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INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 5 HOP BROOK LAKE DAM, CONNECTICUT

by

Haley & Aldrich, Inc.
Cambridge, Massachusetts

for

Department of the Army
New England Division

File No. 11163-004
February 1995

HALEY & ALDRICH INC.

Geotechnical Engineers &
Environmental Consultants

15 February 1995
File No. 11163-004

Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254-9149

Attention: Mr. Richard Reardon
Director of Engineering

Subject: Instrumentation Appendix to Periodic Inspection Report No. 5
Hop Brook Lake Dam
Middlebury, Connecticut

Gentlemen:

We are pleased to submit herewith our report entitled "Instrumentation Appendix to Periodic Inspection Report No. 5, Hop Brook Lake Dam, Connecticut", prepared in accordance with our Contract No. DACW33-93 -D-005 dated 3 August 1994.

This report is a compilation of the results of the instrumentation analysis for the Hop Brook Dam conducted as part of Periodic Inspection Report No. 5. This report has been prepared in consideration of verbal and written comments on the draft report prepared by Haley and Aldrich.

It has been a pleasure working with the New England Division, Corps of Engineers on this project. Please do not hesitate to contact us if you have any questions on this report.

Sincerely yours,
HALEY & ALDRICH, INC.

Douglas G. Gifford
Vice President

cc: Ms. Laura Fraser, New England Division, Corps of Engineers.

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INSTRUMENTATION APPENDIX

TO PERIODIC INSPECTION REPORT NO. 5

HOP BROOK LAKE DAM, CONNECTICUT

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1. PROJECT PERFORMANCE

The dam performance is rated as good based on the visual observations and the analysis of the crest monument and tilt plate data compiled to date. Crest monument data indicates that very little vertical movement has taken place (0.02 foot). It also indicates minimal horizontal movement (0.02 foot). The automated piezometer readings from April 1991 to December 1993 are inconclusive and no evaluation was made based on these readings.

All elevations in this report are in feet and are referenced to the National Geodetic Vertical Datum of 1929 (NGVD).

2. GENERAL PROJECT DESCRIPTION

a. History

(1) General. Hop Brook Lake Dam was constructed by the Corps of Engineers to provide flood control of the Naugatuck River Watershed in the State of Connecticut. The Naugatuck River Watershed, the largest subbasin of the Housatonic River Watershed, has a maximum length of approximately 50 miles, a maximum width of about 12 miles, and a total drainage area of 312 square miles. The general site locus is shown in Figure 1.

Hop Brook Lake Dam is located on Hop Brook in the towns of Middlebury and Naugatuck and the city of Waterbury, Connecticut, 1.4 miles upstream from the confluence of Hop Brook and the Naugatuck River. Construction of the rolled-earth fill type dam began in December 1965 and was completed in December 1968. The top of the dam is at El. 381, it has a total length of 520 feet and a maximum height of 97 feet. A permanent pool is maintained near El. 311. The reservoir plan is shown in Figure 2.

(2) Remedial Work. Remedial work was performed following the occurrence of seepage problems through the dam as explained in the Letter Report, Remedial Measure for Seepage Control and Embankment Stabilization, dated October 1988. Phase I construction consisted of a filter trench at the downstream toe, a sand injection program, and placement of crushed stone over the face of the downstream slope. Phase II construction consisted of stabilization of the existing railroad embankment (located 250 feet downstream of the toe of the dam) and construction of a permanent access road to the downstream toe. All work was completed in 1991.

b. Geology and Foundations.

(1) General. The dam is located in the western Connecticut highlands area of plateau remnants sloping gently to the southeast. The topography is of moderate relief consisting of steep sided bedrock controlled valleys mantled by glacial till. The original topography is shown on a plan of foundation explorations, Figure 3. The glacial till in most areas is overlain by glaciofluvial deposits deposited in temporary lakes formed by local damming of the valleys by remnant ice blocks during glacial recession. The bedrock consists of pretriassic metamorphic rocks which have been later intruded by granite bodies and traprock dikes.

(2) Site Geology. Overburden at the dam site consists of variable deposits of silt, sand, and gravel overlying the bedrock in thicknesses up to 25 feet. Preconstruction geologic profiles are shown in Figure 4. Boulder concentrations occurred in the original streambed and in scattered areas on the abutments. Bedrock consists of granitized schist and is exposed on the easterly side (left) of the streambed and at higher elevations on the left abutment. Construction records describe the bedrock surface exposed for the foundation cutoff and outlet works construction as being extremely rough with steep rock faces, overhangs, and depressions which required special compaction effort. At least the top five feet of bedrock consisted of either highly fractured or disintegrated rock. Additional grout holes were added to the cutoff wall during construction for this reason. While drilling PZ-13 in September 1986, located on the downstream slope and through the left abutment at Sta 5+21 with a centerline offset of 103.5 feet, cloudy water was observed emerging adjacent to the right side of the outlet structure indicating the presence of a seepage path through the downstream left abutment area. Rock cores in this area show heavily stained joint zones further indicating water percolation. The rock quality in the upper layers of rock cores sampled in the left abutment during piezometer installation are poorest in the middle of a triangular area defined by the conduit outlet structure, the entrance to the service bridge, and the entrance to the rotary at the left abutment.

c. Dam and Appurtenant Structures Description. The dam embankment is zoned with a relatively thin upstream inclined compacted impervious fill zone including a foundation cutoff to bedrock, a large central zone of compacted random fill, and a downstream zone of compacted pervious fill. Internal drainage is provided by a downstream horizontal drainage blanket and a downstream rockfill toe. The upstream and downstream slopes are surfaced with rock slope protection on gravel bedding. Typical as-built embankment sections are shown in Figure 5.

The outlet works, located on the left abutment, consists of an intake channel, a concrete control weir, and intake and control tower, a concrete conduit founded on rock under the dam, a stilling basin, and an outlet channel.

The spillway is a chute-type located approximately 1200 feet northeast of the dam in a saddle. The spillway approach channel was excavated from overburden. The spillway weir is a broad crested concrete weir with a top at El. 364.0 and a width of 200 feet. The discharge channel narrows from 200 feet at the weir to approximately 80 feet wide 300 feet downstream of the weir.

Test borings were completed along the upstream and downstream slopes to permit the installation of piezometers and observation wells. The locations of the piezometers are shown on Figure 6 with legends presented on Figure 7. The engineering and piezometer logs are presented in Figures 8 through 11. When plotted against the typical embankment cross sections, the boring data provides confirmation of the general site geology as discussed below. Refer to Figures 12 through 18 for typical profiles and cross sections.

3. INSTRUMENTATION

Instrumentation to monitor embankment performance consists of six crest survey monuments and fifteen piezometers. Four tilt plates were installed on the old railroad stone arch culvert to monitor movement of the arch. There is no instrumentation to monitor the dike. The instrumentation plan is shown in Figure 6.

a. Crest Monuments. Six crest monuments and four control points were installed at the dam in 1985 as part of the New England Division Dam Safety Program. The six crest monuments are located along the downstream edge of the embankment crest and are labeled 1 through 6. The crest survey monuments consist of a 10-foot length of 3-3/16-inch I.D. steel casing filled with concrete and capped with a brass disk. The four control points, Mon A, B, C, and D were drilled into ledge or placed and grouted deep into undisturbed soil, and are assumed to be fixed reference points. An initial survey was performed in July 1985 to establish the elevations of the crest survey monuments. Subsequent surveys were performed in March and July 1987 by New England Division surveyors to establish initial coordinates for the control points and crest monuments. The last survey was performed in April 1992. The March and July 1987 and April 1992 surveys were performed using electronic distance meter (EDM) instruments. The current standards and procedures employed by Corps of Engineers surveyors for crest monument surveys are contained in Appendix A.

b. Piezometers. A total of fifteen piezometers were installed at Hop Brook Dam. Installations were accomplished under 2 separate delivery orders to an open end service contract by Mobile District drill crews. PZ-1 through PZ-7 were installed between 17 February and 20 March 1986. PZ-8 through PZ-14 were installed between 6 August and 26 September 1986. PZ-15 was installed in October 1988 as part of the Phase I remedial work. All piezometers were installed using standard drilling techniques. All piezometers are Casagrande type and were fitted with either vibrating wire or electric current sensors and attached to an automated Geomation instrumentation system.

A summary of piezometer locations, elevations, and a description of the material type at the tip is included in Table I.

c. Tilt Plates. Four tilt plates were installed on the old railroad stone culvert in May 1990. One plate is located in each of the following locations: the upstream face, the top of the upstream stone culvert, the downstream face, and the top of the downstream stone culvert.

4. AUTOMATED INSTRUMENTATION SYSTEM

a. General. The conduits for the automation system wires were installed during Phase I of the remedial repairs by Mobile and Jacksonville Districts. The automated instrument system was installed in May 1990 by Waterways Experiment Station (WES). The system is a real time data acquisition system designed to collect, process and transmit data from piezometers, seepage measurement devices, rainfall and pool level sensors at the dam site to a local PC/AT host computer located in the on-site project office. The data is transmitted to the New England Division, Geotechnical Engineering Division (GED) in Waltham, Massachusetts, via a telephone modem. System documentation and user manuals are kept at the on-site project office and the GED office.

b. System Design. The system was designed using standard off-the-shelf modular components. These modular components are expandable to handle additional instrumentation and utilize a comprehensive distributed network topology scheme. The system is designed for maintenance at the modular level without the need to perform field maintenance at the component level. The system was designed for harsh environments with considerable importance placed in the area of lightning lines, telephone lines and host computer power line. The host computer is equipped with an uninterruptible power supply to provide backup power in case of power loss to the host.

c. System Layout. The system installed at the dam consists of a host computer, located in the project office, with a portable laptop computer as a primary backup, and one remote Measurement and Control Unit (MCU) in the control tower monitoring all sensors via trenched cables. In this configuration, the MCU collects data from the field and communicates with the host computer via a hard wire link.

The MCU, located in the control tower, is directly connected to all sensors by buried cable in conduits with surge protection provided at the input module as well as at each sensor location. A layout of the automated system for the project is shown on Figure 19.

d. System Components.

(1) Host Computer. The host computer for this project is an AST Model Bravo 4/33 (with DOS operating system) standard configuration operator workstation with peripherals for Geomation System 2300 enhanced operation. Included with the host computer is an uninterruptible power supply and a printer.

The software running on the host computer is the Geomation model 2310-900 (Geonet) Standard System 2300 data acquisition and control network software. The basic functions of Geonet are real time data collection and storage, data file management, user friendly interface to the network, data display, alarm annunciation, management of the network topology setups, and allowance for remote user access to stored data files.

(2) Measurement and Control Unit (MCU). The MCU configuration consists of a Geomation 2350A MCU which is permanently mounted on a wall of the control tower. The MCU is a multi-tasking computer designed to handle all network communications and sensor interfaces in very harsh environments.

(3) Portable Laptop Computer. A Hewlett Packard portable laptop computer is used as a backup to the host computer. The portable computer is fully compatible with the host computer and is capable of operating as the host. The portable computer running the Geonet software can actually be placed in the network and use to communicate with other host computers or remotes via telephone modem.

(4) Piezometers. Transducers used to monitor the water level in the piezometers are either a Geokon vibrating wire transducers model 4500C or a Druck electric current model PDCR 35/D.

(5) Pool Level Gauge. Pool level measurements are accomplished using a Geomation Model No. 2350-500 incremental rotary encoder (IRE). This model has a quadrature output and 200 discrete states per revolution. The IRE is connected to the existing float system through a series of sprockets and a chain.

(6) Tailwater. A Druck electric current model PDCR 35/D is used to monitor and record the tailwater just below the outlet structure.

(7) Cable and Conduit. Shielded cable was used for all connections to the sensors as well as the tailwater gage and the communication link between the remote computer and the host computer. The cable was installed inside schedule 40 PVC electrical conduit buried 18 to 24 inches below grade.

5. DATA COLLECTION, INTERPRETATION, AND EVALUATION

a. Crest Monuments.

(1) Data Collection. The results of the crest monument surveys are shown on Figure 20. Dimensions between control points and crest monuments for the survey performed in April 1992 along with the coordinates and elevations of the control points are also shown on Figure 20. Computed horizontal and vertical movements of each monument are plotted on Figure 21.

(2) Interpretation and Evaluation. Two surveys were performed using an electronic distance meter (EDM) with Third Order, Class II accuracy (1:5000) for horizontal measurements and Third Order, Class I accuracy (1:10,000) for vertical measurements according to the standards and procedures presented in Appendix A.

The surveys indicate that the total rise or settlement of all monuments was limited to, or less than 0.02 foot over the five-year period. This range of movement is within the range of third order accuracy so it is possible that no rise or settlement occurred at all. However, minor settlement of the embankments or settlement of the monument itself within the embankment could have occurred. This small amount of settlement or rise is considered negligible.

The computed horizontal movements are less than 0.02 foot between 1987 and 1992. There was no physical evidence of movement at any monument such as slumps, scarps, cracks or depressions which would indicate movement of any magnitude in the embankment. Also the condition of each monument was judged to be satisfactory; no physical damage or displacement was observed.

The lack of any manifestation of movement of the embankment leads to the conclusion that no significant movement of the dam is occurring at this time. From the data which has been acquired to date, it is concluded that there has been insignificant vertical or horizontal movement of the embankment and apparent movements are probably due to limitations and accuracy of measurement.

b. Piezometers.

(1) Data Collection.

- Reading Schedule. Piezometer monitoring at Hop Brook Dam is done by the automation system. The piezometer elevations are recorded every day, and the pool stage is recorded every hour.

- Special Conditions. If unusual changes in readings develop or if piezometers become inoperable, the Geotechnical Engineering Division (GED) should be notified.

Readings obtained from the piezometers are presented in Table II. Pertinent information includes the date of reading, pool stage and elevation, and piezometer water elevations.

(2) Interpretation and Evaluation.

(a) Presentation of Data. In accordance with normal data evaluation procedures, representative plots were developed to present the piezometric data. However, during the evaluation process, discrepancies developed between automated and manual data readings which lead to the

conclusion that the automated data has been unreliable. The procedures used to prepare the plots and a discussion of the data reliability problems are presented in the following paragraphs.

The plots were developed using Quattro Pro Version 5.0 for Windows computer software. All piezometer plots are broken into two categories: time-history plots and "x-y" plots.

Time-history plots were developed for data obtained between April 1991 and December 1993 and are presented on Figures 22 through 32.

Plots of piezometer water level elevation versus pool elevation were developed for each piezometer and are shown on Figures 33 through 47. Projected piezometric levels corresponding to a pool elevation at the spillway crest also were added to the graphs. These projections were calculated by linearly regressing the piezometer data provided and plotting the best fit line. No storm events occurred at Hop Brook Dam between April 1991 and December 1993. Since there have been no major changes in pool elevation during that time, the projected piezometric values are not always realistic. Also, since the piezometer data itself has been erratic, the projections should not be considered accurate.

(b) Field Test of Piezometer Response. Prior evaluation of piezometer data by GED indicated a potential discrepancy between automated and manual readings. Field comparisons of automated and manual readings were conducted. Automated readout data was obtained from the screen output of either the office computer or from a laptop connected to the MCU located in the control tower. Manual readings were obtained by lowering a water level probe down the piezometer standpipe to measure depth to the water level. This comparison was completed on three occasions and indicated significant differences between water levels. The results are presented in Table III.

For example, the data obtained in December 1993 for PZ-1 indicates a small difference of 0.81 foot between automated and manual output, with manual readings showing a higher level. Then in August 1994, the difference increased to 8.66 feet while in October, the difference decreased to 3.77 feet. The change in differences represents erratic behavior of the instrumentation system which includes the transducers, cables, MCU and the software package which is programmed in the output computer. In addition, the discrepancies are not consistent, suggesting that the problem may be within the automation system rather than the piezometers themselves.

During the field visit conducted in October 1994 with GED personnel, tests were performed on selected piezometers to evaluate their performance. Three Geokon vibrating wire transducers were raised in 5 foot increments from their initial elevations and readings were taken with a portable Geokon readout box. A comparison of reading output of the Geokon readout box versus change in elevation for three transducers is shown in Figure 48. As shown on the plot, the transducers responded in a linear manner to the decrease in pressure. The readings became constant after the transducer was pulled above the water level. Also, the slope of the plots varied, indicating different calibration factors for each transducer. Nevertheless, the calibrations were linear, indicating that the piezometer transducers were in satisfactory working order. Discrepancies in the manual versus automated data readings, therefore, must occur in the cabling or automation system.

Similar tests were attempted with several Druck electric strain gauge transducers; however, insufficient amounts of water were present in the standpipes to permit calibration of the transducers.

Based on the historical comparison of automated and manual readings, the transducers in the piezometers were classified as either erratic or stable. The classification is indicated in Table III; all but two transducers were classified as erratic.

As a further check on the data, daily water level records were plotted for each piezometer along with the corresponding pool elevations; these plots are presented in Appendix B. A review of these plots indicates the following:

o The measured "spikes" in the pool level recorded by the automated equipment have been confirmed by duplicate and independent pool level records provided by the Water Control Division NED. These changes in pool level ranged up to approximately 10 to 13 feet for short durations of 1 to 2 days.

o The piezometer plots typically reflect a corresponding spike or increase in level. In general the magnitude of the piezometer response was considerably less than the change in pool level. The change in piezometer level typically was about 20 to 80 percent of the change in pool level.

o Erratic, positive and negative spikes in the piezometer readings also occur with no significant change in the reported pool level.

o Extremely low piezometric levels for PZ-7 in October 1991 and PZ-1 in July ~~193~~ 1993 fall below the absolute elevation of the sensor and the piezometer tip elevation.

o After rapid peaking, the lag time for the apparent water levels to return to normal would correspond to slow internal drainage of the saturated or partially saturated embankment.

In general, the daily plots present contradictory performance, reflecting satisfactory and unsatisfactory performance of the piezometers and the system. For example, plots for PZ-1 and PZ-7 indicate that the piezometers respond to changes to pool level. However, the piezometers also respond erratically with no changes in pool level and automated water levels are presented which fall below the absolute sensor and piezometer tip elevation. This behavior, coupled with the disparity between the manual and automated readings, suggest that there is a problem within the automation system.

In addition, PZ-8 and PZ-9, installed in bedrock, show water levels greater than the pool elevation. This probably represents groundwater conditions in the bedrock relative to placement of the piezometer tip. These water levels do not correlate with pool levels.

Since this unreliable behavior was also found in data plots for the remaining piezometers, the automated data output for the piezometers must be classified as erratic and unreliable for analytic and control purposes. If the erratic behavior problems could be discounted, several general trends could be interpreted from the data:

o The piezometric levels of the piezometers installed in the bedrock beneath the left abutment are higher than the pool levels, indicating a regional or artesian condition.

o General seasonal variations appear to occur in the piezometric levels, consistent with dry and wet weather periods.

o When compared to the manual data readings which had been obtained from February 1986 through March 1989, the automated data fall in a similar range (Reference 1).

Without further investigation of the system accuracy, these general trends would erroneously indicate satisfactory instrument performance. Thus, simply monitoring and plotting the automated output from the piezometers was not sufficient to confirm the performance of the system. The field test readings taken on several occasions proved that the system output was not in agreement with basic manual observations of water levels.

Based on the analysis of the field tests, the automated piezometer output should not be utilized in further detailed evaluation of the seepage performance of the dam, until the system has been repaired.

(c) Individual Piezometer Response. All pertinent information (station, offset, top of riser and tip elevations, zone and material type where piezometer tip is located) for each piezometer is listed in Table I. Falling head tests were performed on all piezometers immediately after completion of installation. These tests confirmed that all piezometer screens were in working order. The piezometers with their tips located in bedrock had a slower response time than the piezometers with their tips in earthen materials, but all response times were satisfactory.

Field calibrations have confirmed that the automated data have not been reliable. ***Thus, the following descriptions of piezometer response to pool level changes has been summarized from the prior Instrumentation Appendix report prepared in 1989 (Reference 1).***

(1.) PZ-1

Installation Summary

PZ-1 is located on the downstream edge of the crest of the dam with its tip located just above the outlet conduit at El. 297.7. The piezometer tip was installed with a wick of filter sand around it which extends 13.9 feet above the tip of the piezometer and is then capped with a bentonite seal. The embankment zone which influences the response of PZ-1 is comprised of compacted random fill that consists of brown SAND with some gravel, and trace of silt (SP), with relative density ranging from medium to very dense.

Typical Performance Data

The normal average water level for PZ-1 was about El. 305 for a normal pool level at El. 311 $\pm$ 2 feet. The piezometric level responded well to controlled changes in the pool elevation, with a time lag of about 2 or 3 days.

Maximum piezometric levels for PZ-1 were projected using the response measurements from the controlled pool raisings in 1986; the results are summarized in Table IV. For pool at spillway level, the projected maximum was about El. 333 compared to the unreliable projection of El. 442 using automated data as shown in Figure 33.

(2.) PZ-2

Installation Summary

PZ-2 is located above the outlet conduit on the downstream slope of the dam, offset from the centerline by 179.4 feet. The piezometer tip is at El. 283.9 and is located in the compacted gravel fill zone of the embankment adjacent to the bedrock cut for the conduit. The piezometer tip was installed

with a wick of filter sand around it which extends 19.7 feet above the piezometer tip and is capped with a bentonite seal. The embankment zone which influences the response of PZ-2 is comprised of compacted gravel fill and consists of brown SAND, some gravel, and trace of silt (SP). The material is assumed to be very dense.

Typical Performance Data

The normal average water level for PZ-2 was below El. 284 and the tip is usually dry with a normal pool level at El. 311. The piezometer only responds to significant storages of water.

Maximum piezometric levels for PZ-2 were projected using the response measurements from the controlled pool raisings in 1986; the results are summarized in Table IV. For pool at spillway level, the projected maximum was about El. 295 compared to the unreliable projection of El. 315 using automated data as shown in Figure 34.

(3.) PZ-3

Installation Summary

PZ-3 is located on the downstream edge of the crest of the dam along the Old River Channel alignment at Sta. 3+57.8. The piezometer tip is at El. 280.3 and is located in the foundation zone close to the foundation-embankment interface. The piezometer tip was installed with a wick of filter sand around it which extends 12.8 feet from the piezometer tip where it is capped with a bentonite seal. The material in the foundation zone which influences the response of PZ-3 consists of brown, silty fine SAND with gravel (SM) which ranges from dense to very dense.

Typical Performance Data

The normal average water level for PZ-3 was about El. 300 with the pool at El. 311. The piezometer responds well to changes in pool level and also appears to be affected by rainfall. Maximum piezometric levels for PZ-3 were projected using the response measurements from one controlled pool raising in 1986 and the flood event in 1987; the results are summarized in Table IV. For pool at spillway level, the projected maximum was about El. 322 compared to the questionable projection of El. 358 using automated data as shown in Figure 35.

The piezometric level responded well to changes in the pool elevation with a time lag of 1 to 2 days.

(4.) PZ-4

Installation Summary

PZ-4 is located adjacent to the right side of the stilling basin at the downstream toe of the dam at Sta. 4+58.4 and is offset 240.8 feet from the centerline of the dam. The piezometer tip is at El. 271.5 and is located at the bedrock-rockfill interface.

Typical Performance Data

The normal average water level for PZ-4 was about El. 279 with the pool at El. 311. The piezometer level was slightly above tailwater and does not fluctuate very much in response to changes in pool level. The maximum piezometric levels for PZ-4 would probably not exceed El. 285 and would be controlled by tailwater elevation. This projection can be compared to the questionable projection of El. 298 using automated data as shown in Figure 36.

Time lag values were not reported for PZ-4 in the previous Instrumentation Appendix report dated June 1989.

(5.) PZ-5

Installation Summary

PZ-5 is located on the downstream slope near the toe of the dam at Sta. 5+04 adjacent to the left side of the stilling basin and is offset from the dam centerline by 214.3 feet. The tip is located at El. 285.3 and is entirely in the bedrock of the left abutment. The piezometer tip was installed with a wick of filter sand around it which extends upward six feet from the tip elevation where it is capped with a bentonite seal.

Typical Performance Data

The normal average water level for PZ-5 was less than El. 285 with the pool at El. 311. The piezometer was normally dry and only responded to pool levels above El. 323. Measured and projected high water levels for PZ-5 in response to the controlled pool raisings in 1986 and the flood in 1987 are summarized in Table IV. Based on measured performance, the maximum piezometric levels for PZ-5 would be about El. 290. This projection can be compared to the questionable projection of El. 297 using automated data as shown in Figure 37.

The time lag between maximum pool elevation and maximum piezometer reading varied between 1 and 2 days for pool levels greater than El. 323.

(6.) PZ-6.

Installation Summary

PZ-6 is located immediately above the outlet conduit on the downstream slope of the dam, offset from the centerline by 100.9 feet. The piezometer tip is at El. 289.6 and is located in the compacted gravel backfill zone of the embankment. The piezometer tip was installed with a wick of filter sand around it which extends upward 12 feet above the tip of the piezometer where it is sealed with a bentonite seal. The embankment zone which influences the response of PZ-6 is comprised of compacted gravel fill material and consists of poorly graded SAND (SP), poorly graded SAND with gravel (SP), and poorly graded SAND with silt (SP-SM). The material was generally very dense.

Typical Performance Data

The normal average water level for PZ-6 was about El. 289.6 with the pool at El. 311. The piezometer was normally dry. Measured and projected high water levels for PZ-6 in response to the controlled pool raisings in 1986 and the flood in 1987 are summarized in Table IV. Based on measured performance, the maximum piezometric levels for PZ-6 would be about El. 306. This projection can be compared to the questionable projection of El. 310 using automated data as shown in Figure 38.

The piezometric level responded well to controlled changes in the pool elevation, with a time lag of about 1 day.

(7.) PZ-7.

Installation Summary

PZ-7 is located on the downstream slope along the Old River Channel alignment at Sta. 3+77.8 and is offset from the centerline by 93.1 feet. The tip, at El. 281.3, is located in the earth foundation of the Old River Channel immediately upstream of the pervious horizontal drain. The piezometer tip was installed with a wick of filter sand around it which extends upward 7.6 feet from the piezometer tip where it is capped with a bentonite seal. The foundation zone which influences the response of PZ-7 is assumed to consist of very dense gravelly SAND with cobbles. Sampling of this zone was unsuccessful.

Typical Performance Data

The normal average water level for PZ-7 was about El. 283.5 with the pool at El. 311. Measured and projected high water levels for PZ-7 in response to the controlled pool raisings in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-7 were projected using the response measurements from the controlled pool raisings in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 303 compared to the unreliable projection of El. 338 using automated data as shown in Figure 39.

PZ-7 responded slowly to pool fluctuations, with a time lag of 4 or more days.

(8.) PZ-8.

Installation Summary

PZ-8 is located on the downstream edge of the crest of the dam at Sta. 5+20. The tip is located in the bedrock at El. 284.4. The piezometer tip was installed with a wick of filter sand around it which extends upward 35 feet from the piezometer tip and is then capped by a bentonite seal. The wick is entirely in schist that is characterized by open vertical joints and intense fracturing with iron stained breaks above El. 311.0.

Typical Performance Data

The normal average water level for PZ-8 was about El. 287 with the pool at El. 311. Measured and projected high water levels for PZ-8 in response to the controlled pool raisings in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-8 were projected using the response measurements from the controlled pool raisings in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 337 compared to the unreliable projection of El. 454 using automated data as shown in Figure 40.

PZ-8 responded rapidly to rising pools; however, for falling pools the time lag was several months.

(9.) PZ-9.

Installation Summary

PZ-9 is located on the upstream slope of the dam at Sta. 5+21.1 and is offset from the centerline by 51.5 feet. The tip is located in bedrock at El. 290.5. The piezometer tip was installed with a wick of filter sand around it which extends upward 28.5 feet from the piezometer tip where it is then capped with a bentonite seal. The wick is entirely in schist that is characterized by highly fractured, muddy joints occurring in the top twenty feet of rock.

Typical Performance Data

The normal average water level for PZ-9 was about El. 318 with the pool at El. 311. Measured and projected high water levels for PZ-9 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-9 were projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 333 compared to the unreliable projection of El. 412 using automated data as shown in Figure 41.

PZ-9 responded rapidly to rising pools; however, for falling pools the time lag was several months.

(10.) PZ-10.

Installation Summary

PZ-10 is located adjacent to the outlet conduit on the upstream slope of the dam, offset from the centerline by 84.1 feet. The tip is located at El. 296.9 in seven feet of bedrock and about 35 feet downstream of the grout curtain. The piezometer tip was installed with a wick of filter sand around it which extends upward 18 feet from the piezometer tip to the top of the impervious fill zone where it is then capped with a bentonite seal. The compacted impervious fill zone which influences the response of PZ-10 above the seven feet of bedrock is comprised mostly of grey-brown silty SAND (SM) and silty SAND with gravel (SM) with density ranging from medium at the top of the column increasing to very dense towards the bottom.

Typical Performance Data

The normal average water level for PZ-10 was about El. 299 with the pool at El. 311. Measured and projected high water levels for PZ-10 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-10 were projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 335 compared to the unreliable projection of El. 428 using automated data as shown in Figure 42.

The response time of PZ-10 was erratic based on the second pool raising of 1986 and the flood event of 1987.

(11.) PZ-11.

Installation Summary

PZ-11 is located on the upstream slope of the dam along the Old River Channel alignment at Sta. 3+81.2, offset from the centerline by 125 feet and about 60 feet downstream of the foundation cutoff. The tip is located at El. 286.5 in the foundation zone just above bedrock surface and immediately below the compacted random fill zone. The piezometer tip was installed with a wick of filter sand around it which extends upward 20.5 feet and is capped with a bentonite seal. The foundation material which influences the response of PZ-11 is mostly classified as grey-brown, silty GRAVEL with sand (GM).

Typical Performance Data

The normal average water level for PZ-11 was about El. 303 with the pool at El. 311. Measured and projected high water levels for PZ-11 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-11 were projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 331 compared to the unreliable projection of El. 362 using automated data as shown in Figure 43.

The piezometric level responded well to controlled changes in the pool elevation, with a time lag of about 1 day.

(12.) PZ-12.

Installation Summary

PZ-12 is located in the left abutment on the downstream slope of the dam at Sta. 5+09.9 and is offset from the centerline by 192 feet. The piezometer tip is located at El. 274.7 and was installed with a wick of filter sand around it which extends upward 12.5 feet from the tip and is capped with a bentonite seal. The wick is located entirely in bedrock in schist, (90 percent pegmatite) and is characterized by moderate fracturing and iron stained joints.

Typical Performance Data

The normal average water level for PZ-12 was about El. 287 with the pool at El. 311. Measured and projected high water levels for PZ-12 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-12 were projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 296 compared to the unreliable projection of El. 289 using automated data as shown in Figure 44.

The piezometric level responded well to controlled changes in the pool elevation, with a time lag of about 1 day.

(13.) PZ-13.

Installation Summary

PZ-13 is located near the left abutment on the downstream slope of the dam at Sta. 5+21.8 and is offset from the centerline by 103.5 feet. The tip is at El. 279.5 in bedrock. The piezometer tip was installed with a wick of filter sand around it which extends upward 40 feet and is capped with a bentonite seal. The zone which influences PZ-13 consists of 40 feet of bedrock. The top 20 feet consists of pegmatitic schist characterized by moderately to intensely fractured joints and contains some iron stained joints. The next 15 feet consist of very hard pegmatite which was moderately fractured. The bottom 5 feet consists of pegmatitic schists with intensely fractured joints. During drilling there was significant water loss at many locations.

Typical Performance Data

The normal average water level for PZ-13 was about El. 300 with the pool at El. 311. Measured and projected high water levels for PZ-13 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-13 were

projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 316 compared to the unreliable projection of El. 358 using automated data as shown in Figure 45.

The piezometric level responded well to controlled changes in the pool elevation, with a time lag of less than 1 day.

(14.) PZ-14.

Installation Summary

PZ-14 is located on the downstream slope of the dam, along the Old River Channel alignment at Sta. 3+97.4 and offset from the centerline of the dam by 162 feet. The piezometer tip was installed at El. 272.6 and is located in the horizontal drainage blanket. The piezometer tip was installed with a wick of filter sand which extends upward 36 feet and is capped with a bentonite seal. The overburden zone which influences the response of PZ-14 consist of 23 feet of random and pervious fill from the embankment consisting mostly of gray-brown, poorly graded GRAVEL with silt and sand (GP-GM), and 6 feet of horizontal drainage blanket which is composed of very pervious sands and gravels (SW, SP, GP, GP-GM). No samples were recovered from this zone during the drilling process.

Typical Performance Data

The normal average water level for PZ-14 was about El. 285 with the pool at El. 311. Measured and projected high water levels for PZ-14 in response to the second controlled pool raising in 1986 and the flood in 1987 are summarized in Table IV. Maximum piezometric levels for PZ-14 were projected using the response measurements from the second controlled pool raising in 1986 and the flood in 1987. For a pool elevation at spillway level, the projected maximum piezometer reading was about El. 295 compared to the unreliable projection of El. 284 using automated data as shown in Figure 46.

The piezometric level responded well to controlled changes in the pool elevation, with a time lag of less than 1 day.

(15.) PZ-15.

Installation Summary

PZ-15 is located on the downstream slope of the dam, along the Old River Channel alignment at Sta. 4+12.5 and offset from the centerline of the dam by 215 feet. The piezometer tip was installed at El. 273.0 and is located in the rock fill toe. The piezometer tip was installed with a wick of filter sand which extends upward 11.6 feet from the tip where it is capped with a bentonite seal. The piezometer was drilled using the ODEX drilling method and no samples were taken. The drill hole was used to inject ¼ inch size stone prior to the installation of this piezometer. PZ-15 was installed in October 1988.

Typical Performance Data

PZ-15 was not evaluated during the previous Instrumentation Appendix because the piezometer was installed in October 1988 and only limited data was available at the time of publication. Since no additional manual data has been obtained, no further evaluation of the performance of the piezometer was made. Using the unreliable automated data, the projected maximum level would be El. 300 for the pool at the spillway crest; however, the accuracy and reliability of the projection is questionable.

(d) Cross-Sectional Evaluation. Three cross sections were prepared and are shown on Figures 49 through 51. Projected piezometric levels are not included on the sections due to the unreliability of the data as discussed previously. The average automated piezometric levels are shown for general information purposes. However, these levels also may be inaccurate as discussed previously. Listed below is a comparison of automated readings from Inspection Report Nos. 4 and 5.

Piezometer Number	Periodic Inspection Report No. 4 Average Piezometer Levels (Automated)	Periodic Inspection Report No. 5 Average Piezometer Levels (Automated)
PZ-1	El. 305	El. 305
PZ-2	El. 284	El. 291
PZ-3	El. 300	El. 300
PZ-4	El. 279	El. 278
PZ-5	El. 285	El. 286
PZ-6	El. 289.6	El. 297
PZ-7	El. 283.5	El. 291
PZ-8	El. 287	El. 331
PZ-9	El. 318	El. 323
PZ-10	El. 299	El. 312
PZ-11	El. 303	El. 302
PZ-12	El. 287	El. 288
PZ-13	El. 300	El. 303
PZ-14	El. 285	El. 290

As can be seen by the above comparison, no trend can be established when evaluating the performance of embankment or foundation piezometers.

(e) Profile Evaluations. Time history data for piezometers located on four longitudinal profiles were prepared and are shown on Figures 52 through 55. Projected piezometric levels are not included on the profiles due to the unreliability of the data as discussed previously. The average automated piezometric levels are shown for general information purposes. However, these levels also may be inaccurate as discussed previously.

(f) Phreatic Surface Elevation Plan. The phreatic surface plan was not presented because the automated piezometer data has been judged unreliable. A phreatic surface plan generated from this unreliable data would be misleading.

c. Tilt Plates.

(1) Data Collection. Four Terra-Tilt plates are located on the face and top of the railroad culvert to monitor movements. The cumulative rotation angle of the railroad culvert measured by the tilt plates is shown in Figure 56. Rotation of the tilt plates was measured periodically by U.S. Army Corps of Engineers personnel between May 1990 and October 1993.

(2) Interpretation and Evaluation. Tilt plate movements are summarized in Table V. The movements recorded during the period of May 1990 to October 1993 are negligible with a maximum rotation angle of 0.11 degrees as shown in Figure 56. The other readings are consistently less than 0.1 degrees. This small amount of movement is considered insignificant and may be due to limitations of measurement.

6. CONCLUSIONS AND RECOMMENDATIONS.

a. General.

Geotechnical instrumentation at Hop Brook Dam consists of crest survey monuments, piezometers and tilt plates. The crest survey monuments and tilt plates are in working order and are reliable. There is a discrepancy between automated and manual data obtained from the piezometers which needs to be further investigated.

b. Crest Monuments.

(1) Schedule. The schedule of crest monument surveys at Hop Brook Dam is once every five years to coincide with the periodic inspection schedule. The next scheduled survey is to be performed in 1997. If unusual readings are obtained during the next survey or if field evidence of embankment movement is discovered, the monitoring schedule will be adjusted as needed.

(2) Evaluation of Adequacy. Total settlement of all bounds was limited to less than 0.02 foot over a five year period. This settlement could be attributed to the survey accuracy, settlement of the embankment or settlement of the bound itself. This small amount of settlement is considered negligible.

The present configuration and number of crest monuments and control points is considered adequate to monitor horizontal and vertical movement of the dam embankment. With the advent of Global Positioning Systems Survey (GPS) such as NAVSTAR, the accuracy of three dimensional movements can be detected at levels of less than 5 millimeters (Ref. ETL 1110-1-133). The implementation of this type of monitoring system within the next five years is recommended if it proves to be cost effective.

c. Piezometers.

(1) Reading Schedule. The current piezometer reading schedule as outlined in paragraph 5.b.1. of this report should continue to be implemented.

(2) Evaluation of Adequacy. The automated piezometer data has been found to be unreliable. Automated water level readings do not agree with manual readings. The automated piezometer output should not be used to evaluate the performance of the dam. Field tests indicate that three of the Geokon vibrating wire piezometers are able to respond to changes in pressure, suggesting that the problem may lie within the automation system. Other components of the automation system such as the MCU, hard wire link, computer hardware and software, and cables should be individually evaluated to determine what is causing the discrepancy in the readings.

(3) Recommendations. Until the cause of the discrepancy in the readings has been identified, water level readings should be obtained manually.

A step by step approach outlined below should be used to try to eliminate possible sources of error in the transducers or the automation system.

1. To further investigate the discrepancy between the automated and manual readings, more comparison water level readings should be obtained. When measuring the water level manually, the transducer should be removed and the water level in the standpipe should be allowed to stabilize at least overnight before using a water level reader sound the water level. Conversely, when measuring the water level electronically, the transducer should be replaced and the water level and transducer should be allowed to stabilize at least overnight. By allowing adequate stabilization time, any volumetric errors caused by adding or removing the transducer and cable should be eliminated.

2. Tests should be performed on all transducers to evaluate their performance. For example, a pressurized chamber could be used to independently evaluate the response of each transducer to changes in pressure. Use the chamber at each piezometer location to calibrate the output of the MCU to a known hydraulic or air pressure measured independently at the chamber.

3. Another option would involve temporarily replacing two or three of the existing Druck PDCR 35/D transducers with a more stable unit, such as the Geokon 4500B transducer. By rotating the more stable units through the system, the erratic piezometer units can be isolated. The 4500B unit will fit inside the existing 0.75 inch PVC pipe.

If one of the suggested field testing options does not locate the system problem, then a more comprehensive testing program should be designed to isolate each component of the automation system and determine if part of the system is malfunctioning. The following considerations should be made when preparing the test program:

- barometric effects on the transducers;
- temperature effects in the transducers and possibly the MCU;
- effect of precipitation on wiring;
- power use; generator testing which may cause surges;
- condition of old telephone lines;
- possibility of reduced voltage;
- accuracy of piezometers in the actual pressure range;
- wire connections to MCU;
- possible transient protection device malfunction.

d. Tilt Plates.

(1) Reading Schedule. A total of ten readings were taken from May 9, 1990 to October 20, 1993. The reading schedule varied from one reading in 1993 to four readings in 1991.

(2) Evaluation of Adequacy. Based on the information provided by GED, a monitoring program was implemented in 1994. The program calls for readings to be taken in the Spring and Fall of each year, as a minimum.

7. REFERENCES.

1. Department of the Army, New England Division, Corps of Engineers. 1989. "Supplemental Instrumentation Appendix to Periodic Inspection Report No. 4, Hop Brook Lake, Middlebury, Connecticut, Instrumentation for Safety Evaluation."

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TABLE I

PIEZOMETER SUMMARY
HOP BROOK DAM

PIEZOMETER NUMBER	TYPE (2)	APPROXIMATE STATION	APPROXIMATE CENTERLINE OFFSET	RISER PIPE TOP ELEVATION	PIEZOMETER TIP ELEVATION	SENSOR ELEVATION	ZONE LOCATED	MATERIAL AT TIP ELEVATION
PZ-1	VW	4+58.4	11.6	382.6	297.7	298.8	COMPACTED RANDOM FILL	Br. SAND w/ some gravel and trace silt (SP)
PZ-2	E	4+77.1	179.4	318.0	283.9	284.6	COMPACTED RANDOM FILL	No sample - Assumed sandy GRAVEL and COBBLES
PZ-3	VW	3+57.8	12.7	383.2	280.3	281.3	FOUNDATION	Br. SAND w/ some gravel, trace cobbles and trace silt (SP-GM)
PZ-4	E	4+58.4	240.8	289.3	271.5	272.6	FOUNDATION	No sample - Assumed COBBLES
PZ-5	E	5+04.1	214.3	306.6	285.3	286.3	BEDROCK	Gneiss Schist Pegmatitic
PZ-6	E	4+70.0	100.9	348.2	289.6	290.1	RANDOM FILL	Br. SAND w/ little cobbles, trace gravel and trace silt (SP)
PZ-7	E	3+77.8	93.1	349.9	281.3	282.5	FOUNDATION	No sample - Assumed gravely SAND and COBBLES
PZ-8	VW	5+20.0	11.3	383.2	284.4	286.1	BEDROCK	Schist, Pegmatitic
PZ-9	VW	5+21.2	51.5	368.5	290.5	292.9	BEDROCK	Schist, Pegmatitic
PZ-10	VW	4+59.8	84.1	356.6	296.9	298.2	BEDROCK	Schist, Pegmatitic
PZ-11	VW	3+81.2	125.1	342.3	286.5	289.6	BEDROCK	Schist, Pegmatitic
PZ-12	E	5+09.9	191.7	315.3	274.7	277.3	BEDROCK	Schist, Pegmatitic
PZ-13	VW	5+21.8	103.5	346.5	279.5	282.6	BEDROCK	Schist, Pegmatitic
PZ-14	E	3+97.4	162.0	324.6	272.6	275.4	FOUNDATION	No sample - Assumed sandy BOULDERS and COBBLES
PZ-15	E	4+12.5	215.0	306.6	273.0	272.1	ROCKFILL	Rockfill

Notes:
1. All elevations in feet and referenced to National Geodetic Vertical Datum (NGVD).
2. E = Electric Strain Gauge; VW = Vibrating Wire

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HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
01-Apr-91	0.00	309.39	306.02	290.67	300.28	277.87	286.23	296.43	291.56	330.96	323.86	312.39	302.51	287.49	303.64	295.29	280.28	282.61
01-Apr-91	15.93	307.93	307.28	290.67	299.77	277.81	286.21	296.41	292.12	331.84	324.53	313.40	301.83	287.87	304.15	296.67	280.29	282.30
02-Apr-91	17.17	309.17	307.30	290.67	300.00	277.82	286.21	296.42	291.92	331.76	324.48	313.40	302.26	287.80	304.15	296.68	280.26	282.45
03-Apr-91	17.35	309.35	307.15	290.67	299.95	277.92	286.21	296.42	291.69	331.61	324.36	313.24	302.37	287.73	304.13	296.57	280.28	282.68
04-Apr-91	17.33	309.33	307.15	290.67	300.21	277.87	286.21	296.42	291.69	331.52	324.33	313.19	302.63	287.67	304.14	296.06	280.20	282.64
05-Apr-91	17.29	309.29	307.08	290.67	300.53	277.85	286.22	296.42	291.77	331.40	324.25	313.06	302.83	287.62	304.07	295.95	280.16	282.61
06-Apr-91	17.29	309.29	306.90	290.67	300.63	277.84	286.22	296.42	291.72	331.19	324.09	312.85	302.84	287.56	303.95	296.38	280.13	282.61
07-Apr-91	17.28	309.28	306.53	290.67	300.50	277.82	286.23	296.42	291.69	330.88	323.83	312.54	302.72	287.51	303.74	296.09	280.09	282.59
08-Apr-91	17.25	309.25	306.06	290.67	300.21	277.80	286.23	296.42	291.58	330.47	323.48	312.09	302.42	287.45	303.44	295.78	280.08	282.56
09-Apr-91	17.25	309.25	305.66	290.67	300.12	277.78	286.23	296.42	291.65	330.13	323.18	311.71	302.27	287.40	303.16	295.88	280.07	282.56
10-Apr-91	17.21	309.21	305.28	290.67	299.94	277.76	286.23	296.42	291.56	329.84	322.89	311.37	302.07	287.34	302.92	295.87	280.01	282.53
11-Apr-91	17.17	309.17	304.88	290.67	299.61	277.73	286.23	296.43	291.29	329.65	322.76	311.09	301.83	287.28	302.85	295.58	279.97	282.47
12-Apr-91	17.13	309.13	304.71	290.67	299.56	277.68	286.22	296.43	291.15	329.69	322.88	310.99	301.88	287.18	303.01	295.24	279.95	282.42
13-Apr-91	17.27	309.27	304.74	290.67	299.85	277.65	286.22	296.43	291.19	329.82	323.07	311.04	302.20	287.09	303.15	295.23	279.91	282.44
14-Apr-91	17.25	309.25	304.75	290.67	300.14	277.69	286.22	296.44	291.13	329.84	323.12	311.07	302.39	287.00	303.24	296.08	279.88	282.55
15-Apr-91	17.25	309.25	304.70	290.67	300.39	277.65	286.21	296.43	291.19	329.85	323.19	311.02	302.55	286.93	303.28	295.96	279.86	282.48
16-Apr-91	17.53	309.53	304.57	290.67	300.56	277.97	286.22	296.44	291.32	329.77	323.14	310.94	302.69	286.92	303.26	295.94	280.39	282.84
17-Apr-91	17.44	309.44	304.30	290.67	300.36	277.75	286.22	296.43	291.21	329.65	323.04	310.75	302.54	286.86	303.14	295.27	280.08	282.59
18-Apr-91	17.41	309.41	303.98	290.67	300.14	277.71	286.23	296.44	291.13	329.47	322.90	310.53	302.37	286.80	302.99	295.10	280.04	282.59
19-Apr-91	17.41	309.41	303.84	290.67	300.07	277.66	286.21	296.44	291.03	329.45	322.89	310.46	302.34	286.74	302.96	294.45	279.94	282.48
20-Apr-91	17.37	309.37	303.81	290.66	300.20	277.61	286.22	296.43	290.99	329.48	322.94	310.46	302.41	286.68	303.01	294.57	279.88	282.45
21-Apr-91	17.45	309.45	303.98	290.67	300.59	277.89	286.22	296.44	291.20	329.55	323.04	310.56	302.70	286.66	303.08	294.72	281.46	282.60
22-Apr-91	18.01	310.01	304.10	290.67	300.74	279.09	286.57	296.43	291.80	331.08	323.74	311.35	302.89	287.92	303.63	295.92	281.91	283.68
23-Apr-91	17.65	309.65	305.31	290.66	300.56	278.38	286.22	296.44	291.89	332.71	325.27	313.33	302.83	287.92	304.29	295.27	281.04	283.03
24-Apr-91	17.53	309.53	307.20	290.67	300.65	278.13	286.22	296.43	291.99	333.24	325.57	314.85	302.96	287.99	304.52	294.84	280.67	282.80
25-Apr-91	17.49	309.49	308.43	290.66	300.62	278.01	286.22	296.43	291.89	333.11	325.39	315.01	302.92	288.07	304.53	294.57	280.49	282.70
26-Apr-91	17.45	309.45	308.65	290.67	300.51	277.94	286.22	296.44	291.82	332.85	325.13	314.84	302.84	288.20	304.44	294.06	280.37	282.64
27-Apr-91	17.45	309.45	308.61	290.66	300.69	277.90	286.22	296.44	291.95	332.63	324.91	314.56	302.91	288.25	304.23	294.03	280.32	282.57
28-Apr-91	17.41	309.41	308.17	290.66	300.47	277.87	286.23	296.43	291.72	332.30	324.62	314.20	302.66	288.24	303.99	293.95	280.25	282.54
29-Apr-91	17.41	309.41	307.79	290.66	300.31	277.83	286.22	296.43	291.70	332.08	324.43	313.95	302.57	288.10	303.86	293.10	280.16	282.52
30-Apr-91	19.20	311.20	307.70	290.66	300.53	277.83	286.22	296.44	291.75	332.00	324.38	313.89	302.71	288.00	303.85	292.79	280.34	282.54
01-May-91	0.00	311.52	307.96	291.93	299.91	278.38	286.45	296.77	292.98	331.85	323.97	313.80	302.73	288.37	303.68	289.53	280.90	282.85
01-May-91	19.40	311.40	307.62	290.66	300.69	278.30	286.23	296.43	292.01	332.13	324.44	313.99	302.84	288.08	303.94	293.44	280.81	282.95
02-May-91	19.31	311.31	307.85	300.81	290.66	278.05	286.23	296.44	292.06	332.24	324.54	314.09	302.92	288.02	303.93	293.12	280.45	282.71
03-May-91	19.24	311.24	307.80	290.66	300.73	277.93	286.22	296.42	291.95	332.09	324.46	314.00	302.82	287.94	303.87	292.94	280.29	282.57
04-May-91	19.20	311.20	307.66	290.66	300.62	277.86	286.22	296.29	291.77	331.99	324.43	313.96	302.77	287.84	303.91	292.81	280.21	282.50

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
05-May-91	19.20	311.20	307.43	290.66	300.42	277.80	286.22	296.43	291.59	331.81	324.32	313.82	302.65	287.78	303.87	292.52	280.11	282.46
06-May-91	19.16	311.16	307.29	290.66	300.54	277.77	286.22	296.43	291.60	331.65	324.20	313.70	302.72	287.72	303.79	292.53	280.08	282.43
07-May-91	26.12	318.12	308.53	291.81	300.92	279.63	287.89	296.43	292.49	333.93	325.46	315.40	304.45	289.75	305.24	294.29	282.54	284.26
08-May-91	19.60	311.60	310.55	292.08	301.24	278.96	287.61	296.54	293.02	334.87	326.01	316.56	303.49	289.77	305.80	294.35	281.72	283.30
09-May-91	19.44	311.44	311.43	292.47	301.53	278.76	287.65	297.44	293.31	335.17	326.14	317.19	303.54	289.94	305.93	289.54	281.40	283.02
10-May-91	19.40	311.40	311.88	292.61	301.94	278.72	287.33	297.85	293.74	335.21	326.14	317.48	303.73	289.84	305.74	289.55	281.32	282.96
11-May-91	19.48	311.48	312.02	302.03	292.66	278.92	286.98	298.04	294.00	335.11	326.04	317.51	303.69	289.74	305.60	289.24	281.60	283.10
12-May-91	19.36	311.36	312.17	292.65	302.40	278.75	286.69	298.10	294.37	334.95	325.92	317.43	303.81	289.59	305.43	289.30	281.39	282.89
13-May-91	19.40	311.40	311.87	292.52	302.25	278.67	286.34	297.94	294.34	334.50	325.57	316.98	303.53	289.42	305.06	289.12	281.26	282.77
14-May-91	19.36	311.36	311.52	292.37	302.09	278.60	286.23	297.74	294.42	333.97	325.21	316.50	303.33	289.26	304.63	289.09	281.23	282.69
15-May-91	19.36	311.36	310.99	292.12	301.26	278.53	286.22	297.39	294.26	333.31	324.79	315.91	303.00	289.09	304.23	288.91	281.14	282.63
16-May-91	19.32	311.32	310.43	291.88	301.02	278.43	286.22	297.00	294.13	332.74	324.39	315.26	302.80	288.87	303.96	288.77	281.03	282.54
17-May-91	19.28	311.28	309.97	291.66	301.11	278.34	286.26	296.65	294.07	332.28	324.07	314.72	302.78	288.62	303.71	288.61	280.94	282.47
18-May-91	19.48	311.48	309.01	291.52	300.21	278.84	286.22	296.42	293.86	331.73	323.67	313.94	302.55	288.52	303.25	288.87	281.68	282.93
19-May-91	19.32	311.32	308.44	291.27	299.97	278.36	286.22	296.45	293.66	331.50	323.56	313.52	302.44	288.36	303.22	288.44	280.97	282.54
20-May-91	19.28	311.28	308.05	291.06	300.19	278.37	286.22	296.45	293.57	331.36	323.56	313.44	302.66	288.22	303.22	288.24	280.87	282.84
21-May-91	19.24	311.24	307.54	290.86	300.30	278.28	286.22	296.44	293.43	331.11	323.46	313.25	302.73	288.08	303.19	288.04	280.76	282.78
22-May-91	19.24	311.24	306.96	290.68	300.31	278.20	286.23	296.44	293.25	330.83	323.30	312.97	302.72	287.95	303.07	287.87	280.66	282.74
23-May-91	19.20	311.20	306.28	290.61	299.94	278.11	286.23	296.44	292.93	330.38	322.98	312.38	302.41	287.81	302.82	287.64	280.54	282.69
24-May-91	19.20	311.20	305.75	290.66	299.79	278.04	286.23	296.44	292.83	330.00	322.73	311.86	302.28	287.67	302.63	287.50	280.46	282.65
25-May-91	19.16	311.16	305.36	290.66	299.80	278.06	286.23	296.45	292.68	329.72	322.52	311.48	302.23	287.56	302.52	287.33	280.43	282.77
26-May-91	19.12	311.12	304.62	290.66	299.32	278.00	286.23	296.45	292.32	329.27	322.18	310.84	301.85	287.42	302.28	287.11	280.35	282.71
27-May-91	19.12	311.12	304.14	290.67	299.19	277.95	286.22	296.45	292.23	328.95	321.98	310.39	301.74	287.30	302.04	286.97	280.26	282.69
28-May-91	19.39	311.39	303.81	290.67	299.16	278.63	286.23	296.45	292.23	328.72	321.82	310.05	301.74	287.28	301.96	287.53	281.24	283.31
29-May-91	19.20	311.20	303.38	290.66	298.98	278.13	286.23	296.45	292.11	328.64	321.73	309.78	301.55	287.22	301.85	287.15	280.51	282.88
30-May-91	19.16	311.16	303.19	290.69	298.92	278.05	286.23	296.44	291.98	328.58	321.73	309.72	301.46	287.16	301.75	286.95	280.36	282.88
31-May-91	19.52	311.52	303.12	290.71	298.93	278.84	286.22	296.45	292.06	328.72	321.75	309.79	301.53	287.65	301.76	287.52	281.37	283.67
01-Jun-91	0.00	311.08	301.50	290.69	298.28	277.60	286.23	296.45	290.71	327.48	321.12	308.43	300.95	286.35	301.35	285.98	279.84	282.34
01-Jun-91	19.33	311.33	303.40	290.70	298.82	278.53	286.23	296.45	292.08	329.41	322.44	310.48	301.46	287.47	301.96	287.49	281.15	283.27
02-Jun-91	19.23	311.23	303.94	290.70	298.71	278.15	286.22	296.45	291.95	329.65	322.64	311.04	301.41	287.43	302.06	287.13	280.54	282.93
03-Jun-91	19.16	311.16	304.27	290.69	298.79	278.09	286.26	296.45	291.85	329.56	322.61	311.26	301.51	287.38	302.12	286.93	280.41	282.95
04-Jun-91	19.16	311.16	304.33	290.69	298.88	278.15	286.23	296.45	291.78	329.28	322.44	311.08	301.57	287.31	302.09	287.01	280.51	283.05
05-Jun-91	19.12	311.12	304.01	290.68	298.74	278.09	286.22	296.45	291.60	328.94	322.11	310.64	301.50	287.20	302.07	286.84	280.39	282.98
06-Jun-91	19.12	311.12	303.72	290.68	298.75	278.03	286.23	296.45	291.43	328.73	321.93	310.22	301.57	287.08	302.09	286.67	280.31	282.94
07-Jun-91	19.11	311.11	303.34	290.67	298.81	277.95	286.23	296.44	291.31	328.52	321.82	309.87	301.59	286.96	302.06	286.55	280.20	282.86
08-Jun-91	19.08	311.08	303.01	290.68	299.00	277.86	286.23	296.45	291.29	328.36	321.77	309.60	301.67	286.85	302.03	286.46	280.08	282.75

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
09-Jun-91	19.08	311.08	302.50	290.67	298.74	277.73	286.23	296.45	291.01	328.02	321.52	309.17	301.41	286.73	301.83	286.22	279.95	282.60
10-Jun-91	19.08	311.08	302.10	290.68	298.60	277.54	286.22	296.45	290.99	327.75	321.35	308.80	301.30	286.61	301.65	286.13	279.79	282.22
11-Jun-91	19.04	311.04	301.78	290.69	298.59	277.48	286.23	296.45	290.89	327.55	321.21	308.50	301.20	286.50	301.51	286.02	279.72	282.18
12-Jun-91	19.04	311.04	301.43	290.69	298.49	277.44	286.22	296.45	290.83	327.31	321.04	308.21	301.08	286.40	301.34	285.85	279.63	282.16
13-Jun-91	19.12	311.12	301.12	290.68	298.28	277.71	286.23	296.46	290.78	327.11	320.90	307.93	300.91	286.35	301.26	286.29	280.16	282.33
14-Jun-91	19.07	311.07	301.00	290.67	298.20	277.51	286.22	296.46	290.68	327.06	320.90	307.83	300.90	286.27	301.28	286.00	279.81	282.20
15-Jun-91	19.04	311.04	300.99	290.69	298.33	277.41	286.22	296.46	290.65	327.10	320.93	307.83	301.01	286.17	301.35	285.82	279.65	282.08
16-Jun-91	19.00	311.00	300.84	290.69	298.36	277.33	286.22	296.45	290.53	326.97	320.79	307.74	300.94	286.09	301.25	285.67	279.55	281.93
17-Jun-91	19.05	311.05	300.56	290.68	298.18	277.54	286.23	296.45	290.52	326.72	320.57	307.47	300.75	286.03	301.08	286.03	279.97	282.07
18-Jun-91	19.36	311.36	300.30	290.68	297.87	278.02	286.23	296.45	290.51	326.56	320.36	307.24	300.61	286.07	300.96	286.28	280.40	282.88
19-Jun-91	19.18	311.18	300.27	290.69	297.98	277.67	286.25	296.46	290.58	326.66	320.41	307.33	300.64	286.05	300.97	286.22	280.19	282.35
20-Jun-91	19.16	311.16	300.34	290.69	298.14	277.54	286.23	296.45	290.62	326.86	320.64	307.52	300.75	286.03	301.06	286.04	279.86	282.26
21-Jun-91	19.08	311.08	300.36	290.69	298.16	277.43	286.23	296.46	290.49	327.02	320.78	307.65	300.74	286.01	301.07	285.76	279.66	282.13
22-Jun-91	19.04	311.04	300.29	290.68	297.98	277.33	286.23	296.46	290.26	327.03	320.80	307.65	300.59	285.95	300.97	285.51	279.52	282.00
23-Jun-91	19.04	311.04	300.26	290.69	297.85	277.28	286.23	296.46	290.09	327.03	320.82	307.65	300.51	285.89	300.94	285.34	279.42	281.98
24-Jun-91	19.00	311.00	300.31	290.69	297.78	277.26	286.23	296.46	289.99	327.04	320.86	307.65	300.51	285.84	300.99	285.23	279.35	281.97
25-Jun-91	19.00	311.00	300.35	290.69	297.81	277.23	286.23	296.46	289.90	326.95	320.81	307.63	300.54	285.77	301.00	285.14	279.29	281.93
26-Jun-91	18.99	310.99	300.32	290.69	297.85	277.20	286.23	296.46	289.86	326.77	320.68	307.52	300.53	285.71	300.94	285.10	279.24	281.90
27-Jun-91	18.96	310.96	300.20	290.69	297.74	277.18	286.23	296.46	289.73	326.52	320.44	307.28	300.42	285.66	300.83	284.99	279.20	281.85
28-Jun-91	18.95	310.95	300.06	290.69	297.73	277.16	286.23	296.46	289.73	326.28	320.20	307.02	300.37	285.61	300.70	284.95	279.16	281.82
29-Jun-91	18.92	310.92	299.90	290.68	297.69	277.14	286.22	296.46	289.67	326.02	320.05	306.77	300.28	285.56	300.60	284.91	279.14	281.82
30-Jun-91	18.88	310.88	299.69	290.69	297.52	277.13	286.23	296.47	289.66	325.73	319.72	306.49	300.14	285.52	300.39	284.89	279.12	281.79
01-Jul-91	0.00	310.78	299.28	290.65	297.05	277.17	286.24	296.47	289.09	324.41	318.85	306.47	299.80	285.38	299.58	285.76	279.17	281.77
01-Jul-91	18.88	310.88	299.52	290.68	297.35	277.13	286.23	296.47	289.54	325.47	319.51	306.27	300.00	285.47	300.26	284.84	279.10	281.79
02-Jul-91	18.84	310.84	299.51	290.67	297.36	277.11	286.23	296.47	289.47	325.35	319.45	306.23	300.01	285.43	300.25	284.77	279.07	281.79
03-Jul-91	18.83	310.83	299.50	290.68	297.41	277.09	286.23	296.46	289.40	325.20	319.48	306.16	300.07	285.38	300.28	284.71	279.04	281.79
04-Jul-91	18.80	310.80	299.44	290.66	297.35	277.09	286.23	296.46	289.34	325.01	319.37	306.09	300.06	285.33	300.30	284.74	279.05	281.79
05-Jul-91	18.83	310.83	299.39	290.68	297.37	277.08	286.23	296.46	289.32	324.81	319.24	305.98	300.07	285.30	300.20	284.70	279.03	281.83
06-Jul-91	18.80	310.80	299.38	290.68	297.47	277.07	286.23	296.46	289.27	324.61	319.10	306.00	300.11	0.00	300.23	284.94	279.01	281.82
07-Jul-91	18.80	310.80	299.40	290.68	297.52	277.06	286.23	296.46	289.21	324.46	319.01	305.95	300.19	0.00	300.26	284.95	278.99	281.82
08-Jul-91	18.80	310.80	299.36	290.69	297.61	277.05	286.23	296.46	289.21	324.27	318.86	305.90	300.24	0.00	300.19	284.97	278.97	281.82
09-Jul-91	18.80	310.80	299.16	290.67	297.32	277.05	286.24	296.46	289.03	323.96	318.58	305.70	300.00	0.00	300.05	284.94	278.94	281.81
10-Jul-91	18.76	310.76	298.98	290.66	297.13	277.04	286.23	296.47	288.97	323.69	318.30	305.51	299.85	0.00	299.88	284.96	278.92	281.80
11-Jul-91	18.68	310.68	298.92	290.66	297.08	277.02	286.24	296.47	288.92	323.48	318.16	305.42	299.83	0.00	299.83	285.29	278.89	281.78
12-Jul-91	18.64	310.64	298.83	290.65	296.95	277.02	286.23	296.47	288.84	323.28	317.98	305.32	299.72	0.00	299.75	285.66	278.88	281.80
13-Jul-91	18.58	310.58	298.83	290.67	297.09	277.00	286.24	296.46	288.87	323.13	317.86	305.29	299.77	0.00	299.73	285.88	278.86	281.79

