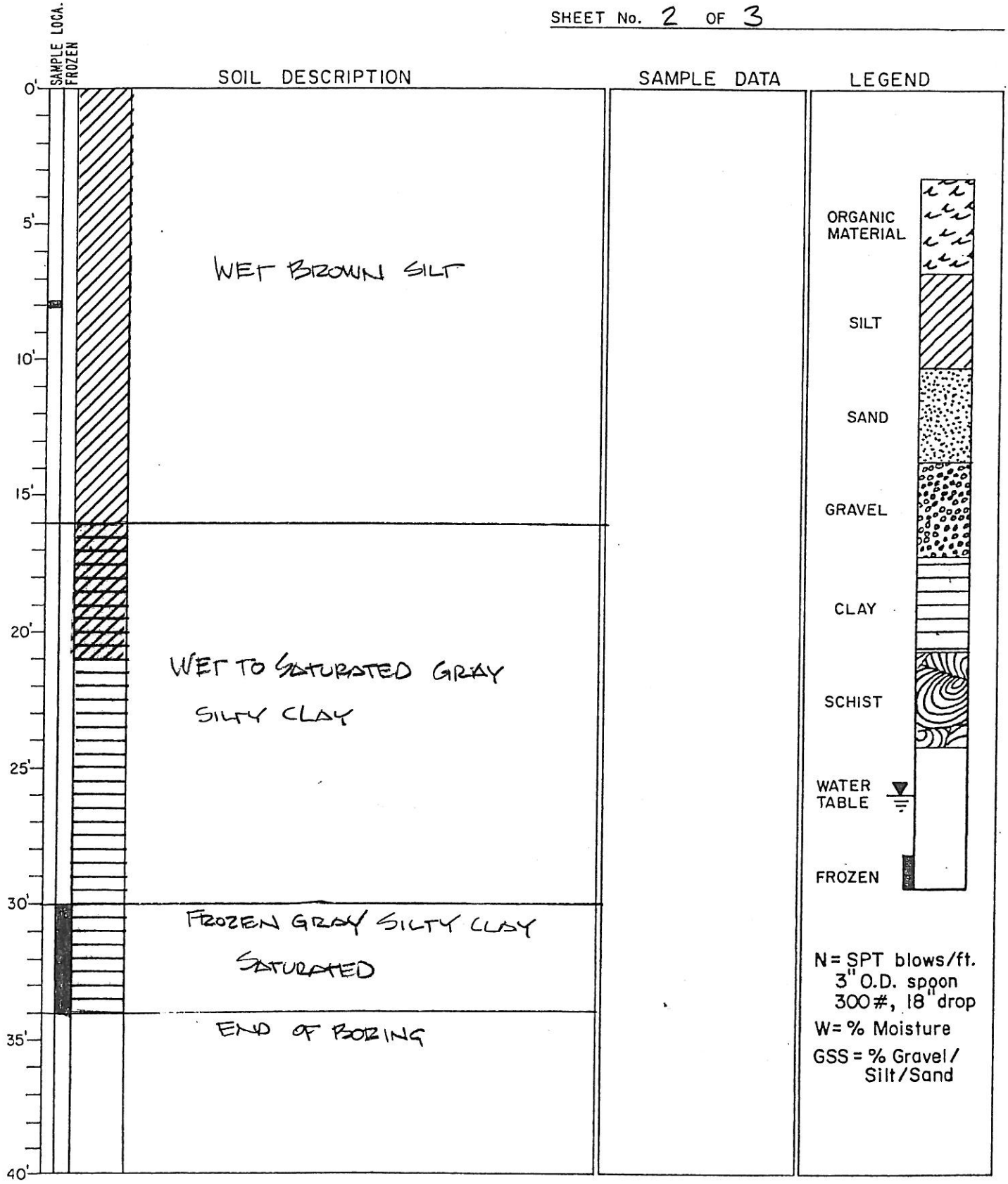
LOCATION: 1411 JONES ROAD

DRILLER: ALSINCO

WEST SIDE OF BUILDING

LOGGED BY: SFW

SHEET No. 2 OF 3



STUTZMANN ENGINEERING ASSOC., INC.

P.O. BOX 1429, FAIRBANKS, ALASKA 99707 — (907) 452-4094

CLIENT: COLDWELL BANKER

JOB No. AHFC # 91838

HOLE No.: 1

DATE 8/9/88

LOCATION: 1411 JONES ROAD

DRILLER: ALSINCO

N.W. COR. OF BUILDING 5' OFF COR.

