APPENDIX B

Mississippi River Borrow Area
Geotechnical Survey

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXES

MISSISSIPPI RIVER BORROW AREA GEOTECHNICAL SURVEY

1.0 INTRODUCTION

The Mississippi River Borrow Area Geotechnical Survey (Survey) was completed in support of the Preliminary Design Phase for the Riverine Sand Mining / Scofield Island Restoration Project (Project). The Project is sponsored by the Louisiana Department of Natural Resources (LDNR), State of Louisiana Office of Coastal Protection and Restoration (OCPR) and NOAA Fisheries. The Project design is funded and authorized in accordance with the provisions of the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) (16 U.S.C.A., Sections 3951-3956) and has been approved by the Public Law 101-646 Task Force. The Project's CWPPRA designation is BA-40.

The purpose of the Survey was to collect geotechnical design data for the Mississippi River borrow areas which shall serve as the sand sources for restoration of the beach and dune system on Scofield Island as fully described in the Preliminary Design Main Report and Mississippi River Borrow Area Design Analysis (Appendix E).

The scope of services included using an Alpine model 270 pneumatic Vibracore, as deployed from a jack-up boat, to collect five cores to 30 feet below river bottom in MR-B-09 and five cores to 20 feet below river bottom and two cores to 30 feet below river bottom in MR-E-09. The Survey was conducted by SJB Group, LLC. (SJB), Coastal Engineering Consultants, Inc. (CEC), and Alpine Ocean Seismic Survey, Inc. (AOS).

2.0 SUMMARY OF PRIOR WORK

The selection of the Project borrow areas was based on the review of prior surveys and analyses that identified multiple areas within the river as containing significant quantities of beach compatible sand. The primary sources of this information included previous geophysical and geotechnical work performed by Coastal Planning and Engineering (CPE, 2004) and Finkl et al. (2005), transport methodology and conveyance corridor analysis (SJB and CEC, 2007a), Mississippi River mining impact assessment (SJB and CHF, 2007), Mississippi River borrow area mining technical analyses (SJB and CEC, 2007b; SJB and CEC, 2007c), previous cultural resources work performed by R. Christopher Goodwin & Associates, Inc. (CGA, 2008), and the Feasibility Study Phase analyses (SJB and CEC, 2008).

CPE (2004) and Finkl et al. (2005) identified potential sand sources within the lower Mississippi River including the two areas designated as MR-B and MR-E. Based on the subsequent surveys and analyses, the boundaries of the two areas were revised multiple times. For the Preliminary Design Phase, these borrow areas have been designated as MR-B-09 and MR-E-09 to reflect that

3.0 PROJECT AREA AND LOCATION

Borrow Area MR-B-09 is located on the east side of the Mississippi River near Empire, Plaquemines Parish, between approximate River Mile Marker (MM) 29 to 31, and Borrow Area MR-E-09 is located on the west side of the river south of Buras between approximate MM 23 to 24 as presented in Figure 1.

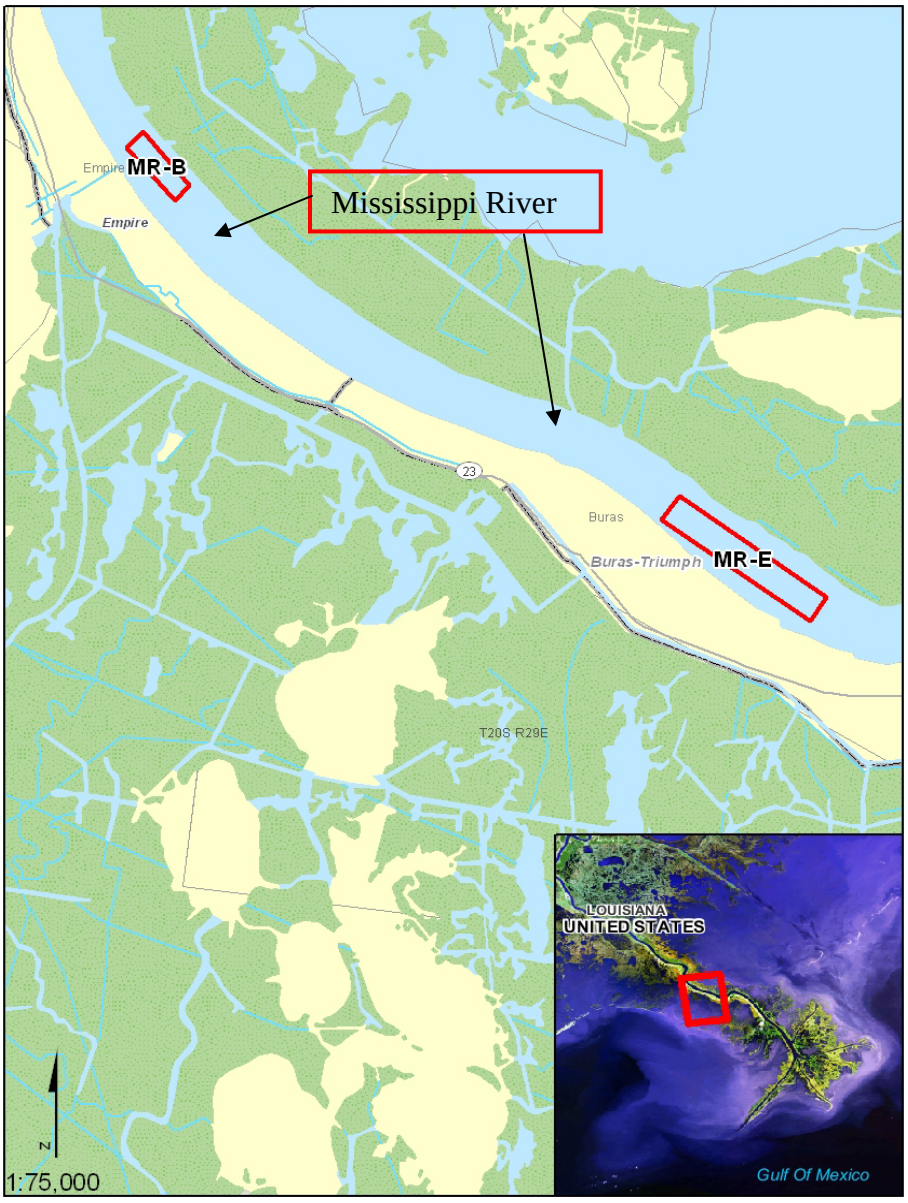


Figure 1: Mississippi River Borrow Area Location Map

4.0 EQUIPMENT AND PERSONNEL

4.1 Survey Vessel

A jack-up boat with 40 foot spuds was used as the platform for vibracoring operation. It had adequate deck space and a large hydraulic crane for vibracoring. The navigational equipment with associated computer and display unit was mounted in the pilothouse.

4.2 Positioning System

The system utilized the Vector Pro which is a complete GPS compass and positioning system in a single enclosure. It is an integrated system that houses two high performance GPS receivers, dual GPS antennas, a DGPS beacon module, H-field beacon antenna, power supply, a single axis gyro, a magnetic compass, and a tilt sensor. The gyro, magnetic compass, and tilt sensor are present to improve system performance and to provide backup heading information in the event that a GPS heading is not available due to signal blockages. The DGPS beacon module obtained differential correction signals from the U.S. Coast Guard GPS transmitter at English Turn in southeastern Louisiana.

4.3 Navigation Data Acquisition and Logging System

The WGS-84 Geographic positions as obtained by the GPS navigation system were converted into North American Datum of 1983 (NAD83), Louisiana South State Plane grid coordinate positions, using a computer and Hypack Max navigation software, version 6.2. The system consists of the following components:

- Dell computer.
- Color video monitor (helmsman's display).
- Hypack Max software.

Differential Correction signals received from U.S. Coast Guard base stations and processed by the navigation system antenna provided an accuracy of +/- 5 feet for the navigation data.

4.4 Vibracore

A model 271 B Alpine Pneumatic Vibracore configured to take cores 20 feet and 30 feet in length was used on this project. The model 271 B is a self-contained freestanding pneumatic Vibracore unit. It consists of: an air-driven vibratory hammer assembly; an aluminum H-beam which acts as the vertical guide for the vibrator; a set of four steel support pads and legs which hold the beam upright on the sea bottom; a steel coring pipe; a cutting edge; a core retainer; a clear lexan core liner; and a penetrometer which records time and depth of penetration of the

core pipe into the sea bottom. An air hose array provides passage of compressed air from the compressor on deck to drive the Vibracore.

Recovery was at least 80 percent on all cores except MRE-08-05, where only 70 percent of the core was recovered. The upper portion of targeted area was penetrated very quickly, indicating the presence of very soft silts or clays. Since these types of sediment are not compatible with the sands needed to restore Scofield Island, no additional actions were taken to collect samples past the refusal depth.