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
14-Jul-91	18.56	310.56	298.84	290.65	297.16	276.99	286.23	296.47	288.77	323.00	317.77	305.29	299.80	0.00	285.84	299.77	278.85	281.80
15-Jul-91	18.52	310.52	298.70	290.64	296.87	276.99	286.23	296.47	288.62	322.81	317.60	305.21	299.62	0.00	299.66	285.53	278.84	281.79
16-Jul-91	18.48	310.48	298.59	290.65	296.76	276.98	286.23	296.46	288.55	322.61	317.42	305.09	299.55	0.00	299.58	285.39	278.81	281.77
17-Jul-91	18.40	310.40	298.53	290.65	296.87	276.97	286.24	296.47	288.60	322.38	317.24	305.00	299.54	0.00	299.46	285.17	278.80	281.56
21-Jul-91	18.20	310.20	297.89	290.64	296.28	276.94	286.24	296.47	288.38	321.22	316.20	304.22	298.93	0.00	298.79	284.80	278.75	281.15
22-Jul-91	18.14	310.14	297.73	290.64	296.11	276.93	286.24	296.47	288.27	320.95	315.98	304.06	298.76	0.00	298.63	284.68	278.74	281.13
23-Jul-91	18.97	310.97	297.72	290.64	296.25	278.56	286.24	296.48	288.47	320.80	315.86	303.99	298.92	0.00	298.59	285.79	281.59	281.57
24-Jul-91	19.15	311.15	297.72	290.64	296.32	277.50	286.24	296.48	288.93	321.22	315.88	304.52	299.10	0.00	298.89	285.90	279.79	281.84
25-Jul-91	19.00	311.00	297.88	290.63	296.32	277.17	286.24	296.47	289.01	322.46	316.61	305.34	299.18	0.00	299.57	285.34	279.26	281.95
26-Jul-91	19.00	311.00	298.16	290.64	296.47	277.09	286.24	296.47	288.92	324.11	317.98	305.93	299.35	0.00	299.93	285.03	279.09	281.82
28-Jul-91	19.24	311.24	299.56	290.59	297.06	277.65	286.24	296.48	289.78	329.92	323.85	311.39	300.04	0.00	302.18	286.06	279.92	282.31
29-Jul-91	19.12	311.12	302.01	290.61	297.36	277.43	286.24	296.47	289.89	330.50	324.18	312.96	300.39	0.00	302.18	285.91	279.63	281.95
30-Jul-91	19.08	311.08	303.31	290.61	297.70	277.33	286.24	296.47	289.95	330.36	323.96	313.17	300.73	0.00	302.10	285.50	279.48	281.80
31-Jul-91	19.04	311.04	303.68	290.60	297.88	277.26	286.25	296.47	289.96	329.97	323.61	312.70	300.90	0.00	302.02	285.40	279.38	281.80
01-Aug-91	0.00	311.80	304.44	291.71	299.37	278.07	286.57	297.33	292.55	329.98	323.14	311.94	301.91	0.00	302.75	287.13	280.54	282.14
01-Aug-91	19.00	311.00	303.54	290.59	297.96	277.21	286.25	296.47	289.93	329.43	323.20	311.94	300.94	0.00	301.85	285.20	279.29	281.75
02-Aug-91	18.96	310.96	303.05	290.60	297.98	277.17	286.25	296.47	289.89	328.78	322.70	311.04	300.88	0.00	301.63	285.24	279.22	281.73
03-Aug-91	18.92	310.92	302.42	290.61	297.83	277.14	286.25	296.47	289.87	328.15	322.21	310.16	300.69	0.00	301.45	284.96	279.17	281.49
04-Aug-91	19.04	311.04	301.90	290.60	297.89	277.74	286.25	296.48	290.02	327.73	321.88	309.51	300.70	0.00	301.37	285.75	280.43	281.69
05-Aug-91	19.04	311.04	301.50	290.58	297.85	277.60	286.25	296.47	290.25	327.52	321.64	309.22	300.64	0.00	301.42	285.86	280.08	281.67
06-Aug-91	19.00	311.00	301.23	290.58	297.72	277.31	286.25	296.47	290.22	327.53	321.62	309.12	300.55	0.00	301.44	285.39	279.55	281.56
07-Aug-91	18.96	310.96	301.18	290.59	297.74	277.23	286.25	296.47	290.14	327.61	321.74	309.18	300.57	0.00	301.48	285.18	279.37	281.77
08-Aug-91	18.92	310.92	301.21	290.60	297.89	277.18	286.25	296.48	290.12	327.62	321.82	309.14	300.63	0.00	301.45	284.98	279.27	281.68
09-Aug-91	18.91	310.91	301.17	290.60	297.92	277.14	286.25	296.47	290.11	327.47	321.67	308.96	300.61	0.00	301.38	284.81	279.20	281.61
10-Aug-91	19.64	311.64	301.19	290.61	298.14	278.95	286.59	296.47	290.65	328.13	321.84	309.26	300.91	0.00	301.71	286.56	281.82	283.24
11-Aug-91	19.20	311.20	301.87	290.61	298.12	277.74	286.17	296.47	290.99	330.32	323.71	311.30	300.93	0.00	302.57	286.00	280.10	282.29
12-Aug-91	19.08	311.08	303.25	290.60	298.16	277.52	286.25	296.47	291.04	330.61	323.95	312.66	301.03	0.00	302.59	285.90	279.82	282.00
13-Aug-91	19.04	311.04	304.05	290.60	298.27	277.45	286.25	296.47	291.09	330.35	323.68	312.86	301.21	0.00	302.44	285.90	279.73	281.88
14-Aug-91	19.03	311.03	304.15	290.61	298.37	277.41	286.25	296.47	291.13	329.86	323.25	312.39	301.26	0.00	302.29	285.79	279.67	281.81
15-Aug-91	19.00	311.00	303.92	290.60	298.39	277.38	286.24	296.47	291.16	329.25	322.81	311.61	301.23	0.00	302.12	285.66	279.60	281.76
16-Aug-91	19.08	311.08	303.35	290.59	298.31	277.61	286.24	296.47	291.26	328.66	322.36	310.77	301.13	0.00	302.00	286.19	279.86	282.03
17-Aug-91	19.00	311.00	302.82	290.58	298.29	277.44	286.24	296.47	291.32	328.28	322.04	310.16	301.08	0.00	301.89	285.87	279.55	281.82
18-Aug-91	18.96	310.96	302.39	290.58	298.35	277.37	286.24	296.47	291.35	327.92	321.70	309.67	301.03	0.00	301.72	285.61	279.44	281.73
19-Aug-91	18.96	310.96	302.00	290.59	298.33	277.96	286.25	296.47	291.39	327.62	321.47	309.21	300.95	0.00	301.60	285.80	281.38	281.77
20-Aug-91	29.84	321.84	303.07	293.84	299.47	279.87	288.78	297.15	293.84	332.10	324.47	313.95	304.32	0.00	304.95	289.35	282.94	283.96
21-Aug-91	29.62	321.62	307.56	294.84	301.13	280.09	289.10	299.36	295.18	333.84	325.39	316.16	305.73	0.00	306.25	290.48	283.59	283.13

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
22-Aug-91	19.80	311.80	309.66	295.34	302.32	279.84	288.18	301.54	296.51	334.57	325.69	316.54	304.53	0.00	306.69	291.04	282.90	283.41
23-Aug-91	19.40	311.40	310.19	295.03	302.63	279.46	287.64	301.40	296.74	334.49	325.68	316.43	304.10	0.00	305.99	290.68	282.29	282.74
24-Aug-91	19.28	311.28	310.10	294.61	302.36	279.23	287.18	300.62	296.51	333.96	325.42	316.01	303.65	0.00	305.11	290.46	281.98	282.49
25-Aug-91	19.24	311.24	309.72	294.03	301.97	278.97	286.49	299.70	296.24	333.14	324.95	315.40	303.28	0.00	304.16	289.92	281.61	282.34
26-Aug-91	19.20	311.20	309.23	293.43	301.79	278.75	286.23	298.92	296.05	332.32	324.43	314.72	303.16	0.00	303.69	289.69	281.35	282.25
27-Aug-91	19.16	311.16	308.40	292.88	301.65	278.56	286.23	298.22	295.81	331.65	323.96	313.93	303.08	0.00	303.33	289.23	281.10	282.23
28-Aug-91	19.16	311.16	307.05	292.38	301.36	278.39	286.24	297.51	295.48	330.97	323.52	313.21	302.91	0.00	303.03	288.84	280.87	282.20
29-Aug-91	19.12	311.12	306.06	291.97	300.97	278.23	286.24	296.82	295.09	330.27	323.09	312.39	302.65	0.00	302.76	288.56	280.68	282.15
30-Aug-91	19.12	311.12	305.28	291.65	300.68	278.10	286.24	296.44	294.81	329.65	322.68	311.61	302.46	0.00	302.51	288.16	280.51	282.11
31-Aug-91	19.12	311.12	305.28	291.65	300.68	278.10	286.24	296.44	294.81	329.65	322.68	311.61	302.46	0.00	302.51	288.16	280.51	282.11
01-Sep-91	0.00	311.15	301.92	290.85	298.93	277.71	286.35	296.49	291.81	327.72	321.45	308.88	301.46	0.00	301.92	286.50	279.78	282.00
01-Sep-91	19.08	311.08	303.68	291.02	299.80	277.87	286.24	296.48	293.91	328.63	321.86	310.18	301.83	0.00	302.08	287.29	280.21	282.09
02-Sep-91	19.08	311.08	303.18	290.72	299.53	277.78	286.23	296.49	293.63	328.37	321.73	309.68	301.75	0.00	302.05	287.10	280.07	282.05
03-Sep-91	19.04	311.04	302.94	290.56	299.65	277.69	286.24	296.49	293.45	328.25	321.70	309.44	301.86	0.00	302.05	286.95	279.96	281.99
04-Sep-91	19.00	311.00	302.75	290.56	299.82	277.62	286.24	296.48	293.33	328.12	321.68	309.23	301.95	0.00	302.04	286.68	279.88	281.96
05-Sep-91	19.01	311.01	302.42	290.64	299.63	277.57	286.23	296.48	292.99	327.86	321.53	308.89	301.79	0.00	301.94	286.45	279.79	281.99
06-Sep-91	19.12	311.12	302.03	290.64	299.28	277.71	286.24	296.47	292.83	327.55	321.33	308.39	301.57	0.00	301.83	286.88	280.01	282.14
07-Sep-91	19.08	311.08	301.77	290.64	299.12	277.58	286.24	296.48	292.58	327.38	321.24	308.17	301.49	0.00	301.74	286.54	279.79	282.04
08-Sep-91	19.04	311.04	301.56	290.64	299.01	277.51	286.23	296.48	292.36	327.21	321.12	307.98	301.40	0.00	301.64	286.66	279.67	281.99
09-Sep-91	19.04	311.04	301.32	290.64	298.81	277.45	286.24	296.48	292.10	326.98	320.91	307.75	301.27	0.00	301.54	286.28	279.58	281.95
10-Sep-91	19.03	311.03	301.17	290.64	298.80	277.41	286.24	296.48	292.00	326.79	320.76	307.60	301.27	0.00	301.44	286.22	279.50	281.96
11-Sep-91	19.00	311.00	301.05	290.64	298.82	277.37	286.24	296.48	291.82	326.58	320.61	307.47	301.23	0.00	301.33	285.81	279.43	281.92
12-Sep-91	18.96	310.96	300.75	290.64	298.35	277.33	286.24	296.49	291.50	326.30	320.35	307.16	300.99	0.00	301.20	285.81	279.36	281.90
13-Sep-91	18.92	310.92	300.65	290.64	298.64	277.30	286.23	296.49	291.36	326.16	320.26	307.03	300.99	0.00	301.19	285.75	279.30	281.91
14-Sep-91	18.88	310.88	300.64	290.64	298.61	277.27	286.24	296.48	291.20	325.99	320.21	306.97	301.01	0.00	301.20	285.66	279.25	281.90
15-Sep-91	18.88	310.88	300.53	290.64	298.46	277.24	286.24	296.48	291.02	325.79	320.05	306.86	300.96	0.00	301.16	285.69	279.19	281.91
16-Sep-91	19.00	311.00	300.54	290.64	298.61	277.27	286.24	296.48	290.97	325.62	319.96	306.87	301.11	0.00	301.19	285.99	279.21	281.97
17-Sep-91	19.00	311.00	300.40	290.64	298.52	277.26	286.24	296.48	290.89	325.31	319.79	306.70	301.04	0.00	301.05	285.62	279.20	281.99
18-Sep-91	19.03	311.03	300.03	290.64	298.09	277.25	286.24	296.47	290.60	324.81	319.35	306.38	300.70	0.00	300.79	285.56	279.13	281.42
19-Sep-91	18.96	310.96	299.89	290.64	298.08	277.22	286.24	296.46	290.65	324.52	319.12	306.22	300.64	0.00	300.64	285.59	279.10	281.33
20-Sep-91	19.24	311.24	299.76	290.64	297.92	277.79	286.23	296.47	290.53	324.33	318.95	306.14	300.63	0.00	300.60	286.11	280.02	281.96
21-Sep-91	19.15	311.15	299.87	290.64	298.05	277.46	286.22	296.48	290.55	324.84	319.20	306.62	300.76	0.00	300.86	285.98	279.45	281.62
22-Sep-91	19.08	311.08	300.05	290.64	298.12	277.32	286.23	296.47	290.42	325.57	319.73	307.01	300.89	0.00	301.09	285.35	279.25	281.45
23-Sep-91	19.04	311.04	300.30	290.64	298.47	277.26	286.22	296.47	290.47	326.52	320.57	307.36	301.14	0.00	301.26	285.67	279.16	281.40
24-Sep-91	19.04	311.04	300.37	290.64	298.41	277.23	286.23	296.47	290.24	327.01	321.11	307.58	301.13	0.00	301.30	285.46	279.08	281.40
25-Sep-91	19.84	311.84	300.64	290.63	298.84	279.14	286.23	296.47	290.57	327.40	321.64	308.07	301.54	0.00	301.41	286.47	281.19	283.19

FILE

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
26-Sep-91	20.28	312.28	301.38	291.50	299.02	279.59	288.17	296.46	291.46	332.14	325.04	312.52	301.93	0.00	304.00	287.70	281.35	283.68
27-Sep-91	19.59	311.59	304.29	292.09	299.23	278.81	287.54	296.47	292.19	333.73	325.92	315.04	302.18	0.00	304.95	288.27	280.40	282.62
28-Sep-91	19.36	311.36	306.99	291.96	299.65	278.50	286.59	296.46	292.66	334.20	326.08	315.77	302.62	0.00	304.91	288.39	280.83	282.22
29-Sep-91	19.31	311.31	308.19	291.86	300.09	278.33	286.22	296.63	292.96	334.13	326.06	315.78	302.96	0.00	304.66	288.57	280.64	282.05
30-Sep-91	19.28	311.28	308.48	291.78	300.34	278.25	286.23	296.70	293.08	333.61	325.75	315.49	303.12	0.00	304.43	288.49	280.54	281.97
01-Oct-91	0.00	311.30	305.90	290.87	300.57	278.12	286.25	296.46	293.11	331.47	324.26	312.85	303.08	0.00	303.06	288.70	279.67	282.05
01-Oct-91	19.24	311.24	308.39	291.68	300.83	278.19	286.22	296.67	293.45	333.04	325.38	315.16	303.37	0.00	304.23	288.60	280.26	281.90
02-Oct-91	19.20	311.20	307.73	291.51	301.01	278.13	286.24	296.43	293.54	332.45	324.95	314.64	303.41	0.00	303.93	288.61	279.72	281.87
03-Oct-91	19.20	311.20	306.93	291.30	300.91	278.06	286.24	296.44	293.56	331.79	324.44	313.81	303.25	0.00	303.63	288.38	279.65	281.82
04-Oct-91	19.18	311.18	306.09	291.07	300.64	277.98	286.24	296.45	293.40	331.08	323.98	312.89	302.98	0.00	303.36	288.11	279.57	281.72
05-Oct-91	19.16	311.16	305.32	290.81	300.37	277.90	286.24	296.45	293.32	330.45	323.57	312.04	302.77	0.00	303.16	287.91	279.46	281.68
06-Oct-91	19.44	311.44	304.82	290.69	300.43	278.52	286.24	296.45	293.38	330.06	323.29	311.46	302.80	0.00	303.01	288.47	280.40	282.38
07-Oct-91	19.52	311.52	304.40	290.87	300.25	278.52	286.24	296.47	293.34	330.75	323.55	311.68	302.67	0.00	303.21	287.73	280.07	282.51
08-Oct-91	19.34	311.34	304.76	290.77	300.19	278.20	286.23	296.47	293.24	331.71	324.42	312.43	302.69	0.00	303.37	287.55	279.76	282.14
09-Oct-91	19.27	311.27	305.44	290.66	300.26	278.07	286.23	296.47	293.18	331.89	324.65	313.13	302.82	0.00	303.48	287.61	279.65	281.98
10-Oct-91	19.23	311.23	305.95	290.59	300.54	277.99	286.23	296.46	293.26	331.79	324.57	313.36	303.05	0.00	303.53	287.52	279.58	281.88
11-Oct-91	19.20	311.20	306.01	290.54	300.76	277.95	286.23	296.47	293.29	331.48	324.31	313.15	303.15	0.00	303.46	287.51	279.52	281.84
12-Oct-91	19.28	311.28	305.76	290.56	300.77	278.02	286.23	296.47	293.14	331.05	324.04	312.67	303.14	0.00	303.41	287.71	279.53	282.05
13-Oct-91	19.24	311.24	305.20	290.64	300.43	277.94	286.23	296.46	292.88	330.59	323.70	312.02	302.93	0.00	303.26	287.51	279.43	281.93
14-Oct-91	19.20	311.20	304.70	290.64	300.23	277.86	286.22	296.46	292.69	330.23	323.41	311.45	302.79	0.00	303.19	287.67	279.34	281.83
15-Oct-91	19.20	311.20	304.34	290.64	300.25	277.79	286.23	296.46	292.61	329.98	323.20	311.01	302.82	0.00	303.13	287.03	279.26	281.78
16-Oct-91	19.92	311.92	304.05	290.64	300.43	278.94	286.72	296.45	292.67	330.85	323.58	311.08	303.07	0.00	303.35	287.96	280.34	283.18
17-Oct-91	19.40	311.40	304.78	290.77	300.36	278.28	286.22	296.45	292.88	332.60	325.10	312.84	302.97	0.00	288.26	303.86	279.80	282.36
18-Oct-91	19.60	311.60	306.14	290.97	300.56	278.58	286.43	296.45	293.01	333.32	325.66	314.55	303.23	0.00	304.11	288.52	280.07	282.73
19-Oct-91	19.44	311.44	307.65	291.20	300.69	278.41	286.37	296.45	293.24	333.75	325.85	315.28	303.37	0.00	304.40	288.87	279.97	282.37
20-Oct-91	19.36	311.36	308.22	291.34	300.67	278.33	286.13	296.45	293.26	333.53	325.72	315.16	303.33	0.00	304.38	288.96	279.91	282.21
21-Oct-91	19.32	311.32	308.30	291.36	300.79	278.27	286.22	296.44	293.36	333.16	325.45	314.96	303.45	0.00	304.33	288.98	279.83	282.11
22-Oct-91	19.28	311.28	308.12	291.27	301.09	278.21	286.22	296.44	293.47	332.82	325.20	314.73	303.64	0.00	304.19	288.93	279.77	282.07
23-Oct-91	19.28	311.28	307.48	291.09	301.00	278.15	286.22	296.44	293.32	332.37	324.88	314.23	303.54	0.00	304.07	288.84	279.68	282.05
24-Oct-91	19.28	311.28	306.94	290.88	300.85	278.08	286.23	296.43	293.24	331.88	324.54	313.63	303.42	0.00	303.90	288.83	279.61	282.01
25-Oct-91	19.24	311.24	306.45	290.70	300.85	278.03	286.23	296.43	293.20	331.42	324.23	313.01	303.36	0.00	303.71	288.62	279.54	281.99
26-Oct-91	19.24	311.24	305.93	290.56	300.72	277.98	286.23	296.43	293.11	331.00	323.90	312.42	303.21	0.00	303.50	288.65	279.48	281.98
27-Oct-91	19.24	311.24	305.41	290.64	300.61	277.94	286.23	296.44	293.02	330.63	323.63	311.90	303.08	0.00	303.30	288.33	279.42	281.95
28-Oct-91	19.23	311.23	304.89	290.64	300.39	277.91	286.24	296.44	292.80	330.27	323.34	311.42	302.87	0.00	303.11	288.22	279.37	281.84
29-Oct-91	19.20	311.20	304.33	290.63	299.99	277.85	286.22	296.45	292.56	329.94	323.09	310.88	302.62	0.00	302.95	288.03	279.29	281.78
30-Oct-91	19.20	311.20	304.29	290.63	300.29	277.79	286.22	296.45	292.62	329.93	323.21	310.77	302.87	0.00	303.01	288.05	279.22	281.75

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
31-Oct-91	19.20	311.20	304.08	290.63	300.42	277.74	286.23	296.44	292.45	329.81	323.16	310.63	302.90	0.00	302.99	287.97	279.17	281.74
01-Nov-91	0.00	311.52	303.97	290.89	299.89	277.68	286.39	296.41	282.70	330.65	323.82	310.95	302.76	0.00	303.08	287.61	278.99	272.06
01-Nov-91	19.20	311.20	303.79	290.63	300.27	277.71	286.23	296.44	292.28	329.63	323.08	310.38	302.82	0.00	302.92	287.76	279.12	281.78
02-Nov-91	19.20	311.20	303.56	290.63	300.21	277.70	286.23	296.43	292.13	329.51	323.02	310.21	302.77	0.00	302.86	287.80	279.08	281.78
03-Nov-91	19.20	311.20	303.23	290.63	299.94	277.70	286.22	296.43	291.85	329.30	322.86	309.92	302.59	0.00	302.77	287.52	279.04	281.86
04-Nov-91	19.20	311.20	303.01	290.70	299.79	277.68	286.22	296.43	278.39	329.17	322.78	309.70	302.51	0.00	302.71	287.49	278.98	281.85
05-Nov-91	19.20	311.20	302.83	290.68	299.71	277.63	286.22	296.43	280.02	329.06	322.73	309.54	302.47	0.00	302.67	287.30	278.79	281.83
06-Nov-91	19.44	311.44	302.68	290.69	299.70	277.54	286.22	296.43	278.73	328.99	322.67	309.41	302.52	0.00	302.60	287.34	278.78	281.73
07-Nov-91	19.56	311.56	302.67	290.69	299.82	277.60	286.23	296.43	280.04	329.02	322.74	309.45	302.64	0.00	302.62	287.32	278.78	281.89
08-Nov-91	19.20	311.20	302.51	290.69	299.74	277.40	286.22	296.43	280.40	328.89	322.65	309.26	302.48	0.00	302.56	287.33	278.65	281.50
09-Nov-91	19.16	311.16	302.25	290.80	299.46	277.33	286.23	296.42	278.41	328.72	322.52	308.94	302.29	0.00	302.43	287.08	278.55	281.45
10-Nov-91	19.16	311.16	302.21	290.79	299.63	277.31	286.22	296.41	279.78	328.72	322.56	308.90	302.40	0.00	302.40	286.98	278.52	281.44
11-Nov-91	19.20	311.20	302.23	290.78	299.92	277.32	286.23	296.40	280.71	328.69	322.58	308.92	302.54	0.00	302.36	286.99	278.50	281.53
12-Nov-91	19.44	311.44	301.97	290.78	299.59	277.86	286.22	296.40	280.57	328.60	322.42	308.71	302.35	0.00	302.29	287.79	279.39	282.14
13-Nov-91	19.36	311.36	301.95	290.78	299.62	277.64	286.21	296.39	281.15	328.87	322.60	308.80	302.43	0.00	302.33	287.41	278.93	281.93
14-Nov-91	20.24	312.24	301.97	290.77	299.57	277.13	286.22	296.39	281.23	329.11	322.74	308.98	302.61	0.00	302.38	287.48	278.58	281.05
15-Nov-91	20.55	312.55	302.05	290.80	299.49	277.32	286.22	296.40	280.96	329.30	322.92	309.24	302.72	0.00	302.41	286.79	278.51	280.56
16-Nov-91	19.28	311.28	302.23	290.78	299.70	277.30	286.23	296.41	281.81	329.45	323.07	309.41	302.54	0.00	302.39	286.70	278.53	280.92
17-Nov-91	19.24	311.24	302.09	290.80	299.27	277.25	286.22	296.42	281.58	329.37	322.99	309.26	302.23	0.00	302.33	286.52	278.45	280.98
18-Nov-91	19.20	311.20	302.16	290.79	299.27	277.21	286.22	296.42	281.45	329.46	323.10	309.30	302.24	0.00	302.35	286.58	278.39	0.00
19-Nov-91	19.20	311.20	302.32	290.81	299.44	277.18	286.22	296.39	281.09	329.57	323.24	309.44	302.37	0.00	302.45	286.37	278.28	280.97
20-Nov-91	19.20	311.20	302.38	290.79	299.45	277.16	286.23	296.38	280.95	329.57	323.25	309.49	302.37	0.00	302.45	286.30	278.27	280.95
21-Nov-91	19.20	311.20	302.31	290.78	299.42	277.14	286.23	296.37	281.17	329.42	323.14	309.43	302.29	0.00	302.34	286.23	278.23	280.89
22-Nov-91	19.56	311.56	302.12	290.77	299.18	277.93	286.23	296.38	281.61	329.26	322.94	309.28	302.19	0.00	302.24	287.48	280.06	280.86
23-Nov-91	22.56	314.56	302.38	290.74	299.45	279.54	288.04	296.39	282.94	332.11	324.71	310.95	303.00	0.00	303.48	288.69	281.16	280.89
24-Nov-91	19.80	311.80	304.70	291.17	299.97	278.48	287.16	296.39	283.53	334.31	326.41	314.69	303.09	0.00	304.66	288.93	279.86	281.01
25-Nov-91	19.64	311.64	307.70	291.33	300.35	278.31	287.11	296.39	283.68	335.13	326.82	315.91	303.38	0.00	305.08	288.91	279.73	280.92
26-Nov-91	19.55	311.55	309.11	291.57	300.49	278.16	287.08	296.40	284.29	335.35	326.88	316.10	303.52	0.00	305.12	289.10	279.47	280.94
27-Nov-91	19.48	311.48	309.70	291.54	300.57	278.07	286.69	296.40	284.11	335.34	326.83	316.16	303.59	0.00	304.97	288.84	279.46	285.91
28-Nov-91	19.44	311.44	310.22	291.46	301.02	278.01	286.37	296.40	285.22	335.38	326.90	316.34	303.90	0.00	304.90	288.88	279.28	280.65
29-Nov-91	19.44	311.44	310.46	291.35	301.31	277.96	286.22	296.40	285.34	335.24	326.83	316.34	304.02	0.00	304.77	288.79	279.23	280.72
30-Nov-91	19.40	311.40	310.41	291.24	301.25	277.91	286.22	296.39	285.54	334.97	326.65	316.10	303.94	0.00	304.69	289.72	279.22	280.78
01-Dec-91	0.00	311.49	309.02	291.23	301.40	278.08	286.30	296.57	288.32	333.48	325.61	314.46	303.90	0.00	304.32	289.36	279.55	280.94
01-Dec-91	19.36	311.36	310.33	291.11	301.33	277.88	286.22	296.38	285.97	334.63	326.47	315.87	303.96	0.00	304.56	289.49	279.15	280.67
02-Dec-91	19.39	311.39	309.99	291.02	301.24	277.85	286.22	296.37	286.20	334.17	326.16	315.49	303.85	0.00	304.34	289.31	279.13	280.92
03-Dec-91	19.68	311.68	309.64	290.86	301.25	278.33	286.22	296.37	286.41	333.89	325.99	315.14	303.93	0.00	304.26	289.54	279.89	281.24

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
04-Dec-91	20.48	312.48	309.69	291.48	301.52	279.40	287.04	296.37	287.21	334.45	326.16	315.52	304.21	0.00	304.49	290.08	280.79	281.08
05-Dec-91	19.68	311.68	310.00	291.67	301.02	278.55	286.47	296.69	286.96	335.07	326.50	315.70	303.72	0.00	305.01	289.74	279.94	281.00
06-Dec-91	19.56	311.56	310.75	291.87	301.56	278.35	286.43	297.08	287.87	335.44	326.78	316.24	304.16	0.00	305.15	290.04	279.77	281.11
07-Dec-91	19.52	311.52	310.99	291.92	301.68	278.28	286.45	297.23	287.86	335.42	326.78	316.33	304.17	0.00	305.11	290.15	279.75	281.01
08-Dec-91	19.52	311.52	311.02	291.83	301.82	278.27	286.25	297.26	288.56	335.20	326.64	316.23	304.17	0.00	304.97	290.52	279.79	280.99
09-Dec-91	19.52	311.52	311.18	291.88	302.18	278.26	286.22	297.18	288.78	335.17	326.72	316.27	304.45	0.00	304.93	290.34	279.78	281.19
10-Dec-91	19.72	311.72	310.88	291.81	301.97	278.51	286.27	296.96	288.70	334.81	326.45	316.00	304.27	0.00	304.83	289.86	279.95	280.95
11-Dec-91	19.56	311.56	310.72	291.72	301.72	278.35	286.27	296.89	288.70	334.76	326.39	315.85	304.10	0.00	304.83	289.93	279.89	280.99
12-Dec-91	19.48	311.48	310.65	291.63	301.70	278.24	286.27	296.77	288.75	334.64	326.34	315.71	304.08	0.00	304.80	289.81	279.81	280.98
13-Dec-91	19.44	311.44	310.78	291.59	302.10	278.19	286.27	296.74	289.12	334.56	326.34	315.74	304.37	0.00	304.73	289.92	279.77	280.99
14-Dec-91	19.56	311.56	310.68	291.57	302.18	278.38	286.27	296.72	289.40	334.32	326.22	315.63	304.39	0.00	304.69	290.17	280.03	281.13
15-Dec-91	19.60	311.60	310.47	291.63	302.00	278.51	286.27	296.69	289.19	334.24	326.08	315.49	304.22	0.00	304.68	290.07	280.16	280.95
16-Dec-91	19.48	311.48	310.28	291.50	301.79	278.28	286.27	296.58	289.19	334.06	325.96	315.23	304.06	0.00	304.52	289.82	279.89	280.98
17-Dec-91	19.43	311.43	309.98	291.34	301.46	278.13	286.27	296.37	288.80	333.77	325.77	314.82	303.84	0.00	304.40	289.49	279.74	280.97
18-Dec-91	19.40	311.40	309.85	291.23	301.71	278.07	286.27	296.35	289.20	333.60	325.68	314.58	303.99	0.00	304.31	289.54	279.65	280.95
19-Dec-91	19.32	311.32	309.15	291.03	301.17	277.92	286.27	296.36	288.88	333.25	325.41	314.08	303.65	0.00	304.26	289.17	279.52	280.97
20-Dec-91	19.36	311.36	308.72	290.81	301.18	277.86	286.27	296.36	288.95	333.05	325.31	313.91	303.74	0.00	304.18	289.35	279.43	280.99
21-Dec-91	19.36	311.36	308.66	290.70	301.66	277.85	286.26	296.34	289.29	332.97	325.33	313.91	304.11	0.00	304.14	289.39	279.42	280.95
22-Dec-91	19.40	311.40	308.10	290.74	301.49	277.84	286.27	296.35	288.99	332.68	325.13	313.64	303.91	0.00	304.07	289.17	279.38	280.90
23-Dec-91	19.36	311.36	307.79	290.80	301.58	277.80	286.27	296.35	288.99	332.49	325.00	313.50	303.98	0.00	303.97	288.98	279.32	280.89
24-Dec-91	19.40	311.40	307.42	290.79	301.45	277.78	286.27	296.34	289.05	332.28	324.88	313.31	303.89	0.00	303.93	288.67	279.24	280.84
25-Dec-91	19.36	311.36	306.88	290.82	300.92	277.70	286.27	296.32	288.56	331.88	324.59	312.81	303.54	0.00	303.76	288.31	279.09	280.97
26-Dec-91	19.32	311.32	306.39	290.77	300.54	277.62	286.27	296.33	288.51	331.55	324.33	312.41	303.32	0.00	303.64	288.43	279.02	280.95
27-Dec-91	19.32	311.32	306.21	290.79	300.69	277.59	286.27	296.35	288.16	331.41	324.27	312.27	303.40	0.00	303.60	288.29	279.05	280.98
28-Dec-91	19.32	311.32	305.94	290.81	300.62	277.54	286.27	296.38	288.10	331.24	324.18	312.00	303.39	0.00	303.55	288.17	279.01	280.96
29-Dec-91	19.29	311.29	305.86	290.77	300.92	277.51	286.26	296.38	288.10	331.17	324.18	311.92	303.54	0.00	303.56	288.42	278.90	280.80
30-Dec-91	19.56	311.56	305.64	290.79	300.89	277.83	286.26	296.39	287.92	330.96	324.04	311.66	303.48	0.00	303.44	288.10	279.05	280.78
31-Dec-91	19.44	311.44	304.93	290.79	300.05	277.67	286.27	296.40	287.52	330.82	323.86	311.17	302.96	0.00	303.25	287.97	278.92	280.06
01-Jan-92	0.00	311.45	306.47	290.86	300.38	277.65	286.29	296.42	290.89	332.17	324.98	312.59	303.24	0.00	303.76	288.52	279.01	280.69
01-Jan-92	19.35	311.35	304.98	290.83	300.21	277.52	286.27	296.40	289.15	331.00	324.07	311.31	303.10	0.00	303.30	288.08	278.80	280.96
02-Jan-92	19.35	311.35	305.10	290.82	300.33	277.47	286.27	296.40	289.13	331.08	324.17	311.42	303.15	0.00	303.33	287.82	278.75	280.95
03-Jan-92	19.32	311.32	305.10	290.84	300.35	277.44	286.27	296.40	290.77	331.03	324.16	311.41	303.13	0.00	303.33	288.30	278.79	280.84
04-Jan-92	19.36	311.36	305.25	290.84	300.56	277.45	286.27	296.40	291.06	331.02	324.21	311.48	303.32	0.00	303.37	288.63	278.78	280.84
05-Jan-92	19.52	311.52	305.19	290.83	300.63	277.75	286.26	296.40	290.99	330.99	324.09	311.41	303.35	0.00	303.33	288.75	279.06	280.81
06-Jan-92	19.44	311.44	305.16	290.80	300.52	277.64	286.27	296.40	290.87	331.20	324.28	311.55	303.26	0.00	303.40	288.55	278.90	280.86
07-Jan-92	19.39	311.39	305.28	290.86	300.37	277.56	286.27	296.41	290.88	331.43	324.51	311.79	303.18	0.00	303.46	287.83	278.91	280.91

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
08-Jan-92	19.36	311.36	305.33	290.85	300.08	277.50	286.27	296.41	290.59	331.55	324.61	311.90	303.01	0.00	303.51	287.96	278.74	280.90
09-Jan-92	19.32	311.32	305.52	290.81	300.12	277.45	286.27	296.41	290.69	331.59	324.68	312.08	303.08	0.00	303.55	288.08	278.69	280.92
10-Jan-92	19.40	311.40	305.82	290.82	300.46	277.60	286.27	296.41	290.88	331.52	324.65	312.23	303.27	0.00	303.53	288.15	278.87	280.78
11-Jan-92	19.36	311.36	305.68	290.85	300.25	277.53	286.27	296.42	290.66	331.37	324.53	312.15	303.10	0.00	303.51	288.68	278.90	280.94
12-Jan-92	19.28	311.28	305.36	290.86	299.87	277.42	286.27	296.42	290.47	331.18	324.32	311.86	302.86	0.00	303.38	287.62	278.75	280.98
13-Jan-92	19.32	311.32	305.61	290.87	300.27	277.41	286.27	296.41	290.68	331.27	324.43	311.95	303.16	0.00	303.47	288.04	278.70	280.92
14-Jan-92	19.32	311.32	305.82	290.85	300.68	277.47	286.27	296.41	290.46	331.37	324.56	312.07	303.44	0.00	303.57	288.34	278.80	280.98
15-Jan-92	19.64	311.64	305.56	290.85	300.34	278.15	286.22	296.42	290.49	332.01	324.77	312.20	303.19	0.00	303.77	288.68	279.68	281.03
16-Jan-92	19.43	311.43	306.11	290.83	300.39	277.75	286.27	296.43	290.97	332.75	325.40	312.93	303.30	0.00	303.99	289.15	279.23	280.34
17-Jan-92	19.32	311.32	306.67	290.78	300.18	277.57	286.27	296.44	290.97	332.82	325.50	313.36	303.12	0.00	303.99	288.60	279.06	278.85
18-Jan-92	19.36	311.36	307.18	290.81	300.31	277.54	286.27	296.43	291.05	332.76	325.45	313.51	303.21	0.00	304.04	287.93	278.99	280.28
19-Jan-92	19.28	311.28	307.07	290.80	300.08	277.45	286.27	296.44	290.87	332.52	325.24	313.34	303.07	0.00	303.97	288.13	278.92	278.62
20-Jan-92	19.28	311.28	307.19	290.80	300.42	277.40	286.27	296.43	291.15	332.48	325.27	313.35	303.32	0.00	303.99	288.34	278.85	279.40
21-Jan-92	19.28	311.28	307.04	290.81	300.48	277.38	286.27	296.43	290.99	332.29	325.13	313.17	303.29	0.00	303.91	287.63	278.82	279.56
22-Jan-92	19.28	311.28	306.60	290.81	300.12	277.37	286.27	296.43	290.76	331.91	324.80	312.72	303.00	0.00	303.68	288.15	278.75	280.96
23-Jan-92	19.28	311.28	306.47	290.84	300.27	277.34	286.27	296.42	290.71	331.76	324.76	312.53	303.15	0.00	303.63	288.49	278.72	281.84
24-Jan-92	21.71	313.71	306.56	291.65	300.94	279.39	286.82	296.43	291.44	332.33	324.91	312.55	304.06	0.00	303.79	290.13	280.93	280.97
25-Jan-92	19.52	311.52	306.34	290.77	300.24	278.19	286.29	296.43	291.11	332.98	325.39	312.63	303.12	0.00	303.94	289.71	279.67	280.97
26-Jan-92	19.48	311.48	307.24	290.93	300.27	277.91	286.27	296.43	291.65	333.61	325.88	313.35	303.19	0.00	304.16	289.09	279.33	280.98
27-Jan-92	19.36	311.36	308.16	290.82	300.14	277.71	286.27	296.43	291.56	333.92	326.11	313.71	303.12	0.00	304.30	288.97	279.11	280.98
28-Jan-92	19.40	311.40	308.96	290.87	300.44	277.69	286.27	296.43	291.62	334.04	326.18	313.97	303.31	0.00	304.35	289.17	279.01	281.05
29-Jan-92	19.40	311.40	309.39	290.87	300.66	277.67	286.27	296.43	291.66	334.03	326.20	314.12	303.45	0.00	304.40	288.93	278.97	280.99
30-Jan-92	19.36	311.36	309.49	290.80	300.82	277.65	286.27	296.43	291.59	333.82	326.11	314.11	303.51	0.00	304.34	288.90	278.97	281.00
31-Jan-92	19.36	311.36	309.45	290.79	301.04	277.65	286.27	296.43	291.73	333.59	325.97	314.03	303.62	0.00	304.28	289.38	278.95	281.03
01-Feb-92	0.00	311.28	306.69	290.74	300.21	277.42	286.27	296.43	290.82	331.64	324.57	312.32	302.97	0.00	302.15	289.65	278.77	280.96
01-Feb-92	19.36	311.36	308.94	290.83	300.78	277.64	286.27	296.43	291.53	333.20	325.64	313.71	303.40	0.00	288.92	304.13	278.90	281.04
02-Feb-92	19.28	311.28	308.32	290.81	300.48	277.53	286.27	296.43	291.42	332.79	325.37	313.40	303.19	0.00	303.93	288.86	278.91	281.01
03-Feb-92	19.28	311.28	307.80	290.80	300.37	277.50	286.27	296.43	291.21	332.50	325.16	313.22	303.14	0.00	303.84	288.45	278.79	280.99
04-Feb-92	19.31	311.31	307.43	290.83	300.38	277.48	286.27	296.43	291.24	332.25	325.00	313.11	303.16	0.00	303.78	288.57	278.84	281.02
05-Feb-92	19.32	311.32	307.16	290.75	300.53	277.47	286.27	296.43	291.06	331.97	324.83	312.94	303.20	0.00	303.67	288.48	278.85	281.06
06-Feb-92	19.24	311.24	306.60	290.77	300.10	277.39	286.27	296.43	290.75	331.53	324.47	312.45	302.91	0.00	303.51	288.16	278.78	280.98
07-Feb-92	19.24	311.24	306.40	290.67	300.31	277.36	286.27	296.43	290.63	331.34	324.40	312.21	303.05	0.00	303.48	287.92	278.74	281.01
08-Feb-92	19.28	311.28	306.03	290.74	300.31	277.37	286.27	296.43	290.63	331.07	324.18	311.85	303.00	0.00	303.36	288.25	278.72	281.06
09-Feb-92	19.28	311.28	305.41	290.64	299.93	277.37	286.27	296.43	290.22	330.70	323.88	311.28	302.68	0.00	303.15	288.03	278.69	281.00
10-Feb-92	19.23	311.23	304.74	290.65	299.36	277.28	286.28	296.44	290.02	330.37	323.63	310.70	302.33	0.00	303.00	287.42	278.62	280.97
11-Feb-92	19.27	311.27	304.72	290.67	299.77	277.28	286.27	296.43	290.34	330.34	323.67	310.59	302.62	0.00	302.98	287.86	278.61	280.38

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
12-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29-Feb-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01-Mar-92	0.00	311.86	309.00	291.21	300.97	278.28	286.61	296.58	292.23	333.89	325.93	314.58	303.56	0.00	304.53	289.38	279.87	281.04
01-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
02-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
03-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
04-Mar-92	19.36	311.36	306.48	290.67	299.77	277.48	286.28	296.43	290.38	332.40	325.19	313.06	302.71	0.00	303.81	288.35	278.77	281.03
05-Mar-92	19.36	311.36	306.56	290.63	299.94	277.47	286.28	296.42	290.49	332.40	325.19	313.07	302.86	0.00	303.83	288.20	278.75	281.08
06-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
08-Mar-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09-Mar-92	19.48	311.48	306.54	290.65	300.32	277.74	286.28	296.42	290.45	332.44	325.36	313.24	303.17	0.00	304.03	288.47	279.07	281.06
10-Mar-92	19.36	311.36	306.69	290.66	300.39	277.66	286.28	296.44	290.87	332.60	325.41	313.36	303.25	0.00	304.07	288.36	278.96	281.07
11-Mar-92	20.24	312.24	306.79	290.73	300.63	279.45	286.27	296.43	290.95	332.66	325.34	313.45	303.42	0.00	303.94	289.64	281.63	281.10
12-Mar-92	19.80	311.80	308.07	291.29	300.45	278.90	286.88	296.45	292.06	334.31	326.27	314.67	303.24	0.00	304.47	289.96	280.70	281.01
13-Mar-92	19.56	311.56	309.44	291.26	300.56	278.39	286.77	296.45	292.28	334.81	326.54	315.21	303.30	0.00	304.89	289.97	280.08	281.02
14-Mar-92	19.44	311.44	310.57	291.39	301.21	278.20	286.81	296.45	292.51	335.43	327.05	316.01	303.84	0.00	305.40	289.89	279.83	280.99
15-Mar-92	19.40	311.40	311.16	291.45	301.68	278.11	286.66	296.46	292.53	335.64	327.28	316.40	304.16	0.00	305.58	289.88	279.69	281.01
16-Mar-92	19.32	311.32	311.36	291.36	301.85	277.98	286.41	296.46	292.40	335.61	327.30	316.40	304.33	0.00	305.60	289.77	279.55	280.98
17-Mar-92	19.32	311.32	310.66	291.19	301.35	277.94	286.28	296.46	292.76	334.69	326.52	315.57	303.74	0.00	304.81	289.53	279.49	280.99

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
18-Mar-92	19.36	311.36	310.19	291.07	300.99	277.93	286.28	296.45	292.42	334.10	326.04	314.99	303.34	0.00	304.50	289.25	279.43	281.07
19-Mar-92	19.36	311.36	310.10	290.87	301.27	277.91	286.28	296.45	292.78	333.89	325.95	314.81	303.61	0.00	304.41	289.41	279.40	281.07
20-Mar-92	19.36	311.36	309.50	290.78	300.96	277.89	286.28	296.46	292.10	333.35	325.50	314.21	303.26	0.00	304.15	288.91	279.36	280.97
21-Mar-92	19.38	311.38	309.01	290.65	300.87	277.87	286.28	296.46	292.42	333.10	325.33	313.81	303.24	0.00	304.09	288.73	279.32	281.00
22-Mar-92	19.36	311.36	308.35	290.72	300.69	277.82	286.28	296.46	292.13	332.81	325.17	313.54	303.15	0.00	303.95	288.73	279.27	281.00
23-Mar-92	19.36	311.36	308.02	290.73	300.84	277.81	286.28	296.45	292.08	332.58	324.98	313.41	303.21	0.00	303.85	288.52	279.24	281.07
24-Mar-92	19.32	311.32	307.29	290.68	300.39	277.75	286.28	296.46	291.78	332.29	324.77	313.13	302.95	0.00	303.74	288.26	279.17	281.00
25-Mar-92	19.35	311.35	306.93	290.70	300.17	277.74	286.27	296.46	291.53	332.16	324.68	312.96	302.85	0.00	303.72	287.99	279.12	281.01
26-Mar-92	19.40	311.40	306.88	290.72	300.37	277.78	286.28	296.46	291.54	332.09	324.65	312.91	303.01	0.00	303.72	288.42	279.13	281.07
27-Mar-92	24.84	316.84	307.17	291.66	301.06	279.87	288.54	296.46	292.32	333.22	325.33	313.83	304.41	0.00	304.10	290.15	281.93	281.09
28-Mar-92	22.64	314.64	309.40	291.99	301.25	279.46	287.21	296.46	292.80	334.95	326.48	315.09	304.54	0.00	305.01	290.29	281.09	281.06
29-Mar-92	19.75	311.75	310.45	292.23	301.43	278.78	287.21	297.00	293.49	335.45	326.73	315.73	303.89	0.00	305.37	290.42	280.47	281.07
30-Mar-92	19.60	311.60	310.98	292.45	301.53	278.60	287.08	297.54	293.50	335.61	326.82	316.10	303.85	0.00	305.43	290.41	280.26	281.06
31-Mar-92	19.72	311.72	311.41	292.52	302.00	278.85	286.82	297.76	293.68	335.68	326.90	316.44	304.09	0.00	305.35	290.71	280.80	281.08
01-Apr-92	0.00	311.46	308.14	291.10	300.94	278.05	286.26	296.61	292.44	332.82	325.13	313.91	303.24	0.00	304.11	289.86	279.46	281.07
01-Apr-92	19.60	311.60	311.45	292.44	302.01	278.61	286.55	297.80	293.54	335.50	326.75	316.45	303.96	0.00	305.21	290.74	280.20	281.06
02-Apr-92	19.56	311.56	311.51	292.34	302.20	278.56	286.33	297.77	294.13	335.34	326.71	316.45	304.08	0.00	305.09	290.71	280.06	281.06
03-Apr-92	19.52	311.52	311.33	292.15	302.15	278.43	286.22	297.58	294.08	334.96	326.47	316.21	303.92	0.00	304.89	290.57	279.97	281.06
04-Apr-92	19.47	311.47	310.98	291.99	301.92	278.34	286.23	297.33	294.05	334.52	326.18	315.82	303.77	0.00	304.69	290.52	279.87	281.06
05-Apr-92	19.44	311.44	310.66	291.82	301.81	278.26	286.24	297.04	293.86	334.11	325.97	315.47	303.71	0.00	304.58	290.32	279.78	281.06
06-Apr-92	19.40	311.40	310.16	291.64	301.43	278.17	286.24	296.68	293.63	333.64	325.62	314.93	303.47	0.00	304.40	290.14	279.67	281.06
07-Apr-92	19.40	311.40	309.87	291.42	301.47	278.08	286.24	296.44	293.47	333.38	325.44	314.55	303.54	0.00	304.32	289.93	279.57	281.06
08-Apr-92	19.36	311.36	309.48	291.29	301.59	278.03	286.24	296.42	293.15	333.07	325.26	314.15	303.61	0.00	304.22	290.30	279.51	281.06
09-Apr-92	19.36	311.36	308.66	291.01	301.13	277.95	286.24	296.46	292.95	332.62	324.93	313.76	303.32	0.00	304.05	290.00	279.43	281.07
10-Apr-92	19.36	311.36	308.10	290.77	301.12	277.93	286.25	296.46	292.84	332.32	324.75	313.57	303.34	0.00	303.94	289.99	279.38	281.08
11-Apr-92	19.33	311.33	307.52	290.63	301.01	277.87	286.24	296.45	292.63	332.07	324.58	313.40	303.33	0.00	303.87	289.82	279.32	281.06
12-Apr-92	19.36	311.36	307.00	290.65	300.90	277.85	286.24	296.43	292.56	331.71	324.31	313.01	303.14	0.00	303.67	289.66	279.28	281.10
13-Apr-92	19.32	311.32	306.39	290.62	300.38	277.79	286.24	296.52	292.12	331.35	324.02	312.49	302.77	0.00	303.55	289.36	279.20	281.07
14-Apr-92	19.32	311.32	306.21	290.68	300.58	277.72	286.24	296.48	292.09	331.25	324.02	312.33	302.98	0.00	303.57	289.37	279.14	281.07
15-Apr-92	19.28	311.28	305.96	290.67	300.59	277.67	286.25	296.41	291.85	331.11	323.94	312.12	302.95	0.00	303.55	289.22	279.07	281.07
16-Apr-92	19.28	311.28	305.58	290.75	300.45	277.62	286.24	296.41	291.71	330.91	323.83	311.85	302.86	0.00	303.47	289.07	279.00	281.07
17-Apr-92	19.64	311.64	305.27	290.75	300.55	278.10	286.25	296.39	291.75	330.60	323.62	311.55	302.93	0.00	303.26	289.30	279.31	281.14
18-Apr-92	19.79	311.79	304.87	290.80	300.20	278.28	286.24	296.39	291.44	330.77	323.58	311.45	302.71	0.00	303.32	289.29	279.45	281.07
19-Apr-92	19.84	311.84	305.14	290.83	300.21	278.36	286.24	296.40	291.35	331.78	324.36	312.09	302.85	0.00	303.67	289.38	279.58	281.09
20-Apr-92	19.52	311.52	305.97	290.85	300.32	278.06	286.25	296.40	291.66	332.76	325.17	313.06	302.89	0.00	303.93	289.55	279.43	281.05
21-Apr-92	19.47	311.47	307.11	290.89	300.54	277.90	286.25	296.39	291.68	333.10	325.50	313.98	303.05	0.00	304.10	289.68	279.28	281.06

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
22-Apr-92	19.40	311.40	307.88	290.90	300.59	277.86	286.26	296.39	291.82	333.06	325.45	314.20	303.11	0.00	304.16	289.74	279.24	281.04
23-Apr-92	19.44	311.44	308.00	290.93	300.55	277.89	286.25	296.39	291.75	332.89	325.30	314.20	303.08	0.00	304.15	289.78	279.25	281.06
24-Apr-92	19.40	311.40	308.00	290.87	300.57	277.85	286.25	296.38	291.77	332.79	325.26	314.12	303.06	0.00	304.09	289.73	279.21	281.05
25-Apr-92	19.76	311.76	307.97	290.86	300.69	278.35	286.26	296.38	291.90	332.80	325.19	314.14	303.13	0.00	304.09	289.89	279.59	281.07
26-Apr-92	19.56	311.56	308.11	290.87	300.51	278.16	286.33	296.33	291.86	333.11	325.36	314.25	303.03	0.00	304.17	289.95	279.50	281.06
27-Apr-92	19.47	311.47	308.53	290.90	300.61	278.05	286.19	296.41	291.93	333.35	325.57	314.41	303.10	0.00	304.28	290.04	279.44	281.06
28-Apr-92	19.40	311.40	308.76	290.89	300.62	277.98	286.25	296.41	291.89	333.39	325.63	314.50	303.09	0.00	304.36	289.90	279.37	281.06
29-Apr-92	19.39	311.39	308.83	290.86	300.65	277.93	286.25	296.41	291.84	333.29	325.57	314.49	303.14	0.00	304.35	289.96	279.32	281.06
30-Apr-92	19.36	311.36	308.81	290.82	300.77	277.89	286.25	296.41	292.02	333.17	325.49	314.40	303.19	0.00	304.26	289.91	279.28	281.07
01-May-92	0.00	311.22	304.59	290.87	299.50	277.47	286.26	296.38	290.54	330.20	323.36	311.25	302.02	0.00	302.84	289.05	278.70	281.10
01-May-92	19.32	311.32	308.52	290.77	300.69	277.85	286.25	296.41	291.83	332.97	325.32	314.21	303.09	0.00	304.17	289.96	279.22	281.05
02-May-92	19.32	311.32	308.36	290.80	300.80	277.84	286.26	296.39	291.97	332.82	325.21	314.14	303.18	0.00	304.09	290.05	279.20	281.05
03-May-92	19.52	311.52	308.02	290.83	300.77	278.01	286.27	296.38	291.98	332.53	325.02	313.94	303.11	0.00	303.96	290.08	279.33	281.04
04-May-92	19.36	311.36	307.41	290.85	300.36	277.85	286.28	296.34	291.64	332.15	324.69	313.65	302.76	0.00	303.72	289.78	279.17	281.06
05-May-92	19.32	311.32	307.04	290.84	300.11	277.78	286.27	296.43	291.49	331.95	324.57	313.49	302.58	0.00	303.65	289.72	279.08	281.03
06-May-92	19.32	311.32	306.78	290.86	299.93	277.72	286.28	296.42	291.22	331.80	324.46	313.36	302.51	0.00	303.63	289.49	279.02	281.03
07-May-92	19.28	311.28	306.62	290.81	299.90	277.67	286.28	296.43	290.91	331.64	324.35	313.17	302.54	0.00	303.66	289.46	278.95	281.04
08-May-92	19.28	311.28	306.51	290.88	300.10	277.62	286.28	296.37	291.18	331.49	324.29	312.99	302.64	0.00	303.59	289.66	278.91	281.02
09-May-92	19.32	311.32	306.34	290.86	300.27	277.71	286.28	296.33	290.94	331.32	324.16	312.78	302.73	0.00	303.52	289.47	278.98	281.02
10-May-92	19.31	311.31	306.03	290.87	300.15	277.63	286.27	296.32	291.04	331.10	324.00	312.47	302.60	0.00	303.43	289.33	278.89	281.02
11-May-92	19.28	311.28	305.62	290.83	299.87	277.58	286.28	296.34	290.92	330.87	323.84	312.12	302.39	0.00	303.32	289.29	278.83	281.01
12-May-92	19.24	311.24	305.37	290.83	299.84	277.53	286.27	296.35	291.03	330.69	323.71	311.88	302.38	0.00	303.22	289.31	278.78	281.10
13-May-92	19.24	311.24	305.19	290.86	299.92	277.50	286.26	296.33	290.80	330.51	323.64	311.70	302.37	0.00	303.07	289.31	278.75	281.08
14-May-92	19.24	311.24	304.87	290.89	299.72	277.48	286.25	296.34	290.58	330.26	323.42	311.39	302.16	0.00	302.90	289.11	278.72	281.06
15-May-92	19.20	311.20	304.42	290.86	299.24	277.43	286.25	296.35	290.57	329.98	323.14	311.00	301.84	0.00	302.73	288.90	278.67	281.05
16-May-92	19.20	311.20	304.11	290.85	299.07	277.43	286.26	296.37	290.30	329.75	322.99	310.71	301.70	0.00	302.59	288.76	278.66	281.06
17-May-92	19.32	311.32	304.00	290.84	299.12	277.53	286.25	296.38	290.30	329.71	322.99	310.62	301.78	0.00	302.60	288.93	278.69	281.07
18-May-92	19.24	311.24	304.00	290.89	299.47	277.42	286.26	296.36	290.24	329.76	323.05	310.67	301.99	0.00	302.64	288.96	278.62	281.08
19-May-92	19.20	311.20	303.65	290.89	299.07	277.39	286.26	296.39	290.03	329.58	322.90	310.45	301.73	0.00	302.56	288.65	278.57	281.09
20-May-92	19.20	311.20	303.45	290.91	299.05	277.35	286.25	296.40	290.03	329.48	322.84	310.27	301.66	0.00	302.51	288.79	278.54	281.10
21-May-92	19.16	311.16	303.26	290.94	299.05	277.31	286.25	296.39	289.95	329.36	322.75	310.16	301.64	0.00	302.42	288.68	278.50	281.11
22-May-92	19.12	311.12	303.09	290.96	299.08	277.28	286.26	296.37	289.86	329.21	322.64	310.01	301.62	0.00	302.31	288.69	278.46	281.14
23-May-92	19.12	311.12	302.82	290.93	298.96	277.26	286.26	296.36	290.21	328.95	322.44	309.78	301.47	0.00	302.12	288.79	278.43	281.17
24-May-92	19.09	311.09	302.57	290.93	298.91	277.23	286.26	296.38	290.06	328.72	322.29	309.55	301.36	0.00	301.93	288.67	0.00	0.00
25-May-92	19.08	311.08	302.25	290.93	298.60	277.21	286.26	296.42	290.06	328.53	322.12	309.31	301.14	0.00	301.82	288.57	278.37	281.20
26-May-92	19.08	311.08	302.20	290.87	298.65	277.20	286.26	296.38	289.69	328.57	322.20	309.29	301.23	0.00	301.93	288.53	278.34	281.20

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
27-May-92	19.08	311.08	302.23	290.86	298.86	277.19	286.25	296.36	289.83	328.66	322.31	309.33	301.39	0.00	302.03	288.52	278.31	281.23
28-May-92	19.12	311.12	302.11	290.85	298.80	277.17	286.26	296.38	289.73	328.63	322.32	309.28	301.38	0.00	302.07	288.32	278.29	281.24
29-May-92	19.08	311.08	301.94	290.85	298.66	277.14	286.26	296.48	289.72	328.56	322.26	309.16	301.29	0.00	302.06	288.31	278.26	281.24
30-May-92	19.08	311.08	301.77	290.87	298.60	277.12	286.26	296.48	289.32	328.44	322.18	309.02	301.23	0.00	301.97	288.27	278.23	281.24
31-May-92	19.08	311.08	301.68	290.83	298.74	277.10	286.25	296.39	289.43	328.36	322.16	308.95	301.31	0.00	301.88	288.34	278.21	281.20
01-Jun-92	0.00	312.00	307.07	292.08	300.46	278.26	286.89	297.31	292.81	332.44	324.54	313.87	302.69	0.00	303.86	291.32	279.67	281.17
01-Jun-92	19.99	311.99	301.65	290.79	298.93	278.23	286.25	296.36	289.66	329.06	322.33	309.13	301.61	0.00	302.06	288.88	279.06	281.20
02-Jun-92	19.43	311.43	301.97	290.80	298.84	277.62	286.26	296.38	289.65	331.04	323.96	310.46	301.49	0.00	302.84	288.68	278.63	281.20
03-Jun-92	19.24	311.24	303.10	290.80	298.85	277.40	286.26	296.40	289.86	331.59	324.64	311.90	301.56	0.00	303.05	288.68	278.50	281.19
04-Jun-92	19.16	311.16	304.04	290.80	298.86	277.30	286.26	296.39	289.82	331.50	324.50	312.63	301.60	0.00	303.03	288.65	278.44	281.18
05-Jun-92	19.12	311.12	304.38	290.77	298.75	277.24	286.26	296.41	289.88	331.11	324.11	312.52	301.52	0.00	302.86	288.77	278.39	281.18
06-Jun-92	29.68	321.68	304.72	294.02	299.21	280.06	292.00	296.36	290.79	333.23	325.24	313.96	303.67	0.00	305.51	290.97	281.95	281.18
07-Jun-92	25.92	317.92	308.71	294.19	301.01	279.87	289.00	298.29	293.46	335.22	326.40	316.53	305.27	0.00	306.92	293.26	281.72	281.17
08-Jun-92	19.67	311.67	310.26	294.66	301.91	279.43	288.54	299.81	294.50	335.53	326.48	316.99	304.17	0.00	306.88	293.72	281.17	281.16
09-Jun-92	19.52	311.52	310.88	294.66	302.22	279.26	288.09	300.17	294.97	335.51	326.35	317.22	303.90	0.00	306.33	293.52	280.89	281.16
10-Jun-92	19.42	311.42	311.07	294.46	302.13	279.04	287.72	299.88	295.14	335.34	326.20	317.23	303.58	0.00	305.71	293.51	280.61	281.17
11-Jun-92	19.35	311.35	311.05	294.05	301.90	278.83	287.25	299.38	295.27	335.07	326.03	317.04	303.32	0.00	305.04	293.20	280.36	281.18
12-Jun-92	19.28	311.28	310.94	293.62	301.72	278.65	286.57	298.88	295.00	334.77	325.85	316.71	303.17	0.00	304.53	293.06	280.15	281.18
13-Jun-92	19.24	311.24	310.73	293.20	301.69	278.48	286.18	298.34	294.85	334.35	325.63	316.32	303.15	0.00	304.24	292.86	279.97	281.17
14-Jun-92	19.23	311.23	310.29	292.91	301.48	278.33	286.26	297.83	294.59	333.73	325.28	315.79	302.99	0.00	303.90	292.57	279.82	281.18
15-Jun-92	19.20	311.20	309.74	292.38	301.18	278.19	286.26	297.32	294.44	333.05	324.85	315.18	302.78	0.00	303.61	292.30	279.67	281.16
16-Jun-92	19.16	311.16	309.02	292.01	300.66	278.06	286.26	296.74	293.97	332.40	324.39	314.42	302.46	0.00	303.40	291.90	279.52	281.18
17-Jun-92	19.16	311.16	308.25	291.68	300.54	277.95	286.26	296.50	293.68	331.94	324.08	313.84	302.43	0.00	303.23	291.61	279.40	281.17
18-Jun-92	19.12	311.12	307.39	291.19	300.47	277.86	286.26	296.48	293.35	331.52	323.80	313.49	302.49	0.00	303.11	291.34	279.31	281.17
19-Jun-92	19.12	311.12	306.72	291.05	300.56	277.76	286.26	296.40	293.26	331.14	323.58	313.13	302.50	0.00	302.97	291.40	279.23	281.15
20-Jun-92	19.12	311.12	306.21	290.83	300.48	277.73	286.26	296.39	293.01	330.80	323.36	312.70	302.41	0.00	302.88	291.15	279.17	281.15
21-Jun-92	19.32	311.32	305.61	290.77	300.19	277.86	286.26	296.41	292.64	330.54	323.17	312.16	302.28	0.00	302.83	290.91	279.20	281.15
22-Jun-92	19.20	311.20	305.26	290.71	300.05	277.69	286.26	296.41	292.46	330.54	323.25	311.95	302.20	0.00	302.82	290.77	279.09	281.15
23-Jun-92	19.16	311.16	305.06	290.63	299.95	277.61	286.26	296.45	292.25	330.43	323.24	311.81	302.12	0.00	302.83	290.40	279.01	281.15
24-Jun-92	19.12	311.12	304.96	290.49	300.01	277.55	286.25	296.41	291.91	330.26	323.19	311.62	302.20	0.00	302.84	290.35	278.95	281.15
25-Jun-92	19.96	311.96	304.84	290.49	299.96	278.52	286.72	296.40	291.77	331.34	323.60	311.99	302.43	0.00	303.18	290.46	279.58	281.09
26-Jun-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27-Jun-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28-Jun-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29-Jun-92	19.24	311.24	307.34	290.71	299.70	277.79	286.26	296.43	292.10	331.66	324.03	313.88	302.24	0.00	303.40	290.63	279.20	281.13
30-Jun-92	19.16	311.16	306.63	290.53	299.68	277.71	286.26	296.39	291.97	331.11	323.61	313.28	302.17	0.00	303.17	290.69	279.13	281.13

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
01-Jul-92	0.00	311.26	303.75	290.69	299.16	277.72	286.32	296.45	291.42	329.60	322.50	310.78	301.56	0.00	302.67	290.16	279.07	281.02
01-Jul-92	19.26	311.26	306.08	290.59	299.63	277.77	286.25	296.39	291.96	330.75	323.34	312.79	302.08	0.00	303.04	290.61	279.15	281.12
02-Jul-92	19.16	311.16	305.53	290.49	299.35	277.67	286.26	296.42	291.72	330.31	323.04	312.20	301.82	0.00	302.85	290.55	279.06	281.13
03-Jul-92	19.12	311.12	305.06	290.49	299.21	277.60	286.26	296.42	291.64	329.90	322.73	311.58	301.71	0.00	302.71	290.37	279.00	281.14
04-Jul-92	19.36	311.36	304.68	290.50	299.30	277.83	286.26	296.40	291.58	329.68	322.55	311.17	301.83	0.00	302.70	290.44	279.09	281.13
05-Jul-92	19.28	311.28	304.58	290.76	299.39	277.75	286.26	296.39	291.62	330.11	322.93	311.44	301.87	0.00	302.92	290.37	279.07	281.13
06-Jul-92	19.32	311.32	304.85	290.76	299.55	277.83	286.26	296.42	291.66	330.49	323.26	311.81	301.98	0.00	303.08	290.31	279.12	281.13
07-Jul-92	19.28	311.28	305.09	290.76	299.39	277.76	286.26	296.45	291.85	330.98	323.60	312.21	301.95	0.00	303.24	290.40	279.11	281.14
08-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
09-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14-Jul-92	19.04	311.04	302.92	290.60	298.82	277.44	286.26	296.44	291.07	328.35	321.53	309.32	301.25	0.00	302.16	289.95	278.84	281.01
15-Jul-92	19.04	311.04	302.50	290.59	298.79	277.40	286.26	296.46	290.92	328.10	321.36	308.99	301.17	0.00	302.03	289.85	278.79	280.97
16-Jul-92	20.32	312.32	302.04	290.61	298.62	278.68	287.30	296.46	290.81	329.76	321.93	309.21	301.24	0.00	302.61	289.98	279.61	280.98
17-Jul-92	19.40	311.40	303.47	291.07	298.75	278.04	286.57	296.46	291.42	331.84	324.28	312.43	301.30	0.00	303.40	290.59	279.44	280.97
18-Jul-92	19.27	311.27	305.61	291.15	299.27	277.91	286.26	296.46	291.79	332.06	324.49	314.07	301.74	0.00	303.50	290.93	279.40	280.97
19-Jul-92	19.20	311.20	306.52	291.11	299.41	277.85	286.26	296.46	291.96	331.61	324.09	314.02	301.86	0.00	303.39	290.98	279.36	280.97
20-Jul-92	19.15	311.15	306.22	290.96	299.51	277.81	286.25	296.47	292.02	331.00	323.57	313.41	301.95	0.00	303.14	290.95	279.31	280.96
21-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26-Jul-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27-Jul-92	19.08	311.08	302.61	290.63	299.50	277.50	286.26	296.46	291.46	328.09	321.44	309.13	301.60	0.00	302.30	289.92	278.92	280.95
28-Jul-92	19.08	311.08	302.20	290.58	299.24	277.47	286.26	296.46	291.28	327.89	321.30	308.86	301.42	0.00	302.17	289.73	278.88	280.97
29-Jul-92	19.04	311.04	301.81	290.59	298.97	277.39	286.26	296.46	291.08	327.67	321.15	308.58	301.21	0.00	302.04	289.39	278.79	280.96
30-Jul-92	19.47	311.47	301.54	290.58	298.79	277.82	286.26	296.47	290.90	327.83	321.10	308.48	301.18	0.00	302.05	289.53	278.97	280.96
31-Jul-92	19.20	311.20	301.55	290.57	298.70	277.50	286.26	296.47	290.86	328.93	321.98	309.01	301.09	0.00	302.32	289.38	278.81	280.96
01-Aug-92	0.00	311.28	303.96	291.49	298.98	277.85	286.48	296.59	291.76	329.94	322.78	311.20	301.71	0.00	302.94	290.03	279.24	280.97
01-Aug-92	19.39	311.39	302.02	298.90	290.60	277.73	286.26	296.46	290.73	329.72	322.89	310.15	301.28	0.00	302.53	289.49	278.93	280.99
02-Aug-92	19.16	311.16	302.77	290.62	298.68	277.50	286.26	296.45	290.65	330.19	323.24	311.09	301.20	0.00	302.72	289.34	278.83	280.98
03-Aug-92	19.10	311.10	303.41	290.66	298.82	277.42	286.26	296.46	290.83	330.23	323.23	311.43	301.32	0.00	302.70	289.41	278.80	280.95

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
04-Aug-92	19.07	311.07	303.64	290.67	298.92	277.39	286.26	296.46	290.94	329.92	323.01	311.30	301.38	0.00	302.62	289.61	278.78	280.95
05-Aug-92	19.08	311.08	303.37	290.69	298.70	277.39	286.26	296.46	290.79	329.38	322.59	310.77	301.21	0.00	302.43	289.27	278.76	280.97
06-Aug-92	19.04	311.04	303.01	290.73	298.54	277.36	286.26	296.46	290.67	328.94	322.22	310.24	301.09	0.00	302.29	289.23	278.72	280.96
07-Aug-92	19.00	311.00	302.63	290.76	298.51	277.32	286.26	296.47	290.70	328.53	321.81	309.73	301.06	0.00	302.15	289.08	278.67	280.95
08-Aug-92	19.00	311.00	302.23	290.75	298.53	277.29	286.26	296.46	290.62	328.17	321.51	309.22	301.02	0.00	302.00	288.91	278.62	280.94
09-Aug-92	19.08	311.08	301.92	290.75	298.66	277.33	286.27	296.46	290.58	327.87	321.32	308.85	301.03	0.00	301.93	289.16	278.61	280.94
10-Aug-92	19.42	311.42	301.83	290.73	298.71	277.77	286.34	296.47	290.59	329.36	322.02	309.50	301.19	0.00	302.63	289.31	278.88	281.00
11-Aug-92	19.20	311.20	302.53	290.60	298.78	277.52	286.26	296.47	290.65	330.62	323.49	310.91	301.25	0.00	302.89	289.52	278.80	280.98
12-Aug-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13-Aug-92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14-Aug-92	19.16	311.16	304.21	290.65	298.79	277.50	286.26	296.47	290.93	330.02	322.93	311.70	301.43	0.00	302.73	289.57	278.84	281.00
15-Aug-92	19.12	311.12	304.09	290.61	298.97	277.47	286.26	296.47	290.90	329.77	322.80	311.36	301.56	0.00	302.76	289.33	278.82	281.01
16-Aug-92	19.36	311.36	303.97	290.59	299.12	277.76	286.26	296.47	290.93	329.82	322.74	311.22	301.68	0.00	302.95	289.57	278.96	281.02
17-Aug-92	22.20	314.20	304.28	291.99	299.47	279.57	289.39	296.47	291.38	331.70	323.89	312.24	302.40	0.00	304.03	290.48	281.01	281.05
18-Aug-92	20.24	312.24	304.81	292.04	299.71	279.50	288.46	296.46	292.66	332.92	324.94	313.89	302.54	0.00	305.04	291.74	281.01	280.95
19-Aug-92	19.60	311.60	306.49	292.81	300.07	279.09	287.69	296.53	292.83	333.64	325.39	315.29	302.61	0.00	305.37	291.88	280.71	281.02
20-Aug-92	19.32	311.32	308.75	292.84	300.52	278.79	287.04	297.53	293.39	333.66	325.32	315.57	302.93	0.00	305.22	291.60	280.44	281.01
21-Aug-92	19.19	311.19	309.10	292.78	300.77	278.62	286.51	297.81	293.75	333.00	324.86	315.22	302.99	0.00	304.79	291.20	280.24	280.99
22-Aug-92	19.12	311.12	308.66	292.63	300.94	278.49	286.25	297.68	293.99	332.23	324.26	314.54	302.98	0.00	304.32	291.28	280.09	280.98
23-Aug-92	19.08	311.08	307.54	292.29	300.91	278.35	286.26	297.22	293.97	331.43	323.66	313.79	302.83	0.00	303.83	291.29	279.94	280.96
24-Aug-92	19.08	311.08	306.56	291.91	300.80	278.19	286.26	296.59	293.94	330.61	323.13	312.92	302.70	0.00	303.40	291.49	279.76	280.95
25-Aug-92	19.08	311.08	305.78	291.64	300.73	278.06	286.26	296.46	293.86	329.96	322.66	311.97	302.63	0.00	303.12	291.43	279.62	280.95
26-Aug-92	19.08	311.08	304.96	291.31	300.52	277.94	286.26	296.47	293.66	329.35	322.11	311.10	302.39	0.00	302.89	291.11	279.48	280.95
27-Aug-92	19.08	311.08	304.17	291.02	300.24	277.83	286.26	296.47	293.47	328.78	321.69	310.29	302.12	0.00	302.61	290.74	279.36	280.95
28-Aug-92	19.04	311.04	303.43	290.72	299.97	277.73	286.26	296.47	293.16	328.26	321.34	309.58	301.85	0.00	302.35	291.00	279.25	280.95
29-Aug-92	19.52	311.52	302.81	290.56	299.76	278.07	286.26	296.47	292.91	327.94	321.09	309.08	301.71	0.00	302.17	290.61	279.37	280.98
30-Aug-92	19.20	311.20	302.39	290.59	299.40	277.73	286.26	296.47	292.59	328.16	321.18	309.03	301.48	0.00	302.23	289.61	279.15	280.97
31-Aug-92	19.12	311.12	302.40	290.63	299.45	277.62	286.26	296.47	292.51	328.31	321.46	309.21	301.54	0.00	302.24	289.80	279.06	280.96
01-Sep-92	0.00	309.07	301.64	290.66	298.30	277.33	286.25	296.49	290.67	328.23	321.66	308.79	300.27	0.00	302.14	290.81	278.61	280.97
01-Sep-92	19.08	311.08	302.26	290.64	299.19	277.54	286.26	296.47	292.18	328.13	321.39	309.13	301.33	0.00	302.16	287.55	278.98	280.96
02-Sep-92	19.04	311.04	302.11	290.61	299.02	277.48	286.25	296.48	291.97	327.96	321.28	308.98	301.27	0.00	302.11	288.23	278.90	280.96
03-Sep-92	19.04	311.04	302.04	290.58	299.13	277.42	286.26	296.47	291.84	327.84	321.26	308.86	301.36	0.00	302.10	289.15	278.83	280.95
04-Sep-92	19.36	311.36	301.87	290.57	299.10	277.79	286.26	296.48	291.63	328.49	321.44	308.89	301.39	0.00	302.34	289.17	279.01	280.98
05-Sep-92	19.18	311.18	302.06	290.62	298.90	277.54	286.26	296.47	291.49	329.80	322.82	309.94	301.29	0.00	302.74	289.32	278.89	280.98
06-Sep-92	19.12	311.12	302.86	290.61	298.91	277.49	286.25	296.47	291.48	330.10	323.21	310.98	301.33	0.00	302.69	289.35	278.87	280.98
07-Sep-92	19.11	311.11	303.55	290.60	299.05	277.46	286.26	296.48	291.45	329.87	323.05	311.39	301.48	0.00	302.69	289.54	278.85	280.99

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
08-Sep-92	19.08	311.08	303.68	290.58	299.17	277.44	286.26	296.47	291.36	329.45	322.73	311.15	301.56	0.00	302.64	289.66	278.83	280.99
09-Sep-92	16.76	308.76	303.36	290.57	299.11	277.90	286.26	296.48	291.21	328.94	322.25	310.52	301.06	0.00	302.45	289.53	279.04	280.99
10-Sep-92	16.16	308.16	302.69	290.59	298.79	277.40	286.26	296.47	291.15	328.34	321.68	309.48	300.51	0.00	302.16	289.47	278.77	280.98
11-Sep-92	16.92	308.92	302.07	290.68	298.54	277.46	286.26	296.48	291.02	328.33	321.56	309.08	300.35	0.00	302.15	289.47	278.77	281.00
12-Sep-92	17.56	309.56	302.00	290.68	298.28	277.39	286.25	296.48	290.90	328.99	322.11	309.77	300.35	0.00	302.35	290.04	278.73	281.00
13-Sep-92	17.72	309.72	302.37	290.60	298.30	277.38	286.24	296.49	290.84	329.30	322.53	310.17	300.52	0.00	302.45	290.98	278.71	280.97
14-Sep-92	17.76	309.76	302.68	290.59	298.46	277.36	286.25	296.49	290.82	329.28	322.56	310.24	300.67	0.00	302.50	291.45	278.70	280.95
15-Sep-92	17.72	309.72	302.66	290.59	298.51	277.34	286.25	296.49	290.68	328.96	322.25	309.98	300.71	0.00	302.46	291.72	278.68	280.93
16-Sep-92	15.56	307.56	302.45	290.58	298.55	277.73	286.25	296.48	290.68	328.57	321.89	309.49	300.32	0.00	302.36	292.11	278.84	280.93
17-Sep-92	14.80	306.80	301.98	290.60	298.43	277.29	286.25	296.49	290.60	328.08	321.54	308.76	300.00	0.00	302.17	291.82	278.62	280.93
18-Sep-92	14.75	306.75	301.53	290.60	298.20	277.27	286.25	296.49	290.49	327.64	321.24	308.19	299.58	0.00	301.96	291.95	278.57	280.93
19-Sep-92	14.64	306.64	301.13	290.59	298.05	277.24	286.26	296.49	290.41	327.25	320.94	307.69	299.34	0.00	301.77	292.09	278.53	280.94
20-Sep-92	14.56	306.56	300.66	290.70	297.56	277.23	286.25	296.50	290.17	326.90	320.63	307.18	298.95	0.00	301.59	291.92	278.47	280.97
21-Sep-92	14.44	306.44	300.49	290.71	297.50	277.20	286.25	296.50	290.10	326.75	320.55	306.90	298.91	0.00	301.58	292.06	278.41	280.97
22-Sep-92	14.28	306.28	300.42	290.76	297.71	277.16	286.25	296.49	290.14	326.61	320.47	306.70	298.97	0.00	301.59	291.94	278.37	280.96
23-Sep-92	14.84	306.84	300.13	290.77	297.46	277.17	286.26	296.50	289.90	326.38	320.25	306.33	298.83	0.00	301.51	291.99	278.35	280.99
24-Sep-92	15.52	307.52	299.91	290.74	297.10	277.14	286.25	296.50	289.69	326.62	320.25	306.31	298.86	0.00	301.58	291.86	278.30	280.99
25-Sep-92	15.56	307.56	299.95	290.77	297.28	277.11	286.25	296.51	289.73	327.02	320.63	306.65	299.07	0.00	301.73	292.04	278.26	280.97
26-Sep-92	15.84	307.84	300.10	290.76	297.57	276.90	286.24	296.51	289.75	327.32	321.02	306.96	299.33	0.00	301.87	291.89	278.16	280.97
27-Sep-92	17.28	309.28	300.23	290.74	297.76	276.94	286.25	296.50	289.72	327.77	321.33	307.32	299.77	0.00	302.00	291.94	278.16	280.99
28-Sep-92	18.32	310.32	300.32	290.78	297.75	276.99	286.25	296.51	289.57	328.34	321.84	308.06	300.09	0.00	302.13	291.76	278.18	281.00
29-Sep-92	18.96	310.96	300.60	290.76	297.88	277.04	286.25	296.51	289.63	328.88	322.40	309.03	300.42	0.00	302.24	291.97	278.20	281.00
30-Sep-92	19.08	311.08	300.90	290.77	297.87	277.12	286.25	296.51	289.56	329.06	322.72	309.73	300.58	0.00	302.30	292.18	278.24	281.00
01-Oct-92	0.00	311.12	301.82	290.80	298.65	277.16	286.24	296.51	289.72	328.33	322.00	309.70	301.37	0.00	302.43	292.39	278.28	281.00
01-Oct-92	19.04	311.04	301.34	290.77	298.02	277.09	286.24	296.51	289.55	329.05	322.76	310.11	300.78	0.00	302.36	292.21	278.22	281.00
02-Oct-92	19.00	311.00	301.63	290.77	298.25	277.07	286.24	296.51	289.56	328.91	322.61	310.20	300.99	0.00	302.37	292.26	278.21	280.99
03-Oct-92	19.00	311.00	301.78	290.83	298.51	277.07	286.25	296.51	289.57	328.69	322.39	310.11	301.17	0.00	302.36	292.19	278.21	280.98
04-Oct-92	19.00	311.00	301.55	290.79	298.29	277.06	286.24	296.50	289.46	328.26	321.97	309.67	301.03	0.00	302.21	292.35	278.19	280.98
05-Oct-92	19.00	311.00	301.30	290.79	298.16	277.04	286.24	296.51	289.45	327.84	321.62	309.20	300.96	0.00	302.02	292.32	278.17	280.98
06-Oct-92	19.08	311.08	301.14	290.79	298.11	277.10	286.24	296.51	289.38	327.54	321.39	308.88	300.93	0.00	301.95	292.19	278.17	280.98
07-Oct-92	19.04	311.04	301.08	290.81	298.26	277.03	286.23	296.52	289.43	327.30	321.20	308.71	301.01	0.00	301.94	292.34	278.13	280.97
08-Oct-92	19.00	311.00	301.00	290.81	298.35	277.00	286.25	296.52	289.40	327.02	321.03	308.49	301.05	0.00	301.90	292.30	278.10	280.97
09-Oct-92	19.00	311.00	300.90	290.81	298.40	276.97	286.25	296.51	289.36	326.78	320.79	308.28	301.09	0.00	301.84	291.89	278.07	280.97
10-Oct-92	19.80	311.80	300.77	294.28	298.47	277.77	286.25	296.51	289.50	326.78	320.62	308.17	301.21	0.00	301.87	292.11	278.50	281.00
11-Oct-92	19.28	311.28	300.85	290.87	298.48	277.31	286.24	296.51	289.75	328.86	321.78	309.12	301.15	0.00	302.65	292.32	278.33	281.00
12-Oct-92	19.32	311.32	301.16	290.72	298.57	277.39	286.25	296.52	289.79	329.92	323.18	310.11	301.30	0.00	302.81	292.46	278.42	281.00

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
13-Oct-92	19.20	311.20	301.87	290.61	298.53	277.30	286.25	296.51	289.89	330.72	323.89	311.58	301.29	0.00	303.07	293.00	278.41	281.00
14-Oct-92	19.16	311.16	302.85	290.63	298.40	277.25	286.24	296.51	289.84	330.96	324.00	312.29	301.33	0.00	303.11	292.69	278.40	281.00
15-Oct-92	19.12	311.12	303.57	290.64	298.67	277.22	286.24	296.51	289.97	330.88	323.94	312.50	301.59	0.00	303.13	292.84	278.39	280.99
16-Oct-92	19.11	311.11	303.81	290.66	298.85	277.20	286.24	296.51	289.99	330.49	323.63	312.28	301.69	0.00	303.04	292.62	278.38	280.99
17-Oct-92	19.11	311.11	303.69	290.65	298.92	277.21	286.24	296.51	290.01	330.01	323.29	311.76	301.71	0.00	302.91	292.52	278.39	281.02
18-Oct-92	19.12	311.12	303.30	290.65	298.76	277.22	286.23	296.51	290.01	329.54	322.92	311.15	301.64	0.00	302.77	293.18	278.38	281.02
19-Oct-92	19.12	311.12	303.04	290.59	299.06	277.20	286.24	296.52	290.20	329.20	322.64	310.80	301.77	0.00	302.66	292.90	278.38	281.00
20-Oct-92	19.08	311.08	302.49	290.59	298.70	277.18	286.23	296.52	289.92	328.71	322.17	310.20	301.46	0.00	302.50	292.37	278.35	281.01
21-Oct-92	19.08	311.08	302.34	290.58	298.88	277.16	286.23	296.52	289.98	328.53	322.08	309.87	301.59	0.00	302.55	292.57	278.33	281.00
22-Oct-92	19.08	311.08	301.99	290.56	298.72	277.14	286.23	296.51	289.82	328.14	321.79	309.40	301.45	0.00	302.45	292.35	278.30	281.02
23-Oct-92	19.08	311.08	301.88	290.56	298.86	277.13	286.23	296.52	289.83	327.96	321.67	309.23	301.58	0.00	302.47	292.55	278.28	281.01
24-Oct-92	19.08	311.08	301.97	290.65	299.34	277.11	286.23	296.52	290.08	327.81	321.64	309.24	301.86	0.00	302.54	292.63	278.27	281.00
25-Oct-92	19.16	311.16	301.83	290.67	299.36	277.19	286.24	296.51	289.95	327.57	321.45	309.09	301.84	0.00	302.50	292.27	278.32	281.01
26-Oct-92	19.12	311.12	301.68	290.67	299.23	277.16	286.24	296.52	289.84	327.38	321.30	308.91	301.78	0.00	302.49	292.14	278.29	281.02
27-Oct-92	19.10	311.10	301.58	290.67	299.15	277.12	286.24	296.51	289.76	327.24	321.21	308.79	301.74	0.00	302.47	291.94	278.26	281.00
28-Oct-92	19.08	311.08	301.24	290.67	298.81	277.09	286.23	296.51	289.67	326.86	320.89	308.42	301.49	0.00	302.21	292.00	278.22	281.00
29-Oct-92	19.08	311.08	301.07	290.58	298.77	277.07	286.24	296.51	289.69	326.63	320.72	308.24	301.41	0.00	302.08	292.23	278.19	281.00
30-Oct-92	19.08	311.08	300.96	290.54	298.72	277.05	286.24	296.50	289.49	326.40	320.72	308.10	301.37	0.00	302.01	292.22	278.16	281.00
31-Oct-92	19.08	311.08	300.84	290.56	298.62	277.04	286.24	296.51	289.31	326.22	320.59	307.92	301.32	0.00	301.95	292.24	278.14	281.00
01-Nov-92	0.00	311.72	304.29	291.28	299.72	277.80	286.72	297.05	290.80	330.90	323.74	311.96	302.41	0.00	303.53	292.25	279.08	281.03
01-Nov-92	19.08	311.08	300.80	290.56	298.64	277.02	286.24	296.51	289.22	326.06	320.52	307.87	301.34	0.00	301.94	291.99	278.11	281.00
02-Nov-92	19.08	311.08	300.77	290.56	298.64	277.00	286.24	296.51	289.10	325.95	320.46	307.82	301.38	0.00	301.94	291.77	278.08	281.00
03-Nov-92	19.20	311.20	300.88	290.52	298.97	277.12	286.24	296.51	289.13	325.91	320.50	307.90	301.63	0.00	302.00	291.67	278.15	281.00
04-Nov-92	19.35	311.35	300.94	290.54	299.05	277.32	286.24	296.51	289.05	326.58	320.70	308.23	301.78	0.00	302.31	291.66	278.31	281.01
05-Nov-92	19.20	311.20	300.56	290.53	298.70	277.16	286.24	296.47	289.10	327.32	320.90	308.21	301.30	0.00	302.11	291.45	278.22	281.02
06-Nov-92	19.24	311.24	300.49	290.56	298.43	277.19	286.24	296.47	289.02	328.08	321.67	308.45	301.11	0.00	302.07	291.35	278.24	281.04
07-Nov-92	19.20	311.20	300.56	290.57	298.17	277.13	286.24	296.41	288.97	328.72	322.34	308.95	300.99	0.00	302.14	291.04	278.20	281.03
08-Nov-92	19.16	311.16	300.66	290.55	298.06	277.09	286.24	296.50	289.02	328.89	322.76	309.36	300.94	0.00	302.07	290.93	278.18	281.03
09-Nov-92	19.12	311.12	300.98	290.55	298.03	277.06	286.23	296.49	288.95	328.96	322.86	309.69	300.94	0.00	302.10	290.45	278.17	281.02
10-Nov-92	19.12	311.12	301.29	290.57	298.16	277.04	286.23	296.48	288.99	328.93	322.77	309.78	301.06	0.00	302.16	290.51	278.16	281.02
11-Nov-92	19.12	311.12	301.54	290.55	298.53	277.03	286.23	296.49	289.12	328.83	322.66	309.78	301.31	0.00	302.20	290.56	278.16	281.00
12-Nov-92	19.16	311.16	301.49	290.55	298.58	277.10	286.24	296.49	289.11	328.58	322.37	309.55	301.32	0.00	302.13	290.49	278.20	281.01
13-Nov-92	20.48	312.48	301.81	290.65	299.21	278.31	286.55	296.48	289.63	329.35	322.66	309.86	301.96	0.00	302.45	291.09	279.22	280.70
14-Nov-92	19.48	311.48	302.11	290.63	298.81	277.73	286.58	296.54	289.81	332.04	324.75	311.79	301.79	0.00	303.72	291.07	278.84	281.04
15-Nov-92	19.35	311.35	303.78	290.56	299.01	277.53	286.17	296.56	290.14	332.71	325.30	313.54	301.96	0.00	303.86	291.46	278.74	281.05
16-Nov-92	19.28	311.28	304.89	290.54	299.06	277.45	286.23	296.56	290.22	332.55	325.15	314.07	302.06	0.00	303.84	291.60	278.70	281.06

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
17-Nov-92	19.24	311.24	305.60	290.54	299.44	277.40	286.24	296.55	290.43	332.29	324.88	314.06	302.38	0.00	303.78	291.59	278.68	281.06
18-Nov-92	19.20	311.20	305.58	290.52	299.53	277.37	286.24	296.54	290.46	331.81	324.46	313.52	302.38	0.00	303.65	291.49	278.66	281.06
19-Nov-92	19.20	311.20	305.21	290.54	299.45	277.34	286.24	296.56	290.47	331.26	324.03	312.77	302.35	0.00	303.54	291.24	278.62	281.07
20-Nov-92	19.20	311.20	304.86	290.54	299.51	277.30	286.23	296.54	290.43	330.90	323.81	312.14	302.40	0.00	303.59	291.33	278.59	281.06
21-Nov-92	19.16	311.16	304.63	290.49	299.80	277.28	286.23	296.53	290.60	330.57	323.61	311.61	302.56	0.00	303.59	291.40	278.57	281.05
22-Nov-92	19.24	311.24	304.40	290.52	300.14	277.33	286.24	296.42	290.65	330.32	323.43	311.29	302.69	0.00	303.56	291.61	278.58	281.04
23-Nov-92	24.65	316.65	304.21	292.13	300.34	280.05	290.57	296.46	290.94	331.92	324.23	311.77	303.61	0.00	304.26	292.89	281.83	281.12
24-Nov-92	25.16	317.16	306.38	293.24	301.10	279.84	288.80	297.16	292.80	334.84	326.37	316.07	305.33	0.00	306.30	294.79	281.49	281.05
25-Nov-92	19.80	311.80	309.43	293.40	301.75	279.16	288.20	298.63	293.73	335.47	326.60	316.34	304.40	0.00	306.44	295.19	280.85	281.05
26-Nov-92	19.64	311.64	310.31	293.57	302.24	278.97	287.80	299.21	294.36	335.60	326.58	316.60	304.35	0.00	306.21	295.60	280.67	281.05
27-Nov-92	19.96	311.96	310.90	293.66	302.66	279.27	287.66	299.40	294.86	335.74	326.61	316.92	304.49	0.00	306.02	295.55	280.81	281.06
28-Nov-92	19.64	311.64	311.12	293.62	302.58	278.99	287.32	299.44	295.11	335.73	326.55	316.97	304.23	0.00	305.65	295.39	280.63	281.06
29-Nov-92	19.55	311.55	311.21	293.39	302.56	278.84	287.02	299.20	295.25	335.60	326.45	316.90	304.12	0.00	305.25	295.26	280.44	281.05
30-Nov-92	19.48	311.48	311.26	293.10	302.58	278.71	286.50	298.82	295.23	335.47	326.37	316.83	304.08	0.00	304.99	295.12	280.27	281.05
01-Dec-92	0.00	311.58	310.28	291.86	301.78	278.33	286.55	297.41	294.37	334.37	325.71	315.17	303.67	0.00	304.69	293.88	279.89	281.05
01-Dec-92	19.47	311.47	311.12	292.76	302.44	278.57	286.19	298.43	295.05	335.14	326.18	316.55	303.94	0.00	304.76	294.75	280.11	281.05
02-Dec-92	19.44	311.44	310.97	292.34	302.39	278.44	286.24	298.00	294.98	334.88	326.08	316.32	303.93	0.00	304.66	294.49	279.97	281.04
03-Dec-92	19.72	311.72	310.76	292.15	302.38	278.63	286.24	297.60	294.80	334.62	325.91	316.07	304.01	0.00	304.52	294.24	280.05	281.04
04-Dec-92	19.50	311.50	310.31	291.80	301.77	278.34	286.24	297.30	294.38	334.26	325.64	315.58	303.55	0.00	304.40	293.83	279.81	281.04
05-Dec-92	19.44	311.44	310.47	291.62	302.25	278.18	286.24	296.95	294.60	334.21	325.71	315.60	303.94	0.00	304.42	293.87	279.67	281.03
06-Dec-92	19.44	311.44	309.85	291.43	301.55	278.08	286.24	296.78	293.95	333.74	325.36	314.96	303.40	0.00	304.22	293.28	279.55	281.04
07-Dec-92	19.40	311.40	309.76	291.28	301.78	277.98	286.24	296.50	294.03	333.65	325.37	314.76	303.66	0.00	304.22	293.33	279.48	281.03
08-Dec-92	19.36	311.36	309.19	291.09	301.45	277.90	286.24	296.54	293.71	333.36	325.20	314.30	303.40	0.00	304.15	293.04	279.39	281.03
09-Dec-92	19.31	311.31	308.48	290.90	301.09	277.79	286.23	296.62	293.70	333.01	324.96	313.91	303.25	0.00	304.01	292.76	279.30	281.03
10-Dec-92	19.28	311.28	307.98	290.59	301.00	277.70	286.23	296.58	293.55	332.78	324.82	313.72	303.23	0.00	303.93	292.83	279.22	281.02
11-Dec-92	19.32	311.32	307.91	290.51	301.41	277.71	286.24	296.43	293.68	332.66	324.73	313.62	303.50	0.00	303.84	292.71	279.21	281.02
12-Dec-92	19.88	311.88	307.42	290.69	301.17	278.40	286.42	296.39	293.35	332.80	324.73	313.44	303.39	0.00	303.90	292.70	279.79	281.03
13-Dec-92	19.56	311.56	307.89	290.61	300.80	278.06	286.24	296.45	293.16	333.50	325.16	313.92	303.14	0.00	304.12	292.76	279.56	281.03
14-Dec-92	19.48	311.48	308.91	290.68	300.75	277.96	286.24	296.57	293.21	334.18	325.65	314.33	303.19	0.00	304.37	292.83	279.51	281.04
15-Dec-92	19.48	311.48	309.79	290.88	301.01	277.94	286.24	296.60	293.38	334.50	325.88	314.77	303.38	0.00	304.52	292.20	279.50	281.05
16-Dec-92	19.44	311.44	310.12	291.05	301.20	277.92	286.24	296.58	293.48	334.62	325.95	315.02	303.51	0.00	304.58	292.33	279.48	281.04
17-Dec-92	19.48	311.48	310.36	291.21	301.38	277.97	286.24	296.44	293.52	334.60	325.94	315.15	303.54	0.00	304.61	292.71	279.50	281.05
18-Dec-92	20.72	312.72	310.63	292.26	301.38	279.21	288.21	296.89	293.54	335.41	326.30	315.62	303.82	0.00	305.45	293.56	280.56	281.06
19-Dec-92	19.80	311.80	311.29	293.01	301.37	278.79	288.14	298.31	294.07	335.97	326.63	316.08	303.64	0.00	306.15	294.18	280.45	281.06
20-Dec-92	19.68	311.68	311.97	293.47	302.21	278.76	287.90	299.06	294.94	336.23	326.80	316.62	304.11	0.00	306.18	294.81	280.47	281.06
21-Dec-92	19.80	311.80	312.00	293.61	302.04	278.98	287.78	299.32	294.85	336.12	326.63	316.56	303.85	0.00	306.07	295.01	280.62	281.06

FILE NO.

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
22-Dec-92	19.60	311.60	312.33	293.74	302.48	278.83	287.40	299.53	295.45	336.13	326.69	316.73	304.08	0.00	305.92	295.15	280.62	281.07
23-Dec-92	19.56	311.56	312.36	293.55	302.64	278.76	287.05	299.41	295.71	335.93	326.56	316.70	304.12	0.00	305.60	295.40	280.53	281.07
24-Dec-92	19.52	311.52	312.38	293.31	302.90	278.68	286.54	299.14	295.87	335.72	326.47	316.62	304.26	0.00	305.31	295.22	280.43	281.07
25-Dec-92	19.40	311.40	311.77	292.75	302.17	278.45	286.28	298.62	295.39	335.10	326.04	315.99	303.61	0.00	304.89	294.69	280.18	281.07
26-Dec-92	19.44	311.44	311.72	292.47	302.55	278.40	286.27	298.24	295.57	334.80	325.94	315.88	303.97	0.00	304.77	294.96	280.11	281.08
27-Dec-92	19.32	311.32	310.99	292.02	301.77	278.19	286.28	297.63	294.87	334.13	325.50	315.14	303.38	0.00	304.54	294.57	279.88	281.08
28-Dec-92	19.32	311.32	310.61	291.72	301.83	278.08	286.28	297.24	294.88	333.72	325.27	314.77	303.51	0.00	304.42	294.67	279.75	281.08
29-Dec-92	19.34	311.34	310.19	291.49	301.90	278.03	286.28	296.84	294.68	333.37	325.06	314.27	303.62	0.00	304.32	294.48	279.65	281.07
30-Dec-92	19.84	311.84	309.84	291.32	302.06	278.40	286.28	296.53	294.62	333.13	324.90	313.83	303.85	0.00	304.26	294.33	279.85	281.07
31-Dec-92	20.51	312.51	309.35	291.35	302.01	279.08	286.27	296.35	294.44	333.25	324.87	313.57	303.99	0.00	304.27	294.49	280.42	281.07
01-Jan-93	0.00	311.49	309.39	291.16	301.51	278.12	286.28	296.57	293.75	333.38	325.12	313.96	303.59	0.00	304.40	293.54	279.70	283.52
01-Jan-93	19.87	311.87	309.58	291.38	301.85	278.60	286.28	296.46	294.33	333.85	325.31	313.92	303.76	0.00	304.51	294.56	280.18	281.07
02-Jan-93	19.56	311.56	309.70	291.30	301.33	278.27	286.28	296.48	294.13	333.91	325.42	314.04	303.42	0.00	304.47	294.39	279.95	283.80
03-Jan-93	19.44	311.44	309.76	291.23	301.16	278.10	286.28	296.56	294.00	333.68	325.28	314.07	303.27	0.00	304.41	294.36	279.78	283.59
04-Jan-93	19.48	311.48	309.92	291.19	301.56	278.10	286.28	296.48	294.10	333.48	325.17	314.10	303.60	0.00	304.34	294.37	279.72	283.87
05-Jan-93	19.64	311.64	310.05	291.16	302.11	278.43	286.27	296.41	294.16	333.54	325.26	314.16	304.05	0.00	304.47	294.36	279.87	283.00
06-Jan-93	19.88	311.88	309.92	291.68	301.53	278.70	286.36	296.54	293.92	334.21	325.61	314.51	303.67	0.00	304.80	294.32	280.25	282.36
07-Jan-93	19.64	311.64	310.36	291.79	301.53	278.42	286.28	296.87	294.09	334.48	325.81	314.93	303.60	0.00	304.78	294.23	280.08	282.80
08-Jan-93	19.56	311.56	310.75	291.84	301.81	278.34	286.28	297.01	294.31	334.48	325.86	315.22	303.79	0.00	304.76	294.10	280.00	283.45
09-Jan-93	19.51	311.51	310.57	291.75	301.57	278.26	286.28	296.94	294.06	334.08	325.58	314.98	303.52	0.00	304.66	293.87	279.90	283.55
10-Jan-93	19.40	311.40	310.24	291.56	301.37	278.14	286.28	296.75	294.00	333.67	325.23	314.57	303.37	0.00	304.45	293.97	279.78	283.73
11-Jan-93	19.42	311.42	309.98	291.39	301.50	278.07	286.28	296.54	293.98	333.38	325.05	314.22	303.48	0.00	304.36	293.72	279.69	283.86
12-Jan-93	19.42	311.42	309.98	291.39	301.50	278.07	286.28	296.54	293.98	333.38	325.05	314.22	303.48	0.00	304.36	293.72	279.69	283.86
13-Jan-93	19.40	311.40	309.75	291.21	301.58	278.02	286.28	296.50	293.90	333.12	324.86	313.84	303.57	0.00	304.27	293.68	279.62	283.95
14-Jan-93	19.40	311.40	309.46	291.03	301.73	278.02	286.28	296.43	293.86	332.90	324.76	313.56	303.73	0.00	304.21	293.54	279.59	284.02
15-Jan-93	19.60	311.60	308.77	290.92	301.51	278.17	286.28	296.42	293.59	332.73	324.60	313.23	303.54	0.00	304.07	293.29	279.68	283.42
16-Jan-93	19.48	311.48	308.36	290.67	301.25	278.00	286.28	296.42	293.48	332.72	324.61	313.18	303.42	0.00	304.01	293.09	279.53	283.96
17-Jan-93	19.40	311.40	308.23	290.54	301.24	277.91	286.28	296.44	293.41	332.58	324.56	313.14	303.39	0.00	303.97	292.80	279.44	283.96
18-Jan-93	19.39	311.39	308.53	290.54	301.78	277.85	286.28	296.45	293.32	332.84	324.92	313.48	303.88	0.00	304.31	292.44	279.39	283.91
19-Jan-93	19.37	311.37	308.17	290.60	301.55	277.80	286.28	296.54	292.83	332.86	325.01	313.51	303.78	0.00	304.50	292.32	279.31	284.06
20-Jan-93	19.24	311.24	307.97	290.59	301.45	277.65	286.28	296.63	292.71	332.90	325.13	313.54	303.86	0.00	304.68	291.83	279.19	283.83
21-Jan-93	19.28	311.28	307.19	290.63	300.85	277.62	286.28	296.59	292.68	332.12	324.41	312.75	303.32	0.00	303.96	291.50	279.14	283.97
22-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
26-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31-Jan-93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
01-Feb-93	0.00	311.27	305.55	290.70	299.84	277.42	286.31	296.52	291.01	331.46	324.09	311.64	302.53	0.00	303.43	289.19	278.77	281.08
01-Feb-93	19.32	311.32	307.67	290.70	300.84	277.64	286.28	296.38	292.30	332.24	324.56	312.98	303.15	0.00	303.88	290.88	279.10	281.11
02-Feb-93	19.20	311.20	306.93	290.66	300.16	277.50	286.29	296.62	291.83	331.85	324.23	312.57	302.72	0.00	303.70	290.36	278.99	281.02
03-Feb-93	19.26	311.26	306.77	290.69	300.26	277.50	286.28	296.55	291.91	331.67	324.13	312.37	302.91	0.00	303.67	290.17	278.95	281.05
04-Feb-93	19.28	311.28	306.58	290.71	300.45	277.48	286.28	296.48	291.80	331.52	324.03	312.20	302.97	0.00	303.64	290.20	278.92	281.10
05-Feb-93	19.24	311.24	306.12	290.70	300.15	277.43	286.28	296.53	291.65	331.21	323.84	311.79	302.76	0.00	303.50	289.78	278.86	281.06
06-Feb-93	19.25	311.25	305.85	290.71	300.19	277.42	286.28	296.58	291.39	331.06	323.76	311.60	302.74	0.00	303.50	289.96	278.82	281.11
07-Feb-93	19.16	311.16	305.24	290.67	299.76	277.32	286.29	296.61	291.29	330.70	323.45	311.08	302.41	0.00	303.19	289.30	278.75	281.04
08-Feb-93	19.20	311.20	305.20	290.70	300.11	277.33	286.28	296.42	291.34	330.65	323.47	311.02	302.63	0.00	303.21	289.60	278.73	281.07
09-Feb-93	19.20	311.20	304.77	290.67	299.71	277.31	286.29	296.61	290.96	330.45	323.34	310.74	302.35	0.00	303.15	289.30	278.69	281.04
10-Feb-93	19.20	311.20	304.68	290.68	299.82	277.29	286.28	296.53	291.04	330.37	323.34	310.56	302.49	0.00	303.12	289.44	278.67	281.07
11-Feb-93	19.20	311.20	304.44	290.68	299.78	277.30	286.28	296.52	290.83	330.22	323.24	310.37	302.38	0.00	303.07	289.43	278.64	281.11
12-Feb-93	19.20	311.20	304.08	290.69	299.60	277.29	286.29	296.54	290.83	330.02	323.11	310.10	302.29	0.00	302.91	289.22	278.62	281.11
13-Feb-93	19.32	311.32	304.16	290.72	300.36	277.44	286.28	296.38	291.20	329.95	323.07	310.16	302.67	0.00	302.81	289.28	278.70	281.12
14-Feb-93	19.39	311.39	303.73	290.73	299.86	277.48	286.29	296.45	290.72	330.22	323.14	309.93	302.31	0.00	302.81	288.98	278.73	281.12
15-Feb-93	19.24	311.24	303.45	290.70	299.24	277.33	286.29	296.61	290.41	330.52	323.37	309.87	301.99	0.00	302.80	288.64	278.62	281.12
16-Feb-93	19.28	311.28	303.73	290.71	299.28	277.32	286.29	296.58	290.46	330.82	323.67	310.19	302.10	0.00	302.93	288.70	278.59	281.09
17-Feb-93	20.00	312.00	304.13	290.72	299.81	278.29	286.98	296.44	290.75	331.37	323.95	310.53	302.48	0.00	303.07	289.55	279.53	281.11
18-Feb-93	19.48	311.48	304.55	290.71	299.50	277.75	286.40	296.52	290.78	332.23	324.62	311.29	302.33	0.00	303.42	288.95	279.02	281.12
19-Feb-93	19.28	311.28	305.27	290.71	299.50	277.51	286.29	296.55	290.78	332.64	324.97	312.06	302.30	0.00	303.73	288.77	278.84	281.09
20-Feb-93	19.27	311.27	305.99	290.73	299.58	277.42	286.29	296.56	290.84	332.79	325.12	312.66	302.41	0.00	303.81	288.51	278.77	281.05
21-Feb-93	19.24	311.24	306.47	290.73	299.62	277.38	286.29	296.57	290.76	332.79	325.14	312.99	302.47	0.00	303.89	288.51	278.74	281.05
22-Feb-93	19.28	311.28	307.00	290.72	300.17	277.38	286.29	296.41	291.06	332.81	325.17	313.25	302.86	0.00	303.95	288.94	278.71	281.07
23-Feb-93	19.28	311.28	306.90	290.73	299.96	277.37	286.29	296.42	290.82	332.63	325.02	313.11	302.68	0.00	303.89	288.99	278.69	281.09
24-Feb-93	19.21	311.21	306.73	290.70	299.77	277.33	286.29	296.50	290.66	332.48	324.90	312.97	302.58	0.00	303.87	288.64	278.65	281.09
25-Feb-93	19.16	311.16	306.41	290.69	299.39	277.26	286.29	296.64	290.46	332.17	324.66	312.64	302.37	0.00	303.72	288.24	278.62	281.08
26-Feb-93	19.16	311.16	306.29	290.68	299.46	277.24	286.29	296.59	290.50	332.00	324.55	312.49	302.43	0.00	303.66	288.27	278.58	281.07
27-Feb-93	19.16	311.16	306.15	290.70	299.57	277.23	286.28	296.58	290.47	331.79	324.39	312.32	302.48	0.00	303.58	288.32	278.57	281.07
28-Feb-93	19.16	311.16	306.06	290.72	299.73	277.22	286.28	296.52	290.46	331.66	324.31	312.16	302.56	0.00	303.57	288.39	278.53	281.08
01-Mar-93	0.00	312.43	307.87	291.81	300.29	278.10	287.13	297.22	291.77	333.51	325.31	313.50	303.21	0.00	304.54	290.30	279.62	281.13

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
01-Mar-93	19.16	311.16	305.78	290.72	299.71	277.20	286.29	296.50	290.43	331.39	324.09	311.85	302.53	0.00	303.42	288.35	278.51	281.08
02-Mar-93	19.19	311.19	305.59	290.73	299.82	277.20	286.28	296.40	290.39	331.20	324.00	311.62	302.56	0.00	303.40	288.45	278.48	281.08
03-Mar-93	19.20	311.20	305.28	290.72	299.65	277.21	286.28	296.48	290.24	330.96	323.83	311.33	302.49	0.00	303.33	288.52	278.48	281.09
04-Mar-93	19.24	311.24	304.87	290.71	299.43	277.25	286.28	296.54	290.11	330.73	323.65	310.93	302.32	0.00	303.25	288.67	278.46	281.11
05-Mar-93	19.24	311.24	304.59	290.74	299.58	277.24	286.28	296.40	290.24	330.55	323.50	310.61	302.32	0.00	303.04	288.60	278.47	281.13
06-Mar-93	19.24	311.24	304.25	290.73	299.45	277.22	286.28	296.39	290.13	330.49	323.41	310.33	302.18	0.00	302.90	288.55	278.45	281.13
07-Mar-93	19.24	311.24	304.11	290.73	299.35	277.22	286.28	296.48	289.98	330.69	323.55	310.28	302.16	0.00	302.98	288.29	278.42	281.14
08-Mar-93	19.32	311.32	304.27	290.73	299.56	277.33	286.79	296.40	290.16	331.14	323.88	310.47	302.40	0.00	303.22	288.55	278.57	281.14
09-Mar-93	19.44	311.44	304.38	290.76	299.54	277.57	286.50	296.38	290.24	331.60	324.17	310.69	302.37	0.00	303.36	288.59	278.83	281.14
10-Mar-93	19.48	311.48	304.59	290.76	299.19	277.66	286.29	296.55	290.23	331.99	324.43	311.09	302.15	0.00	303.51	288.46	278.94	281.13
11-Mar-93	19.36	311.36	305.39	290.75	299.66	277.53	286.28	296.38	290.55	332.32	324.78	311.78	302.49	0.00	303.79	288.47	278.79	281.32
12-Mar-93	19.32	311.32	305.47	290.74	299.24	277.45	286.29	296.60	290.38	332.35	324.76	311.97	302.24	0.00	303.85	288.56	278.73	280.72
13-Mar-93	19.28	311.28	305.90	290.74	299.40	277.40	286.28	296.57	290.54	332.52	324.91	312.37	302.41	0.00	303.92	288.75	278.69	281.26
14-Mar-93	19.24	311.24	306.62	290.77	300.36	277.35	286.29	296.44	290.76	332.66	325.03	312.84	302.84	0.00	303.96	288.99	278.67	282.27
15-Mar-93	19.32	311.32	305.99	290.75	298.90	277.39	286.29	296.71	290.14	332.42	324.76	312.46	302.03	0.00	303.75	288.83	278.64	281.13
16-Mar-93	19.28	311.28	306.32	290.76	299.01	277.34	286.29	296.62	290.26	332.68	324.94	312.73	302.23	0.00	303.87	289.03	278.61	281.13
17-Mar-93	19.29	311.29	306.77	290.75	299.51	277.36	286.28	296.51	290.35	332.95	325.12	313.05	302.60	0.00	304.03	289.23	278.60	281.14
18-Mar-93	20.08	312.08	307.25	291.85	299.51	278.78	288.03	296.57	290.67	333.80	325.59	313.61	302.68	0.00	304.49	290.42	280.25	281.14
19-Mar-93	19.52	311.52	308.34	291.21	299.36	278.03	287.04	296.61	291.09	334.44	325.93	313.96	302.60	0.00	304.65	290.31	279.47	281.15
20-Mar-93	19.40	311.40	309.55	291.10	299.85	277.84	286.92	296.54	291.42	335.03	326.31	314.48	302.94	0.00	304.97	290.53	279.29	281.14
21-Mar-93	19.44	311.44	310.10	291.22	300.18	277.82	286.96	296.48	291.67	335.21	326.41	314.94	303.13	0.00	305.03	290.51	279.23	281.15
22-Mar-93	19.44	311.44	310.32	291.22	300.14	277.82	286.88	296.49	291.73	335.19	326.35	315.12	303.08	0.00	304.99	290.24	279.21	281.15
23-Mar-93	19.52	311.52	310.53	291.90	300.14	278.07	287.56	296.50	291.94	335.29	326.37	315.32	303.12	0.00	305.19	290.64	279.47	281.15
24-Mar-93	20.38	312.38	310.90	293.07	300.54	279.77	289.66	296.54	292.46	335.57	326.50	315.65	303.52	0.00	305.61	291.82	281.87	281.18
25-Mar-93	20.20	312.20	311.15	294.00	300.76	279.48	289.32	298.23	293.45	335.98	326.62	315.80	303.65	0.00	306.19	292.65	281.39	280.99
26-Mar-93	20.24	312.24	311.62	294.33	301.22	279.55	288.98	299.07	294.21	336.28	326.81	316.24	303.86	0.00	306.55	293.27	281.59	280.82
27-Mar-93	22.20	314.20	312.08	294.51	301.78	279.67	288.79	299.49	294.96	336.52	326.95	316.67	304.57	0.00	306.69	293.66	281.66	281.11
28-Mar-93	21.80	313.80	312.44	294.46	302.35	279.84	288.44	299.67	295.62	336.58	326.97	316.92	304.79	0.00	306.62	294.20	282.19	281.11
29-Mar-93	31.04	323.04	312.90	294.94	303.39	279.76	288.59	300.23	296.59	336.79	327.06	317.67	307.30	0.00	306.90	294.80	282.21	280.85
30-Mar-93	29.32	321.32	313.39	294.93	304.29	279.96	288.37	300.54	297.08	336.83	327.05	318.04	307.74	0.00	306.87	294.79	282.19	281.05
31-Mar-93	22.95	314.95	313.21	294.72	304.25	279.81	287.94	300.43	296.96	336.53	326.80	317.53	306.28	0.00	306.44	294.43	281.84	280.78
01-Apr-93	0.00	311.94	311.48	292.82	302.61	278.85	286.61	296.84	295.92	334.61	325.73	316.18	304.23	0.00	305.18	292.74	280.51	281.05
01-Apr-93	20.15	312.15	313.17	294.45	304.15	279.49	287.63	300.09	296.92	336.36	326.77	317.55	305.31	0.00	306.13	294.29	281.47	281.09
02-Apr-93	28.88	320.88	313.19	294.83	304.33	279.12	287.87	300.31	297.27	336.36	326.68	317.87	307.05	0.00	306.34	294.36	281.54	281.08
03-Apr-93	19.95	311.95	313.10	294.59	304.19	279.46	287.58	300.24	297.10	336.08	326.49	317.45	305.33	0.00	305.97	294.31	281.43	281.08
04-Apr-93	19.72	311.72	312.86	294.17	303.80	279.22	287.42	299.91	296.79	335.80	326.35	317.26	304.79	0.00	305.64	293.88	281.09	281.07

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
05-Apr-93	19.64	311.64	312.61	293.78	303.46	279.02	287.16	299.50	296.54	335.45	326.16	316.90	304.48	0.00	305.38	293.64	280.82	281.08
06-Apr-93	19.59	311.59	312.43	293.35	303.39	278.86	286.80	299.12	296.22	335.22	326.09	316.70	304.44	0.00	305.32	293.13	280.60	281.08
07-Apr-93	19.52	311.52	312.11	292.98	303.21	278.72	286.55	298.70	295.94	334.85	325.90	316.44	304.35	0.00	305.20	293.20	280.41	281.07
08-Apr-93	19.48	311.48	311.75	292.70	303.03	278.62	286.18	298.24	295.77	334.47	325.67	316.14	304.28	0.00	305.05	292.99	280.27	281.08
09-Apr-93	19.44	311.44	311.35	292.43	302.86	278.51	286.24	297.79	295.53	334.11	325.45	315.76	304.18	0.00	304.93	292.87	280.14	281.05
10-Apr-93	19.40	311.40	311.00	292.22	302.90	278.48	286.25	297.29	295.53	333.86	325.28	315.45	304.30	0.00	304.83	292.82	280.10	281.05
11-Apr-93	19.64	311.64	310.70	292.24	302.82	278.78	286.25	297.13	295.50	333.68	325.11	315.30	304.25	0.00	304.83	292.88	280.49	281.04
12-Apr-93	19.72	311.72	310.73	292.56	302.56	278.98	286.18	297.42	295.47	334.20	325.44	315.69	304.16	0.00	305.05	292.91	280.65	281.07
13-Apr-93	19.60	311.60	310.80	292.52	302.26	278.80	286.25	297.54	295.39	334.13	325.43	315.67	303.89	0.00	304.90	292.68	280.49	281.07
14-Apr-93	19.48	311.48	310.83	292.37	302.24	278.62	286.25	297.45	295.23	334.03	325.40	315.62	303.93	0.00	304.92	292.42	280.30	281.06
15-Apr-93	19.43	311.43	310.69	292.19	302.21	278.51	286.25	297.24	295.09	333.79	325.26	315.42	303.94	0.00	304.87	292.36	280.13	281.05
16-Apr-93	19.40	311.40	310.40	292.02	302.18	278.43	286.25	296.89	294.97	333.52	325.07	315.04	303.94	0.00	304.74	292.10	280.01	281.04
17-Apr-93	20.52	312.52	310.19	292.29	302.37	279.34	286.44	296.60	295.08	333.64	325.06	314.88	304.28	0.00	304.85	292.38	280.77	281.05
18-Apr-93	19.68	311.68	310.49	292.57	302.12	278.95	286.42	297.24	295.07	334.35	325.55	315.57	303.97	0.00	305.10	292.29	280.53	281.05
19-Apr-93	19.51	311.51	310.85	292.54	302.01	278.74	286.37	292.15	295.13	334.54	325.74	315.83	303.81	0.00	305.11	291.93	280.37	281.06
20-Apr-93	19.44	311.44	311.08	292.51	302.08	278.64	286.48	292.06	295.07	334.48	325.73	315.99	303.86	0.00	305.09	292.01	280.21	281.05
21-Apr-93	19.40	311.40	311.04	292.38	302.09	278.56	286.39	292.07	295.02	334.18	325.53	315.86	303.89	0.00	304.91	291.74	280.10	281.04
22-Apr-93	19.36	311.36	310.95	292.26	302.22	278.49	286.17	292.07	295.06	333.90	325.33	315.60	303.92	0.00	304.76	292.04	280.02	281.03
23-Apr-93	19.88	311.88	311.09	292.71	302.39	279.23	286.99	292.06	295.24	334.53	325.64	316.18	304.09	0.00	305.14	292.22	280.69	280.87
24-Apr-93	19.52	311.52	311.16	292.68	301.73	278.84	286.63	292.06	307.09	334.75	325.82	316.21	303.55	0.00	305.24	292.56	280.47	281.04
25-Apr-93	19.48	311.48	311.59	292.67	301.92	278.76	286.75	297.23	295.00	334.93	326.02	316.55	303.81	0.00	305.29	292.61	280.33	281.03
26-Apr-93	19.43	311.43	311.73	292.68	302.10	278.68	286.70	297.35	295.02	334.72	325.89	316.61	303.88	0.00	305.18	292.60	280.22	281.02
27-Apr-93	20.28	312.28	311.51	292.59	301.85	279.37	286.77	297.32	294.82	334.52	325.66	316.48	303.86	0.00	305.10	292.56	280.69	281.03
28-Apr-93	19.60	311.60	311.65	292.57	301.80	278.91	286.58	297.53	294.81	334.71	325.81	316.54	303.74	0.00	305.22	292.23	280.41	281.04
29-Apr-93	19.48	311.48	311.80	292.48	302.03	278.74	286.35	297.40	294.93	334.68	325.84	316.59	303.89	0.00	305.19	292.12	280.27	281.03
30-Apr-93	19.44	311.44	311.67	292.40	302.05	278.65	286.20	297.16	294.95	334.36	325.65	316.38	303.88	0.00	305.06	292.20	280.15	281.03
01-May-93	0.00	311.18	306.77	291.51	299.85	277.86	286.25	296.45	292.79	331.09	323.43	312.40	302.55	0.00	303.41	290.56	279.26	281.00
01-May-93	19.40	311.40	311.28	292.22	301.83	278.56	286.25	297.00	294.74	333.90	325.31	315.93	303.67	0.00	304.83	292.10	280.06	281.03
02-May-93	19.40	311.40	311.28	292.22	301.83	278.56	286.25	297.00	294.74	333.90	325.31	315.93	303.67	0.00	304.83	292.10	280.06	281.03
03-May-93	19.32	311.32	310.10	291.80	301.10	278.35	286.25	296.44	294.27	332.97	324.58	314.68	303.20	0.00	304.27	291.58	279.80	281.03
04-May-93	19.28	311.28	309.73	291.55	301.06	278.26	286.25	296.47	294.12	332.64	324.39	314.25	303.19	0.00	304.13	291.51	279.69	281.02
05-May-93	19.28	311.28	309.32	291.35	301.03	278.18	286.25	296.42	293.84	332.37	324.22	313.82	303.20	0.00	304.02	291.53	279.61	281.01
06-May-93	19.36	311.36	308.72	291.17	301.07	278.20	286.25	296.34	293.77	332.11	324.08	313.52	303.19	0.00	303.90	291.41	279.60	281.01
07-May-93	19.28	311.28	307.91	290.95	300.72	278.06	286.25	296.34	293.33	331.77	323.87	313.22	302.89	0.00	303.73	291.19	279.48	281.02
08-May-93	19.24	311.24	307.15	290.71	300.34	277.96	286.25	296.39	293.03	331.40	323.63	312.91	302.66	0.00	303.56	290.94	279.37	281.01
09-May-93	19.20	311.20	306.77	290.70	300.29	277.88	286.25	296.38	292.91	331.15	323.46	312.67	302.60	0.00	303.45	290.86	279.29	281.01

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
10-May-93	19.16	311.16	306.38	290.72	300.13	277.80	286.25	296.36	292.60	330.90	323.26	312.33	302.46	0.00	303.31	290.65	279.20	281.00
11-May-93	19.12	311.12	306.08	290.76	300.13	277.74	286.25	296.32	292.60	330.68	323.14	312.02	302.42	0.00	303.20	290.14	279.15	281.00
12-May-93	19.12	311.12	305.79	290.78	300.17	277.70	286.26	296.34	292.55	330.46	322.97	311.75	302.36	0.00	303.04	290.18	279.10	281.00
13-May-93	19.08	311.08	305.37	290.77	299.94	277.63	286.26	296.36	292.59	330.19	322.78	311.39	302.16	0.00	302.89	290.10	279.03	280.98
14-May-93	19.08	311.08	305.00	299.61	290.78	277.59	286.26	296.37	291.97	329.97	322.63	311.05	301.97	0.00	302.80	289.84	278.97	280.99
15-May-93	19.04	311.04	304.76	290.80	299.56	277.54	286.26	296.41	291.72	329.90	322.66	310.89	301.97	0.00	302.82	289.72	278.91	280.98
16-May-93	19.04	311.04	304.53	290.79	299.58	277.49	286.26	296.33	291.67	329.80	322.64	310.73	301.98	0.00	302.80	289.72	278.85	280.97
17-May-93	19.04	311.04	304.17	290.85	299.36	277.47	286.26	296.43	291.54	329.61	322.50	310.45	301.81	0.00	302.68	289.47	278.81	280.98
18-May-93	19.00	311.00	303.93	290.82	299.29	277.42	286.26	296.44	291.32	329.48	322.43	310.31	301.79	0.00	302.63	289.47	278.76	280.97
19-May-93	19.00	311.00	303.71	290.82	299.45	277.41	286.26	296.38	291.38	329.36	322.40	310.16	301.87	0.00	302.61	289.34	278.69	280.96
20-May-93	19.08	311.08	303.47	290.83	299.41	277.43	286.26	296.37	291.16	329.31	322.40	310.04	301.87	0.00	302.62	289.33	278.70	280.96
01-Jun-93	0.00	311.07	300.96	291.40	297.89	277.05	286.27	296.31	290.87	327.99	321.35	308.37	300.65	301.43	301.55	288.02	278.25	280.97
01-Jun-93	19.72	311.72	301.39	290.92	298.77	277.85	286.26	296.35	290.01	328.09	321.57	308.51	301.41	0.00	301.82	288.80	279.05	281.12
02-Jun-93	19.32	311.32	301.32	291.69	298.52	277.46	286.26	296.39	0.00	329.32	322.02	308.97	301.24	0.00	302.29	288.31	278.66	280.99
03-Jun-93	19.20	311.20	301.65	290.87	298.62	277.28	286.26	296.35	290.13	330.25	322.99	309.56	301.31	0.00	302.59	288.60	278.49	280.98
04-Jun-93	19.16	311.16	302.07	290.86	298.62	277.20	286.26	296.37	289.93	330.55	323.48	310.32	301.33	0.00	302.64	288.30	278.41	280.98
05-Jun-93	19.15	311.15	302.58	290.84	298.49	277.17	286.26	296.40	289.92	330.45	323.43	310.85	301.29	0.00	302.62	288.32	278.40	280.98
06-Jun-93	19.20	311.20	302.94	290.88	298.65	277.24	286.26	296.36	290.01	330.23	323.25	310.96	301.44	0.00	302.61	288.45	278.49	280.97
07-Jun-93	19.16	311.16	302.96	290.84	298.59	277.19	286.26	296.41	289.86	329.96	323.08	310.84	301.44	0.00	302.60	288.43	278.41	280.97
08-Jun-93	19.12	311.12	302.84	290.79	298.62	277.14	286.26	296.41	289.80	329.69	322.87	310.58	301.47	0.00	302.54	288.61	278.37	280.97
09-Jun-93	19.12	311.12	302.59	290.83	298.63	277.12	286.26	296.36	289.95	329.35	322.56	310.20	301.40	0.00	302.37	288.29	278.32	280.96
10-Jun-93	19.16	311.16	302.26	290.82	298.55	277.16	286.27	296.14	289.76	328.96	322.19	309.80	301.30	0.00	302.17	288.41	278.39	280.95
11-Jun-93	19.12	311.12	301.86	290.81	298.25	277.10	286.26	296.36	289.73	328.60	321.86	309.32	301.03	0.00	301.94	288.15	278.32	280.94
12-Jun-93	19.08	311.08	301.41	290.78	297.87	277.06	286.28	296.45	308.74	328.25	321.55	308.84	300.73	0.00	301.72	288.20	278.29	280.94
13-Jun-93	19.04	311.04	301.17	293.71	297.80	277.02	286.28	296.36	0.00	328.04	321.39	308.54	300.63	0.00	301.61	288.07	278.25	280.94
14-Jun-93	19.04	311.04	301.04	291.71	297.87	277.00	286.28	296.34	0.00	327.88	321.29	308.37	300.63	0.00	301.54	287.81	278.23	280.99
15-Jun-93	19.04	311.04	300.91	291.71	297.87	276.98	286.28	296.32	0.00	327.71	321.17	308.17	300.61	0.00	301.44	287.39	278.21	281.01
16-Jun-93	19.00	311.00	300.73	294.89	297.76	276.96	286.28	296.25	0.00	327.51	320.99	307.96	300.49	0.00	301.33	287.80	278.18	280.97
17-Jun-93	19.00	311.00	300.54	291.71	297.58	276.94	286.28	296.36	0.00	327.32	320.82	307.74	300.35	0.00	301.23	287.87	278.15	280.99
18-Jun-93	19.00	311.00	300.46	291.72	297.59	276.91	286.28	296.36	0.00	327.13	320.71	307.56	300.36	0.00	301.17	287.53	278.12	280.97
19-Jun-93	19.00	311.00	300.31	291.74	297.64	276.89	286.28	296.28	0.00	326.95	320.57	307.36	300.33	0.00	301.04	287.81	278.09	280.96
20-Jun-93	18.99	310.99	300.05	291.75	297.34	276.87	286.28	296.25	0.00	326.65	320.29	307.05	300.12	0.00	300.85	287.89	278.06	280.98
21-Jun-93	18.96	310.96	299.95	290.61	297.38	276.86	286.28	296.11	0.00	326.47	320.15	306.87	300.11	0.00	300.73	287.84	278.04	280.98
22-Jun-93	19.16	311.16	299.93	291.73	297.59	277.10	286.28	296.18	0.00	326.50	320.11	306.89	300.26	0.00	300.75	287.83	278.28	280.86
23-Jun-93	19.04	311.04	299.81	291.71	297.36	276.94	286.28	296.27	290.41	326.62	320.11	306.96	300.08	0.00	300.84	287.55	278.12	280.96
24-Jun-93	19.00	311.00	299.78	291.68	297.12	276.88	286.28	296.34	289.76	326.76	320.21	307.04	300.00	301.95	300.95	287.50	278.05	280.96

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
25-Jun-93	18.95	310.95	299.83	291.28	297.22	276.86	286.28	296.42	289.80	326.86	320.38	307.08	300.08	300.99	301.00	287.59	278.02	280.95
26-Jun-93	18.88	310.88	299.82	291.28	297.34	276.86	286.28	296.26	289.87	326.81	320.39	307.03	300.09	301.35	300.96	287.71	278.01	280.99
27-Jun-93	18.80	310.80	299.76	291.59	297.35	276.84	286.28	296.19	289.76	326.70	320.30	306.92	300.05	301.45	300.89	287.84	277.98	280.98
28-Jun-93	18.92	310.92	299.71	290.77	297.33	276.86	286.27	296.22	292.06	326.69	320.24	306.89	300.03	301.69	300.84	288.01	278.06	280.98
29-Jun-93	18.92	310.92	299.66	290.80	297.20	276.83	286.27	296.25	288.99	326.71	320.20	306.95	299.93	301.45	300.80	287.88	278.00	280.96
30-Jun-93	18.92	310.92	299.56	290.76	297.07	276.81	286.27	296.25	288.96	326.69	320.21	306.89	299.84	301.12	300.77	287.89	277.97	280.94
01-Jul-93	0.00	310.45	298.64	291.27	296.47	276.65	286.26	296.33	288.36	323.76	317.97	305.46	299.20	298.81	299.82	287.40	277.78	279.66
01-Jul-93	18.84	310.84	299.57	291.74	297.14	276.76	286.27	296.18	0.00	326.44	320.06	306.71	299.89	300.94	300.69	287.79	277.91	280.92
02-Jul-93	18.92	310.92	299.61	293.42	297.19	276.79	286.27	296.24	294.57	326.39	320.02	306.74	299.96	299.07	300.70	287.83	277.91	280.93
03-Jul-93	18.92	310.92	299.53	291.75	297.02	276.78	286.27	296.29	0.00	326.22	319.86	306.65	299.86	299.66	300.62	287.76	277.91	277.15
04-Jul-93	18.88	310.88	299.43	292.93	296.93	276.76	286.27	296.32	0.00	325.99	319.69	306.51	299.80	300.07	300.49	288.00	277.88	277.16
06-Jul-93	18.84	310.84	299.43	291.00	296.96	276.00	286.00	296.00	289.00	325.00	319.00	305.00	299.00	299.00	301.23	288.18	277.86	277.19
07-Jul-93	18.84	310.84	299.33	291.76	296.93	276.74	286.27	296.27	290.09	325.73	319.51	306.38	299.74	302.13	300.38	288.18	277.87	277.17
08-Jul-93	18.83	310.83	299.19	291.77	296.84	276.73	286.26	296.26	289.89	325.40	319.27	306.20	299.62	0.00	300.21	287.25	277.84	280.89
09-Jul-93	18.76	310.76	298.98	291.76	296.68	276.72	286.27	296.21	290.34	325.04	319.10	305.97	299.46	0.00	300.01	287.25	277.83	280.89
10-Jul-93	18.68	310.68	298.83	291.78	296.55	276.71	286.27	296.23	0.00	324.68	318.81	305.78	299.32	0.00	299.83	287.59	277.82	280.88
11-Jul-93	18.64	310.64	298.66	291.76	296.38	276.70	286.27	296.32	290.08	324.35	318.52	305.58	299.14	301.47	299.66	287.24	277.80	280.89
12-Jul-93	18.56	310.56	298.57	291.73	296.41	276.69	286.27	296.26	0.00	324.11	318.33	305.43	299.12	301.94	299.57	287.29	277.80	280.88
13-Jul-93	18.48	310.48	298.49	291.75	296.25	276.68	286.27	296.36	290.16	323.90	318.15	305.35	298.99	301.38	299.55	287.43	277.78	280.89
14-Jul-93	18.40	310.40	298.45	291.74	296.18	276.67	286.26	296.45	289.54	323.73	318.03	305.30	298.97	298.43	299.56	287.23	277.76	277.15
15-Jul-93	18.36	310.36	298.46	290.79	296.39	276.66	286.26	296.31	289.25	323.57	317.92	305.26	299.06	299.12	299.55	287.05	277.76	277.65
16-Jul-93	18.28	310.28	298.40	290.75	296.28	276.65	286.27	296.37	288.37	323.37	317.73	305.19	298.97	296.97	299.51	287.25	277.74	277.14
17-Jul-93	18.20	310.20	298.39	290.78	296.29	276.64	286.27	296.40	288.39	323.23	317.61	305.15	298.97	297.14	299.51	287.52	277.73	280.48
18-Jul-93	18.12	310.12	298.40	290.74	296.23	276.63	286.27	296.46	288.32	323.11	317.59	305.11	298.93	297.10	299.54	287.33	277.72	277.48
19-Jul-93	18.08	310.08	298.37	290.75	296.30	276.61	286.26	296.43	288.37	322.98	317.43	305.08	298.97	297.35	299.52	287.24	277.71	277.16
20-Jul-93	18.04	310.04	298.42	290.74	296.51	276.61	286.26	296.31	288.33	322.84	317.35	305.08	299.09	298.04	299.54	286.83	277.71	280.74
21-Jul-93	18.00	310.00	298.43	290.74	296.45	276.60	286.27	296.39	288.22	322.72	317.24	305.07	299.09	297.50	299.54	287.07	277.70	280.64
22-Jul-93	17.99	309.99	298.38	290.76	296.34	276.60	286.27	296.42	288.24	322.52	317.08	304.97	298.99	295.08	299.47	287.19	277.69	280.31
23-Jul-93	17.92	309.92	298.31	290.72	296.33	276.59	286.27	296.38	288.14	322.32	316.94	304.90	298.96	295.91	299.42	287.31	277.68	280.89
24-Jul-93	17.88	309.88	298.28	290.69	296.23	276.58	286.27	296.47	287.91	322.16	316.80	304.84	298.92	295.49	299.39	286.92	277.67	280.89
25-Jul-93	17.84	309.84	298.20	290.75	296.21	276.57	286.26	296.48	287.84	322.02	316.67	304.76	298.86	295.82	299.34	287.12	277.66	280.89
26-Jul-93	17.76	309.76	298.12	290.74	296.10	276.57	286.26	296.54	287.75	321.81	316.46	304.63	298.76	295.58	299.23	287.09	277.64	280.88
28-Jul-93	18.53	310.53	298.14	290.75	296.20	276.76	286.26	296.31	287.88	321.76	316.37	304.63	299.05	296.35	299.23	287.59	277.92	280.35
29-Jul-93	18.76	310.76	298.12	290.74	296.19	276.68	286.26	296.27	287.91	322.07	316.37	304.94	299.16	296.84	299.63	287.20	277.77	280.90
30-Jul-93	18.80	310.80	298.11	290.69	296.11	276.66	286.26	296.32	287.95	322.53	316.51	305.43	299.11	295.88	299.92	287.42	277.73	279.97
31-Jul-93	18.76	310.76	298.09	290.81	295.93	276.65	286.26	296.39	287.92	323.13	316.77	305.72	299.02	296.05	299.98	287.47	277.70	280.90

FILE

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL, FT NGVD (1)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
01-Aug-93	0.00	310.64	300.00	291.08	296.64	276.96	286.37	295.51	288.87	325.92	319.67	307.89	299.70	289.56	300.95	288.83	278.11	280.91
01-Aug-93	18.67	310.67	298.18	290.70	295.89	276.64	286.26	296.03	287.83	323.63	317.22	305.88	298.99	296.03	300.02	287.22	277.68	280.90
02-Aug-93	18.56	310.56	298.26	290.80	295.98	276.63	286.26	295.20	287.80	323.97	317.57	305.94	299.03	296.75	300.03	287.23	277.68	280.89
03-Aug-93	18.48	310.48	298.21	290.71	295.82	276.62	286.26	295.34	287.71	324.05	317.72	305.86	298.89	295.99	299.97	287.26	277.66	280.89
04-Aug-93	18.36	310.36	298.16	290.75	295.76	276.61	286.26	295.35	287.65	324.04	317.77	305.69	298.81	290.89	299.87	287.22	277.64	280.89
05-Aug-93	18.27	310.27	298.13	290.93	295.70	276.61	286.26	294.92	287.59	323.92	317.75	305.50	298.72	290.65	299.80	287.33	277.63	280.90
06-Aug-93	18.16	310.16	298.13	290.98	295.70	276.60	286.26	295.30	287.49	323.80	317.71	305.41	298.69	290.37	299.78	287.38	277.61	280.89
07-Aug-93	18.08	310.08	298.21	293.67	295.84	276.59	286.26	295.40	0.00	323.71	317.72	305.34	298.76	290.17	299.81	287.32	277.61	280.89
08-Aug-93	18.00	310.00	298.25	291.79	295.80	276.58	286.26	295.10	0.00	323.55	317.59	305.29	298.76	289.09	299.86	287.32	277.60	280.90
09-Aug-93	17.92	309.92	298.22	290.53	295.78	276.57	286.26	295.33	0.00	323.34	317.42	305.18	298.76	288.93	299.82	287.30	277.58	280.90
10-Aug-93	17.84	309.84	298.19	291.74	295.83	276.56	286.26	295.58	288.24	323.10	317.24	305.07	298.75	288.63	299.70	287.22	277.57	280.90
11-Aug-93	17.78	309.78	298.16	290.59	295.85	276.55	286.27	295.51	0.00	322.87	317.06	304.97	298.73	288.92	299.56	287.31	277.56	280.90
12-Aug-93	17.72	309.72	298.13	291.74	295.90	276.54	286.26	295.32	291.72	322.63	316.88	304.84	298.72	288.58	299.47	287.34	277.55	280.89
13-Aug-93	17.64	309.64	298.10	291.75	295.92	276.54	286.26	295.30	291.27	322.42	316.69	304.75	298.74	287.86	299.39	287.31	277.56	280.90
14-Aug-93	17.60	309.60	298.06	290.49	295.88	276.53	286.25	295.37	288.03	322.17	316.52	304.69	298.68	287.60	299.31	287.38	277.53	280.90
15-Aug-93	17.64	309.64	298.00	290.49	295.80	276.54	286.25	295.53	287.85	322.00	316.36	304.59	298.62	288.11	299.25	287.61	277.56	280.91
16-Aug-93	17.68	309.68	297.92	290.49	295.69	276.52	286.25	295.35	287.78	321.89	316.20	304.62	298.56	288.07	299.23	287.58	277.54	280.94
17-Aug-93	24.72	316.72	298.24	292.18	296.13	279.35	288.72	295.57	288.50	327.38	319.99	307.92	300.67	292.54	302.58	289.90	280.37	281.00
18-Aug-93	19.31	311.31	299.47	291.66	296.85	277.84	287.01	295.39	289.73	330.90	324.43	312.46	300.27	291.90	303.41	290.62	279.10	280.95
19-Aug-93	19.16	311.16	302.44	291.37	297.35	277.51	286.25	295.53	290.01	331.72	325.01	313.94	300.71	291.80	303.43	290.87	278.82	280.96
20-Aug-93	19.08	311.08	304.17	291.17	297.96	277.38	286.25	295.54	290.51	331.66	324.91	314.24	301.21	292.26	303.36	291.16	278.75	280.94
21-Aug-93	19.04	311.04	304.80	291.09	298.28	277.34	286.24	295.82	290.66	331.20	324.40	313.84	301.42	292.17	303.17	291.23	278.74	280.94
22-Aug-93	19.00	311.00	304.59	290.86	298.12	277.30	286.25	295.87	290.81	330.63	323.83	313.03	301.32	288.65	302.92	291.31	278.73	280.93
23-Aug-93	18.96	310.96	304.35	290.68	298.33	277.26	286.25	295.17	290.83	330.13	323.46	312.29	301.44	287.91	302.76	291.21	278.65	280.91
24-Aug-93	18.92	310.92	303.89	290.48	298.42	277.21	286.25	296.16	290.83	329.58	323.07	311.51	301.43	285.73	302.62	291.18	278.59	280.90
25-Aug-93	18.92	310.92	303.33	290.51	298.41	277.28	286.24	295.93	290.88	329.07	322.67	310.78	301.32	284.20	302.45	291.23	278.79	280.90
26-Aug-93	18.95	310.95	302.69	290.53	298.22	277.18	286.24	295.81	290.89	328.63	322.30	310.21	301.13	282.78	302.25	291.12	278.54	280.91
27-Aug-93	18.87	310.87	301.83	290.53	298.13	277.07	286.23	296.03	290.81	327.89	321.67	309.30	300.88	281.49	301.84	291.30	278.42	280.90
01-Sep-93	0.00	311.16	304.31	290.56	300.01	277.44	286.29	295.41	292.24	330.35	323.44	310.72	301.02	277.09	302.97	292.16	278.81	280.80
08-Sep-93	19.04	311.04	304.58	290.58	300.36	277.39	286.24	295.20	293.00	329.61	322.79	310.26	301.20	273.96	302.83	292.49	278.83	280.96
09-Sep-93	19.04	311.04	304.42	290.51	300.42	277.38	286.27	295.05	292.74	329.47	322.69	310.10	301.18	276.58	302.80	292.61	278.82	280.95
10-Sep-93	19.00	311.00	303.77	290.56	300.01	277.33	286.27	295.05	292.40	329.02	322.30	309.57	300.84	276.90	302.56	292.20	278.76	280.82
11-Sep-93	19.00	311.00	303.28	290.57	299.59	277.28	286.27	295.20	292.11	328.71	322.10	309.05	300.65	277.67	302.46	291.97	278.68	278.08
12-Sep-93	19.00	311.00	303.21	290.57	299.91	277.24	286.27	295.00	292.07	328.67	322.14	308.95	300.84	276.91	302.49	291.98	278.63	280.93
13-Sep-93	19.76	311.76	302.96	290.57	299.86	278.06	286.55	294.41	291.94	329.69	322.39	308.99	300.89	278.12	302.69	291.86	279.08	280.71
14-Sep-93	19.28	311.28	303.21	290.56	299.56	277.54	286.27	296.04	291.87	331.51	324.47	310.51	300.75	277.99	303.24	291.83	278.84	280.94

HALEY & ALDRICH, INC.

TABLE II
PIEZOMETER DATA
HOP BROOK DAM

DATE	POOL STAGE	POOL El.	PIEZOMETRIC LEVEL (FT, NGVD)															
			PZ-1	PZ-2	PZ-3	PZ-4	PZ-5	PZ-6	PZ-7	PZ-8	PZ-9	PZ-10	PZ-11	PZ-12	PZ-13	PZ-14	PZ-15	TAIL WATER
14-Dec-93	19.44	311.44	305.94	292.65	303.16	278.45	286.34	292.06	296.03	335.88	327.29	316.29	303.05	279.72	304.87	299.80	280.17	280.91
15-Dec-93	19.44	311.44	305.72	292.39	303.17	278.37	286.34	292.07	295.72	335.41	327.03	315.94	303.06	278.79	304.68	298.76	280.09	281.51
16-Dec-93	19.40	311.40	305.15	292.13	302.85	278.28	286.35	292.07	295.44	334.83	326.62	315.38	302.80	278.16	304.44	297.97	279.98	281.53
17-Dec-93	19.36	311.36	304.29	291.80	302.12	278.15	286.36	292.05	295.17	334.23	326.12	314.60	302.34	278.11	304.17	296.97	279.83	279.23
18-Dec-93	19.36	311.36	303.91	291.56	302.15	278.04	286.37	294.46	295.07	333.95	325.95	314.17	302.46	277.67	304.08	296.45	279.72	280.07
19-Dec-93	19.34	311.34	303.58	291.37	302.29	277.98	286.37	292.06	294.69	333.69	325.75	313.77	302.56	277.00	303.98	296.54	279.65	280.64
20-Dec-93	19.52	311.52	302.75	301.79	291.18	278.12	286.37	292.05	294.47	333.38	325.45	313.30	302.24	276.96	303.82	295.88	279.70	279.72
21-Dec-93	19.48	311.48	302.70	302.12	290.99	278.06	286.37	293.65	294.28	333.53	325.63	313.42	302.56	276.74	303.84	296.44	279.65	281.22
22-Dec-93	19.92	311.92	303.26	291.67	302.03	278.75	286.66	292.09	294.36	334.85	326.45	314.14	302.55	277.42	304.50	297.10	280.34	281.06
23-Dec-93	19.60	311.60	304.11	291.84	301.77	278.40	286.32	295.03	294.61	335.40	326.94	314.84	302.39	277.47	304.71	296.48	280.18	279.83
24-Dec-93	19.51	311.51	304.70	291.91	301.81	278.26	286.42	293.82	294.71	335.55	327.08	315.29	302.39	277.60	304.81	296.09	280.02	280.48
25-Dec-93	19.44	311.44	305.26	291.99	302.39	278.22	286.37	296.14	294.76	335.59	327.20	315.60	302.80	277.26	304.79	296.52	279.96	280.86
26-Dec-93	19.44	311.44	305.17	291.91	302.51	278.17	286.30	296.85	294.61	335.31	326.99	315.43	302.79	277.34	304.70	296.50	279.89	281.01
27-Dec-93	19.28	311.28	304.51	291.59	301.75	277.96	286.37	296.18	294.46	334.66	326.47	314.71	302.19	277.25	304.45	294.73	279.70	280.12
28-Dec-93	19.32	311.32	304.28	291.35	301.79	277.90	286.38	295.77	294.39	334.37	326.27	314.37	302.35	276.97	304.39	294.02	279.62	279.92
29-Dec-93	19.28	311.28	303.91	291.17	301.85	277.82	286.38	297.19	294.19	334.06	326.05	313.94	302.40	276.85	304.25	293.40	279.55	280.01
30-Dec-93	19.28	311.28	303.77	291.03	302.28	277.79	286.37	296.92	294.08	333.82	325.89	313.69	302.66	275.96	304.18	295.78	279.52	279.00
31-Dec-93	19.30	311.30	302.78	290.72	301.60	277.72	286.37	297.13	293.79	333.33	325.53	313.10	302.16	274.41	304.00	296.77	279.42	278.00
AVERAGE LEVEL DURING NORMAL POOL (1.)			305.03	291.21	299.68	277.74	286.36	296.49	291.32	330.54	323.35	311.62	302.16	287.99	303.01	289.82	279.32	

NOTES:
1. AVERAGE LEVEL FOR PIEZOMETERS IS BASED ONLY ON READINGS WHEN THE POOL ELEVATION FALLS BETWEEN EL. 309 AND EL. 313.

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07-Feb-95

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HALEY & ALDRICH, INC.

TABLE III

COMPARISON OF AUTOMATED AND MANUAL PIEZOMETER READINGS
HOP BROOK DAM

PZ	TYPE	SENSOR EL	RISER EL	7 December 1993 WATER ELEVATION AUTOMATED	7 December 1993 WATER ELEVATION MANUAL	DIFF.	30 August 1994 WATER ELEVATION AUTOMATED	30 August 1994 WATER ELEVATION MANUAL	DIFF.	6 October 1994 WATER ELEVATION AUTOMATED	6 October 1994 WATER ELEVATION MANUAL	DIFF.	ERRATIC
PZ-1	VW	298.76	382.72	313.01	313.82	0.81	304.37	313.03	8.66	302.09	305.86	3.77	Y
PZ-2	E	284.57	318.07	294.11	287.98	-6.13	293.01	286.77	-6.24	290.54	284.20	-6.34	N
PZ-3	VW	281.29	383.26	303.41	304.25	0.84	301.91	303.60	1.69				Y
PZ-4	E	272.63	289.26	278.82	278.83	0.01	278.57	278.63	0.06	280.01	273.40	-6.61	Y
PZ-5	E	286.31	306.68	287.18	287.06	-0.12	286.26	306.68	20.42				Y
PZ-6	E	290.07	348.02	299.78	293.95	-5.83	292.33	291.85	-0.48				Y
PZ-7	E	282.46	350.31	296.32	296.47	0.15	279.19	296.63	17.44	279.47	283.02	3.55	Y
PZ-8	VW	286.06	384.29	336.70	330.61	-6.09	333.65	328.64	-5.01				Y
PZ-9	VW	292.90	368.59	327.83			332.67	325.67	-7.00	330.69	320.35	-10.34	Y
PZ-10	VW	298.19	356.56	317.09			315.11	316.04	0.93	310.35	310.23	-0.12	N
PZ-11	VW	289.58	342.50	303.43			301.95	306.70	4.75				Y
PZ-12	E	277.27	315.36	279.83	290.39	10.56		289.41					Y
PZ-13	VW	282.56	346.57	305.90	306.74	0.84	303.60	305.66	2.06				Y
PZ-14	E	275.37	324.71	296.04	290.13	-5.91	292.52	289.37	-3.15				Y
PZ-15	E	272.07	304.42	280.48	280.90	0.42	279.70	280.34	0.64				N

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NOTE:

E = Electric Strain Gauge
VW = Vibrating Wire

FILE

HALEY & ALDRICH, INC.

TABLE IV
SUMMARY OF PROJECTED PIEZOMETER LEVELS
HOP BROOK DAM

		CONTROLLED FILLING FEBRUARY 1986 POOL FILLED TO EL 333.0		CONTROLLED FILLING NOVEMBER 1986 POOL FILLED TO EL 340.0		FLOOD EVENT APRIL 1987 POOL FILLED TO EL 342.6	
PIEZOMETER NO.	NORMAL LEVEL EL.	ACTUAL PIEZOMETER EL.	PROJECTED PIEZOMETER EL.	ACTUAL PIEZOMETER EL.	PROJECTED PIEZOMETER EL. (1)	ACTUAL PIEZOMETER EL.	PROJECTED PIEZOMETER EL. (1)
1	300.0	316.0	NC	318.2	332.6	317.6	NA
2	<284.0	285.6	NC	289.4	295.2	NR	NA
3	300.0	308.2	NC	311.7	320.4	312.6	323.3
4	279.3	NA	NA	NA	NA	NA	NA
5	<285.3	287.0	NC	289.6	289.6	290.0	290.4
6	<289.6	293.6	NC	296.9	303.9	299.4	305.9
7	283.5	313.0	NC	297.9	302.8	298.6	294.6
8	287.0	322.0	NC	331.0	336.7	322.8	337.0
9	318.0	NA (2)	NA (2)	326.8	331.3	329.8	333.3
10	299.0	NA (2)	NA (2)	323.2	334.6	317.7	NA
11	303.0	NA (2)	NA (2)	318.0	328.7	315.0	330.7
12	287.0	NA (2)	NA (2)	293.3	296.1	293.8	295.4
13	300.0	NA (2)	NA (2)	309.4	315.7	311.3	314.8
14	285.0	NA (2)	NA (2)	291.8	294.6	293.0	294.6
15	NA (3)	NA (3)	NA (3)	NA (3)	NA (3)	NA (3)	NA (3)

NOTES
1. FOR POOL FILLED TO SPILLWAY CREST (EL. 364)
2. PIEZOMETER INSTALLED AFTER FIRST POOL RAISING
3. LIMITED DATA; INTERPRETATION NOT MADE

NC: NOT COMPUTED
NA: NOT APPLICABLE
NR: NOT RESPONSIVE

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HALEY & ALDRICH, INC.

TABLE V

TERRA TILT RESULTS
HOP BROOK DAM

Plate No. 1 Upstream Face

Date	2SIN Ao rdg	2SIN A180 rdg	Bo rdg	B180 rdg	SIN Ao	SIN A180	SIN A avg	SIN A cum.	A Rot'n	Bo	B180	B avg.	B cum.	B Rot'n
09-May-90	-0.1637	-0.1496	ND	ND	-0.0819	-0.0748	-0.0784	0.0000	0.0000	ND	ND	ND	ND	ND
25-Jul-90	-0.1661	-0.1504	ND	ND	-0.0831	-0.0752	-0.0792	-0.0008	-0.0458	ND	ND	ND	ND	ND
11-Dec-90	-0.1630	-0.1497	ND	ND	-0.0815	-0.0749	-0.0782	0.0002	0.0115	ND	ND	ND	ND	ND
06-Mar-91	-0.1641	-0.1501	ND	ND	-0.0821	-0.0751	-0.0786	-0.0002	-0.0115	ND	ND	ND	ND	ND
25-Jul-91	-0.1660	-0.1497	ND	ND	-0.0830	-0.0749	-0.0790	-0.0006	-0.0344	ND	ND	ND	ND	ND
09-Sep-91	-0.1671	-0.1502	ND	ND	-0.0836	-0.0751	-0.0794	-0.0010	-0.0573	ND	ND	ND	ND	ND
17-Oct-91	-0.1650	-0.1500	ND	ND	-0.0825	-0.0750	-0.0788	-0.0004	-0.0229	ND	ND	ND	ND	ND
15-Jan-92	-0.1632	-0.1501	ND	ND	-0.0816	-0.0751	-0.0784	0.0000	0.0000	ND	ND	ND	ND	ND
30-Jun-92	-0.1666	-0.1488	ND	ND	-0.0833	-0.0744	-0.0789	-0.0005	-0.0286	ND	ND	ND	ND	ND
20-Oct-93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1. NA denotes not available.
2. ND denotes values that were not determined because the readings were not representative.

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FILE NO.

HALEY & ALDRICH, INC.

TABLE V

TERRA TILT RESULTS
HOP BROOK DAM

Plate No: 2 Upstream Top

Date	2SIN Ao rdg	2SIN A180 rdg	2SIN Bo rdg	2SIN B180 rdg	SIN Ao	SIN A180	SIN A avg	SIN A cum.	A Rot'n	SIN Bo	SIN B180	SIN B avg.	SIN B cum.	B Rot'n
09-May-90	0.0305	-0.0474	-0.041	0.0246	0.0153	-0.0237	0.0195	0.0000	0.0000	-0.0205	0.0123	-0.0164	0.0000	0.0000
25-Jul-90	0.0306	-0.0484	-0.041	0.0231	0.0153	-0.0242	0.0198	0.0003	0.0172	-0.0205	0.0116	-0.0161	0.0003	0.0172
11-Dec-90	0.0338	-0.047	-0.0393	0.0256	0.0169	-0.0235	0.0202	0.0007	0.0401	-0.0197	0.0128	-0.0163	0.0001	0.0057
06-Mar-91	0.035	-0.0507	-0.0404	0.0249	0.0175	-0.0254	0.0215	0.0020	0.1146	-0.0202	0.0125	-0.0164	0.0000	0.0000
25-Jul-91	0.0328	-0.0509	-0.0413	0.0228	0.0164	-0.0255	0.0210	0.0015	0.0859	-0.0207	0.0114	-0.0161	0.0003	0.0172
09-Sep-91	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
17-Oct-91	0.0343	-0.0501	-0.0397	0.0238	0.0172	-0.0251	0.0212	0.0017	0.0974	-0.0199	0.0119	-0.0159	0.0005	0.0286
15-Jan-92	0.0327	-0.046	-0.038	0.0248	0.0164	-0.0230	0.0197	0.0002	0.0115	-0.0190	0.0124	-0.0157	0.0007	0.0401
30-Jun-92	0.0295	-0.0495	-0.0407	0.0207	0.0148	-0.0248	0.0198	0.0003	0.0172	-0.0204	0.0104	-0.0154	0.0010	0.0573
20-Oct-93	0.0313	-0.0474	-0.0375	0.0214	0.0157	-0.0237	0.0197	0.0002	0.0115	-0.0188	0.0107	-0.0148	0.0016	0.0917

Notes:
1. NA denotes not available.
2. ND denotes values that were not determined because the readings were not representative.

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FILE NO.

HALEY & ALDRICH, INC.

TABLE V

TERRA TILT RESULTS
HOP BROOK DAM

Plate No: 3 Downstream Top

Date	2SIN Ao rdg	2SIN A180 rdg	2SIN Bo rdg	2SIN B180 rdg	SIN Ao	SIN A180	SIN A avg	SIN A cum.	A Rot'n	SIN Bo	SIN B180	SIN B avg.	SIN B cum.	B Rot'n
09-May-90	0.0836	-0.1	-0.1088	0.0918	0.0418	-0.0500	0.0459	0.0000	0.0000	-0.0544	0.0459	-0.0502	0.0000	0.0000
25-Jul-90	0.0832	-0.101	-0.1096	0.0908	0.0416	-0.0505	0.0461	0.0002	0.0115	-0.0548	0.0454	-0.0501	0.0001	0.0057
11-Dec-90	0.0849	-0.0983	-0.1068	0.0925	0.0425	-0.0492	0.0459	0.0000	0.0000	-0.0534	0.0463	-0.0499	0.0003	0.0172
06-Mar-91	0.0837	-0.0993	-0.1076	0.0913	0.0419	-0.0497	0.0458	-0.0001	-0.0057	-0.0538	0.0457	-0.0498	0.0004	0.0229
25-Jul-91	0.0824	-0.1005	-0.108	0.0895	0.0412	-0.0503	0.0458	-0.0001	-0.0057	-0.0540	0.0448	-0.0494	0.0008	0.0458
09-Sep-91	0.0821	-0.1009	-0.1082	0.0891	0.0411	-0.0505	0.0458	-0.0001	-0.0057	-0.0541	0.0446	-0.0494	0.0008	0.0458
17-Oct-91	0.0834	-0.0989	-0.107	0.0912	0.0417	-0.0495	0.0456	-0.0003	-0.0172	-0.0535	0.0456	-0.0496	0.0006	0.0344
15-Jan-92	0.0836	-0.0973	-0.1062	0.092	0.0418	-0.0487	0.0453	-0.0006	-0.0344	-0.0531	0.0460	-0.0496	0.0006	0.0344
30-Jun-92	0.0830	-0.1033	-0.1092	0.0891	0.0415	-0.0517	0.0466	0.0007	0.0401	-0.0546	0.0446	-0.0496	0.0006	0.0344
20-Oct-93	0.0871	-0.1032	-0.1071	0.0909	0.0436	-0.0516	0.0476	0.0017	0.0974	-0.0536	0.0455	-0.0496	0.0006	0.0344

Notes:
1. NA denotes not available.
2. ND denotes values that were not determined because the readings were not representative.

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FILE NO.

HALEY & ALDRICH, INC.

TABLE V

TERRA TILT RESULTS
HOP BROOK DAM

Plate No: 4 Downstream Face

Date	2SIN Ao rdg	2SIN A180 rdg	Bo rdg	B180 rdg	SIN Ao	SIN A180	SIN A avg	SIN A cum.	A Rot'n	Bo	B180	B avg.	B cum.	B Rot'n
09-May-90	-0.127	-0.1127	ND	ND	-0.0635	-0.0564	-0.0600	0.0000	0.0000	ND	ND	ND	ND	ND
25-Jul-90	-0.1273	-0.1111	ND	ND	-0.0637	-0.0556	-0.0597	0.0003	0.0172	ND	ND	ND	ND	ND
11-Dec-90	-0.1245	-0.1111	ND	ND	-0.0623	-0.0556	-0.0590	0.0010	0.0573	ND	ND	ND	ND	ND
06-Mar-91	-0.1257	-0.1118	ND	ND	-0.0629	-0.0559	-0.0594	0.0006	0.0344	ND	ND	ND	ND	ND
25-Jul-91	-0.126	-0.1103	ND	ND	-0.0630	-0.0552	-0.0591	0.0009	0.0516	ND	ND	ND	ND	ND
09-Sep-91	-0.1262	-0.1103	ND	ND	-0.0631	-0.0552	-0.0592	0.0008	0.0458	ND	ND	ND	ND	ND
17-Oct-91	-0.1248	-0.1103	ND	ND	-0.0624	-0.0552	-0.0588	0.0012	0.0688	ND	ND	ND	ND	ND
15-Jan-92	-0.1232	-0.1102	ND	ND	-0.0616	-0.0551	-0.0584	0.0016	0.0917	ND	ND	ND	ND	ND
30-Jun-92	-0.1270	-0.1103	ND	ND	-0.0635	-0.0552	-0.0594	0.0006	0.0344	ND	ND	ND	ND	ND
20-Oct-93	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
1. NA denotes not available.
2. ND denotes values that were not determined because the readings were not representative.

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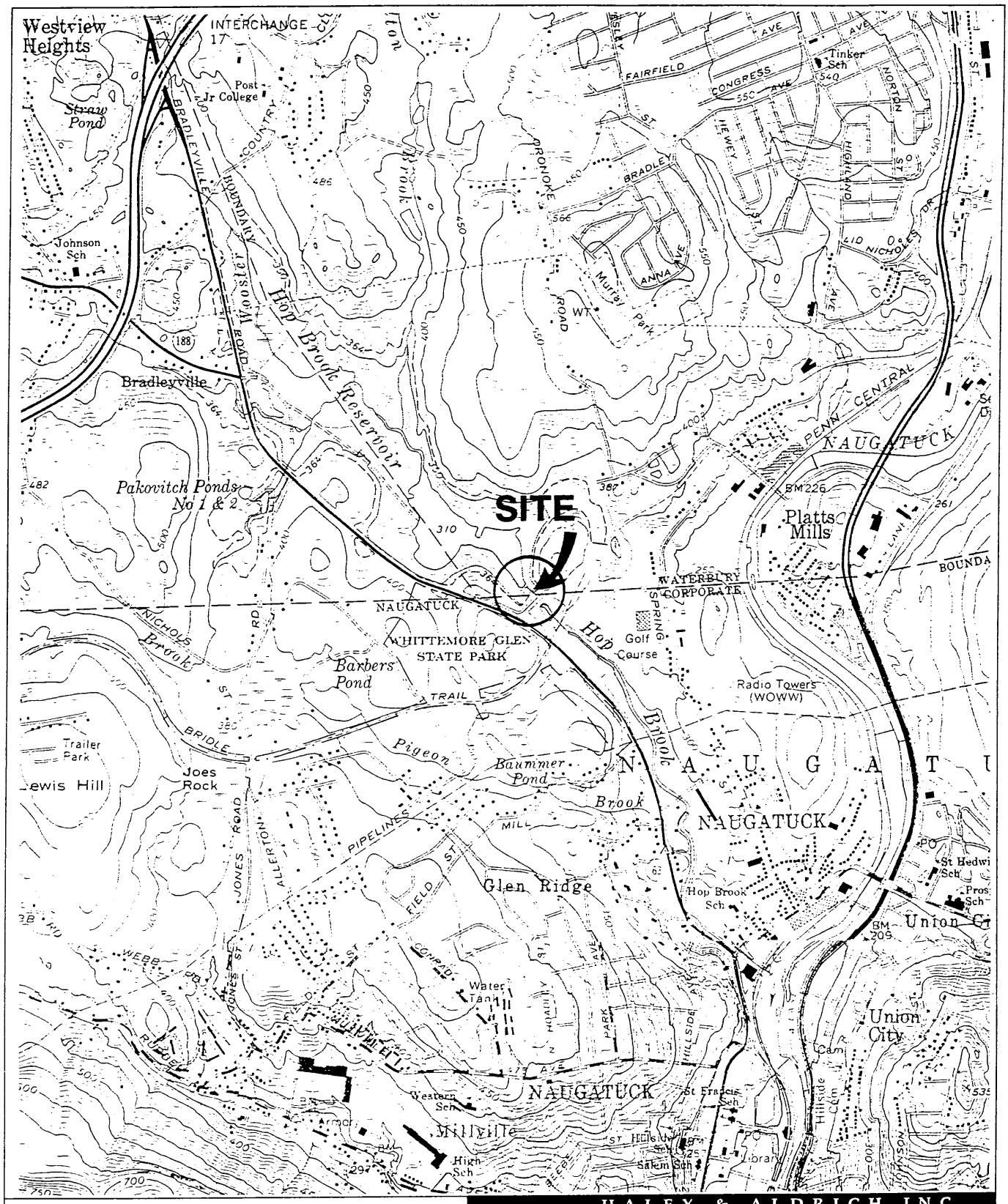
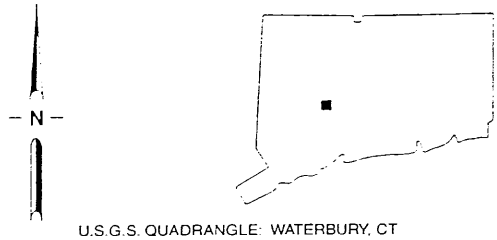


SITE COORDINATES: 41°30'52"N 73°04'01"W



U.S.G.S. QUADRANGLE: WATERBURY, CT

HALEY & ALDRICH INC.

Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PROJECT LOCUS

APPROXIMATE SCALE: 1:25,000

FEBRUARY 1995

FILE NO. 11163-004 A1

FIGURE 1

CORPS OF ENGINEERS

U. S. ARMY

LOCATION MAP
SCALE 1"=2000' (APPROX.)

HOP BROOK DAM

NEW HAVEN COUNTY

WESTVIEW HEIGHTS

LIMIT OF CONTRACTOR'S WORK AREA

ROAD TO BE RAISED

FLOW LINE AT SPILLWAY CREST EL. 364.0

RESERVOIR CLEARING EL. 313.0

CITY OF WATERBURY

DIKE

SPILLWAY

DAM

ROAD IMPROVED (BY OTHERS)

BORROW AREA

ACCESS ROAD

WHITTEMORE GLEN STATE PARK

PROVIDE 15' GRAVEL DRIVEWAY

FIELD LAB

FIELD OFFICE

ROUTE 63 RELOCATION (BY OTHERS)

TOWN OF MIDDLEBURY

TOWN OF NAUGATUCK

NEW HAVEN COUNTY

NOTES:

Contour interval equals 25 foot.

Topography based on photogrammetric survey.

Grid system is Connecticut Lambert conformal.

GRAPHIC SCALE

1" = 2000' 2000' 0 2000' 4000'

1" = 400' 400' 0 400' 800'

RESERVOIR PLAN
SCALE: 1" = 400'

Record Drawing
Contract No DA-19-016-CIV ENG 66-38.

REVISION	DATE	DESCRIPTION	BY
1	11-24-65	Gravel driveway revised (Am. #1)	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY I.R. | DR. BY E.K. | CK. BY

SUBMITTED: CHIEF, LAYOUT SECTION

REVIEWED: PROJECT ENGINEER

APPROVED: CHIEF, DESIGN BRANCH

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
RESERVOIR PLAN AND LIMITS OF CONTRACTOR'S WORK AREA

HOP BROOK CONNECTICUT

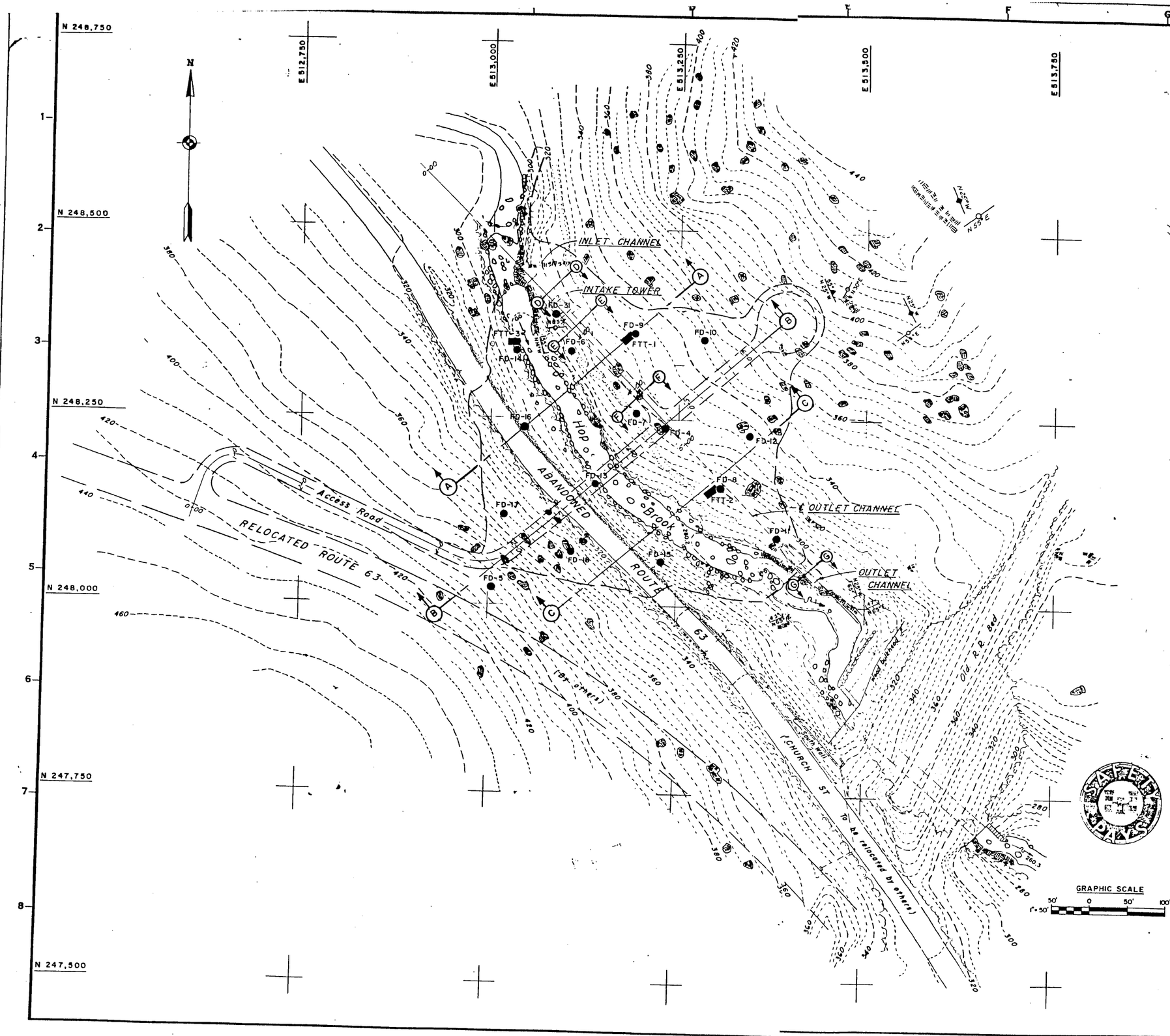
APPROVED: CHIEF, ENGINEERING DIVISION

DATE SEPT. 1965

SCALE AS NOTED | SPEC. NO. CIV. ENG. 19-016-66-20

DRAWING NUMBER HOU-5

FIGURE 2



LEGEND

- FTT — Foundation Test Trench
- FD — Foundation Test Boring
- Bedrock Outcrop
- Boulders
- 50° N 25°E — Strike and Dip of Foliation
- N 25°W — Strike of Vertical Foliation
- 50° N 30°W — Strike and Dip of Joint Plane
- N 30°E — Strike of Vertical Joints
- (A)—(A) — Location and Direction of View for Geologic Sections

NOTES

Elevations refer to Mean Sea Level Datum

Contour interval is 5 feet

For Geologic Sections see Sheets 59 and 60

For Record of Foundation Explorations see Sheets 62 and 63

Record Drawing

Contract No. DA-19-016-CIV ENG 66-38

REVISION	DATE	DESCRIPTION	BY
		Final field corrections	

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY E.A.B. | DR. BY L.H.I. | CK. BY R.C.G.

SUBMITTED: CHIEF, GEOLOGY SECTION — CHIEF, F&M BRANCH

REVIEWED: PROJECT ENGINEER

APPROVED: CHIEF, DESIGN BRANCH — APPROVED: CHIEF, ENGINEERING DIVISION

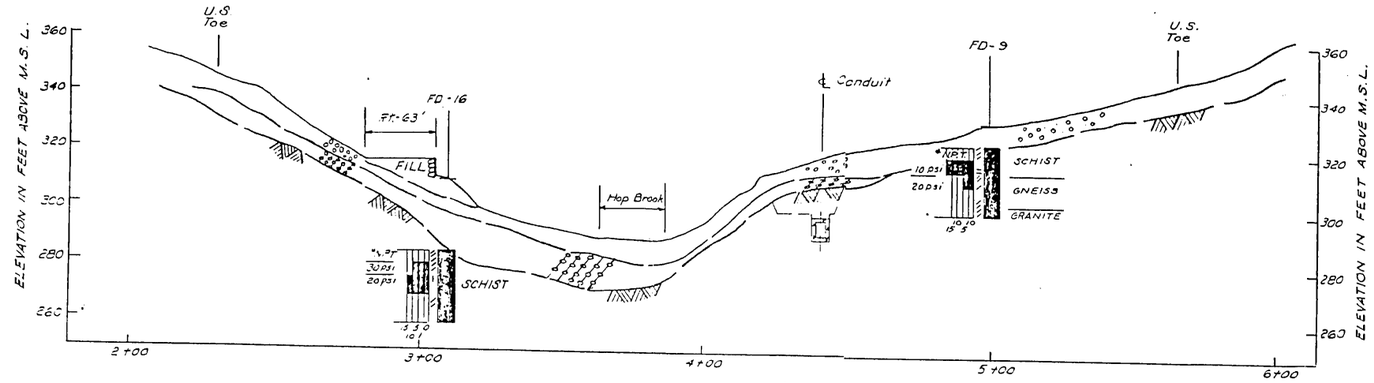
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
DAM
PLAN OF FOUNDATION EXPLORATIONS
HOP BROOK — CONNECTICUT

DATE SEPT. 1965

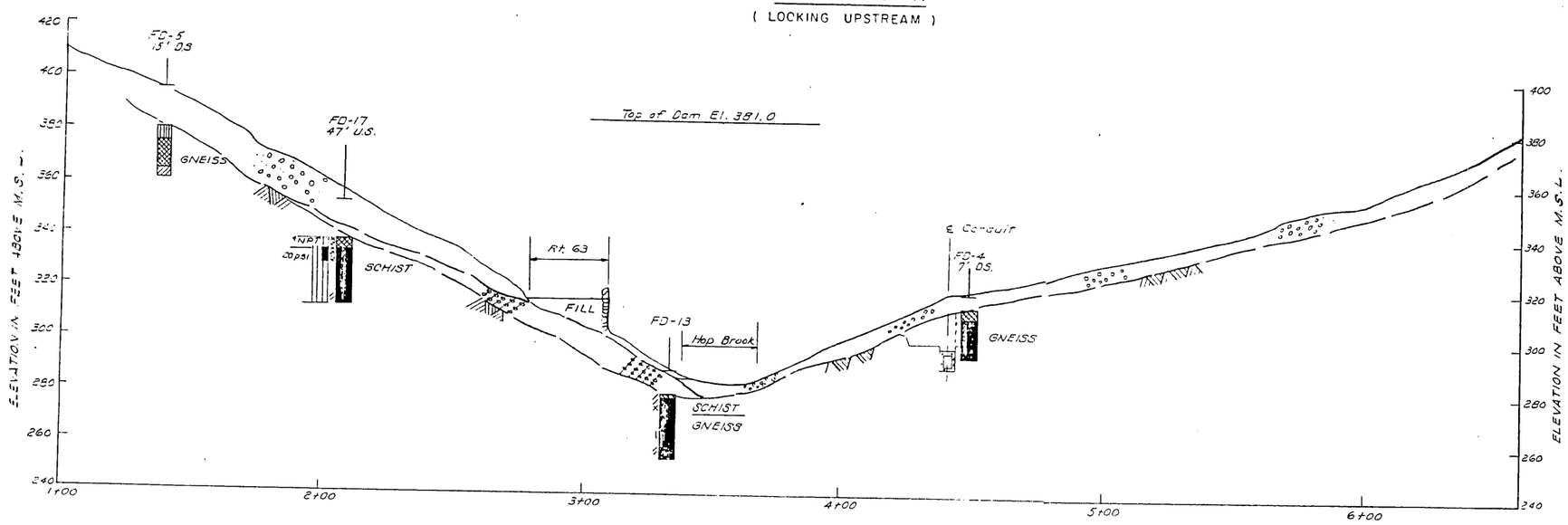
SCALE: 1"=50' | SPEC. NO. CIV. ENG. 19-016-66-20

DRAWING NUMBER
HOU - 5

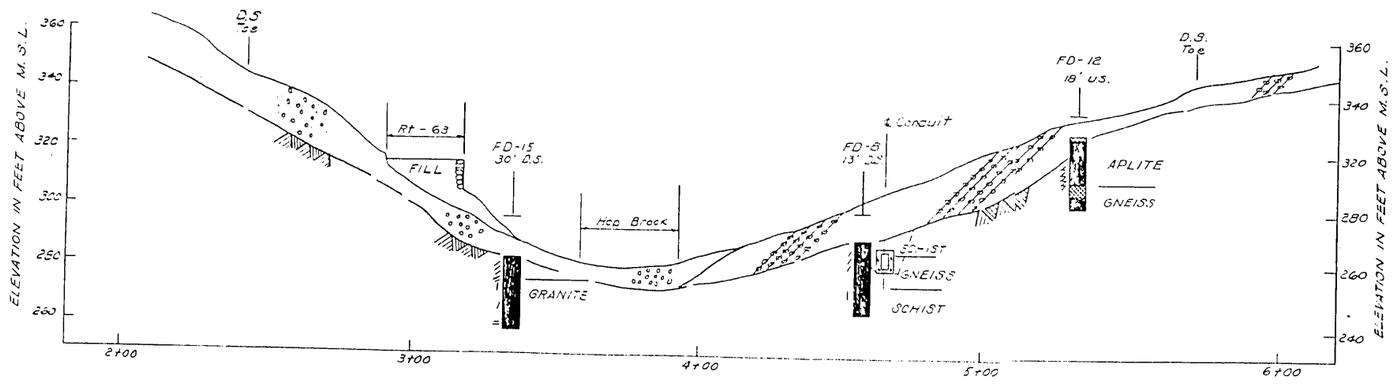
FIGURE 3



SECTION A – A
(LOOKING UPSTREAM)

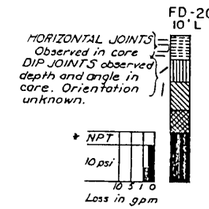


SECTION B – B (℄ of Dam)
(LOOKING UPSTREAM)



SECTION C – C
(LOOKING UPSTREAM)

LEGEND FOR CORE BORING IN ROCK



Foundation Test Boring
Distance and Direction of Offset

0 - 25 % Rock Core Recovery

25 - 50 % Rock Core Recovery

50 - 75 % Rock Core Recovery

75 - 90 % Rock Core Recovery

90 - 100 % Rock Core Recovery

* NPT — No pressure test performed. Asterisk denotes that section could not be sealed for testing.

10 psi — Constantly maintained pressure for 1 to 5 minutes. Volume loss in gallons per minute under constant pressure. Tested continuously in 5-foot sections. Scale expanded from 0 gpm to 1 gpm for clarification of low pressure losses.

GRAPHIC LEGEND

Varies from silty, sandy GRAVEL to gravelly, silty SAND with cobbles and boulders (TILL)

Gravelly silty SAND to silty, sandy GRAVEL with cobbles and boulders

Assumed Bedrock Surface

NOTES

For location of geologic sections see Sheet 57.

For Record of Foundation Explorations see Sheets 62 and 63.

GRAPHIC SCALE
1" = 20' — 20' 0 20' 40'

Record Drawing
Contract No. DA-19-016-CIV ENG 66-38

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS

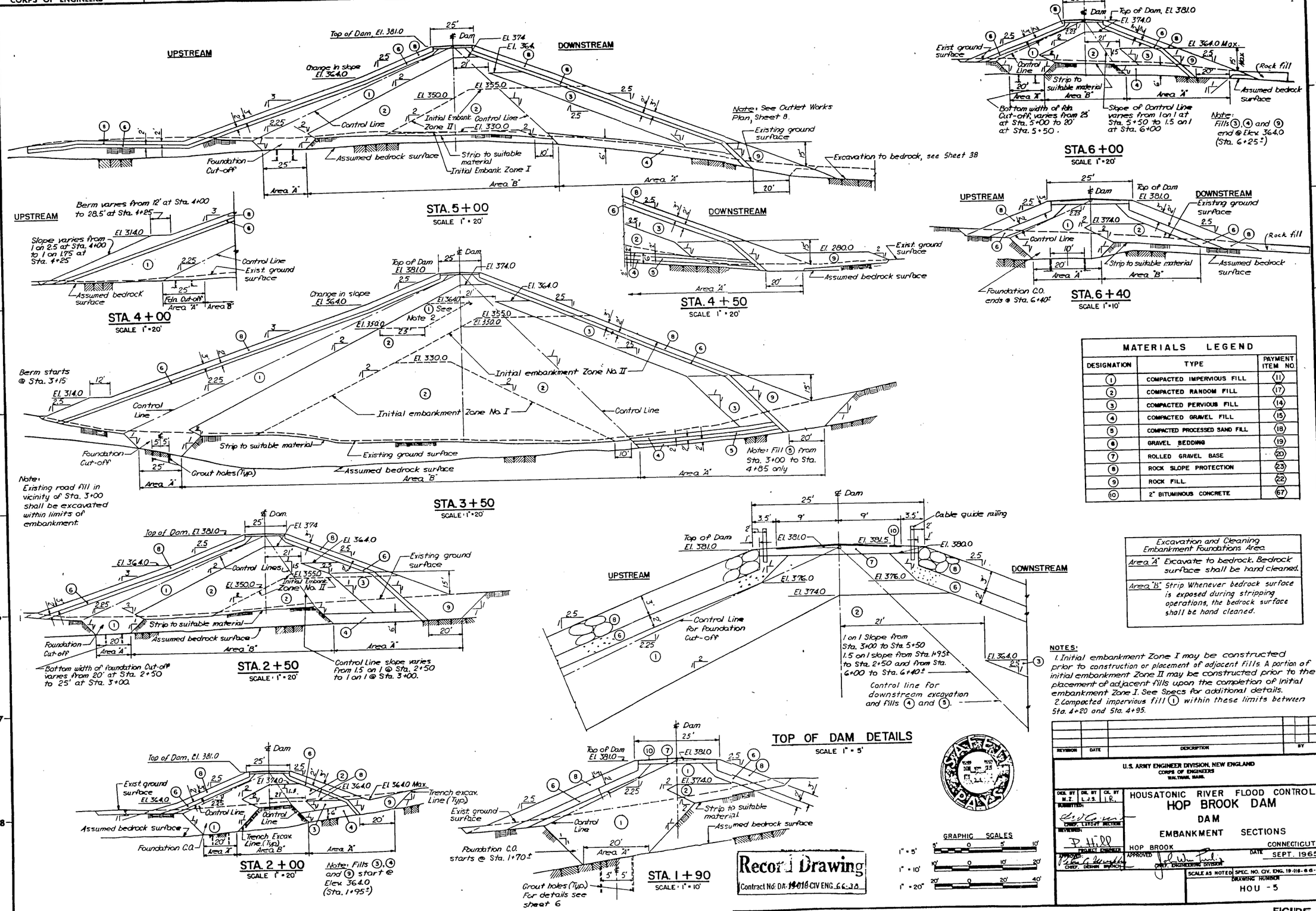
DES. BY E.A.B. | DR. BY L.H.I. | CK. BY R.C.G.
SUBMITTED — CHIEF, GEOLOGY SECTION
CHIEF, F&M BRANCH
REVIEWED — PROJECT ENGINEER
APPROVED — CHIEF, DESIGN BRANCH
APPROVED — CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
DAM
GEOLOGIC SECTIONS
HOP BROOK CONNECTICUT
DATE SEPT. 1965
SCALE: 1" = 20'
SPEC. NO CIV. ENG.-19-016-66-20
DRAWING NUMBER
HOU – 5

FIGURE 4

CORPS OF ENGINEERS

U. S. ARMY



MATERIALS LEGEND		
DESIGNATION	TYPE	PAYMENT ITEM NO.
1	COMPACTED IMPERVIOUS FILL	11
2	COMPACTED RANDOM FILL	17
3	COMPACTED PERVIOUS FILL	14
4	COMPACTED GRAVEL FILL	15
5	COMPACTED PROCESSED SAND FILL	18
6	GRAVEL BEDDING	19
7	ROLLED GRAVEL BASE	20
8	ROCK SLOPE PROTECTION	23
9	ROCK FILL	22
10	2" BITUMINOUS CONCRETE	67

Excavation and Cleaning Embankment Foundations Area
Area "A" Excavate to bedrock. Bedrock surface shall be hand cleaned.
Area "B" Strip Whenever bedrock surface is exposed during stripping operations, the bedrock surface shall be hand cleaned.

NOTES:

1. Initial embankment Zone I may be constructed prior to construction or placement of adjacent fills. A portion of initial embankment Zone II may be constructed prior to the placement of adjacent fills upon the completion of Initial embankment Zone I. See Specs for additional details.
2. Compacted impervious fill ① within these limits between Sta. 4+20 and Sta. 4+95.

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY H.Z. | DR. BY L.J.S. | CK. BY J.R.

SUBMITTED: CHIEF, LAYOUT SECTION

REVIEWED: PROJECT ENGINEER

PROPOSED: CHIEF, DESIGN BRANCH

APPROVED: CHIEF, ENGINEERING DIVISION

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
DAM
EMBANKMENT SECTIONS

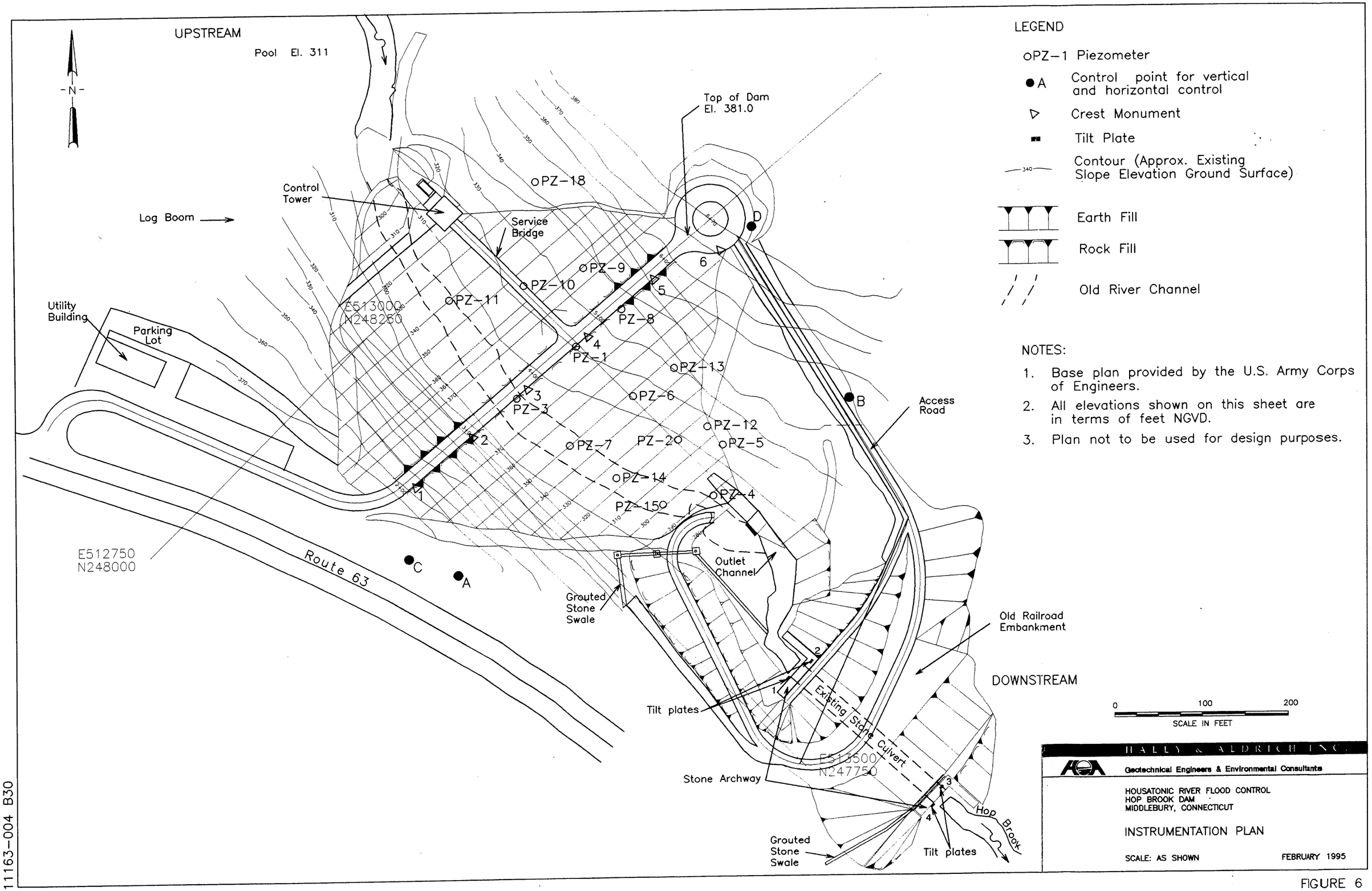
HOP BROOK — CONNECTICUT

DATE SEPT. 1965

SCALE AS NOTED | SPEC. NO. CIV. ENG. 19-018-66-20

DRAWING NUMBER HOU - 5

FIGURE 5



11163-004 B30

FIGURE 6

LEGEND FOR GRAPHIC LOGS

FD90-2
1/30/90
EL. 515

Type, year and number of exploration.
Date exploration completed.
Elevation of ground surface at time of exploration.

Maximun artesian head.

Subsurface water level.

Artesian flow encountered.

Range of subsurface water level during period of observation.

SM — Group letter symbol according to ASTM D2487 AND ASTM D2488.

NR — No recovery or unsatisfactory soil samples recovered.

NS — Not sampled

25 — Number of blows per foot of penetration using a 140 lb. hammer falling freely an average drop of 30 inches to drive a sample spoon of 2" O.D – 1-3/8" I.D. in size equipped with bevelled and sharpened drive shoe.

* — Indicates sample taken with a 300 lb. hammer and a drop of 18 inches.

Cobbles or boulders.

Coarse gravel or nested cobbles and boulders.

El. 5.0 Elevation of bedrock surface.

Rock core recovery 0–25%.

Rock core recovery 25–50%

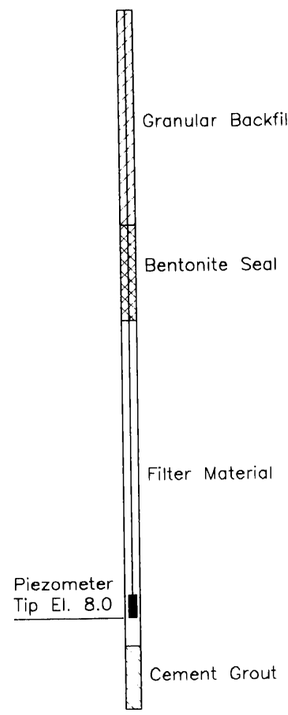
Rock core recovery 50–75%

Rock core recovery 75–90%

Rock core recovery 90– 100%

El. 9.0 Elevation at bottom of exploration.

LEGEND FOR PIEZOMETER



Boring Number	Piezometer Number
FD-86-1	PZ-1
FD-86-2	PZ-2
FD-86-3	PZ-3
FD-86-4	PZ-4
FD-86-5	PZ-5
FD-86-6	PZ-6
FD-86-7	PZ-7
FD-86-8	PZ-8
FD-86-9	PZ-9
FD-86-10	PZ-10
FD-86-11	PZ-11
FD-86-12	PZ-12
FD-86-13	PZ-13
FD-86-14	PZ-14
DH-14	PZ-15

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

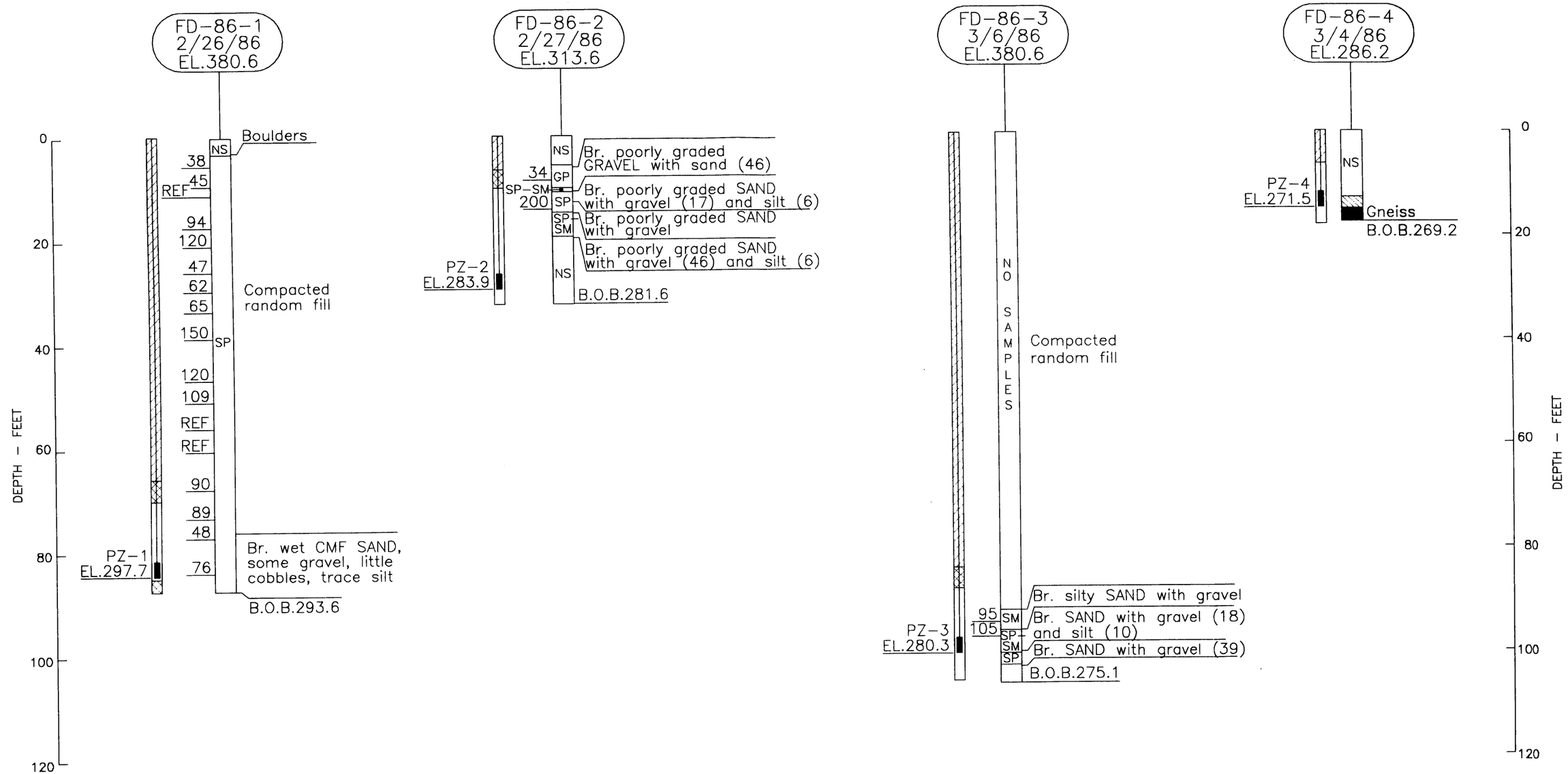
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

GENERAL LEGEND AND NOTES

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B31

FIGURE 7



NOTE:

1. ENGINEERING AND PIEZOMETER LOGS DRAWN BY THE U.S. ARMY CORPS OF ENGINEERS AND PRESENTED IN PLATES 5 THROUGH 11 OF THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989. INTERPRETATION OF BORING LOGS WAS MADE BY THE U.S. ARMY CORPS OF ENGINEERS.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

HALEY & ALDRICH, INC.

Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

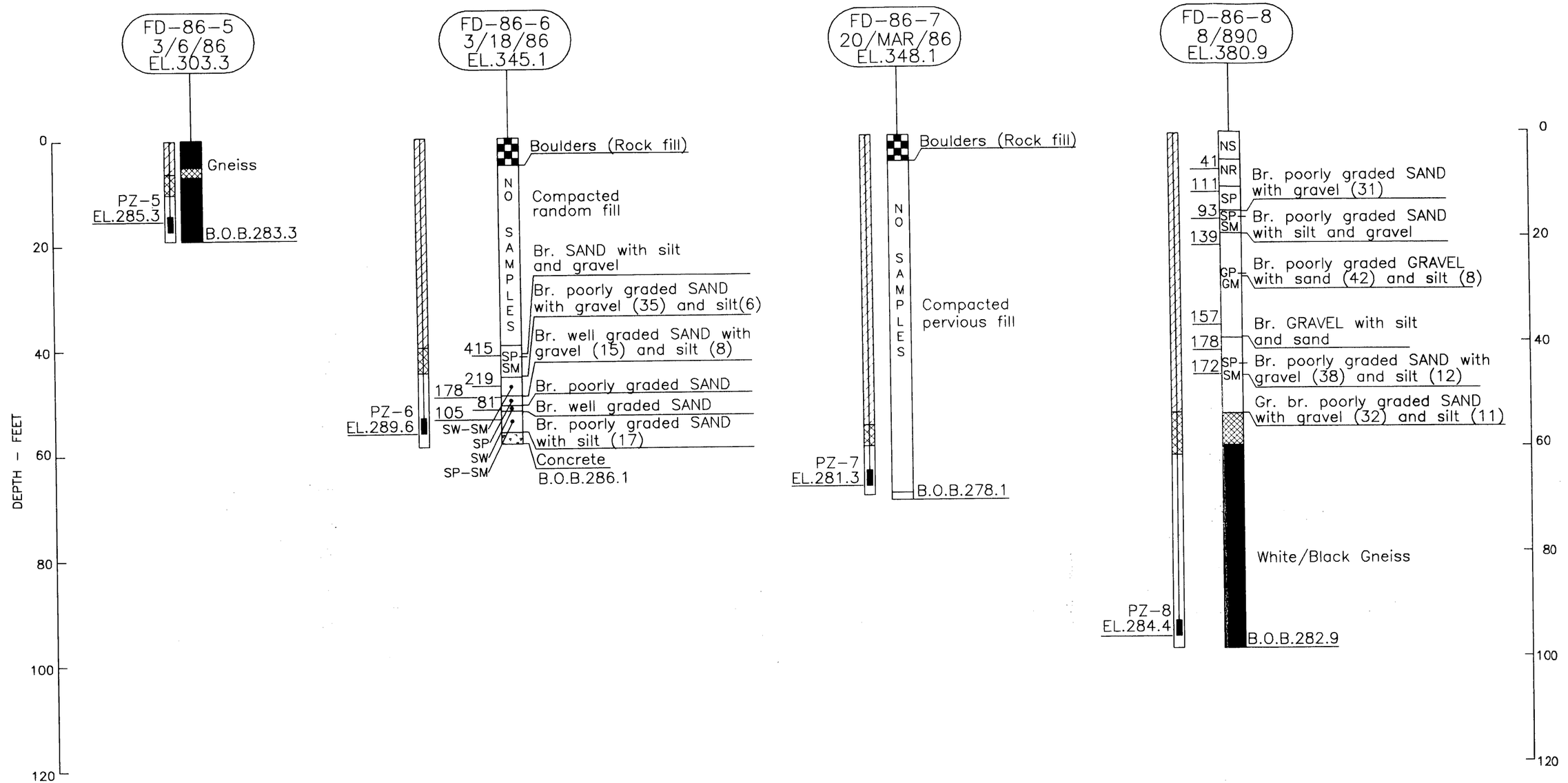
ENGINEERING LOGS
PIEZOMETER EXPLORATIONS
PZ-1, PZ-2, PZ-4, PZ-5

SCALE: AS SHOWN

FEBRUARY 1995

11163-004 B17

FIGURE 8



NOTE:

1. ENGINEERING AND PIEZOMETER LOGS DRAWN BY THE U.S. ARMY CORPS OF ENGINEERS AND PRESENTED IN PLATES 5 THROUGH 11 OF THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989. INTERPRETATION OF BORING LOGS WAS MADE BY THE U.S. ARMY CORPS OF ENGINEERS.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

HALEY & ALDRICH, INC.

Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

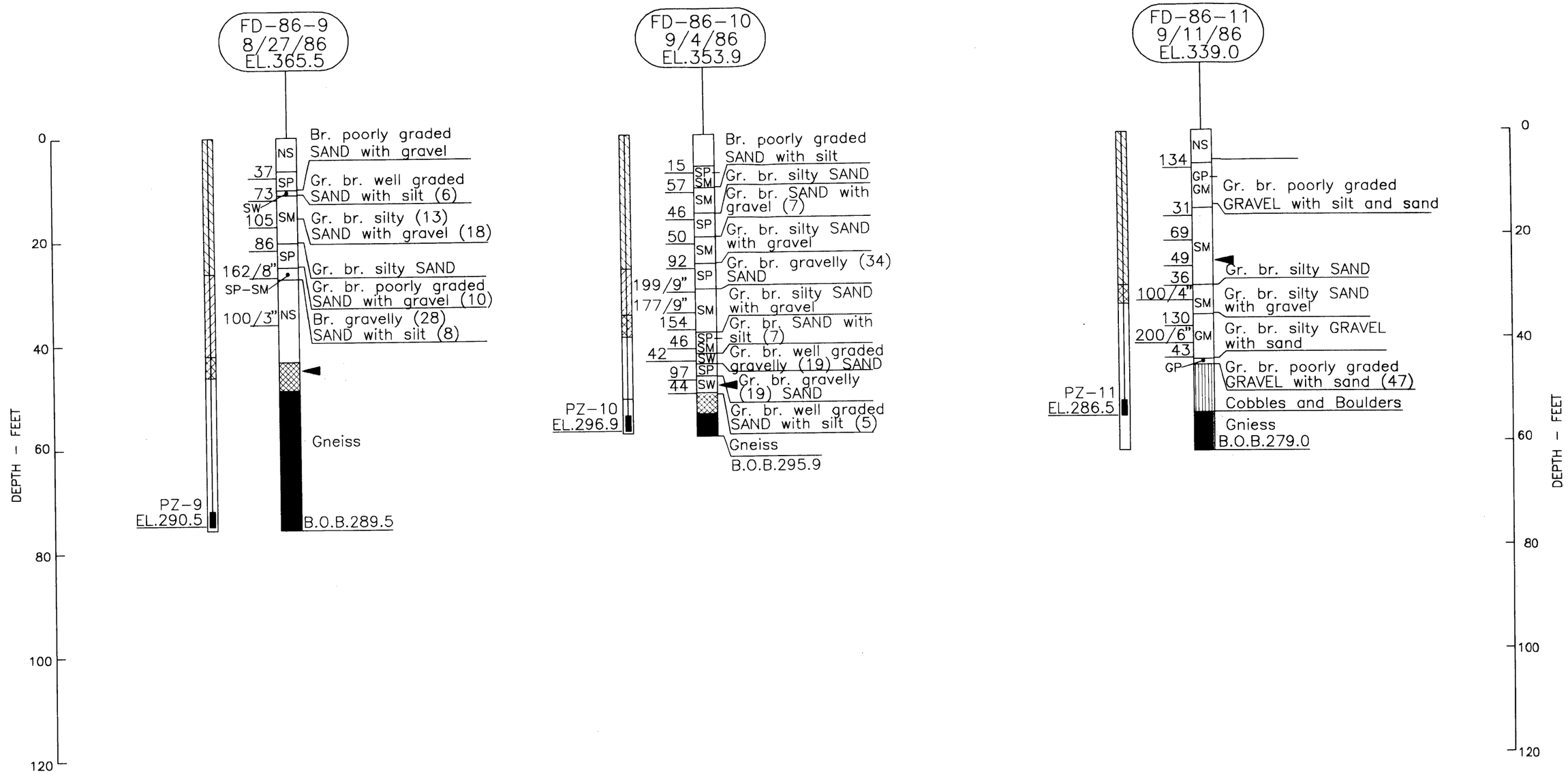
ENGINEERING LOGS
PIEZOMETER EXPLORATIONS
PZ-5, PZ-6, PZ-7, PZ-8

SCALE: AS SHOWN

FEBRUARY 1995

11163-004 B18

FIGURE 9



NOTE:

1. ENGINEERING AND PIEZOMETER LOGS DRAWN BY THE U.S. ARMY CORPS OF ENGINEERS AND PRESENTED IN PLATES 5 THROUGH 11 OF THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989. INTERPRETATION OF BORING LOGS WAS MADE BY THE U.S. ARMY CORPS OF ENGINEERS.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

HAILEY ALFORD ASSOC.

Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

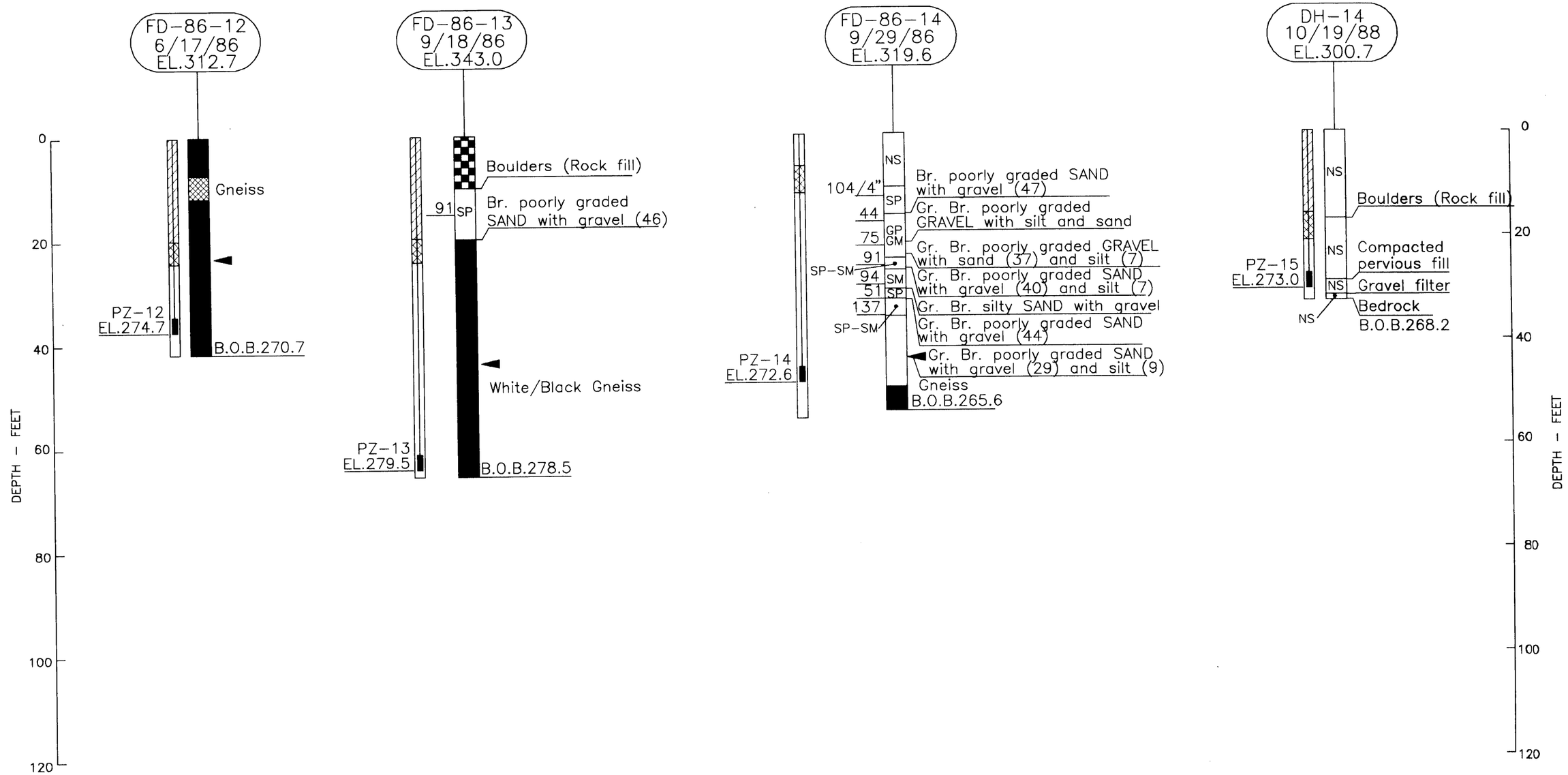
ENGINEERING LOGS
PIEZOMETER EXPLORATIONS
PZ-9, PZ-10, PZ-11

SCALE: AS SHOWN

FEBRUARY 1995

11163-004 B19

FIGURE 10



NOTE:

1. ENGINEERING AND PIEZOMETER LOGS DRAWN BY THE U.S. ARMY CORPS OF ENGINEERS AND PRESENTED IN PLATES 5 THROUGH 11 OF THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989. INTERPRETATION OF BORING LOGS WAS MADE BY THE U.S. ARMY CORPS OF ENGINEERS.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

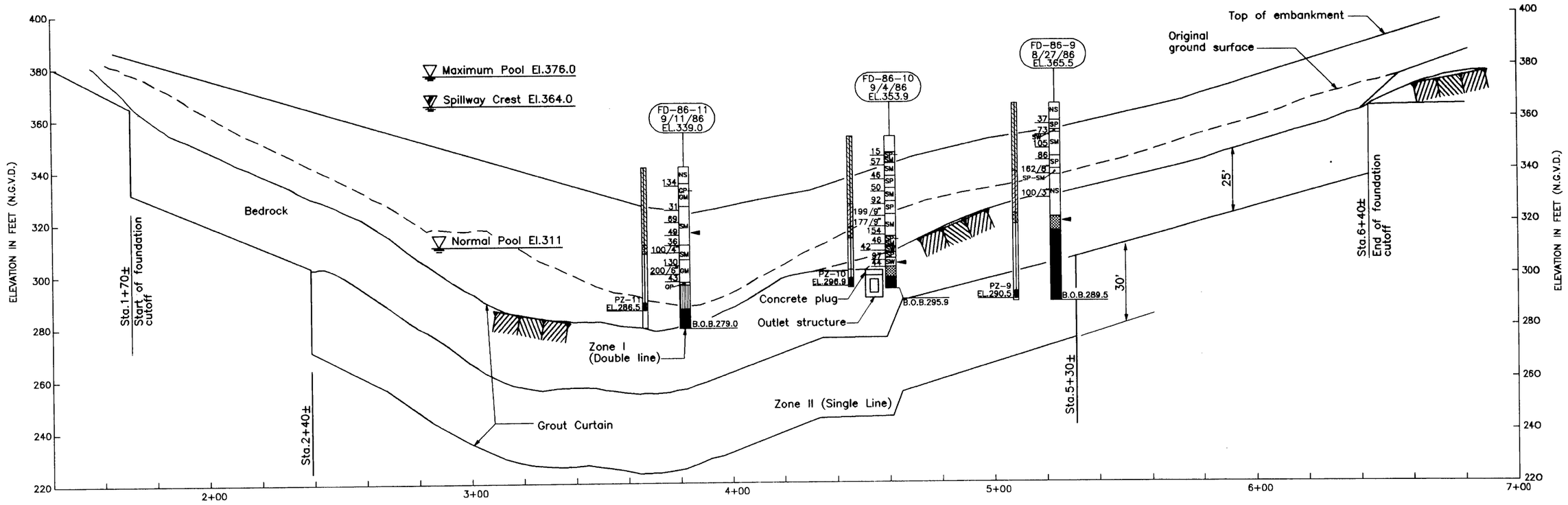
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOGS
PIEZOMETER EXPLORATIONS
PZ-12, PZ-13, PZ-14, PZ-15

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B20

FIGURE 11



ENGINEERING LOG PROFILE (CENTERLINE FOUNDATION CUTOFF)

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

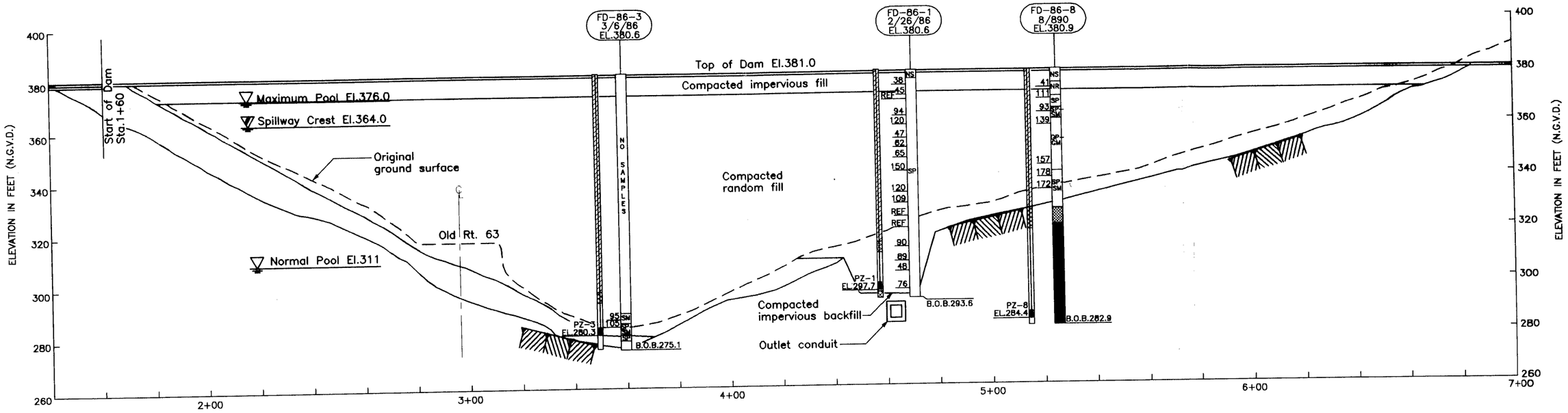
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG PROFILE
UPSTREAM SLOPE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B24

FIGURE 12



ENGINEERING LOG PROFILE (10 FT. D/S OF DAM CENTERLINE)

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HAYES, SEERIG, INC.
Geotechnical Engineers & Environmental Consultants

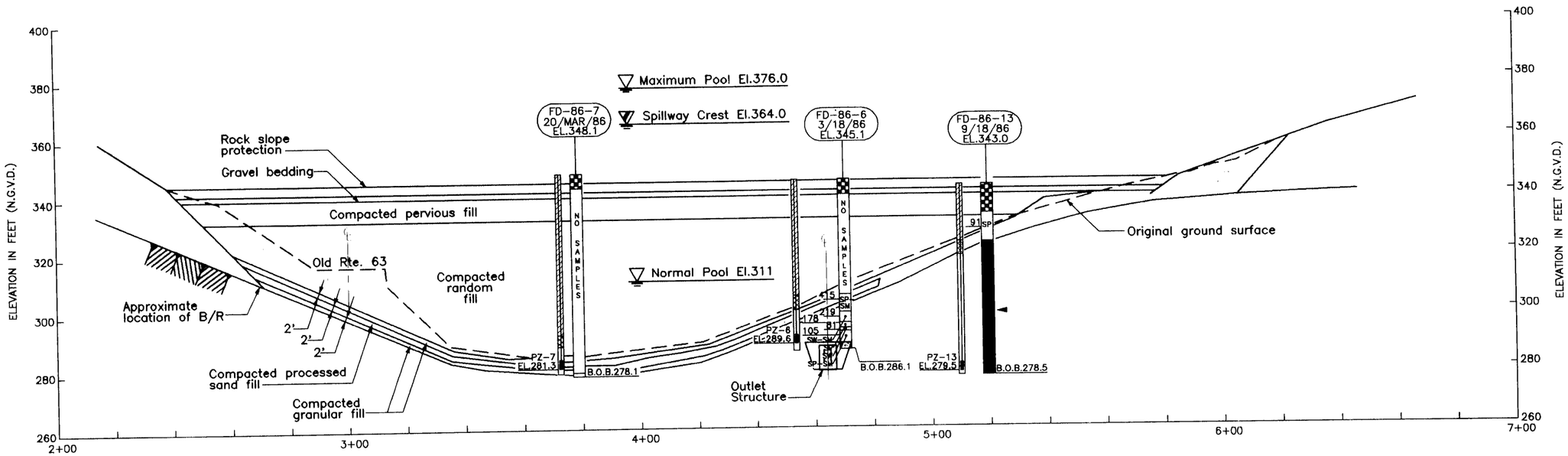
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG PROFILE
CENTERLINE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B28

FIGURE 13



ENGINEERING LOG PROFILE (100 FT. D/S OF DAM CENTERLINE)

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HAILEY & WEDRICK INC
Geotechnical Engineers & Environmental Consultants

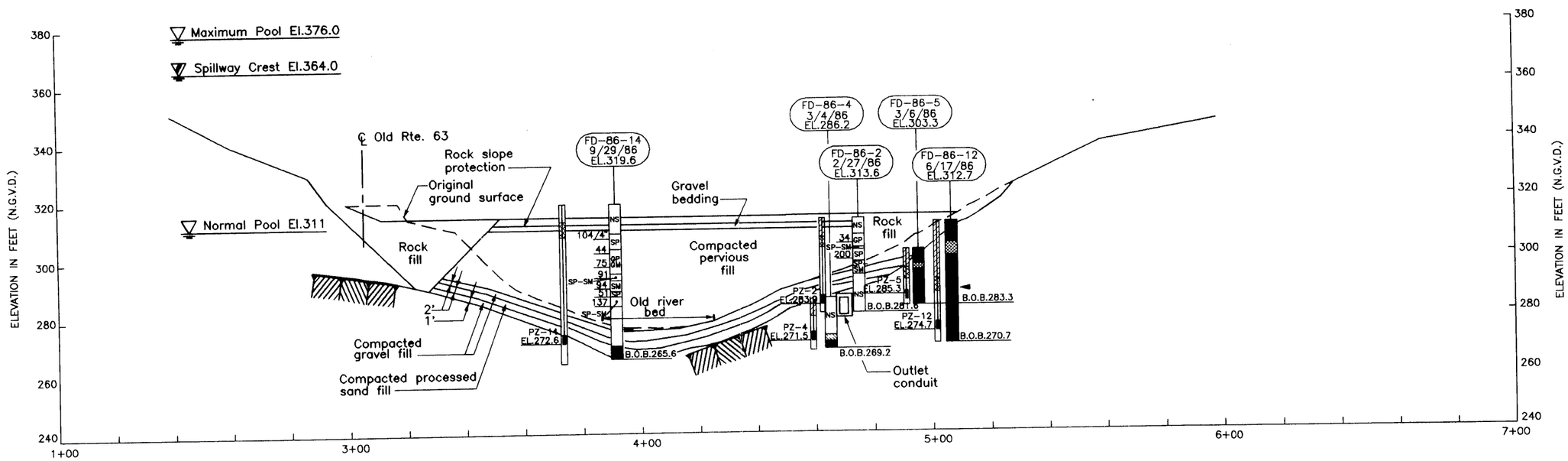
HOUSATONIC RIVER FLOOD CONTROL
HOPB ROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG PROFILE
DOWNSTREAM SLOPE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B29

FIGURE 14



ENGINEERING LOG PROFILE (180 FT. D/S OF DAM CENTERLINE))

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

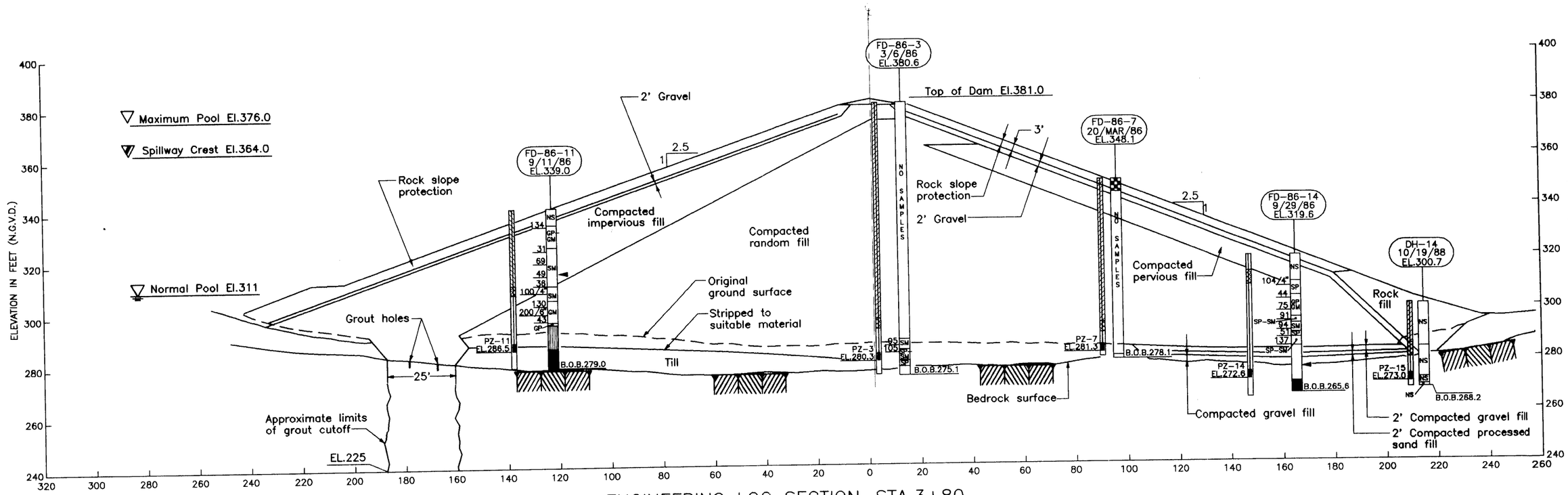
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG PROFILE
DOWNSTREAM TOE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B32

FIGURE 15



ENGINEERING LOG SECTION–STA.3+80

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HALEY & ALDRICH, INC.
Geotechnical Engineers & Environmental Consultants

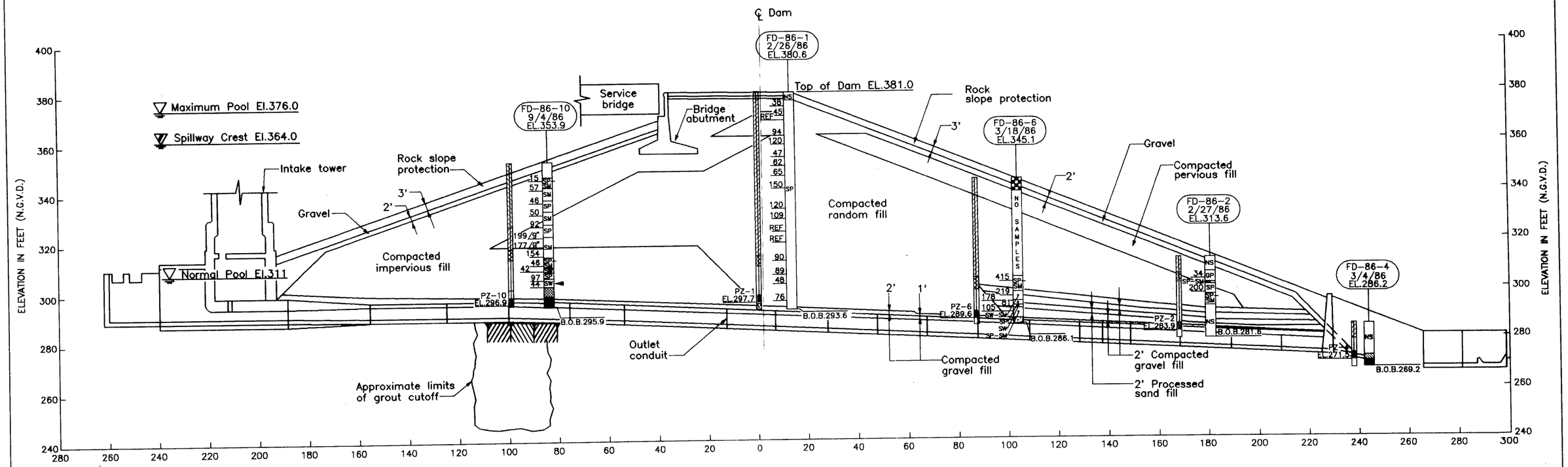
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG SECTION
STATION 3+80

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B21

FIGURE 16



ENGINEERING LOG SECTION–STA.4+60

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISished IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

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Geotechnical Engineers & Environmental Consultants

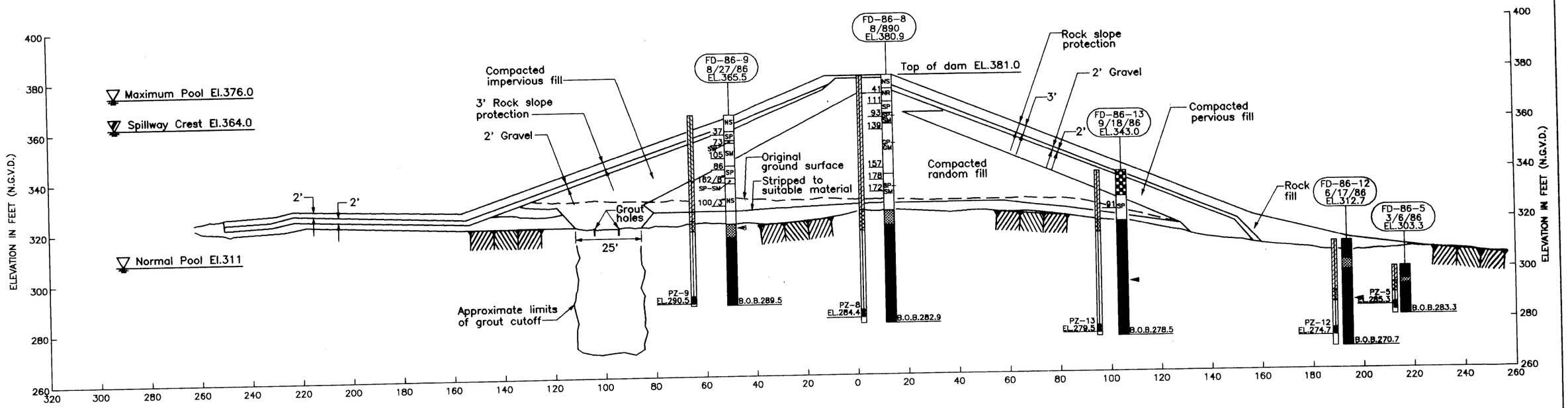
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

ENGINEERING LOG SECTION
STATION 4+60

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B22

FIGURE 17



ENGINEERING LOG SECTION–STA.5+20

NOTE:

1. BASE PLAN PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO. 4, HOP BROOK LAKE, MIDDLEBURY, CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION," DATED JUNE 1989.

2. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.

0 40 80
SCALE IN FEET

HAYES, SEELIGER & ... INC
Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

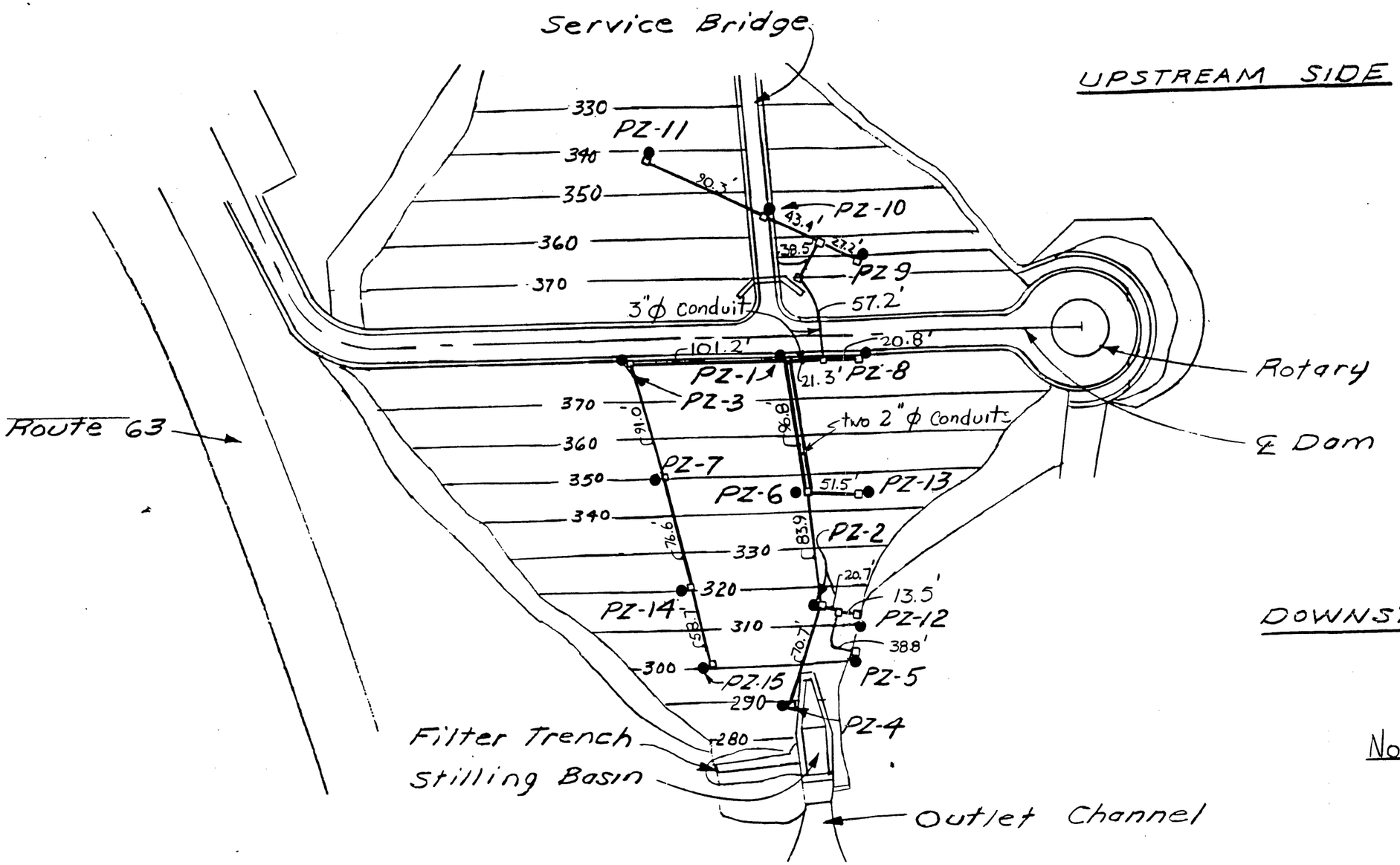
ENGINEERING LOG SECTION
STATION 5+20

SCALE: AS SHOWN

FEBRUARY 1995

11163-004 B23

FIGURE 18



Note:

1. All conduit is 2" diameter SCH. 40 PVC electrical Conduit except as noted

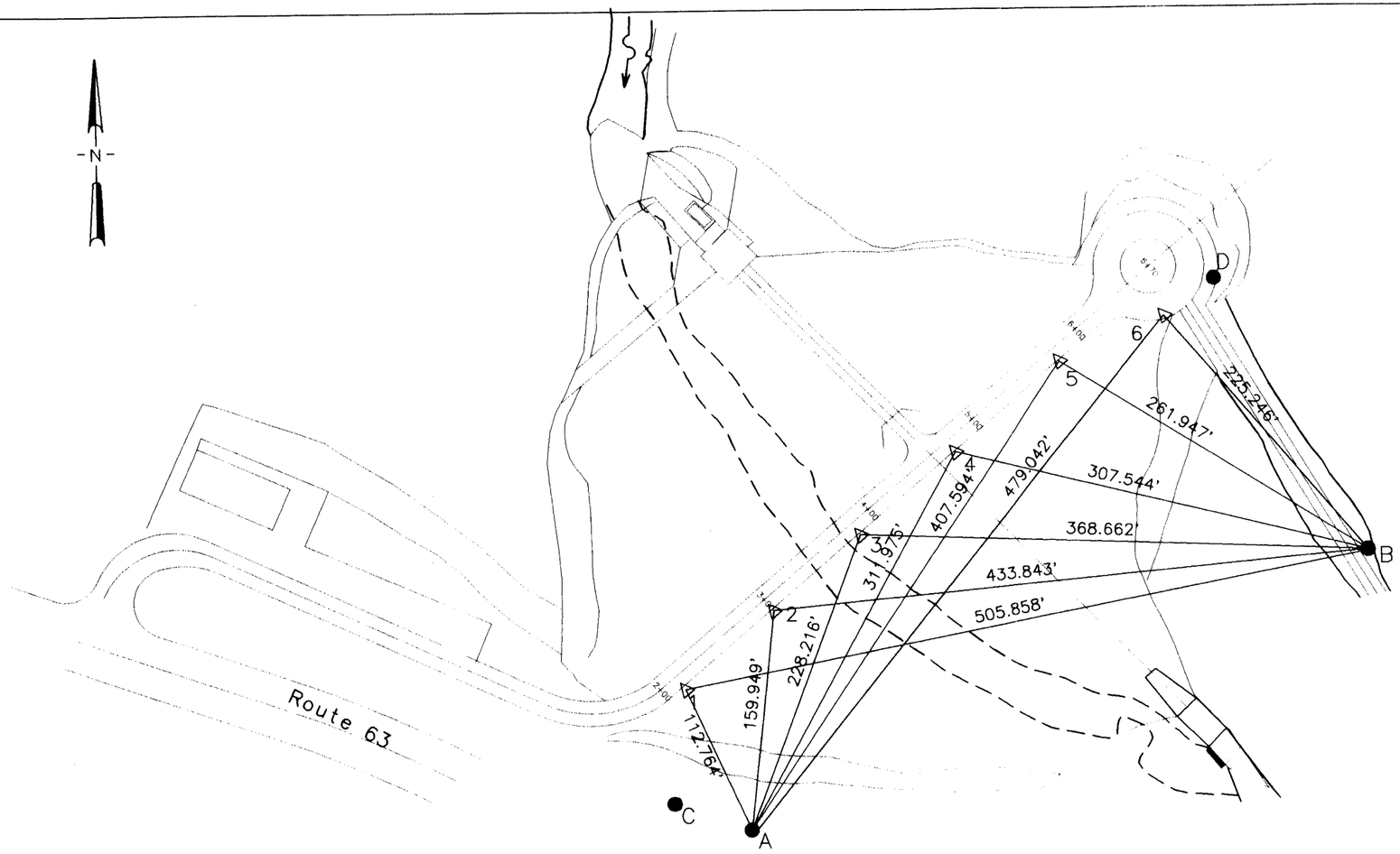
LEGEND

- ● Piezometer
- ▫ Junction Box

PLAN - CONDUIT LAYOUT

DEPARTMENT OF THE ARMY NEW ENGLAND DIVISION CORPS OF ENGINEERS WALTHAM, MASS.	
DES. BY: P L	HOP BROOK DAM PIEZOMETER AUTOMATION CONDUIT LAYOUT
DR. BY: R F	
CK. BY: P L	
GEOTECH. ENG. BR.	SCALE: N.T.S. DATE: APRIL 89

FIGURE 19



LEGEND

- ●A Control point for vertical and horizontal control
- ▷ Crest Monument 1992
- Old River Channel

NOTES

1. Measurements shown are from April 1992 survey. Refer to survey book FC 406 for description and location of control points. Books are stored in Survey Branch, NED.
2. All elevations shown on this sheet are in terms of feet NGVD.

0 100 200
SCALE IN FEET

CREST MONUMENT SETTLEMENT AND MOVEMENT RECORD

DATE	JULY 1985			MARCH/JULY 1987			APRIL 1992								
MONUMENT	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION	NORTHING	EASTING	ELEVATION
MON 1	NO	DATA	381.20	248077.073	513054.818	381.22	248077.054	513054.819	381.22						
MON 2			381.02	248133.522	513119.382	381.02	248133.529	513119.387	381.01						
MON 3			380.92	248187.871	513182.999	380.93	248187.865	513182.977	380.92						
MON 4			380.93	248247.573	513252.842	380.94	248247.567	513252.827	380.94						
MON 5			380.80	248312.742	513329.394	380.80	248312.734	513329.375	380.81						
MON 6			381.08	248345.194	513405.371	381.07	248345.189	513405.357	381.08						

CONTROLS POINTS
LOCATION AND ELEVATION RECORD

	NORTHING	EASTING	ELEVATION
A	247974.560	513101.854	N/R
B	248173.678	513551.369	N/R
C	N/R	N/R	378.18
D	N/R	N/R	380.90

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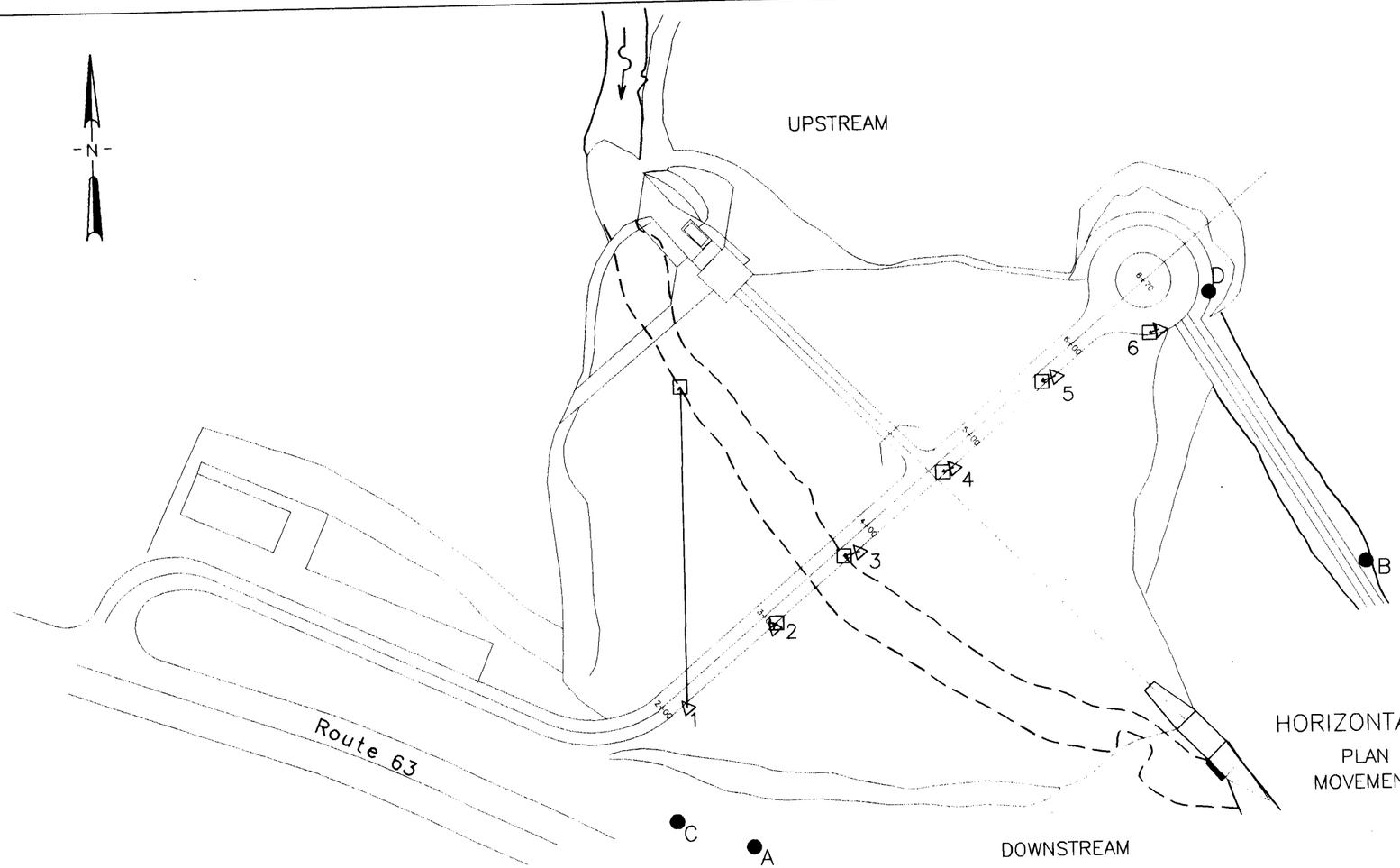
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

CREST SURVEY MONUMENTS
HORIZONTAL AND VERTICAL MOVEMENT

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B27

FIGURE 20



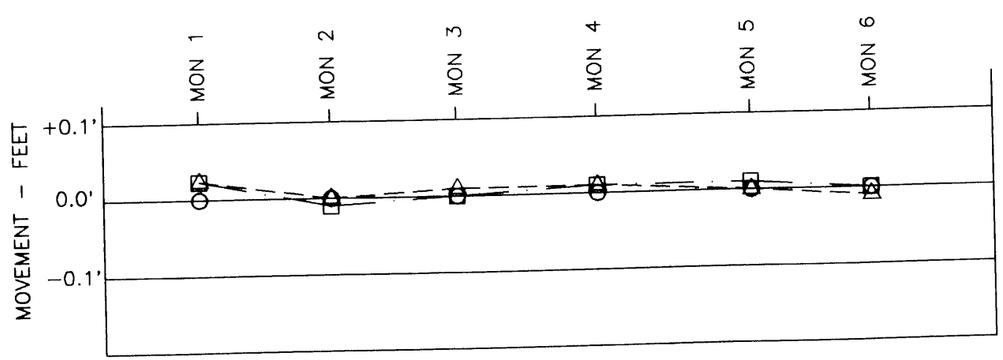
LEGEND

- △ Initial Coordinates 1987
- □ Crest Monument 1992
- → Direction of Horizontal Movement Scale: 1 inch = 0.2 feet
- // Old River Channel

NOTE

All elevations shown on this sheet are in terms of feet NGVD or referred to the elevations shown for the top (crest) of dam (also given in feet NGVD)

PLAN
HORIZONTAL CREST MOVEMENT
PLAN SCALE: 1" = 100'
MOVEMENT SCALE: 1" = 0.2'



LEGEND

- Initial Elevation (June 1987)
- Elevation as of March/July 1987
- Elevation as of April 1992

ELEVATION
VERTICAL CREST MOVEMENT
SCALE: VERT. 1" = 0.2'
HORZ. 1" = 100'

0 100 200
SCALE IN FEET

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

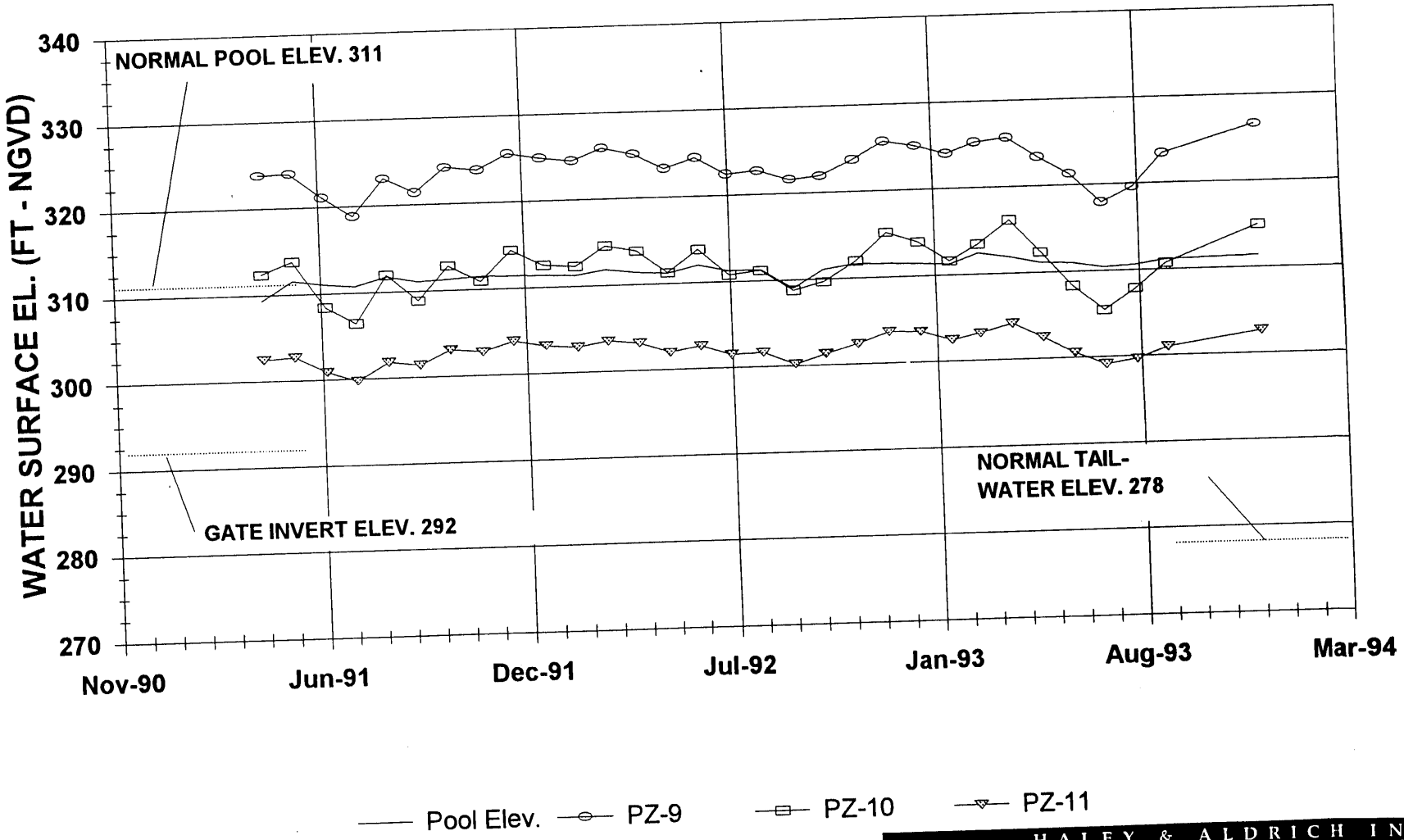
CREST SURVEY MONUMENTS
HORIZONTAL AND VERTICAL MOVEMENT

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B26

FIGURE 21

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-9	368.5	290.5
PZ-10	356.6	296.9
PZ-11	342.3	286.5

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

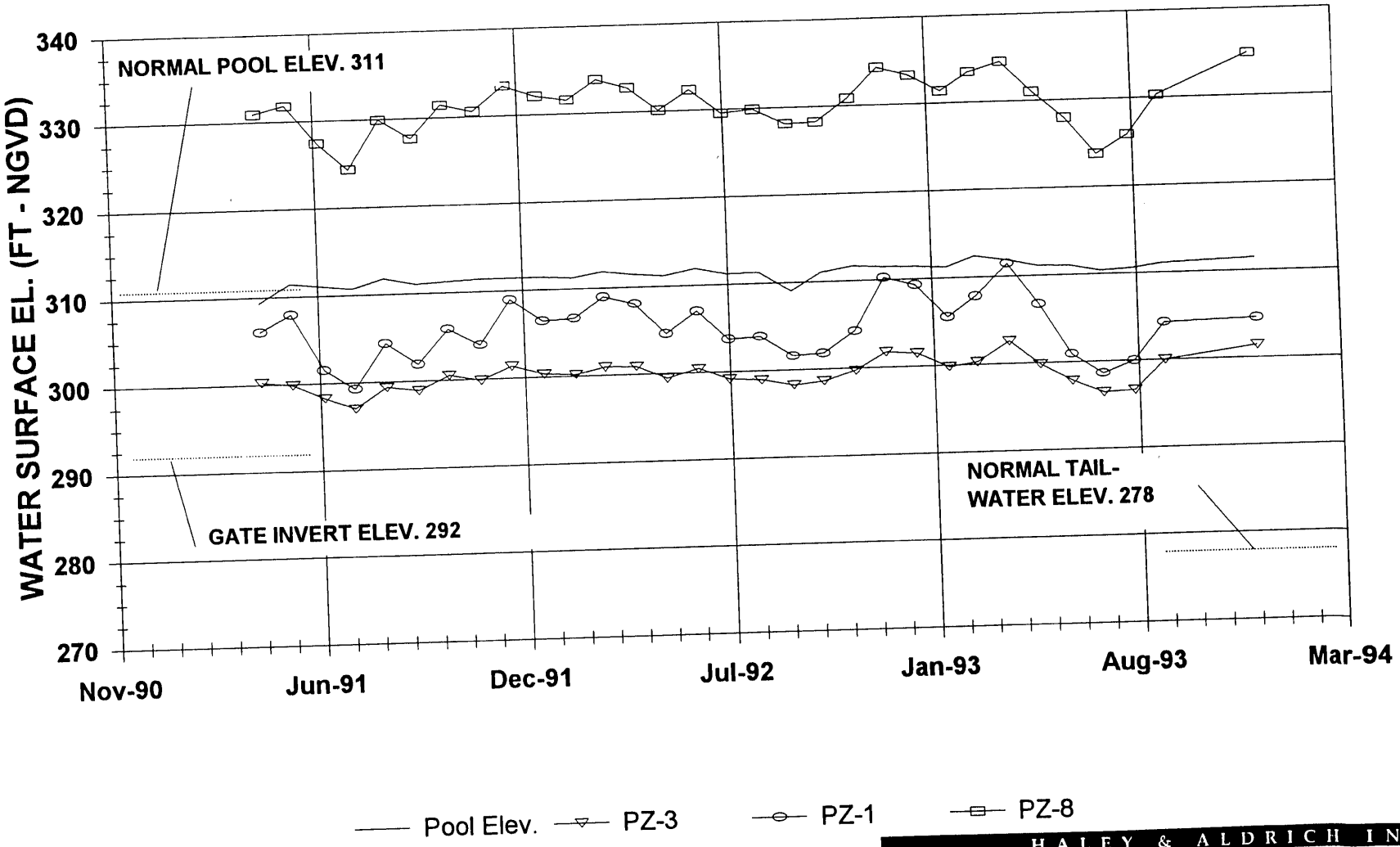
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-9, 10, 11
UPSTREAM SLOPE OF DAM

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 22

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-1	382.6	297.7
PZ-3	383.2	280.3
PZ-8	383.2	284.4

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

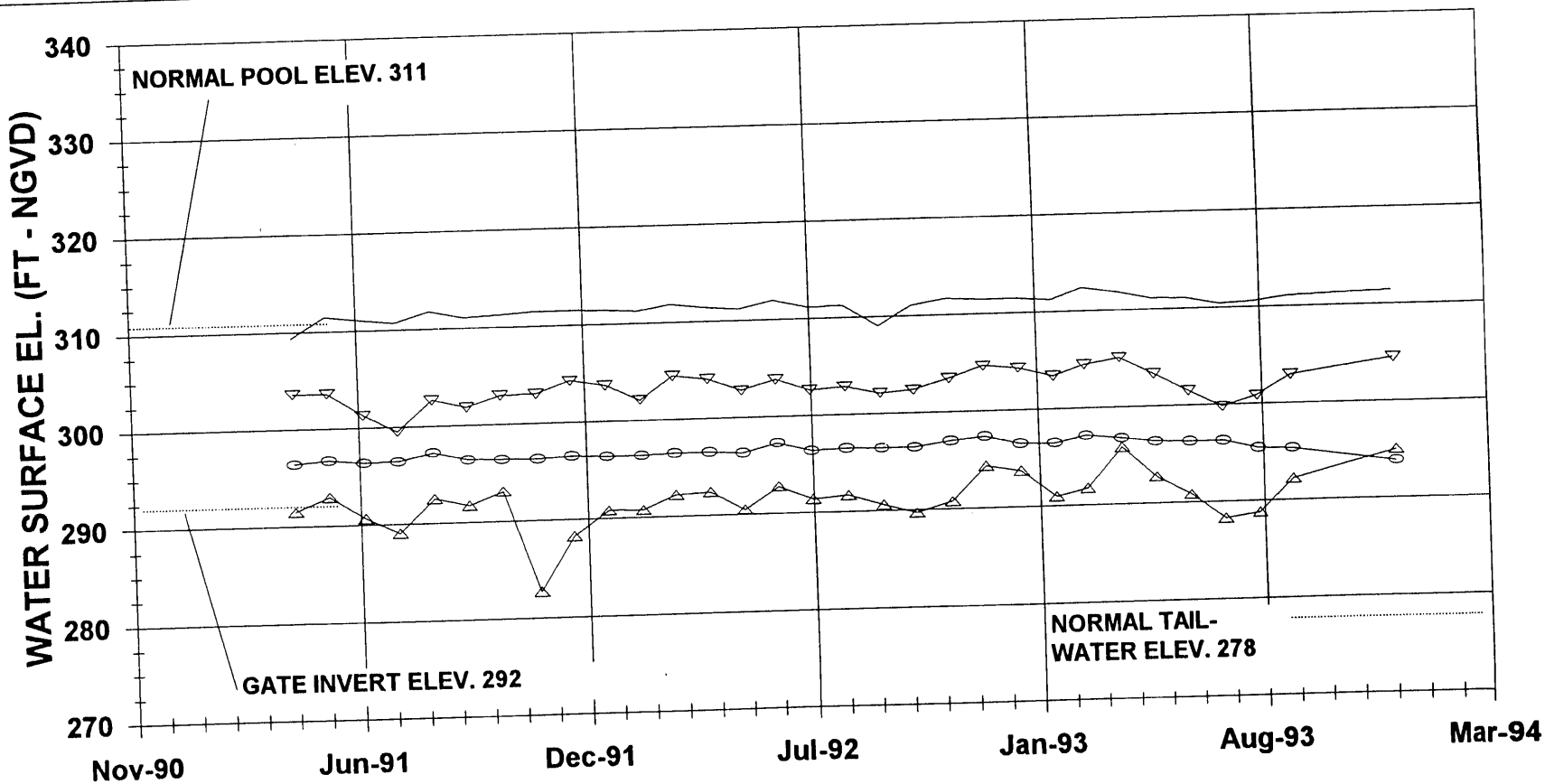
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-3, 1, 8
CENTERLINE OF DAM

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 23

FILE NO. 11163-004



Pool Elev. — PZ-7 — PZ-6 — PZ-13

Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-6	348.2	289.6
PZ-7	349.9	281.3
PZ-13	346.5	279.5

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

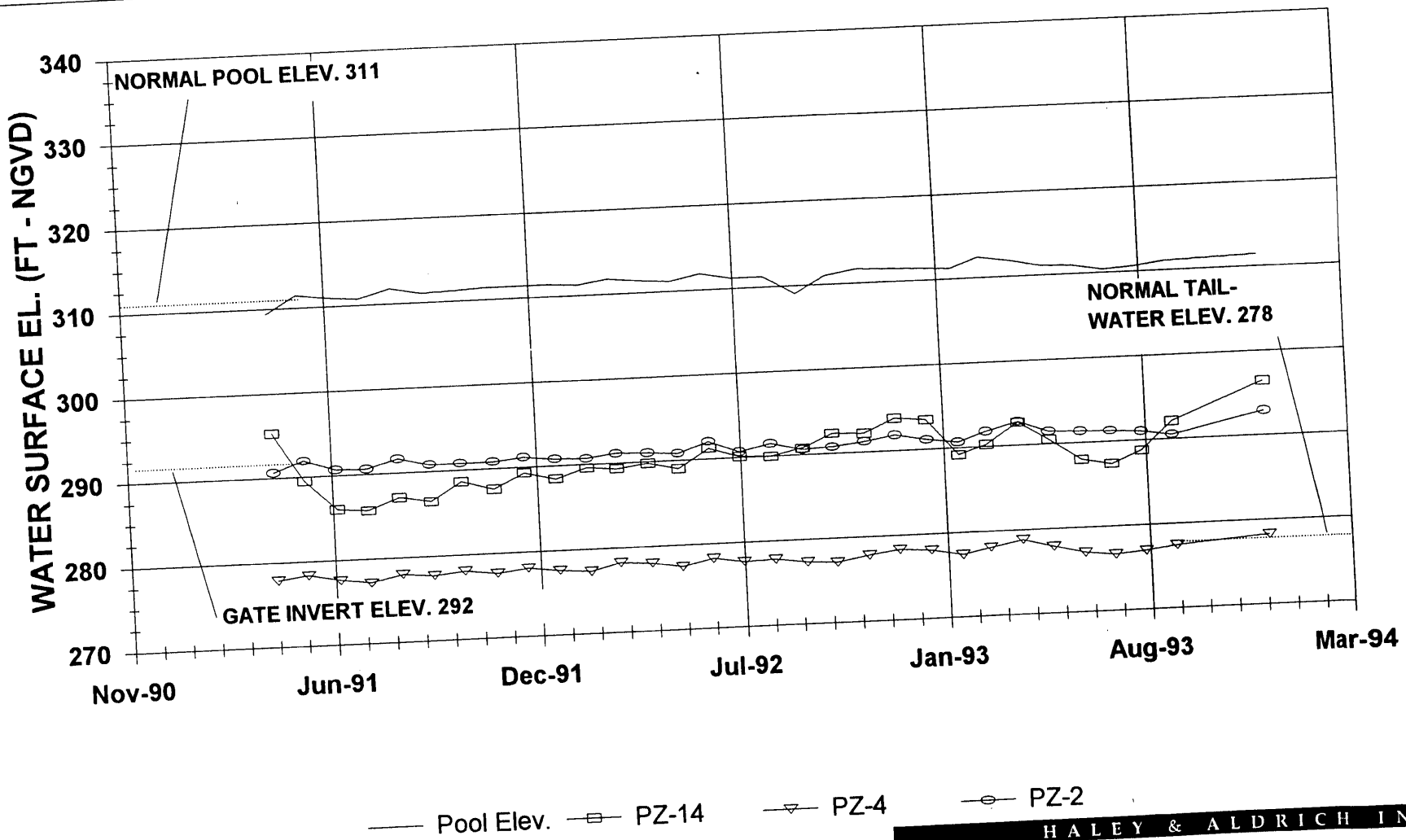
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-7, 6, 13
DOWNSTREAM SLOPE OF DAM

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 24

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-2	318.0	283.9
PZ-4	289.3	271.5
PZ-14	324.6	272.6

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

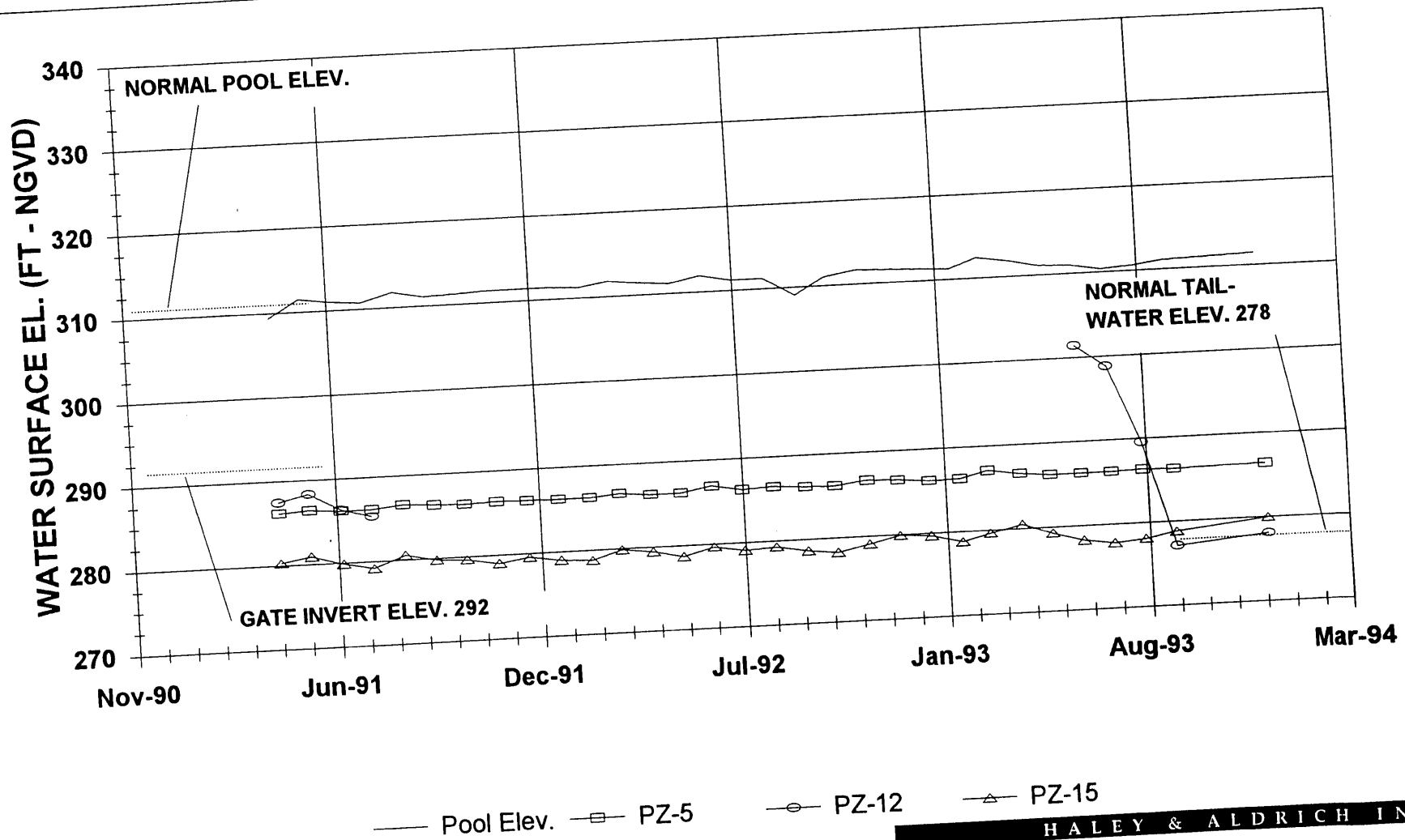
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-14, 4, 2
DOWNSTREAM TOE OF DAM

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 25

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-5	306.6	285.3
PZ-12	315.3	274.7
PZ-15	306.6	273.0

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

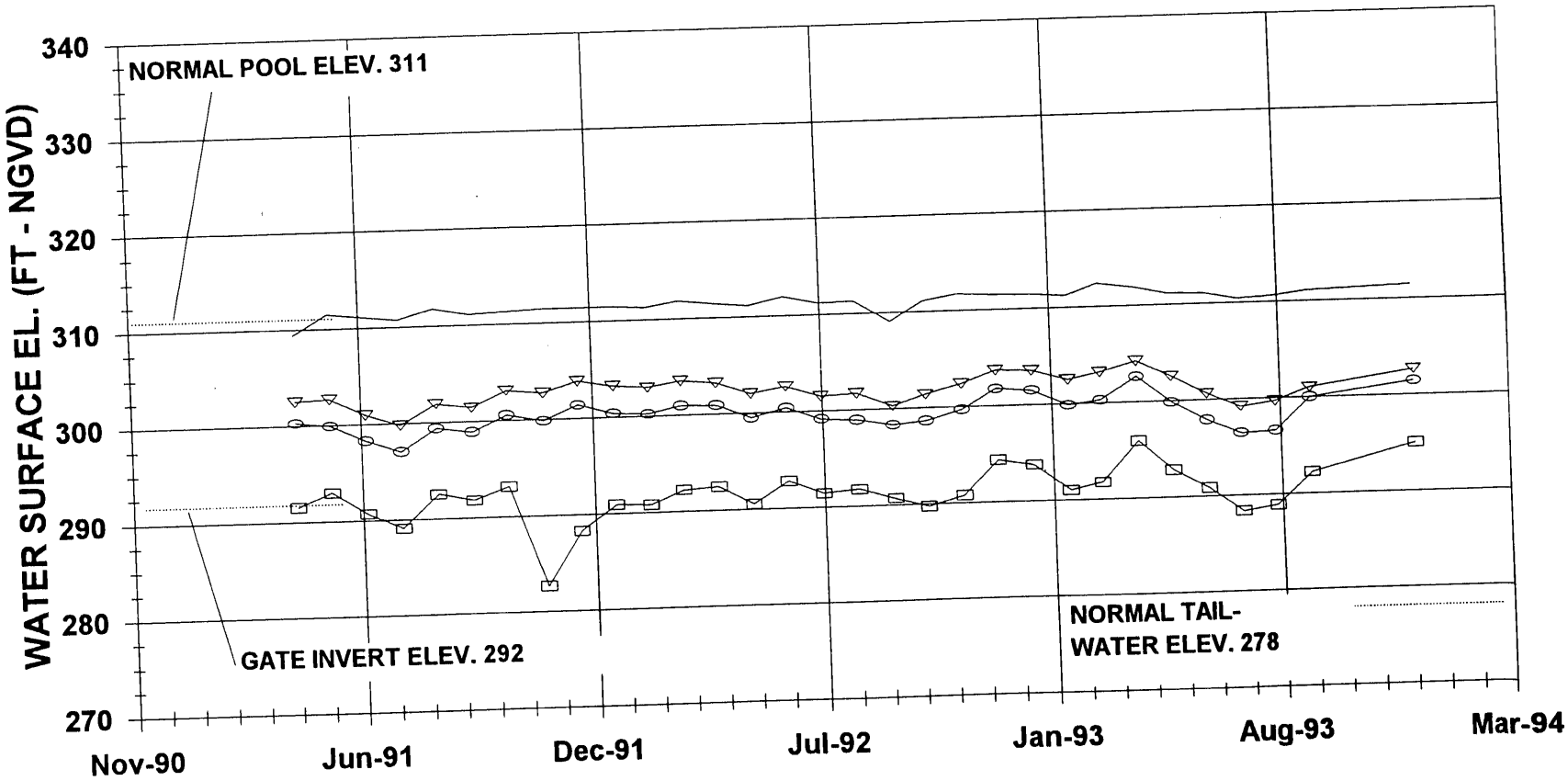
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-5, 12, 15
DOWNSTREAM TOE OF DAM

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 26

FILE NO. 11163-004



Pool Elev. — PZ-11 — PZ-3 — PZ-7

Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-3	383.2	280.3
PZ-7	349.9	281.3
PZ-11	342.3	286.5

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

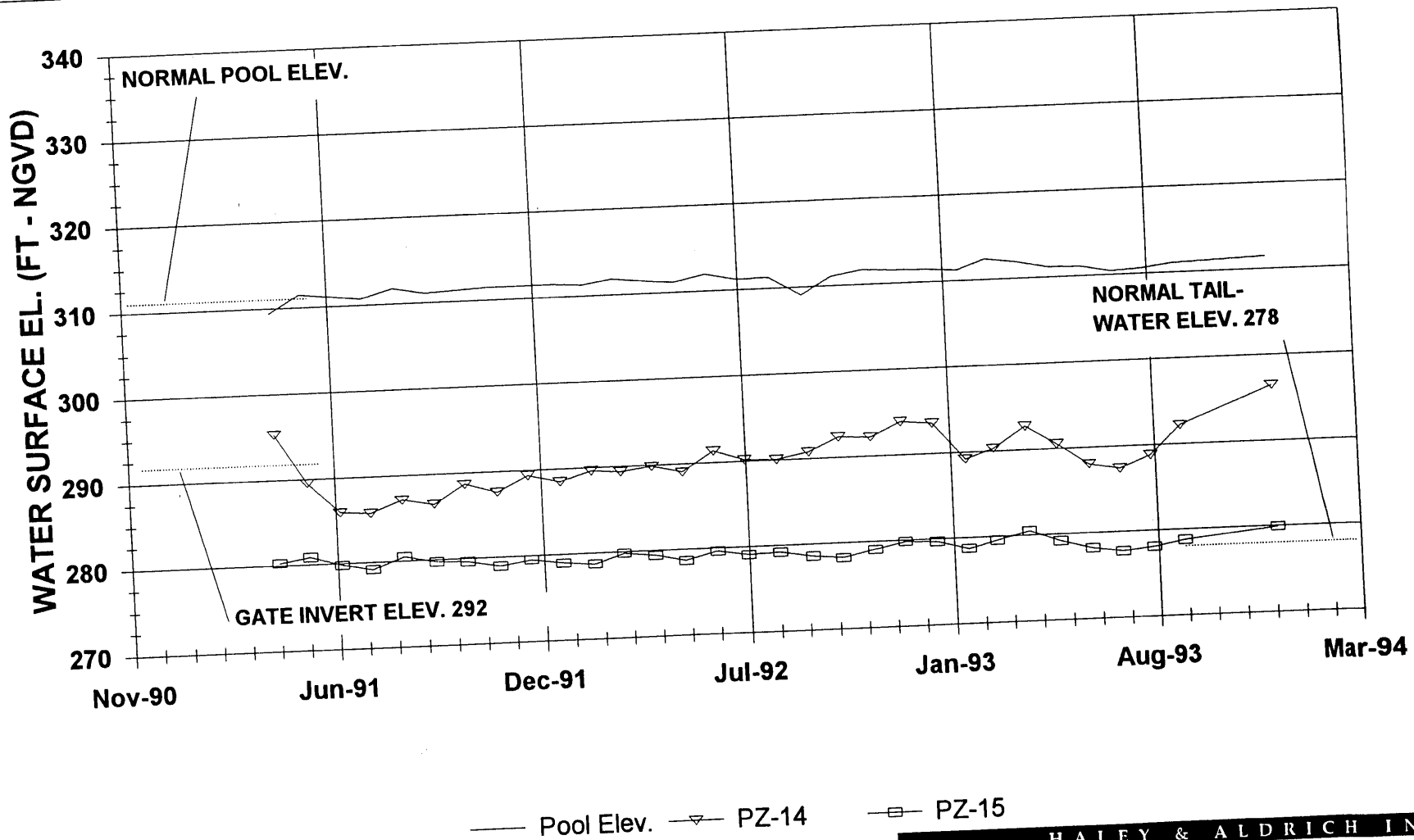
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-11, 3, 7
STATION 3+80

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 27

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-14	324.6	272.6
PZ-15	306.6	273.0

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

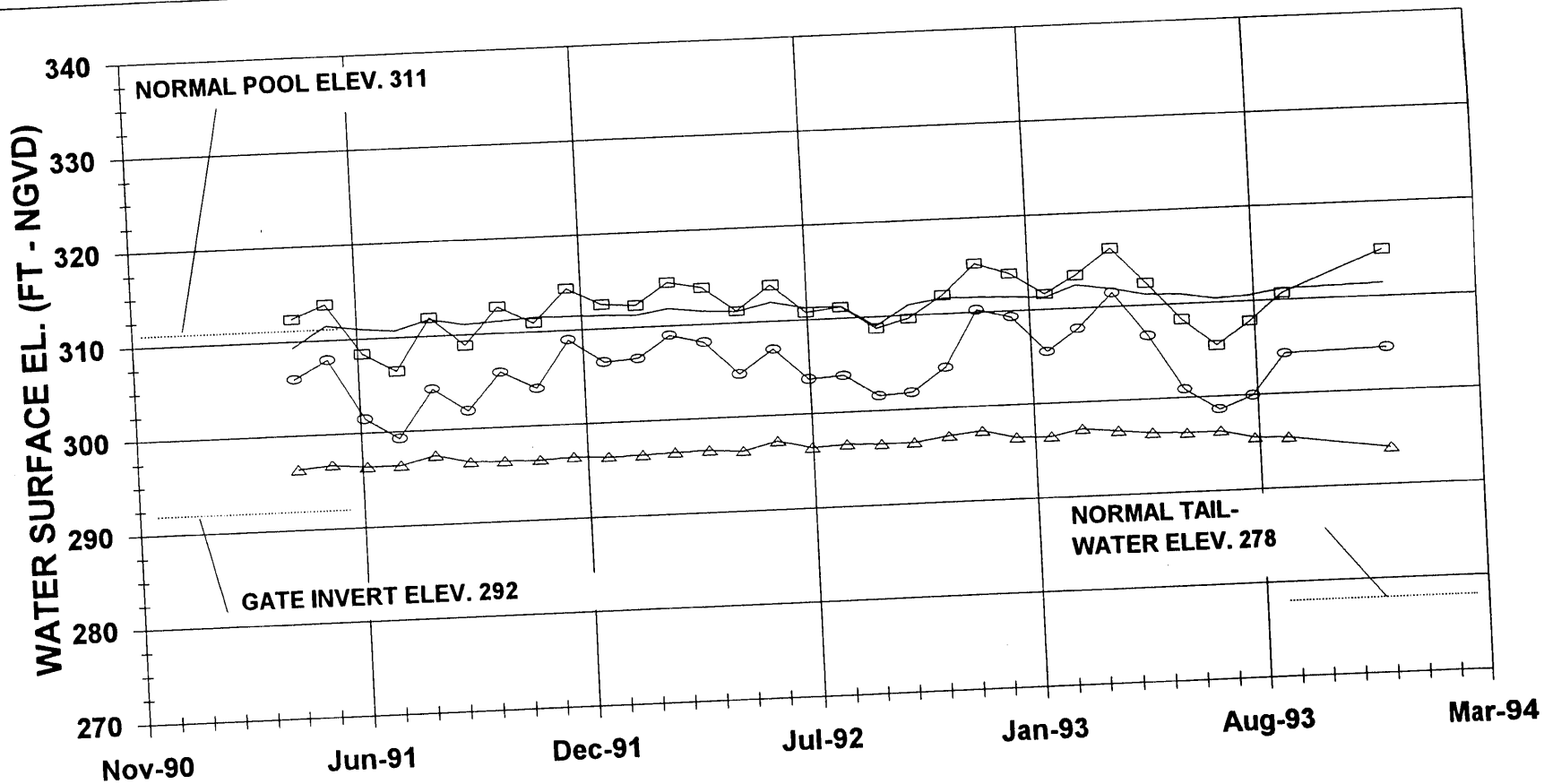
PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-14, 15
STATION 3+80

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 28

FILE NO. 11163-004



Pool Elev. — PZ-10 — PZ-1 — PZ-6

Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-1	382.6	297.7
PZ-6	348.2	289.6
PZ-10	356.6	296.9

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-10, 1, 6
STATION 4+60

SCALE: AS SHOWN

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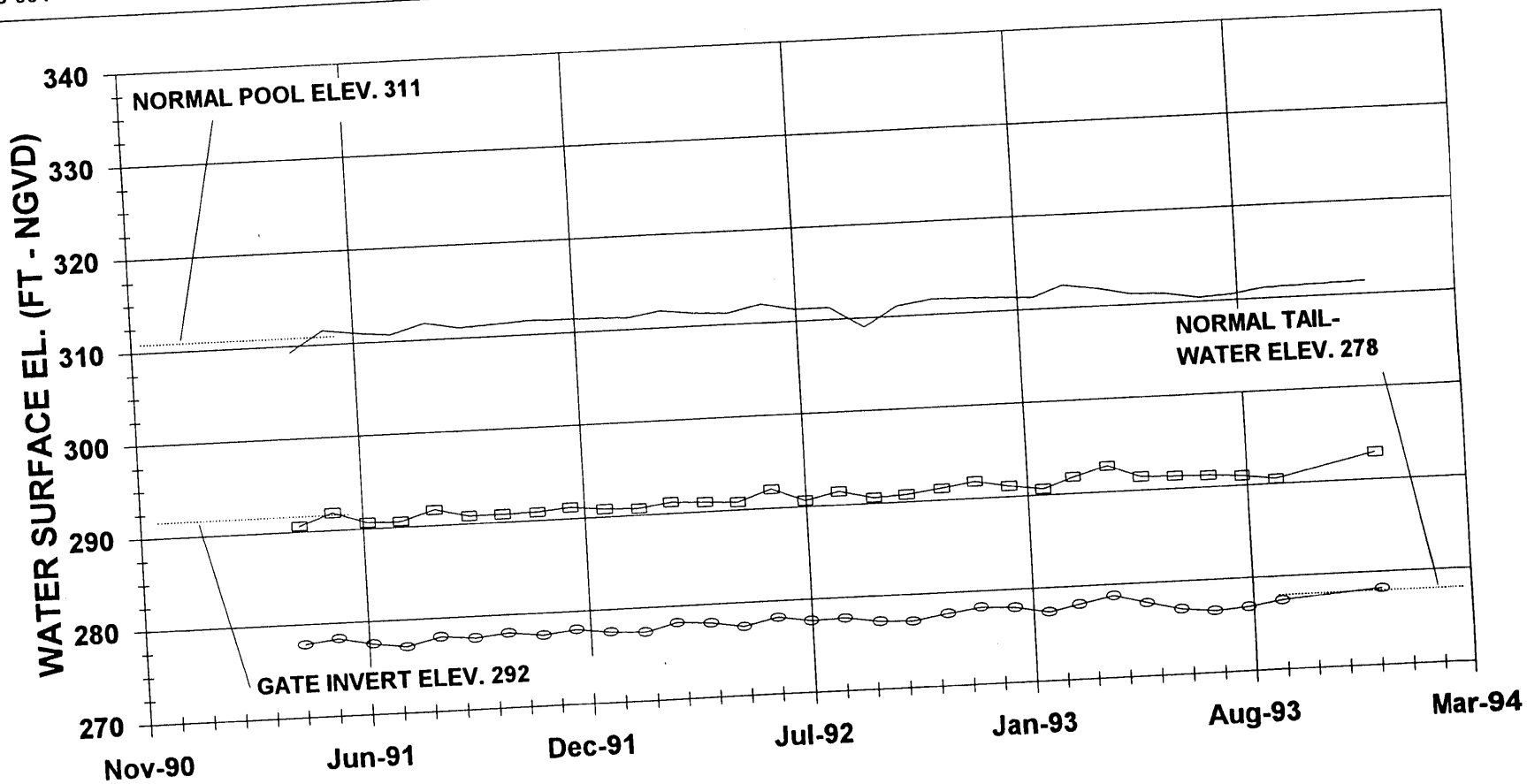
FIGURE 29

FILE NO. 11163-004



Pool Elev. PZ-2 PZ-4

Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-2	318.0	283.9
PZ-4	289.3	271.5

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-2, 4
STATION 4+60

SCALE: AS SHOWN

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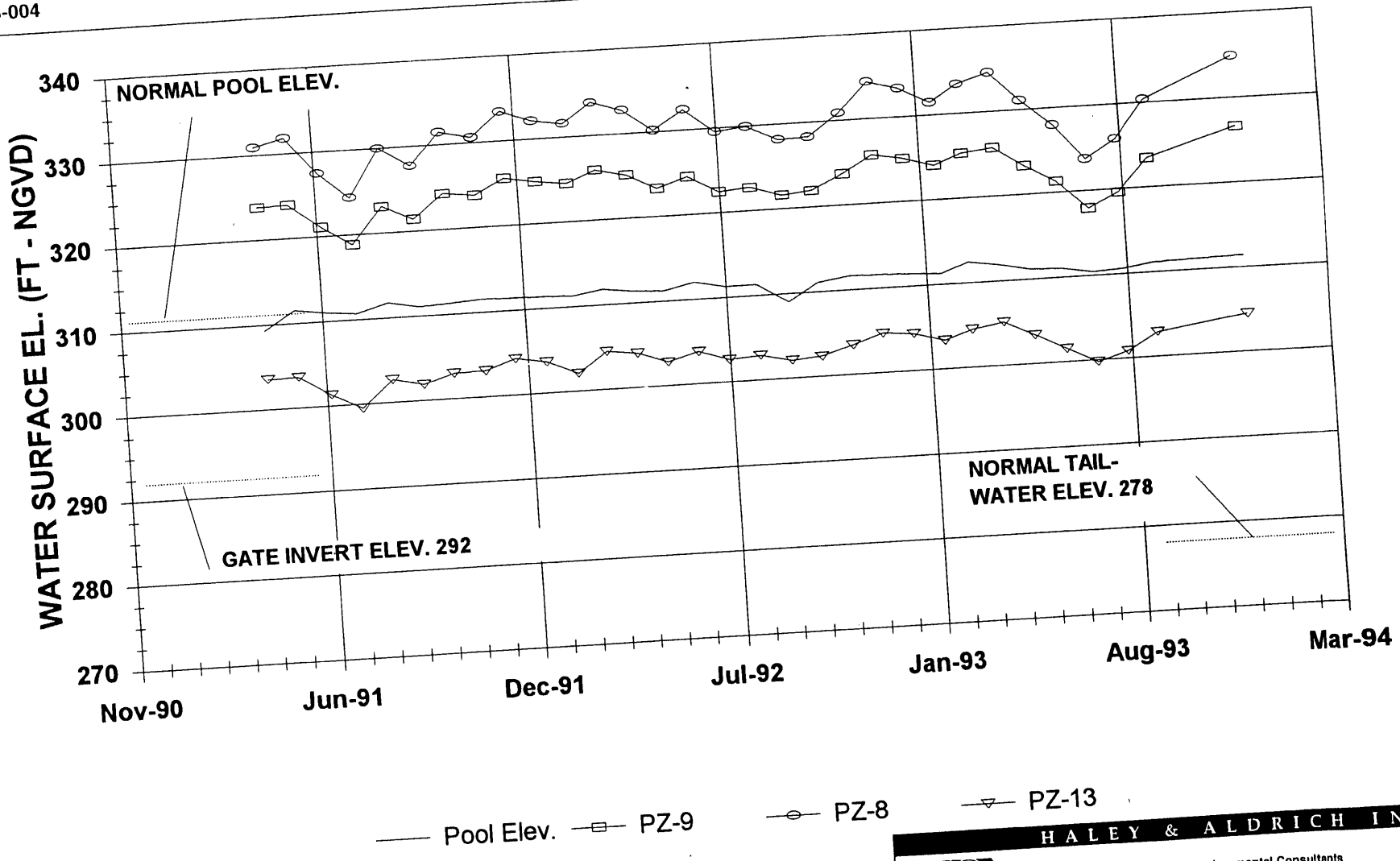
FIGURE 30

FILE NO. 11163-004



Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-8	383.2	284.4
PZ-9	368.5	290.5
PZ-13	346.5	279.5

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-9, 8, 13
STATION 5+20

SCALE: AS SHOWN

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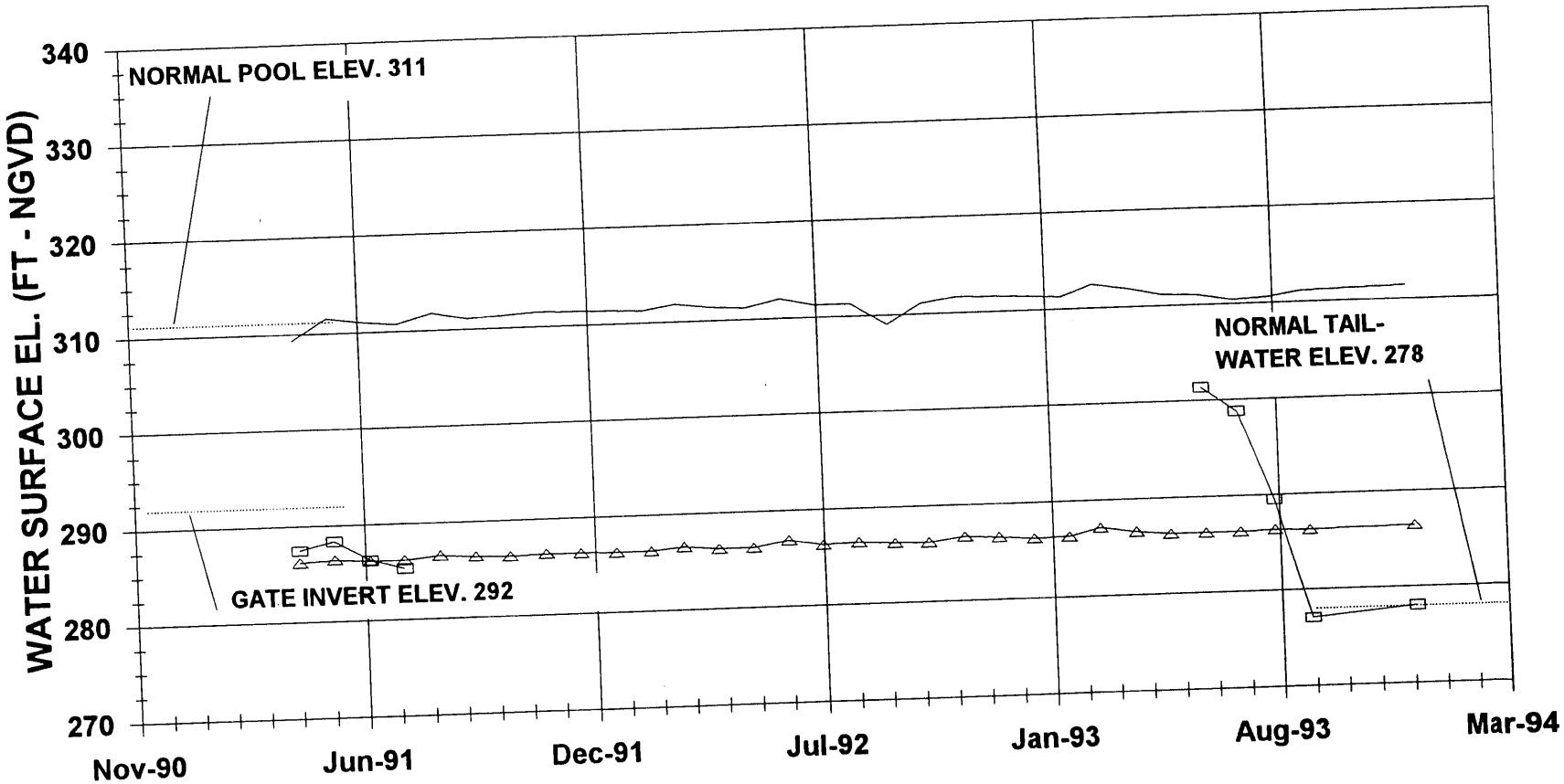
FIGURE 31

FILE NO. 11163-004



Pool Elev. PZ-12 PZ-5

Piezometer No.	Riser Pipe Elevation (ft. NGVD)	Tip Elevation (ft. NGVD)
PZ-5	306.6	285.3
PZ-12	315.3	274.7

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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER DATA 1991 - 1993
TIME HISTORY PLOTS PZ-12, 5
STATION 5+20

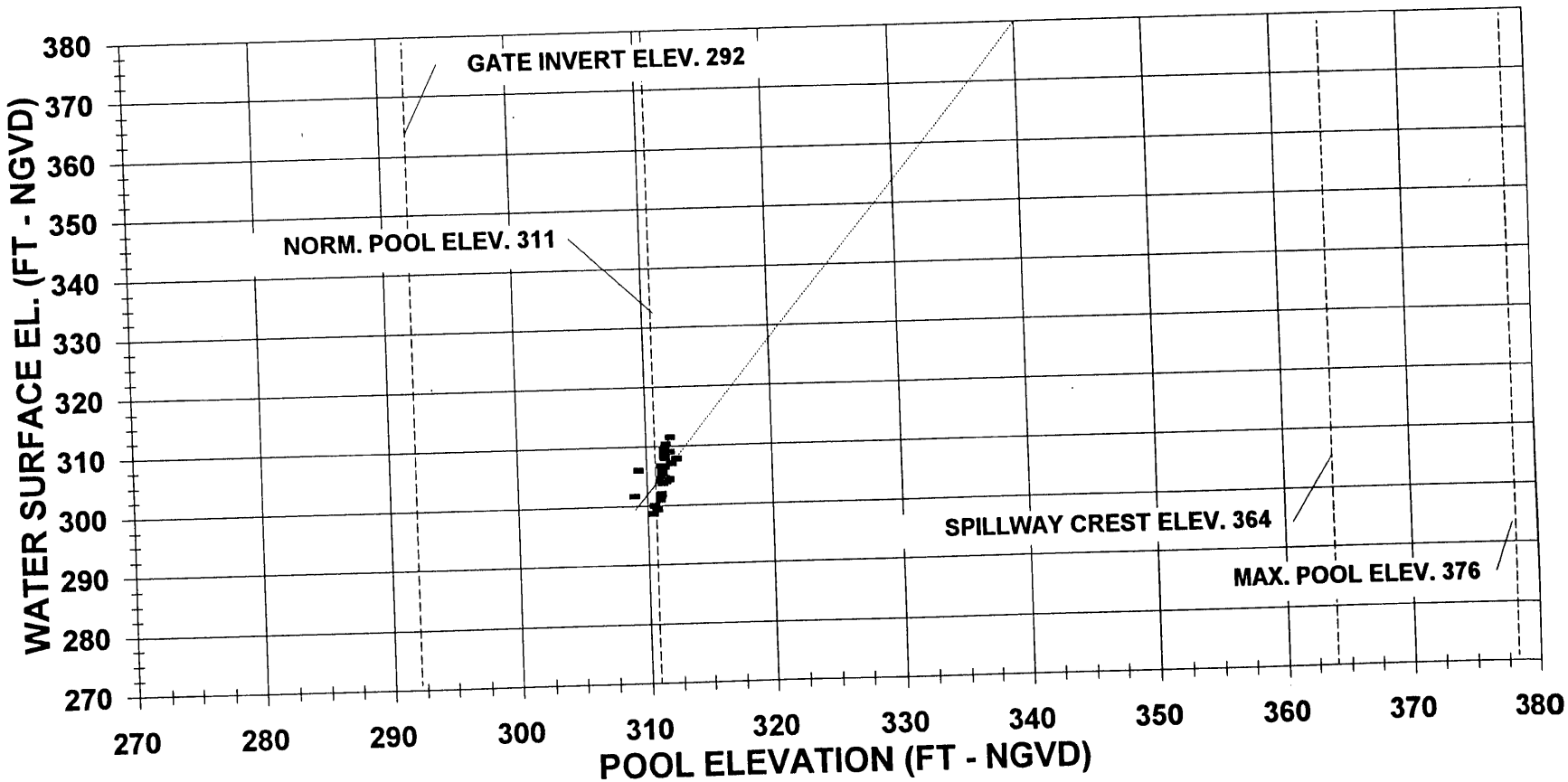
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 32

FILE NO. 11163-004

PZ - 1



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

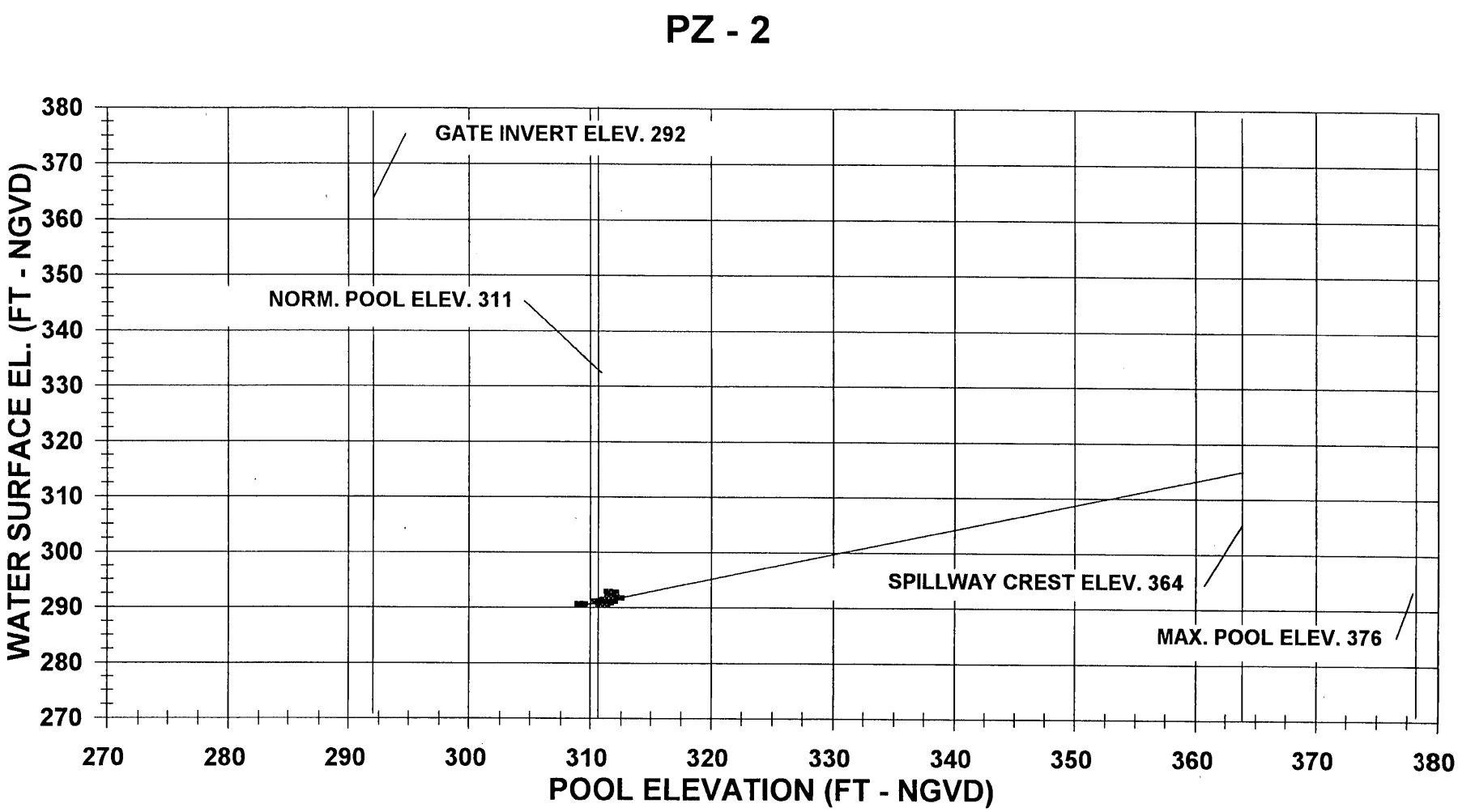
PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-1

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 33

FILE NO. 11163-004



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-2

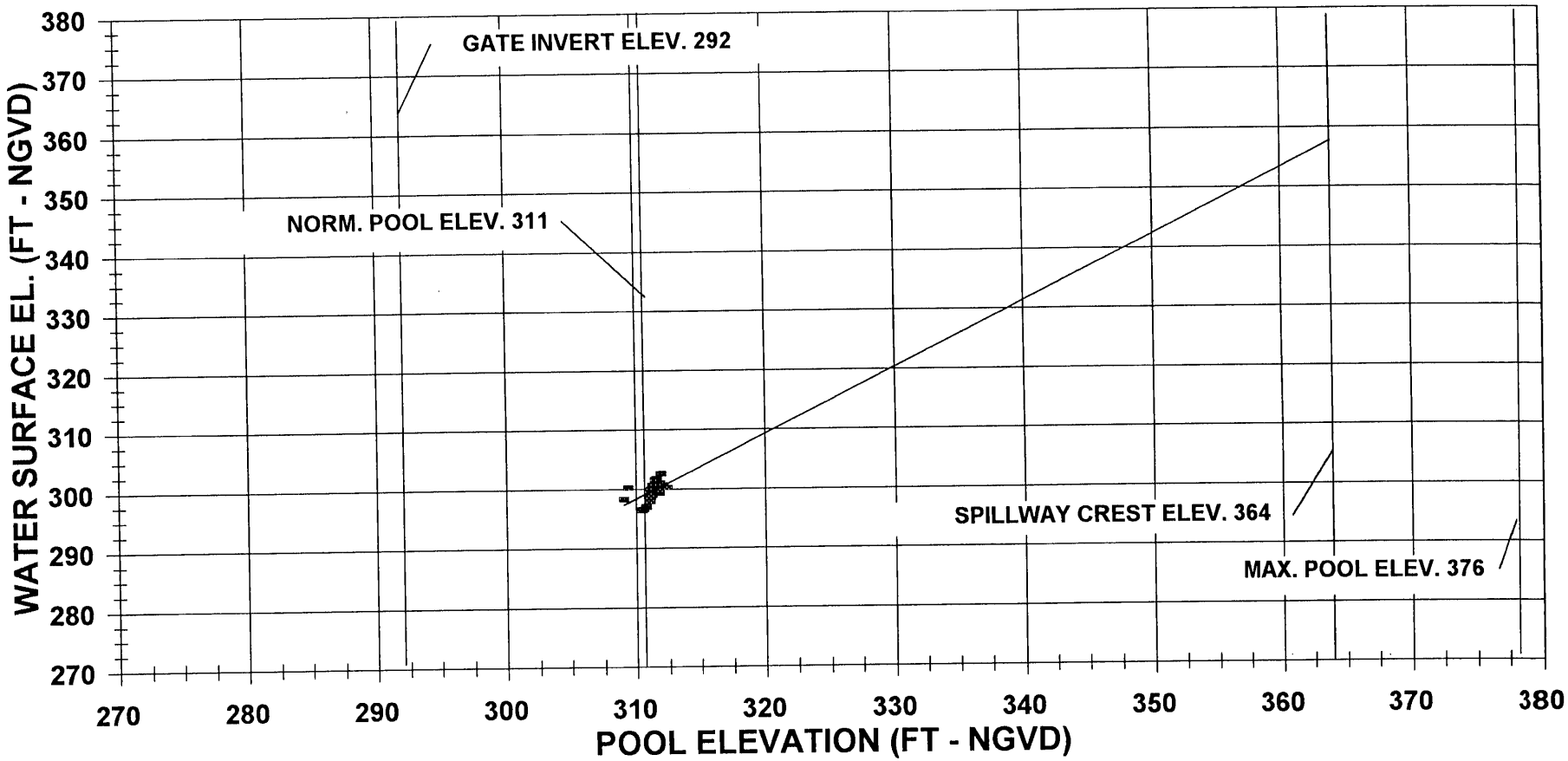
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 34

FILE NO. 11163-004

PZ - 3



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-3

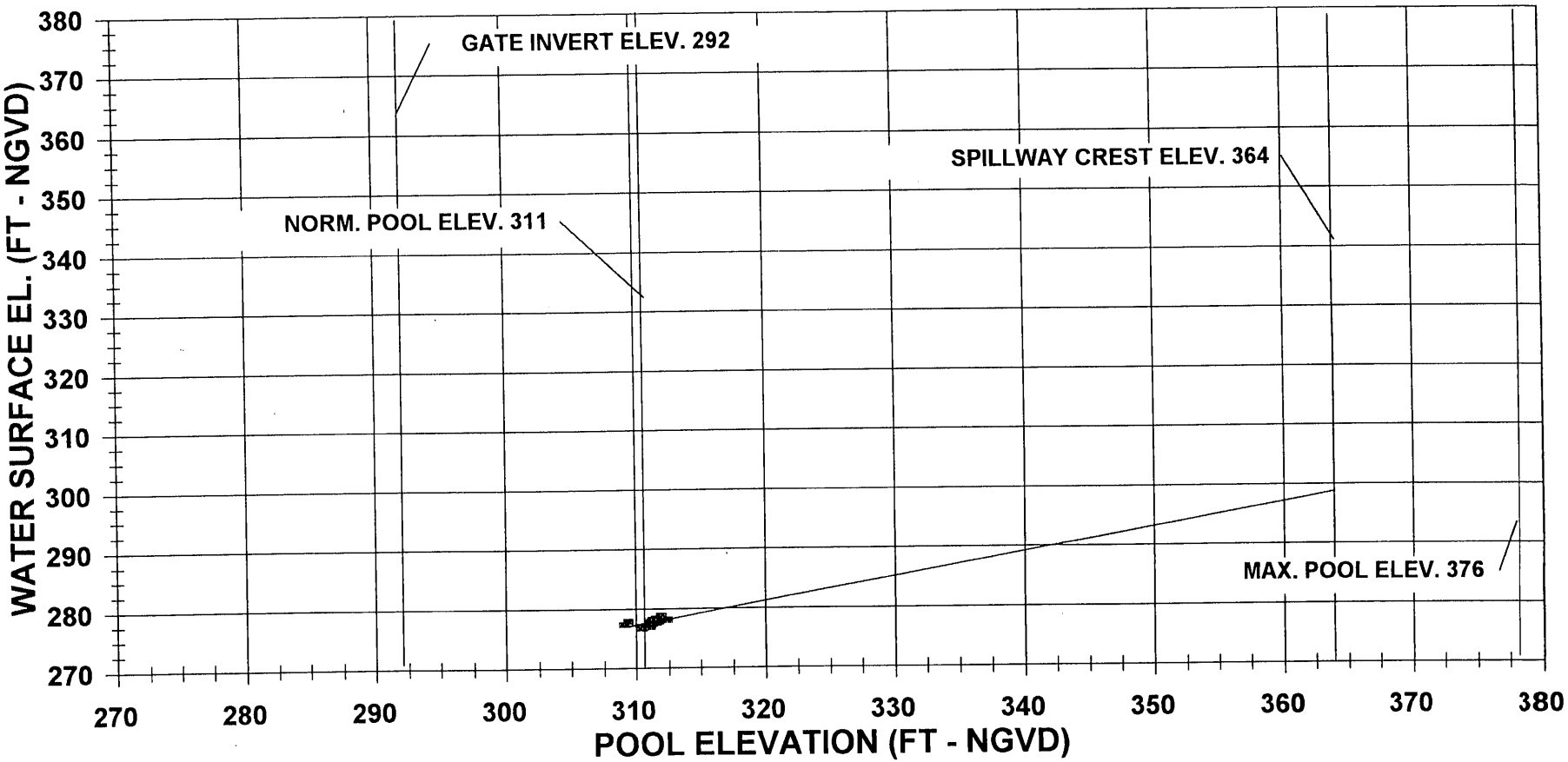
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 35

FILE NO. 11163-004

PZ - 4



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-4

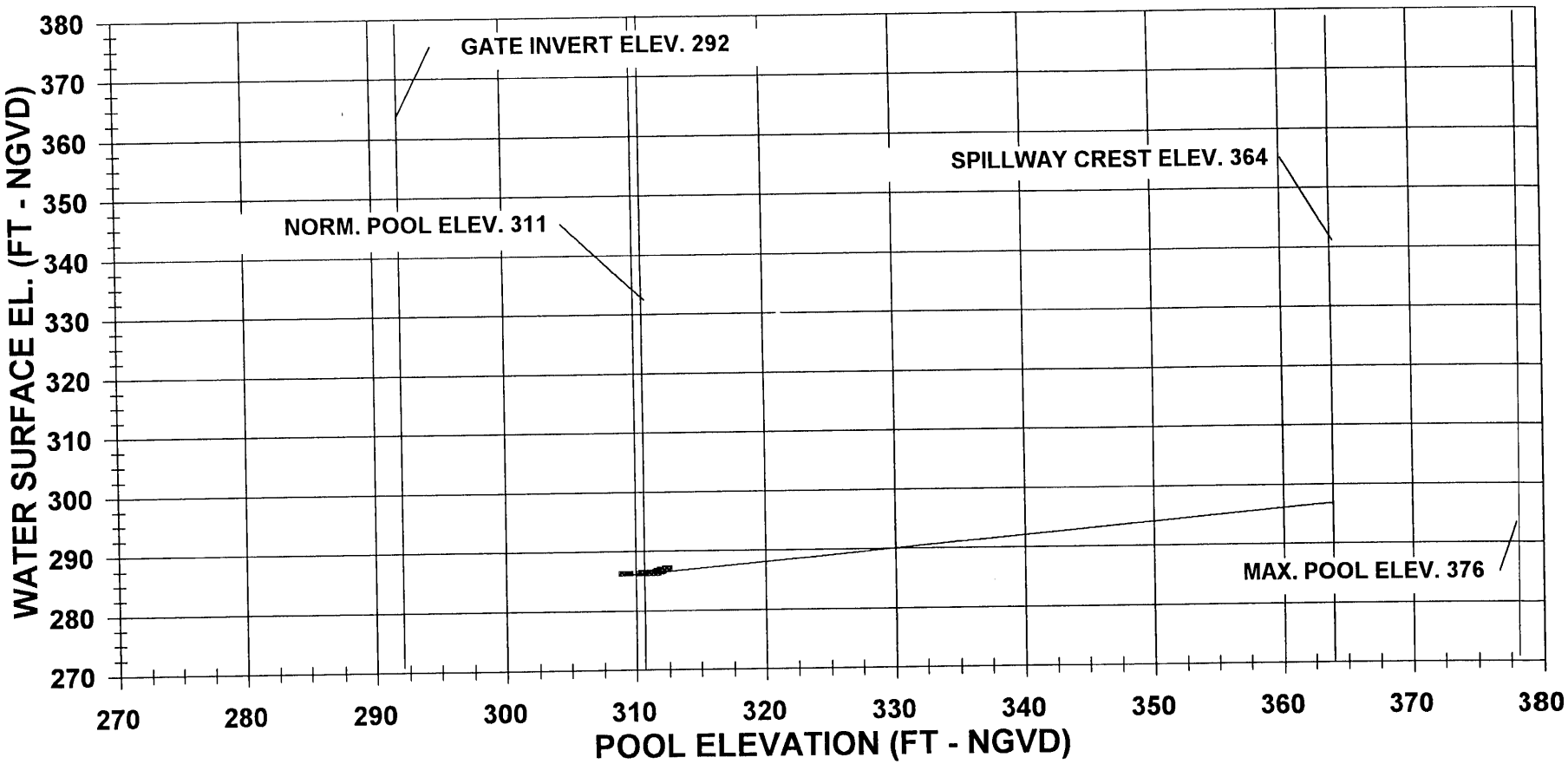
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 36

FILE NO. 11163-004

PZ - 5



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-5

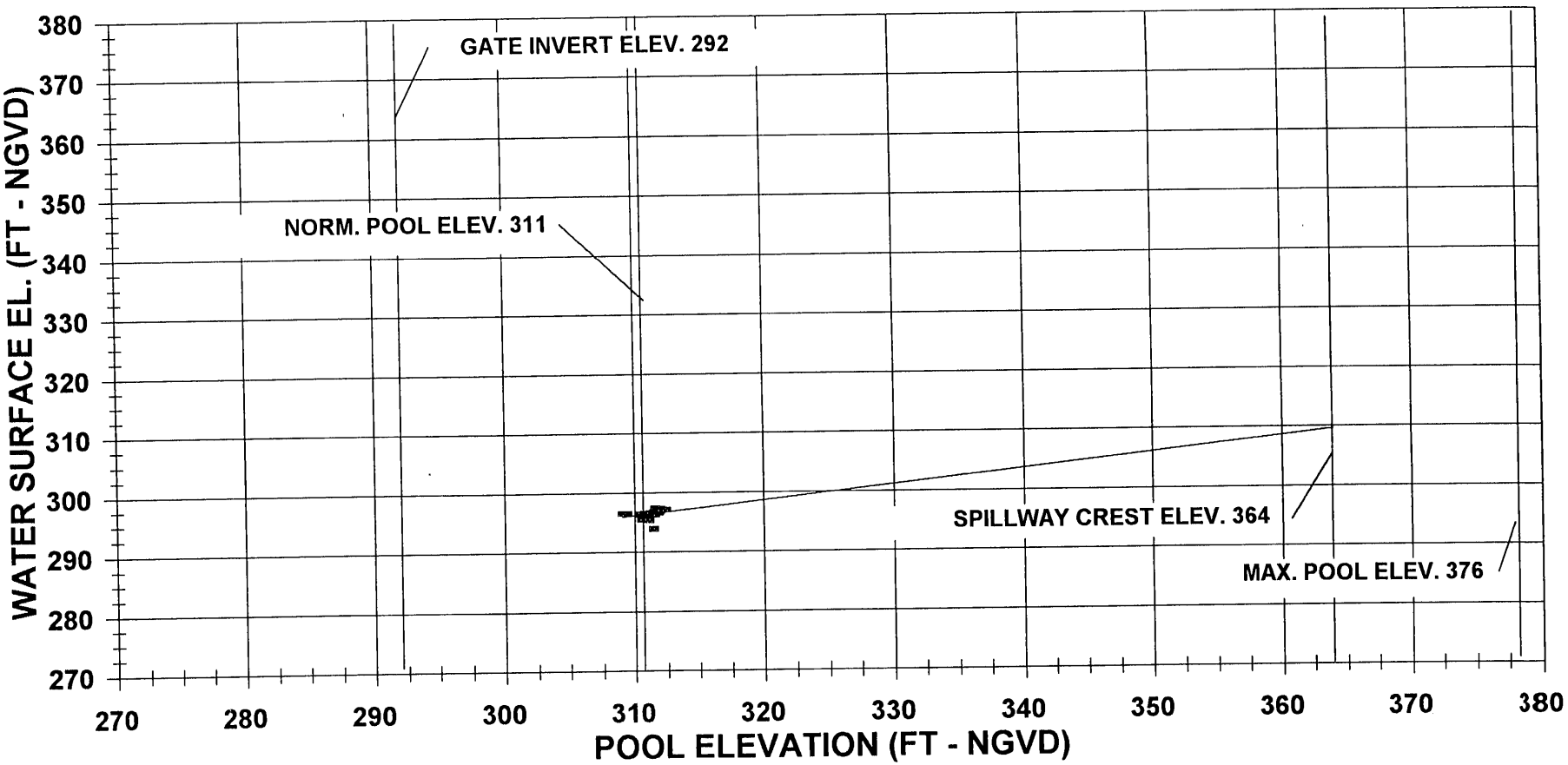
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 37

FILE NO. 11163-004

PZ - 6



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

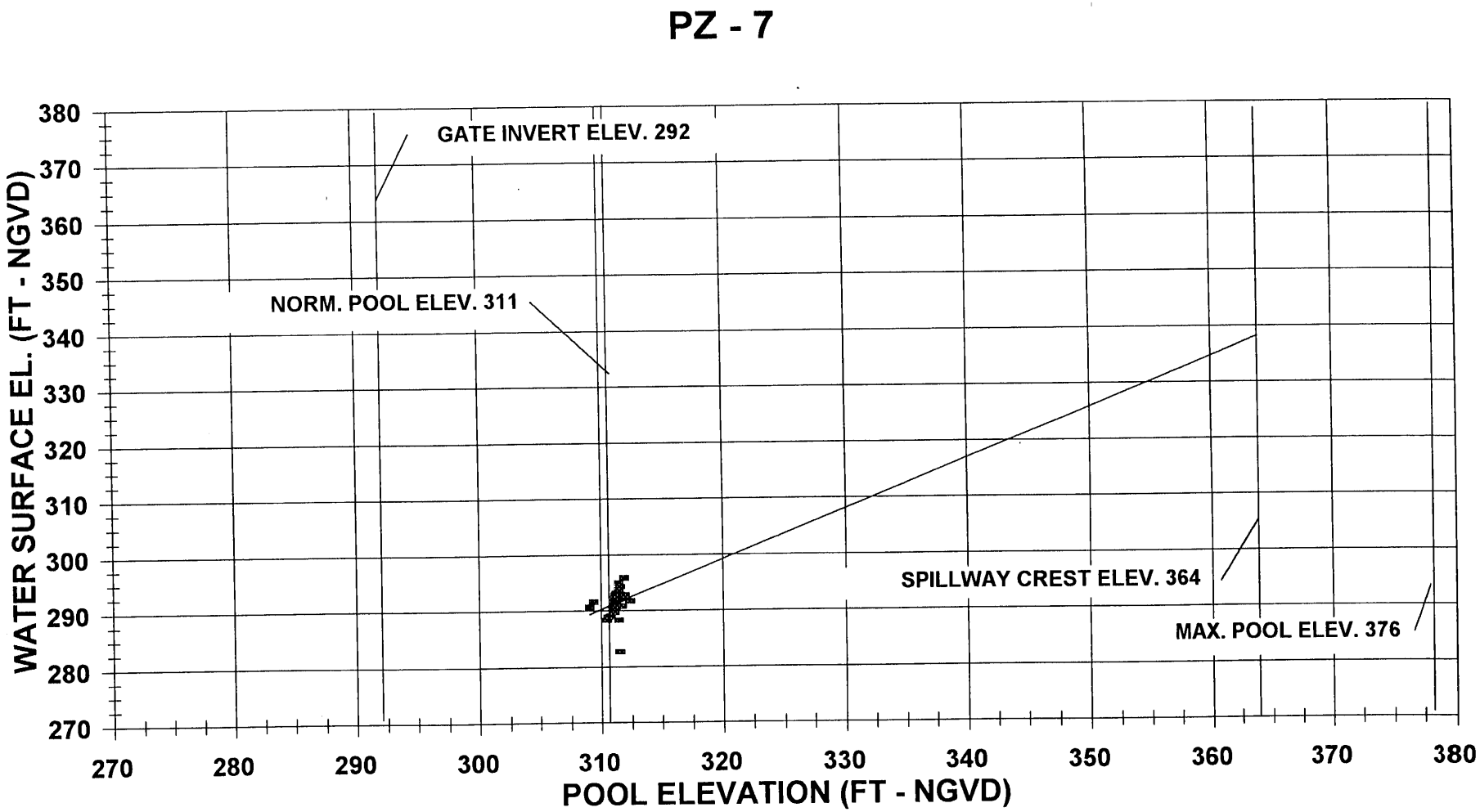
PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-6

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 38

FILE NO. 11163-004



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Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-7

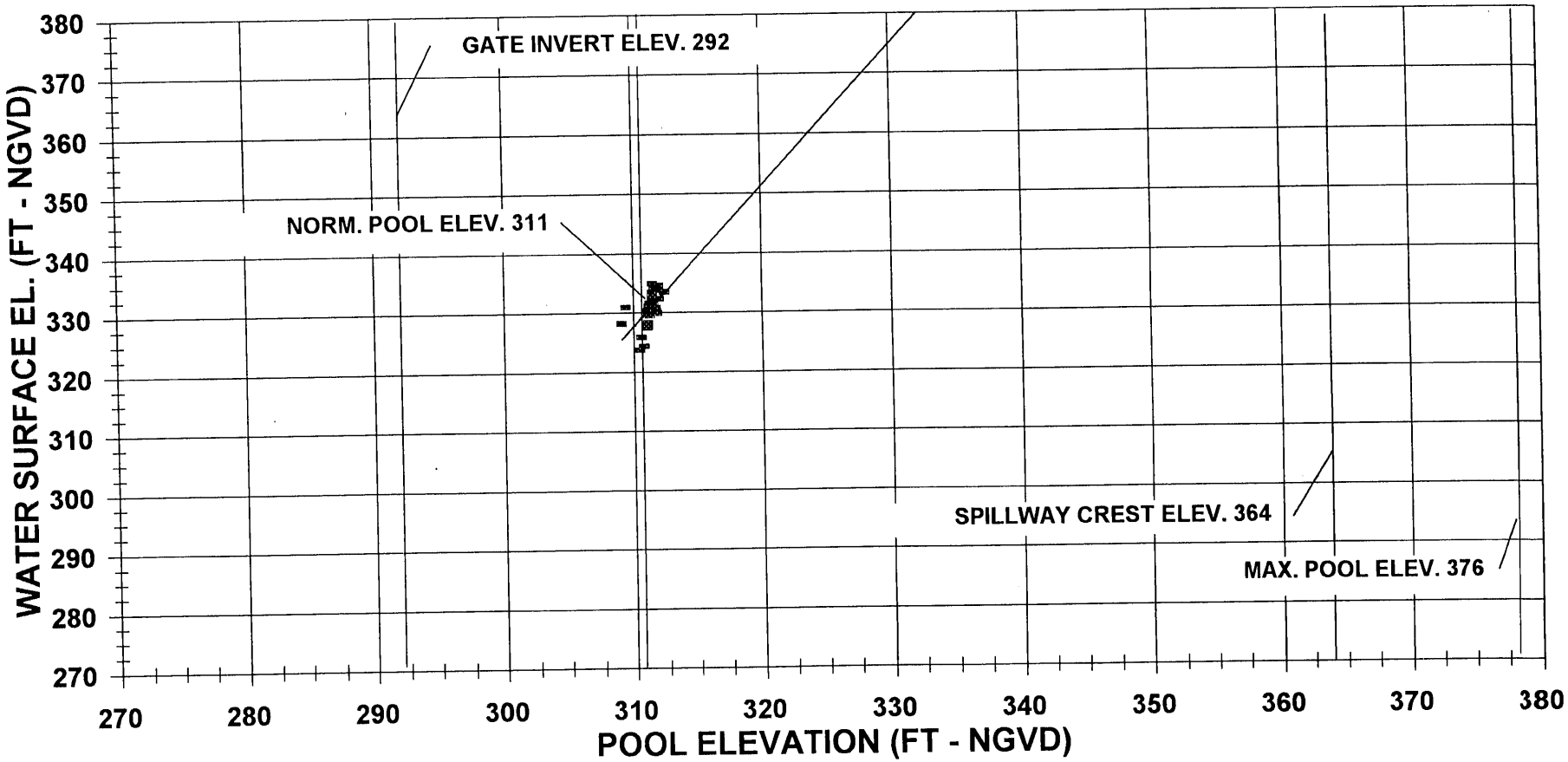
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 39

FILE NO. 11163-004

PZ - 8



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Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-8

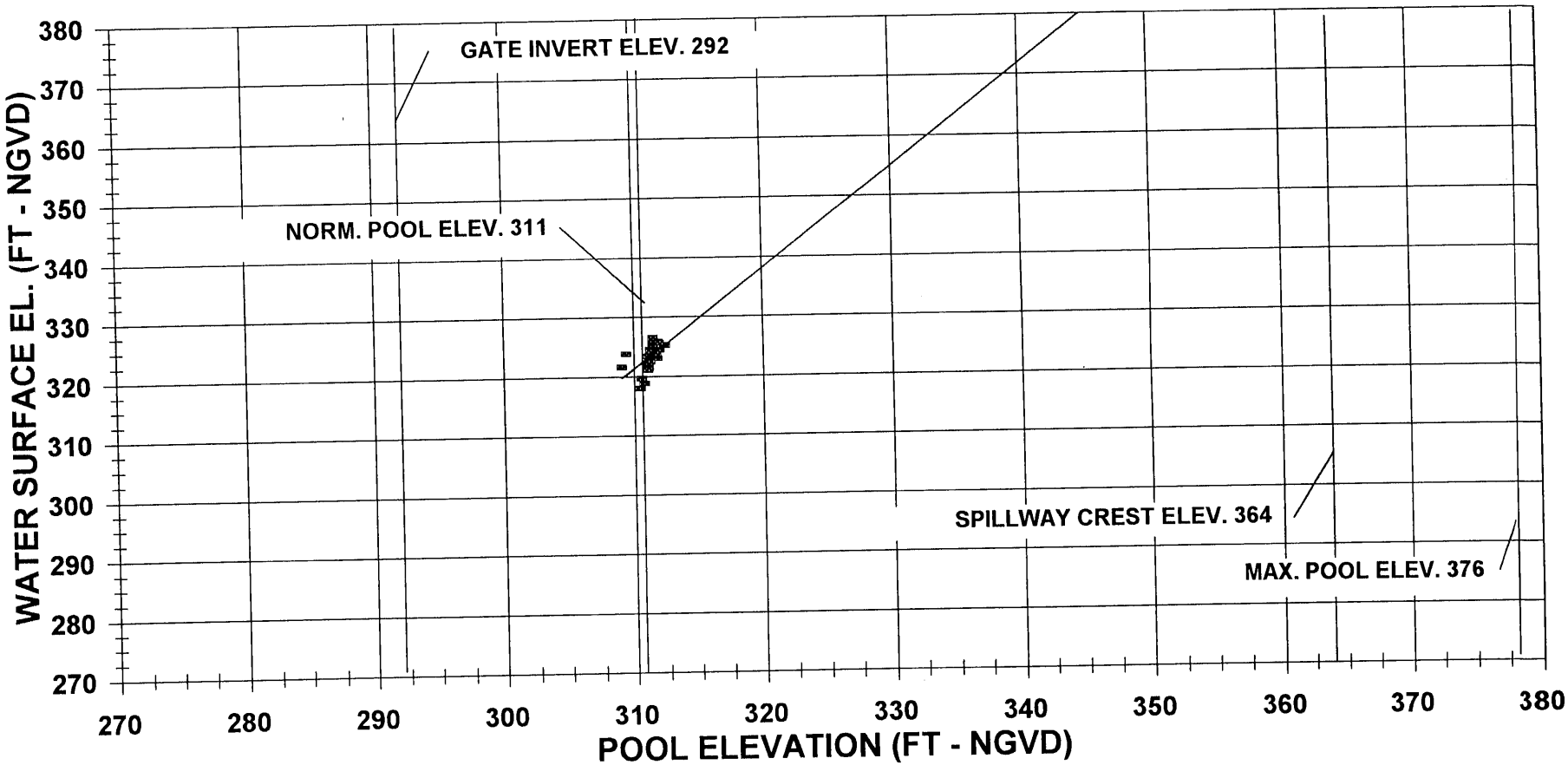
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 40

FILE NO. 11163-004

PZ - 9



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Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-9

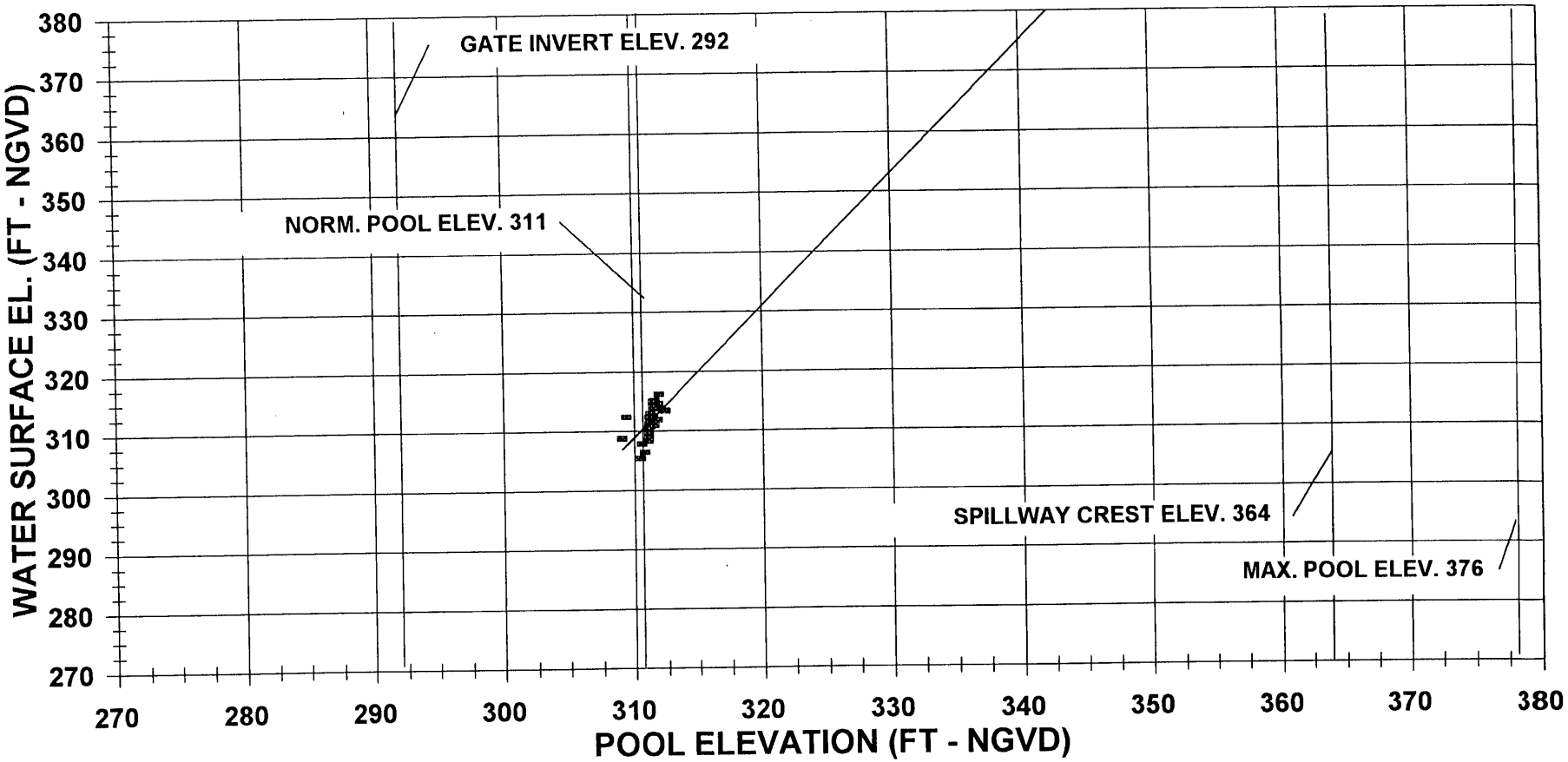
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 41

FILE NO. 11163-004

PZ - 10



HALEY & ALDRICH INC.

Geotechnical Engineers & Environmental Consultants

HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-10

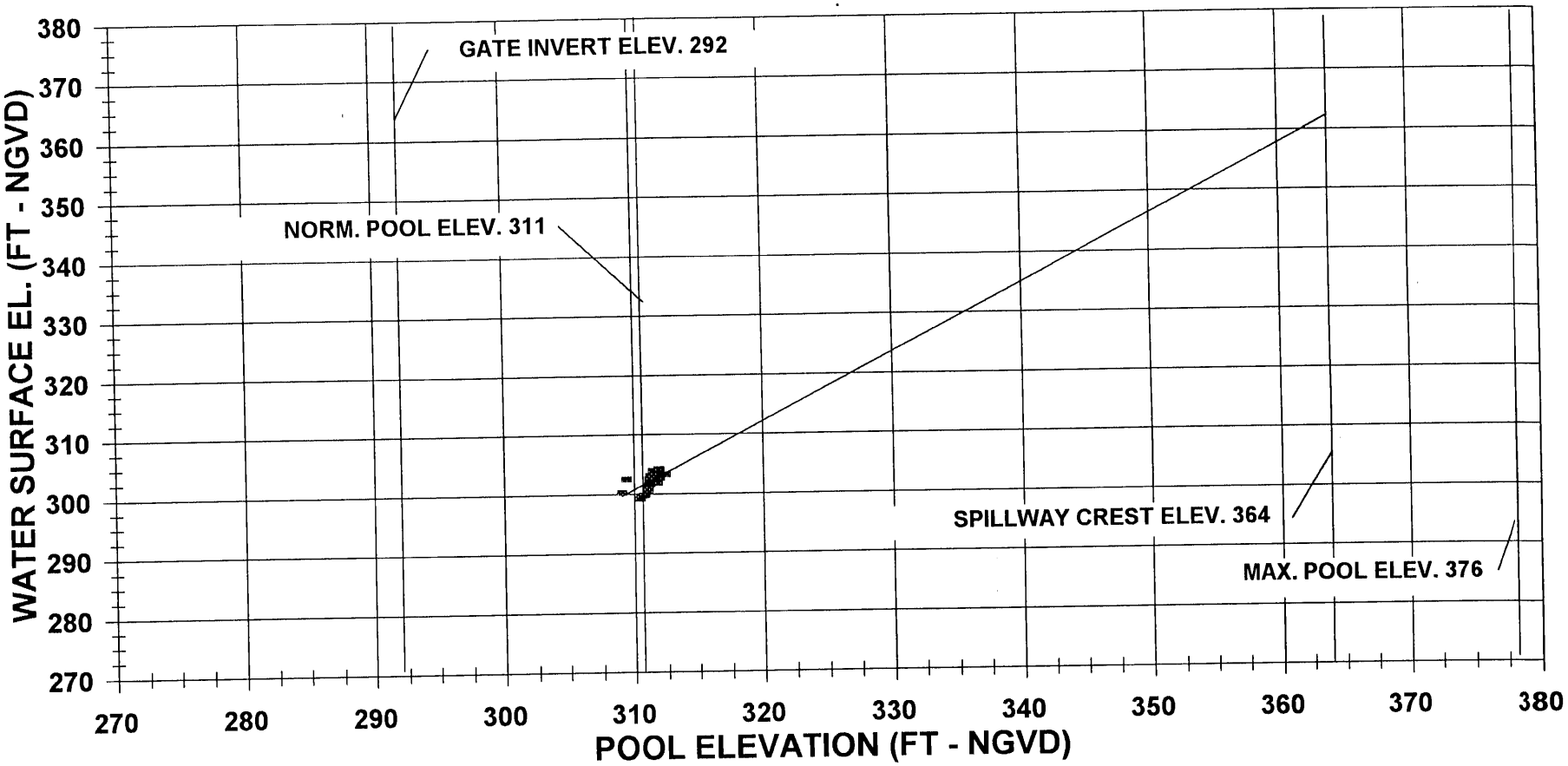
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 42

FILE NO. 11163-004

PZ - 11



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-11

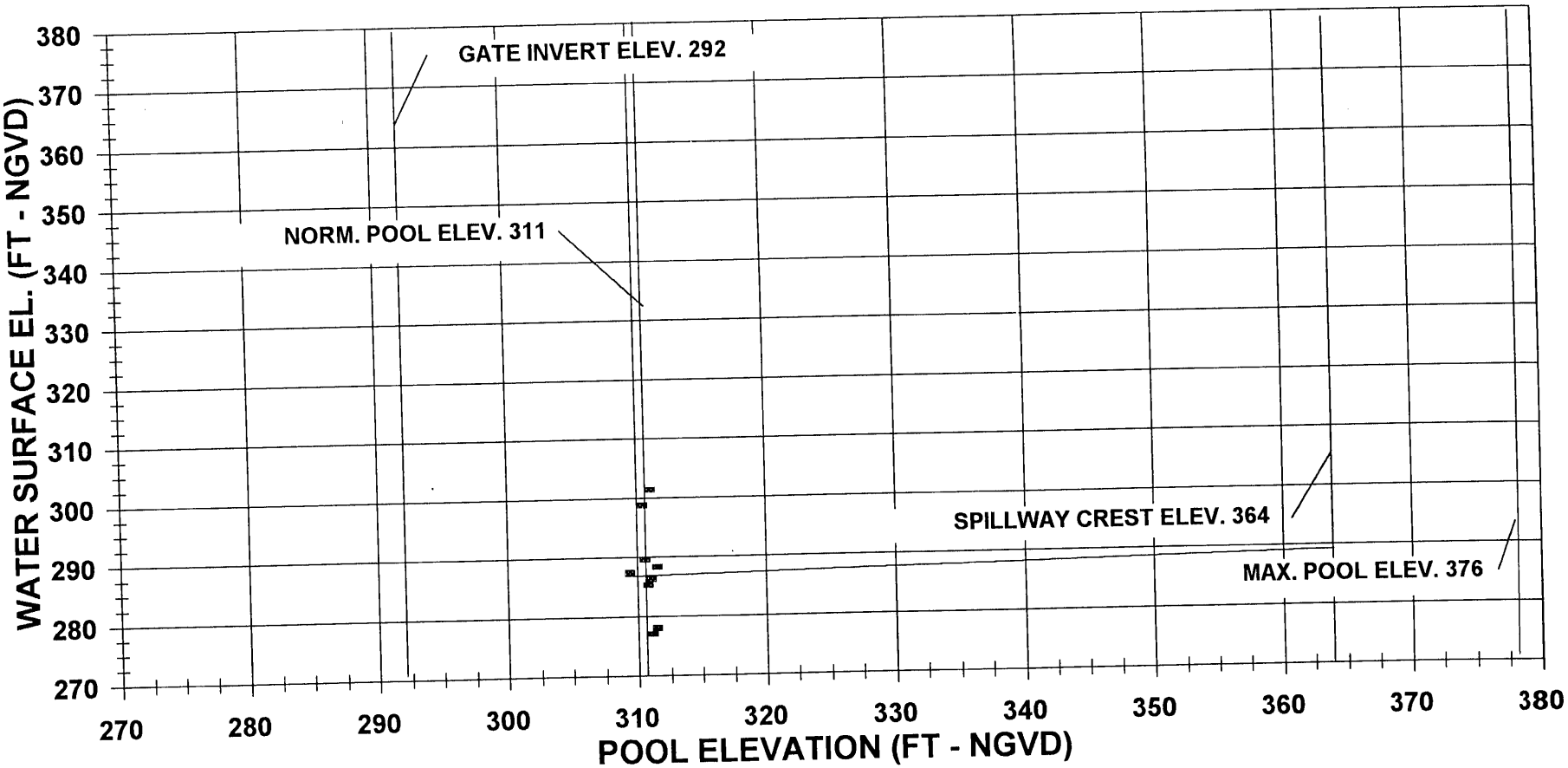
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 43

FILE NO. 11163-004

PZ - 12



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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-12

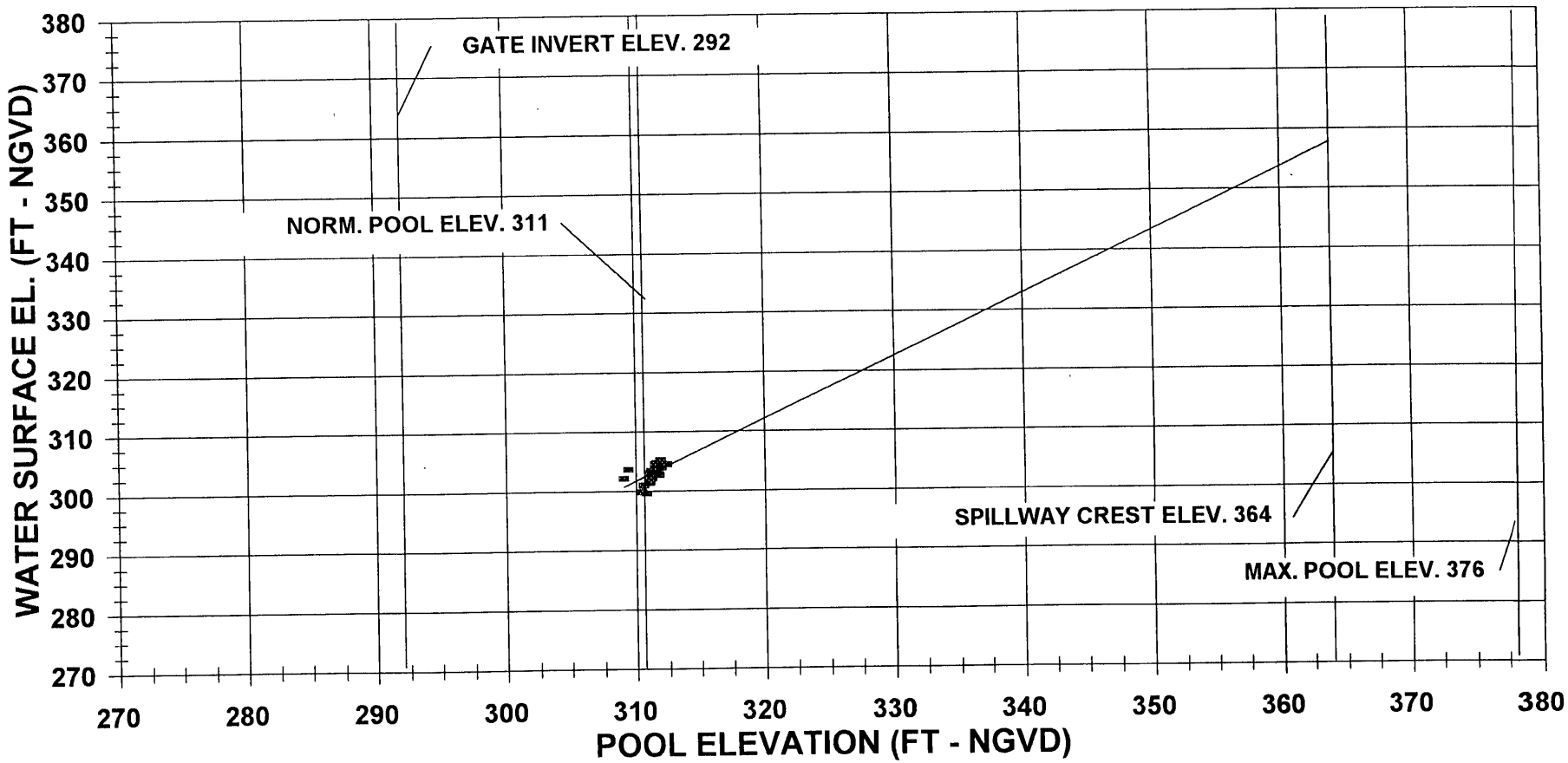
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 44

FILE NO. 11163-004

PZ - 13



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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-13

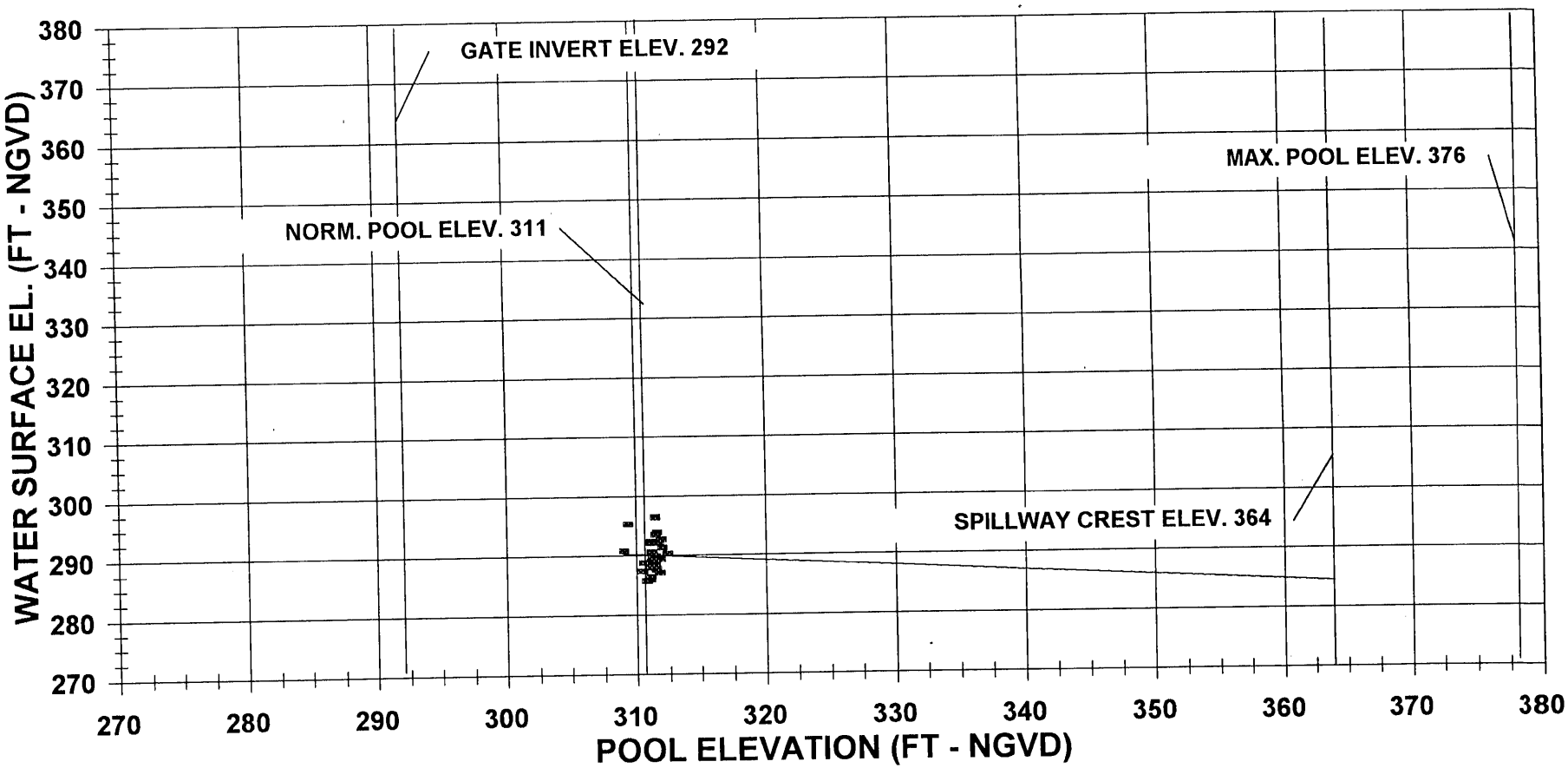
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 45

FILE NO. 11163-004

PZ - 14



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HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER ELEVATION vs. POOL ELEVATION
PZ-14

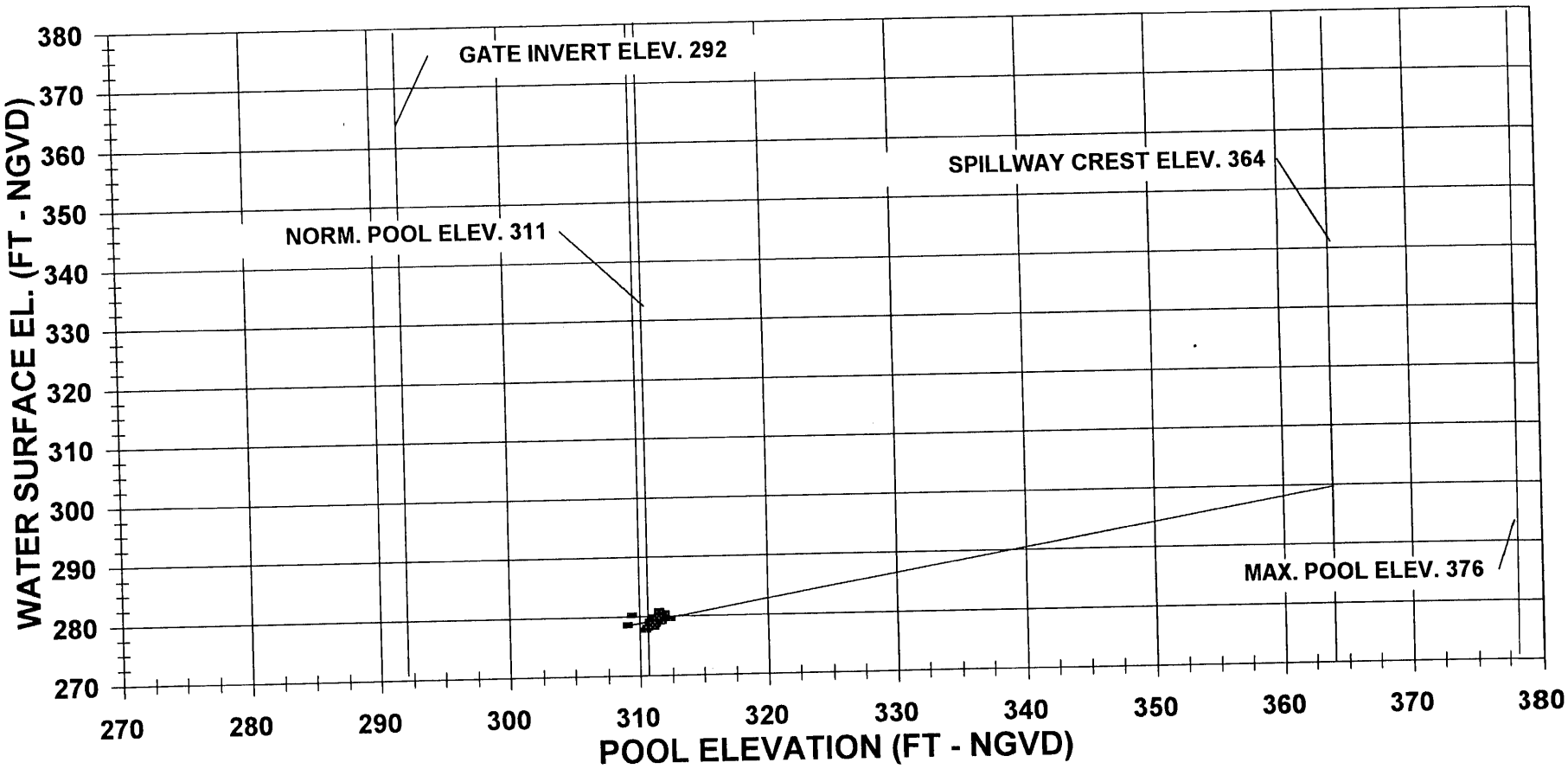
SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 46

FILE NO. 11163-004

PZ - 15



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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

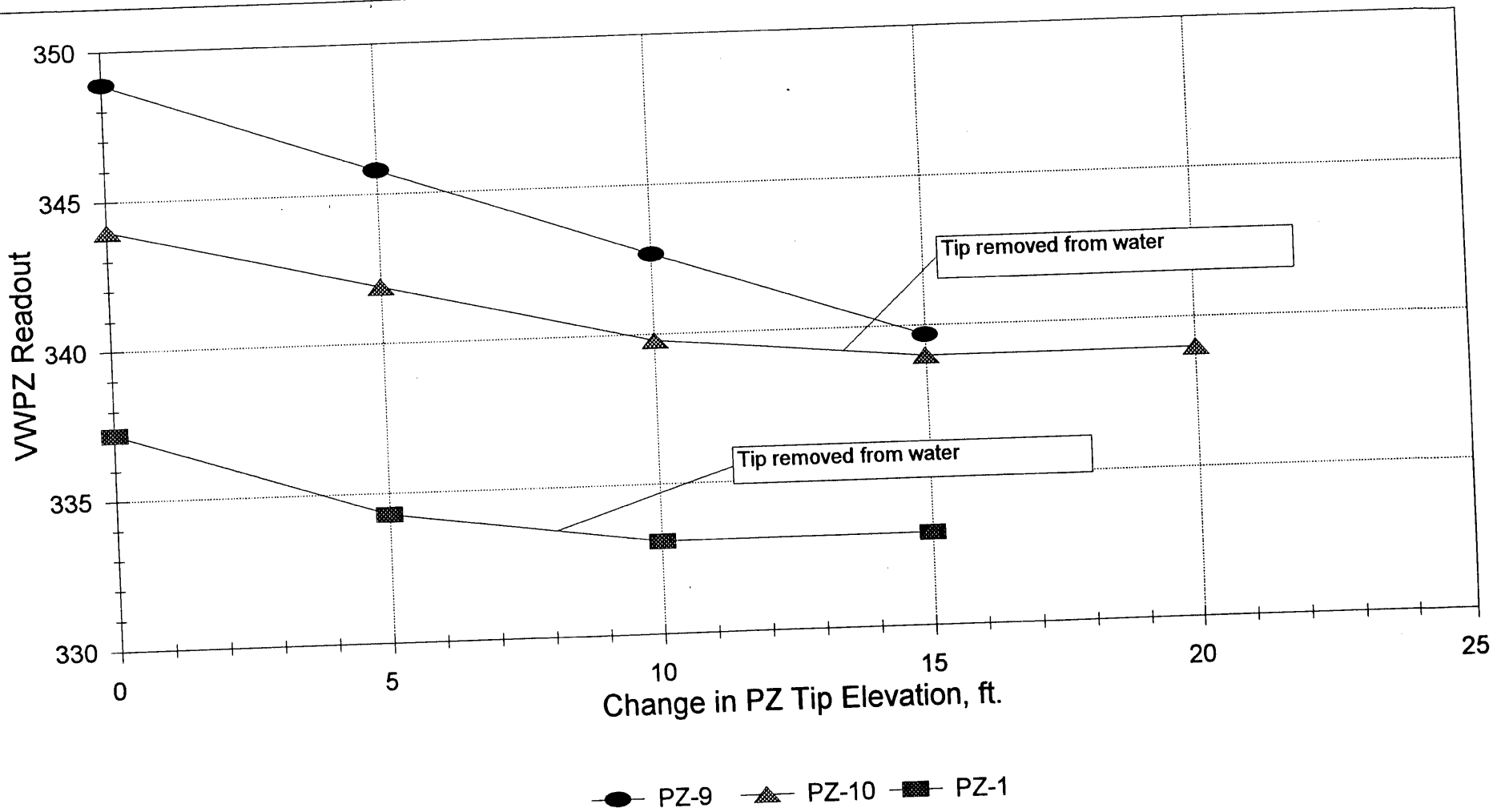
PIEZOMETER ELEVATION vs. POOL ELEVATION PZ-15

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 47

FILE NO. 11163-004



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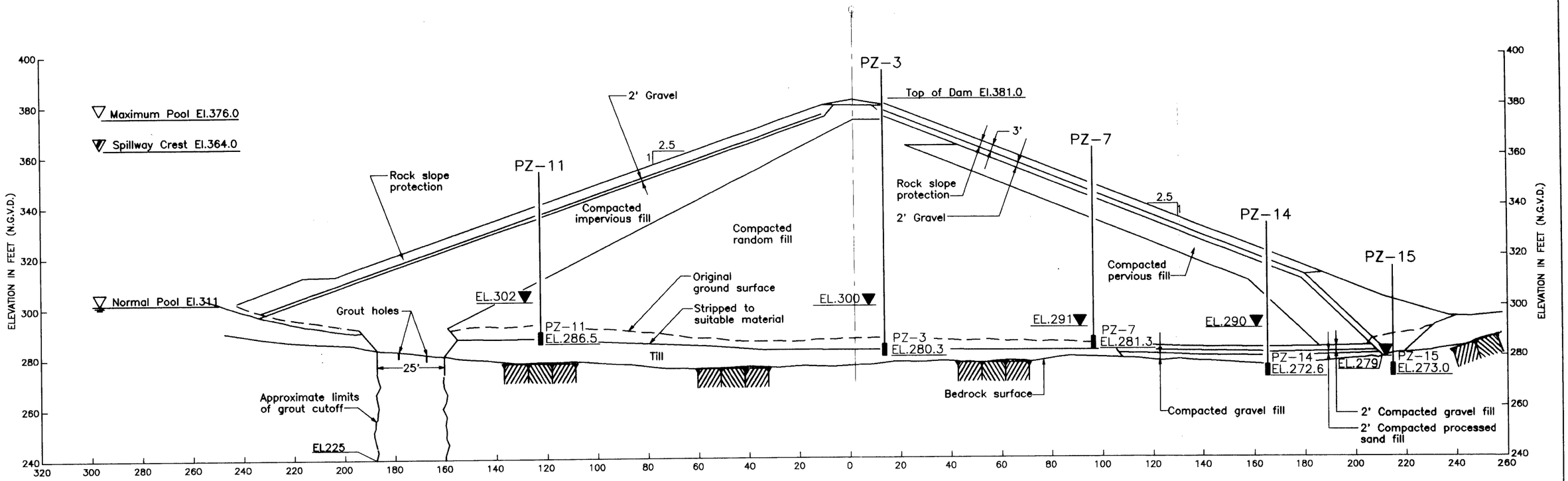
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

FIELD TEST RESULTS FOR SELECTED PIEZOMETERS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE 48



ENGINEERING LOG SECTION–STA.3+80

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311)
PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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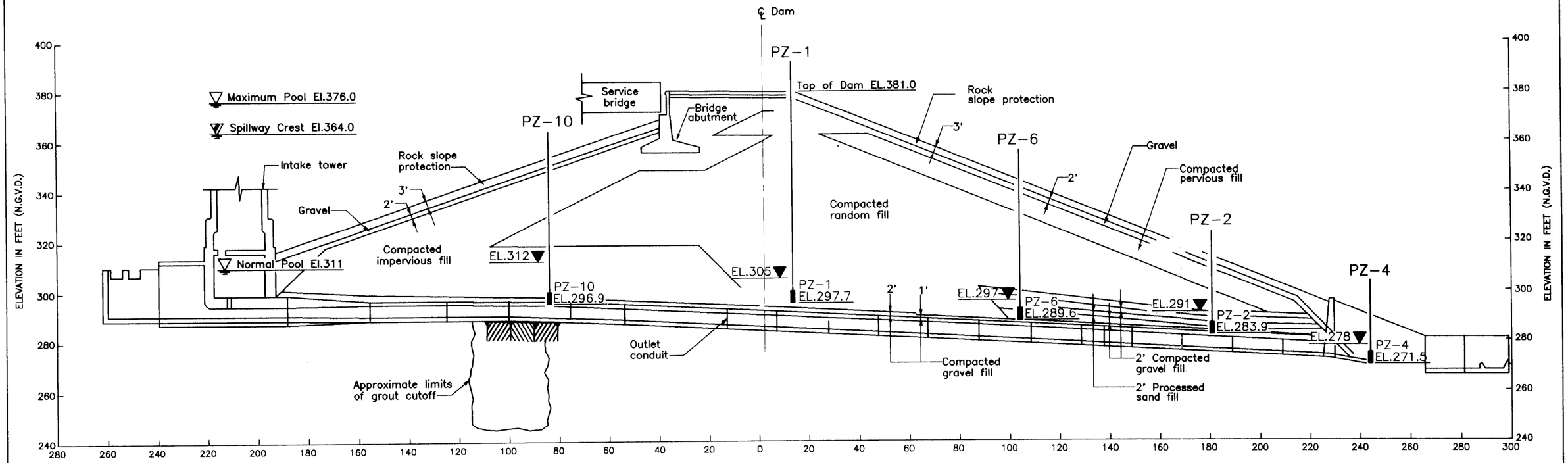
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
STATION 3+80

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B33

FIGURE 49



ENGINEERING LOG SECTION–STA.4+60

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311) PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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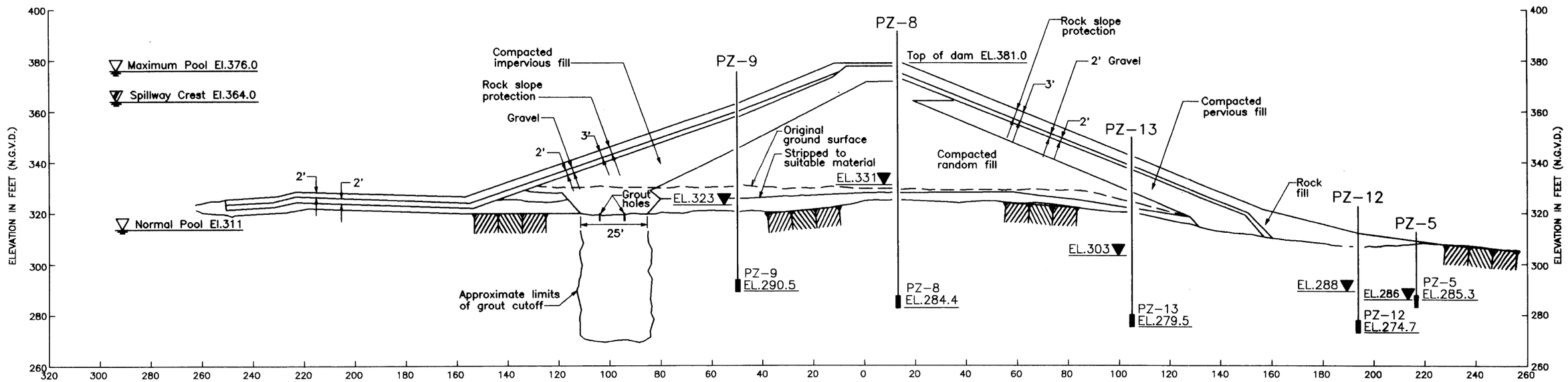
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
STATION 4+60

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B34

FIGURE 50



ENGINEERING LOG SECTION–STA.5+20

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311) PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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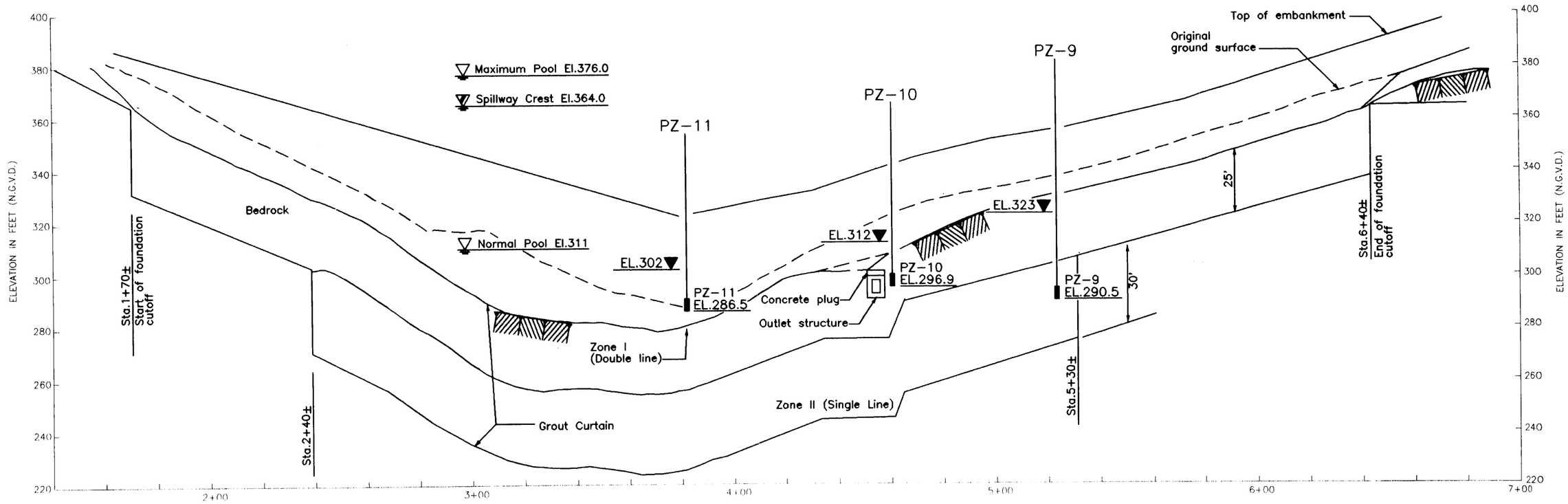
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
STATION 5+20

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B35

FIGURE 51



ENGINEERING LOG PROFILE (CENTERLINE FOUNDATION CUTOFF)

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311)
PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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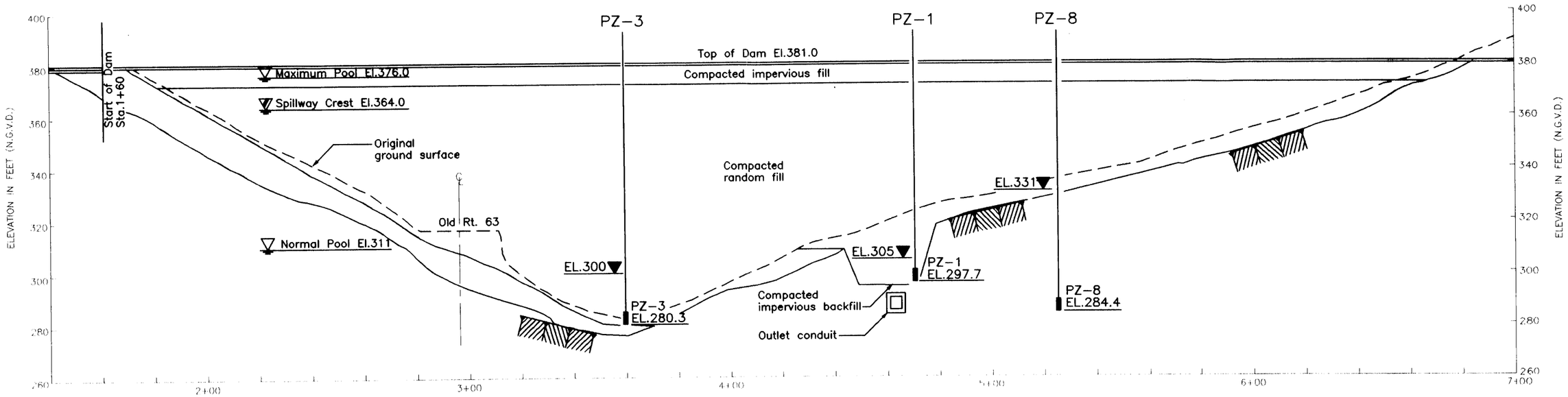
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
UPSTREAM SLOPE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B36

FIGURE 52



ENGINEERING LOG PROFILE (10 FT. D/S OF DAM CENTERLINE)

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311) PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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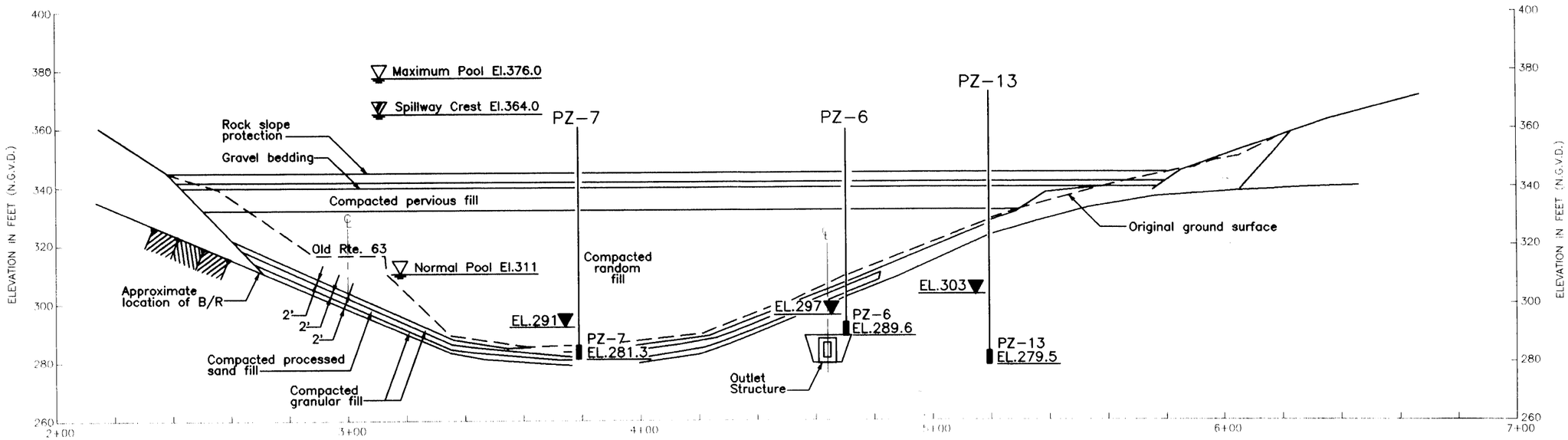
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
CENTERLINE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B37

FIGURE 53



ENGINEERING LOG PROFILE (100 FT. D/S OF DAM CENTERLINE)

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311) PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
3. REFER TO FIGURE 7 FOR GENERAL LEGEND AND NOTES.
4. PROJECTED PIEZOMETER LEVELS NOT INCLUDED ON FIGURE; REFER TO TEXT OF THIS REPORT FOR DISCUSSION.
5. NORMAL PIEZOMETER LEVELS REPRESENT THE AVERAGE PIEZOMETRIC VALUE FOR POOL LEVELS BETWEEN EL.309 AND 313; REFER TO TABLE II. HOWEVER, THESE LEVELS MAY BE INACCURATE; REFER TO DISCUSSION OF FIELD TEST OF PIEZOMETER RESPONSE IN SECTION 5 OF THIS REPORT.

0 40 80
SCALE IN FEET

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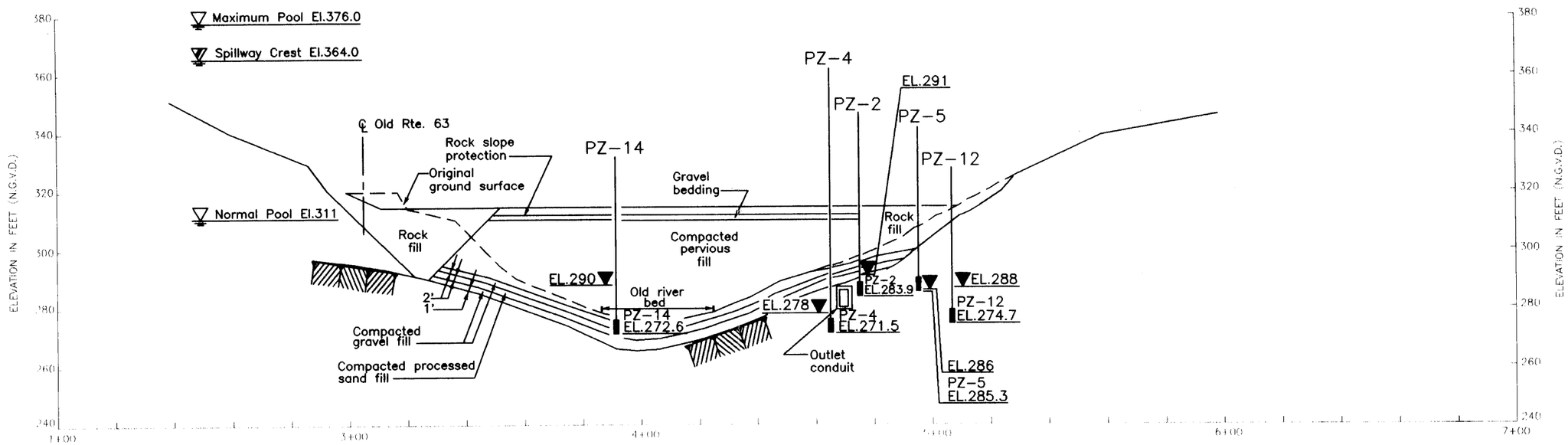
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

PIEZOMETER LEVELS
DOWNSTREAM SLOPE OF DAM

SCALE: AS SHOWN FEBRUARY 1995

11163-004 B38

FIGURE 54



ENGINEERING LOG PROFILE (180 FT. D/S OF DAM CENTERLINE)

LEGEND:

▼ PIEZOMETER LEVEL AT NORMAL POOL (EL.311)
PIEZOMETER ELEVATIONS SHOWN REFER TO TIP ELEVATIONS

NOTES:

1. CROSS SECTIONS PREPARED BY THE U.S. ARMY CORPS OF ENGINEERS AND PUBLISHED IN THE REPORT ENTITLED "SUPPLEMENTAL INSTRUMENTATION APPENDIX TO PERIODIC INSPECTION REPORT NO.4, HOPBROOK LAKE, MIDDLEBURY CONNECTICUT, INSTRUMENTATION FOR SAFETY EVALUATION",DATED JUNE 1989.
2. ALL ELEVATIONS CORRESPOND TO FEET N.G.V.D.
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0 40 80
SCALE IN FEET

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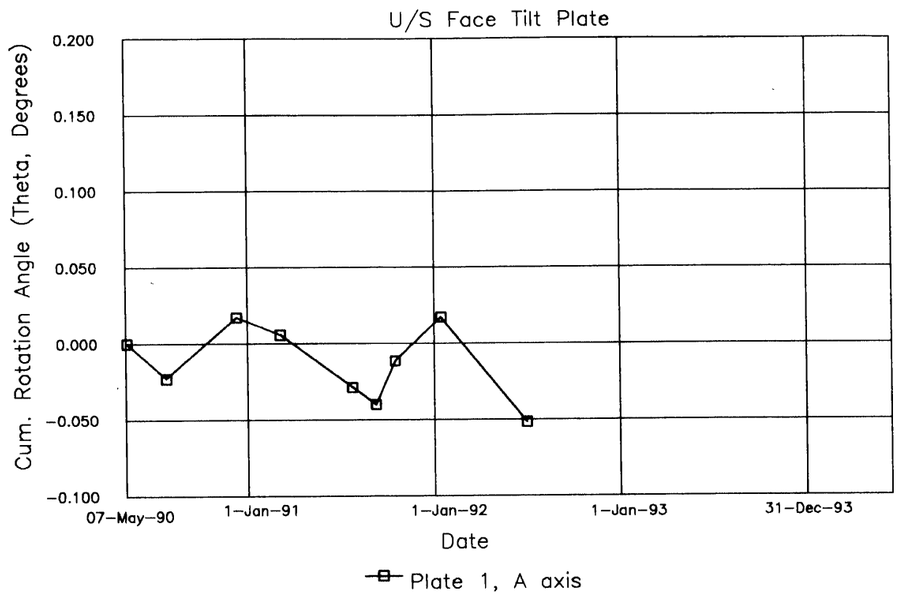
HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

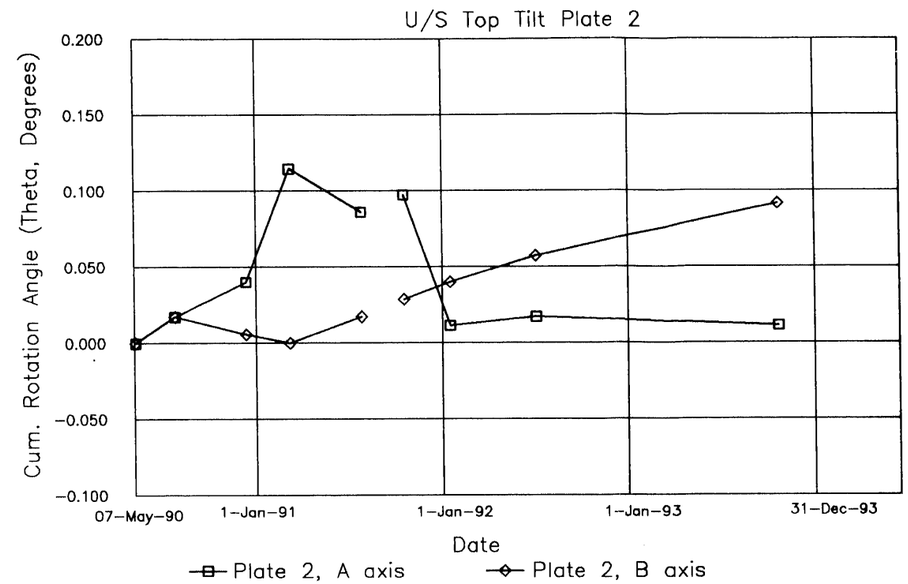
PIEZOMETER LEVELS
DOWNSTREAM TOE OF DAM

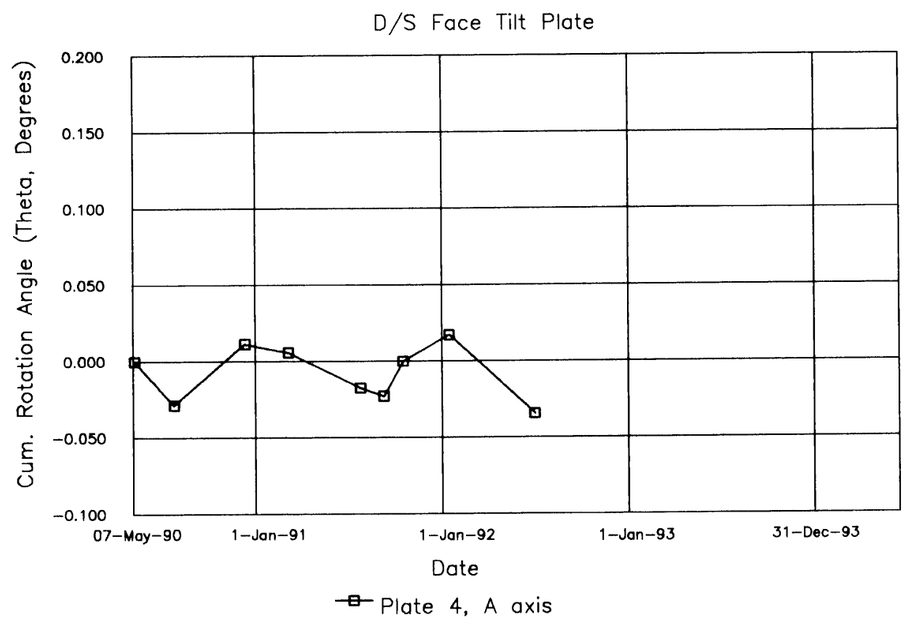
SCALE: AS SHOWN FEBRUARY 1995

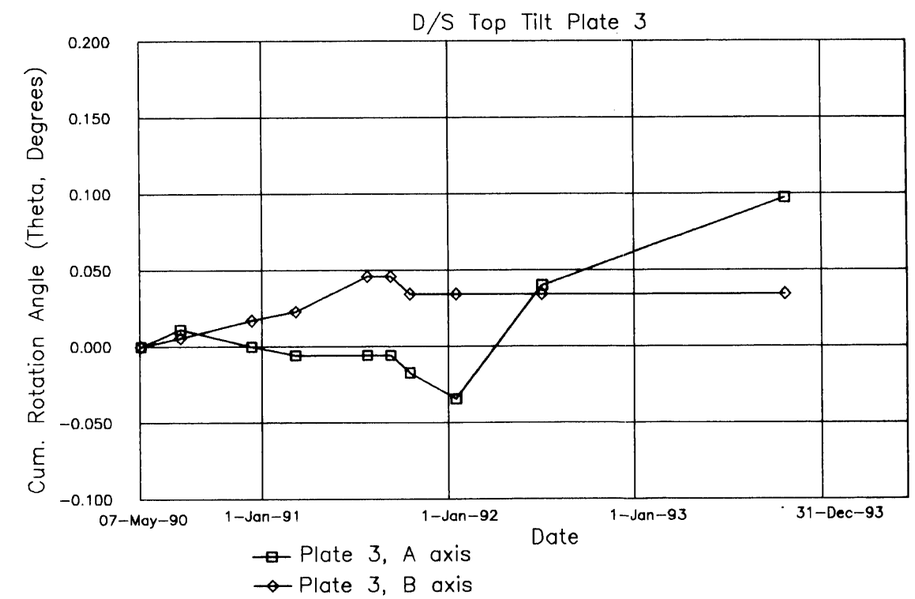
11163-004 B39

FIGURE 55









NOTE:

1. Excavation of Embankment August 1991 – September 1991
2. Grouting of stone culvert archway January 1992
3. Plates 1 & 4 are vertical plates; B–axis readings are zero.
4. Plates 2 & 3 are horizontal plates.
5. See Table 1 for actual readings

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

RAIL ROAD CULVERT
TILT PLATE MOVEMENTS

SCALE: AS SHOWN FEBRUARY 1995

11163–004 B25

FIGURE 56

APPENDIX A

Standards for Settlement Survey

APPENDIX A

STANDARDS FOR SETTLEMENT SURVEYS

1. Control points are stamped brass disks preferably set in a ledge area. Where no ledge is available, they are set in concrete bounds placed flush with the ground.