LOGGED BY: SCOTT WORTMAN

SHEET No. 1 OF 3

SAMPLE LOCA. FROZEN

SOIL DESCRIPTION

SAMPLE DATA

LEGEND

0'

5'

10'

15'

20'

25'

30'

35'

40'

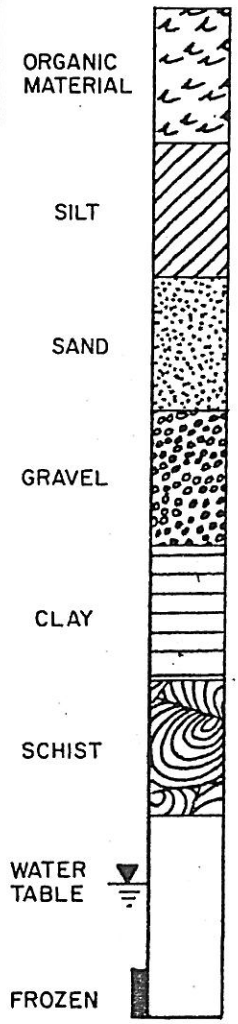
VARY MOIST TO SATURATED BROWN SILT

SATURATED GREY CLAYEY SILT

SAMPLE @ 17'
53% MOISTURE CONTENT

END OF BORING FROZEN

(APPARENTLY DUE TO THE SLOPE OF THE UNDERLYING PERMAFROST THE DRILL BIT "WANDERED" AND DRILLING FURTHER AT THIS LOCATION WAS NOT POSSIBLE.)



N = SPT blows/ft.
3" O.D. spoon
300#, 18" drop

W = % Moisture

GSS = % Gravel / Silt / Sand

STUTZMANN ENGINEERING ASSOC., INC.
P.O. BOX 1429
FAIRBANKS, ALASKA 99707
(907) 452-4094

May 30, 1989

Coldwell Banker
105 Adak Avenue
Fairbanks, Alaska 99701

Attn: Tom Hovenden

Re: AHFC #91838 (Thompson)
1411 Jones Road
East 330' of N1/2 S1/2 SW1/4 SW1/4, Sec. 11, T.1N., R.2W., F.M.

Dear Madam or Sir:

As requested, we have designed a piling foundation for the above mentioned house. Engineering reports previously submitted and dated April 7, 1989, July 25, 1989, and September 1, 1988 describe the geotechnical and structural conditions of the subsurface soils and the house.

Our design consists of installing nine steel pipe piles adjacent to the house. The house would be supported by five Glulam beams connected to the piling. Because of the depth of the beams the house will need to be raised about 30 inches. Raising the house will require the utilities to be disconnected and then restored to original condition. The existing porch stairs will need to be raised about 30 inches and restored to original condition. The base of the stairs will be founded on 2 four foot deep concrete piles formed with an eight inch diameter "Sonotube" and reinforced with one No. 4 rebar. The base of the pile will be bell shaped with a 16 inch diameter bell, constructed to resist uplift. Refer to the attached drawings for construction details.

The underlying soils conditions consist of permafrost soils and thawed saturated fine grain soils of low bearing capacity. The piling will be either end bearing or friction bearing piles depending on the soils conditions. End bearing piles on permafrost will be set at a design depth of 30 feet into the permafrost. This depth will insure end bearing for many years should the permafrost continue to melt. Buildings with piling foundations usually reduce the rate of, or eliminate, thawing of the permafrost.

The friction piles will be a minimum depth of 60 feet. Load tests at that depth will determine if deeper piles are necessary. Design loads are shown on the attached Drawings No. 3 of 4.

Construction details are shown on the attached drawing.

SUMMARY OF REPAIRS

1. Raise house approximately 30 inches.
2. Disconnect utilities and restore to original condition.
3. Extend stairs and add stair foundation.
4. Install 9 six inch diameter steel piles approximately 60 feet deep.
5. Install Glulam support beams and connections.

All of the above construction shall conform to standard practice and the Uniform Building Code.

Our recommendations are based on problems which were readily apparent during the inspection. This report is meant to address only those concerns specifically mentioned herein and does not address the adequacy of the structure as a whole. Construction methods identified in one particular area have been assumed to be representative of like portions of the building. Hidden structural defects or deficiencies which may exist, but have not manifested themselves through some movement or failure were likely to not have been identified with the inspection.

If the contractor encounters more structural problems during construction, he should contact us for our recommendations. It is assumed that the contractor will be knowledgeable enough to perform his duties in a proper

manner and be capable of identifying other possible deficiencies if they are revealed during construction.

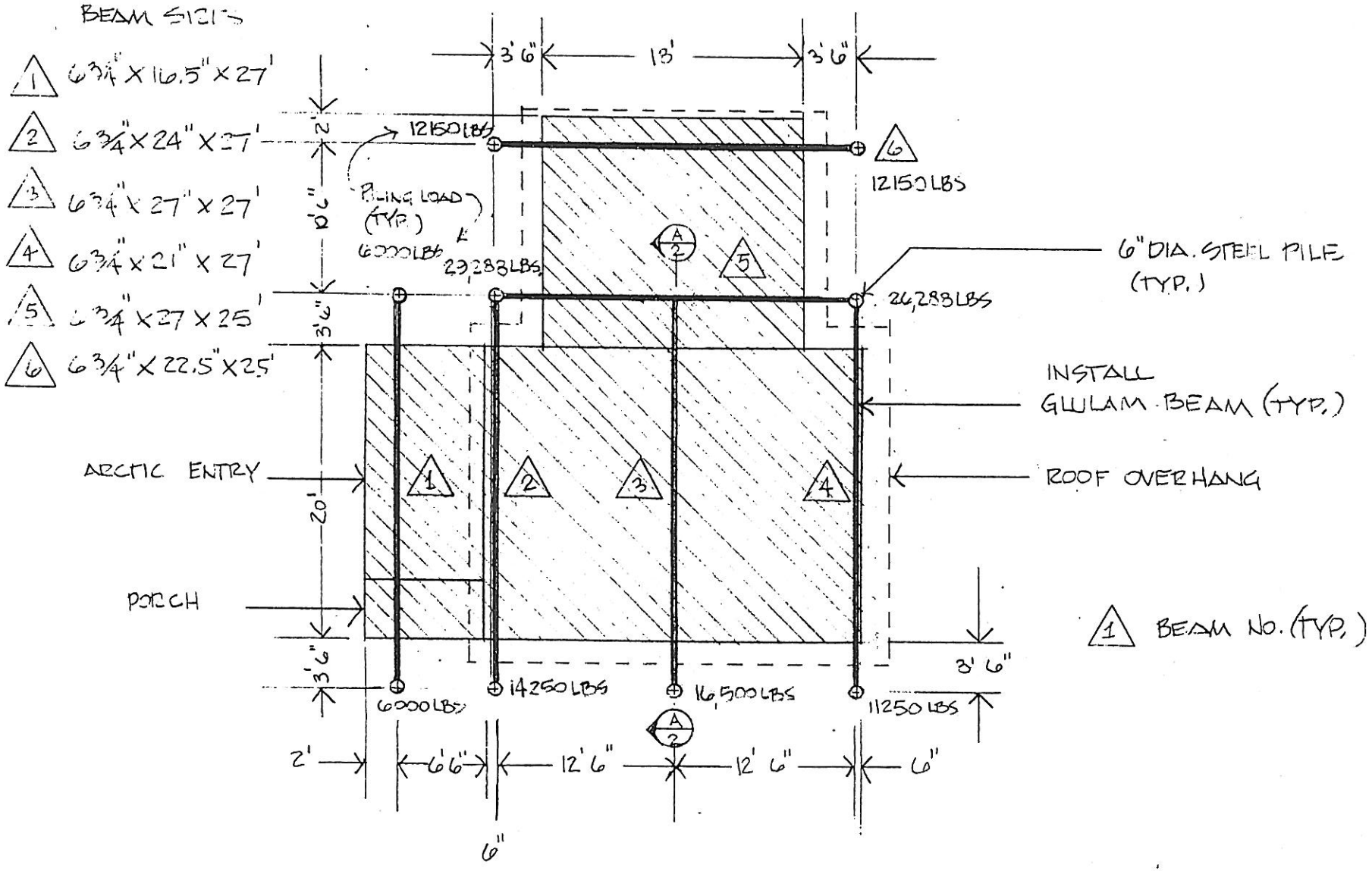
Prior to commencing work, the contractor should contact us to set up an inspection schedule. It is the responsibility of the contractor to contact us as work progresses, so that we can inspect items being repaired. Repairs should not be covered before inspection.

If you have any questions regarding this report, please contact our office.

Sincerely,

STUTZMANN ENGINEERING ASSOC., INC.

Scott E. Wortman, P.E.
48-TT

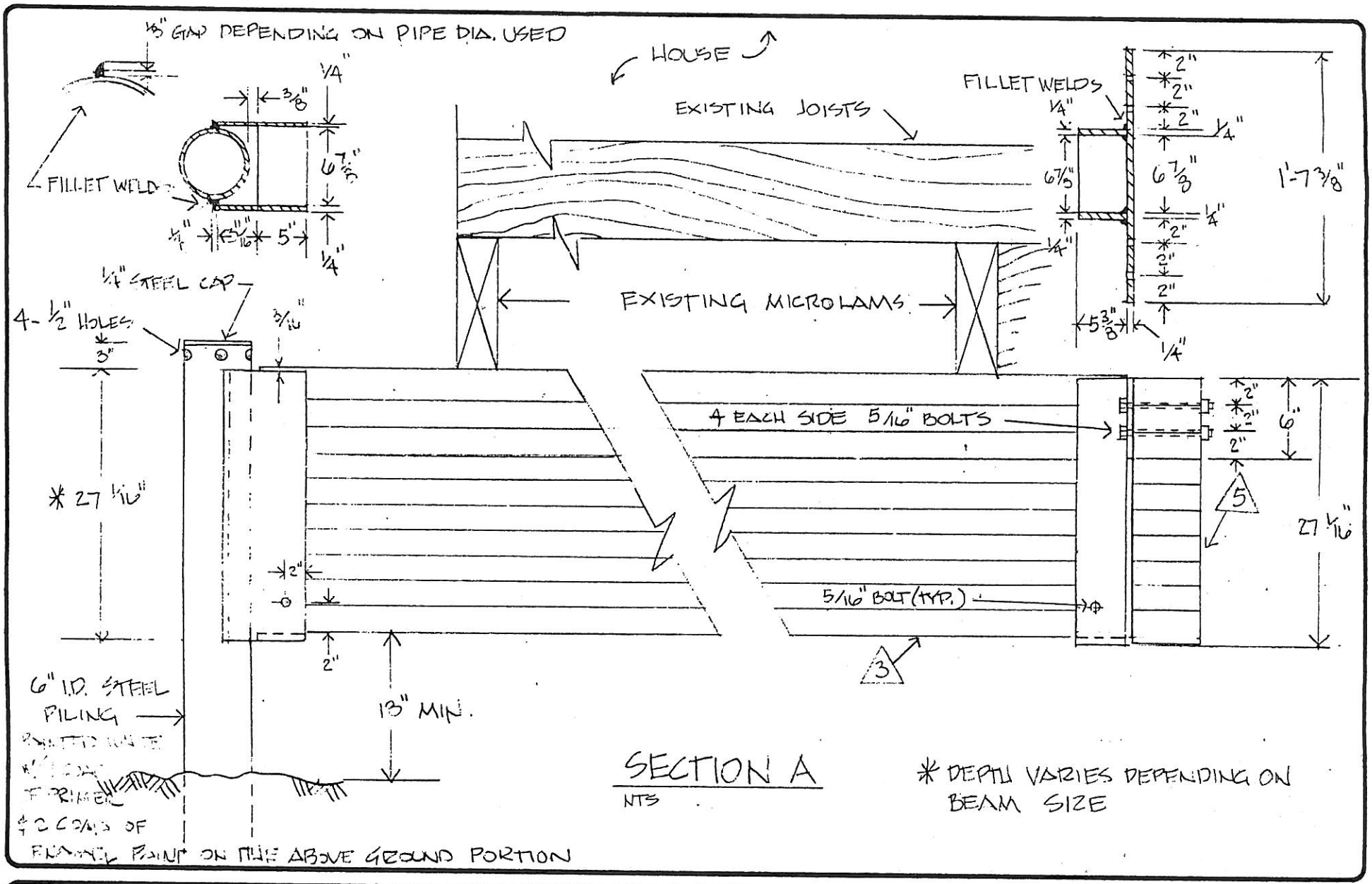


STUTZMANN ENGINEERING ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
P. O. BOX 1429, FAIRBANKS, ALASKA 99707 (907) 452-4094

A.H.F.C. # 91838 (THOMPSON)
1411 JONES ROAD
PILING LOCATION
FOR: COLDWELL BANKER

DRAWN BY: SEW
DATE: 5/24/99
SCALE: NTS
REVISED:

DRAWING NUMBER 1 OF 3



SECTION A

NTS

* DEPTH VARIES DEPENDING ON BEAM SIZE

STUTZMANN ENGINEERING ASSOCIATES, INC.

ENGINEERS SURVEYORS PLANNERS

P. O. BOX 1429, FAIRBANKS, ALASKA 99707 (907) 452-4094

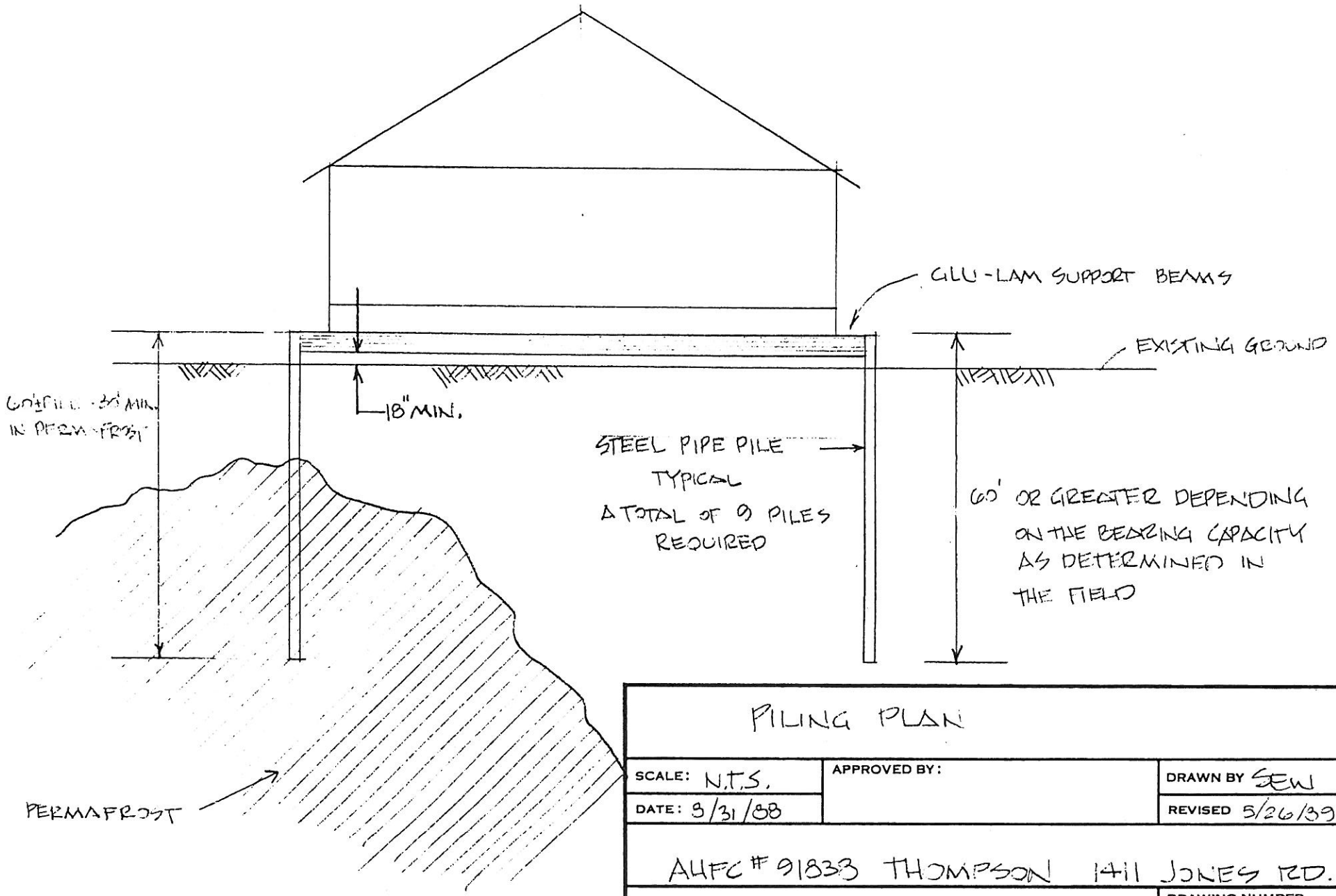
A.H.F.C. # 91838 (THOMPSON)

1411 JONES ROAD
PILING DETAILS

FOR: COLDWELL BANKER

DRAWN BY: SEW
DATE: 5/24/89
SCALE: NTS
REVISED:

DRAWING NUMBER 2 OF 3



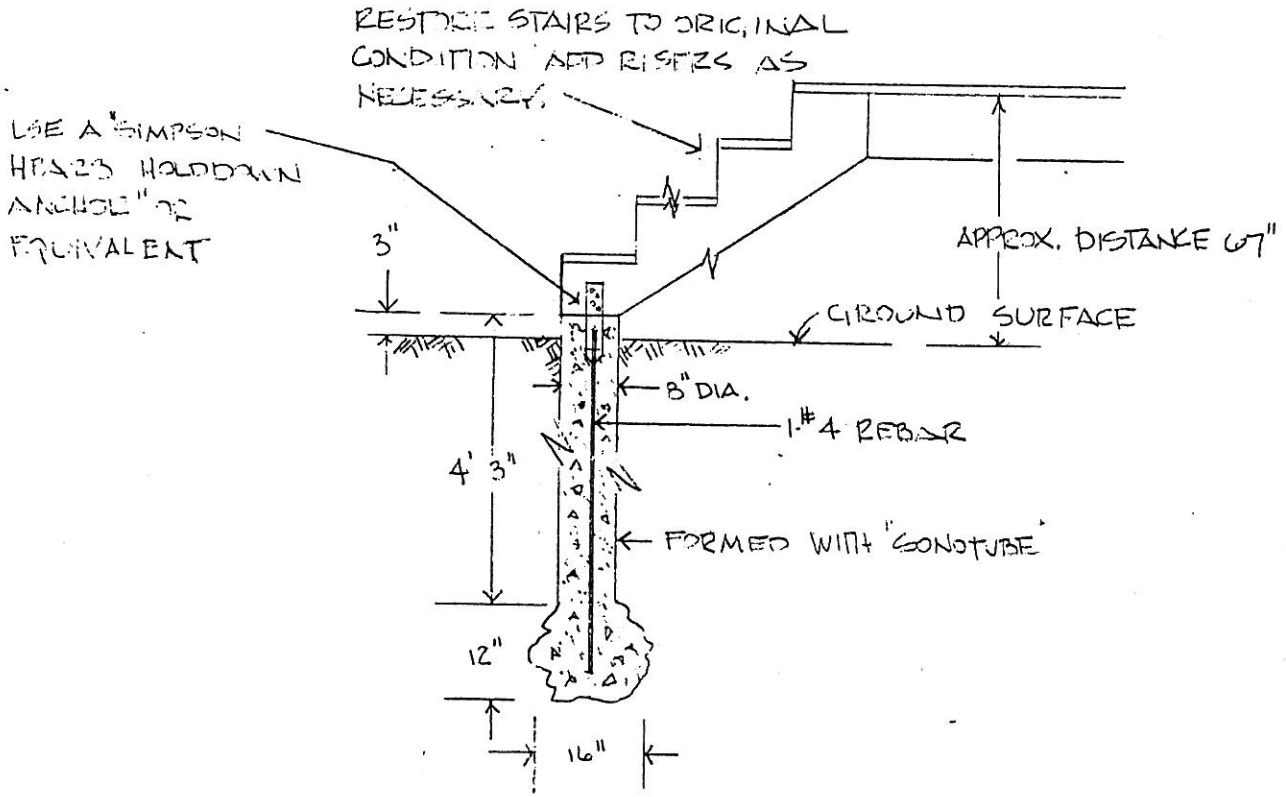
PILING PLAN

SCALE: N.T.S.	APPROVED BY:	DRAWN BY SEW
DATE: 9/31/88		REVISED 5/26/89

AHFC # 91833 THOMPSON 1411 JONES RD.

FOR COLDWELL BANKER

DRAWING NUMBER 3 OF 3



STAIR FOUNDATION (TYPICAL)
NTS

STUTZMANN ENGINEERING ASSOCIATES, INC.
ENGINEERS SURVEYORS PLANNERS
P. O. BOX 1429, FAIRBANKS, ALASKA 99707 (907) 452-4094

A.H.F.C. # 91838 (THOMPSON)
1411 JONES ROAD
STAIRWAY FOUNDATION
FOR: COLDWELL BANKER

DRAWN BY: SEW
DATE: 5/30/89
SCALE: NTS
REVISED:

DRAWING NUMBER 4 OF 4