4.5 Field Methods

The proposed location of each core was entered into the Hypack program, which displays the location of the survey vessel relative to each selected core. The vessel was spudded down within 50 feet of a given core location and the water depth obtained and recorded. Once the vessel was determined to be in a stable position, the Vibracore was lowered to the river bed and coring commenced. Once the Vibracore reached the desired core depth, the air power was turned off, core barrel retracted from the bottom, and Vibracore secured to the deck of the survey boat, where the sample was removed and placed on deck.

4.6 Summary of Operations

December 15, 2008.
0800-1630 Mobilized equipment onto boat at Braithwaite, LA.

December 16, 2008.
Boat traveled toward work site, but stopped on east side of locks into the river due to fog.

December 17, 2008.
0950 – Boat on site after fog lifted; completed equipment mobilization.
1235 - Underway to work site MR-E-09.
1650 – Completed Vibracores MRE-08-09, MRE-08-10 and MRE-08-07 with 20 foot core Vibracore.
1715 - Docked at landing in Buras, LA.

December 18, 2008.
0800 - On board at Buras Landing, waited for fog to lift.
0840 – Underway to work site MR-E-09.
1055 – Completed Vibracores MRE-08-11 and MRE-08-13 with 20 foot Vibracore.
1115 – Docked at Buras Landing to extend Vibracore to 30 foot configuration.
1345 – Underway to work site MR-E-09.
1605 – Completed Vibracores MRE-08-05 and MRE-08-08 with 30 foot Vibracore.

1640 – Docked at Buras Landing.
December 19, 2008.
0730 – Underway to work site MR-B-09.
0900 – On site near Vibracore location MRB-08-01.
1440 – Completed Vibracores MRB-08-01, MRB-08-07, MRB-08-02 and MRB-08-05.
1445 – Underway back to Buras Landing.
1540 – Docked at Buras Landing.

December 20, 2008.
1215 - En route to survey site after waiting for fog to lift.
1315 – Tried at least five times to get boat to stabilize on spuds near Vibracore site MRB-08-04, but boat kept moving after spuds sank into very soft unstable sediments on river bottom.
1350 – Rig on bottom and core penetrated in 11 feet when boat started to move offsite, breaking pipe off in sea floor.
1545 – Recovered rig and replaced core pipe section- retried to spud down several times again. A stable setting was not achievable at this site due to the soft sediments. The site was abandoned and the boat returned to Buras Landing to demobilize.
1645 – Docked at Buras Landing.

December 21 and 22, 2008.
Boat cannot move from Buras, LA to Braithwaite, LA to demobilize due to strong northeast winds and high seas across Breton Sound, which had to be crossed to get to Buras, LA.

December 23, 2009.
0630-1500 – Boat moved to Braithwaite, LA.
1500-1700 – Demobilized Vibracore equipment and prepared for shipment.

December 24, 2008.
0700-0830 – Loaded truck with Vibracore equipment, and loaded core samples on four pallets for shipment to the Coastal Technology Corporation, Inc., office in Melbourne, Florida, for splitting, sampling, descriptions and photographs.

5.0 VIBRACORE DATA PRESENTATION

Immediately upon removal of the plastic liner from the core pipe, the sediment filled liners were measured, marked, cut into sections and sealed. Shipboard descriptions were made and the heading data were entered onto the shipboard log sheet. These data included date, time, location, water depth, penetration and recovery information. Table 1 presents a summary of the final core locations for all the samples. Vibracore location maps are presented in Annex B1.

Table 1: Vibracore Sample Listing

Core No.	Date	Time	Easting	Northing	Water Depth	Penetration	Recovery
MRB-08-01	12/19/2008	09:30:30	3832110	335681	44	25.79	25
MRB-08-02	12/19/2008	12:02:05 PM	3832742	332947	42	26.93	23
MRB-08-04	12/20/2008	1:55:00 PM	3834250	330481	45	11.25	None[1]
MRB-08-05	12/19/2008	1:17:26 PM	3836308	328198	41	26.16	21
MRB-08-06	12/19/2008	3:12:24 PM	3837783	326934	38	29.76	24.5
MRB-08-07	12/19/2008	10:27:00 AM	3832227	334768	42	27.53	23.5
MRE-08-05	12/18/2008	3:23:01 PM	3863072	313581	42	28.03	20
MRE-08-07	12/17/2008	5:20:36 PM	3865625	312116	44	17.72	16.5
MRE-08-08	12/18/2008	2:32:55 PM	3865158	312471	40	28.12	25
MRE-08-09	12/17/2008	1:12:05 PM	3861961	314068	38	18.77	18
MRE-08-10	12/17/2008	3:39:40 PM	3863592	313297	44	18.43	18.6
MRE-08-11	12/18/2008	10:43:17 AM	3866407	311734	46	18.93	17
MRE-08-13	12/18/2008	10:33:36 AM	3864226	312822	41	18.9	16

1. No recovery was achieved at this site as the Vibracore fell over, breaking the core pipe.

The penetration graphs for each of the cores are presented in Annex B2. The graph headers contain the core number, location in state grid location for each core, length of penetration and recovery, along with the corrected water depths, and time of each core. The changes in rate of penetration with depth at each core were provided to assist in describing the cores.

6.0 CONCLUSIONS

Vibracore sampling conducted to 30 feet below river bottom in Borrow Areas MR-B-09 and MR-E-09 confirmed there are significant quantities of sand in those areas with grain size suitable for the restoration of Scofield Island's beach and dune system. Although some portions of the work area were noted in the field to contain interbedded peat layers and other non-usable sediments, there were still large areas where the sediments were mostly sandy in nature.

Although the magnetometer data collected during the geophysical surveys in these Borrow Areas, particularly MR-B-09, indicated the presence of large numbers of relatively small debris, no evidence of metallic objects was noted in the field in any of the cores, and no evidence of difficulty in penetration, which might be indicative of debris in the sediments, was noted.

The Alpine Vibracore was found to be stable on the river bottom at all the core sites during the time that the project was conducted. The only time the Vibracore fell over was when the support pads for the survey vessel slipped in the sediment, allowing the vessel to move away from the core site when the Vibracore pipe was already several feet into the sediments.

7.0 REFERENCES

Christopher Goodwin & Associates, Inc. 2008. Phase I Marine Archeological Remote Sensing Survey of the Proposed Mississippi River Sand Borrow Sites for the Louisiana Coastal Area Barrier Shoreline Restoration Project, Plaquemines Parish, Louisiana (DRAFT). Submitted to U.S. Army Corps of Engineers, New Orleans District.

Coastal Planning & Engineering. 2004. Technical Assessment of Riverine Sand Mining to Support Scofield Island Restoration. Submitted to National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service.

Finkl et al., C.W., J.L. Andrews, L. Benedet, and T. Campbell. 2005. Geotechnical Investigation for Exploration of Sand Resources in the Lower Mississippi River and South Pass, and Exploration for Sand via Vibracoring in South Pelto Blocks 12 & 13. Boca Raton Florida: Coastal Planning & Engineering, Inc. 40p. Report Prepared for the Louisiana Department of Natural Resources, Baton Rouge, Louisiana.

SJB Group, LLC and C. H. Fenstermaker and Associates, Inc. 2007. Mississippi River Mining Impact Assessment Technical Memorandum, Task A.4.3 Riverine Sand Mining / Scofield Island Restoration (BA-40). LDNR Contract No. 2511-07-02, Technical Memorandum A.4.3. Submitted to Louisiana Department of Natural Resources, Coastal Engineering Division.

SJB Group, LLC and Coastal Engineering Consultants, Inc. 2007a. Transport Methodology and Access Corridors Technical Memorandum, Riverine Sand Mining / Scofield Island Restoration (BA-40). LDNR Contract No. 2511-07-02, Technical Memorandum A.4.1. Submitted to Louisiana Department of Natural Resources, Coastal Engineering Division.

SJB Group, LLC and Coastal Engineering Consultants, Inc. 2007b. Mississippi River Mining Technical Memorandum, Riverine Sand Mining / Scofield Island Restoration (BA-40). LDNR Contract No. 2511-07-02, Technical Memorandum A.4.2. June 27, 2007. Submitted to Louisiana Department of Natural Resources, Coastal Engineering Division.

SJB Group, LLC and Coastal Engineering Consultants, Inc. 2007c. Mississippi River Mining Technical Memorandum, Riverine Sand Mining / Scofield Island Restoration (BA-40). LDNR Contract No. 2511-07-02, Technical Memorandum B.5.1 & B.5.2. October 17, 2007. Submitted to Louisiana Department of Natural Resources, Coastal Engineering Division.