2. Control points are set in areas such that the maximum possible number of crest monuments on the dam are visible.

3. Control points are tied into four reference points by distance. This provides a check each time they are occupied for settlement surveys or allow them to be replaced if found to be destroyed.

4. Distances are read and recorded between settlement bounds. Both distance and angle are read and recorded from the control points that are being occupied to locate each settlement bound on the dam.

5. In locating each settlement bound, a control point will be occupied setting 0-00'-00" (referenced line of site) on a second control point, reading and recording both interior and exterior angle closure, along with distances through each settlement bound located on the dam. Each settlement bound is located from a minimum of two control points. These locations are third order, class II survey with relative accuracies of not less than 1 part in 5,000.

6. Levels are run from control points through each settlement bound on the dam with a return run back into the control points to check the elevation closure on the run. Closure tolerance should be no greater than 0.05 feet. These levels are third order, class I survey with relative accuracies no less than 1 part in 10,000.

7. Crest monument surveys are performed using Topcon EDM Total Stations and recording both horizontal angles and horizontal distances.

PROCEDURE FOLLOWED FOR SETTLEMENT SURVEYS

The horizontal and vertical monitoring plan for settlement bound movement points employed a combination of triangulation and trilateration angle and distance techniques to survey the control network. Control points, in the form of stamped brass disks, were placed off the dam structure in areas from which the entire length of the dam is visible. Settlement bounds themselves, with stamped brass disks, were placed on the control points. Horizontal coordinates of the control points are based on the State Plane Coordinate System. Elevations of the control points are based on the National Geodetic Vertical Datum (NGVD). Control points are occupied utilizing an EDM Total Station; observed distances and angles (interior and exterior angles), between control points and settlement bound establishing permanent bench marks. Standard leveling techniques are followed. Levels are double run and the means of the front and back runs were computed and recorded.

DATA ADJUSTMENT

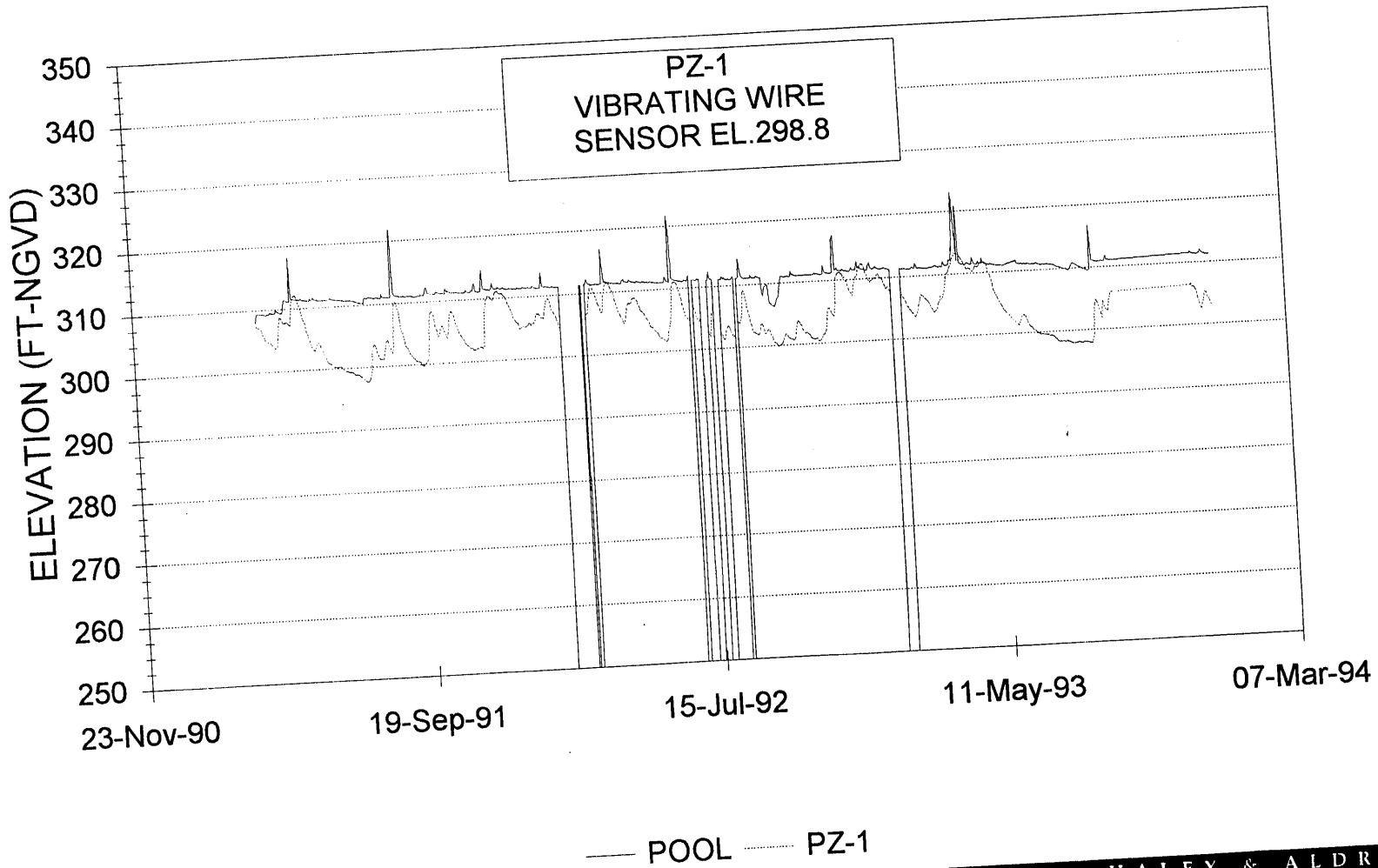
A combination of triangulation and trilateration surveying techniques are applied. Each crest monument is located from two control points whereby two sets of coordinates are calculated using

adjusted field angles and compliments and EDM distances. The two sets of coordinates are averaged to give a net result. The averaged coordinates are then established on each settlement bound for use in determining shifts in the dam surface structure over a period of years by comparing repetitive surveys.

APPENDIX B

Piezometer Daily Readings

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

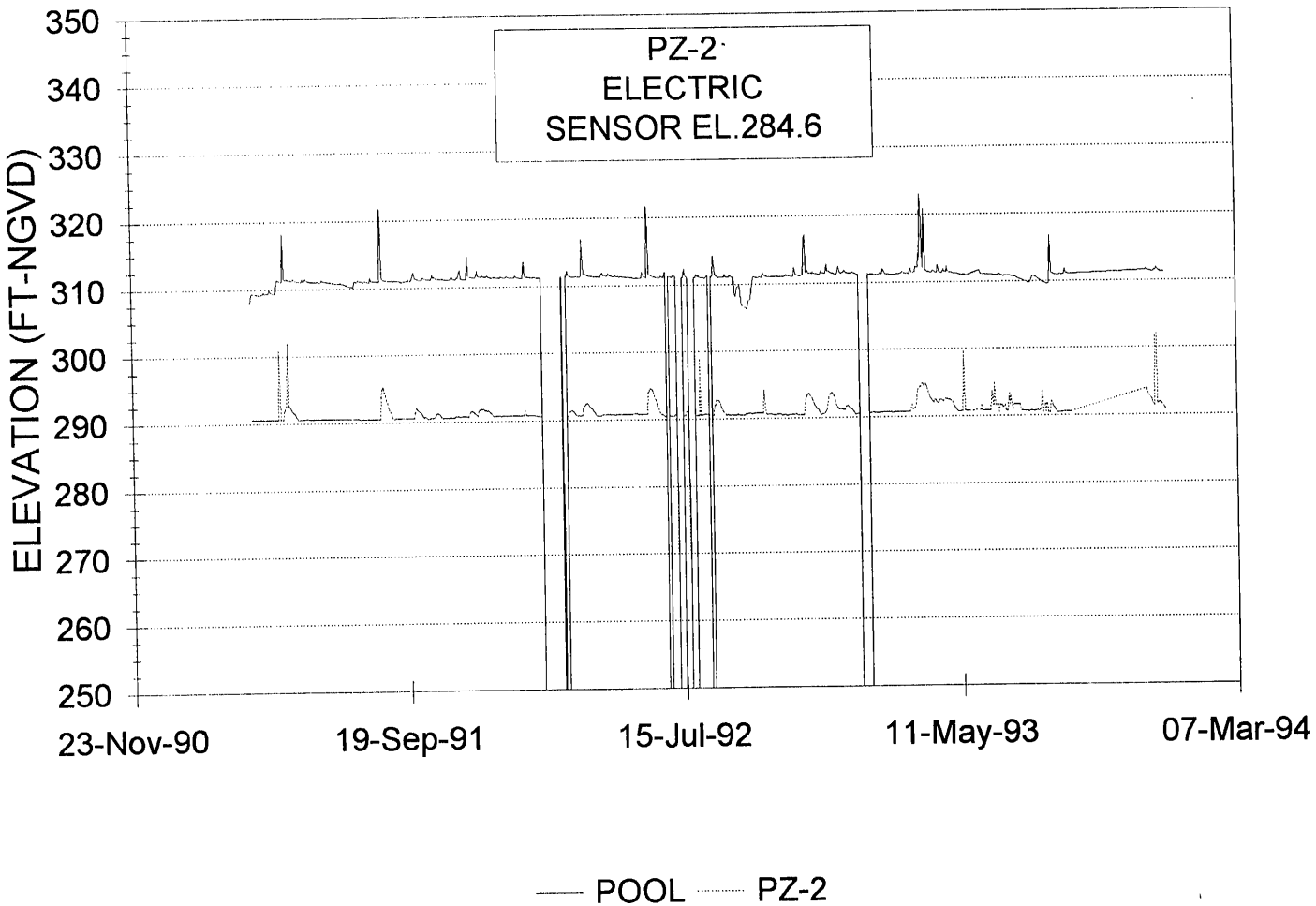
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B1

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

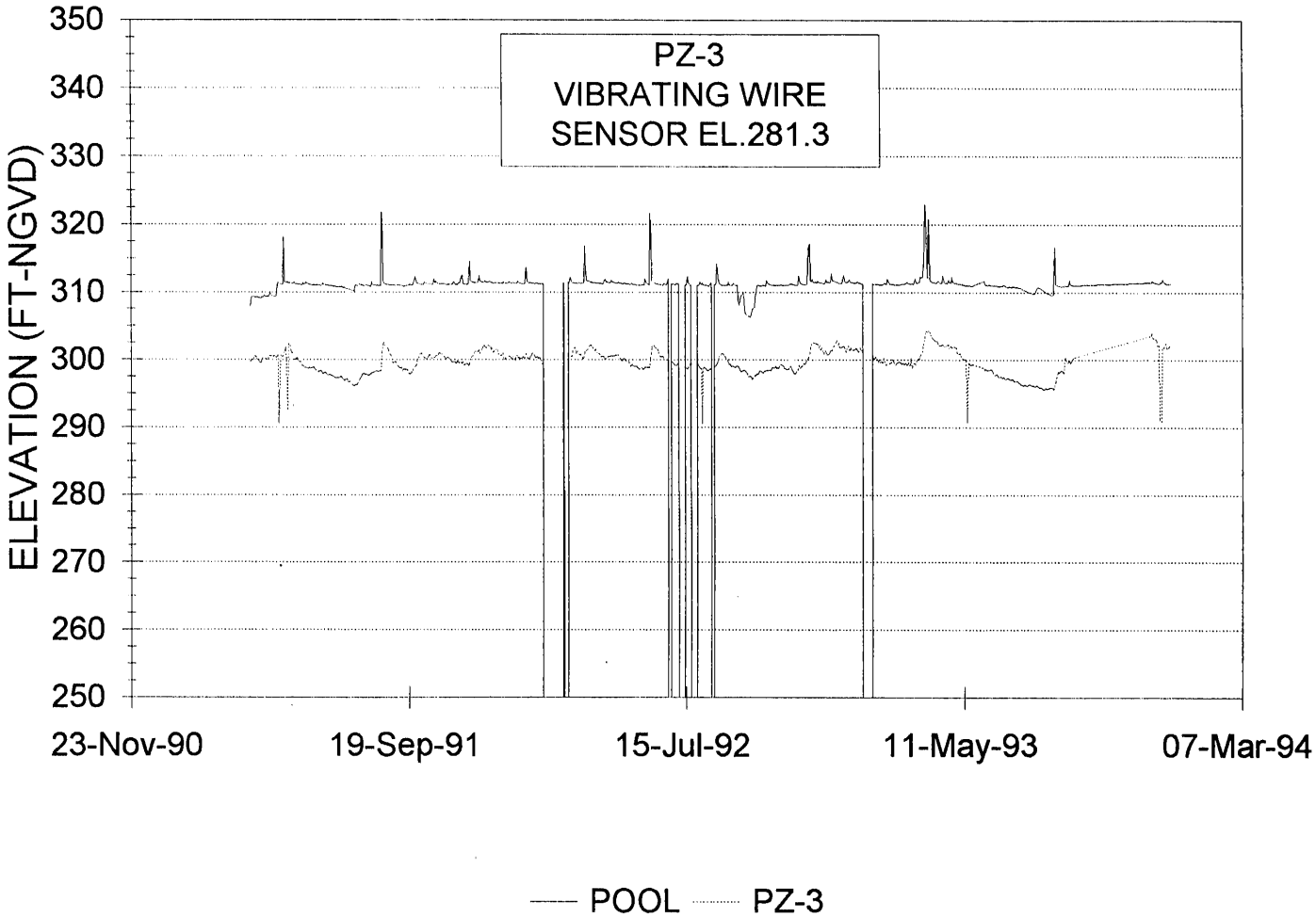
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B2

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

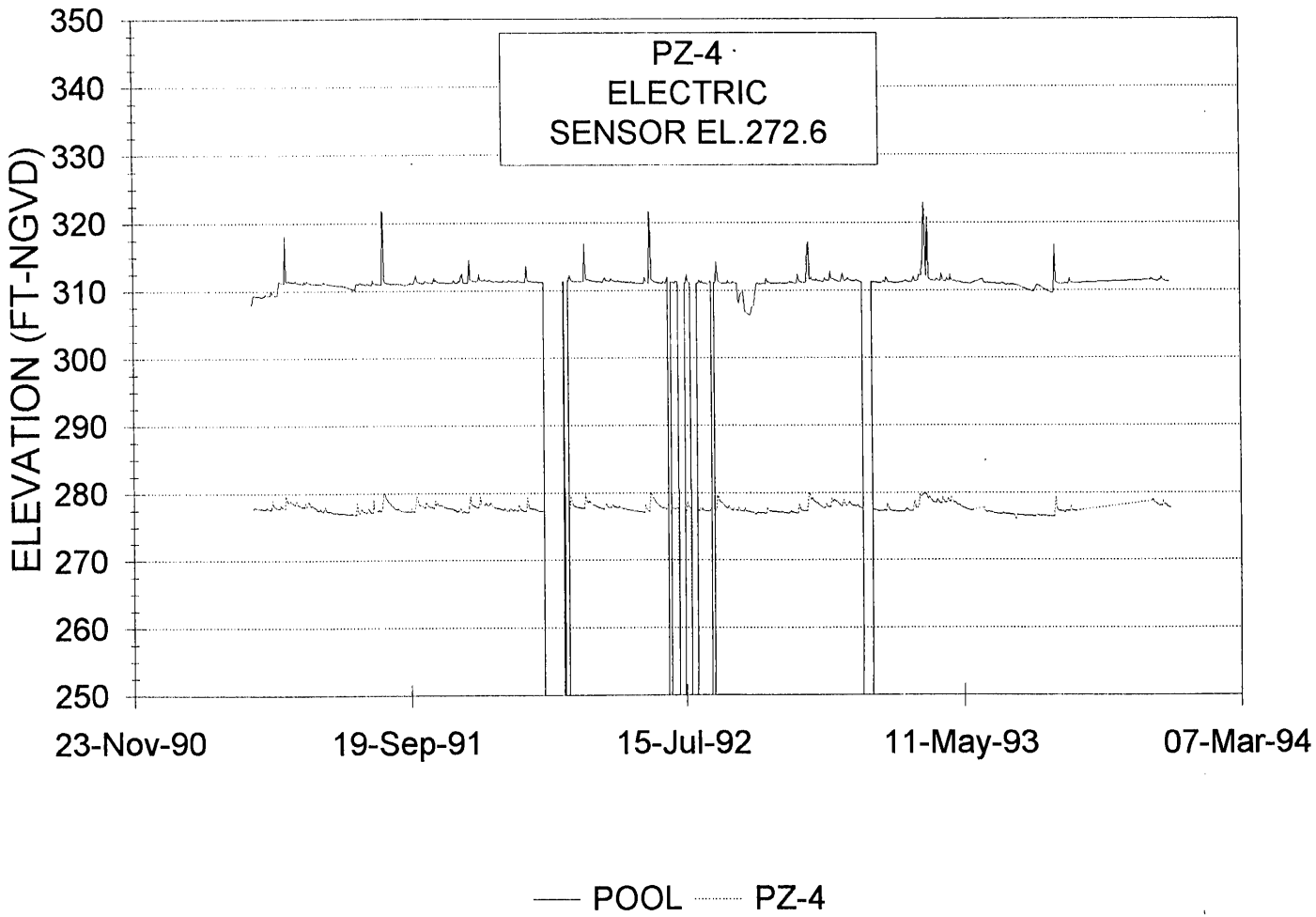
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B3

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

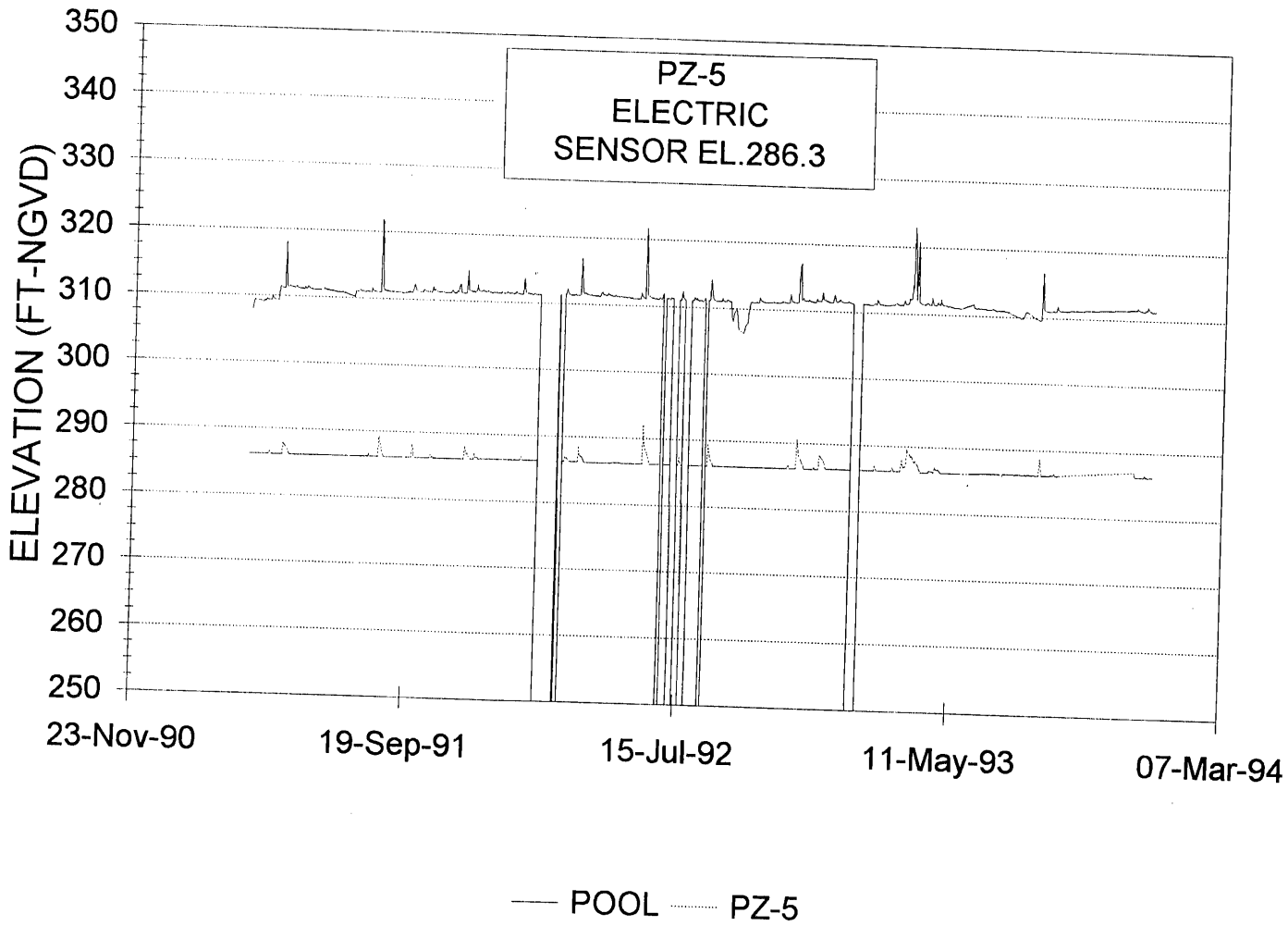
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B4

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

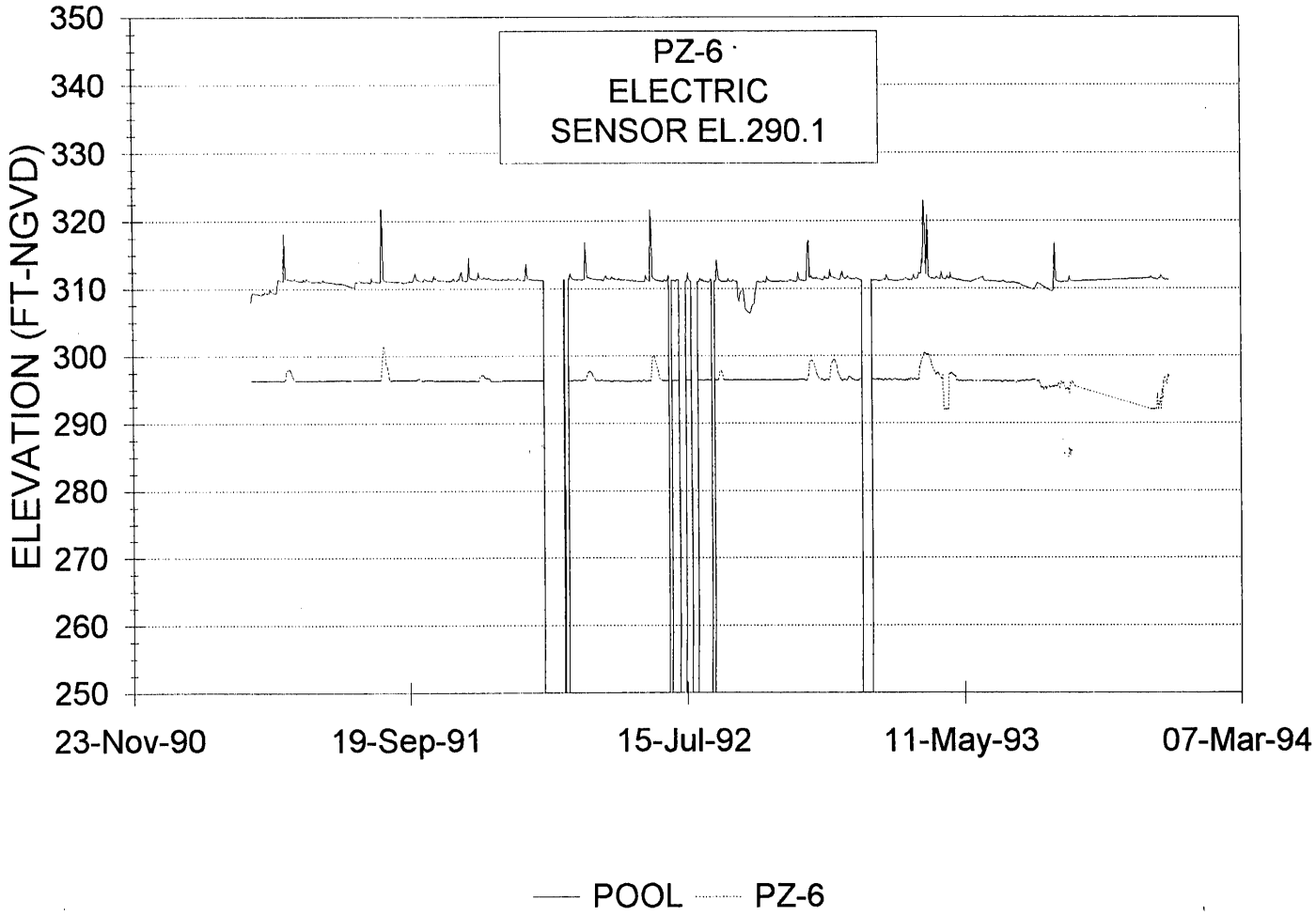
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B5

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

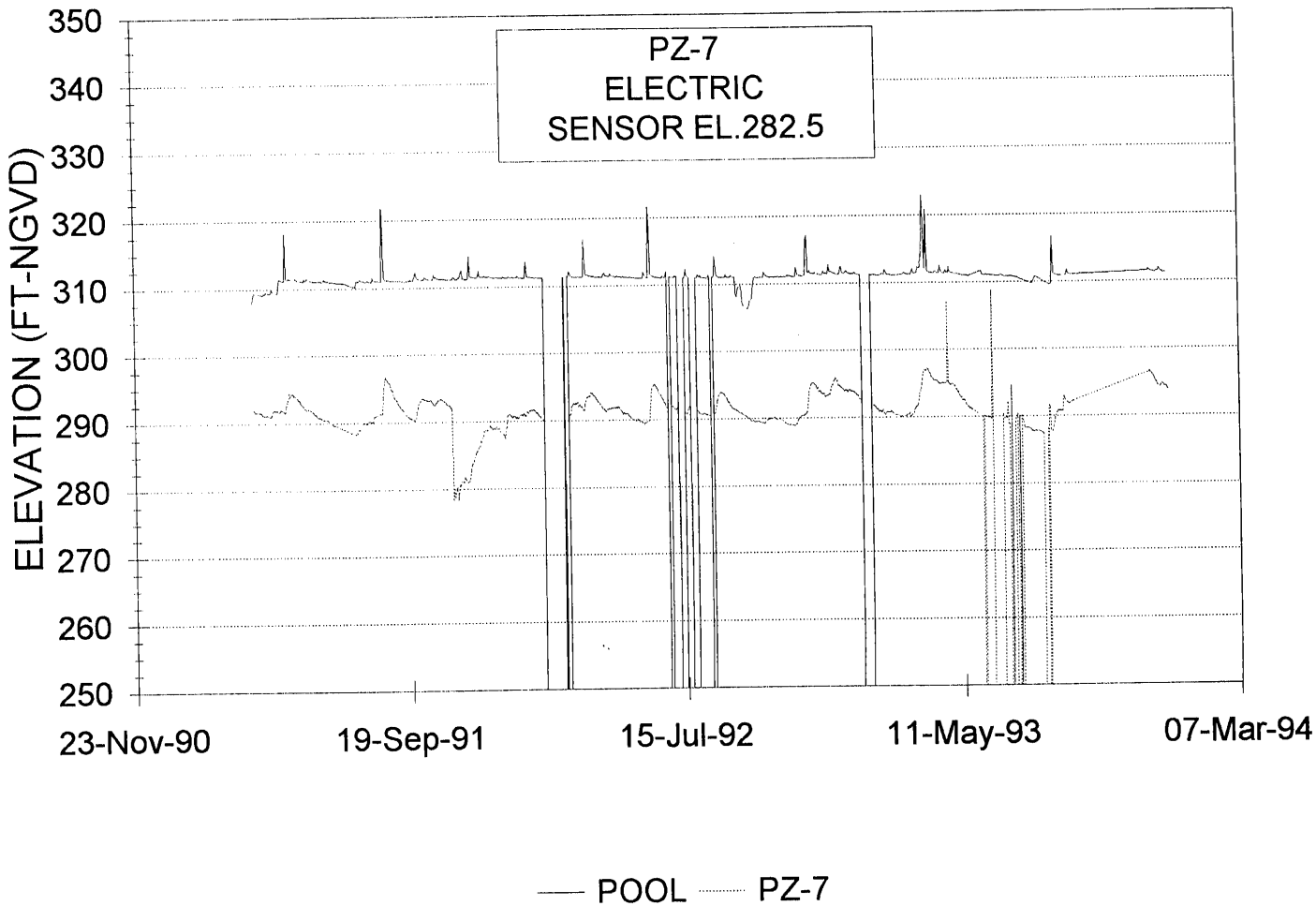
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B6

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

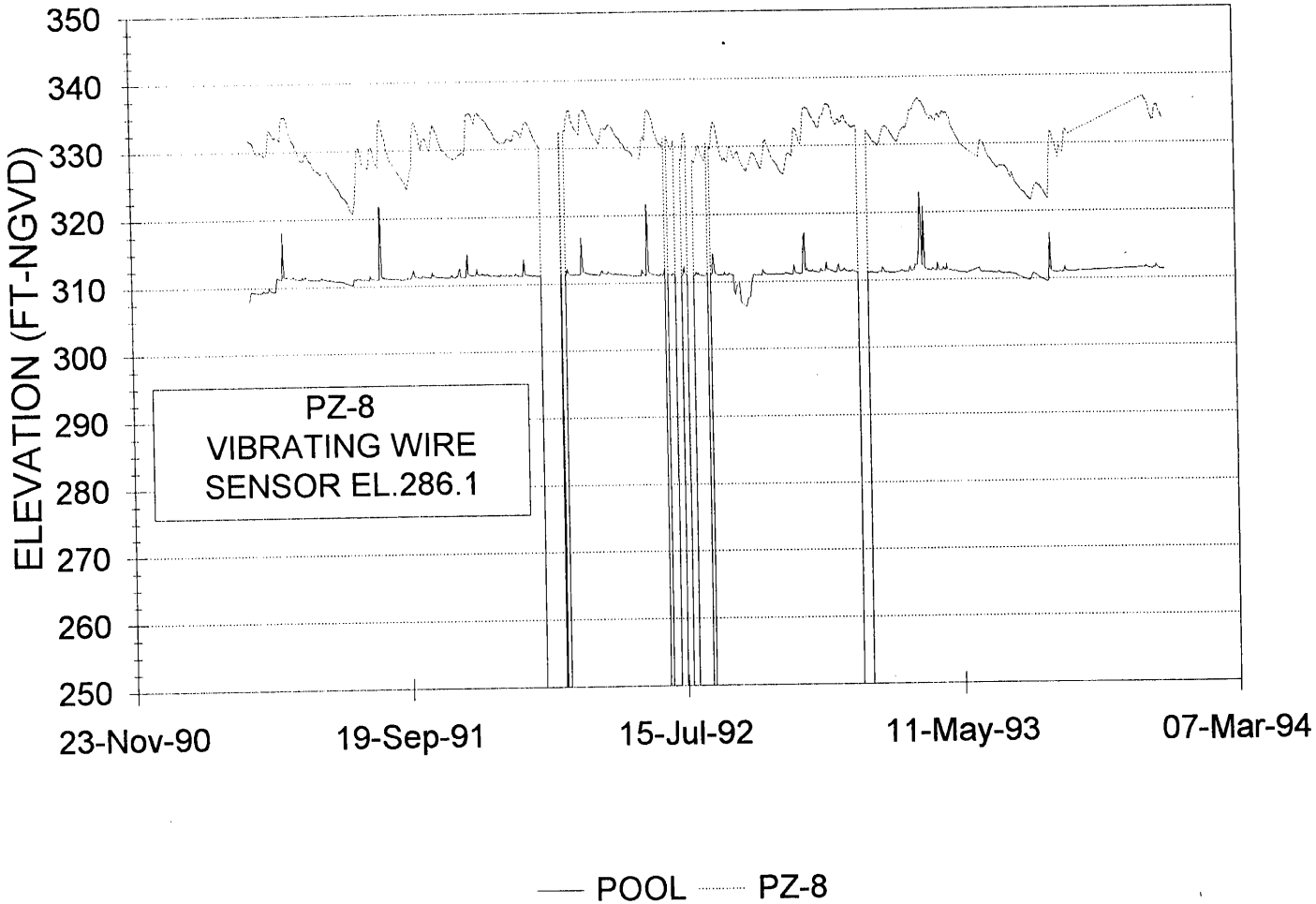
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B7

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

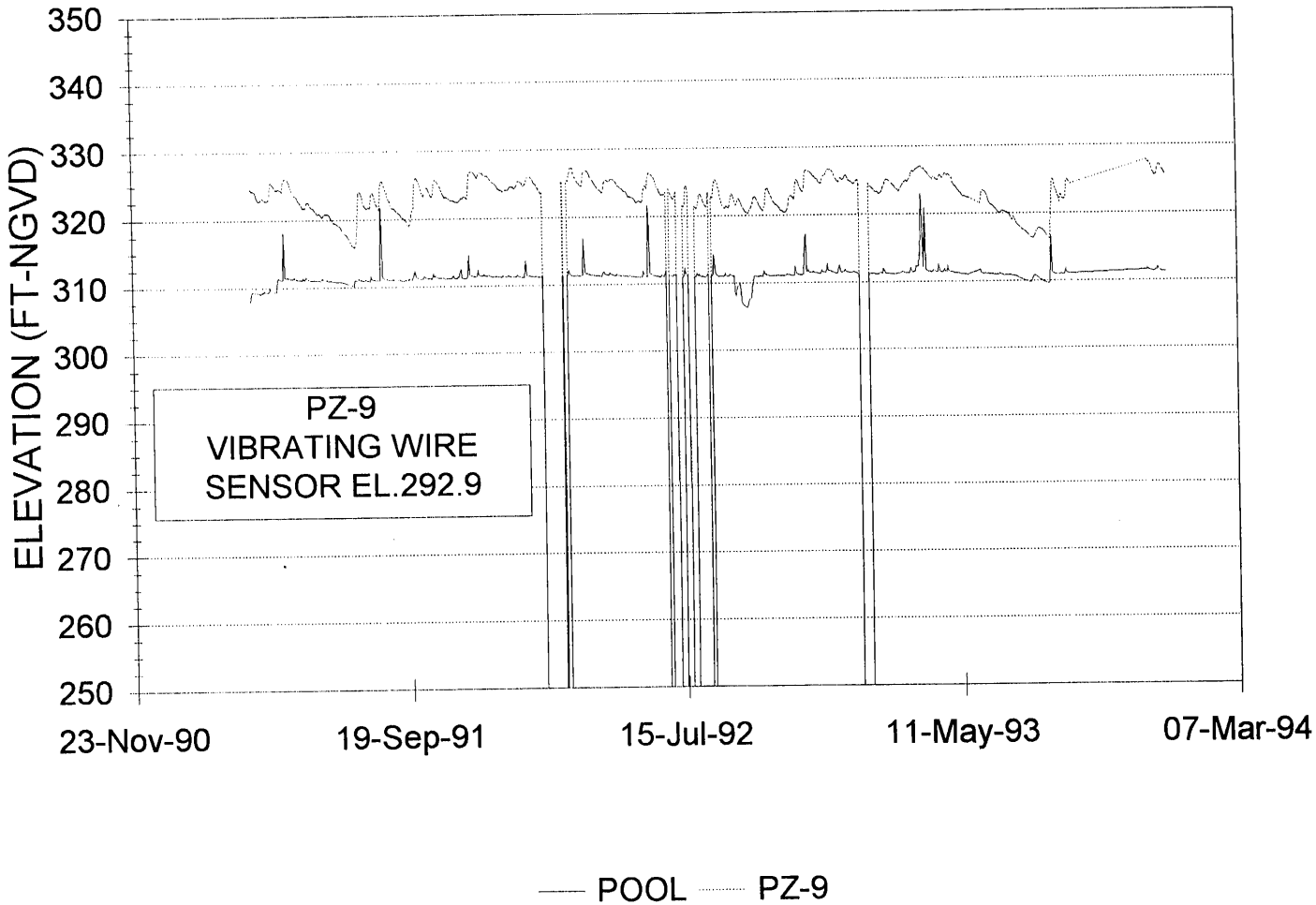
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B8

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

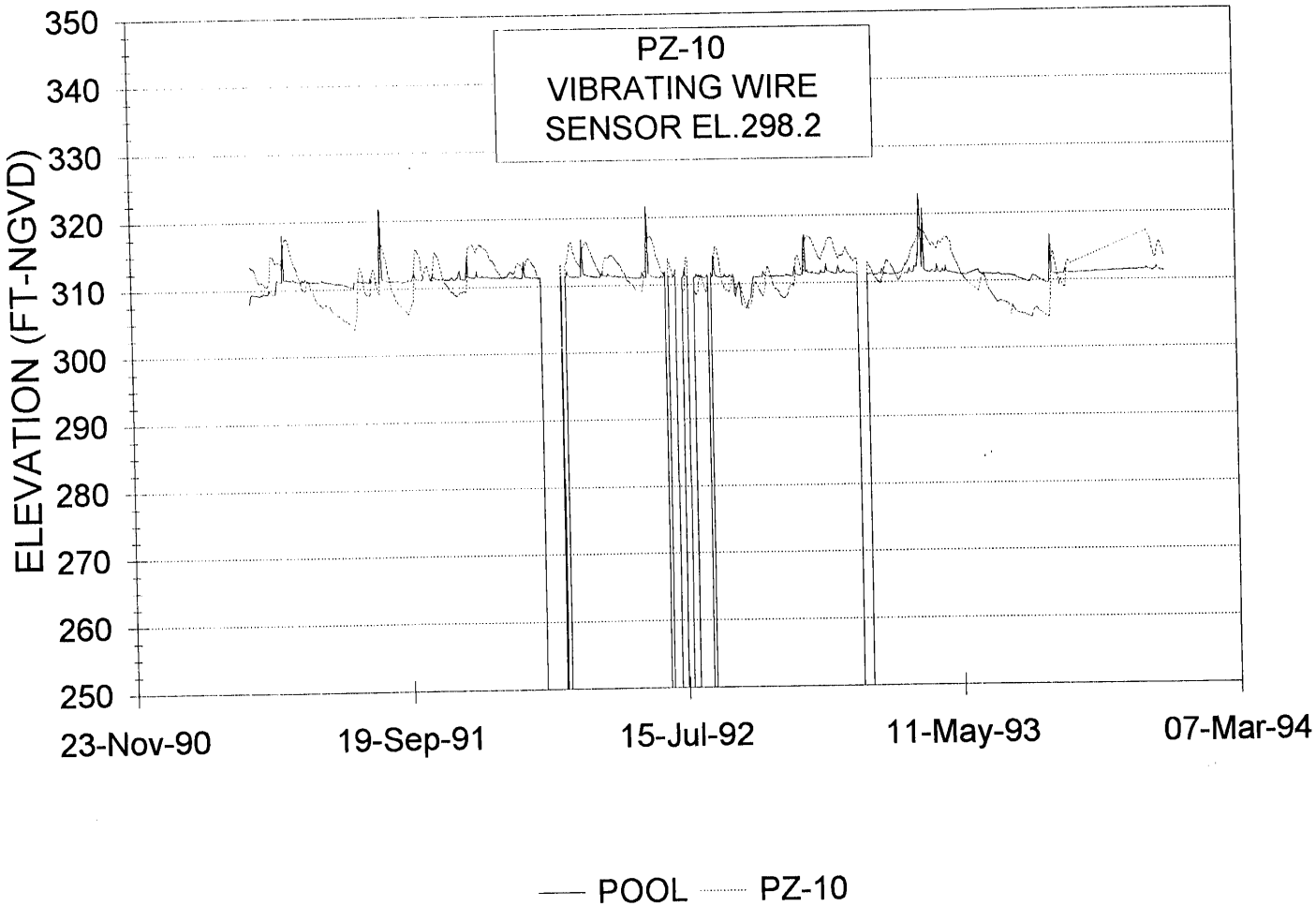
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B9

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

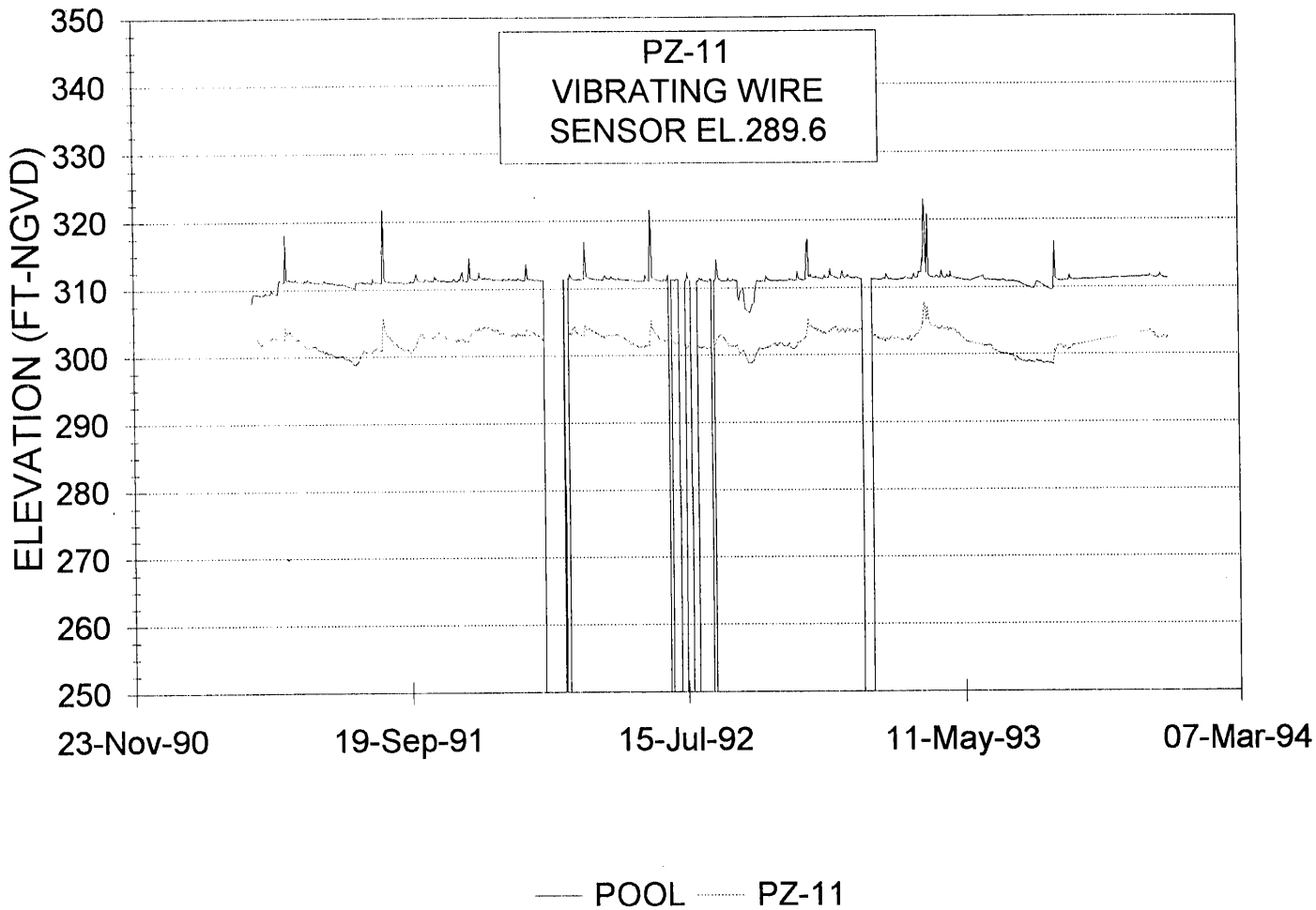
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B10

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

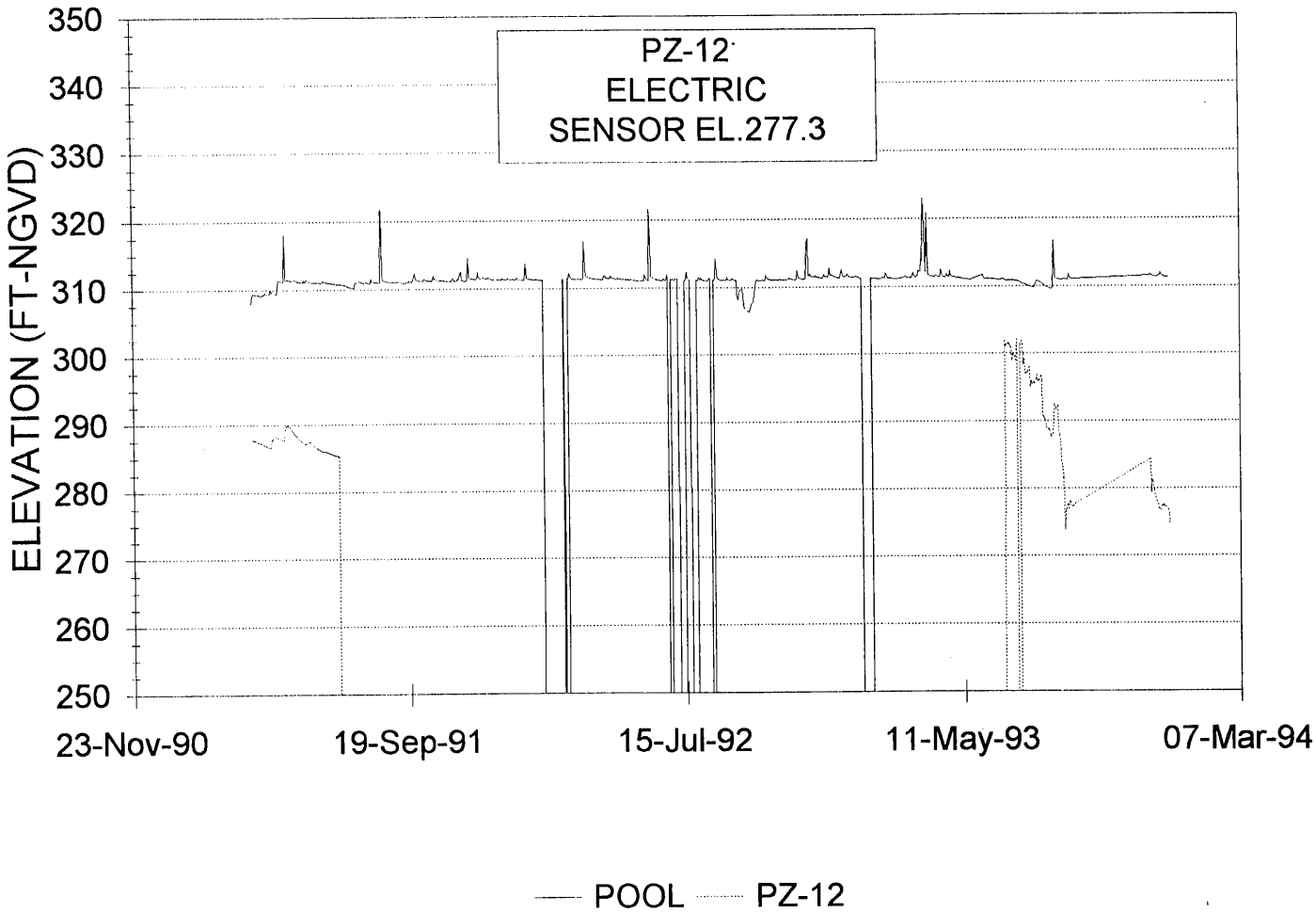
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B11

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

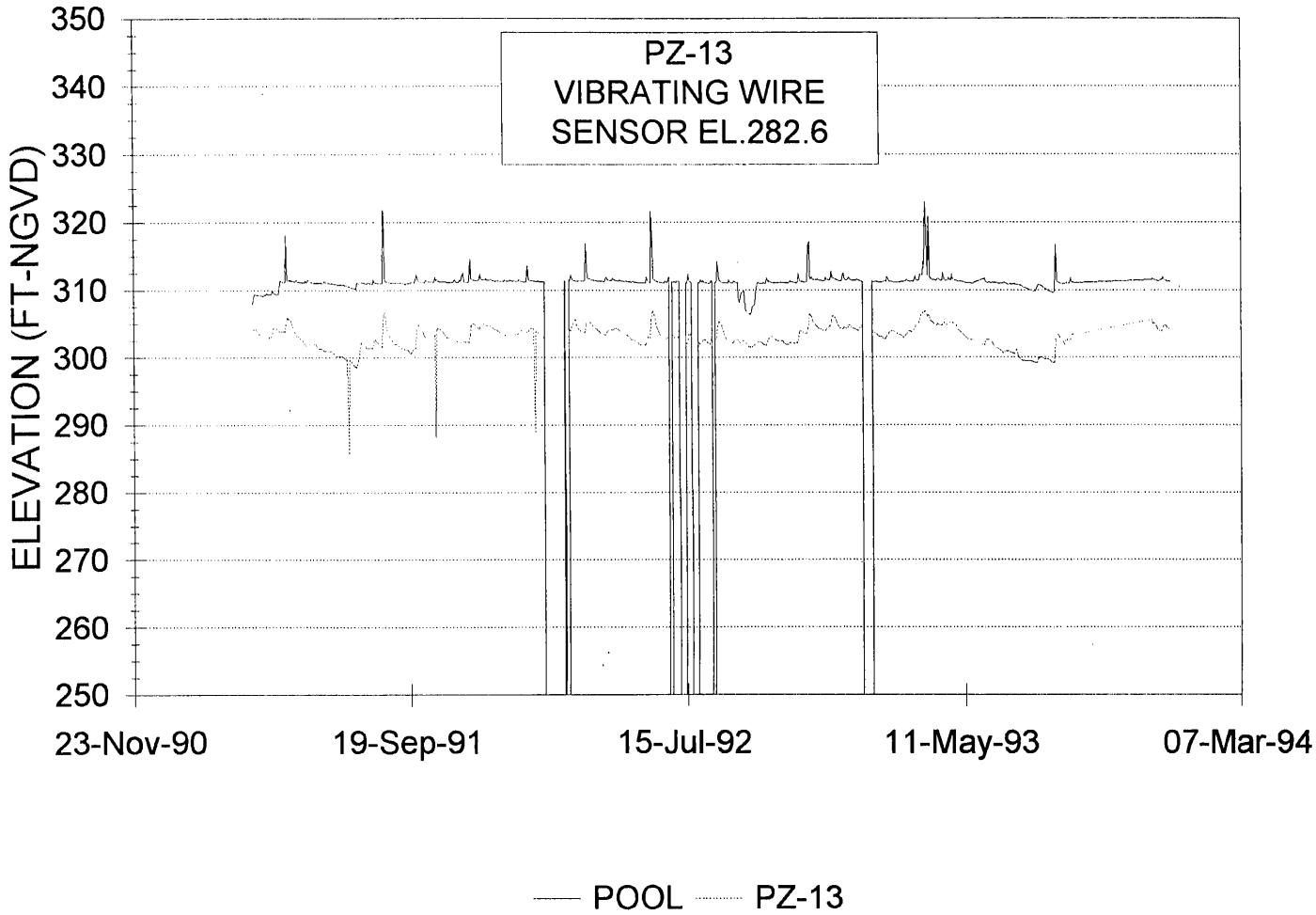
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B12

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

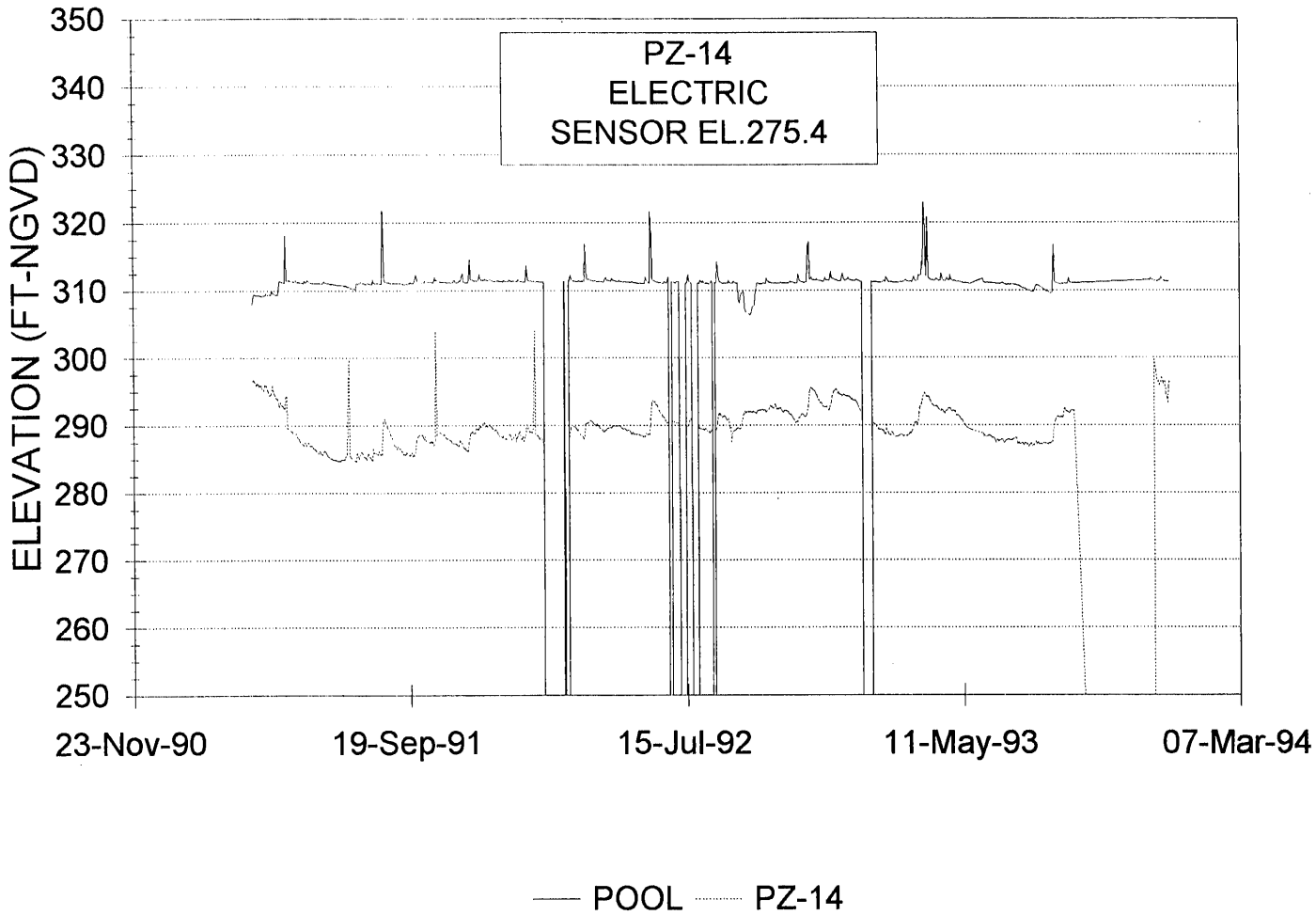
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B13

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

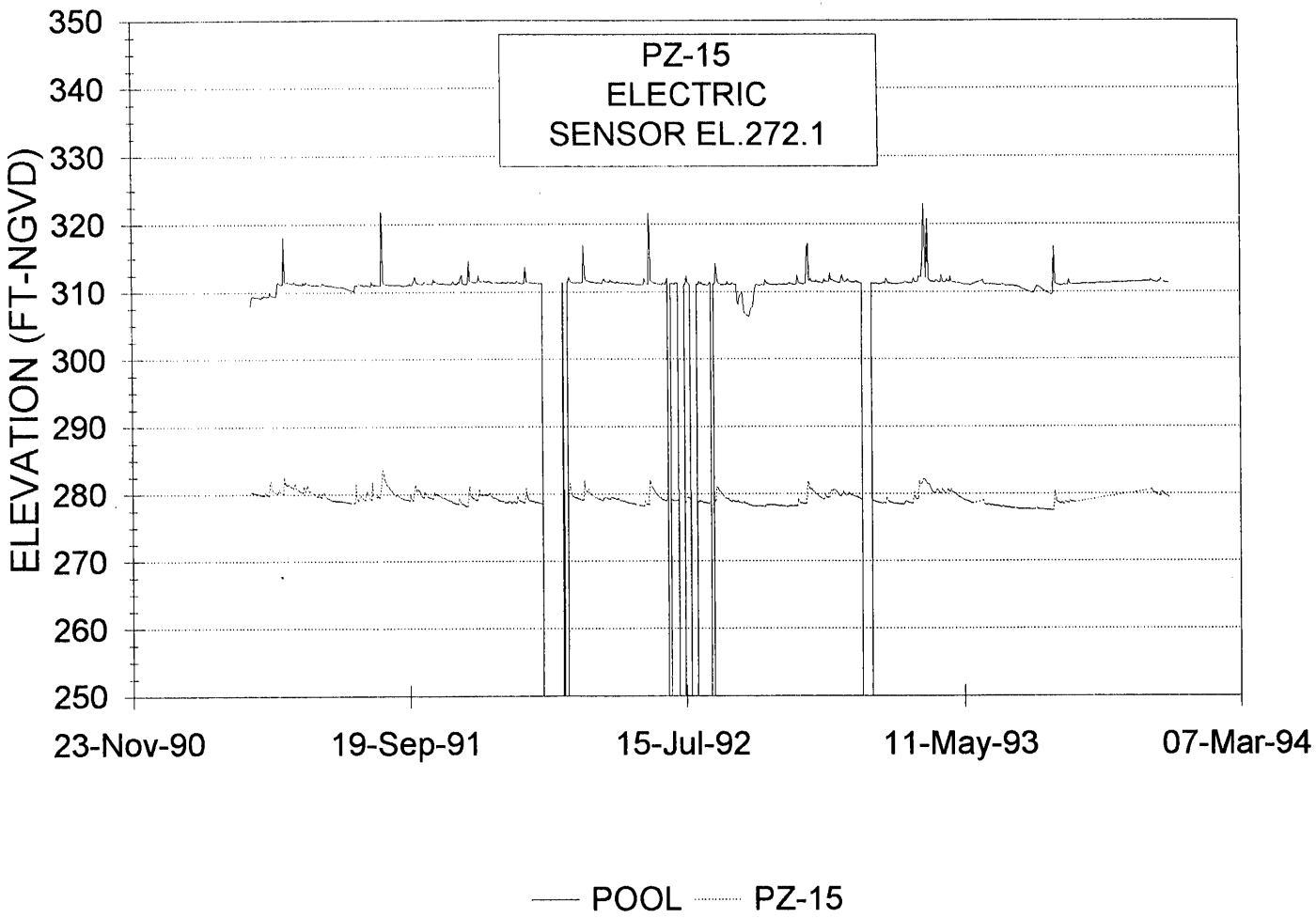
DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B14

FILE NO. 11163-004



NOTE: Vertical lines correspond to a lack of data in the record.

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HOUSATONIC RIVER FLOOD CONTROL
HOP BROOK DAM
MIDDLEBURY, CONNECTICUT

DAILY PIEZOMETRIC WATER LEVELS

SCALE: AS SHOWN

FEBRUARY 1995

FIGURE B15