SJB Group, LLC and Coastal Engineering Consultants, Inc. 2008. Draft Feasibility Study Report. Mississippi River Riverine Sand Mining / Scofield Island Restoration (BA-40). LDNR

Contract No. 2511-07-02. March 10, 2008. Submitted to Louisiana Department of Natural Resources, Coastal Engineering Division.

ANNEX B1

VIBRACORE LOCATION MAPS

LEGEND

- Survey Baseline
- Borrow Area Boundaries
- Shoreline Digitized From NOAA ENC Chart
- Vibracore: MRVC-05-XX (2005)
- Vibracore: MRB-08-XX (2008)
- Bathymetric Contour, 2008
- Revetment
- River Mile Marker

GEODETIC INFORMATION
Horizontal DATUM : WGS84
PROJECTION: NAD 83 Louisiana South State Plane
Vertical DATUM: FEET NAVD 88

MRB-08-01
MRB-08-07
MRB-08-02
MRVC-05-04
MRB-08-04
MRVC-05-05
MRB-08-05
MRB-08-06
MRVC-05-06
BOTTOM OF CUT
TOP OF CUT
MISSISSIPPI RIVER LEVEE
EMPIRE LOCKS

0+00 5+00 10+00 15+00 20+00 25+00 30+00 35+00 40+00 45+00 50+00 55+00 60+00 65+00 70+00 75+00 80+00 85+00 90+00 95+00 100+00 105+00 110+00 115+00 120+00 125+00 130+00 135+00 140+00 145+00

31 30 29

332000N 331000N 330000N 329000N 328000N 327000N 326000N
3839000E 3840000E 3841000E 3842000E 3829000E 3830000E 3831000E 3832000E 3833000E 3834000E

1000' 500' 0' 1000' 2000'

CHART 1: RIVERINE BORROW AREA MR-B-09
VIBRACORE LOCATIONS

COASTAL ENGINEERING CONSULTANTS INC.
PH: (239) 643-2324
FAX: (239) 643-1143
3106 SOUTH HORSESHOE DRIVE
NAPLES, FLORIDA 34104

STB GROUP, LLC
QUALITY BY DESIGN
P.O. BOX 1751
BATON ROUGE, LA. 70821
PHONE (225) 769-3400
FAX (225) 769-3596

LEGEND

- Survey Baseline (0+00)
- Borrow Area Boundaries
- Shoreline Digitized From NOAA ENC Chart
- Vibracore: MRVC-05-XX (2005)
- Vibracore: MRE-08-XX (2008)
- Bathymetric Contour, 2008 (-20)
- Revetment
- 30 River Mile Marker

GEODETIC INFORMATION
Horizontal DATUM : WGS84
PROJECTION: NAD 83 Louisiana South State Plane
Vertical DATUM: FEET NAVD 88

3864000E 320000N 3865000E 317000N 3867000E 316000N 3868000E 315000N 3869000E 314000N 3870000E 313000N 312000N

BOTTOM OF CUT
TOP OF CUT
MRVC-05-07
CHANNEL MARKER G"23" SEE NOTE 1
MRVC-05-10
MISSISSIPPI RIVER LEVEE
MRE-08-09
MRE-08-05
MRE-08-10
MRE-08-13
MRE-08-08
MRE-08-11
MRE-08-07
295+00 290+00 285+00 280+00 275+00 270+00 265+00 260+00 255+00 250+00 245+00 240+00 235+00 230+00 225+00 220+00 215+00 210+00 205+00 200+00
22 23 24

NOTES:
1. G "23" ANCHOR LOCATED N 3863870, E 314070 AOS (2008)

800' 400' 0' 800' 1600'

CHART 2: RIVERINE BORROW AREA MR-E-09 VIBRACORE LOCATIONS

COASTAL ENGINEERING CONSULTANTS INC.
PH: (239) 643-2324
FAX: (239) 643-1143
3106 SOUTH HORSESHOE DRIVE
NAPLES, FLORIDA 34104

STB GROUP, LLC
QUALITY BY DESIGN
P.O. BOX 1751
BATON ROUGE, LA. 70821
PHONE (225) 769-3400
FAX (225) 769-3596

ANNEX B2

PENETRATION GRAPHS

Penetration Graph for Core No. MRB-08-01, Run 1

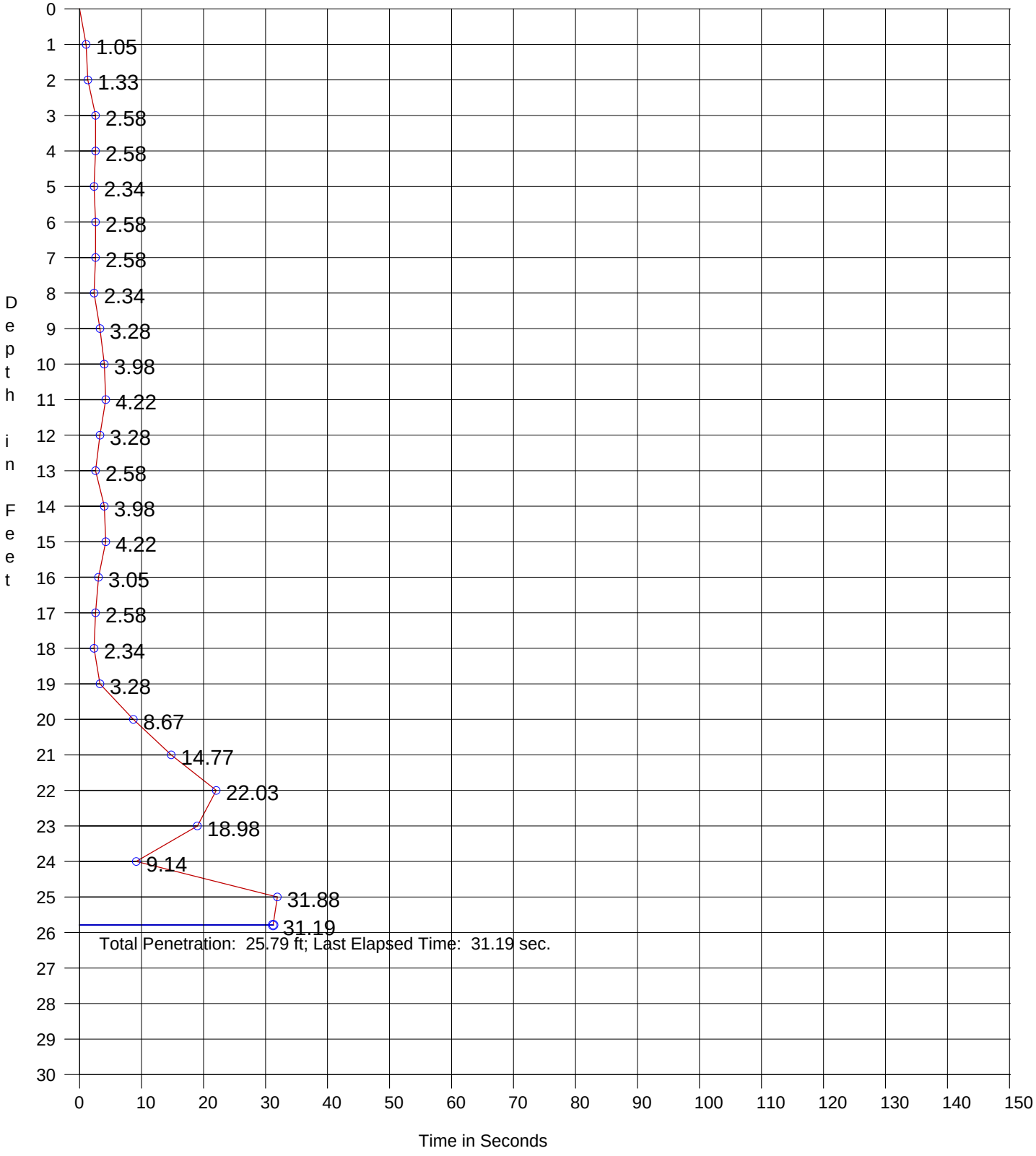
Date: 12/19/2008
Start Time: 9:27:09 AM
End Time: 9:30:30 AM

Penetration: 25.79 ft
Recovery: 25 ft
W. D. Corrected: 44 ft
W. D. Raw: 44 ft

Easting: 3832110.66
Northing: 335681.36
Coord. System: LA S. NAD 83

Lat: 29d24.6954'
Long: 089d36.1119'
Datum:

Comment:



Penetration Graph for Core No. MRB-08-02, Run 1

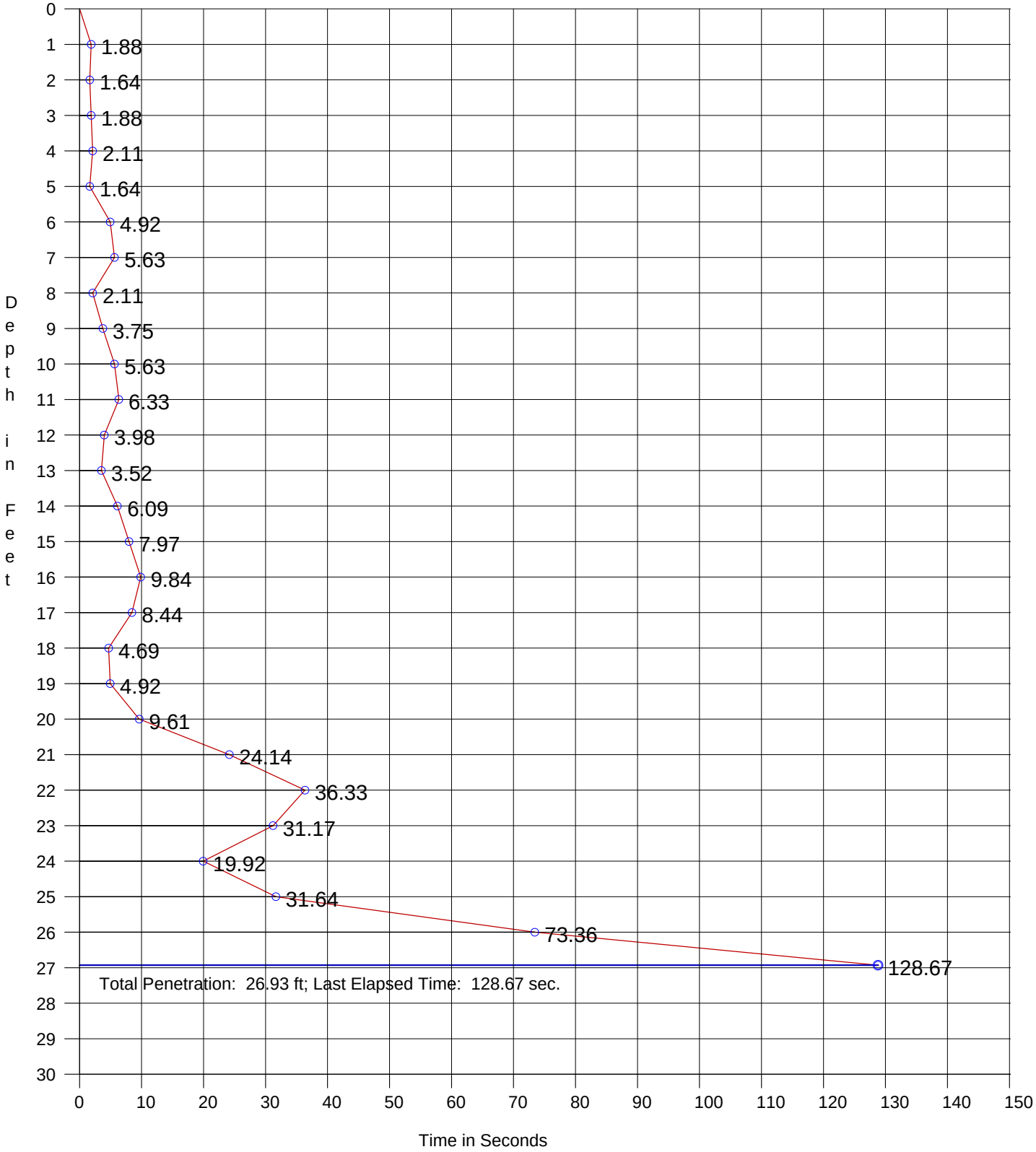
Date: 12/19/2008
Start Time: 12:02:05 PM
End Time: 12:09:27 PM

Penetration: 26.93 ft
Recovery: 23 ft
W. D. Corrected: 42 ft
W. D. Raw: 42 ft

Easting: 3832741.51
Northing: 332946.86
Coord. System: LA-S, NAD-83

Lat: 29d24.2427'
Long: 089d36.0008'
Datum:

Comment:



Penetration Graph for Core No. MRB-08-04, Run 1

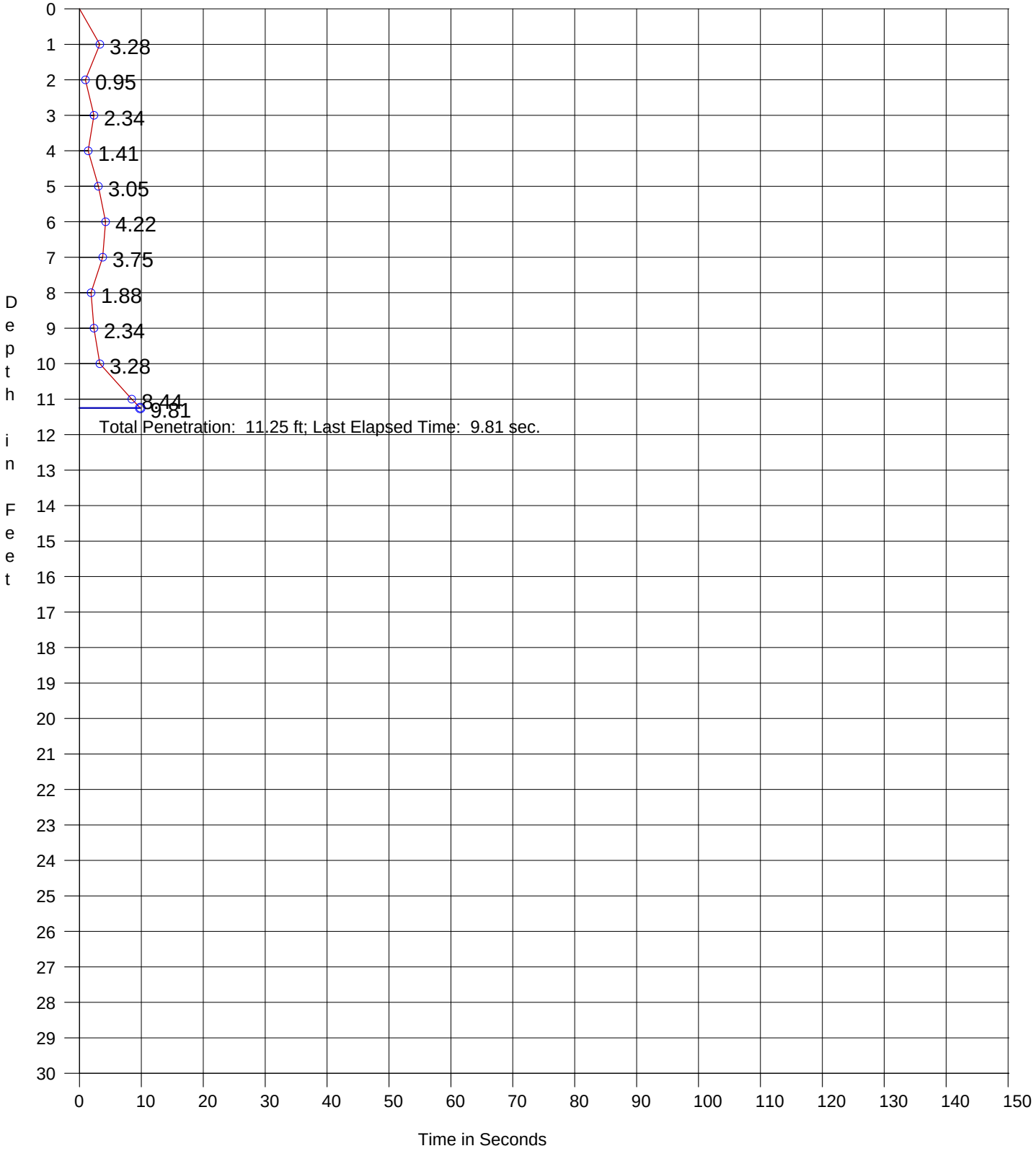
Date: 12/20/2008
Start Time: 1:55:00 PM
End Time: 1:58:04 PM

Penetration: 11.25 ft
Recovery: NONE
W. D. Corrected: 45 ft
W. D. Raw: 45 ft

Easting: 3834250.30
Northing: 330480.74
Coord. System: LA S. NAD-83

Lat: 29d23.8321'
Long: 089d35.7236'
Datum:

Comment: Rig pulled over. pipe broke



Penetration Graph for Core No. MRB-08-05, Run 1

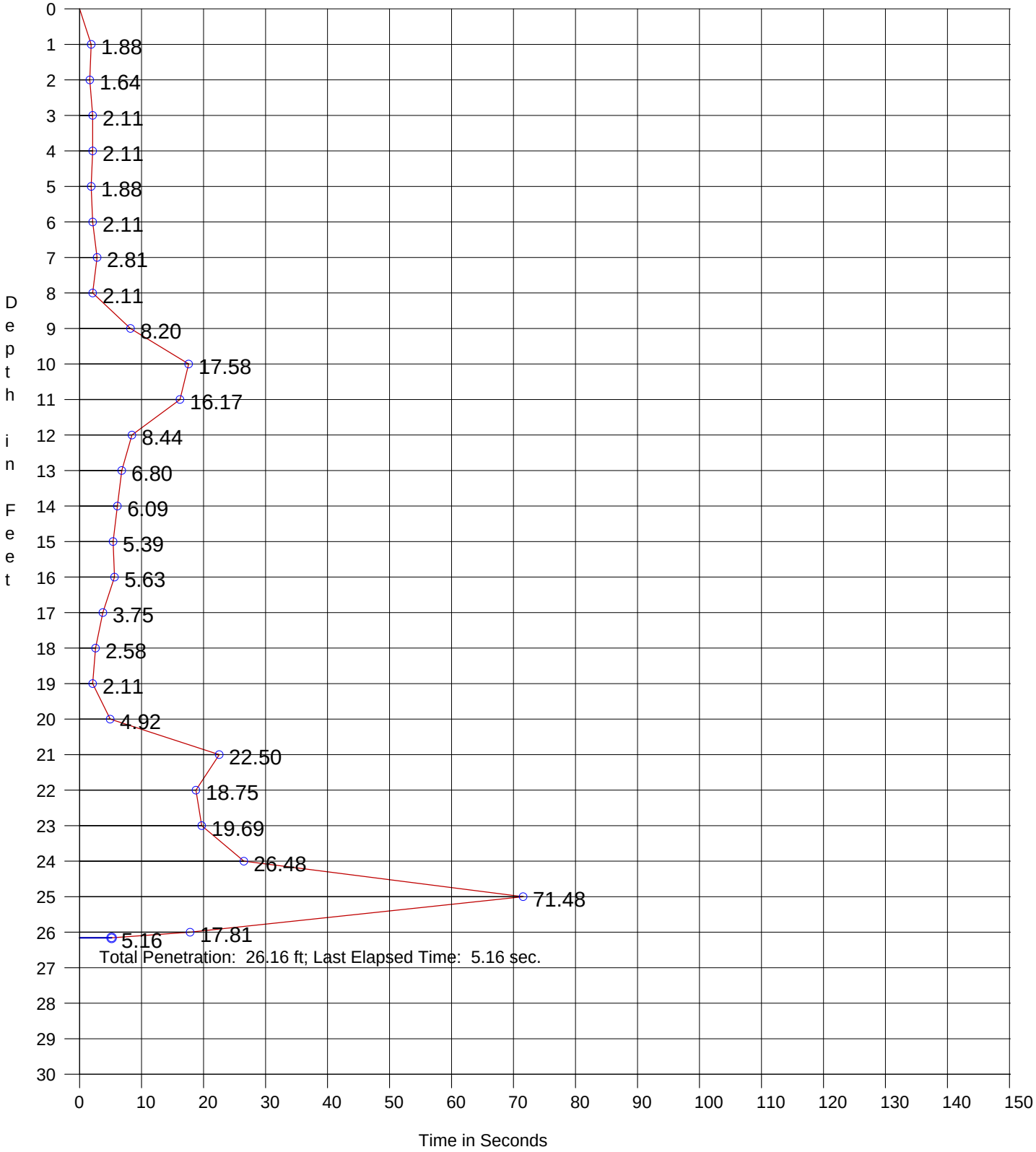
Date: 12/19/2008
Start Time: 1:17:26 PM
End Time: 1:22:12 PM

Penetration: 26.16 ft
Recovery: 21 ft
W. D. Corrected: 41 ft
W. D. Raw: 41 ft

Easting: 3836308.42
Northing: 328198.21
Coord. System: LA S. NAD-83

Lat: 29d23.4504'
Long: 089d35.3424'
Datum:

Comment:



Penetration Graph for Core No. MRB-08-06, Run 1

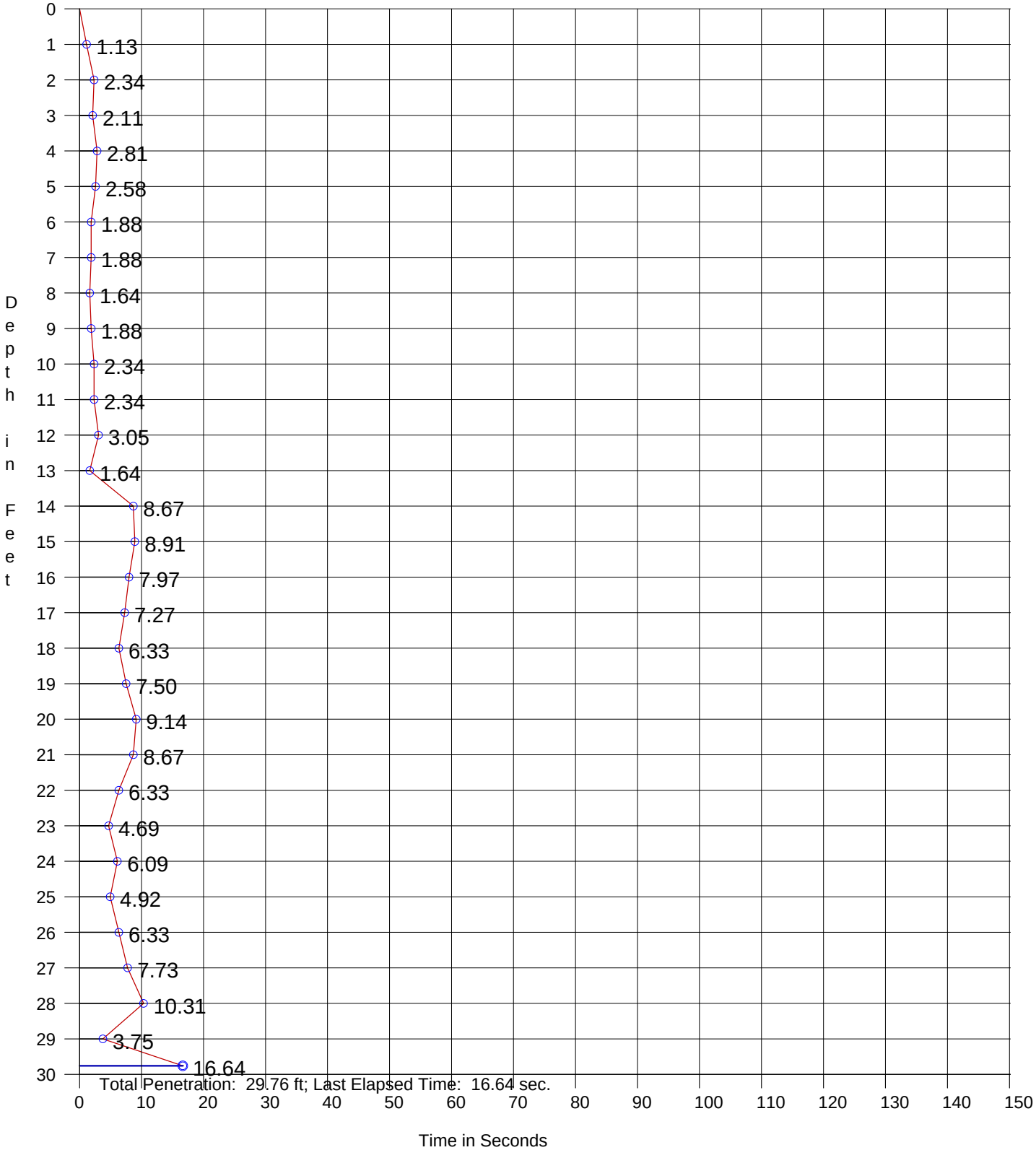
Date: 12/19/2008
Start Time: 3:12:24 PM
End Time: 3:15:15 PM

Penetration: 29.76 ft
Recovery: 24.5 ft
W. D. Corrected: 38 ft
W. D. Raw: 38 ft

Easting: 3837782.95
Northing: 326933.95
Coord. System: LA S. NAD-83

Lat: 29d23.2381'
Long: 089d35.0683'
Datum:

Comment:



Penetration Graph for Core No. MRB-08-07, Run 1

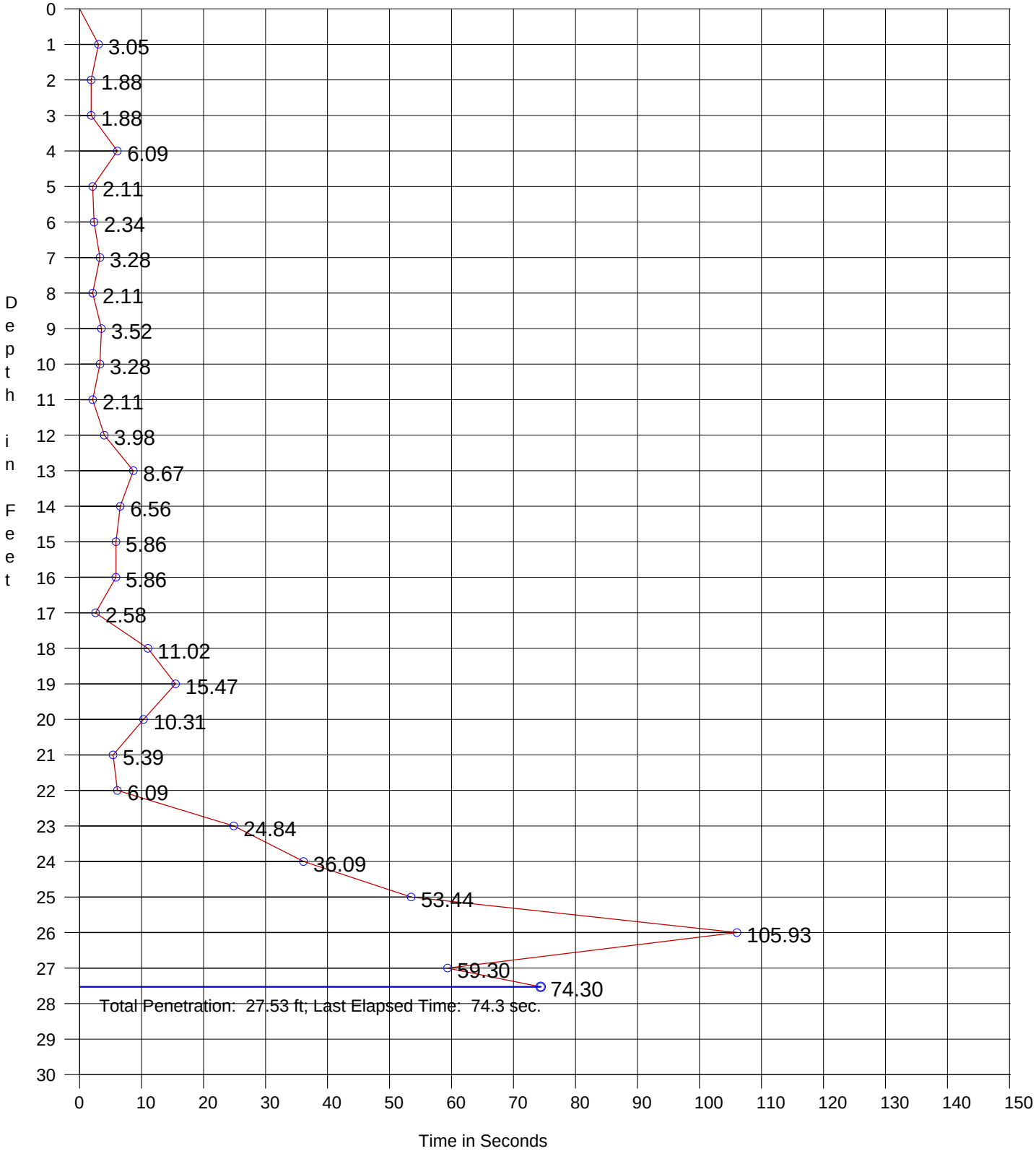
Date: 12/19/2008
Start Time: 10:27:00 AM
End Time: 10:34:47 AM

Penetration: 27.53 ft
Recovery: 23.5 ft
W. D. Corrected: 42 ft
W. D. Raw: 42 ft

Easting: 3832226.53
Northing: 334767.70
Coord. System: LA-S, NAD-83

Lat: 29d24.5444'
Long: 089d36.0926
Datum:

Comment:



Penetration Graph for Core No. MRE-08-05, Run 1

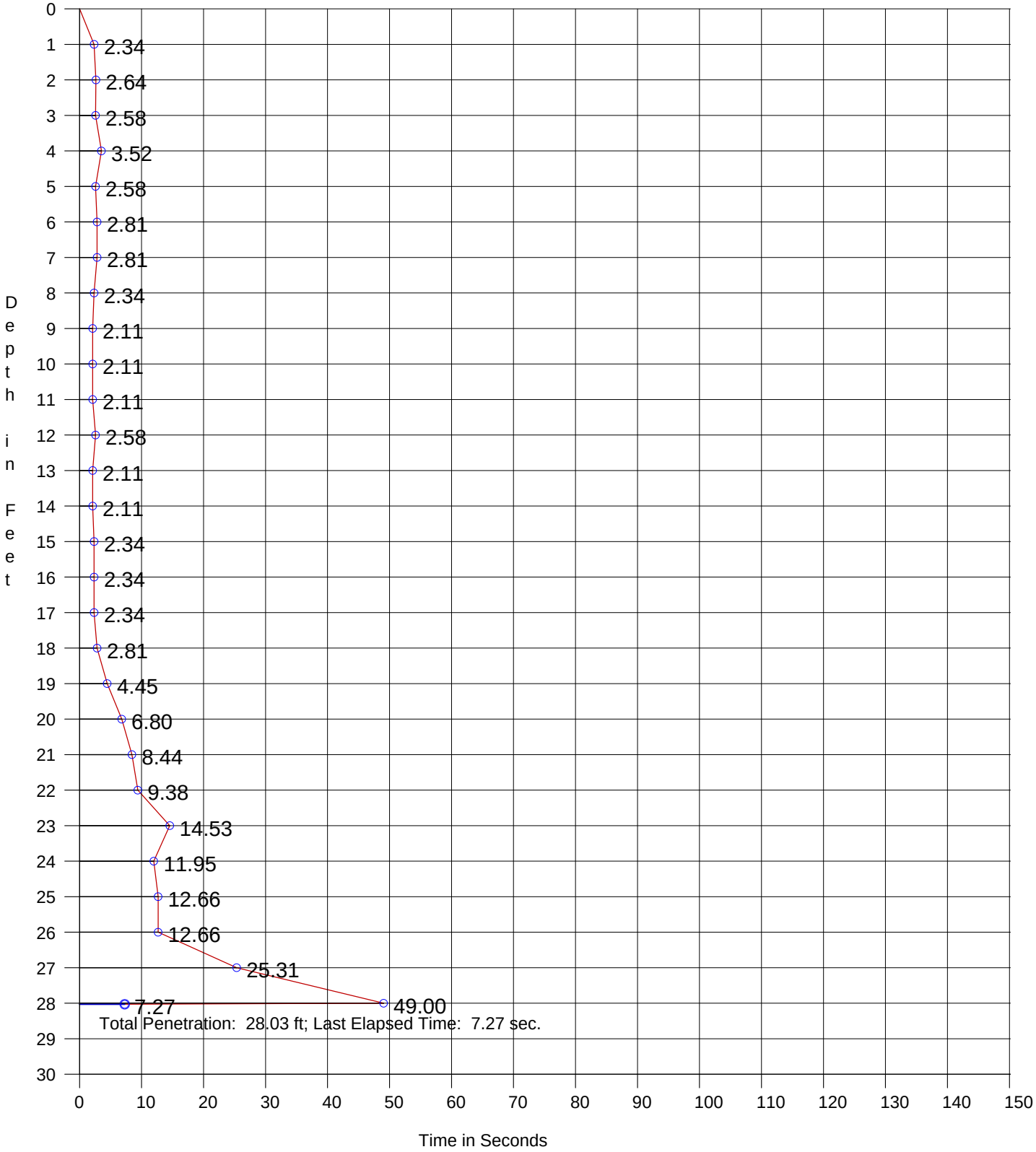
Date: 12/18/2008
Start Time: 3:23:01 PM
End Time: 3:26:42 PM

Penetration: 28.03 ft
Recovery: 20 ft
W. D. Corrected: 42 ft
W. D. Raw: 42 ft

Easting: 3863072
Northing: 313581
Coord. System: LA S. NAD-83

Lat: 29 20' 58.2"N
Long: 89 30'20.676"W
Datum:

Comment:



Penetration Graph for Core No. MRE-08-07, Run 1

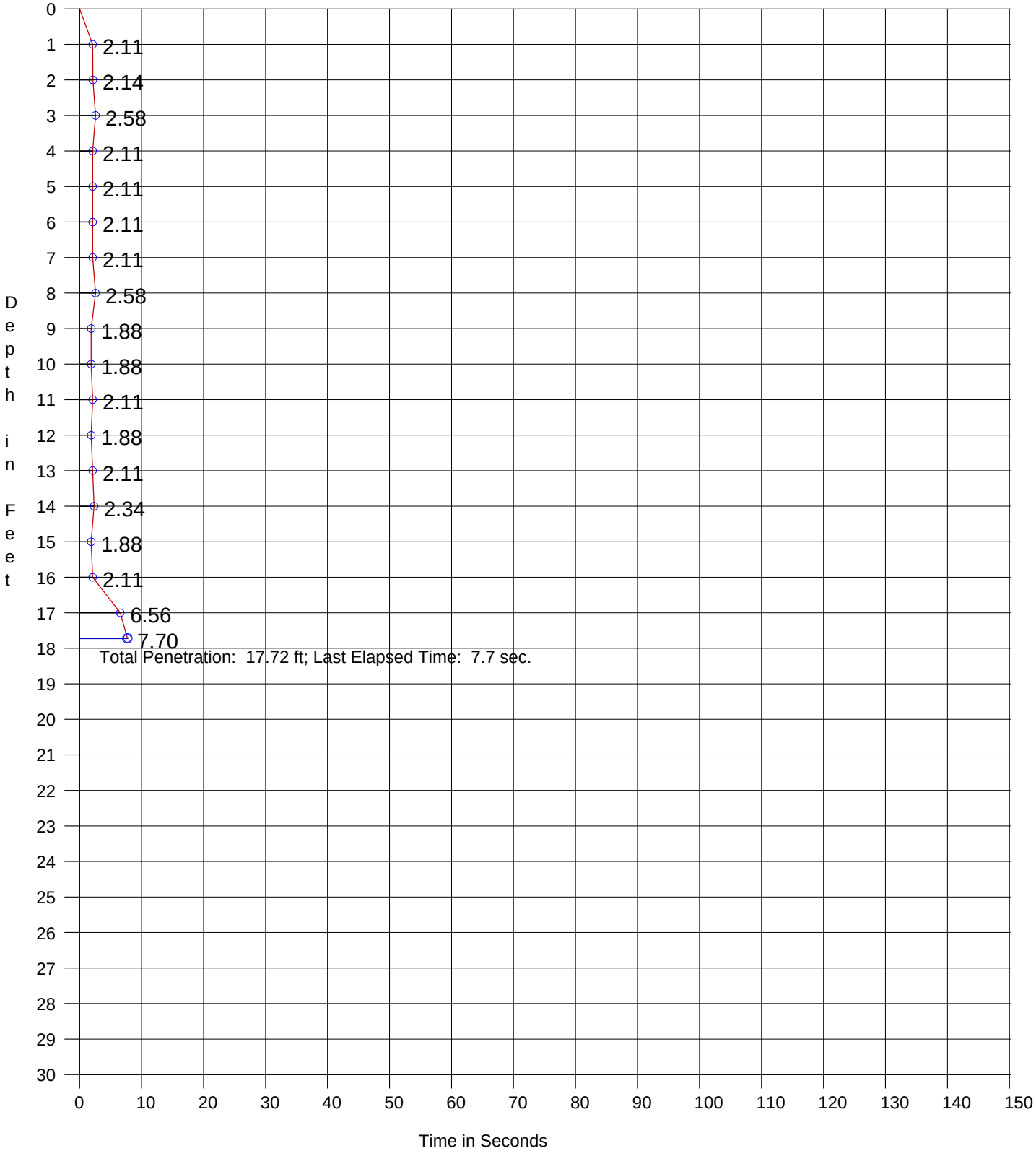
Date: 12/17/2008
Start Time: 5:20:36 PM
End Time: 5:23:43 PM

Penetration: 17.72 ft
Recovery: 16.5 ft
W. D. Corrected: 44 ft
W. D. Raw: 44 ft

Easting: 3865625
Northing: 312116
Coord. System: LA S. NAD-83

Lat: 29 20'43.30"N
Long: 89 29'52.097"W
Datum:

Comment:



Penetration Graph for Core No. MRE-08-08, Run 1

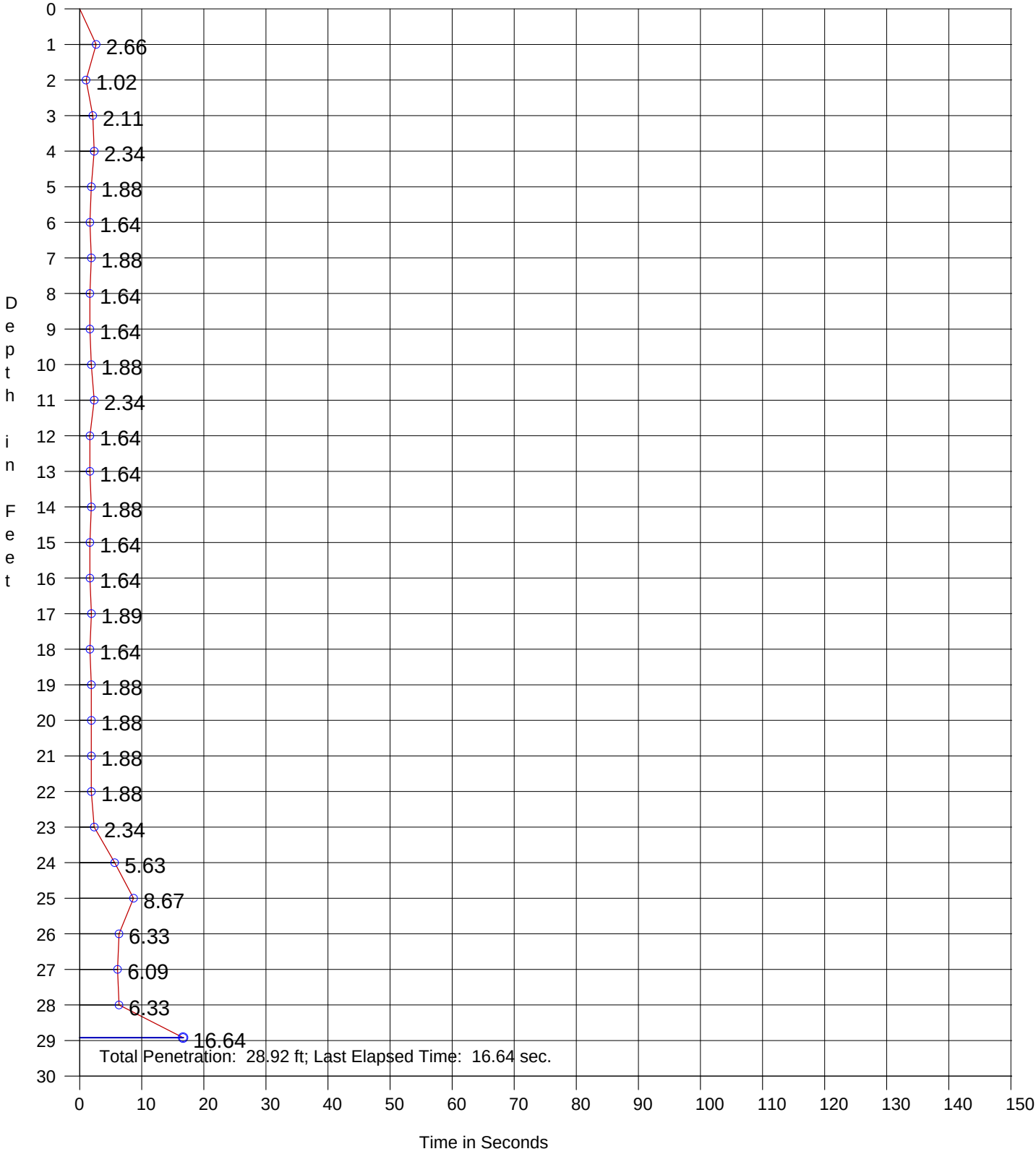
Date: 12/18/2008
Start Time: 2:32:55 PM
End Time: 2:34:47 PM

Penetration: 28.92 ft
Recovery: 25 ft
W. D. Corrected: 40 ft
W. D. Raw: 40 ft

Easting: 3865158
Northing: 312471
Coord. System: LA S. NAD-83

Lat: 29 20'46.89"N
Long: 89 29'57.309"W
Datum:

Comment:



Penetration Graph for Core No. MRE-08-09, Run 1

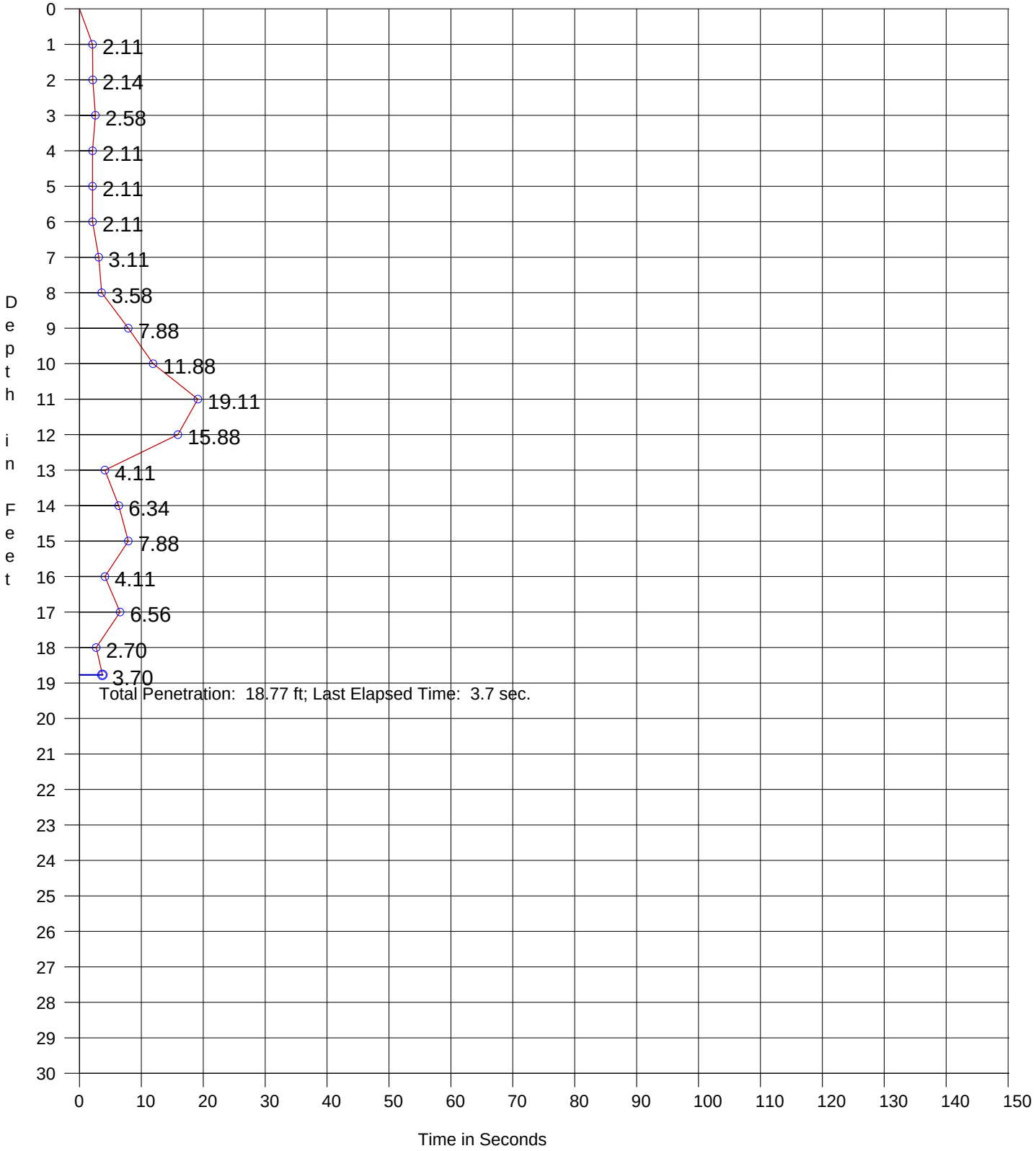
Date: 12/17/2008
Start Time: 1:12:05 PM
End Time: 1:14:50 PM

Penetration: 18.77 ft
Recovery: 18 ft
W. D. Corrected: 38 ft
W. D. Raw: 38 ft

Easting: 3861961
Northing: 314068
Coord. System: LA S. NAD-83

Lat: 29 21'03.20"N
Long: 89 30'33.141"W
Datum:

Comment:



Penetration Graph for Core No. MRE-08-10, Run 1

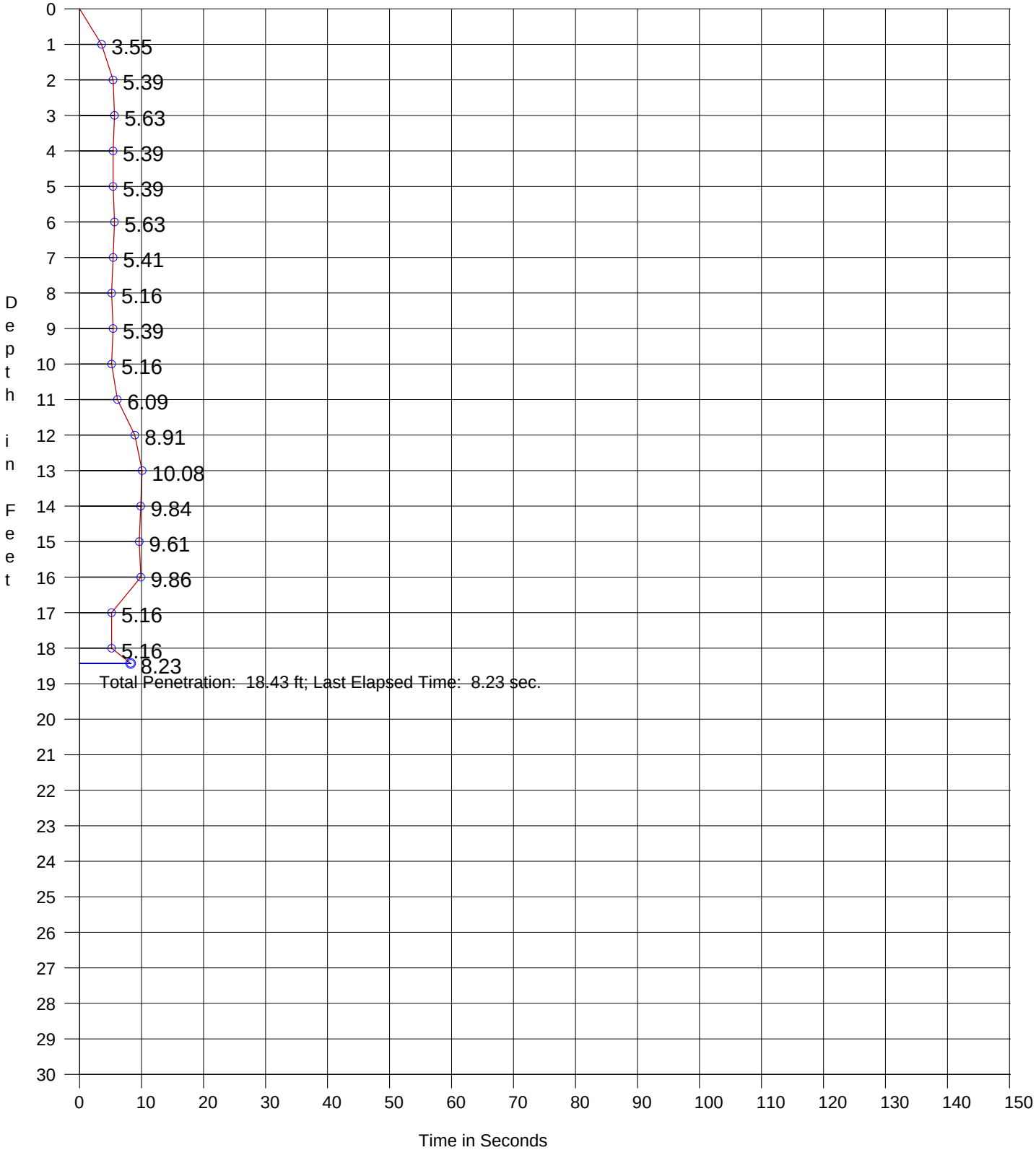
Date: 12/17/2008
Start Time: 3:39:40 PM
End Time: 3:41:52 PM

Penetration: 18.43 ft
Recovery: 18.6 ft
W. D. Corrected: 44 ft
W. D. Raw: 44 ft

Easting: 3863592
Northing: 313297
Coord. System: LA S. NAD-83

Lat: 29 20'55.312"N
Long: 89 30'14.852"W
Datum:

Comment:



Penetration Graph for Core No. MRE-08-11, Run 1

Date: 12/18/2008
Start Time: 10:43:17 AM
End Time: 10:45:32 AM

Penetration: 18.93 ft
Recovery: 17 ft
W. D. Corrected: 46 ft
W. D. Raw: 46 ft

Easting: 3866407
Northing: 311734
Coord. System: LA S. NAD-83

Lat: 29 20'39.395"N
Long: 89 29'43.332"W
Datum:

Comment: