7.0 SUMMARY AND CONCLUSIONS

The OU-1/OU-3 RI program at JPL was focused on the physical and chemical characteristics of groundwater both beneath and surrounding JPL. The RI activities have evaluated the presence of a wide variety of constituents and monitored groundwater flow conditions under a wide variety of circumstances. Detailed results of these activities are presented in the previous sections. A summary of the RI results and conclusions reached from this study are provided below.

As stated at the beginning of this report, the four major objectives of the JPL OU-1/OU-3 RI were to: 1) characterize the nature and extent of contaminants in the groundwater beneath and near the JPL site; 2) assess the fate and transport of contaminants in the groundwater beneath the JPL site; 3) provide evaluation of potential risk from contaminants in the groundwater to human health and the environment; and 4) provide sufficient information for the OU-1/OU-3 Feasibility Study (FS) to evaluate potential technologies for remediation of groundwater. How each of these objectives were met during the RI are summarized below.

During the RI program, the nature and extent of contamination has been well characterized. From June, 1994 to February, 1998, groundwater beneath JPL and the surrounding area was sampled 10 times and water levels routinely measured via a series of on- and off-site monitoring wells. Samples were subjected to extensive chemical analysis and groundwater flow directions were carefully evaluated in order to primarily assess the extent of groundwater contamination, both on- and off-site, believed to have resulted from past activities at JPL. For various groundwater sampling events conducted during the RI, analyses have included VOCs, SVOCs, perchlorate, Title 26 metals, strontium, aluminum, hexavalent chromium, cyanide, tributyltin, gross alpha/gross beta, total petroleum hydrocarbons, and a suite of general mineral parameters.

It is apparent from the RI that past activities at JPL have resulted in groundwater contamination. However, from this extensive investigation, only five constituents were identified as being present above drinking water standards or interim action levels. These include three VOCs (CCl_4, TCE, 1,2-DCA); perchlorate (ClO_4^-); and Cr (both total and hexavalent). Of these, 1,2-DCA was detected on-site only, at levels slightly exceeding the state and Federal MCL (0.5 µg/L). Cr has been frequently detected only in two on-site wells, with very rare, sporadic detects at very low levels in few off-site wells. Only CCl_4, TCE, and ClO_4^- have been detected at levels exceeding state and Federal drinking water standards or action levels in monitoring wells both on-site and off-site.

The City of Pasadena municipal production wells have been shown to exert considerable influence on groundwater flow beneath JPL and surrounding area. The data suggest that pumping by the City of Pasadena production wells has apparently contributed to downward and southeasterly, off-site migration of CCl_4, TCE, and ClO_4^-, but has also apparently inhibited significant further off-site migration of these contaminants.

With the large amount of water-quality data and water-level data collected over the last 5 years for the RI, the fate and transport of constituents of concern are generally well known, having been essentially characterized throughout the RI program. Extensive fate and transport modeling was therefore not warranted. As indicated by the RI data, concentrations of 1,2-DCA and Cr in JPL monitoring wells have generally decreased over the RI period, and there is no evidence of significant migration, or of the potential for significant migration of these constituents. Concentrations of CCl_4 and TCE have generally decreased or remained constant in JPL monitoring wells during the RI period, and data suggest that plume sizes are generally decreasing in size (ClO_4^- trends could not be reliably established). Analysis of fate and transport with respect to measured concentrations of the JPL contaminants, their chemical and physical properties, and site conditions suggest that if the City of Pasadena municipal production wells operate as in the past, further downgradient contamination migration will be inhibited.

Fate and transport modeling simulations were, however, conducted to estimate the potential for further off-site migration of CCl_4, TCE and ClO_4^- in the event that the City of Pasadena and other nearby production wells were shut down for an extended period of time. Modeling results, under conservative assumptions, suggested production wells would need to stop pumping for over 20 years for contaminant migration to be significant. There is a very low probability this will happen, however, since it is very unlikely nearby municipal wells will stop pumping for the long periods of time required for significant migration to occur.

Through baseline risk assessment conducted in accordance with EPA and DTSC protocol, it was concluded that the only potential pathway for exposure to contaminated groundwater for humans was through hypothetical municipal consumption of untreated groundwater. Total cancer risk from hypothetical exposure to untreated groundwater at each of the JPL monitoring wells and at each of the nearby municipal production wells was determined by adding the risks calculated for ingestion, inhalation and dermal contact pathways. Results, using conservative assumptions, showed five on-site monitoring wells, two off-site monitoring wells, and one municipal production well had total cancer risk values outside EPA's range for acceptable risk. The JPL monitoring wells with "elevated" risk extend from the north-central portion of the site towards the City of Pasadena Arroyo well. The only municipal production well with "elevated" cancer risk, based on hypothetical exposure to untreated groundwater, is the Valley Water Company Well No. 1, located approximately ½ mile to the west of JPL. This well is outside the observed known influence of JPL impacted groundwater due to the lack of PCE at the JPL site and appears to be impacted from commercial activities not associated with JPL. Even if the well was impacted by activities at JPL, the health risks were calculated assuming exposure to untreated groundwater, which does not occur. Valley Water Company, like all purveyors, is required to monitor water quality and treat groundwater when necessary to meet strict drinking water standards prior to distribution.

The total risk from non-carcinogenic materials, expressed as a hazard index (HI), was also determined for hypothetical exposure to untreated groundwater at each of the JPL monitoring wells and at each of the nearby municipal production wells. Results, again using very conservative assumptions, showed that, based on target organ effects, 10 JPL monitoring wells

and three municipal production wells had HI values that exceeded the benchmark value of 1.0. The monitoring wells with "elevated" HI values are primarily located between the north-central portion of the site and the Lincoln Avenue Municipal Well No. 3 to the southeast. The three municipal production wells with "elevated" HI values include the City of Pasadena Arroyo well, the City of Pasadena Well 52, and the Lincoln Avenue Well No. 3. It is important to note that the Agency for Toxic Substances and Disease Registry (ATSDR), in their recent assessment of JPL, concluded in their public comment draft report (ATSDR, 1998) that on-site and off-site groundwater do not pose a present or future public health hazard since wellhead treatment and water blending are used by local water purveyors to meet stringent drinking water standards prior to distribution of the water for public use.

The scoping assessment of ecological risks completed at JPL concluded that since there were no complete exposure pathways from untreated groundwater to animals and plants, there are no risks to potential ecological receptors from site groundwater. Further characterization of ecological risks to biota due to groundwater contamination was therefore not warranted.

The information obtained during the OU-1/OU-3 RI is also sufficient for preparation of the OU-1/OU-3 Feasibility Study. The characterization of the nature and extent of contamination provides a starting point for developing remedial action objectives based on chemical-specific and location-specific Applicable or Relevant and Appropriate Requirements (ARARs). The extent of contamination (vertical and horizontal distribution) also serves as a basis for developing the volume of impacted groundwater and the general response actions for meeting the remedial action objectives. This information will help screen out impractical technologies in terms of effectiveness, implementability, or relative cost. Specific chemical data, including water quality data, will be used in the remedial alternative screening process. The hydrological characteristics of the aquifer, in terms of water elevations under different municipal well pumping situations and the distribution of VOCs in these situations, will also play a major role in the remedial alternative screening process. For example, if an alternative considers using existing down-gradient production wells as a major component, the flow patterns and/or VOC distribution due to the pumping of these down-gradient wells will significantly impact the decision to retain or eliminate that alternative.

8.0 SELECTED REFERENCES

1. Agbabian Associates. 1977. Seismic Studies for the Jet Propulsion Laboratory Facilities, Parts I, II, III. Agbabian Associates, April.

2. ATSDR (Agency for Toxic Substances and Disease Registry). 1997. *ATSDR Toxicological Profiles on CD-ROM. US Public Health Service*. Lewis Publishers, CRC Incorporated.

3. ATSDR (Agency for Toxic Substances and Disease Registry). 1998. *Public Health Assessment for the National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California.* Public Comment Draft. CERCLIS No. CA9800013030.

4. Attaway, H. and M. Smith. 1993. *Reduction of Perchlorate by an Anaerobic Enrichment Culture*. J. Industrial Microbiology. 12:408-412.

5. Beljin, M.S. and P.K.M. van der Heijde. 1997. *SOLUTE: Analytical Models for Solute Transport in Groundwater. Version 4.04.* February.

6. Bouwer, H. and R. C. Rice. 1976. *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells.* Water Resources Research, Volume 12, Number 3, June.

7. Bouwer, H. 1978. *Groundwater Hydrology*, McGraw-Hill Book Company, New York, NY 479 p.

8. Bouwer, H. 1989. *The Bouwer and Rice Slug Test - An Update.* Groundwater, May-June 1989. Volume 25, Number 3.

9. Boyle Engineering. 1988. *Jet Propulsion Laboratory Facilities Master Plan.*

10. Bradford, G. R., A. C. Chang, A. L. Page, D. Bakhtar, J. A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils.* Special Report. Kearney Foundation of Soil Science. Division of Agriculture and Natural Resources, University of California.

11. Brownlow, Arthur H. 1979. *Geochemistry*. Prentice Hall, Inc., Englewood Cliffs, New Jersey, 498 p.

12. Burkhard, L.P. and D.W. Kuehl. 1986. *N-Octanol/Water Partition Coefficients by Reverse Phase Liquid Chromatography/Mass Spectrometry for Eight Tetrachlorinated Planar Molecules*. Chemosphere, pp. 163-167.

13. California Office of Environmental Health Hazard Assessment (CAOEHHA). 1994. California Cancer Potency Factors: Update. November.

14. CDM (Camp, Dresser and McKee). 1990. *Environmental Resources Document for the Jet Propulsion Laboratory.* December.

15. CH2MHill. 1989. *Technical Memorandum Task 1: Describe Current Situation, Phase 1 Devils Gate Multiuse Project.*

16. CH2MHill. 1990. *Phase I Report: Devil's Gate Multi-Use Project.* Prepared for the City of Pasadena, Water and Power Department, in cooperation with the Metropolitan Water District of Southern California, Santa Aria. January 26.

17. Crandall & Associates. 1977a. *Report of Subsurface Investigation, Overall Investigation of Geology, Soils and Seismic Hazard, Seismic Safety Plan, Jet Propulsion Laboratory Site, Pasadena, California.*

18. Crandall & Associates. 1977b. *Report of Fault Hazard Study, Jet Propulsion Laboratory, Pasadena, California.*

19. Crandall & Associates 1981. *Dewatering Well System, Building 150, Jet Propulsion Laboratory, Pasadena, California.*

20. Crook, R., C. Allen, B. Kamb, C. Payne and R. Proctor. 1981. *Quaternary Geology and Seismic Hazard of the Sierra Madre and Associated Faults, Western San Gabriel Mountains.* USGS Professional Paper 1339, pp. 27-63.

21. Department of Public Works (State of California). 1954. *Report of Referee on a Review of the Determination of the Safe Yield of the Raymond Basin Area, Los Angeles County, California.*

22. DTSC (California Department of Toxic Substances Control). 1992. *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste and Permitted Facilities.* July.

23. DTSC (California Department of Toxic Substances Control). 1994. *Preliminary Endangerment Assessment Guidance Manual.*

24. DTSC (California Department of Toxic Substances Control). 1996. *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities.* Prepared by the Office of Scientific Affairs.

25. DWR (Department of Water Resources). 1991. *California Well Standards: Bulletin 74-90.* (Supplement to Bulletin 74-81). California Department of Water Resources, June, 1990, 174 pp.

26. Dragun, J. 1988. *The Soil Chemistry of Hazardous Materials.* HMCRI, Silver Spring, MD.

27. Drever, James I. 1997. *Geochemistry of Natural Waters; Surface and Groundwater Environments*, 3rd ed. Prentice Hall, Inc., Englewood Cliffs, New Jersey, 480 p.

28. Ebasco Environmental Corp. 1990a. *Expanded Site Inspection Report for NASA - Jet Propulsion Laboratory.* May.

29. Ebasco Environmental Corp. 1990b. *Supplemental Information to the Expanded Site Inspection Report on the NASA - Jet Propulsion Laboratory.* November.

30. Ebasco Environmental Corp. 1990c. *Report on Groundwater Elevations at JPL During Start-Up of City of Pasadena Production Wells.* November.

31. Ebasco Environmental Corp. 1990d. *Groundwater Monitoring Well Resampling, Water Level Measurements and Well Surveying.*

32. Ebasco Environmental Corp. 1991a. *Analytical Results of Groundwater Samples Collected in December, 1990, from Monitoring Wells at the Jet Propulsion Laboratory.* February.

33. Ebasco Environmental Corp. 1991b. *JPL Groundwater Monitoring Report Number 4.* October.

34. Ebasco Environmental Corp. 1992a. *Groundwater Model Selection for NASA - JPL Site.*

35. Ebasco Environmental Corp. 1992b. *JPL Groundwater Monitoring Report Number 5.* January.

36. Ebasco Environmental Corp. 1992c. *JPL Groundwater Monitoring Report Number 6.* Ebasco Environmental. July.

37. Ebasco Environmental Corp. 1992d. *JPL Groundwater Monitoring Report Number 7.* Ebasco Environmental. November.

38. Ebasco Environmental Corp. 1993a. *Final Work Plan for Performing a Remedial Investigation/Feasibility Study at the NASA - Jet Propulsion Laboratory.* June.

39. Ebasco Environmental Corp. 1993b. *JPL Groundwater Monitoring Report Number 8.* June.

40. Ebasco Environmental Corp. 1993c. *JPL Groundwater Monitoring Report Number 9.* August.

41. Ebasco Environmental Corp. 1993d. *JPL Groundwater Monitoring Report Number 10.* October.

42. Ebasco Environmental Corp. 1993e. *Draft JPL Groundwater Elevation Data Report Number 1, September 1992 through June 1993.* October.

43. Ebasco Environmental Corp. 1993f. *Final Health and Safety Plan, Remedial Investigation.* December.

44. Ebasco Environmental Corp. 1993g. *Quality Assurance Program for Performing a Remedial Investigation for the NASA-Jet Propulsion Laboratory.* December.

45. Ebasco Environmental Corp. 1993h. *Final Field Sampling and Analysis Plan for Performing a Remedial Investigation at Operable Unit 1: On-Site Groundwater, NASA-Jet Propulsion Laboratory.* December.

46. Ebasco Environmental Corp. 1993i. *Final Field Sampling and Analysis Plan for Performing a Remedial Investigation at Operable Unit 2: Potential On-Site Contaminant Source Areas, NASA-Jet Propulsion Laboratory.* December.

47. Ebasco Environmental Corp. 1994a. *Draft JPL Groundwater Elevation Report Number 2, July 1993 through December 1993.* February.

48. Ebasco Environmental Corp. 1994b. *Final Field Sampling and Analysis Plan for Performing a Remedial Investigation at Operable Unit 3: Off-Site Groundwater, NASA-Jet Propulsion Laboratory.*

49. Ebasco Environmental Corp. 1994c. *Laboratory Audit at Montgomery Laboratory, Pasadena, California.* June 30.

50. EPA (U.S. Environmental Protection Agency). 1979. *Methods for Chemical Analysis of Water and Wastes.* EPA Manual 600/4-79-020.

51. EPA (U.S. Environmental Protection Agency). 1986a. *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document.* Office of Waste Programs Enforcement, OSWER-9950.1, September 1986, 208 pp.

52. EPA (U.S. Environmental Protection Agency). 1986b. *Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition.* USEPA Office of Solid Waste and Emergency Response. Washington D.C.

53. EPA (U.S. Environmental Protection Agency). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* Interim final, OSWER Directive 9355.3-01.

54. EPA (U.S. Environmental Protection Agency). 1989. *Risk Assessment Guidance for Superfund (RAGS): Volume I – Human Health Evaluation Manual (Part A).* Interim Final. Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-89/002. December.

55. EPA (U.S. Environmental Protection Agency). 1990. *Methods for the Determination of Organic Compounds in Drinking Water.* Manual 600/4-90/020.

56. EPA (U.S. Environmental Protection Agency). 1991a. *Management of Investigation-Derived Wastes During Site Inspections:* USEPA Office of Research and Development, EPA/540/ G-91/009, May 1991.

57. EPA (U.S. Environmental Protection Agency). 1991b. *Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part B) Development of Risk-Based Preliminary Remediation Goals.*

58. EPA (U.S. Environmental Protection Agency). 1991c. *Current Regulatory Issues in Risk Assessment and Risk Management.* Executive Office of the President. Government Printing Office, Washington, DC. S/N 041-001-00354-1.

59. EPA (U.S. Environmental Protection Agency). 1991d. *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual. Supplemental Guidance "Standard Default Exposure Factors".* Office of Emergency and Remedial Response, Washington, DC. OSWER Directive 9285.3-03. March.

60. EPA (U.S. Environmental Protection Agency). 1992a. *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring-Draft Technical Guidance.* USEPA Office of Solid Waste and Emergency Response, EPA/530-R-93-001, November, 1992, 219 pp.

61. EPA (U.S. Environmental Protection Agency). 1992b. *Guide to Management of Investigation-Derived Wastes*: USEPA Office of Solid Waste and Emergency Response. Publication 9345.3-03FS, April 1992.

62. EPA (U.S. Environmental Protection Agency). 1992c. Supplemental *Guidance to RAGS: Calculating the Concentration Term, May 1992, Publication 9285.7-81*. Office of Solid Waste and Emergency Response. Washington, DC 20460.

63. EPA (U.S. Environmental Protection Agency). 1992d. *Dermal Exposure Assessment: Principles and Applications Interim Report*. EPA/600/8-91/011B. January.

64. EPA (U.S. Environmental Protection Agency). 1992e. *Guidelines for Exposure Assessment.* Federal Register, 57(104):22888-22938. May 29.

65. EPA (U.S. Environmental Protection Agency). 1993a. *Compilation of Groundwater Models.* Office of Research and Development. EPA/600/R-93/118. May 1993.

66. EPA. (U.S. Environmental Protection Agency). 1993b. *Supplemental Guidance to RAGS: Estimating Risk from Groundwater Contamination.* Office of Solid Waste and Emergency Response, Washington, DC. December.

67. EPA (U.S. Environmental Protection Agency). 1994a. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*. February.

68. EPA (U.S. Environmental Protection Agency). 1994b. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. February.

69. EPA (U.S. Environmental Protection Agency). 1995a. *Exposure Factors Handbook (Draft)*. Exposure Assessment Group Office of Health and Environmental Assessment Washington, DC. EPA/600/P-95/002A June 1995.

70. EPA (U.S. Environmental Protection Agency). 1995b. *Supplemental Region IV Risk Assessment Guidance*. Atlanta, GA.

71. EPA (U.S. Environmental Protection Agency). 1996a. *Final Update No. III, Test Methods for Evaluating Solid Waste, SW-846.* USEPA Office of Solid Waste and Emergency Response. Washington, D.C. December.

72. EPA (U.S. Environmental Protection Agency). 1996b. *Proposed Guidelines for Carcinogen Risk Assessment*. Office of Research and Development. EPA/600/P-92/003C. April.

73. EPA (U.S. Environmental Protection Agency). 1996c. *Environmental Protection Agency Region III Risk-Based Concentration Table*. January-June 1996.

74. EPA (U.S. Environmental Protection Agency). 1997. *Health Effects Assessments Summary Tables (HEAST)*, EPA 540/R.97-036. July, 1997.

75. EPA (U.S. Environmental Protection Agency). 1998a. *Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part D) Standardized Planning, Reporting and Review of Superfund Risk Assessment*. Publication 9285.7-01D. Interim Office of Emergency and Remedial Response Washington DC.

76. EPA (U.S. Environmental Protection Agency). 1998b. *Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual. Supplemental Guidance. Dermal Risk Assessment Guidance*. Interim Guidance NCEA-W-0364. May 1998.

77. EPA (U.S. Environmental Protection Agency). 1998c. *Integrated Risk Information System (IRIS)*. On-line database.

78. EPA (U.S. Environmental Protection Agency). 1999. *Region IX Preliminary Remediation Goals*, Sacramento, CA. (PRG table expires 5/99).

79. Foster Wheeler Environmental Corporation. 1996a. *Draft-Final "Part A" Addendum to the Work Plan for Performing a Remedial Investigation/Feasibility Study at the NASA-Jet Propulsion Laboratory, Pasadena, California.* September.

80. Foster Wheeler Environmental Corporation. 1996b. *Draft-Final "Part B" Addendum to the Work Plan for Performing a Remedial Investigation/Feasibility Study at the NASA-Jet Propulsion Laboratory, Pasadena, California.* September.

81. Foster Wheeler Environmental Corporation. 1996c. *Draft-Final "Part A" Addendum to the Field Sampling and Analysis Plan (FSAP) for Performing a Remedial Investigation at Operable Unit 1: On-Site Groundwater*. September.

82. Foster Wheeler Environmental Corporation. 1996d. *Draft-Final "Part B" Addendum to the Field Sampling and Analysis Plan (FSAP) for Performing a Remedial Investigation at Operable 1: On-Site Groundwater*. September.

83. Foster Wheeler Environmental Corporation. 1996e. *Draft-Final Addendum to the Quality Assurance Program for Performing a Remedial Investigation*. September.

84. Foster Wheeler Environmental Corporation. 1996f. *Report on Quarterly Groundwater Monitoring Results, August-September, 1996*. December.

85. Foster Wheeler Environmental Corporation. 1996g. *Scoping Assessment of Ecological Risk at the Jet Propulsion Laboratory, Pasadena, California.* September.

86. Foster Wheeler Environmental Corporation. 1996h. *JPL Groundwater Screening Assessment.* Memorandum from Mark Jones, Foster Wheeler to Chuck Buril, Manager Environmental Affairs Office, JPL. September.

87. Foster Wheeler Environmental Corporation. 1996i. *Draft Data Validation Summary Report for Operable Unit 1 Groundwater Samples Collected June/July, 1994.*

88. Foster Wheeler Environmental Corporation. 1996j. *Draft Data Validation Summary Report for Operable Unit 1 Groundwater Samples Collected November/December, 1994.*

89. Foster Wheeler Environmental Corporation. 1996k. *Report on the Preliminary Evaluation of Groundwater Data Collected at JPL Prior to the CERCLA RI/FS.*

90. Foster Wheeler Environmental Corporation. 1997a. *Report on Quarterly Groundwater Monitoring Results, October-November, 1996.* March.

91. Foster Wheeler Environmental Corporation. 1997b. *Report on Quarterly Groundwater Monitoring Results, February-March, 1997.* April.

92. Foster Wheeler Environmental Corporation. 1997c. *Report on Quarterly Groundwater Monitoring Results, June-July, 1997.* September.

93. Foster Wheeler Environmental Corporation. 1997d. *Report on Laboratory Audit Conducted at Montgomery Watson Laboratories, Pasadena, California.* September.

94. Foster Wheeler Environmental Corporation. 1997e. *Data Validation Summary Report for Operable Unit 3 Groundwater Samples Collected July/August, 1995.*

95. Foster Wheeler Environmental Corporation. 1997f. *Data Validation Summary Report for Operable Unit 3 Groundwater Samples Collected December, 1995/January, 1996.*

96. Foster Wheeler Environmental Corporation. 1998a. *Report on Quarterly Groundwater Monitoring Results, September-October, 1997.* March.

97. Foster Wheeler Environmental Corporation. 1998b. *Report on Quarterly Groundwater Monitoring Results, January-February, 1998.* April.

98. Foster Wheeler Environmental Corporation. 1998c. *Draft-Final Addendum Number 2 to the Work Plan for Performing a Remedial Investigation/Feasibility Study.* May.

99. Foster Wheeler Environmental Corporation. 1998d. *Draft-Final Addendum Number 2 to the Field Sampling and Analysis Plan (FSAP) for Performing a Remedial Investigation at Operable Unit 2: Potential On-Site Contaminant Source Areas.* May.

100. Foster Wheeler Environmental Corporation. 1998e. *Draft Baseline Risk Assessment for Operable Units 1 and 3: On-Site and Off-Site Groundwater*, Jet Propulsion Laboratory. July.

101. Foster Wheeler Environmental Corporation. 1998f. *Data Validation Summary Report for Operable Units 1 and 3 Groundwater Samples Collected September/October 1997*, Jet Propulsion Laboratory. November 1998.

102. Foster Wheeler Environmental Corporation. 1998g. *Data Validation Summary Report for Operable Units 1 and 3 Groundwater Samples Collected January/February 1998*, Jet Propulsion Laboratory. December 1998.

103. Foster Wheeler Environmental Corporation. 1999. *Draft Remedial Investigation Report for Operable Unit 2: Potential On-Site Contaminant Source Areas,* Jet Propulsion Laboratory. February 1999.

104. Freeze, Allan R. and Cherry, John A. 1979. *Groundwater.* Prentice Hall, Inc. Englewood Cliffs, New Jersey, 604 pp.

105. Geotechnical Consultants, Inc. 1982. Draft report and set of notes and correspondence concerning drilling and installation of monitoring well MH-01 in the Arroyo Seco for the City of Pasadena.

106. Geotechnical Consultants, Inc. 1989. *Interim Report, Evaluation of Groundwater Quality Upgradient of Jet Propulsion Laboratory, Pasadena, California.* U.S. Army Corps of Engineers Contract.

107. Geraghty and Miller, Inc. 1991. *AQTESOLV®, Aquifer Test Design and Analysis Computer Software Version 1.1.* Geraghty and Miller, Inc. Modeling Group. Reston, Virginia.

108. Greenwood, N.N. and A. Earnshaw. 1985. *Chemistry of the Elements.* Pergammon. New York.

109. Hem, J. D. 1985. *Study and Interpretation of the Chemical Characteristics of Natural Water:* United States Geological Survey, Water-Supply Paper 2254.

110. Hill, M. C. 1993. A computer program (MODFLOWP) for Estimating Parameters of a Transient, Three-Dimensional Groundwater, Flow Model using Non-Linear Regression, U.S. Geological Survey, Open File Report 91-484, 358 pp.

111. Howard, P.H. 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals Volume I – Large Production and Priority Pollutants.* Lewis Publishers, Inc. Chelsea, Michigan.

112. Jet Propulsion Laboratory (JPL). 1990. Untitled set of memoranda, laboratory analyses, notes, sketches, and other correspondence associated with the removal of storm drain catch basin and contaminated soil.

113. Jet Propulsion Laboratory (JPL). 1996. *RPM Consensus Statement on RI Addenda, November 22, 1996.* Statement signed by all RPMs considering Draft-Final Addenda to Work Plan, FSAPs and QAPP Final pursuant to changes referenced in statement.

114. Losi, M.E., C. Amrhein, and W.T. Frankenberger, Jr. 1994. *Environmental Biochemistry of Chromium.* Reviews of Environmental Contamination and Toxicology. 136:91-129. Springer-Verlag, Inc., New York.

115. Mayer, K. 1998. Data presented by Kevin Mayer, USEPA Region IX, at the Perchlorate Stakeholders Forum. May 19-21, 1998. Henderson, Nevada.

116. Micromedex, Incorporated. 1997. *Tomes Database.* Hazardous Substance Data Bank (HSDB). Boulder, Colorado.

117. Moore, J.W. and S. Ramamoorthy. 1984. *Heavy Metals in Natural Waters.* Springer-Verlag, New York, New York.

118. Montgomery, J.M. Inc. 1986. Untitled letter report outlining hydrogeologic data and contamination along with contaminant transport predictions.

119. Multimedia Environmental Technology. 1996. *Development and Calibration of the Two-Dimensional Groundwater Flow Model of the Jet Propulsion Laboratory, Pasadena, California.*

120. Multimedia Environmental Technology. 1997. *Development and Calibration of the 3-D Groundwater Flow Model of the Jet Propulsion Laboratory, Pasadena, California.*

121. Multimedia Environmental Technology. 1998. *Calibration and Refinement of the 3-D Groundwater Flow Model of the Jet Propulsion Laboratory, Pasadena, California.*

122. OEHHA (California Office of Environmental Health Hazard Assessment). 1994. *California Cancer Potency Factors: Update*. November.

123. Openheimer, J., and A. D. Eaton. 1986. *Quality Control and Mineral Analysis, in Proc. Water Quality Technology Conference, Houston, TX, December 8-11, 1985:* American Water Works Association, Denver, CO, p. 15-33.

124. Raymond Basin Management Board. 1985. *AB 1803 Water Analysis Plan for the Raymond Basin*. May.

125. Raymond Basin Management Board. 1998. *Watermaster Service in the Raymond Basin.* September.

126. Slade, R. C. 1984. *Preliminary Hydrogeologic Assessment of Soil and Groundwater Monitoring at Jet Propulsion Laboratory, Pasadena, California.*

127. Smith, D. P. 1986. *Geology of the North Half of the Pasadena Quadrangle, Los Angeles County, California*. California Division of Mines and Geology Open File Report 86-4 LA.

128. University of California, 1996. *Background Concentrations of Trace and Major Elements in California Soils*. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources. March 1996.

129. USGS. 1984. McDonald, M. G. and Harbaugh, A. W. *A Modular Three-Dimensional Finite Difference Groundwater Flow Model.* U.S. Geological Survey, National Center, Reston, Virginia.

APPENDIX A

STIFF DIAGRAMS FROM WATER CHEMISTRY DATA COLLECTED DURING THE PRE-RI GROUNDWATER SAMPLING PROGRAM AT JPL

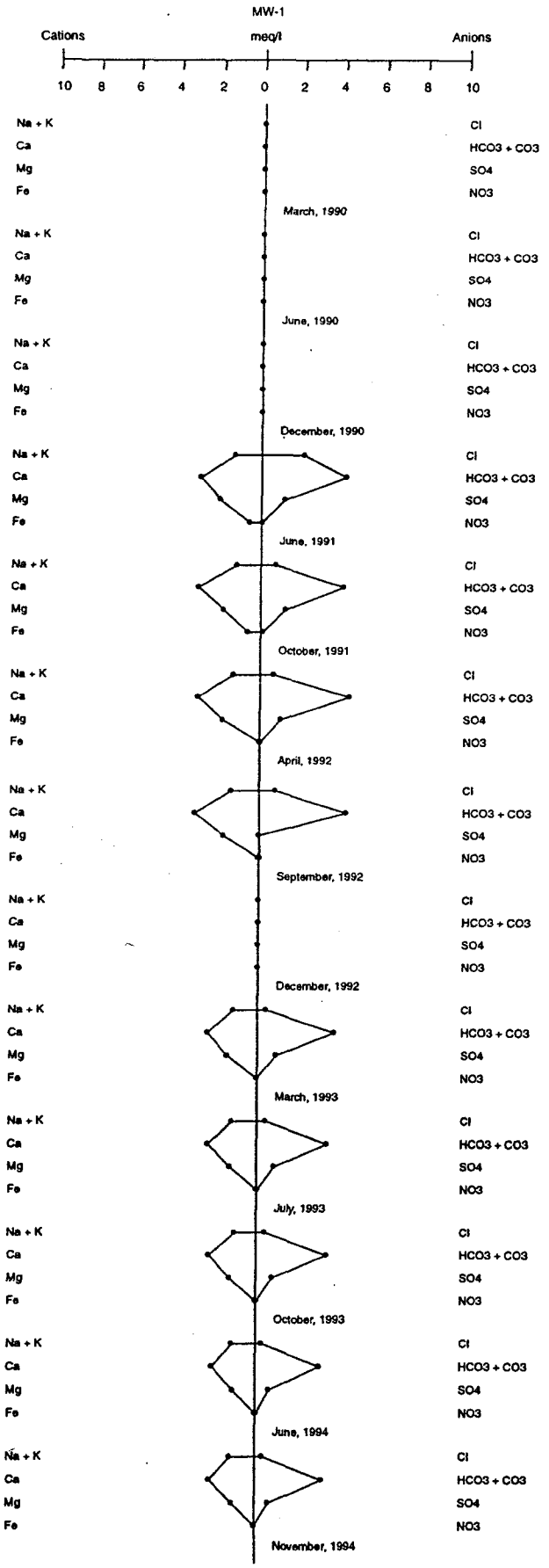


Figure A-1

Stiff Diagrams for MW-1 (through 1994)

Jet Propulsion Laboratory

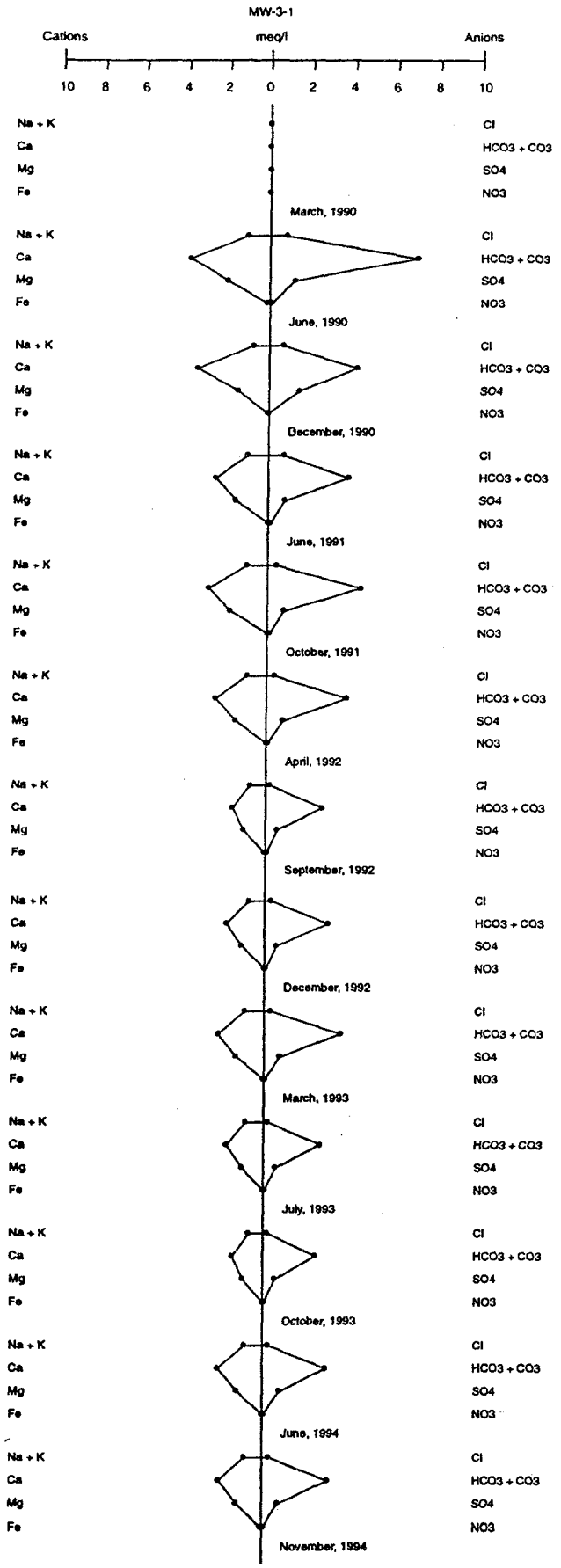


Figure A-2

Stiff Diagrams for MW-3 Screen 1 (through 1994)

Jet Propulsion Laboratory

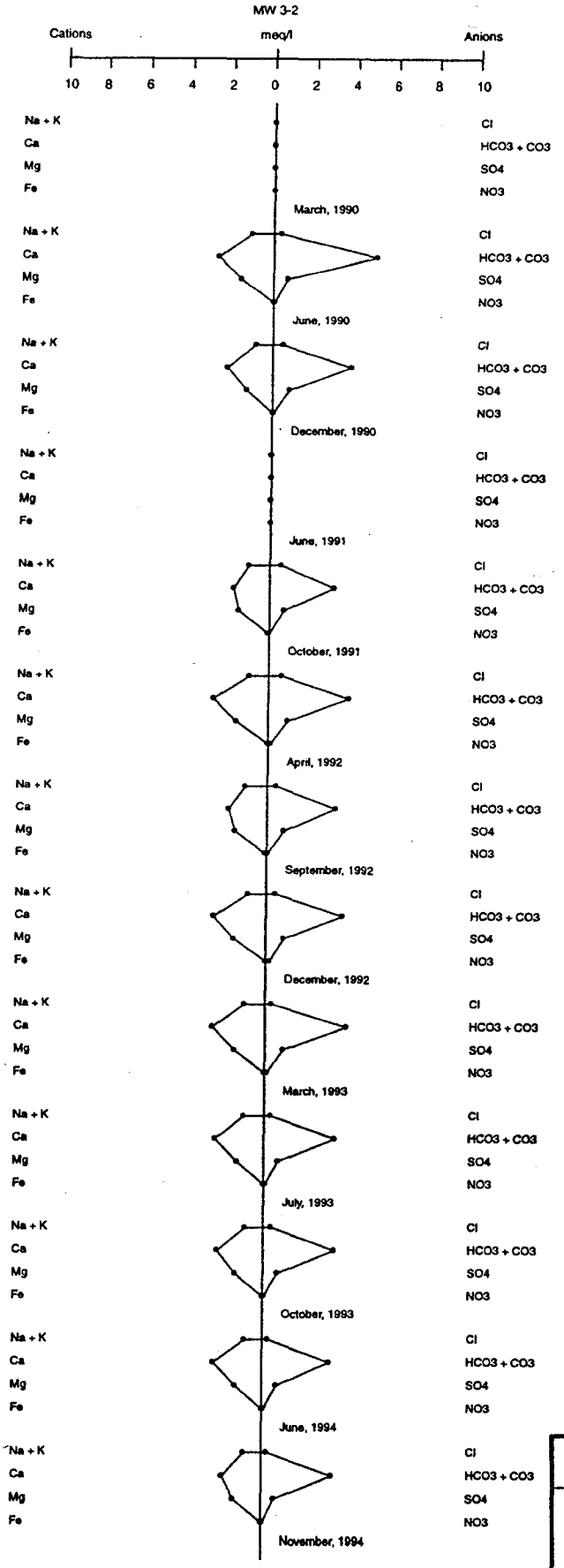


Figure A-3

Stiff Diagrams for MW-3 Screen 2 (through 1994)

Jet Propulsion Laboratory

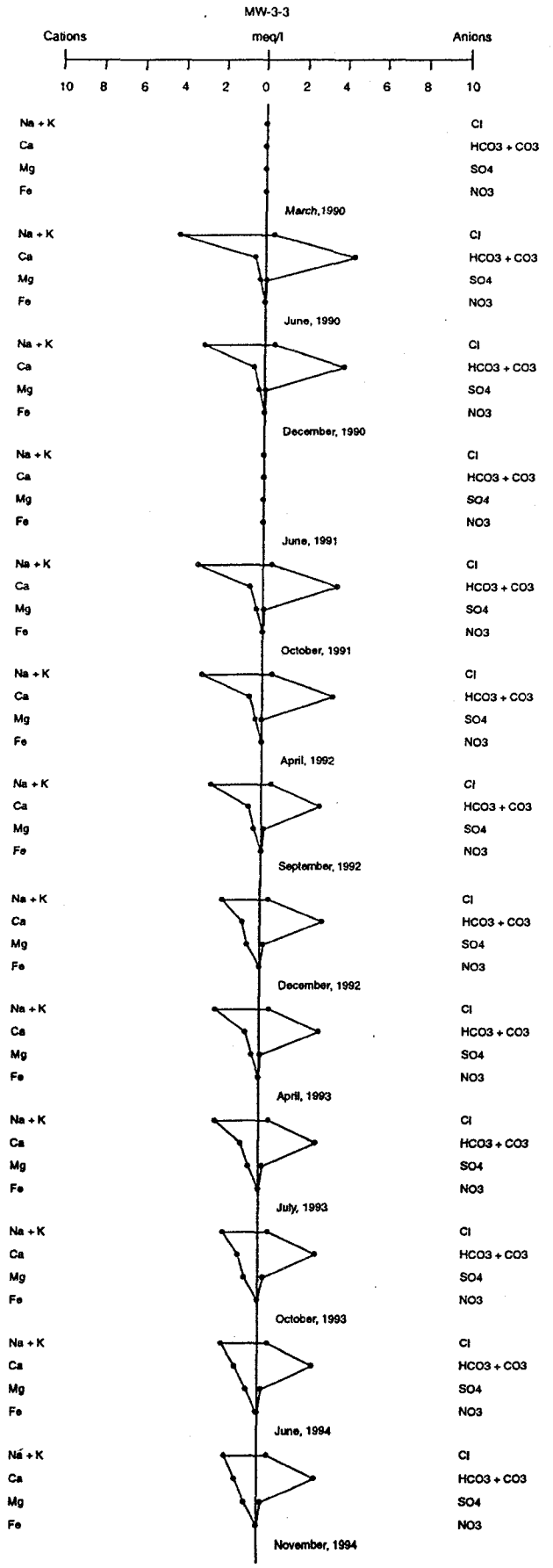


Figure A-4

Stiff Diagrams for MW-3 Screen 3 (through 1994)

Jet Propulsion Laboratory

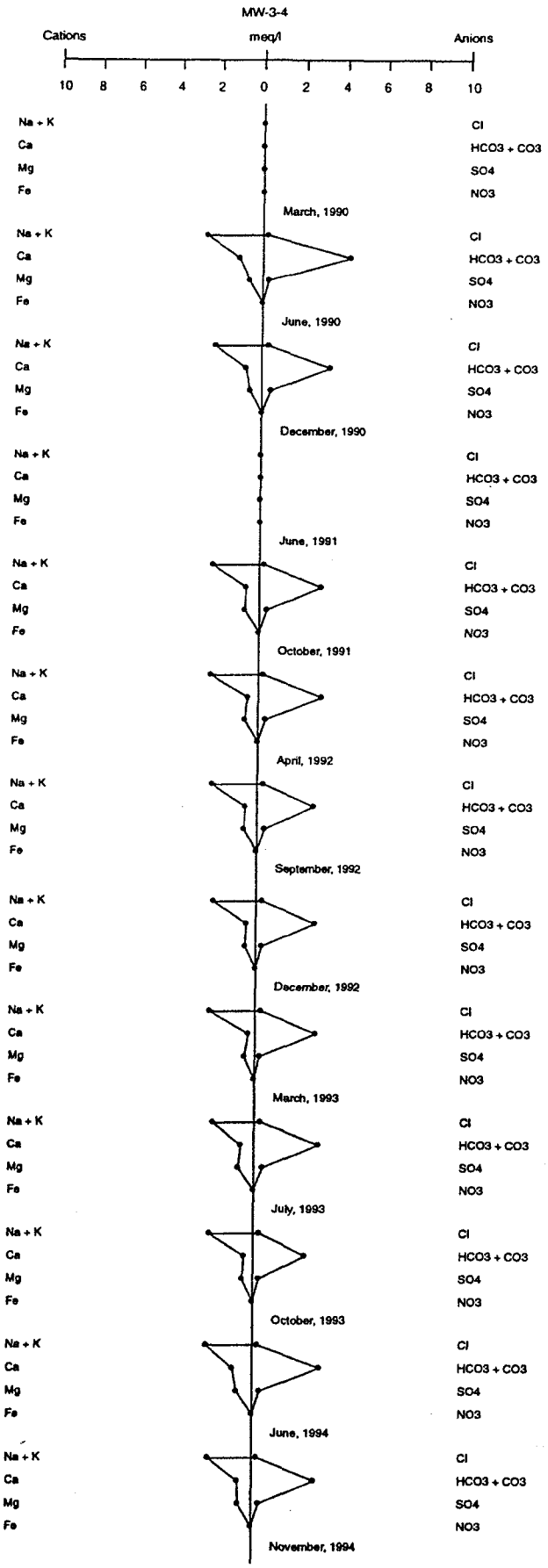


Figure A-5

Stiff Diagrams for MW-3 Screen 4 (through 1994)

Jet Propulsion Laboratory

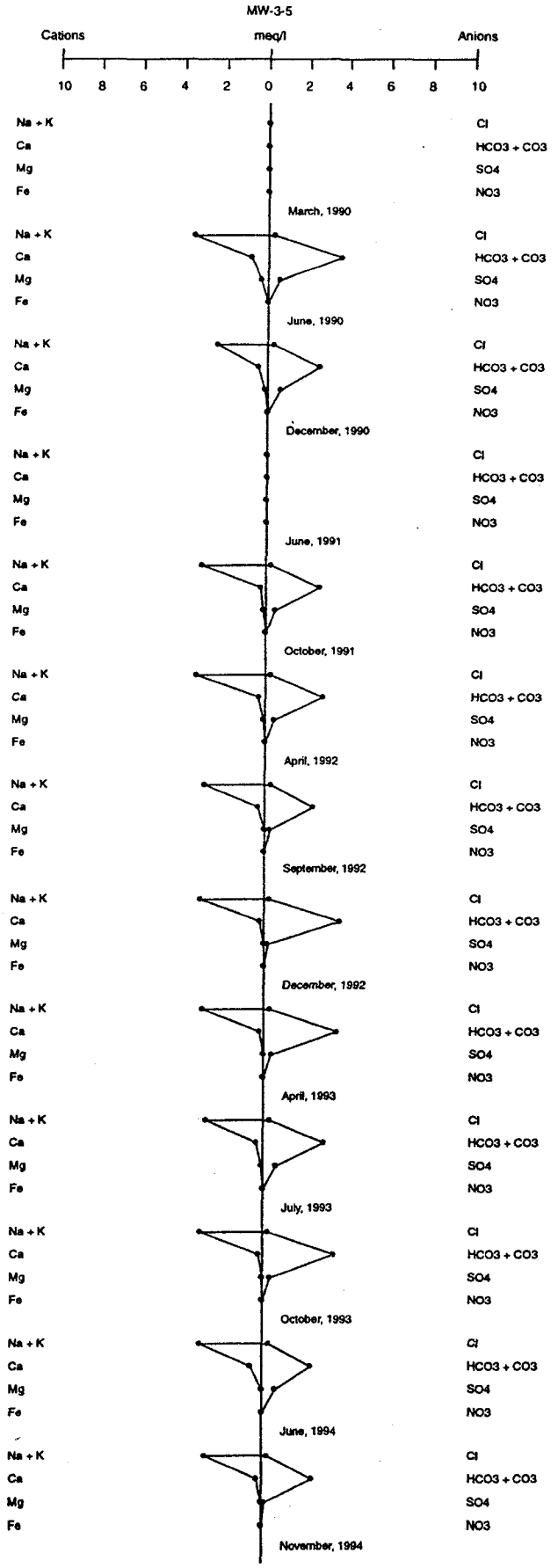


Figure A-6

Stiff Diagrams for MW-3 Screen 5 (through 1994)

Jet Propulsion Laboratory

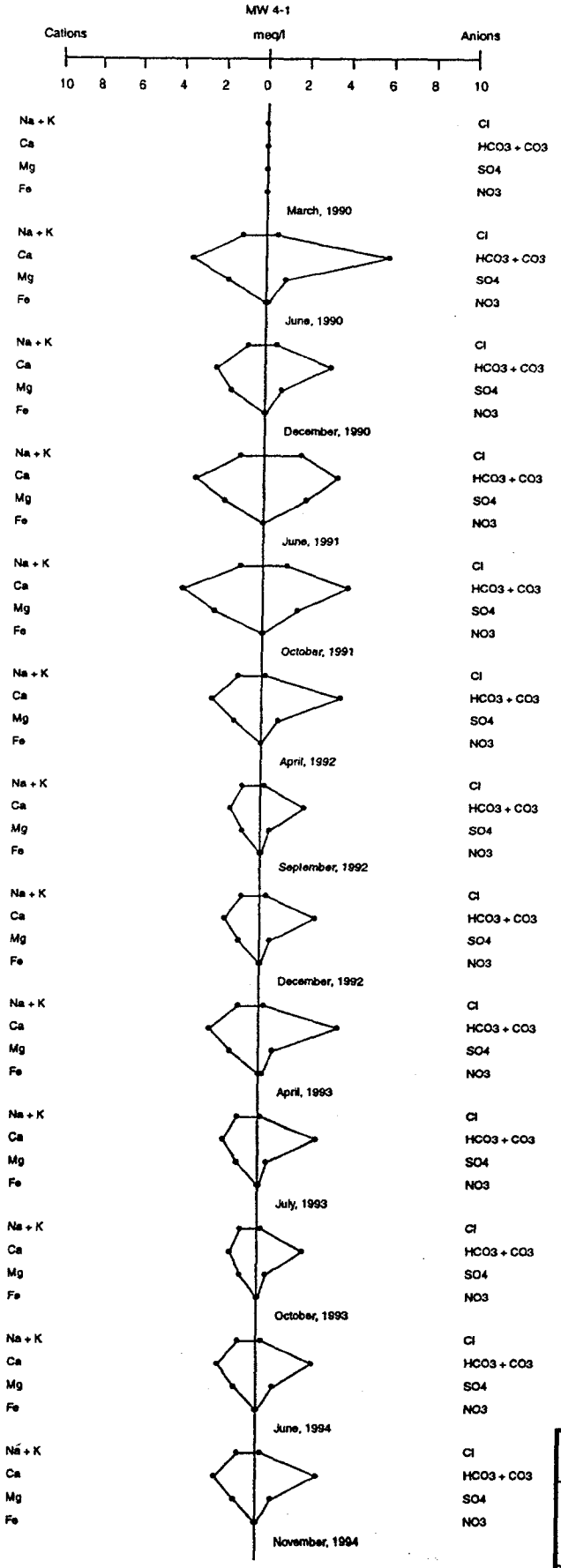


Figure A-7

Stiff Diagrams for MW-4 Screen 1 (through 1994)

Jet Propulsion Laboratory

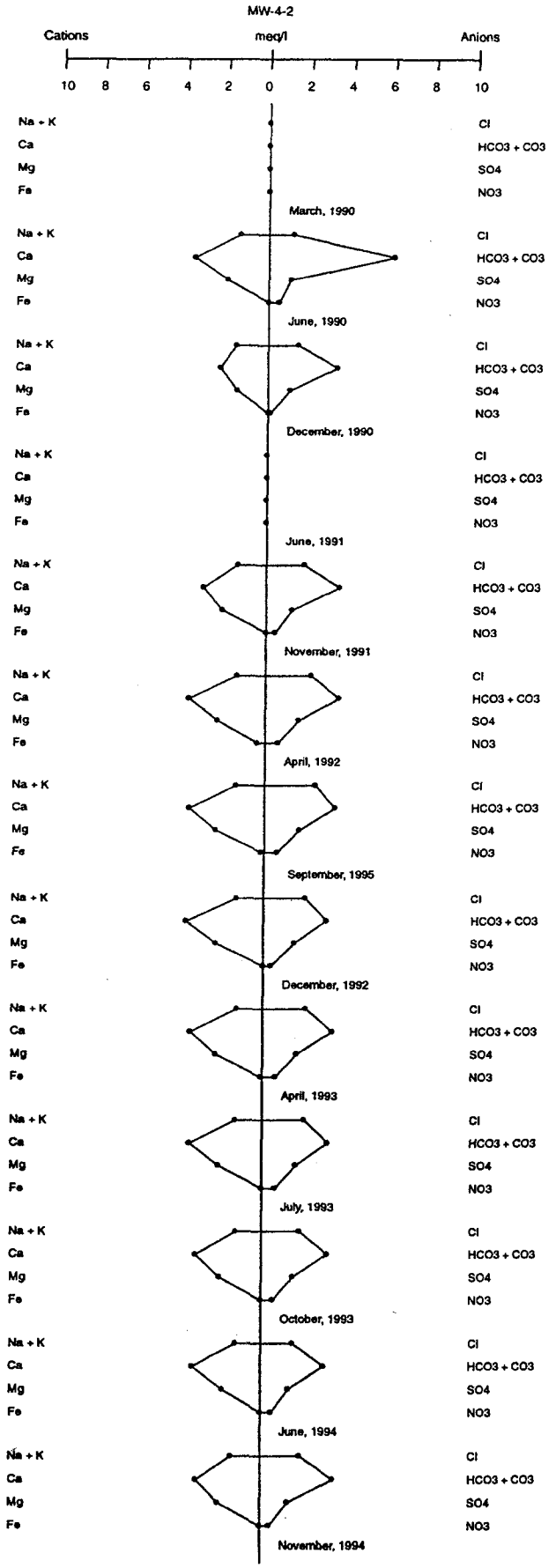


Figure A-8

Stiff Diagrams for MW-4 Screen 2 (through 1994)

Jet Propulsion Laboratory

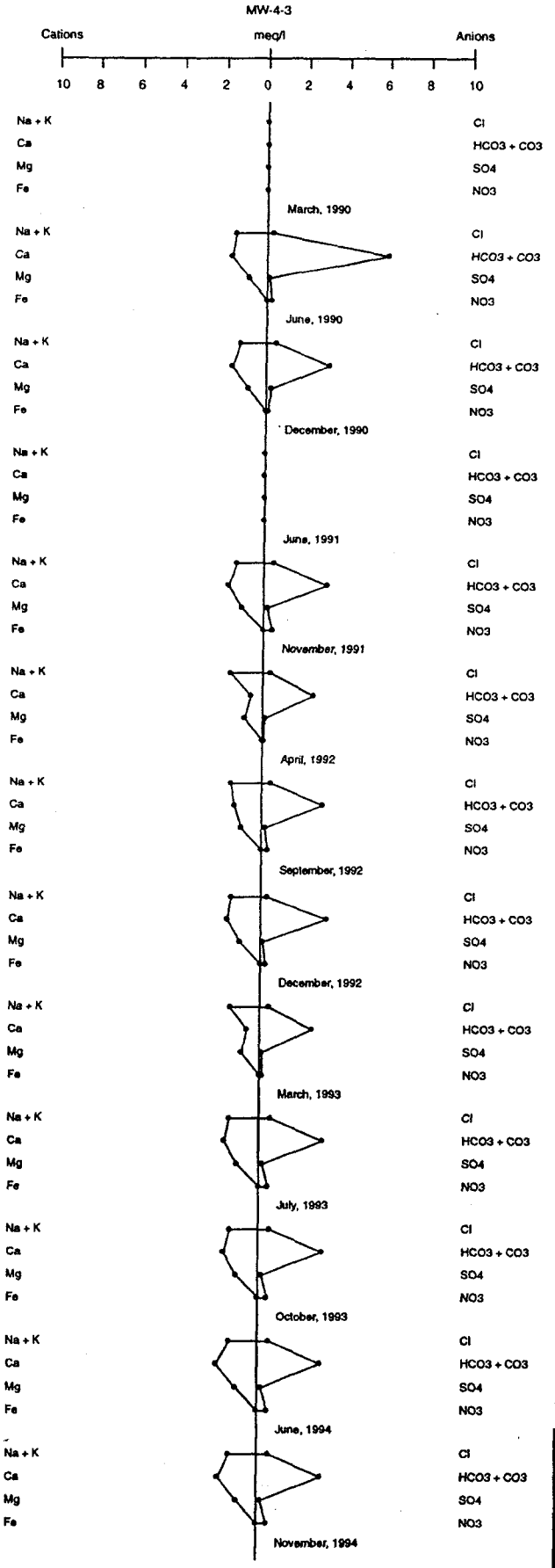


Figure A-9

Stiff Diagrams for MW-4 Screen 3 (through 1994)

Jet Propulsion Laboratory

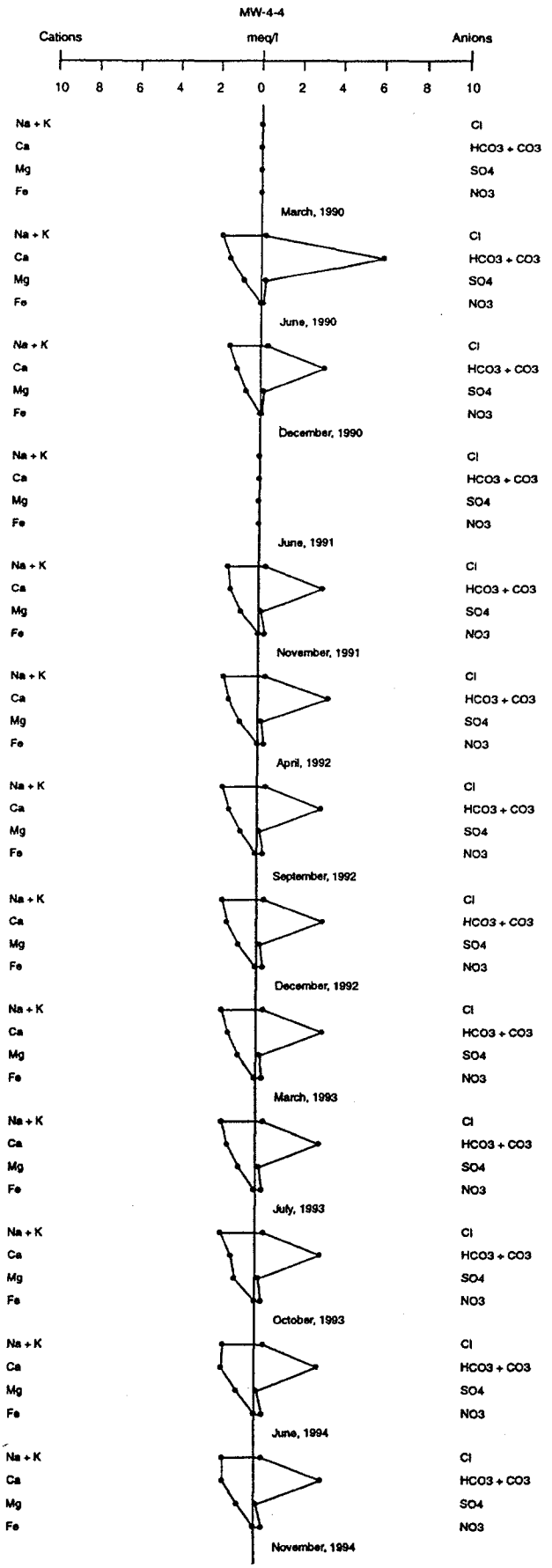


Figure A-10

Stiff Diagrams for MW-4 Screen 4 (through 1994)

Jet Propulsion Laboratory

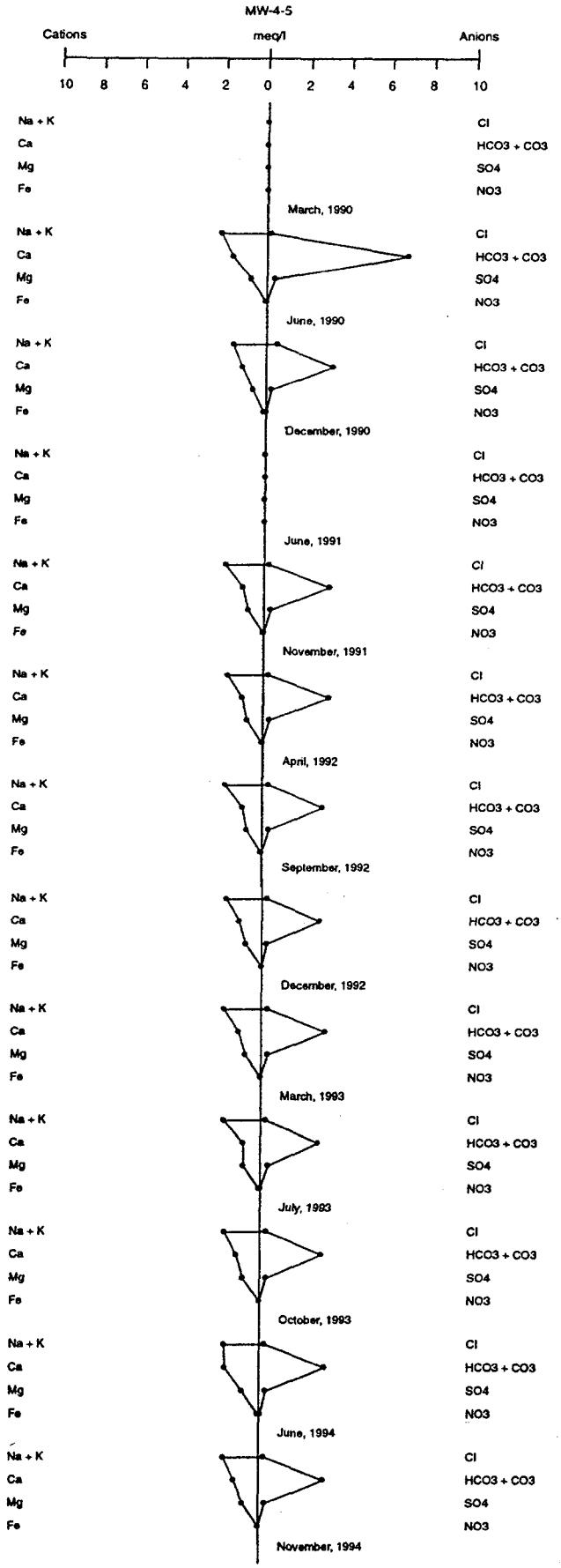


Figure A-11

Stiff Diagrams for MW-4 Screen 5 (through 1994)

Jet Propulsion Laboratory

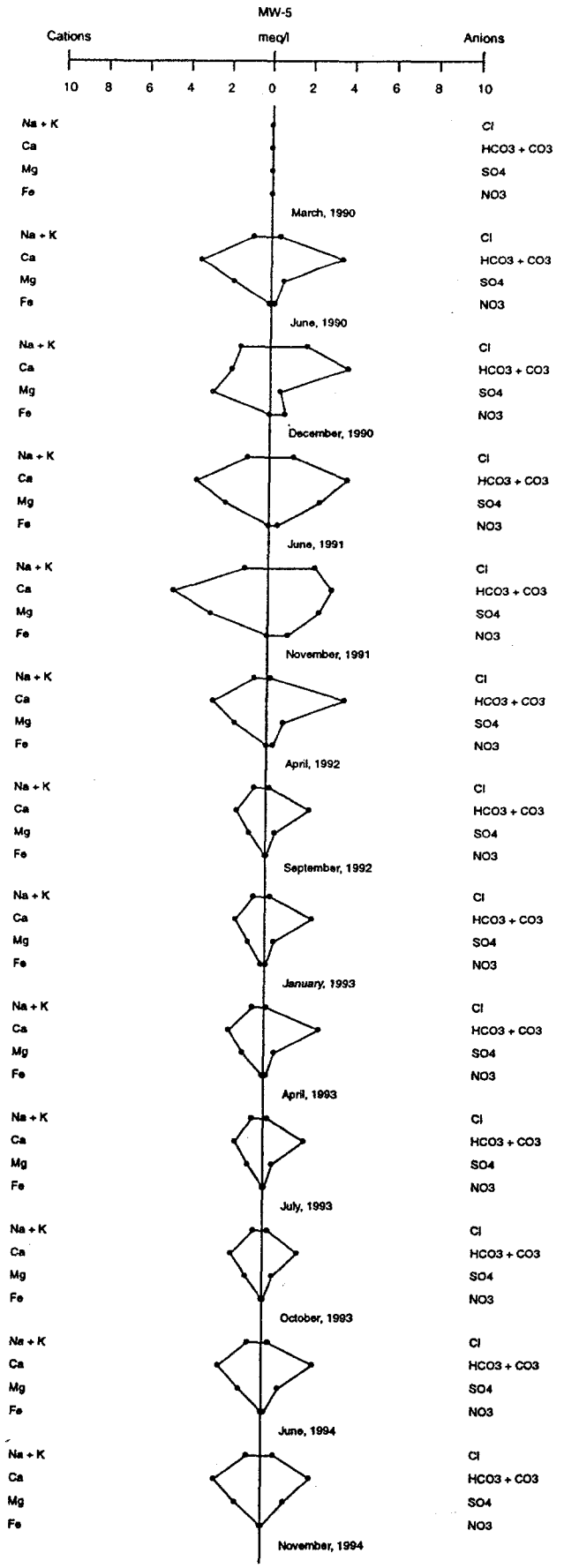


Figure A-12

Stiff Diagrams for MW-5 (through 1994)

Jet Propulsion Laboratory

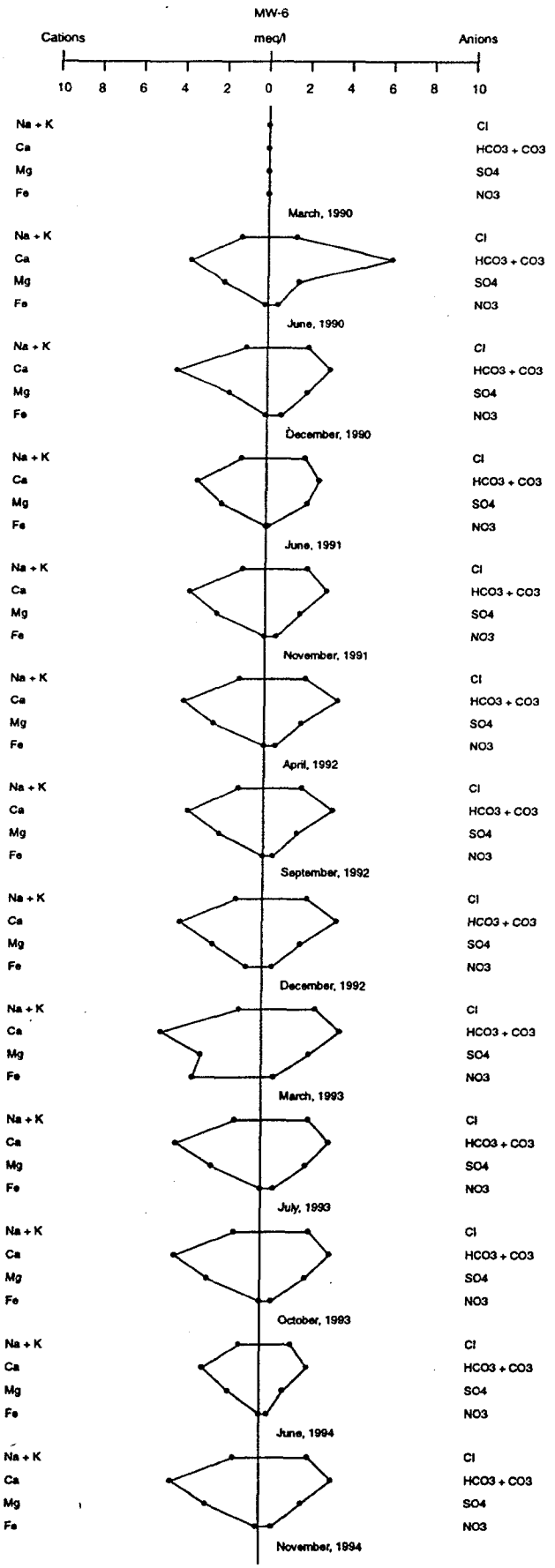


Figure A-13

Stiff Diagrams for MW-6 (through 1994)

Jet Propulsion Laboratory

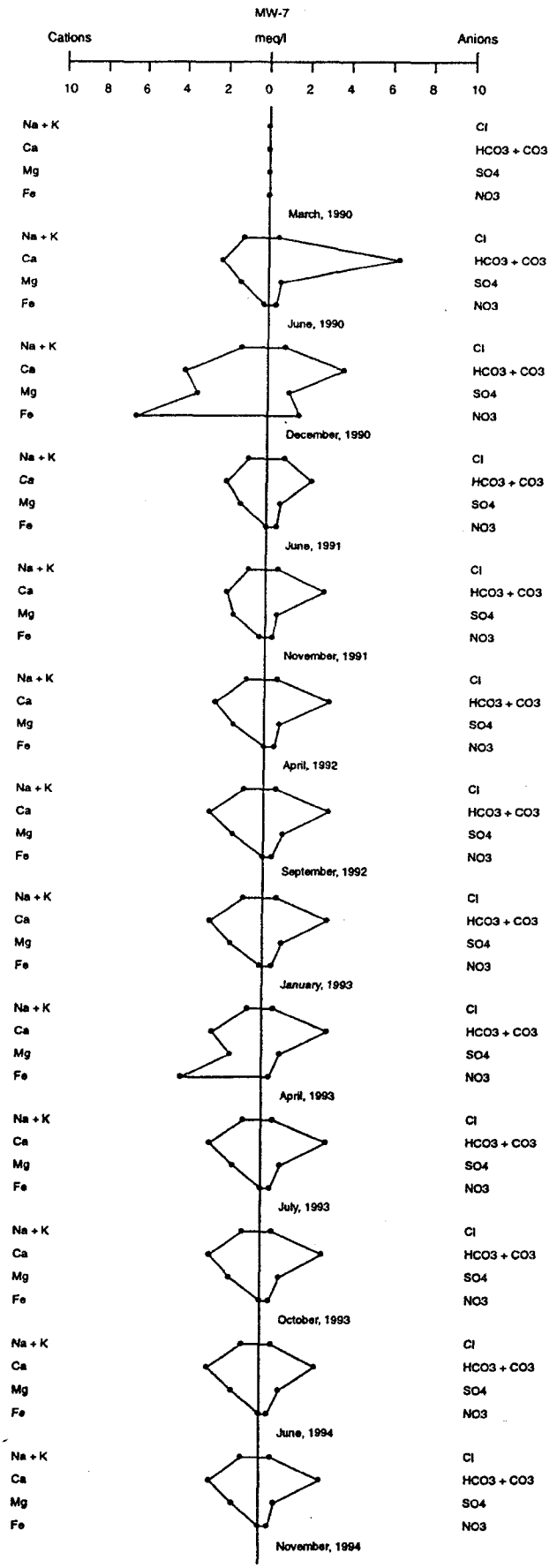


Figure A-14

Stiff Diagrams for MW-7 (through 1994)

Jet Propulsion Laboratory

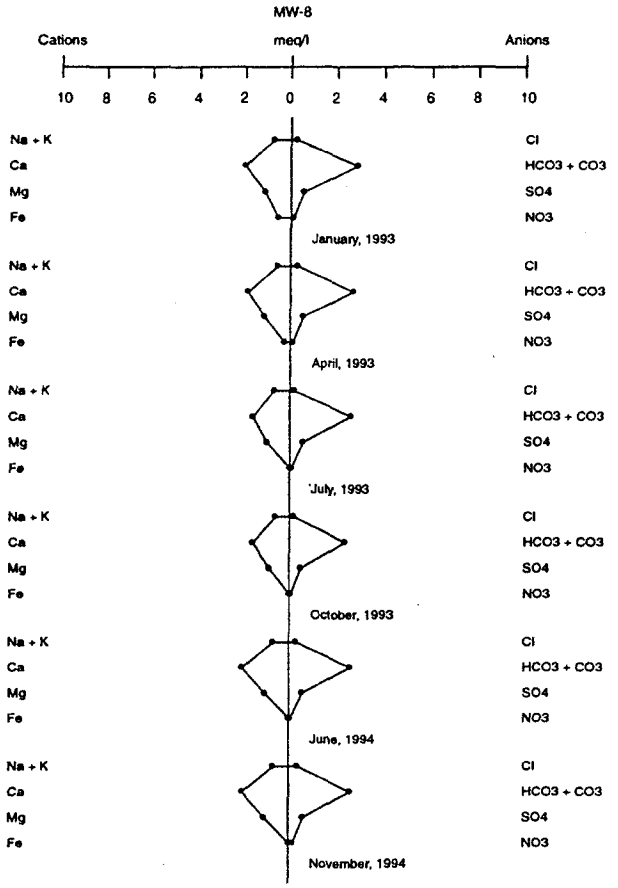


Figure A-15

Stiff Diagrams for MW-8 (through 1994)

Jet Propulsion Laboratory

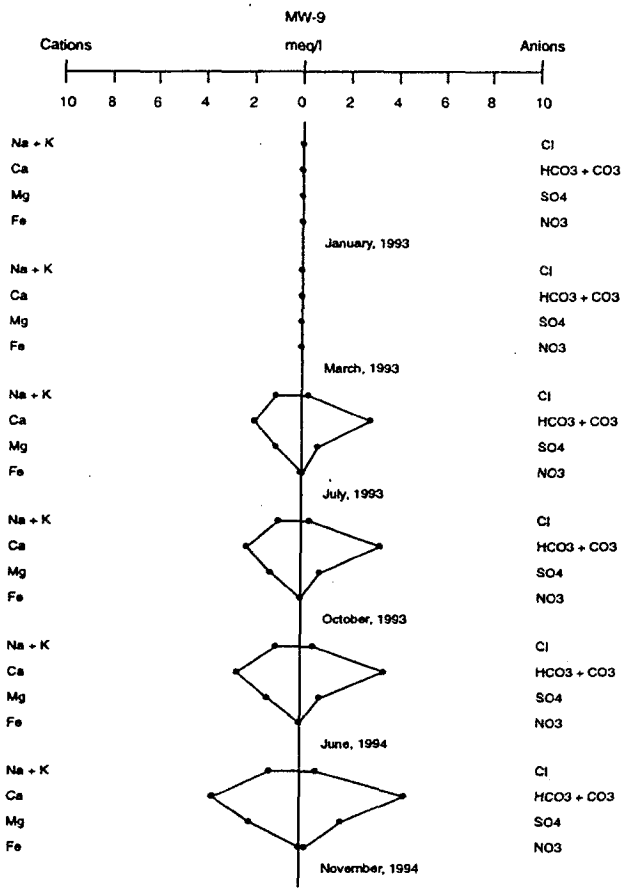


Figure A-16

Stiff Diagrams for MW-9 (through 1994)

Jet Propulsion Laboratory

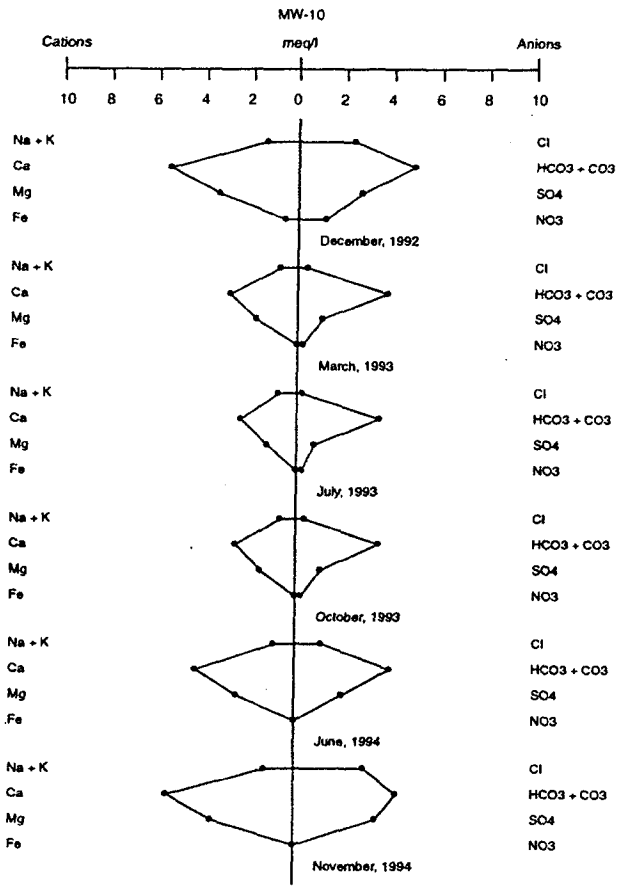


Figure A-17

Stiff Diagrams for MW-10 (through 1994)

Jet Propulsion Laboratory

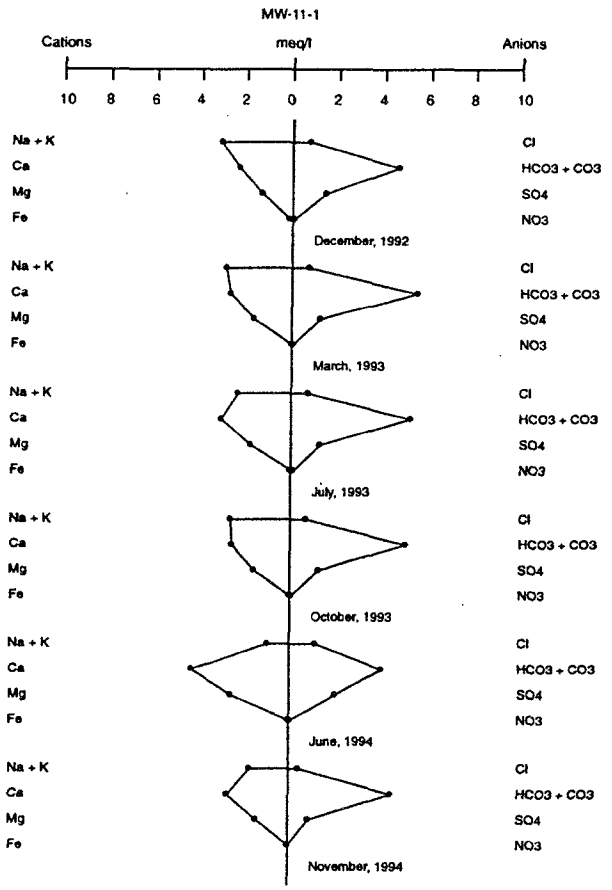


Figure A-18

Stiff Diagrams for MW-11 Screen 1 (through 1994)

Jet Propulsion Laboratory

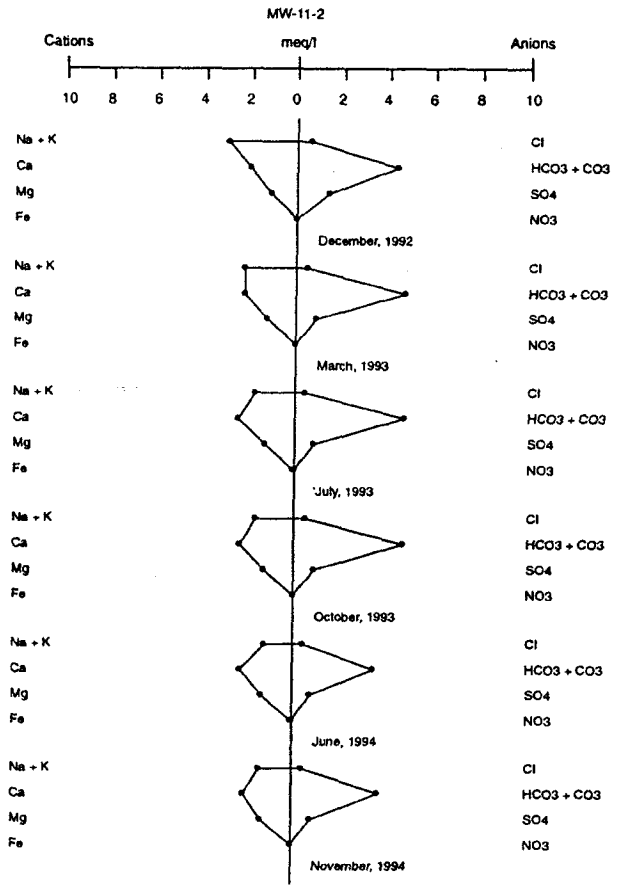


Figure A-19

Stiff Diagrams for MW-11 Screen 2 (through 1994)

Jet Propulsion Laboratory

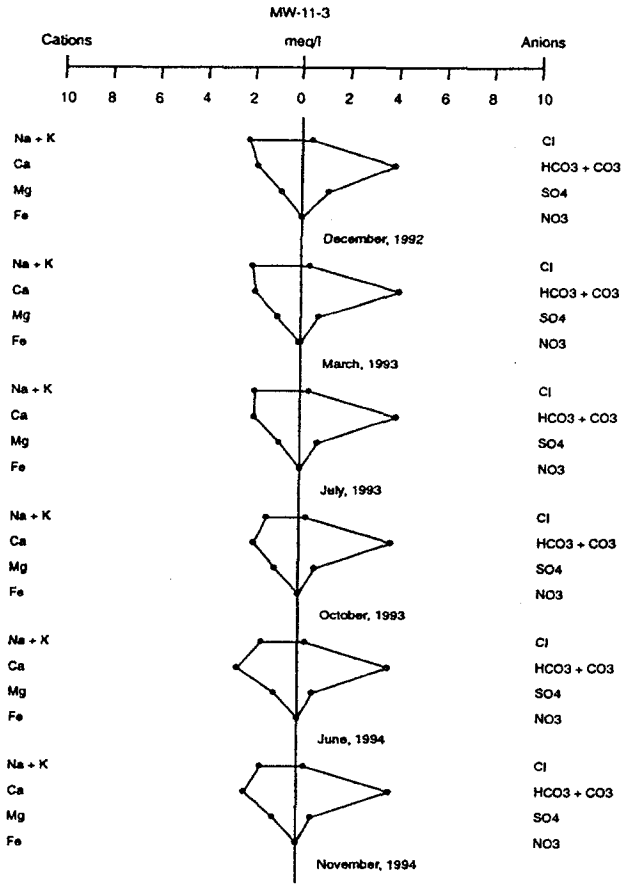


Figure A-20

Stiff Diagrams for MW-11 Screen 3 (through 1994)

Jet Propulsion Laboratory

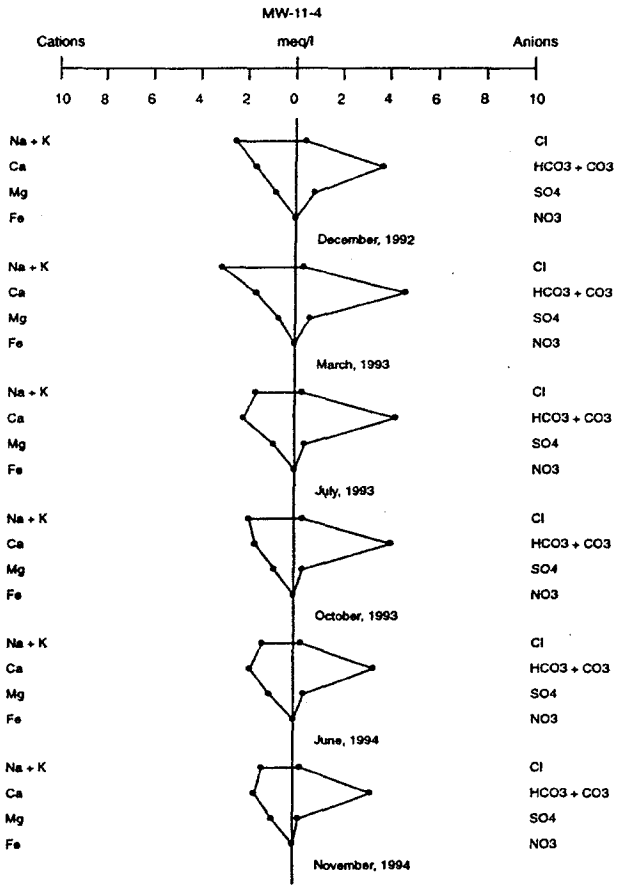


Figure A-21

Stiff Diagrams for MW-11 Screen 4 (through 1994)

Jet Propulsion Laboratory

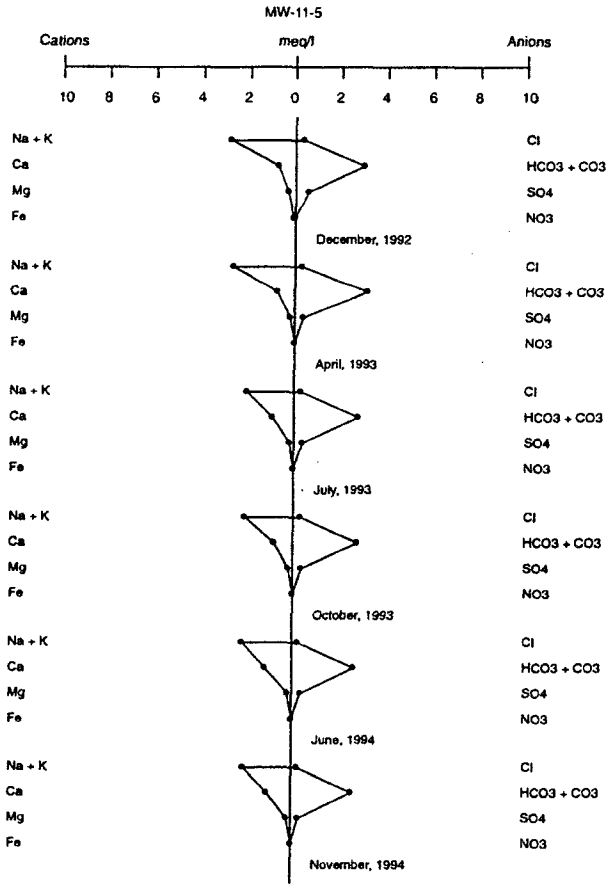


Figure A-22

Stiff Diagrams for MW-11 Screen 5 (through 1994)

Jet Propulsion Laboratory

APPENDIX B

BORING LOGS AND WELL COMPLETION DETAILS FOR JPL GROUNDWATER MONITORING WELLS

WELL MW-1

BORING LOG AND WELL COMPLETION DIAGRAM

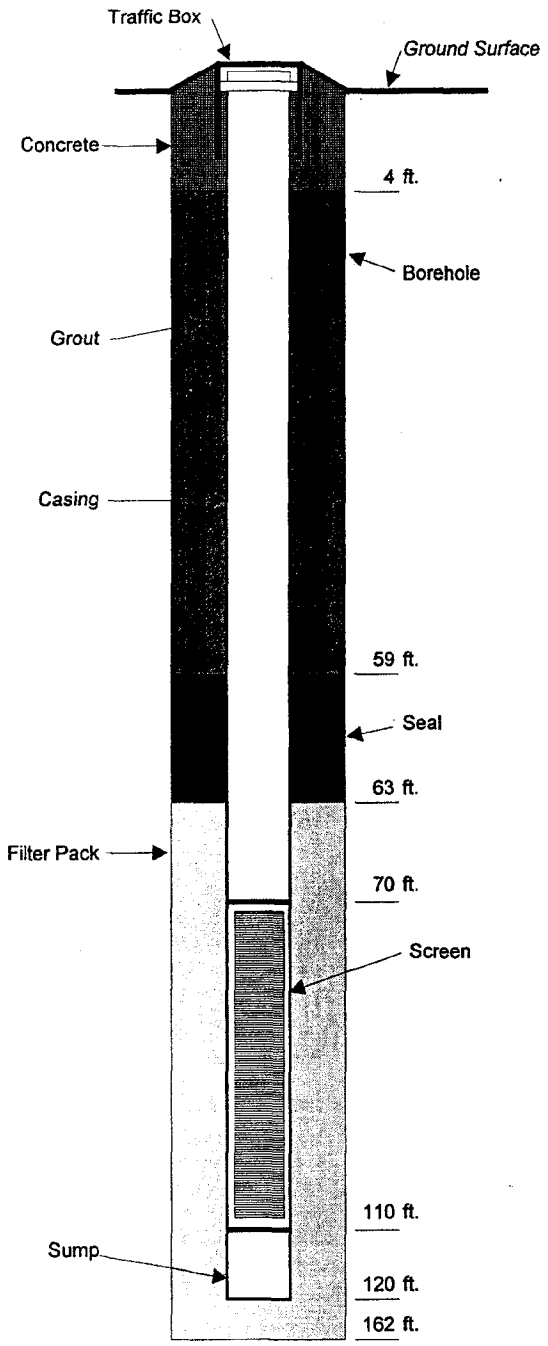
WELL CONSTRUCTION LOG

WELL NUMBER: MW-1

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1115.84

CASING ELEV (ft. above MSL): 1116.70



DRILLING SUMMARY

DATE COMPLETED:	8/22/89
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	162 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	120 ft.
BLANK CASING TYPE:	Polyvinylchloride (PVC)
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	80 ft
SCREEN TYPE:	Polyvinylchloride (PVC)
SCREEN SLOT SIZE:	0.020-inch
SCREEN LENGTH:	40 ft.
SUMP LENGTH:	10 ft.
PROTECTIVE CASING STICKUP:	2 ft.
GROUT MATERIAL:	Cement
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#3 Sand
COMMENTS:	

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
1110						"ALLUVIUM (Qal)" SILTY SAND (SM) with cobbles and boulders, light brown, dry, loose.						
10												
1100												
						set 10" conductor to 15 feet, end of shift 8/22/89.						
20						"ALLUVIUM (Qal)" SAND (SP) brown with white quartz and feldspar, medium to very coarse grained, angular with traces of clayey silt.						
1090												
30						cobbles.						
1080												
						∇ boulders.						
40						"ALLUVIUM (Qal)" SILTY CLAY (CL) brown, soft, soluble, with very fine grained sand and lenses of cobbles.						
1070												
50						cobbles.						
1060												
60						"ALLUVIUM (Qal)" SAND (SP) brown, medium to coarse grained, angular with scattered gravel and cobbles.						
1050												

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
						"ALLUVIUM (Qal)" SAND (SP) brown, medium to coarse grained, angular with scattered gravel and cobbles.						
70												
1040												
80						grading to fine to medium grained sand, with lenses of clayey silt.						
1030												
90						becoming coarse to very coarse grained.						
1020												
100						end of shift 8/23/89.						
1010												
110						"ALLUVIUM (Qal)" CLAYEY SAND (SC) brown, very fine to coarse grained, large amount fines as seen in thickening mud, occasional cobbles.						
1000												
120						cobble lens.						
990												
130						traces of weathered feldspar in CLAYEY SAND.						

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-1
DRILLING DATE: August 22, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1115 Feet

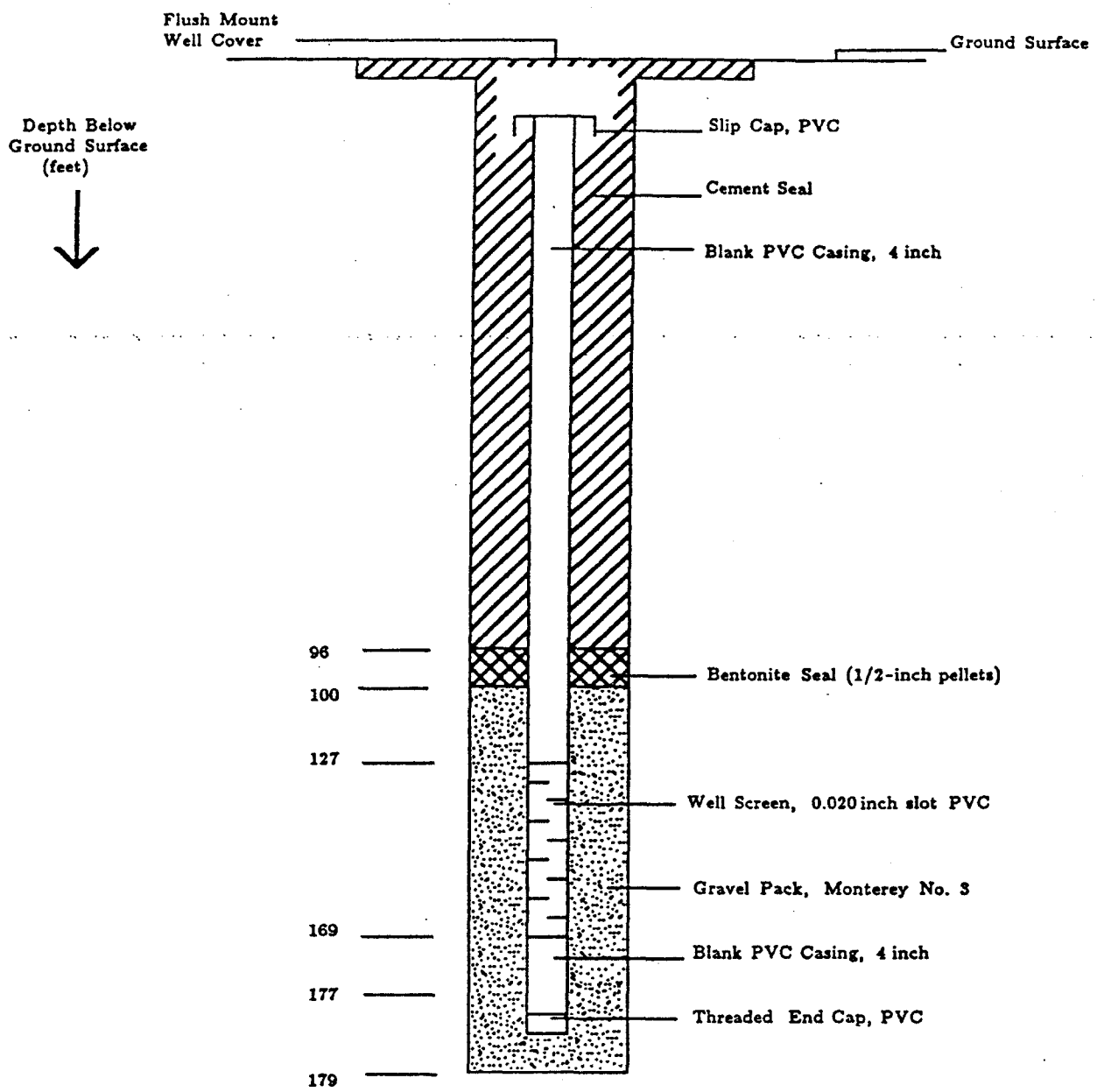
ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
						"ALLUVIUM (Qal)" CLAYEY SAND (SC) brown, very fine to coarse grained, large amount fines as seen in thickening mud, occasional cobbles.						
980												
140												
970												
150						becoming finer grained.						
960												
160						becoming coarser grained.						
						Bottom of drill hole at 162 feet, on 8/24/89. Groundwater estimated at approximate depth of 85 feet based on electric log. Boring completed as Monitoring Well MW-1, water level measured September 5, 1989 at depth of 39.04 feet.						

LEGEND TO LOGS ON PLATE A-2

WELL MW-2

BORING LOG AND WELL COMPLETION DIAGRAM

AS BUILT WELL COMPLETION SCHEMATIC
MW-2



LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) / DEPTH	DRILLING RATE / REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
						Parking lot pavement, 4" over 8" base.						
						"ALLUVIUM (Qal)" SANDY SILT (ML) light brown, soft, dry, with moderate amount very fine grained sand and scattered rock fragments.						
						becomes damp at 5 feet.						
1160 / 10						cobbles at 8 feet.						
						set 10" conductor to 17 feet, end of shift 8/14/89.						
1150 / 20						"ALLUVIUM (Qal)" SAND (SP) multi-colored, predominantly very coarse grained and rounded, with appreciable fines or silt beds.						
						numerous cobbles below 22 feet, primarily granitic fragments, with fine to coarse sand.						
1140 / 30												
						"ALLUVIUM (Qal)" SAND (SP) multi colored, medium to very coarse grained, with scattered gravel.						
1130 / 40												
1120 / 50						thinned mud, end of shift 8/15/89.						
						increasing gravel.						
1110 / 60												
						numerous cobbles below 61 feet, predominantly granatic with sand. Clear and milky quartz, white and pink feldspar, rare green (metamorphic?), rock fragments, considerable fines as seen in thickening mud.						

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
1100 / 70						"ALLUVIUM (Qal)" SAND (SP) with cobbles, multi-colored, medium to very coarse grained.						
1090 / 80						"ALLUVIUM (Qal)" SILT (ML) brown, micaceous, slightly clayey, with some very fine grained sand. Below 80 feet, becoming thinly interbedded as noted. cobbles, primarily granitic rock fragments, with fine-coarse sand and fines.						
1080 / 90						silt lenses.						
						cobbles, as above.						
1070 / 100						SILTY SAND (SM) brown, very fine sand with large amount of silt.						
						CLAYEY SAND (SC) brown, soft, with fine-coarse sand.						
1060 / 110						cobbles, granatic rock fragments with fine-coarse sand and silt lenses.						
1050 / 120												
1040 / 130						SILTY SAND (SM) brown, soft, slightly clayey with very fine to medium sand.						

LEGEND TO LOGS ON PLATE A-2

LOG OF DRILL HOLE

JOB NO.: S88042
PROJECT: JPL Upgradient Wells
LOCATION: Pasadena, California
DRILLING METHOD: Rotary Mud, 9 7/8-in.

LOGGED BY: E. Powers
CHECKED BY: C. Kendall

DRILL HOLE NO.: MW-2
DRILLING DATE: August 14, 1989
DATUM: USGS, PP1339, Plate 2.6
REFERENCE EL.: 1168 Feet

ELEVATION (FEET) DEPTH	DRILLING RATE	REAL TIME/DEPTH	SAMPLE	SAMPLE NO.	BLOW COUNT (BLOWS PER FOOT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION AND CLASSIFICATION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	TORVANE (PSF)	ADDITIONAL TESTS
							Cobbles, primarily granitic rock fragments with traces of dark gray metamorphic (?) fragments, with fine to coarse grained sand and silt.						
							end of shift 8/16/89. SAND (SP) primarily quartz and feldspar, very fine to coarse grained, with some fines.						
1030 140													
							Cobbles, granitic rock fragments with large amount of very fine to coarse grained sand and soluble clay as seen in thickening mud.						
1020 150							CLAYEY SAND (SC) brown, fine to coarse grained sand with SILTY CLAY matrix.						
1010 160							Ran E-LOG to 158 feet. SAND (SP) white quartz and feldspar, medium to very coarse grained.						
							Cobbles, granitic rock fragments with medium to very coarse grained sand.						
1000 170													
							SAND (SP) predominantly quartz and feldspar, medium to very coarse grained, with traces of mottled gray brown clay.						
990													
							Bottom of drill hole at 179 feet, on 8/17/89. Possible groundwater zones below depth 140 feet based on electric log. Boring completed as Monitoring Well MW-2. As of September 5, 1989 no free water has entered the well.						

LEGEND TO LOGS ON PLATE A-2

WELL MW-3

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

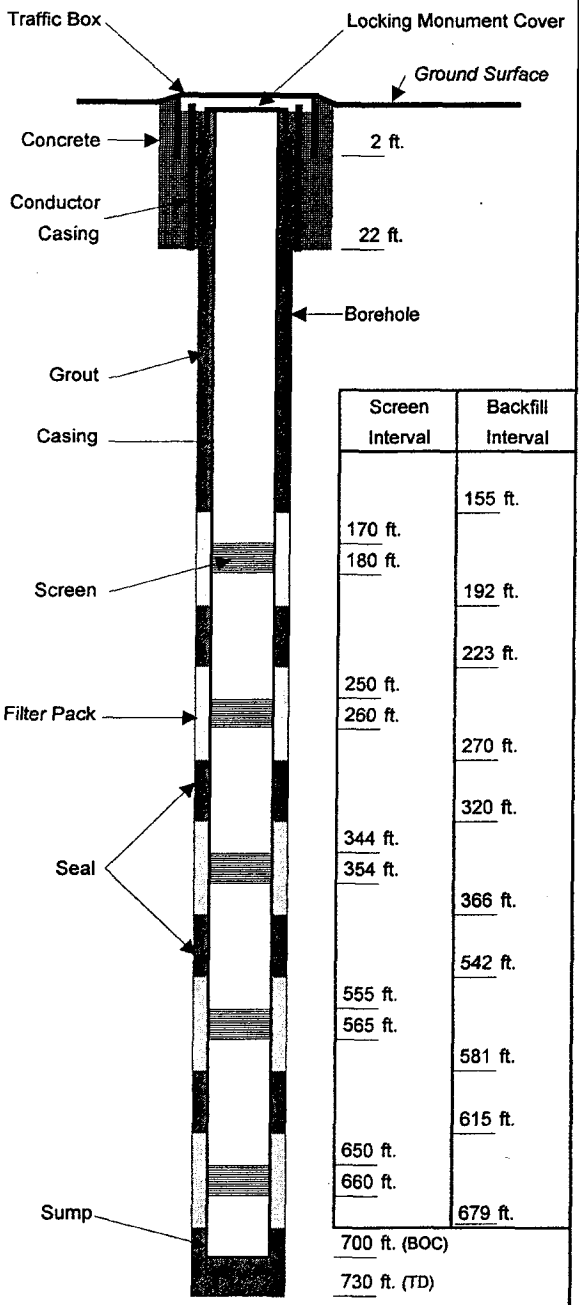
WELL CONSTRUCTION LOG

WELL NUMBER: MW-3

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1099.59

CASING ELEV (ft. above MSL): 1099.82



Screen Interval	Backfill Interval
	155 ft.
170 ft.	
180 ft.	
	192 ft.
	223 ft.
250 ft.	
260 ft.	
	270 ft.
	320 ft.
344 ft.	
354 ft.	
	366 ft.
	542 ft.
555 ft.	
565 ft.	
	581 ft.
	615 ft.
650 ft.	
660 ft.	
	679 ft.

DRILLING SUMMARY

DATE COMPLETED:	1/11/90 to 1/24/90
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	730 ft.

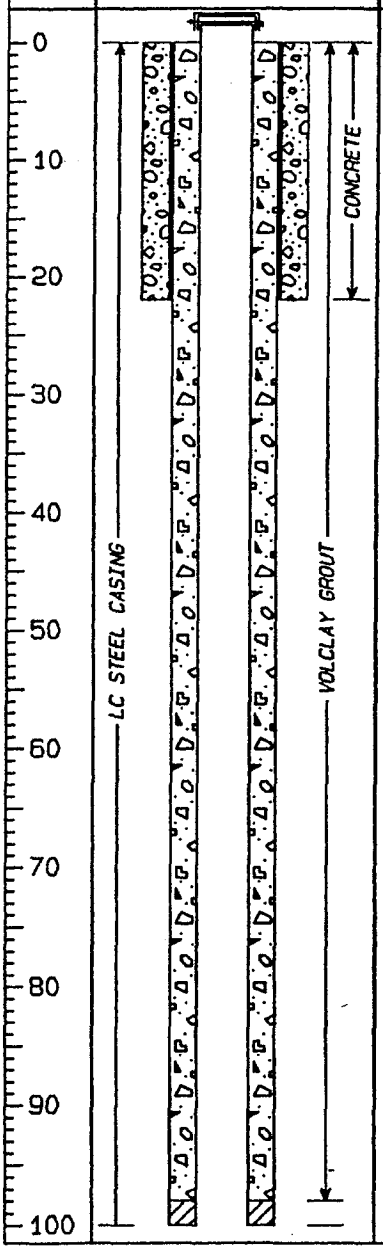
CONSTRUCTION DETAILS

BOREHOLE DIAMETER: (CONDUCTOR CASING)	18.5 in.
CONDUCTOR CASING DIAMETER:	16 in
CONDUCTOR CASING LENGTH:	22 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	700 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	650 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	2 ft.
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90

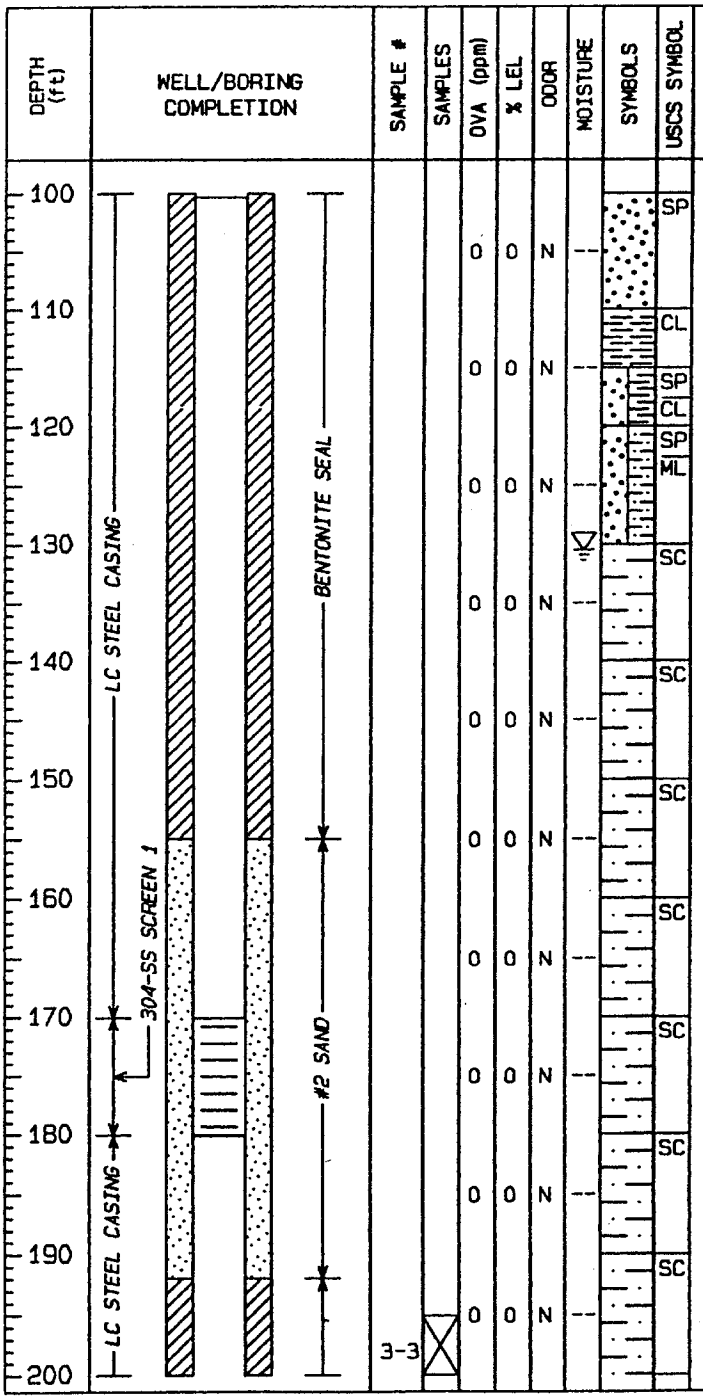


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
0			--	--	N	--	SP	SAND, MULTICOLORED medium to very coarse grained with abundant gravel, predominantly quartz and feldspar. BOULDERS granitic, rounded, up to 2 ft in diam.
10			--	--	N	--	SP	SAND, MULTICOLORED medium to very coarse grained with abundant gravel, predominantly quartz and feldspar. BOULDER granitic.
20	3-1	X	0	0	N	--	SP	SAND, MULTICOLORED medium to very coarse grained with abundant gravel, predominantly quartz and feldspar. (drilled 15.75 in. hole to 22 ft.; set conductor pipe; continued drilling with 9.875 in. bit) ("soil-3-1 collected at 9:10 on 1-17-90)
30			0	0	N	--	ML	SAND, MULTICOLORED medium to very coarse grained with scattered gravel predominantly quartz and feldspar.
40			0	0	N	--	SP	SAND, SILTY, LIGHT BROWN moderate amount of very fine grained sand and scattered gravel.
50			0	0	N	--	SP	SAND, MULTI-COLORED medium to very coarse grained with some gravel, predominantly quartz and feldspar, occasional granitic cobbles. BOULDER
60			0	0	N	--	SP	SAND, MULTI-COLORED medium to coarse grained with some gravel, subangular to subrounded, few thin lenses of clayey silt.
70			0	0	N	--	SP	SAND, MULTI-COLORED fine to very coarse grained with abundant gravel, subangular, poorly sorted.
80			0	0	N	--	SP	SAND, MULTI-COLORED fine to very coarse grained with few granitic cobbles or boulders.
90	3-2	X	0	0	N	--	SP	BOULDERS SAND, MULTI-COLORED medium to coarse grained, with abundant gravel, predominantly quartz and feldspar. ("soil-3-2" collected at 12:35 on 1-17-90)
100								

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90



DESCRIPTION AND NOTES

SAND, MULTI-COLORED
medium to coarse grained with trace gravel.

SAND, MULTI-COLORED
medium to coarse grained with trace gravel.

SILT, CLAYEY, LIGHT BROWN
BOULDER

SAND, MULTI-COLORED
medium to coarse grained with common light brown clayey silt to sandy silt (~25%).

SAND, BROWN
medium to coarse grained with abundant brown clayey to sandy silt, percentage of silt increasing (~50%).
(hole angle: 0.125 degrees)

SAND, CLAYEY, BROWN
very fine to coarse grained, large amount of clay and very fine sand matrix (~70%), occasional granite boulder.

SAND, CLAYEY, BROWN
very fine to medium grained, large amount of clay and very fine sand matrix, occasional gravel and coarse sand.

SAND, CLAYEY, BROWN
very fine to coarse grained, trace gravel, becoming coarser grained, silt and clay matrix.

BOULDER
SAND, CLAYEY, BROWN
fine to coarse grained, occasional very coarse sand and gravel, silt and clay matrix.

SAND, CLAYEY, BROWN
fine to coarse grained, trace gravel, clay and very fine sand matrix (~20%)

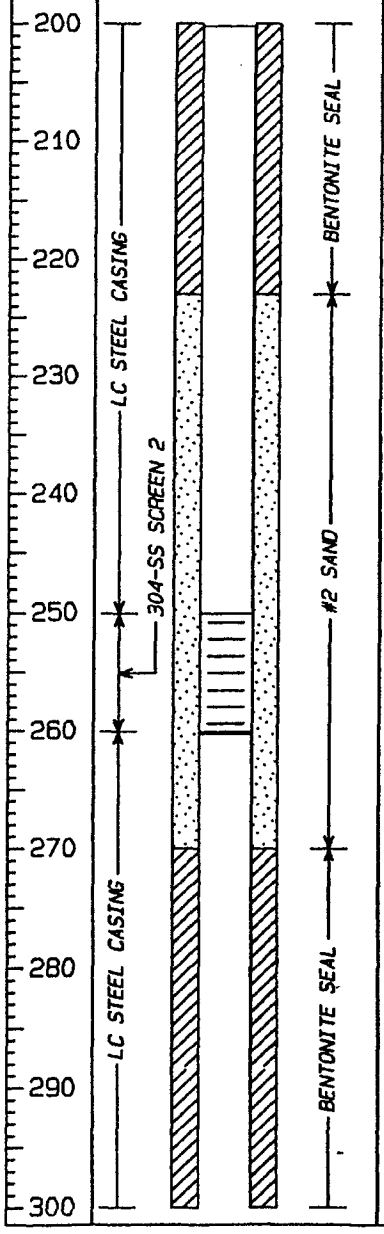
SAND, CLAYEY, BROWN-MULTI-COLORED
fine to coarse grained, clay and silt matrix (~15%)

("soil-3-3" collected at 13:00 on 1-18-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90

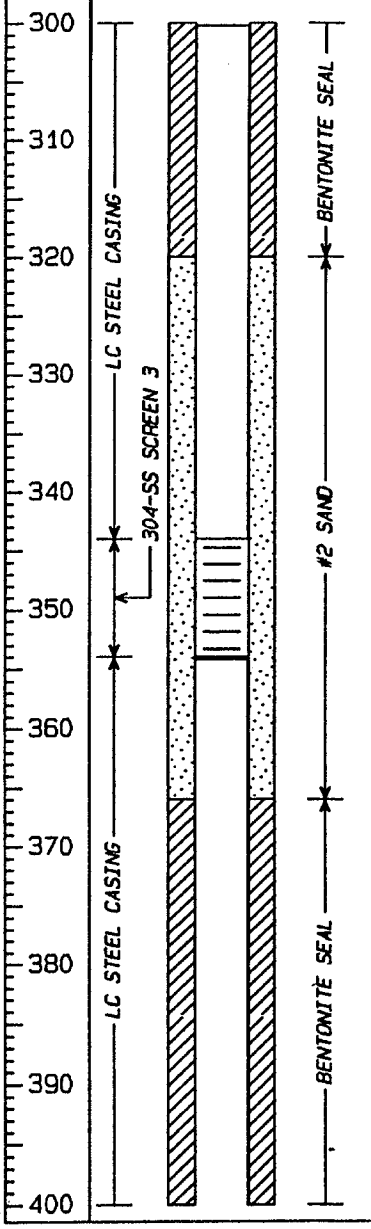


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
200			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to coarse grained, clay and silt matrix (~35%).
210			0	0	N	--		SC	SAND, CLAYEY, BROWN-MULTI-COLORED fine to medium grained, occasional gravel and coarse sand. BOULDER
220			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to coarse grained, abundant clay and silt matrix (~50%), occasional gravel.
230			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to coarse grained, clay and silt matrix (~40%).
240			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to medium grained, cuttings mostly clay and silt (~70%).
250			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to coarse grained, trace gravel, very abundant clay and silt matrix (~75%). (hole angle: 1 degree)
260			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to coarse grained, trace gravel, very abundant clay and silt matrix (~65%).
270			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine grained to coarse grained, abundant clayey silt matrix, some silty clay present.
280			0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to medium grained, abundant clay and silt matrix, occasional coarse sand and gravel.
290	3-4	X	0	0	N	--		SC	SAND, CLAYEY, BROWN very fine to medium grained, abundant clay and silt matrix, occasional coarse sand and gravel. ("soil-3-4" collected at 8:35 on 1-19-90)
300									

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
300			0	0	N	--	SC	SAND, CLAYEY, BROWN fine to coarse grained, common silt and clay matrix (~45%), occasional boulders.
310			0	0	N	--	SC	SAND, CLAYEY, BROWN fine to coarse grained, common silt and clay matrix (~45%), occasional boulders.
320			0	0	N	--	SC	SAND, CLAYEY, BROWN fine to coarse grained, common silt and clay matrix (~45%), occasional boulders and gravel.
330			0	0	N	--	SC	SAND, CLAYEY, BROWN very fine to coarse grained sand with silty clay matrix (~45%).
340			0	0	N	--	SC	SAND, CLAYEY, BROWN very fine to coarse grained sand with silty clay matrix (~45%).
350			0	0	N	--	SC	SAND, CLAYEY, BROWN very fine to coarse grained sand with silty clay matrix (~45%), occasional gravel. BOULDER
360			0	0	N	--	SP	SAND, CLAYEY, BROWN fine to coarse grained with silty clay matrix (~55%), occasional very coarse and and gravel.
370			0	0	N	--	SC	SAND, MULTI-COLORED medium to very coarse grained, minor amounts or brown silty clay, predominantly quartz and feldspar
380			0	0	N	--	SP	SAND, CLAYEY, BROWN fine to very coarse grained sand with silty clay matrix (~50%), trace gravel.
390	3-5	X	0	0	N	--	SC	SAND, MULTI-COLORED medium to very coarse grained, minor brown silty clay, occasional gravel. ("soil-3-5" collected at 12:30 on 1-19-90)
400								

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT JPL ESI
LOCATION Pasadena, California
GEOLOGIST/ENGINEER M. Cutler, T. Tomczyk
DRILLING COMPANY Beylik
DRILLING METHOD Mud Rotary

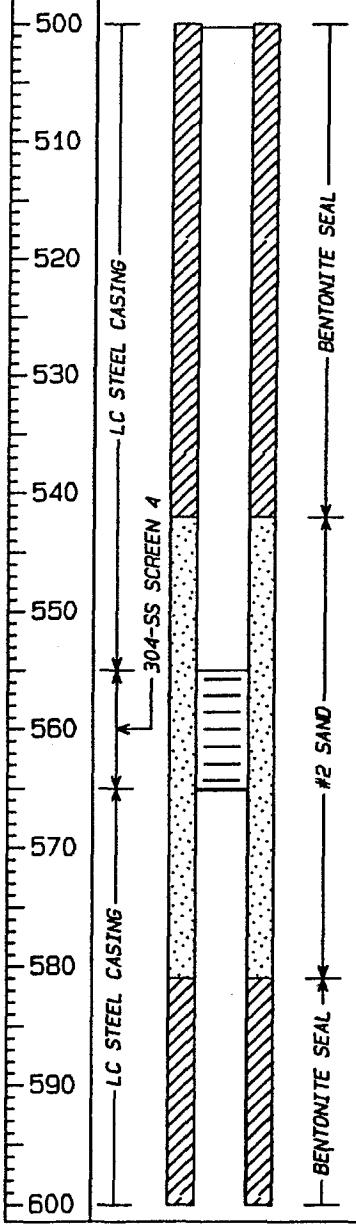
DRILL HOLE DIAMETER (in) 15.75/9.875
GROUND LEVEL ELEVATION (ft) 1100
TOTAL DEPTH OF HOLE (ft) 730
DEPTH TO WATER (ft) 130.50
DATE (start/finish) 1-11-90 to 1-24-90

DEPTH (ft)	WELL/BORING COMPLETION	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
400	LC STEEL CASING; BENTONITE SEAL			0	0	N	--		SC	SAND, CLAYEY, BROWN fine to coarse grained sand with silty clay matrix (~35%).
										(hole angle: 0.75 degrees)
410				0	0	N	--		SC	SAND, CLAYEY, BROWN fine to coarse grained sand with silty clay matrix (~35%). BOULDER
420				0	0	N	--		SC	SAND, CLAYEY, BROWN fine to coarse grained sand with silty clay matrix (~30%), becoming coarser grained.
430				0	0	N	--		SP	SAND, CLAYEY, BROWN fine to coarse grained sand with silty clay matrix (~30%), becoming coarser grained.
440				0	0	N	--		SP	SAND, MULTI-COLORED medium to coarse grained, trace silty clay, occasional gravel. BOULDER
450				0	0	N	--		SP	SAND, MULTI-COLORED medium to coarse grained, trace silty clay, occasional gravel. BOULDERS
460				0	0	N	--		SC	SAND, MULTI-COLORED medium to coarse grained, some silty clay (~15%) occasional boulders.
470				0	0	N	--		SC	SAND, CLAYEY, BROWN fine to very coarse grained with silty clay (~25%), occasional gravel. BOULDER
480				0	0	N	--		SC	SAND, CLAYEY, BROWN fine to very coarse grained with silty clay matrix more predominant (~60%). BOULDER
490				0	0	N	--		SP	SAND, CLAYEY, BROWN fine to very coarse grained with silty clay matrix more predominant (~60%).
500		3-6	X							("soil-3-6" collected at 10:00 on 1-20-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90

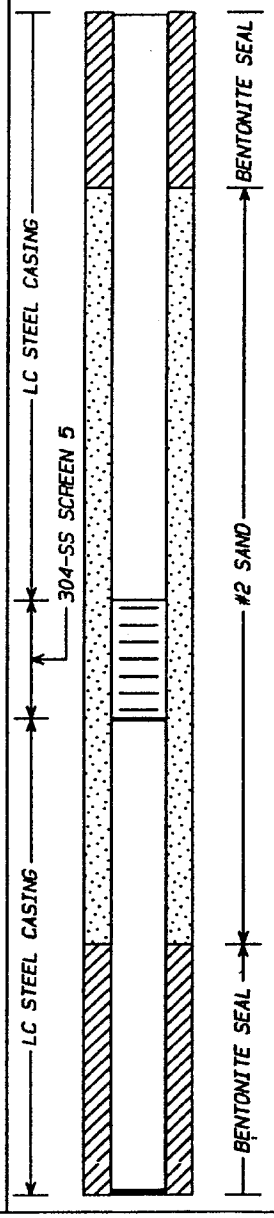


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
500			0	0	N	--	SC	SAND, MULTI-COLORED trace brown silty clay, trace gravel.
510			0	0	N	--	SC	SAND, CLAYEY, BROWN medium to coarse grained, silty clay matrix (~60%)
								BOULDERS
520			0	0	N	--	SC	SAND, CLAYEY, BROWN fine to coarse grained, silty clay matrix (~25%).
530			0	0	N	--	ML	SAND, CLAYEY, BROWN fine to coarse grained, silty clay matrix (~50%).
								(hole angle: 1.125 degrees)
540			0	0	N	--	ML	SILT, CLAYEY, BROWN silty clay, occasional to common medium to coarse sand present (~10-15%), rare gravel.
550			0	0	N	--	SC	SILT, CLAYEY, BROWN silty clay, occasional to common medium to coarse sand present (~15%), rare gravel.
560			0	0	N	--	SP	SAND, CLAYEY, MULTI-COLORED medium to coarse grained, silty clay present (~40%).
570			0	0	N	--	SP	SAND, MULTI-COLORED medium to coarse grained, predominantly quartz and feldspar, minor silty clay present (~15%). BOULDERS
580			0	0	N	--	SC	SAND, MULTI-COLORED medium to coarse grained, predominantly quartz and feldspar, silty clay increases to (~20%).
590			0	0	N	--	SC	SAND, CLAYEY, MULTI-COLORED medium to coarse grained, silty clay matrix (~40%).
600	3-7	X						("soil-3-7" collected at 11:35 on 1-22-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	15.75/9.875
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1100
GEOLOGIST/ENGINEER	M. Cutler, T. Tomczyk	TOTAL DEPTH OF HOLE (ft)	730
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	130.50
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-11-90 to 1-24-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
600			0	0	N	--	SP	SAND, CLAYEY, MULTI-COLORED medium to coarse grained, silty clay matrix (~30%).
610			0	0	N	--	SP	SAND, MULTI-COLORED medium to coarse grained, silty clay matrix (~15%).
620			0	0	N	--	SC	SAND, MULTI-COLORED medium to coarse grained, silty clay matrix (~15%).
630			0	0	N	--	SC	SAND, CLAYEY, LIGHT BROWN hard, medium to coarse grained, silty clay matrix (~60%).
								BOULDER
640			0	0	N	--	SC	SAND, CLAYEY, LIGHT BROWN hard, medium to coarse grained, silty clay matrix (~60%), common boulders.
								CLAY, SILTY, BROWN
650			0	0	N	--	SC	SAND, CLAYEY, BROWN hard, fine to coarse grained sand with silty clay matrix (~60%), some decomposed granite (~3-5%).
660			0	0	N	--	SC	SAND, CLAYEY, BROWN hard, fine to coarse grained sand with silty clay matrix (~70%), common boulders.
670			0	0	N	--	SC	SAND, CLAYEY, BROWN hard, fine to coarse grained sand with silty clay matrix (~60%), common boulders.
								(hole angle: 1.5 degrees)
680			0	0	N	--	ML	SAND, CLAYEY, BROWN fine to coarse grained sand with abundant silty clay matrix (~75%).
690			0	0	N	--	ML	CLAY, SILTY, BROWN some medium to coarse grained sand (~15%).
700	3-8	X						("soil-3-8" collected at 7:30 on 1-24-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-3

PROJECT JPL ESI
LOCATION Pasadena, California
GEOLOGIST/ENGINEER M. Cutler, T. Tomczyk
DRILLING COMPANY Beylik
DRILLING METHOD Mud Rotary

DRILL HOLE DIAMETER (in) 15.75/9.875
GROUND LEVEL ELEVATION (ft) 1100
TOTAL DEPTH OF HOLE (ft) 730
DEPTH TO WATER (ft) 130.50
DATE (start/finish) 1-11-90 to 1-24-90

DEPTH (ft)	WELL/BORING COMPLETION	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
700	BENTONITE SEAL			0	0	N	--		ML	CLAY, SILTY, BROWN some medium to coarse grained sand (~20%). common boulders.
710				0	0	N	--		ML	CLAY, SILTY, GREY some medium to coarse grained sand (~15%).
720				0	0	N	--		ML	CLAY, SILTY, GREY some medium to coarse grained sand (~15%).
730									GR	GRANITE, LIGHT BLUE hard, predominantly quartz, feldspar and mafics (40%). (granitic basement encountered at 724 ft.)

TABLE 6

Westbay Instruments Inc.

MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW3 Installed by: ER/KS/D. NYE/M. CUTC

Hole Depth: 720 ft MP Depth: 688 ft Hole Diameter: 9 7/8"/4" STEEL Date Installed: FEB 11, 1990

Measurement Datum: ORIGINAL GROUND SURFACE Datum Elevation: _____ Date Drawn: JAN 31/90

Depth, ft	Geological Description	Geologic Log	MP Casing Log	Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
0	Total length of steel 702'6"		83 82 81			82 13:37	✓	✓
	Original ground surface 2'6" Below top of steel		80			81 – 90psi 13:33	✓	✓
10	Changed Ground Surface then cut off 2' 11" of					80 – 90psi 13:39	✓	✓
	4" steel Add 8" protective casing		79			13:24	✓	✓
20	1.5' above 4" casing					+ 8 Litres + 8 Litres		
	center of coupling		78			90psi 13:20	✓	✓
30	1.0' 82							
	Original Grnd Surf 5" 1.5' 81 6" 8"		77			90psi 13:17	✓	✓
40	6" 16"							
			76			90psi 13:14	✓	✓
50								
			75			90psi 13:11	✓	✓
60						+ 7 Litres + 5 Litres H_2O		
			74			90psi 13:07	✓	✓
70	4" 1.5" HP							
			73			90psi 13:04	✓	✓
80	Hydraulic Integrity Test 392.7 @ 15:05							
	392.62 @ 15:16 392.61 @ 15:24		72			90psi 13:01	✓	✓
90	NOTE: 8" CASING HAS A LOCKABLE TOP.		71			90psi 12:58	✓	✓
100	Grout To 98' →							

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

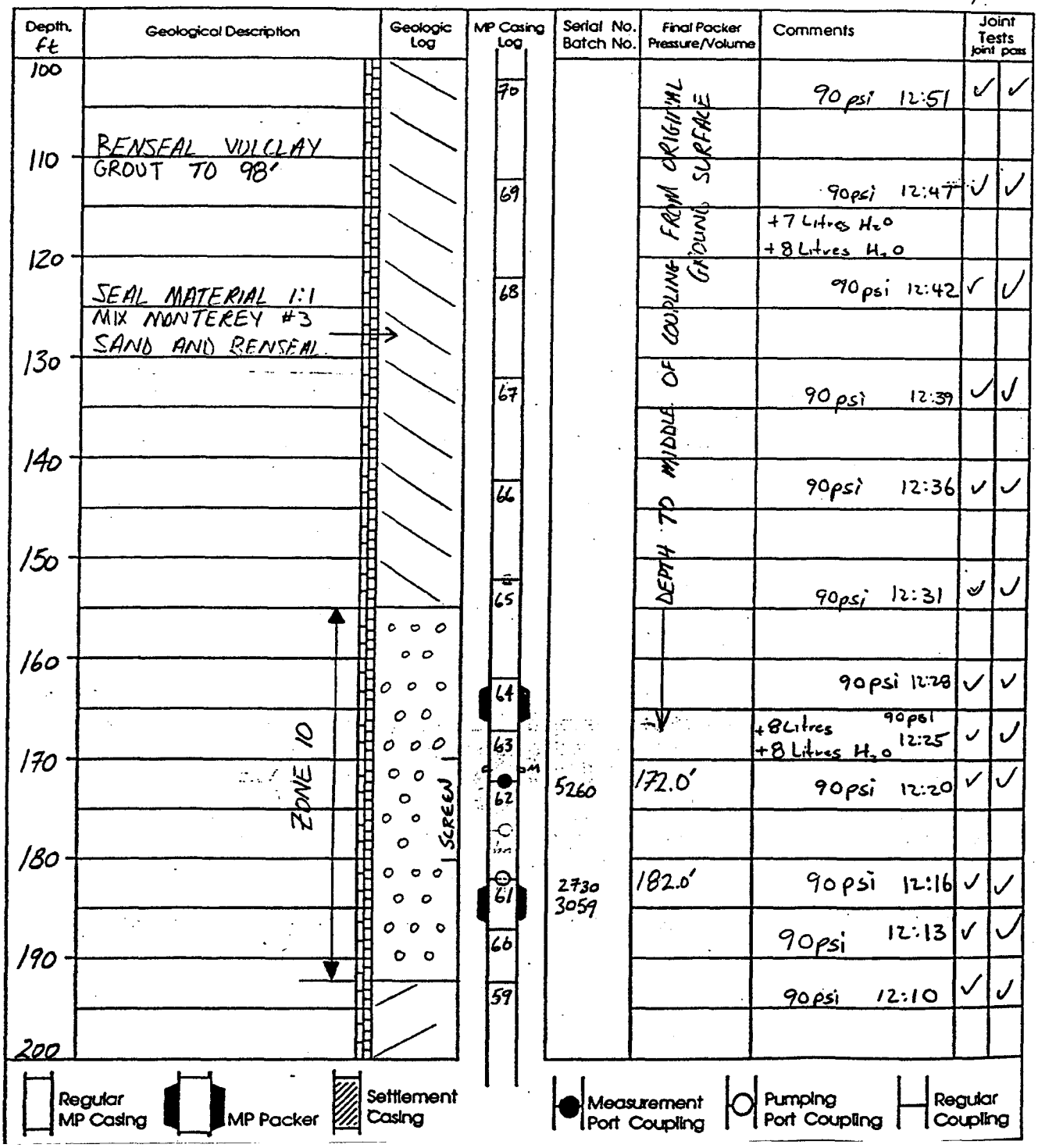
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D. NYE/M. CUTZ

Hole Depth: 720 ft MP Depth: 688 ft (ORIGINAL) Hole Diameter: 9 7/8" / 4" STEEL Date Installed: FEB. 11, 1990

Measurement Datum: GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90



Westbay Instruments Inc.

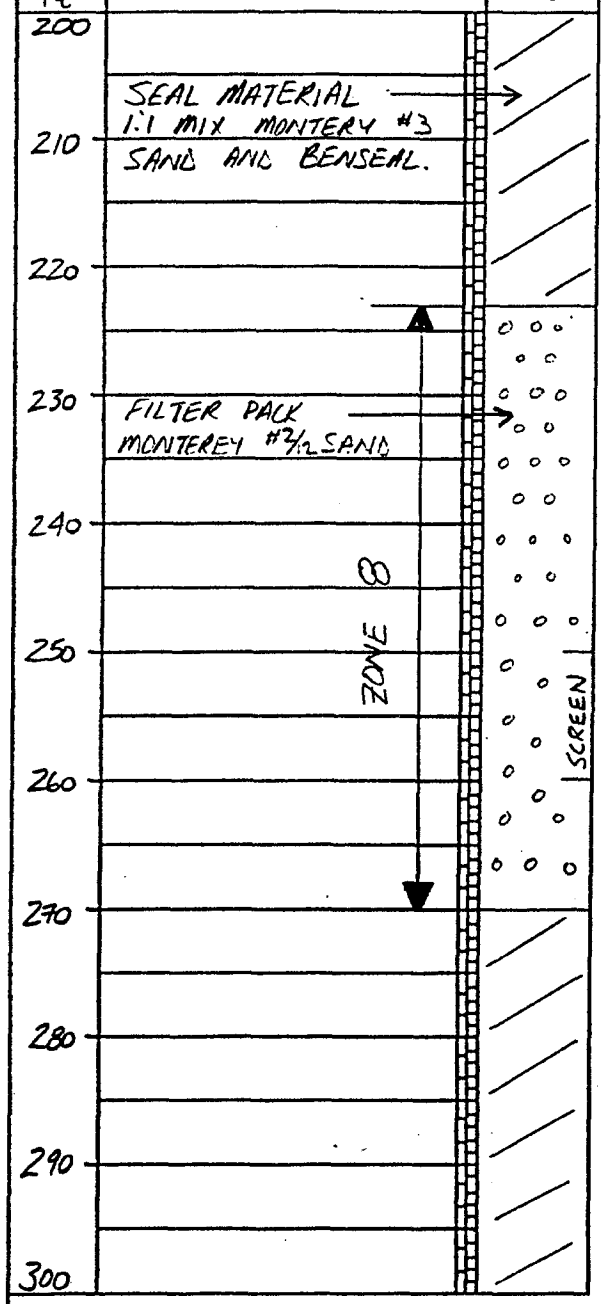
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D.NYE/M.CUTL

Hole Depth: 720 ft MP Depth: ORIGINAL 688 ft. Hole Diameter: 9 7/8" / 4" STEEL Date Installed: FEB 11, 1990

Measurement Datum: GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90



Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
		90psi 12:05	✓	✓
		90psi 12:02	✓	✓
		90psi 11:59	✓	✓
5262	232.0'	90psi 11:56	✓	✓
		90psi 11:53	✓	✓
3060		90psi 11:50	✓	✓
5263	252.0'	90psi 11:47	✓	✓
		+ 8 litres + 8 litres Tapwater		
2737 3061	262.0'	90psi 11:42	✓	✓
		90psi 11:38	✓	✓
		90psi 11:35	✓	✓
		90psi 11:31	✓	✓
		90psi 11:25	✓	✓
		90psi 11:23	✓	✓
		90psi 11:28	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

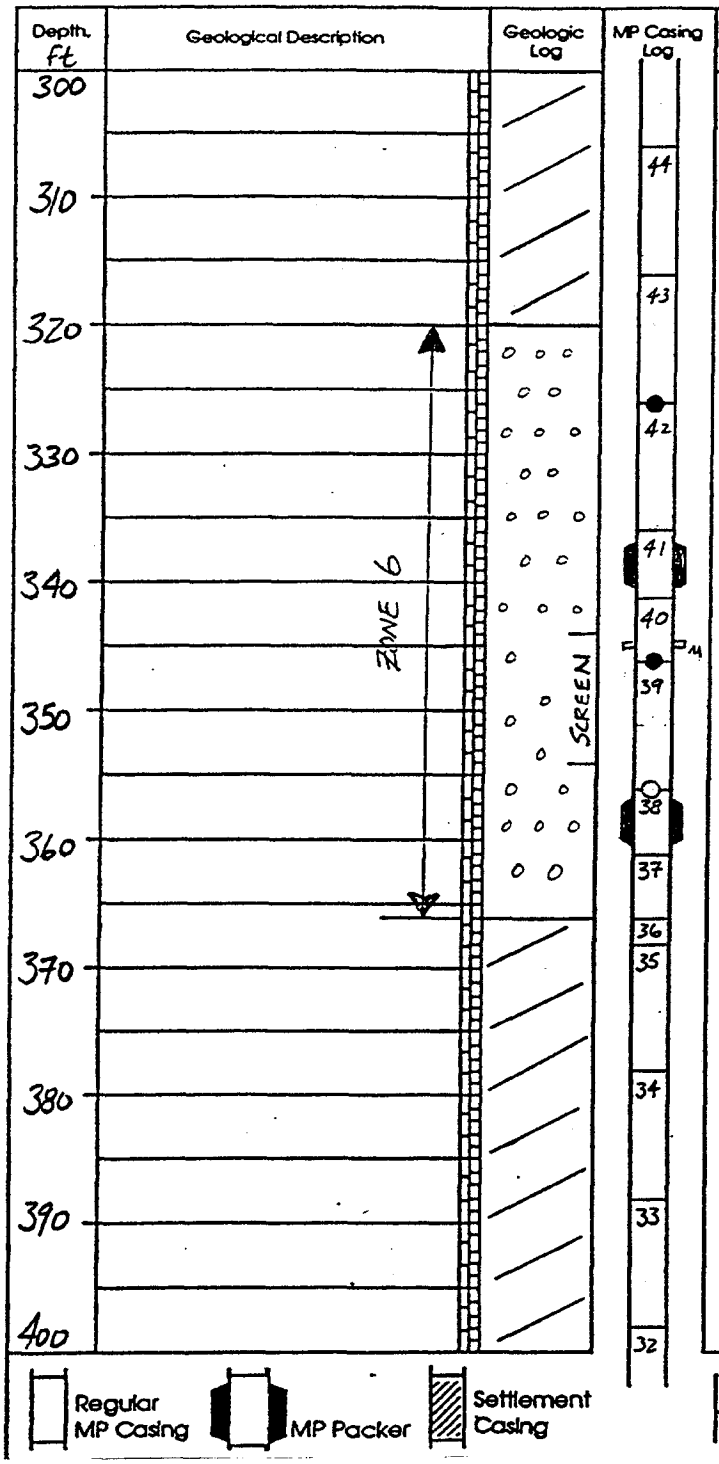
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D. NYE/M. CUT

Hole Depth: 720 ft MP Depth: ORIGINAL 688 ft. Hole Diameter: 9 7/8 / 4" STEEL Date Installed: FEB 11, 1990

Measurement Datum: GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90



Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
		90psi 11:20	✓	✓
		90psi 11:16	✓	✓
		Add 9 litres H_2O		
5261	326.0'	90psi 11:11	✓	✓
		Add 8 litres H_2O Pasadena City water from JPL Lab Tap.		
		90psi 11:07	✓	✓
3057				
		90psi 11:04	✓	✓
5254	346.0'	90psi 11:00	✓	✓
2734 3056	356.0'	90psi 10:56	✓	✓
		90psi 10:53	✓	✓
		90psi 10:47	✓	✓
		90psi 10:49	✓	✓
		90psi 10:43	✓	
		90psi 10:40	✓	✓
		90psi 10:36	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D.NYE/M.CUT

Hole Depth: 720 ft MP Depth: ORIGINAL 688 ft. Hole Diameter: 9 7/8/4" STEEL Date Installed: FEB. 11, 1990

Measurement Datum: GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90

Depth, Ft	Geological Description	Geologic Log	MP Casing Log	Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
400								
						90psi 10:32	✓	✓
410			31					
						90psi 10:28	✓	✓
420			30					
						90psi 10:25	✓	✓
430			29					
						90psi 10:09	✓	
440			28					
						90psi 10:06	✓	✓
450			27					
						90psi 10:01	✓	✓
460			26					
						90psi 9:57	✓	✓
470			25					
						90psi 9:54	✓	✓
480			24					
						90psi 9:50	✓	✓
490			23					
						90psi 9:45	✓	✓
500			22					

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

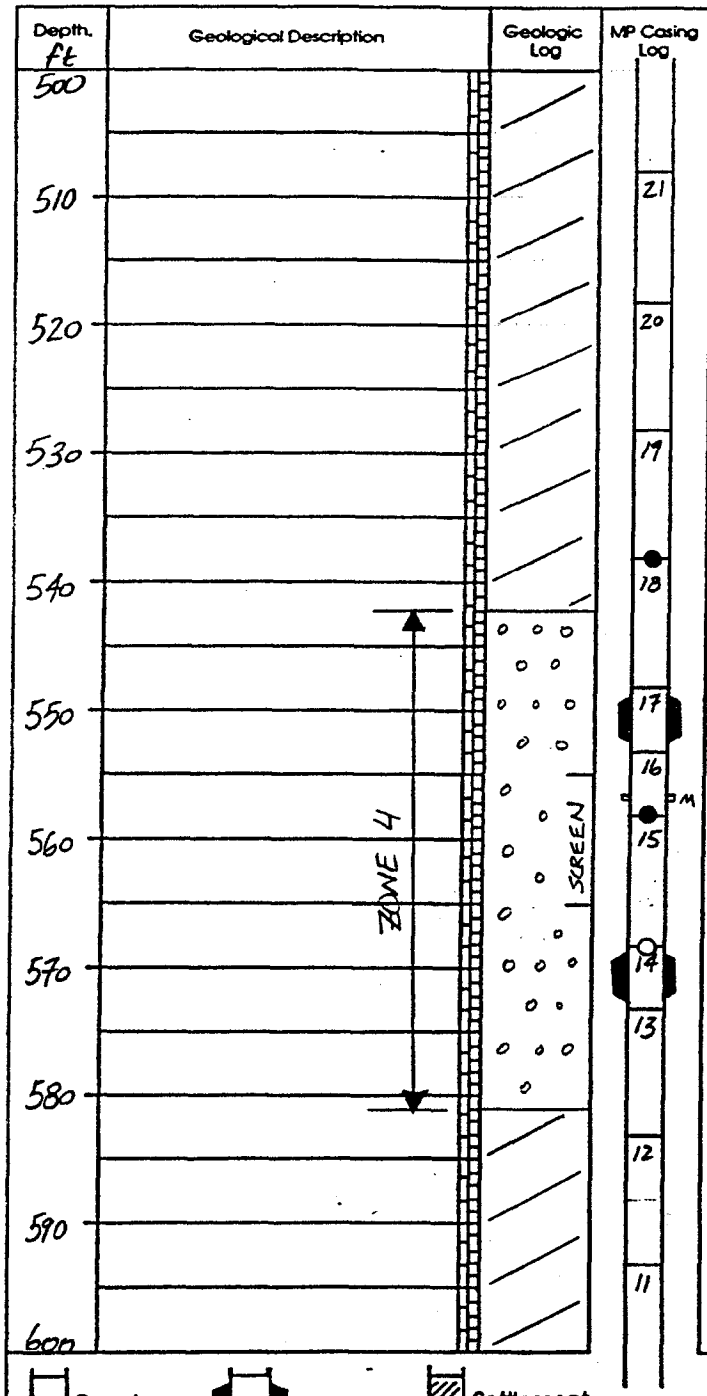
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D.NYE/M. CUT

Hole Depth: 720 ft MP Depth: 688 ft Hole Diameter: 9 7/8/4" STEEL Date Installed: FEB. 11, 1990

Measurement Datum: ORIGINAL GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90



Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
		90psi 9:42	✓	✓
		90psi 9:37	✓	✓
		90psi 9:34	✓	✓
5255	538.0'	90 psi ~~9:28~~ 9:31	✓	✓
		90psi 9:25	✓	✓
3062		90psi 9:22	✓	✓
5256	558.0'	90psi 9:19	✓	✓
2728 3055	568.0'	90psi 9:15	✓	✓
		90psi 9:11	✓	✓
		90psi 9:07	✓	✓
		90psi 9:03	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: WB 650

Location: PASADENA, CALIFORNIA Hole No: MW 3 Installed by: ER/KS/D.NYE/M.CUTL

Hole Depth: 720 ft MP Depth: 688 ft Hole Diameter: 9 7/8"/4" STEEL Date Installed: FEB. 11, 1990

Measurement Datum: ORIGINAL GROUND SURFACE Datum Elevation: Date Drawn: JAN 31/90

Depth ft.	Geological Description	Geologic Log	MP Casing Log	Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
600						90psi 08:59	✓	✓
			10					
610						90 psi 08:56	✓	✓
			9					
620						90psi 08:53	✓	✓
			8					
630								
			7	5258	633.0'	90psi 08:49	✓	✓
640								
	ZONE 2		6	3054		90psi 08:45	✓	✓
						90psi 08:41	✓	✓
650		SCREEN	5					
			4	5257	653.0'	90psi 08:34	✓	✓
660								
			3	2731 3053	663.0'	90psi 08:30	✓	✓
670			2	5259	668.0'	90psi 08:26	✓	✓
680			1			90psi 08:21	✓	✓
	INFLATION TOOL SET TO 280psi AFTER 1 MINUTE STABILIZATION							
						250-160 = 90psi 08:08	✓	✓
690	BOTTOM OF 4" STEEL CASING = 700' 2 1/4" BGL					4" STEEL HAS CAP WELDED ON BOTTOM.		
700	BOTTOM OF DRILLHOLE = 720 FT BGL				JOINT TEST TOOL SET TO 160psi 8:00 AM			

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

WELL MW-4

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

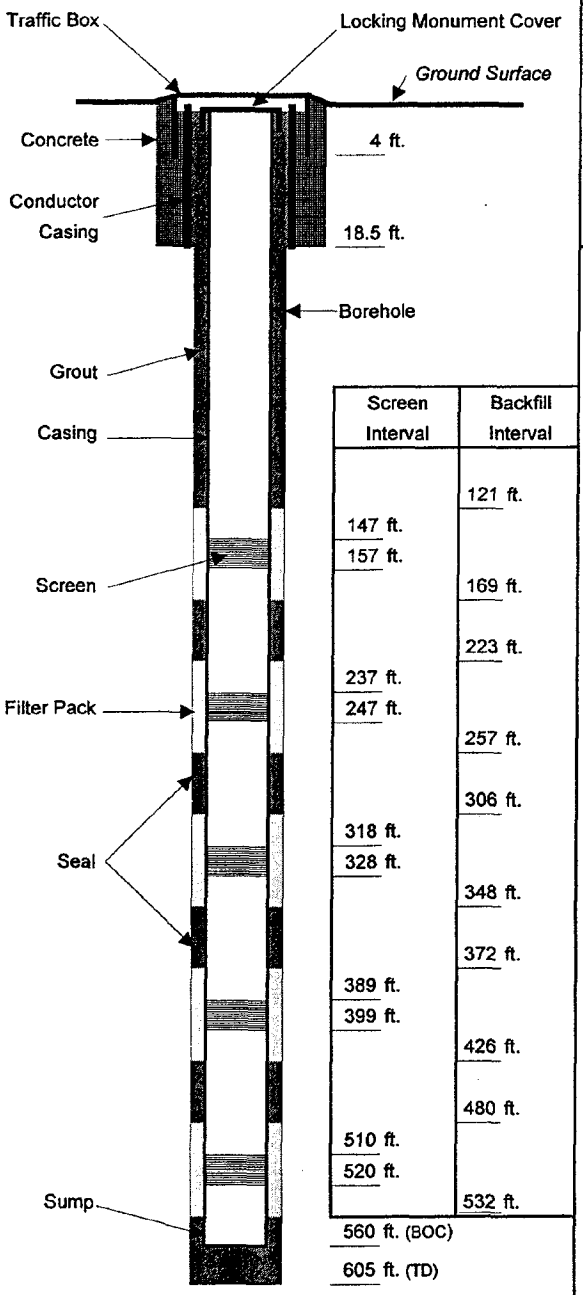
WELL CONSTRUCTION LOG

WELL NUMBER: MW-4

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1083.69

CASING ELEV (ft. above MSL): 1082.72



Screen Interval	Backfill Interval
	121 ft.
147 ft.	
157 ft.	
	169 ft.
	223 ft.
237 ft.	
247 ft.	
	257 ft.
	306 ft.
318 ft.	
328 ft.	
	348 ft.
	372 ft.
389 ft.	
399 ft.	
	426 ft.
	480 ft.
510 ft.	
520 ft.	
	532 ft.

DRILLING SUMMARY

DATE COMPLETED:	1/31/90 to 2/6/90
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	605 ft.

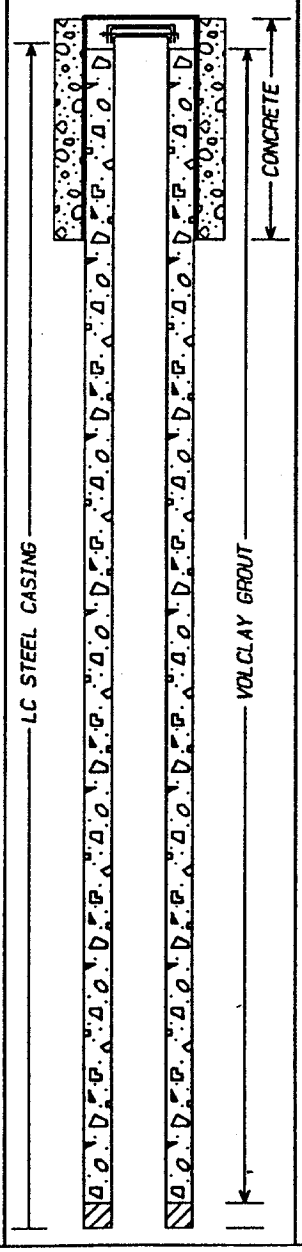
CONSTRUCTION DETAILS

BOREHOLE DIAMETER: (CONDUCTOR CASING)	18.5 in.
CONDUCTOR CASING DIAMETER:	16 in
CONDUCTOR CASING LENGTH:	18.5 ft.
BOREHOLE DIAMETER:	12.25 in.
TOTAL WELL DEPTH:	560 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	510 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	41 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90

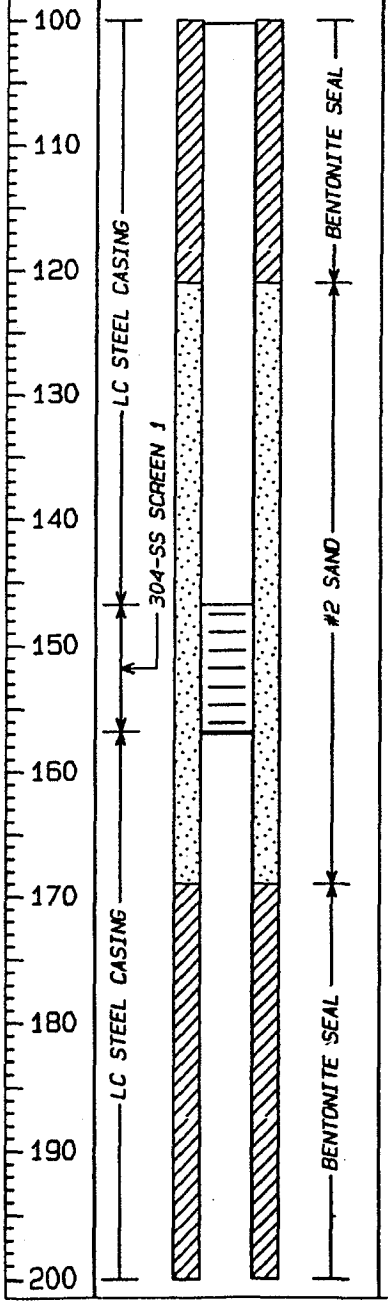


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
0			--	0	N	--	SP	SAND, OLIVE-BROWN coarse-medium grain, angular-subangular, poorly sorted, loose, occasional gravel. BOULDER
10			--	0	N	--	SP	SAND, OLIVE-BROWN coarse-medium grain, angular-subangular, poorly sorted, loose, occasional gravel. BOULDERS (drilled to 18.5 ft. with 18.5 in. bit; set conductor pipe; continued drilling with 12.25 in. bit)
20	4-1	X	0	0	N	--	SP	SAND, OLIVE-BROWN coarse-medium grain, angular-subangular, poorly sorted, loose, occasional gravel. BOULDERS ("soil-4-1" collected at 14:15 on 2-1-90)
30			0	0	N	--	SP	SAND, MULTICOLORED coarse grain, angular-subangular, poorly sorted, abundant boulder fragments. BOULDERS
40			0	0	N	--	SP	SAND, MULTICOLORED coarse grain, subangular-angular, poorly sorted, loose, abundant gravel.
50			0	0	N	--	SP	SAND, MULTICOLORED medium-coarse grain, angular-subangular, poorly sorted, abundant gravel.
60			0	0	N	--	SP	SAND, MULTICOLORED medium-coarse grain, angular-subangular, poorly sorted, occasional gravel.
70			0	0	N	--	SP	SAND, MULTICOLORED medium-coarse grain, angular-subangular, poorly sorted, occasional gravel, abundant rock fragments (schist).
80			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, occasional gravel.
90	4-2	X	0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, occasional rock fragments. ("soil-4-2" collected on 2-2-90)
100								

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90

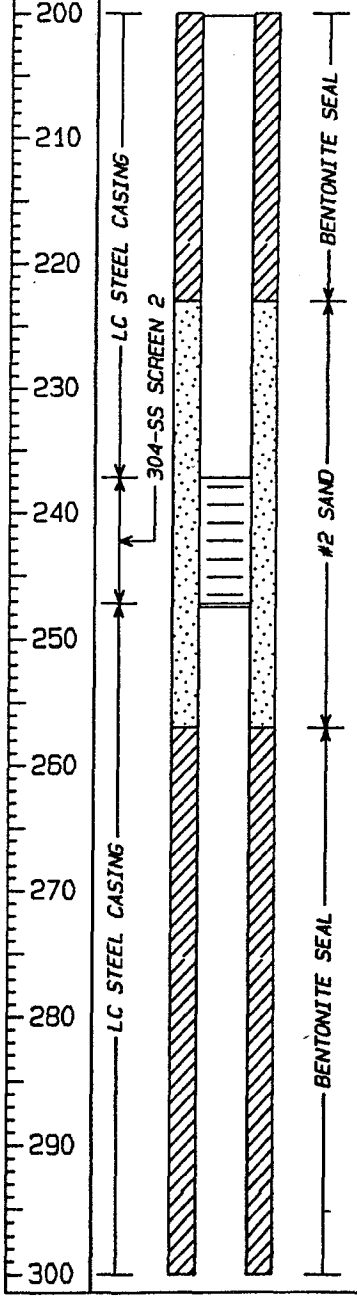


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
100			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, occasional gravel.
110			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, some rock fragments.
120			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional rock fragments.
130			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
140			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. BOULDER
150			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional boulder fragments.
160			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
170			0	0	N	--		SP CL	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. CLAY, BROWN
180			0	0	N	--		SP CL	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. CLAY, SANDY, BROWN
190			0	0	N	--		SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
200	4-3	X							("soil-4-3" collected on 2-2-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90

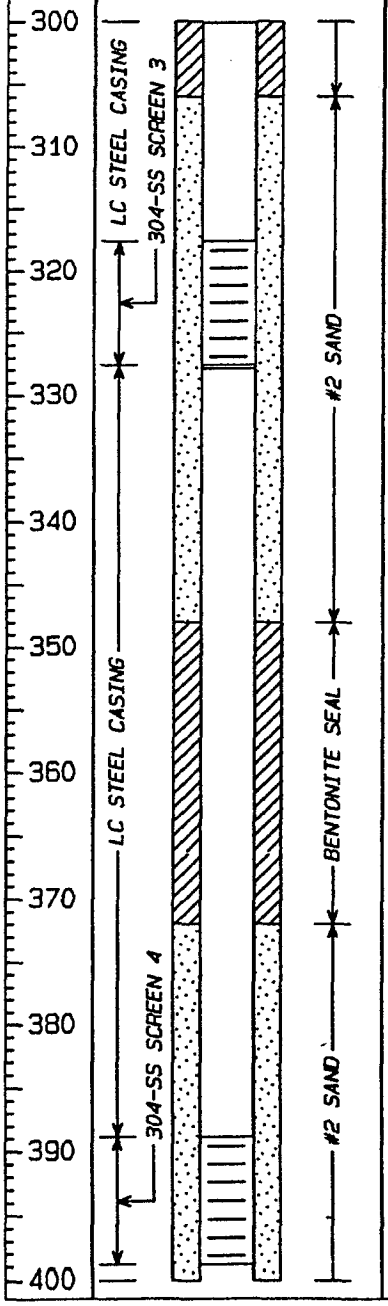


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
200			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. BOULDER
210			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional granite fragments.
220			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, some rock fragments (metamorphic).
230			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, some rock fragments (metamorphic).
240			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional rock fragments.
250			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
260			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
270			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional rock fragments.
280			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional rock fragments.
290	4-4	X	0	0	N	--	SP / CL	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose, occasional rock fragments. CLAY, SILTY, BROWN ("soil-4-4" collected on 2-2-90)
300								

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90

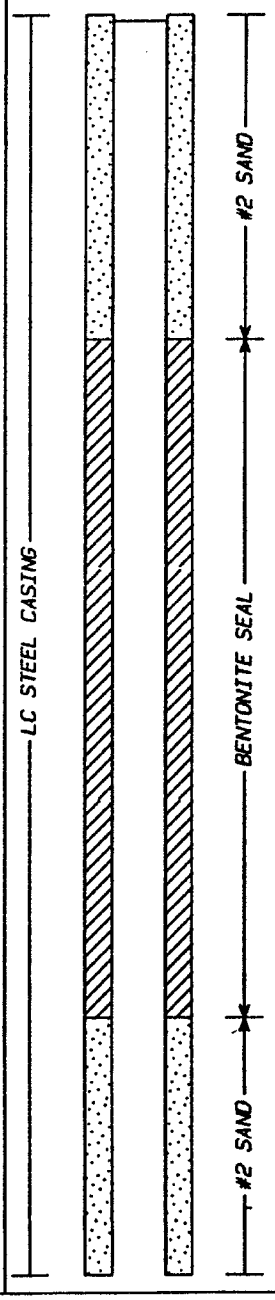


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
300			0	0	N	--	CL	CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
310			0	0	N	--	SP CL	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. CLAY, SILTY, OLIVE-BROWN
320			0	0	N	--	SP	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. BOULDER
330			0	0	N	--	SP CL	CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
340			0	0	N	--	SP CL	SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose. CLAY, SILTY, OLIVE-BROWN
350			0	0	N	--	SP CL	CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
360			0	0	N	--	SP CL	CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
370			0	0	N	--	SP CL	CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, angular-subangular, poorly sorted, loose.
380			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED coarse to medium grain, angular-subangular, poorly sorted, loose.
390	4-5	X	0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED coarse to medium grain, angular-subangular, poorly sorted, loose. ("soil-4-5" collected at 11:40 on 2-5-90)
400								

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90

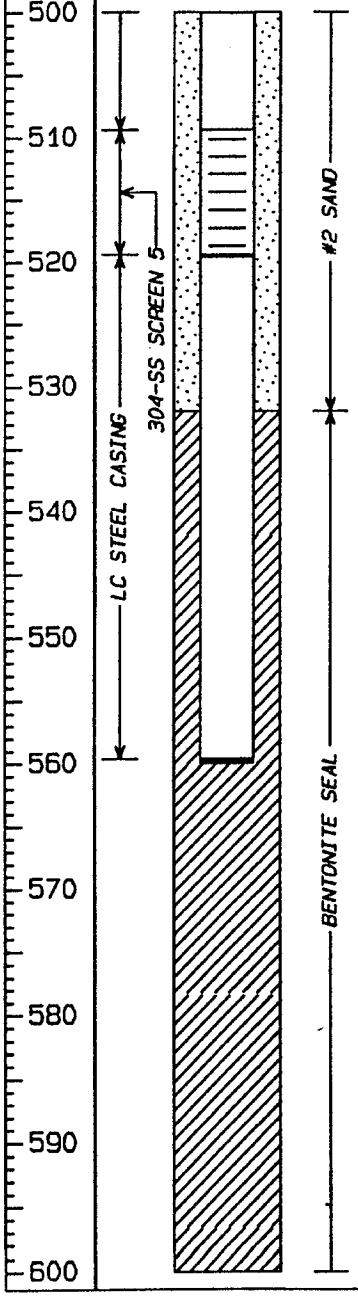


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
400			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose.
410			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose.
420			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose (possibly recirculated material).
430			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose (possibly recirculated material).
440			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose (possibly recirculated material).
450			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose.
460			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose. BOULDER
470			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted, loose.
480			0	0	N	--	SP ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted.
490	4-6	X	0	0	N	--	SP ML	SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted. SILT, CLAYEY, OLIVE-BROWN ("soil-4-6" collected at 15:30 on 2-5-90)
500								

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	18.5/12.25
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1083
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	605
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	108.6
DRILLING METHOD	Mud Rotary	DATE (start/finish)	1-31-90 to 2-6-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
500			0	0	N	--	SP, ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted.
510			0	0	N	--	SP, ML	SILT, CLAYEY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted. BOULDER
520			0	0	N	--	SP, CL	SILT, CLAYEY, OLIVE-BROWN CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted.
530			0	0	N	--	SP, CL	SILT, CLAYEY, OLIVE-BROWN CLAY, SILTY, OLIVE-BROWN SAND, MULTICOLORED medium to coarse grain, subangular-angular, poorly sorted. BOULDER
540			0	0	N	--	SP, CL	CLAY, SILTY, OLIVE-BROWN SILT, CLAYEY, OLIVE-BROWN
550			0	0	N	--	SP, CL	CLAY, SILTY, OLIVE-BROWN GRANITIC ROCK, LIGHT BUFF hard, 7% mafics.
560			0	0	N	--	GR, CL	(granitic basement rock encountered at 556 ft.) GRANITIC ROCK, LIGHT BUFF 7% mafics.
570			0	0	N	--	GR, ML	SILT, CLAYEY, OLIVE-BROWN GRANITIC ROCK, LIGHT BUFF hard, 7% mafics.
580			0	0	N	--	GR, ML	SILT, CLAYEY, GRAY-GREEN CLAY, SILTY, OLIVE-BROWN GRANITIC ROCK, LIGHT BUFF hard, 7% mafics.
590			0	0	N	--	GR	GRANITIC ROCK, LIGHT BUFF hard, 7% mafics.
600	4-7	X						("soil-4-7" collected on 2-6-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-4

PROJECT JPL ESI
LOCATION Pasadena, California
GEOLOGIST/ENGINEER M. Cutler, M. Barnes
DRILLING COMPANY Beylik
DRILLING METHOD Mud Rotary

DRILL HOLE DIAMETER (in) 18.5/12.25
GROUND LEVEL ELEVATION (ft) 1083
TOTAL DEPTH OF HOLE (ft) 605
DEPTH TO WATER (ft) 108.6
DATE (start/finish) 1-31-90 to 2-6-90

DEPTH (ft)	WELL/BORING COMPLETION	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
600				0	0	N	--		GR	GRANITIC ROCK, LIGHT BUFF hard, 7% mafics.

TABLE 8

Westbay Instruments Inc.

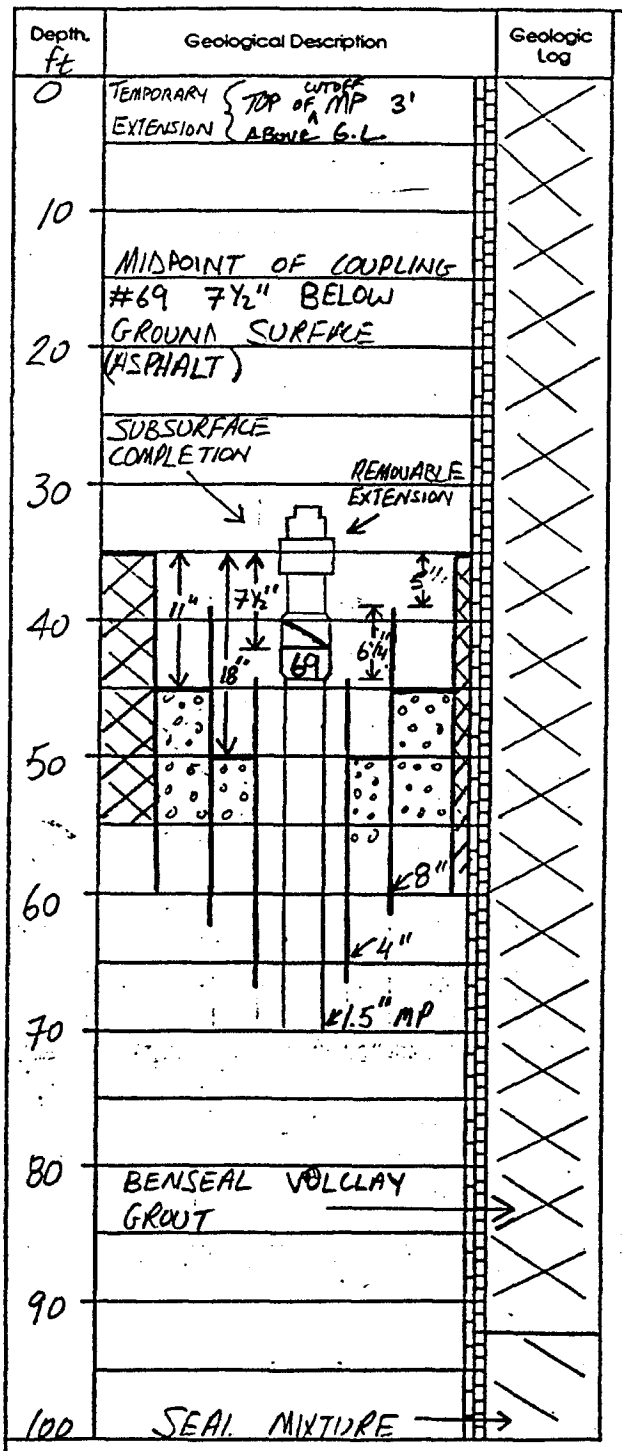
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS/M. BARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¼"/4" STEEL Date Installed: FEB 16/90

Measurement Datum: GROUND SURFACE (ASPHALT) Datum Elevation: Date Drawn: FEB 15/90



Serial No. Batch No.	Final Packer Pressure/Volume	Comments ADD 16 L H_2O	Joint Tests joint	Joint Tests pass
	HYDRAULIC TEST @ 6:37 p.m. FEB 16 = 311.40 ~5 min	69 [illegible]	✓	✓
		68 100psi 18:17	✓	✓
		67 100psi 18:16 FROM TOP MP	✓	✓
	adding H_2O 9:45 a.m. FEB 17 311.43 = SEALED SYSTEM.	105psi 18:20	✓	✓
		100psi 18:00	✓	✓
		90psi 17:58	✓	✓
		100psi 17:54	✓	✓
		110psi 17:52	✓	✓
		100psi 17:48	✓	✓
		130psi 17:47	✓	✓
		100psi 17:44	✓	✓
		ADD 14 L		
		130psi 17:39	✓	✓
		105psi 17:37	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

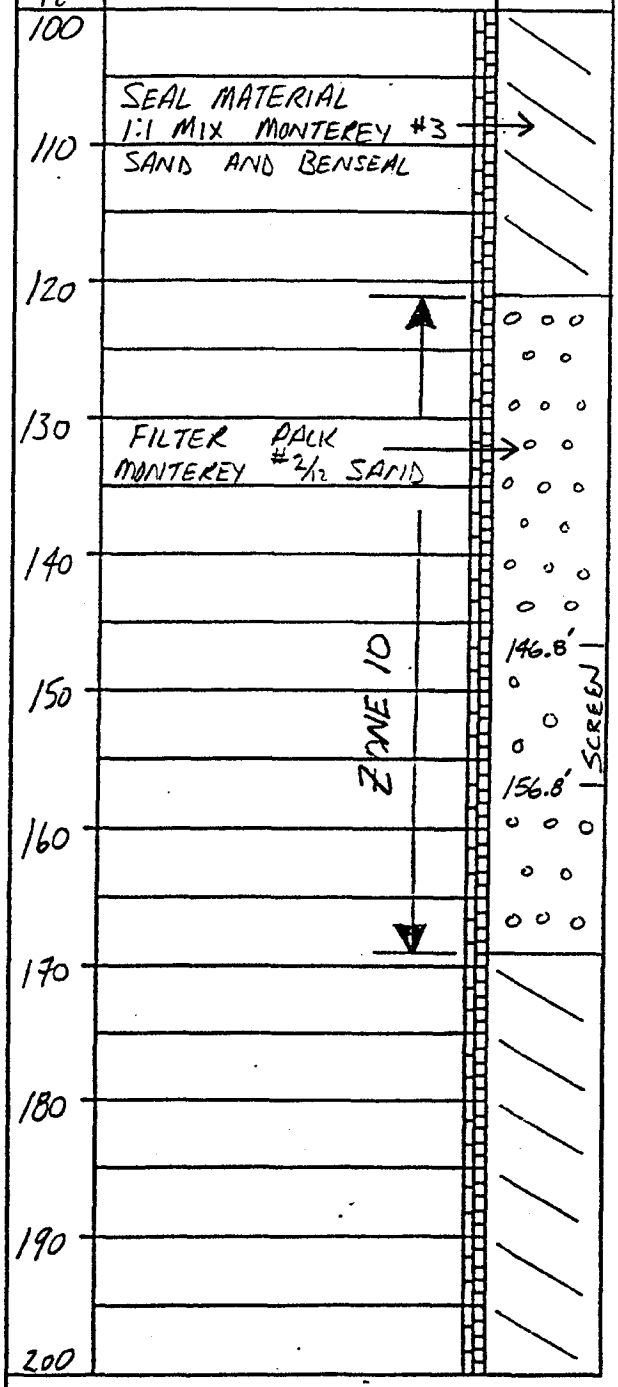
MP System Casing Installation Log

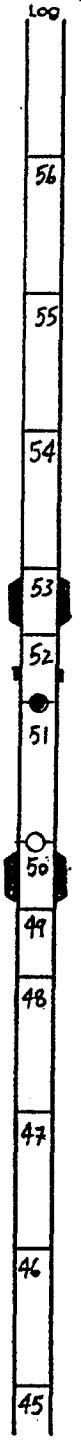
Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS/M. RARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¼"/4" STEEL Date Installed: FEB 16/90

Measurement Datum: GROUND SURFACE (ASPHALT) Datum Elevation: Date Drawn: FEB 15/90





Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
	DEPTH TO MIDDLE OF COUPLING FROM GROUND SURFACE			
		110psi 17:35	✓	✓
		105psi 17:33	✓	✓
		105psi 17:31	✓	✓
		100psi 17:28	✓	✓
3051		100psi 17:24	✓	✓
		ADD 14 ℓ H_2O		
5121	149.6'	100psi 17:19	✓	✓
2732	159.6'	95psi 17:16	✓	✓
3043		80psi 17:13	✓	✓
		100psi 17:09	✓	✓
		110psi 17:06	✓	✓
		110psi 17:04	✓	✓
		100psi 17:01	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

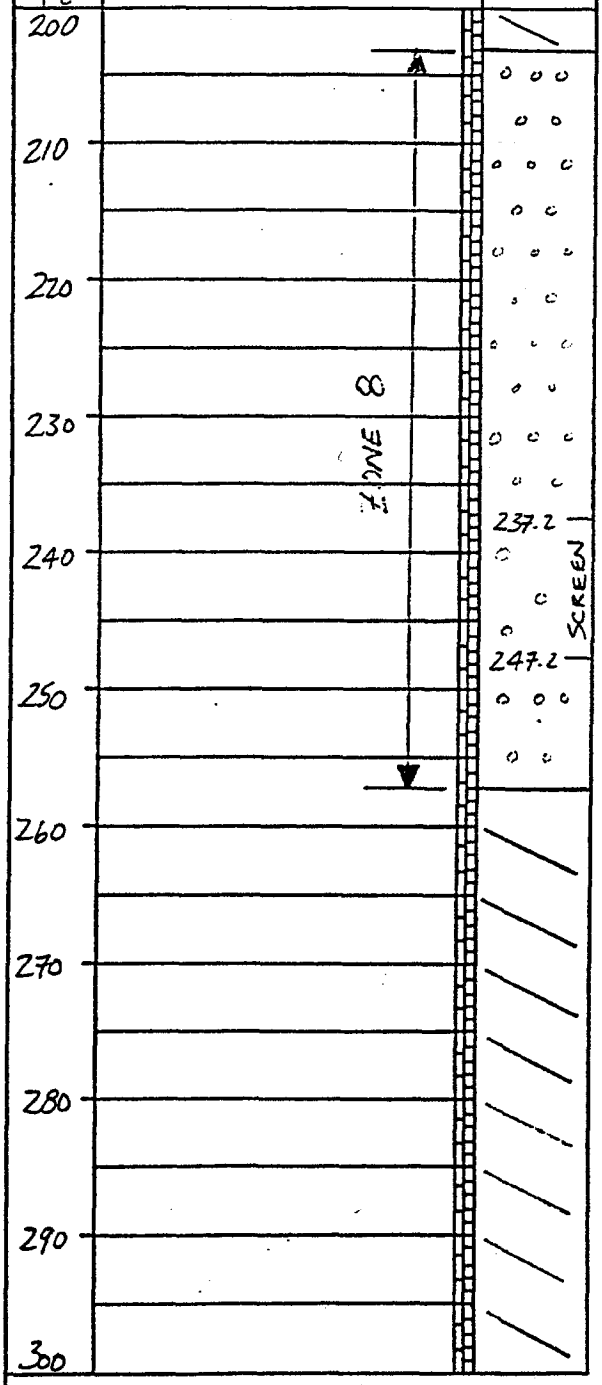
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS/M. BARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¾"/4" STEEL Date Installed: Feb 14/90

Measurement Datum: GROUND SURFACE/ASPHALT Datum Elevation: Date Drawn: FEB 15/90



Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
		100psi 16:56	✓	✓
		ADD 16 l H_2O		
5273 QA9	219.6'	120psi 16:51	✓	✓
		100psi 16:47	✓	✓
3050		110psi 16:44	✓	✓
5264	239.6'	100psi 16:40	✓	✓
2729 3049	249.6'	100psi 16:35	✓	✓
		100psi 16:30	✓	✓
		110psi 16:22	✓	✓
		110psi 16:26	✓	✓
		120 psi 16:17	✓	✓
		100 psi 16:14	✓	✓
		115psi 16:10	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS/MIKE BARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¼" / 4" STEEL Date Installed: FEB 16, 1990

Measurement Datum: GROUND SURFACE / ASPHALT Datum Elevation: _____ Date Drawn: FEB 15, 1990

Depth, ft	Geological Description	Geologic Log	MP Casing Log	Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
300			32	5267 QA7	301.6'	95psi 16:07	✓	✓
310			31	3048	16:04 ✓ 110psi	LEAKS REPLACE 15:59	✓	✓
			30			110psi 15:54	✓	✓
320	ZONE 6	319.6	29	5120	321.6'	105psi 15:51	✓	✓
		SCREEN						
330		329.6	28	2735 3044	331.6	105psi 15:48	✓	✓
			27			100psi 15:45	✓	✓
340			26			105psi 15:41	✓	✓
350			25			105psi 15:39	✓	✓
360			24			110psi 15:35	✓	✓
370			23	5119 QA5	371.6'	105psi 15:32	✓	✓
380			22	3052		110psi 15:29	✓	✓
	ZONE 4	388.9	21			105psi 15:25	✓	✓
390			20	5265	391.6	95psi 15:23	✓	✓
		SCREEN						
400		398.9						

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

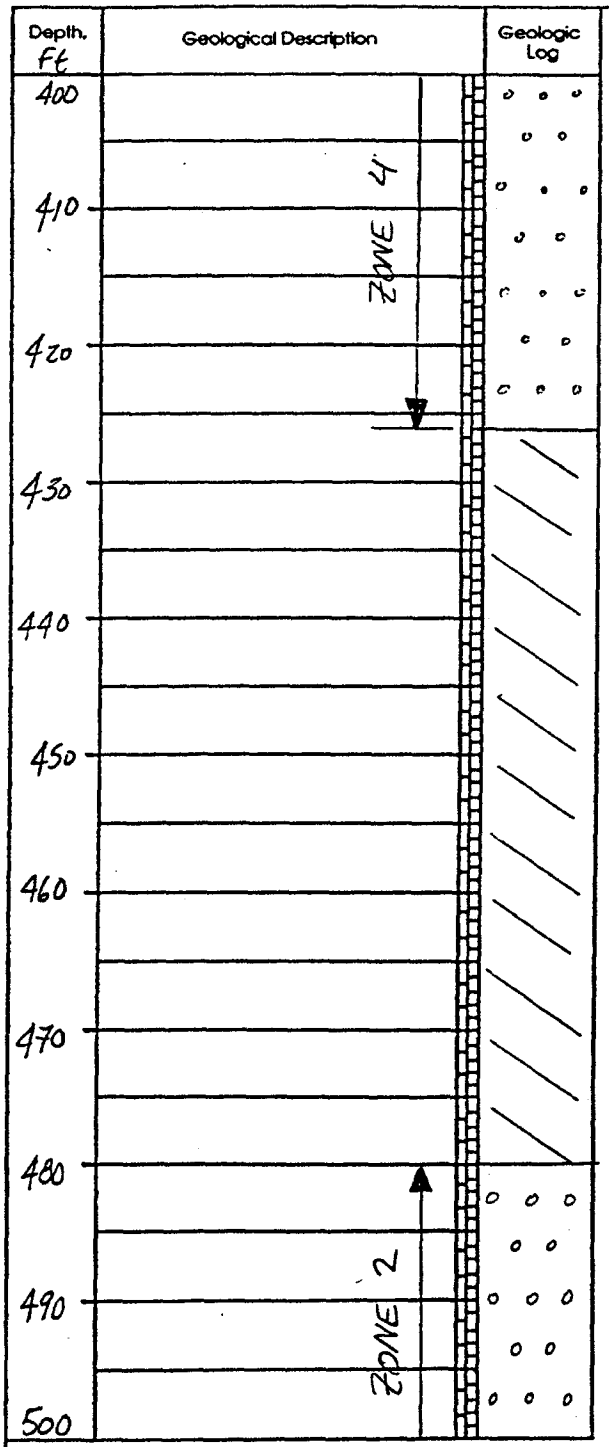
MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY / EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS M. BARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¼" / 4" STEEL Date Installed: Feb 16/90

Measurement Datum: GROUND SURFACE / ASPHALT Datum Elevation: Date Drawn: FEB 15, 1990



Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
2733 3045	401.6'	110psi 15:16	✓	✓
		100psi 15:09	✓	✓
		105 psi 15:04	✓	✓
		110 psi 14:56	✓	✓
		115psi 14:59	✓	✓
		95psi 15:01	✓	✓
		100psi 14:52	✓	✓
		100psi 14:47	✓	✓
		95psi 14:42	✓	✓
		100psi 14:39	✓	✓
		100psi 14:36	✓	
		80psi 14:32	✓	
4231 QA3	492.6'	80psi 14:29	✓	✓

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

Westbay Instruments Inc.

MP System Casing Installation Log

Project: NASA JET PROPULSION LABORATORY/EBASCO WB Ref: 650

Location: PASADENA, CALIFORNIA Hole No: MW-4 Installed by: ER/KS/M. BARNES

Hole Depth: 605' MP Depth: 547' Hole Diameter: 12¼"/4" STEEL Date Installed: Feb 16/90

Measurement Datum: GROUND SURFACE/ASPHALT Datum Elevation: Date Drawn: FEB 15, 1990

Depth, ft.	Geological Description	Geologic Log	MP Casing Log	Serial No. Batch No.	Final Packer Pressure/Volume	Comments	Joint Tests joint	Joint Tests pass
500			6	3046		70psi 14:25	✓	✓
						90psi 14:19	✓	✓
510	ZONE 2	509.4 SCREEN	5					
			4	5269	512.6'	90psi 14:15	✓	✓
520		519.4						
			3	2736 3047	522.6'	90psi 14:11	✓	✓
			2	5266 QA1	527.6'	90psi 14:06	✓	✓
530								
					✓	90psi 14:01	✓	✓
540			1					
						90psi 13:51	✓	✓
550						Inflation tool valve		
						set at 150psi		
						Set supply @ 240psi		
560				BOTTOM	OF 4"	STEEL 559.6'		
570								
580								
590								
600					TD OF HOLE	= 605 ft.		

Regular MP Casing | MP Packer | Settlement Casing | Measurement Port Coupling | Pumping Port Coupling | Regular Coupling

WELL MW-5

BORING LOG AND WELL COMPLETION DIAGRAM

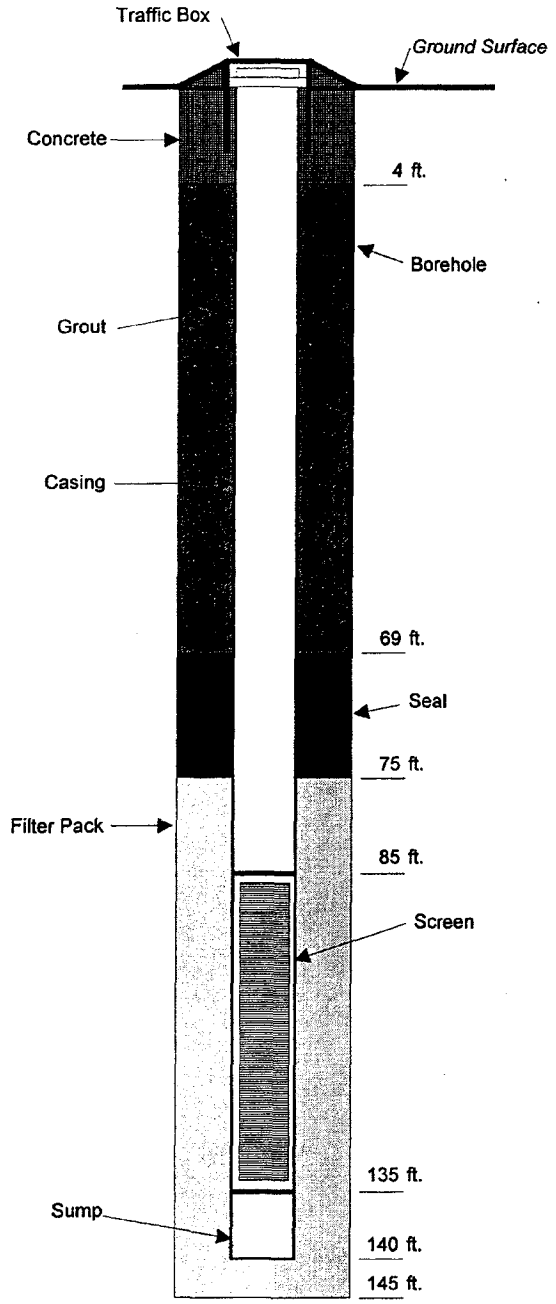
WELL CONSTRUCTION LOG

WELL NUMBER: MW-5

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1072.20

CASING ELEV (ft. above MSL): 1071.60



DRILLING SUMMARY

DATE COMPLETED:	2/12/90 to 1/13/90
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	145 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	140 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4-in.
TOTAL BLANK CASING LENGTH:	90 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	5 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

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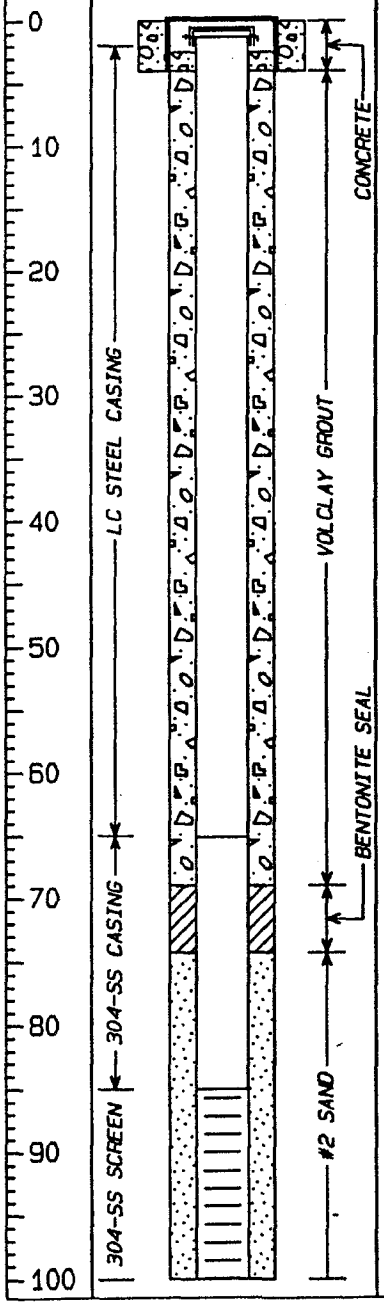
EBASCO ENVIRONMENTAL

WELL NO. MW-5

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	11
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1070
GEOLOGIST/ENGINEER	M. Cutler, M. Barnes	TOTAL DEPTH OF HOLE (ft)	145
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	98.43
DRILLING METHOD	Percussion Hammer	DATE (start/finish)	2-12-90 to 2-13-90



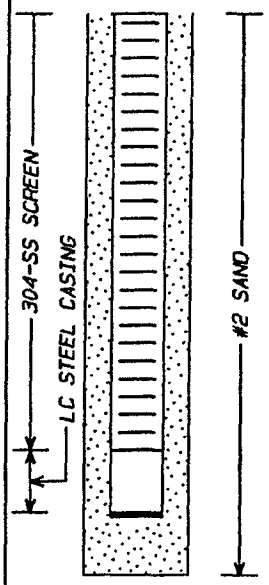
DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
0			0	0	N	SM	SW	SAND, OLIVE-BROWN coarse-fine grained, subangular, poorly sorted, abundant gravel
10	5-1	X						("soil-5-1" collected at 9:15 on 2-12-90)
			0	0	N	SM	SW	SAND, OLIVE-BROWN fine-coarse grained, subangular, v.poorly sorted, abundant cobbles up to 6 cm.
20			0	0	N	SM	SW	SAND, RED-BROWN fine-coarse grained, subangular, v. poorly sorted, abundant gravel up to 3 cm.
30			0	0	N	SM	SW	SAND, RED-BROWN fine-coarse grained, subangular, v. poorly sorted, occasional gravel up to 3 cm.
40			0	0	N	SM	SW	SAND, RED-BROWN fine-coarse grained, subangular, v. poorly sorted, occasional gravel.
50	5-2	X						("soil-5-2" collected at 10:00 on 2-12-90)
			0	0	N	SM	SW	SAND, RED-BROWN fine-coarse grained, subangular-subrounded, poorly sorted, abundant gravel up to 2 cm
60			0	0	N	SM	SW	SAND, TAN-MEDIUM BROWN fine-coarse grained, subangular, poorly sorted, abundant gravel up to 2 cm.
70			0	0	N	DR	SW CL	SAND, SILTY, TAN fine-coarse grained, subangular, poorly sorted, some gravel, boulder at 73 ft., and CLAY, TAN
80			0	0	N	--	SW	SAND, TAN-RED BROWN fine-coarse grained, subangular, poorly sorted, some gravel, boulder at 84 ft.
90			0	0	N	--	SW	SAND, OLIVE BROWN-RED BROWN medium-coarse grained, subangular-angular, poorly sorted, occasional gravel up to 1.5 cm.
100	5-3	X						("soil-5-3" collected at 15:30 on 2-12-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-5

PROJECT: JPL ESI
LOCATION: Pasadena, California
GEOLOGIST/ENGINEER: M. Cutler, M. Barnes
DRILLING COMPANY: Beylik
DRILLING METHOD: Percussion Hammer

DRILL HOLE DIAMETER (in): 11
GROUND LEVEL ELEVATION (ft): 1070
TOTAL DEPTH OF HOLE (ft): 145
DEPTH TO WATER (ft): 98.43
DATE (start/finish): 2-12-90 to 2-13-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
100			0	0	N	WT		SM	SAND, SILTY, BROWN medium-coarse grained, subangular-angular, poorly sorted, occasional gravel up to 1 cm.
110			0	0	N	WT		SP	SAND, SILTY, BROWN coarse grained, subangular, poorly sorted, occasional gravel up to 1.5 cm.
120			0	0	N	WT		SM	SAND, SILTY, BROWN coarse grained, subangular, poorly sorted, occasional gravel up to 2 cm.
130			0	0	N	WT		SW	SAND, MULTICOLORED coarse grained, subangular, moderately sorted, occasional gravel.
140	5-4	☒							("soil-5-4" collected at 12:00 on 2-13-90)
			0	0	N	WT		SW	SAND, MULTICOLORED coarse grained, subangular, moderately sorted, occasional gravel.

WELL MW-6

BORING LOG AND WELL COMPLETION DIAGRAM

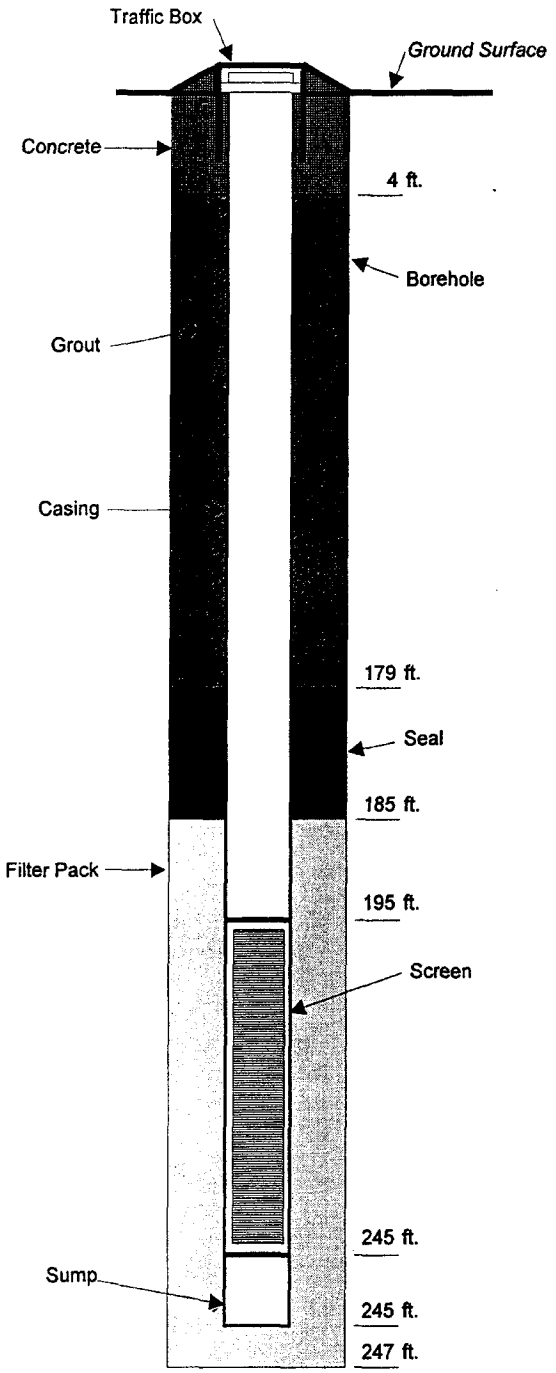
WELL CONSTRUCTION LOG

WELL NUMBER: MW-6

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1189.09

CASING ELEV (ft. above MSL): 1188.52



DRILLING SUMMARY

DATE COMPLETED:	2/12/90 to 1/13/90
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	247 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	245 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	195 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	None
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

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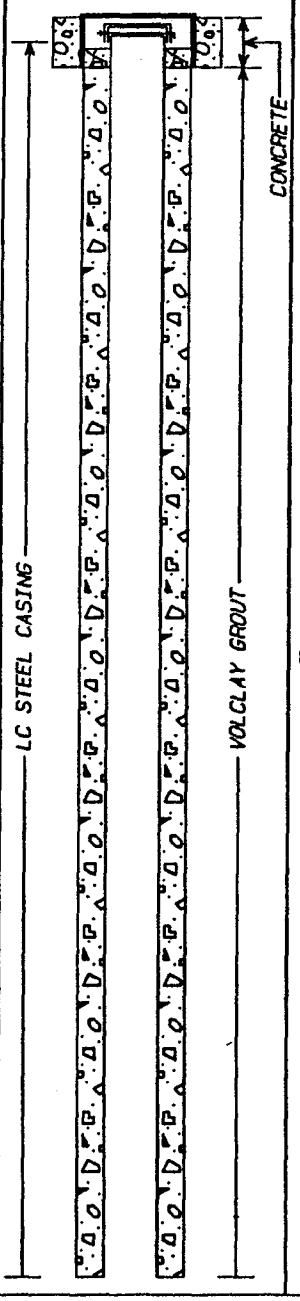
EBASCO ENVIRONMENTAL

WELL NO. MW-6

PROJECT *JPL ESI*
LOCATION *Pasadena, California*
GEOLOGIST/ENGINEER *M. Cutler, H. Papenguth*
DRILLING COMPANY *Beylik*
DRILLING METHOD *Percussion Hammer*

DRILL HOLE DIAMETER (in) *11*
GROUND LEVEL ELEVATION (ft) *1189*
TOTAL DEPTH OF HOLE (ft) *247*
DEPTH TO WATER (ft) *205.8*
DATE (start/finish) *2-15-90 to 2-24-90*

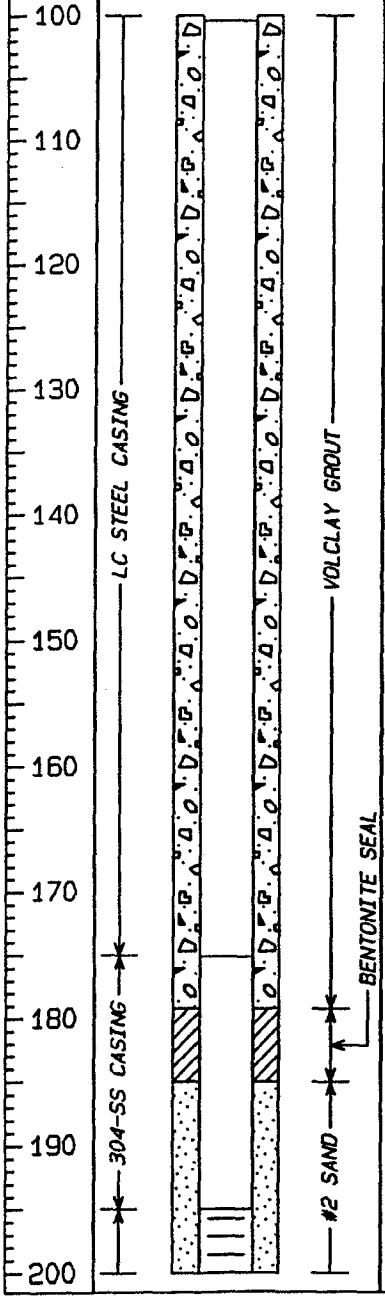


DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
0			0	0	N	SM		SW	SAND, SILTY, BROWN medium grain, silty, subangular, moderately sorted, abundant gravel and cobbles. ("soil-6-1" collected at 14:45 on 2-15-90)
10	6-1	☒	0	0	N	SM		SW	SAND, SILTY, BROWN medium grain, subangular, moderately sorted.
20			0	0	N	SM		SW	SAND, SILTY, BROWN-RED BROWN medium grain, subangular, moderately sorted, occasional gravel.
30			0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm.
40			0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm. ("soil-6-2" collected at 15:20 on 2-15-90)
50	6-2	☒	0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm.
60			0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm.
70			0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm.
80			0	0	N	SM		SW	SAND, SILTY, BROWN fine grain, subangular, moderately sorted, occasional gravel up to 1 cm.
90			0	0	N	SM		SW	SAND, BROWN medium grain, subangular, moderately sorted, occasional gravel up to 2 cm. BOULDER ("soil-6-3" collected at 16:40 on 2-15-90)
100									

EBASCO ENVIRONMENTAL

WELL NO. MW-6

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	11
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1189
GEOLOGIST/ENGINEER	M. Cutler, H. Papenguth	TOTAL DEPTH OF HOLE (ft)	247
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	205.8
DRILLING METHOD	Percussion Hammer	DATE (start/finish)	2-15-90 to 2-24-90



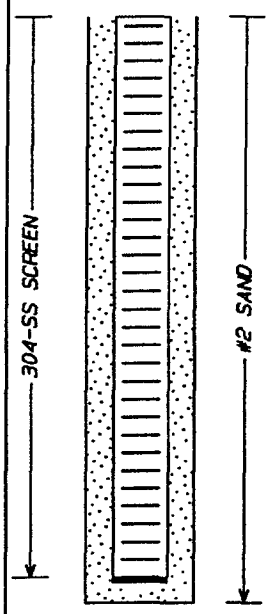
DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
100	6-3	☒	0	0	N	SM		SW	SAND, BROWN medium grain, subangular, moderately sorted, occasional gravel up to 2 cm.
110			0	0	N	SM		SW	SAND, BROWN medium grain, gravely, subangular, moderately sorted.
120			0	0	N	SM		SW	SAND, BROWN medium grain, gravely, subangular, moderately sorted.
130			0	0	N	SM		SW	SAND, BROWN medium grain, gravely, subangular, moderately sorted.
140			0	0	N	SM		SM	SAND, SILTY, BROWN fine to coarse grained, occasional pebbles and cobbles of granitic rock. BOULDER ("soil-6-4" collected at 8:00 on 2-16-90)
150	6-4	☒	0	0	N	SM		SW	SAND, SILTY, BROWN fine to coarse grained, occasional pebbles and cobbles.
160			0	0	N	SM		SW	SAND, SILTY, BROWN fine to coarse grained, occasional pebbles and cobbles.
170			0	0	N	SM		SW	SAND, BROWN very fine to coarse grained, poorly sorted, occasional gravel to cobbles.
180			0	0	N	SM		SW / ML	SAND, BROWN very fine to coarse grained, abundant silt and clay, few pebbles, and SILT, CLAYEY, BROWN-GRAY
190			0	0	N	SM / DR		SW	GRANITIC ROCK SAND, BROWN fine to very coarse grained, abundant subrounded gravel. BOULDER ("soil-6-5" collected at 14:15 on 2-16-90)
200	6-5	☒							

EBASCO ENVIRONMENTAL

WELL NO. MW-6

PROJECT *JPL ESI*
LOCATION *Pasadena, California*
GEOLOGIST/ENGINEER *M. Cutler, H. Papenguth*
DRILLING COMPANY *Beylik*
DRILLING METHOD *Percussion Hammer*

DRILL HOLE DIAMETER (in) *11*
GROUND LEVEL ELEVATION (ft) *1189*
TOTAL DEPTH OF HOLE (ft) *247*
DEPTH TO WATER (ft) *205.8*
DATE (start/finish) *2-15-90 to 2-24-90*

DEPTH (ft)	WELL/BORING COMPLETION	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
200				0	0	N			SW	SAND, BROWN fine to medium grained, abundant silt and clay, moderately sorted, abundant biotite, some metamorphic rock fragments. BOULDERS
210				0	0	N	DR		SW	SAND, BROWN fine to medium grained, abundant silt and clay, moderately sorted, abundant biotite, occasional igneous and metamorphic rock fragments. BOULDERS
220				0	0	N	SM		SW	SAND, SILTY, BROWN coarse grained, abundant clay, moderately sorted, igneous and metamorphic rock fragments, abundant gravel up to 8mm.
230				0	0	N	WT		SW	SAND, SILTY, BROWN coarse grained, abundant clay, moderately sorted, igneous and metamorphic rock fragments, abundant gravel up to 8mm.
240		6-6	☒	0	0	N	WT		SW	SAND, SILTY, BROWN coarse grained, abundant clay, moderately sorted, igneous and metamorphic rock fragments, abundant gravel up to 8mm. ("soil-6-6" collected at 8:10 on 2-23-90)

WELL MW-7

BORING LOG AND WELL COMPLETION DIAGRAM

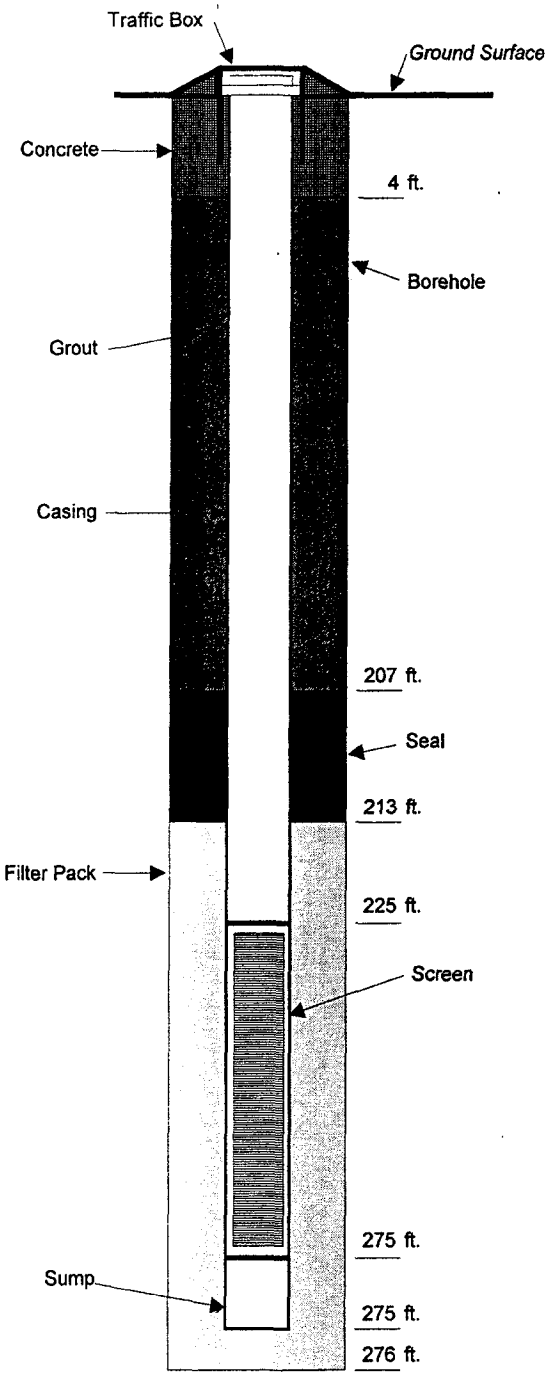
WELL CONSTRUCTION LOG

WELL NUMBER: MW-7

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1213.43

CASING ELEV (ft. above MSL): 1212.88



DRILLING SUMMARY

DATE COMPLETED:	2/28/90 to 3/5/90
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	276 ft.

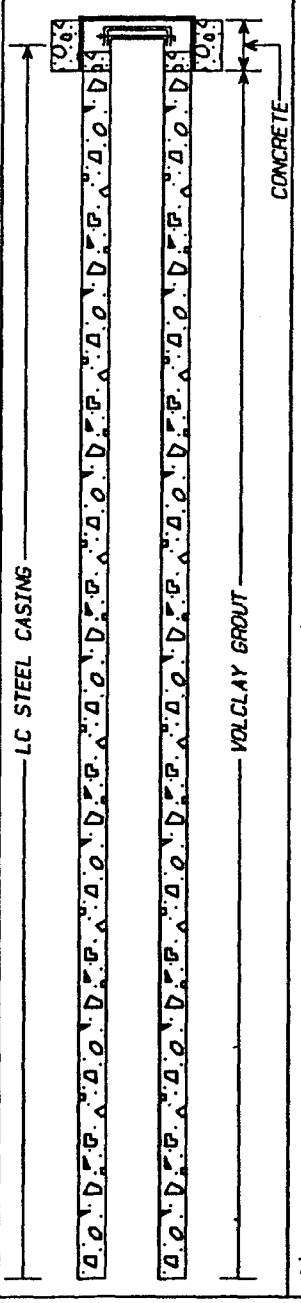
CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	275 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	225 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	None
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

EBASCO ENVIRONMENTAL

WELL NO. MW-7

PROJECT	JPL ESI	DRILL HOLE DIAMETER (in)	11
LOCATION	Pasadena, California	GROUND LEVEL ELEVATION (ft)	1213
GEOLOGIST/ENGINEER	M. Cutler	TOTAL DEPTH OF HOLE (ft)	276
DRILLING COMPANY	Beylik	DEPTH TO WATER (ft)	236.2
DRILLING METHOD	Percussion Hammer	DATE (start/finish)	2-28-90 to 3-5-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
0	7-1	X	0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, abundant silt and clay, subangular, poorly sorted, common gravel and pebbles. ("soil-7-1" collected at 11:00 on 2-28-90)
10			0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, abundant silt and clay, poorly sorted, common gravel.
20			0	0	N	SM		SC	SAND, BROWN very fine to medium grained, abundant silt and clay, poorly sorted, abundant cobbles of granite rock.
30			0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, abundant silt and clay, subangular, poorly sorted, abundant pebbles and cobbles.
40			0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, common silt, abundant gravel and pebbles.
50	7-2	X							("soil-7-2" collected at 11:50 on 2-28-90)
			0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, common silt, abundant gravel and pebbles. BOULDERS
60			0	0	N	SM		SC	SAND, BROWN fine to very coarse grained, abundant pebbles and cobbles.
70			0	0	N	SM		SC	SAND, BROWN fine to very coarse grained, abundant pebbles and cobbles.
80			0	0	N	SM		SC	SAND, BROWN very fine to coarse grained, abundant silt, subangular, poorly sorted, common gravel.
90			0	0	N	SM		SM	SAND, LIGHT BROWN fine to very coarse grained, subangular, poorly sorted, loose, abundant gravel.
100	7-3	X							("soil-7-3" collected at 13:05 on 2-28-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-7

PROJECT: JPL ESI
LOCATION: Pasadena, California
GEOLOGIST/ENGINEER: M. Cutler
DRILLING COMPANY: Beylik
DRILLING METHOD: Percussion Hammer

DRILL HOLE DIAMETER (in): 11
GROUND LEVEL ELEVATION (ft): 1213
TOTAL DEPTH OF HOLE (ft): 276
DEPTH TO WATER (ft): 236.2
DATE (start/finish): 2-28-90 to 3-5-90

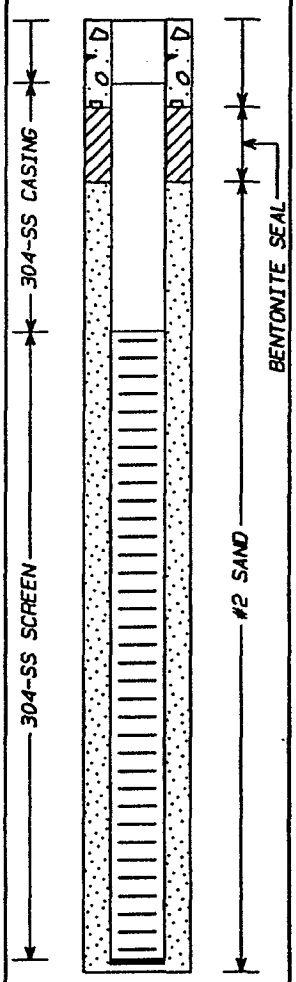
DEPTH (ft)	WELL/BORING COMPLETION	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	SYMBOLS	USCS SYMBOL	DESCRIPTION AND NOTES
100	LC STEEL CASING; VOLCLAY GROUT			0	0	N	SM		SM	SAND, BROWN fine to very coarse grained, subangular, poorly sorted, common silt, common gravel and pebbles.
110				0	0	N	SM		SC	SAND, BROWN fine to very coarse grained, subangular, poorly sorted, with trace silt and clay. BOULDERS
120				0	0	N	DR		SC	SAND, BROWN fine to very coarse grained, subangular, poorly sorted, common silt, abundant pebbles and cobbles.
130				0	0	N	DR		SM	SAND, BROWN fine to very coarse grained, subangular, poorly sorted, with trace of clay and silt.
140				0	0	N	DR		SM	SAND, BROWN fine to very coarse grained, subangular, poorly sorted, common silt, common gravel and pebbles.
150		7-4	☒	0	0	N	DR		SM	("soil-7-4" collected at 14:15 on 2-28-90) SAND, BROWN fine to very coarse grained, subangular, poorly sorted, common silt, common gravel and pebbles.
160				0	0	N	DR		SM	BOULDER SAND, BROWN fine to very coarse grained, subangular, poorly sorted, common silt, common gravel and pebbles.
170				0	0	N	SM		SM	SAND, BROWN fine to coarse grained, abundant silt, subangular, poorly sorted, common gravel and pebbles.
180				0	0	N	DR		SM	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant gravel to cobble sized granitic rocks.
190				0	0	N	DR		SM	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant gravel and cobble sized rocks.
200		7-5	☒							("soil-7-5" collected at 16:50 on 2-28-90)

EBASCO ENVIRONMENTAL

WELL NO. MW-7

PROJECT: JPL ESI
LOCATION: Pasadena, California
GEOLOGIST/ENGINEER: M. Cutler
DRILLING COMPANY: Beylik
DRILLING METHOD: Percussion Hammer

DRILL HOLE DIAMETER (in): 11
GROUND LEVEL ELEVATION (ft): 1213
TOTAL DEPTH OF HOLE (ft): 276
DEPTH TO WATER (ft): 236.2
DATE (start/finish): 2-28-90 to 3-5-90



DEPTH (ft)	SAMPLE #	SAMPLES	OVA (ppm)	% LEL	ODOR	MOISTURE	USCS SYMBOL	DESCRIPTION AND NOTES
200			0	0	N	DR	SM	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant gravel and cobble sized granitic rocks.
210			0	0	N	DR	SM	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant gravel and cobble sized granitic rocks.
220			0	0	N	DR	SC	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant silt and clay, common pebbles of granitic rocks. BOULDER
230			0	0	N	▽	SC	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant clay, pebbles, and cobbles, and boulders of granitic rocks. BOULDER
240			0	0	N	ST	SM	SAND, BROWN fine to very coarse grained, with abundant silt and gravel. BOULDERS
250	7-6	☒						("soil-7-6" collected at 10:00 on 3-2-90)
			0	0	N	ST	SM	SAND, BROWN fine to very coarse grained, abundant silt, subangular, poorly sorted, abundant cobbles. BOULDER
260			0	0	N	ST	SW	SAND, BROWN medium to coarse grained, subangular to subrounded, moderately sorted, abundant cobbles. BOULDER
270	7-7	☒	0	0	N	ST	SW	SAND, BROWN medium to coarse grained, subangular, moderately sorted, abundant cobbles. BOULDER ("soil-7-7" collected at 8:10 on 3-5-90)

WELL MW-8

BORING LOG AND WELL COMPLETION DIAGRAM

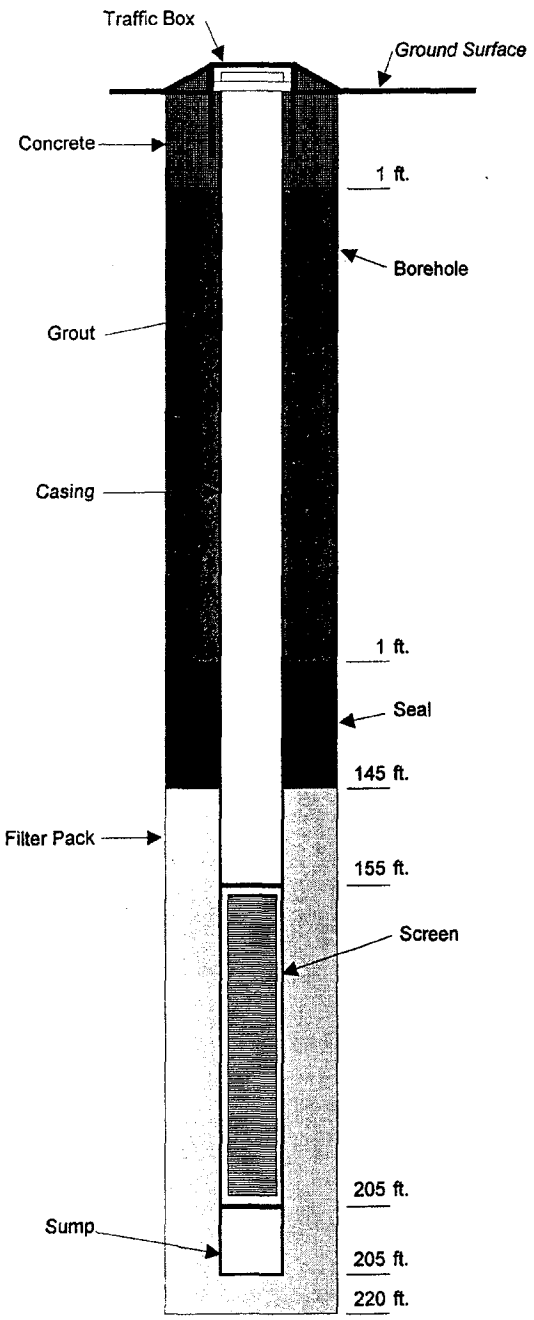
WELL CONSTRUCTION LOG

WELL NUMBER: MW-8

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1140.22

CASING ELEV (ft. above MSL): 1139.53



DRILLING SUMMARY

DATE COMPLETED:	10/29/92
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	220 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	10.75 in.
TOTAL WELL DEPTH:	205 ft.
BLANK CASING TYPE:	Stainless Steel
BLANK CASING DIAMETER:	4.5 in.
TOTAL BLANK CASING LENGTH:	155 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	None
PROTECTIVE CASING STICKUP:	0.5-foot
GROUT MATERIAL:	None
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/12 Sand
COMMENTS:	

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EBASCO ENVIRONMENTAL

Monitoring Well 8

PROJECT *Jet Propulsion Laboratory*
LOCATION *Near loading dock, Building 303*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/27/92 to 10/28/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1140.1*
TOTAL DEPTH (ft) *220.0*
DEPTH TO WATER (ft) *166.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0									ASPHALT - Pavement (3 inches thick).
		MW-8-1A MW-8-1B						SP	SAND (fill) - Fine to coarse sand with some fine gravel and trace silt, orange-brown, slightly moist to moist, medium dense.
10				0	0	0			Gray-brown from 5' to 7', no gravel. Small pieces of wood.
								GP	SANDY GRAVEL - Fine to coarse sandy gravel, light orange-brown, slightly moist, very dense.
20				0	0	0			Boulder at 14.5' to 17.5'.
								SP	SAND - Fine to medium sand, light gray-brown, slightly moist, dense.
30				0	0	0		GP	SANDY GRAVEL - Fine to coarse sandy gravel with cobbles, light orange-brown, slightly moist, very dense.
40				0	0	0		SP	SAND - Fine to medium sand with some coarse sand and fine gravel, orange-brown, slightly moist, dense, micaceous.
								SP	GRAVELLY SAND - Gravelly fine to coarse sand, orange-brown, slightly moist, medium dense.
50		MW-8-2A MW-8-2B		0	0	0		SW	SAND - Fine to coarse sand with fine gravel and occasional pieces of coarse gravel, orange-brown, moist very dense, micaceous.
60				0	0	0		GP	SANDY GRAVEL - Fine to coarse sandy gravel with occasional cobbles, dark orange-brown and light yellow-brown, slightly moist, very dense.
								SP	SAND - Fine to medium sand with occasional fine gravel and trace silt, orange-brown, slightly moist, very dense, micaceous.
70				0	0	0		GP	SANDY GRAVEL - Sandy gravel with cobbles and small boulders, pale orange-brown to yellow-brown, slightly moist to dry, very dense, micaceous.
								SW	SAND - Fine to course sand with some gravel, light orange-brown, slightly moist, very dense, micaceous.
80				0	0	0		SP	SAND - Fine sand with some medium sand, dark orange-brown, slightly moist, very dense, micaceous.
								GP	SANDY GRAVEL - Fine to coarse sandy gravel with occasional cobbles and small boulders, orange-brown to reddish-brown, slightly moist, very dense, micaceous.
90				0	0	0			
100									

EBASCO ENVIRONMENTAL

Monitoring Well 8

PROJECT *Jet Propulsion Laboratory*
LOCATION *Near loading dock, Building 303*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/27/92 to 10/28/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1140.1*
TOTAL DEPTH (ft) *220.0*
DEPTH TO WATER (ft) *166.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
100		MW-8-3A MW-8-3B	■	0	0	0		GP	Cobbles from 101' to 111'.
110				0	0	0			Cobbles and boulders from 112.5' to 123'.
120				0	0	0			Sandy fine gravel from 123' to 126', slightly moist, very dense. Cobbles (boulder?) at 127'.
130				0	0	0		SP	GRAVELLY SAND - Gravelly fine to coarse sand with trace silt, light orange-brown, slightly moist, very dense, micaceous. Occasional cobbles from 133' to 139'.
140				0	0	0			Cobbles (small boulders) from 142' to 145'.
150		MW-8-4A MW-8-4B	■	0	0	0		GP	SANDY GRAVEL - Fine to coarse sandy gravel with cobbles occasional boulders, light yellow-brown to orange-brown, slightly moist, very dense, trace mica.
								SP	GRAVELLY SAND - Gravelly fine to coarse sand with trace silt, dark orange-brown, slightly moist, very dense, micaceous.
160				0	0	0			Occasional cobbles or small boulders from 156' to 166'.
170				0	0	0		GP	SANDY GRAVEL - Medium to coarse sandy gravel, dark orange-brown, moist, very dense. Boulder at 173' to 178'.
180				0		0			Encounter groundwater at 180'.
190								SP	SAND - Medium to coarse sand with trace fine gravel, light brown, saturated, very dense.
200									

EBASCO ENVIRONMENTAL

Monitoring Well 8

PROJECT *Jet Propulsion Laboratory*
LOCATION *Near loading dock, Building 303*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/27/92 to 10/28/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1140.1*
TOTAL DEPTH (ft) *220.0*
DEPTH TO WATER (ft) *166.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
200		MW-8-5A MW-8-5B	■					SP	
								SW	Cobbles at 203'. GRAVELLY SAND – Medium to coarse sandy gravel, light brown, saturated, very dense.
210									
220									Total depth = 220' Natural gamma log completed 10/28/92 Static water level at 166.6' bgs (0810, 10/29/92) Converted to monitoring well on 10/29/92.
230									
240									
250									
260									
270									
280									
290									
300									

WELL MW-9

BORING LOG AND WELL COMPLETION DIAGRAM

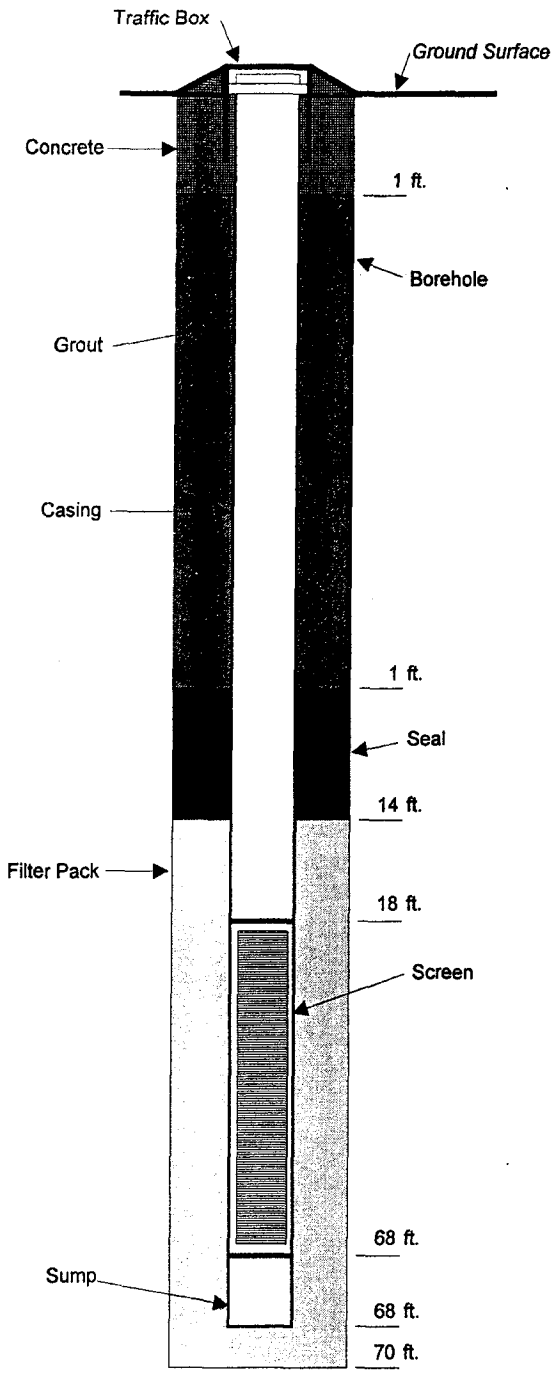
WELL CONSTRUCTION LOG

WELL NUMBER: MW-9

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1104.78

CASING ELEV (ft. above MSL): 1106.02



DRILLING SUMMARY

DATE COMPLETED:	10/23/92
DRILLING COMPANY:	Layne Environmental
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	70 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	10.75 in.
TOTAL WELL DEPTH:	68 ft.
BLANK CASING TYPE:	Sch 40 PVC
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	18 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	None
PROTECTIVE CASING STICKUP:	2.3-ft.
GROUT MATERIAL:	None
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/12 Sand
COMMENTS:	

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EBASCO ENVIRONMENTAL

Monitoring Well 9

PROJECT *Jet Propulsion Laboratory*
LOCATION *In Arroyo near Building 103*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/22/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1104.5*
TOTAL DEPTH (ft) *70.0*
DEPTH TO WATER (ft) *24.7*

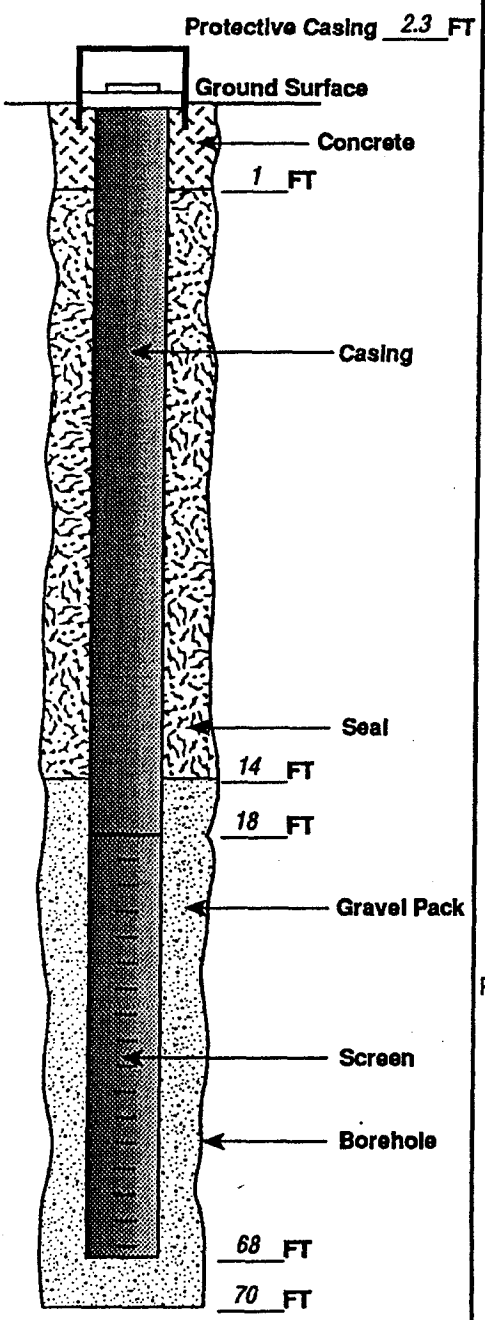
Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0								SM	SILTY SAND – Silty fine to medium sand with some gravel, pale brown, dry, medium dense, slightly moist at 4', trace mica.
		MW-9-1A	▬						
		MW-9-1B	▬						
10				.4	0	0			Boulder at 10.5' to 12'.
								SP	SAND – Fine to medium sand with fine to coarse gravel and occasional cobbles, yellow-brown, slightly moist to moist, medium dense, trace mica.
20				0	0	0			
									Very moist at 25'.
30				0	.5	0			Increase in gravel and cobbles.
									Boulder 32' to 36'.
									Groundwater at 33'.
40				.5		0			
								SM	SILTY SAND – Silty fine to medium sand with trace gravel, yellow-brown, saturated, dense, trace mica.
50		MW-9-2A MW-9-2B	▬	0	.2	0			
								SW GW	GRAVELLY SAND/SANDY GRAVEL – Fine to coarse sandy gravel, yellow-brown, saturated, dense, trace mica.
60				0	.1	0			
								SP	SAND – Fine to medium sand with trace gravel, yellow-brown, saturated, trace mica.
									Fine sand with trace silt.
70				0	0	0			Total depth = 70' bgs (10/22/92) Natural gamma log (10/22/92) Static water level at 24.7' bgs (0730, 10/23/92) Converted to monitoring well (10/23/92).
80									
90									
100									

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4050

WELL CONSTRUCTION LOG

PROJECT NAME: JPL Phase I RI/FS
PROJECT OFS: JPL 3723.001
LOCATION: 4800 Oak Grove Dr.
Pasadena, CA
EBASCO PERSONNEL: B.G. Randolph / Rob Tweidt

WELL NUMBER: MW-9
WELL LOCATION: Arroyo Seco
SURFACE ELEV (ft above MSL): Approximately 1104.5
CASING ELEV (ft above MSL): 1106.02



DRILLING SUMMARY

DATE: 10/23/92
DRILLING COMPANY: Layne Environmental, Inc.
DRILLING FOREMAN: Steve Johnson
RIG TYPE: Portadrill 10 TLT-320
TOTAL DEPTH OF BORING: 70 feet
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

WELL TYPE: Monitoring
BORING DIAMETER: 10.75 inches
TOTAL WELL DEPTH: 68 feet
CASING TYPE: Sch. 40 PVC
CASING DIAMETER: 4 inches
CASING LENGTH: 20 feet
SCREEN TYPE: Stainless Steel Type 304
SCREEN SIZE: 0.010 inches
SCREEN LENGTH: 50 feet
TAILPIPE LENGTH: 0.32 feet
CASING STICKUP: 1.5 feet
PROTECTIVE CASING TYPE: Low Carbon Steel
PROTECTIVE CASING STICKUP: 2.3 feet
CENTRALIZERS: None
SEAL MATERIAL: Enviroplug 1/4" Bentonite Pellets
SEAL VOLUME: 5.72 cubic feet
FILTER MATERIAL: RMC Lonestar #2/12 Sand
FILTER VOLUME: 29.34 cubic feet
COMMENTS: Used Six Bags Concrete (Top Three Feet of Annulus)

WELL MW-10

BORING LOG AND WELL COMPLETION DIAGRAM

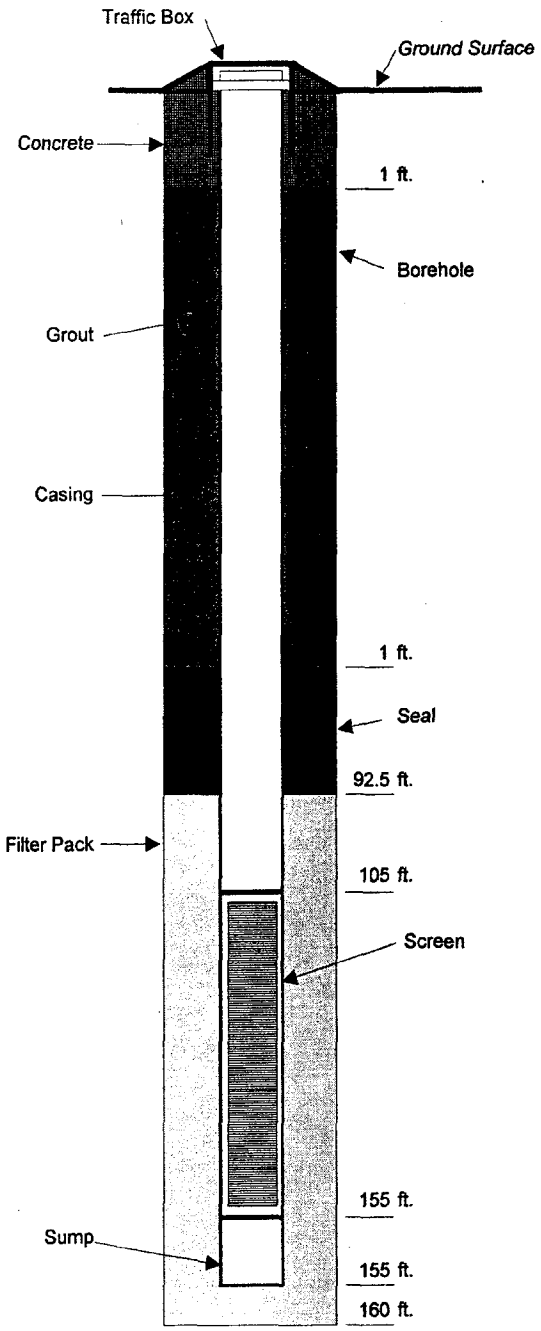
WELL CONSTRUCTION LOG

WELL NUMBER: MW-10

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1088.27

CASING ELEV (ft. above MSL): 1087.71



DRILLING SUMMARY

DATE COMPLETED:	10/31/92
DRILLING COMPANY:	Layne Environmental
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	160 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	10.75 in.
TOTAL WELL DEPTH:	155 ft.
BLANK CASING TYPE:	0'-80' PVC; 85'-105' SS
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	105 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	None
PROTECTIVE CASING STICKUP:	0.5-in.
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/12 Sand
COMMENTS:	

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EBASCO ENVIRONMENTAL

Monitoring Well 10

PROJECT *Jet Propulsion Laboratory*
LOCATION *Between Buildings 190 and 201*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/30/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1088.3*
TOTAL DEPTH (ft) *170.0*
DEPTH TO WATER (ft) *116.1*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0									ASPHALT – Pavement (3 inches thick)
								SP	SAND – Fine to medium sand with trace fine gravel, light brown, fine to medium grained, slightly moist, dense.
		MW-10-1A MW-10-1B	■						
10				0	0	0			
									Boulder from 14' to 19'.
20				0	0	0			
									Fine grained sand with trace silt.
30				0	0	0			
									Fine to medium sand with trace fine to coarse gravel.
40				0	0	0			
								GP	SANDY GRAVEL – Medium to coarse sandy gravel, slightly moist, dense.
50		MW-10-2A MW-10-2B	■	0	0	0			
								SP	SAND – Fine to medium sand with some fine gravel, light brown, moist, very dense.
60				0	0	0			Trace silt.
								SM	SILTY SAND – Silty fine sand with trace fine gravel, brown, micaceous.
70				0	0	0		SP	SAND – Fine sand with trace meium sand and fine gravel, moist, very dense, trace mica.
									Boulder at 75' to 77'.
									Occassional cobbles.
80				0	0	0			
									Cobble layer 86' to 88'.
90				0	0	0		SW	GRAVELLY SAND – Gravelly fine to medium sand with trace silt, brown, moist, trace mica.
100				0	0	0			

EBASCO ENVIRONMENTAL

Monitoring Well 10

PROJECT *Jet Propulsion Laboratory*
LOCATION *Between Buildings 190 and 201*
GEOLOGIST *Rob Tweidt/B.G. Randolph*
DRILLING CO *Layne Environmental*
DATE (start/finish) *10/30/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1088.3*
TOTAL DEPTH (ft) *170.0*
DEPTH TO WATER (ft) *116.1*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
100		MW-10-3B						SW	
								SP	SAND - Fine to medium sand, brown, moist, very dense, trace mica.
110				0	0	0			Boulder from 111' to 113'.
								SP SW	SAND/GRAVELLY SAND - Fine to medium sand and gravelly sand with occasional cobbles, light yellow-brown, moist, very dense.
120				0	0	0			Medium to coarse gravelly sand.
130				0	0	0			Encounter groundwater at 128'. Boulder from 132' to 135'.
140									
150		MW-10-4A MW-10-4B							Fine to coarse sand with fine gravel, light orange-brown.
160									
								ML	SILT - Clayey silt with trace fine sand, light brown, saturated, stiff, micaceous.
170									Total depth = 170' (10/30/92) Natural gamma log 10/30/92. Static water level at 116.1' bgs (0855, 10/31/92) Natural gamma log 10/30/92.
180									
190									
200									

WELL MW-11

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

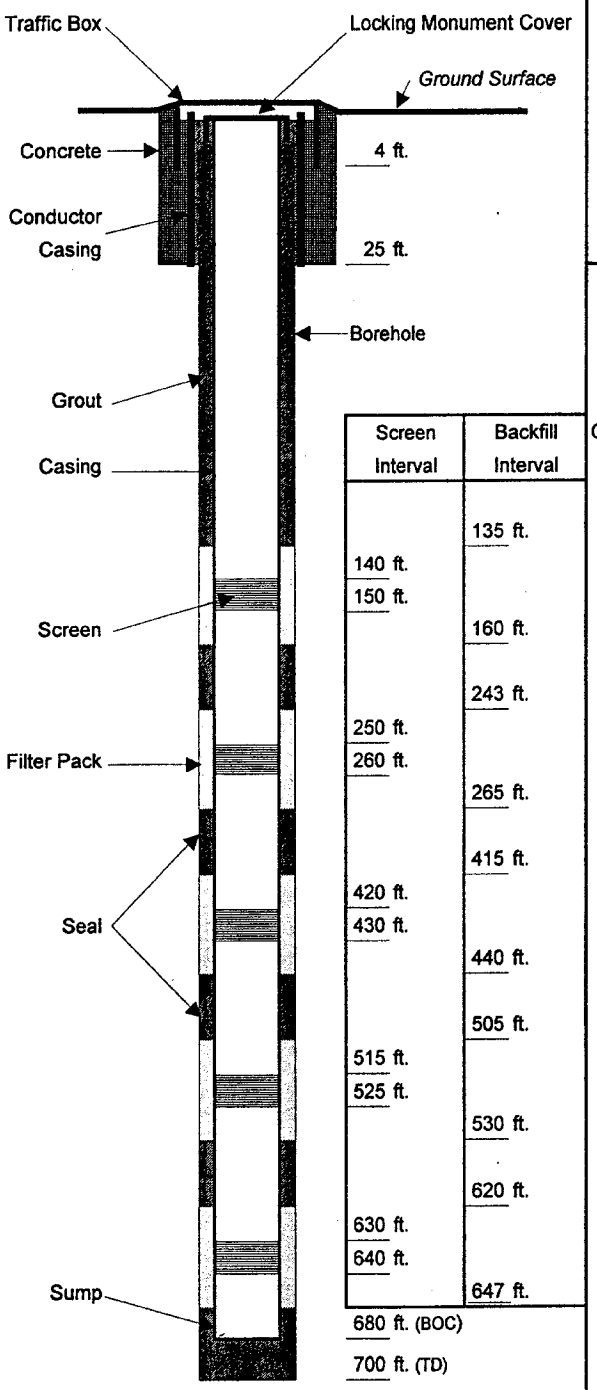
WELL CONSTRUCTION LOG

WELL NUMBER: MW-11

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1139.63

CASING ELEV (ft. above MSL): 1139.55



DRILLING SUMMARY

DATE COMPLETED:	11/5/92 to 11/17/92
DRILLING COMPANY:	Layne Environmental
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	700 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER: (CONDUCTOR CASING)	18.5 in.
CONDUCTOR CASING DIAMETER:	16 in
CONDUCTOR CASING LENGTH:	25 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	680 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	630 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-inch
IDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*

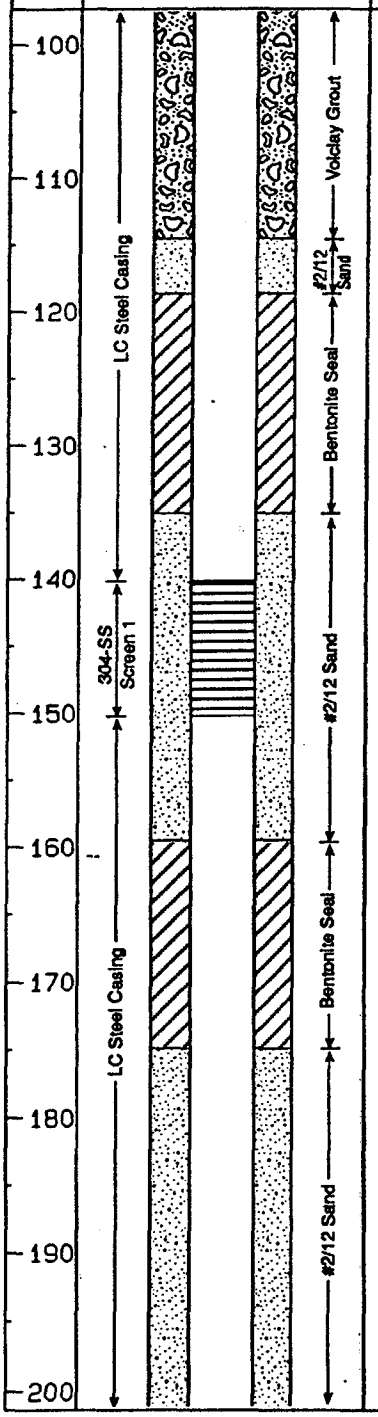
Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0	LC Steel Surface Casing; Cement/Bentonite							SM	ASPHALT – Pavement (4 inches thick)
								SW	SILTY SAND (fill) – Silty fine to medium sand with some fine gravel, dark orange-brown, slightly moist, medium dense.
									GRAVELLY SAND – Gravelly fine to coarse sand, yellow-brown, slighlty moist, dense. Granitic boulder from 7' to 10'.
10				0	–	0		SW	
								SP	SAND – Medium to coarse sand with some fine sand and fine gravel, yellow-brown, slighlty moist, dense, micaceous.
20									
30								GP	SANDY GRAVEL – Fine to coarse sandy gravel with occasional cobbles, yellow-brown, dense, micaceous. Cobbles and small boulders from 34' to 47'.
40		MW-11-1A MW-11-1B	■						
50	LC Steel Casing; Volclay Grout							SP	GRAVELLY SAND – Gravelly fine to coarse sand with occasional cobbles, orange-brown to gray-brown, very dense, micaceous. Boulder from 55' to 56.5'.
60									Cobbles from 61.5' to 64'.
70								GP	SANDY GRAVEL – Fine to coarse gravel with cobbles and boulders, pale orange-brown and dark gray, very dense.
80									
90								SP	SAND – Fine to coarse sand with some gravel and occasional cobble, multi-colored sand grains and rock fragments, very dense. Fine to medium sand with trace silt, micaceous. Cobbles from 92' to 93.5'.
100		MW-11-2A MW-11-2B	■						Gravelly at 96'.

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*



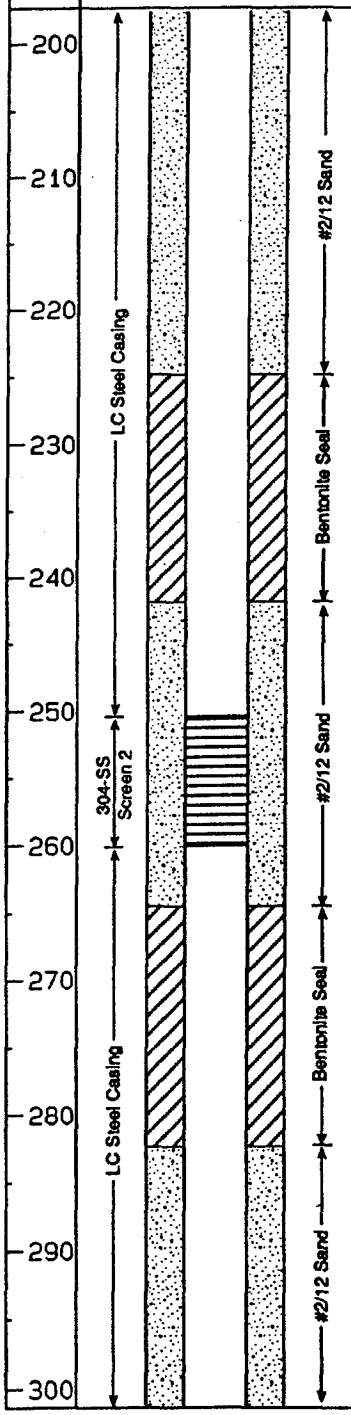
Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
						SP	
						GP	SANDY GRAVEL – Fine to coarse sandy gravel with occasional cobbles and small boulders, multi-colored grains, very dense.
							Boulders from 121' to 125.5'.
						SP	GRAVELLY SAND – Gravelly fine to coarse sand with occasional cobbles, multi-colored, very dense, micaceous.
							Boulder from 130' to 132'.
							Cobbles from 148' to 150'.
		0	–	0		SM	SILTY SAND – Silty gravelly fine to medium sand with occasional cobbles, orange-brown and multi-colored grains, very dense, micaceous.
		0	–	0			
						SP	SAND – Fine to medium sand with some silt and fine gravel, multi-colored grains, very dense.
							Gravelly sand at 177'.
							Numerous cobbles and small boulders from 184' to 199'.
						SM	

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*



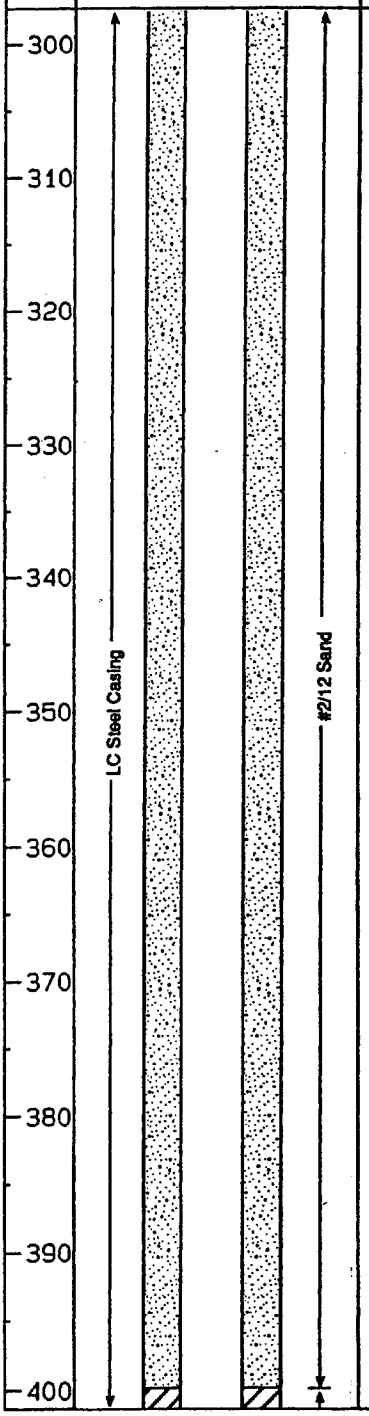
Sample No.	Samples	OVA (ppm) Drill Pipe	Sample	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
						SM	SILTY SAND – Silty fine to medium sand with trace coarse sand, multi-colored, micaceous, very dense.
						SP	SAND – Fine to medium sand with some gravel and trace silt, multi-colored, very dense.
						SC	CLAYEY SAND – Clayey fine sand with some silt and trace medium sand, light yellow-brown, dense.
						SP	SAND – Fine to medium sand with trace coarse sand, light yellow-brown, micaceous, dense. Gravelly at 236'.
							Medium to coarse sand.
						SM	SILTY SAND – Silty fine to medium sand with trace clay, yellow-brown, dense, trace mica.
						SP	SAND – Fine to medium sand with trace silt and fine gravel, yellow-brown and multi-colored grains, very dense, micaceous.
						SM	SILTY SAND – Silty fine to medium sand, multi-colored, very dense, micaceous. Occasional gravel from 280' to 288'.
							Silty fine sand with trace clay.
							Medium to coarse sand, trace gravel.
MW-11-3A MW-11-3B							Trace clay.

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*



Depth (ft)	Samples	OVA (ppm) Drill Pipe	Sample	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
300						SM	Trace gravel.
310						SP SM	SAND AND SILTY SAND – Alternating layers of fine to medium sand and silty fine sand with trace clay, yellow-brown, very dense, and micaceous from 308' to 322'.
320						SP	SAND – Fine to medium sand with trace silt and some fine gravel, multi-colored, very dense, micaceous. Occasional coarse gravel or small cobbles.
330						SM	SILTY SAND – Silty fine to medium sand with trace clay and fine gravel, multi-colored, very dense, micaceous. Cobbles at 336'.
340						SP	SAND – Fine to medium sand, yellow-brown, very dense, micaceous. Gravelly from 346' to 348'.
350							
360						SM	SILTY SAND – Silty fine to medium sand with trace clay and coarse sand, multi-colored, very dense, micaceous.
370							
380						SM SP	SILTY SAND AND SAND – Alternating layers silty fine sand with traces of clay and fine to medium sand with some silt and occasional gravel from 375' to 402', very dense, micaceous.
390							
400							

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*

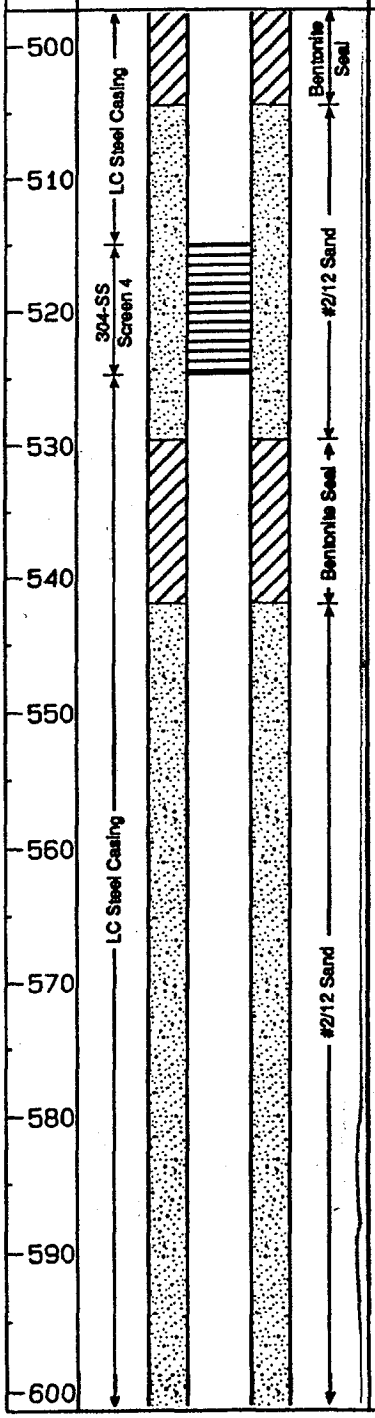
Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm) Drill Pipe	OVA (ppm) Sample	OVA (ppm) Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
400	LC Steel Casing; Bentonite Seal							SM, SP, SP	SAND - Medium to coarse sand with some fine gravel and trace silt, multi-colored, very dense, trace mica. Gravelly.
410								SM	SILTY SAND - Silty fine to medium sand with trace clay, light yellow-brown, very dense, micaceous.
								SP	SAND - Fine to medium sand with some gravel, light yellow-brown, very dense, trace mica.
420	304-SS Screen 3; #2/12 Sand							SM	SILTY SAND - Silty fine to medium sand, multi-colored, very dense, micaceous. Gravelly from 426' to 428'.
430									
440								SP	SAND - Fine to medium sand with trace coarse sand and fine gravel, multi-colored, very dense, trace mica. Gravelly at 442'.
	Bentonite Seal							SM	SILTY SAND - Silty fine to medium sand with trace clay, light yellow-brown, very dense, micaceous. Gravelly from 451' to 453'.
450								SC	CLAYEY SAND - Clayey fine to medium sand with trace silty and fine gravel, light yellow-brown, very dense, trace mica.
460	LC Steel Casing							SM	SILTY SAND - Silty fine to medium sand, light yellow-brown, very dense, micaceous. Occasional thin lenses gravelly sand from 462' to 495'.
470	#2/12 Sand								
480									
490	Bentonite Seal							SC	CLAYEY SAND AND SANDY CLAY - Clayey fine to medium sand with silt, light orange-brown to dark gray-brown, very dense, trace mica. Gravel and cobbles from 498' to 502'.
500		MW-11-5A MW-11-5B							

EBASCO ENVIRONMENTAL

Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*



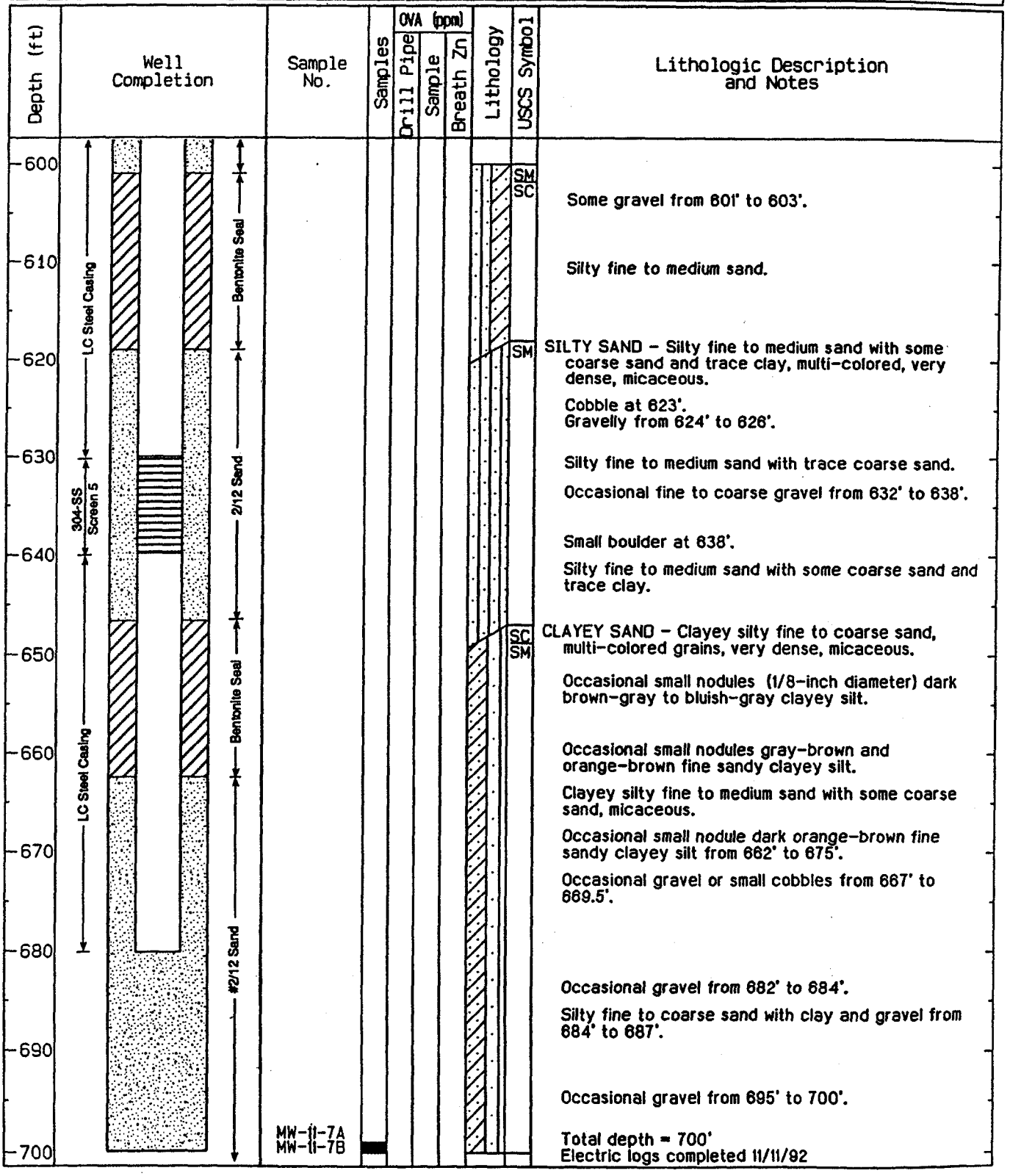
USCS Symbol	Lithologic Description and Notes
SC	Trace coarse sand.
	Occasional coarse gravel or small cobbles from 512' to 522'.
SM	SILTY SAND – Silty fine to medium sand with trace clay and occasional fine gravel, multi-colored, very dense, micaceous.
	Some coarse sand.
	Silty fine to medium sand. Gravel from 538' to 539.5'.
	Silty fine to medium sand with some clay.
GM	GRAVELLY SILTY SAND – Silty fine to medium sand with cobbles, multi-colored, very dense, trace mica.
	Silty sand from 556' to 559'.
SM	SILTY SAND – Silty fine to coarse sand with occasional gravel, multi-colored, very dense, micaceous.
	Occasional cobbles from 569' to 576'.
GM	SILTY SANDY GRAVEL – Silty fine to medium sandy gravel with some coarse sand, multi-colored, very dense, trace mica.
	Occasional cobbles and boulders from 578' to 587'.
SM SC	SILTY SAND – Silty fine to medium sand with some clay and trace coarse sand, multi-colored, very dense, trace mica.
	Clayey silty sand from 591' to 596'.

EBASCO ENVIRONMENTAL

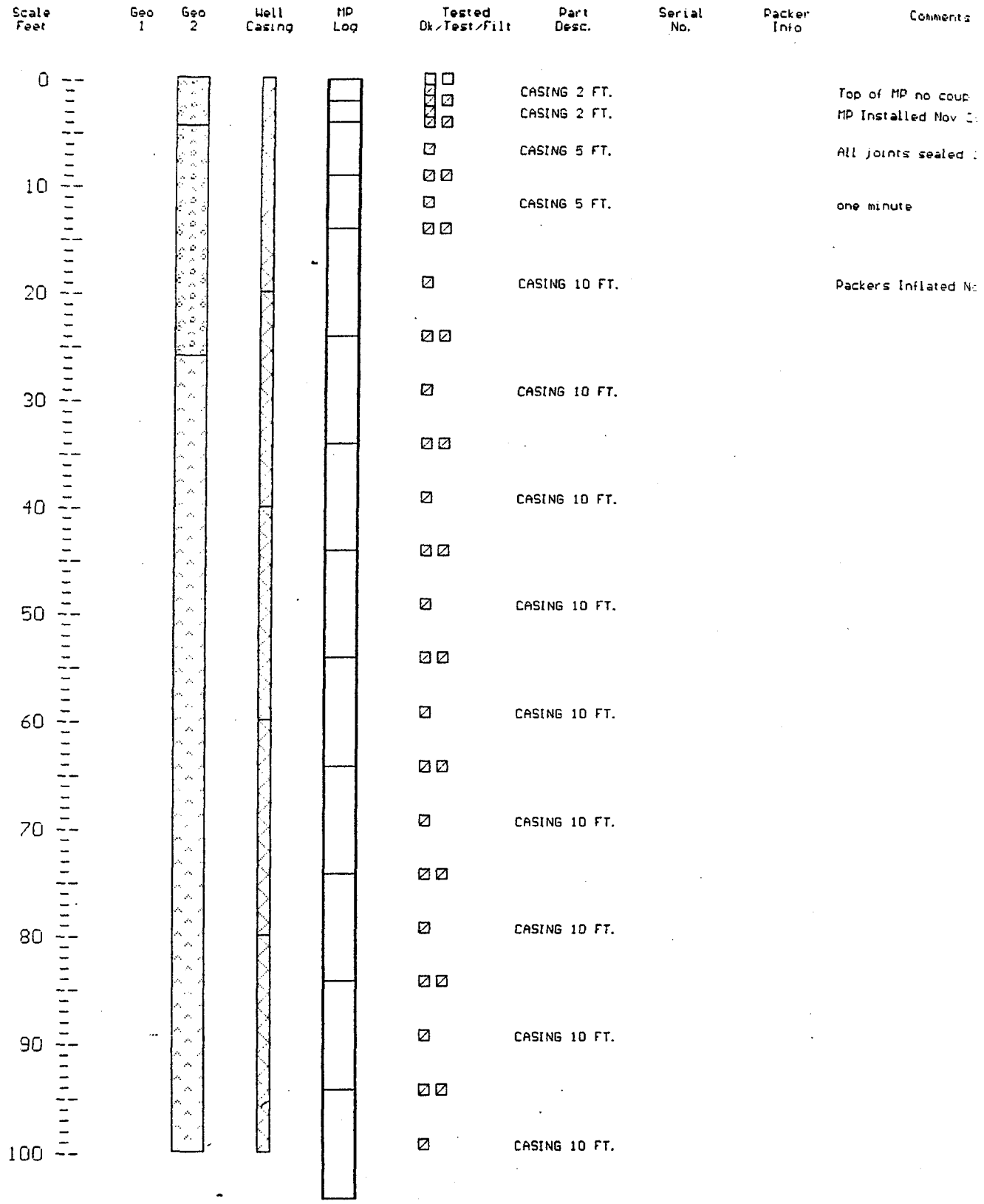
Monitoring Well 11

PROJECT *Jet Propulsion Laboratory*
LOCATION *South side of Building 277*
GEOLOGIST *B.G. Randolph/R. Tweidt*
DRILLING CO *Layne Environmental*
DATE (start/finish) *11/5/92 to 11/17/92*

DRILLING METHOD *Mud Rotary*
SAMPLING METHOD *Grab samples*
SURFACE ELEVATION *1139.6'*
TOTAL DEPTH (ft) *700*
DEPTH TO WATER (ft) *118.52*

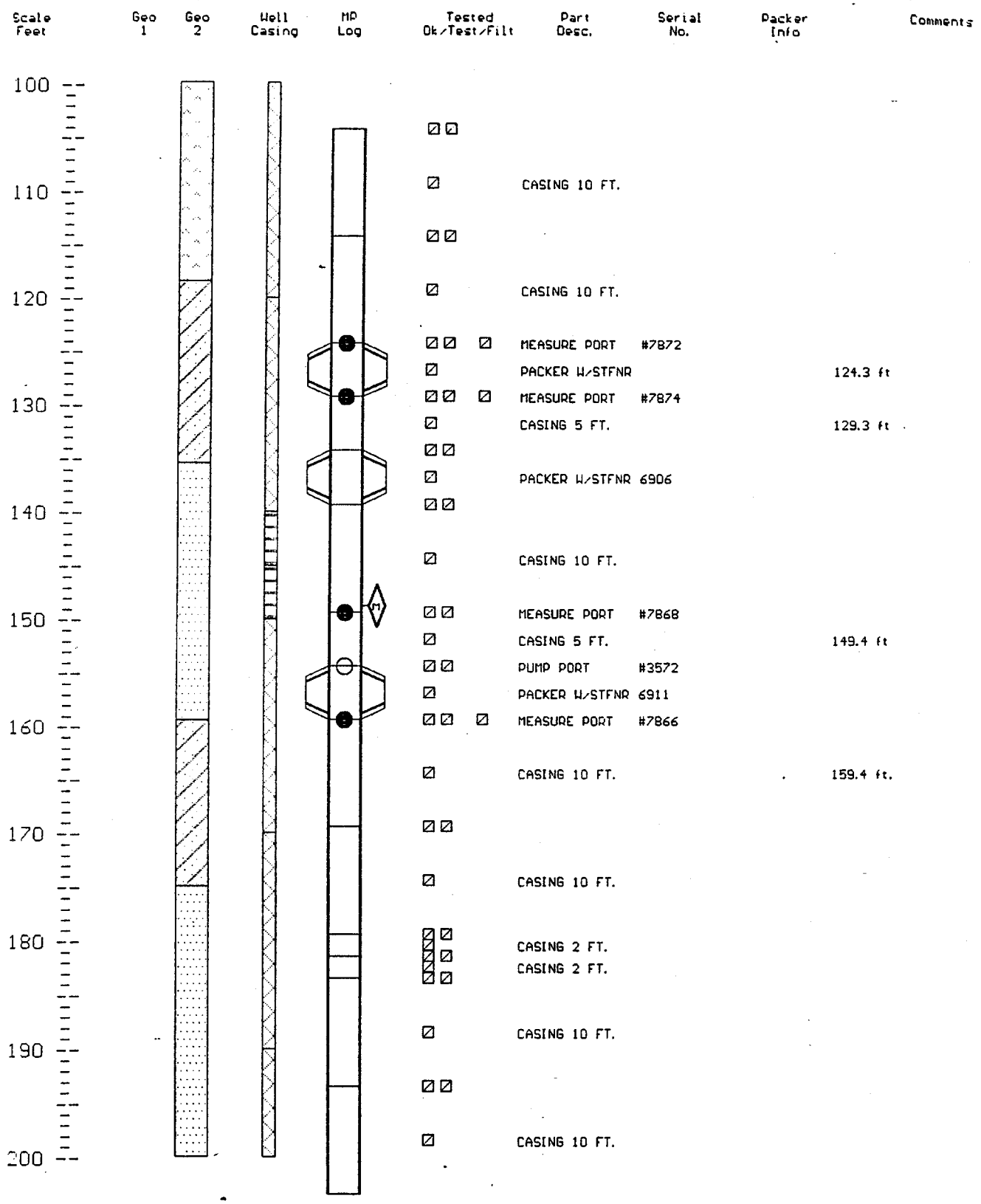


WB Ref. 650-92 Well EMW-11 JPL EBASCO



Installation Log Sat Dec 05 18:51:13 1992 Page: 1

WB Ref. 650-92 Well EMW-11 JPL EBASCO



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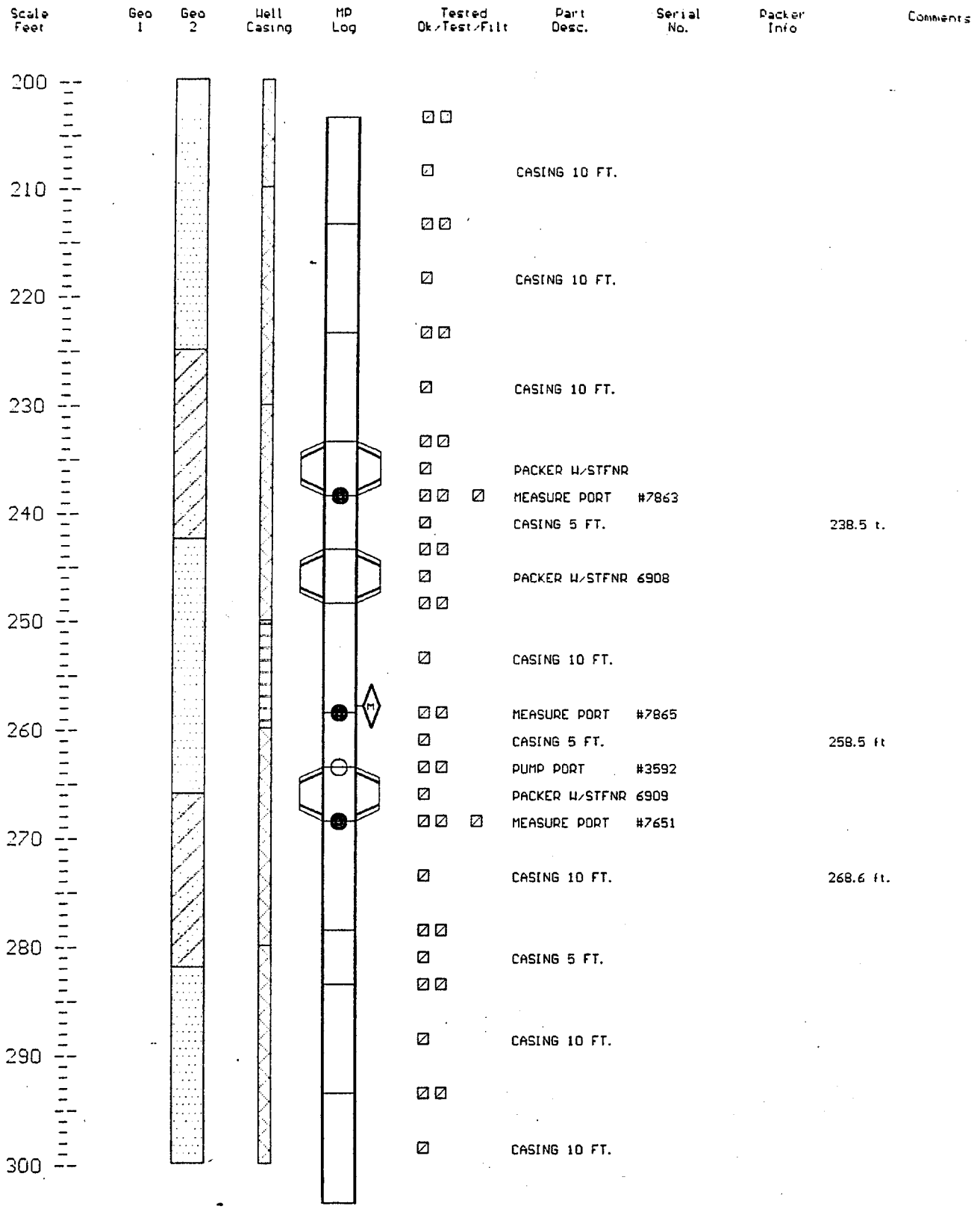
NB Ref. 650-92 Well EMW-11 JPL EBASCO

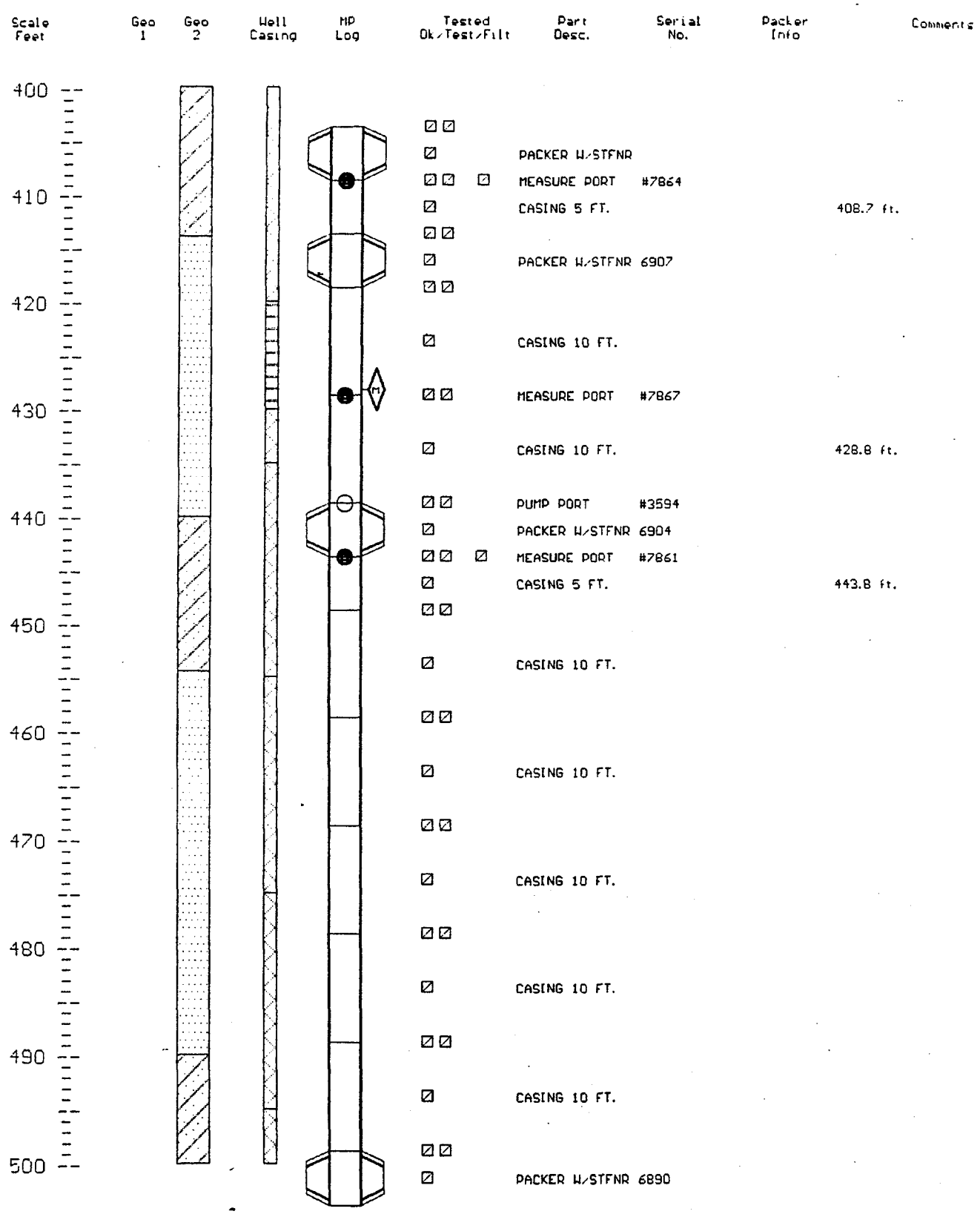


Installation Log Sat Dec 05 18:51:13 1992 Page: 3

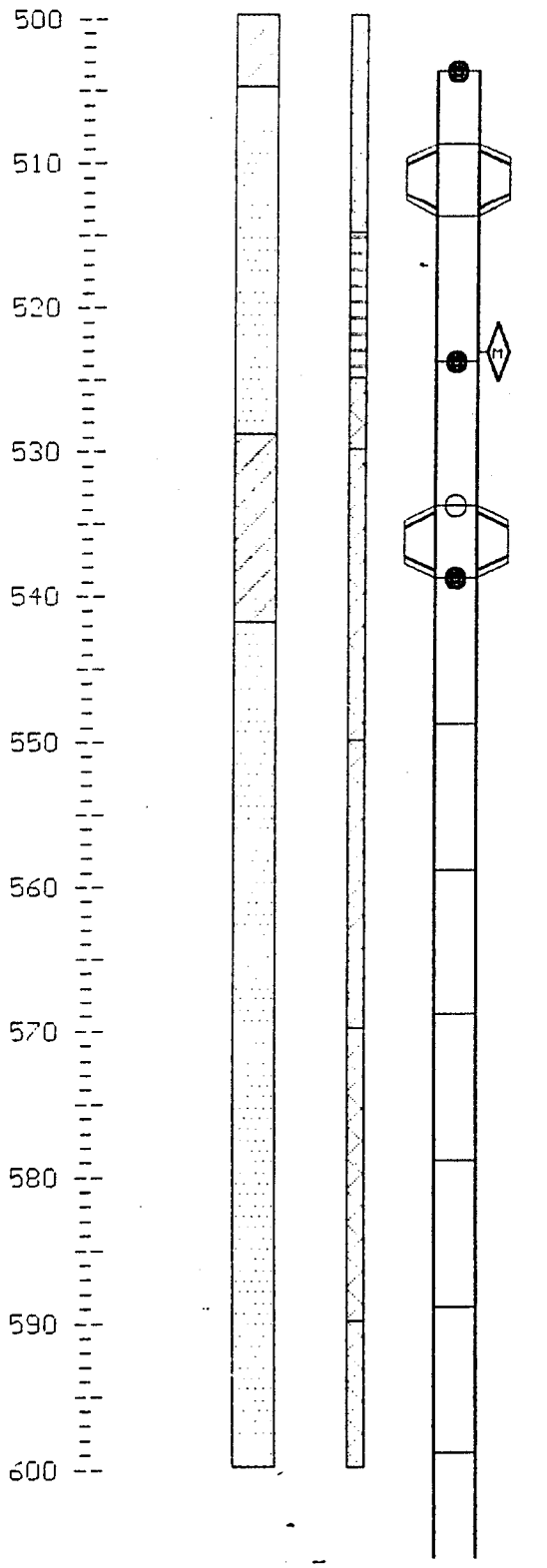
Well EMW-11 JPL EBASCO

Scale Feet	Geo 1	Geo 2	Well Casing	MP Log	Tested Ok/Test/Filt	Part Desc.	Serial No.	Packer Info	Comments
300									
						CASING 10 FT.			
310									
						CASING 10 FT.			
320									
						CASING 10 FT.			
330									
						CASING 10 FT.			
340									
						CASING 10 FT.			
350									
						CASING 10 FT.			
360									
						CASING 10 FT.			
370									
						CASING 10 FT.			
380									
						CASING 10 FT.			
390									
						CASING 10 FT.			
400									

NB Ref. 650-92 Well EMW-11 JPL EBASCO



Well EMW-11 JPL EBASCO



Tested Ok/Test/Filt	Part Desc.	Serial No.	Packer Info	Comments
☐ ☑ ☐	MEASURE PORT	#7870		
☑	CASING 5 FT.			503.87 ft.
☑ ☑				
☑	PACKER W. STFNR	6900		
☑ ☑				
☑	CASING 10 FT.			
☑ ☑	MEASURE PORT	#7871		
☑	CASING 10 FT.			523.9 ft.
☑ ☑	PUMP PORT	#3593		
☑	PACKER W/STFNR	6901		
☑ ☑ ☑	MEASURE PORT	#7869		
☑	CASING 10 FT.			539.9 ft.
☑ ☑				
☑	CASING 10 FT.			
☑ ☑				
☑	CASING 10 FT.			
☑ ☑				
☑	CASING 10 FT.			
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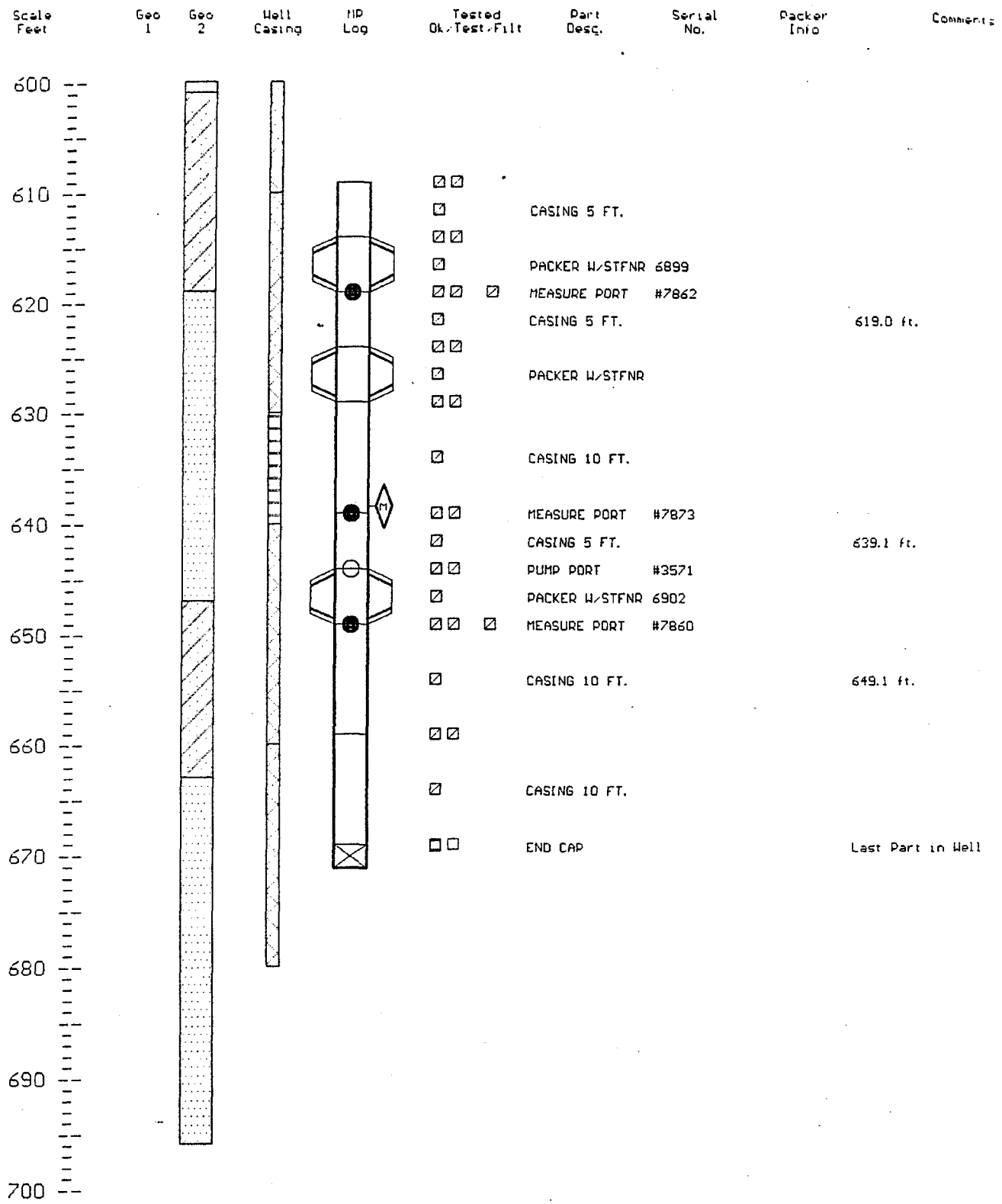
☑ ☑				
☑	CASING 10 FT.			


Scale Feet
Geo 1
Geo 2
Well Casing
MP Log
Tested Ok/Test/Filt
Part Desc.
Serial No.
Packer Info
Comments
600
610
620
630
640
650
660
670
680
690
700
CASING 5 FT.
PACKER W/STFNR 6899
MEASURE PORT #7862
CASING 5 FT.
619.0 ft.
PACKER W/STFNR
CASING 10 FT.
MEASURE PORT #7873
CASING 5 FT.
639.1 ft.
PUMP PORT #3571
PACKER W/STFNR 6902
MEASURE PORT #7860
CASING 10 FT.
649.1 ft.
CASING 10 FT.
END CAP
Last Part in Well

WELL MW-12

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

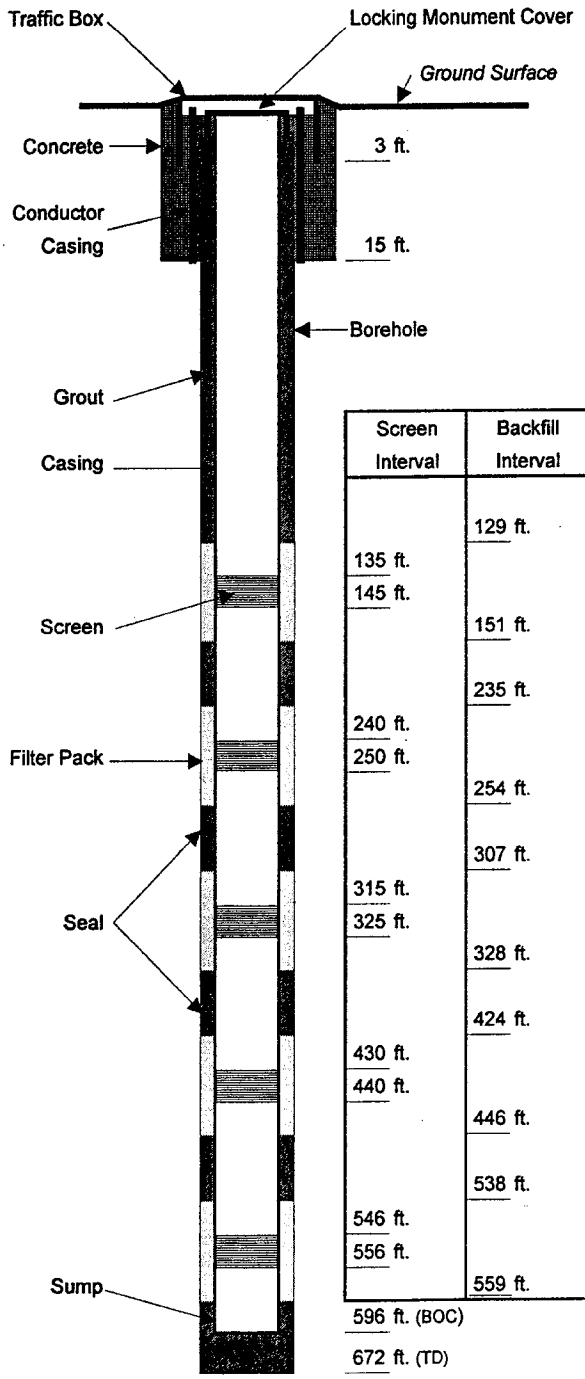
WELL CONSTRUCTION LOG

WELL NUMBER: MW-12

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1102.42

CASING ELEV (ft. above MSL): 1102.14



Screen Interval	Backfill Interval
	129 ft.
135 ft.	
145 ft.	
	151 ft.
	235 ft.
240 ft.	
250 ft.	
	254 ft.
	307 ft.
315 ft.	
325 ft.	
	328 ft.
	424 ft.
430 ft.	
440 ft.	
	446 ft.
	538 ft.
546 ft.	
556 ft.	
	559 ft.

DRILLING SUMMARY

DATE COMPLETED:	2/23/94 to 3/5/98
DRILLING COMPANY:	Belik
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	672 ft.

CONSTRUCTION DETAILS

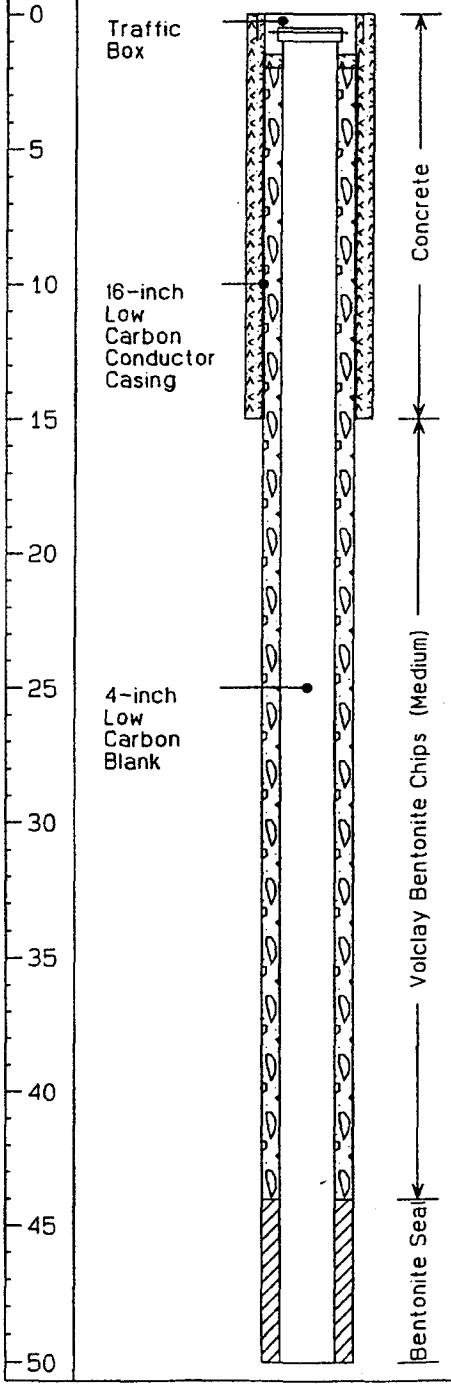
BOREHOLE DIAMETER: (CONDUCTOR CASING)	18.5 in.
CONDUCTOR CASING DIAMETER:	16 in
CONDUCTOR CASING LENGTH:	15 ft.
BOREHOLE DIAMETER:	12.75 in.
TOTAL WELL DEPTH:	596 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	546 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
SCREEN LENGTH:	10 ft.
INDIVIDUAL SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL	1:1 Sand/Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*



Depth (ft)	Sample No.	Blows/6-in.	OVA (ppm)	Moisture	Consistency	USCS Symbol	Lithologic Description and Notes
0							ASPHALT PAVEMENT (0.25 feet thick)
						SP	POORLY GRADED SAND. Medium dark brown; approximately 95% medium to coarse sand, subangular; approximately 5% nonplastic to low plastic fines; trace fine subangular gravel; slightly moist, no odor; occasional subrounded granitic cobbles.
5			0	SM			
							Encountered 1 foot by 1/2-inch galvanized pipe in soil cuttings at 7 feet.
						SP SM	POORLY GRADED SAND WITH SILT Dark brown; approximately 85% fine to medium sand, subangular; 10% nonplastic fines; 5% fine subangular granitic gravel; slightly moist, no odor, trace of subangular coarse gravel and cobbles.
10	Soil-01	30 40	0	SM			
15							Drilled the upper 17-feet of the hole with an auger. Began using drilling mud at 17 feet after 16-inch diameter conducter casing was installed.
						SP	
20	No Recovery						POORLY GRADED SAND WITH GRAVEL AND COBBLES. Light brown; approximately 75% fine to coarse sand, subangular; approximately 20% fine to coarse subrounded granitic gravel and 5% nonplastic fines. Abundant granitic cobbles, no odor.
	No Recovery						
25	No Recovery						Collected grab sample of soil cuttings (SC-04) at 20 feet. Very difficult drilling. Attempted to collect soil sample with split spoon sampler at 20', 22' 25', 31' and 34'. Refusal at all attempts. Abundant cobbles.
30	No Recovery						Drilling Mud: Weight: 75.4 lbs/cu.ft. Viscosity: 53 seconds Sand Content: 1.5 percent
35	No Recovery						As above, difficult drilling.
40							
45	Soil-02	>100	0	NA			Collected soil sample "SOIL-02" with split spoon sampler between 45 and 46 feet. Only 4-inches recovery.
50							

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50	4-inch Low Carbon Blank								SP	Drilling mud: Weight: 65.1 lbs/cu.ft. Viscosity: 36 seconds Sand Content: 2.5 percent
									SM	SILTY SAND WITH GRAVEL Light brown; approximately 70% fine to medium sand, poorly graded; subangular; approximately 15% fine subrounded granitic gravel and 15% nonplastic fines, no odor.
55										
60										As above.
									SP	POORLY GRADED SAND WITH GRAVEL AND COBBLES. Light brown; approximately 75% medium to coarse sand, subangular to subrounded; approximately 20% fine to coarse granitic gravel with cobbles; approximately 5% nonplastic fines, no odor.
65										
70										As above with more cobbles.
75	4-inch Low Carbon Blank								SM	SILTY SAND WITH GRAVEL Light brown; approximately 70% fine to medium sand, poorly graded, subangular; 15% nonplastic fines and 15% fine to coarse granitic gravel; no odor.
										Very difficult drilling. Boulder from 79 feet to 80 feet.
80									SP	POORLY GRADED SAND. Light brown; approximately 85% fine to coarse sand, poorly graded, subangular; 5% nonplastic fines; approximately 10% gravel, subangular; some cobbles; no odor.
85									SM	Increase in cobbles from 82-84 feet; drilling difficult.
										SILTY SAND. Light brown; approximately 85% fine to medium sand, poorly graded, subangular; approximately 15% nonplastic fines; no odor. Trace granitic gravel and cobbles. Easy drilling.
90									SP	POORLY GRADED SAND WITH GRAVEL Light brown; approximately 75% medium to coarse sand, subangular to subrounded; approximately 20% fine granitic gravel and 5% nonplastic fines; no odor.
95										Drilling mud: Weight: 63.6 lbs/cu.ft. Viscosity: 37 seconds Sand Content: 0.5 percent
100										

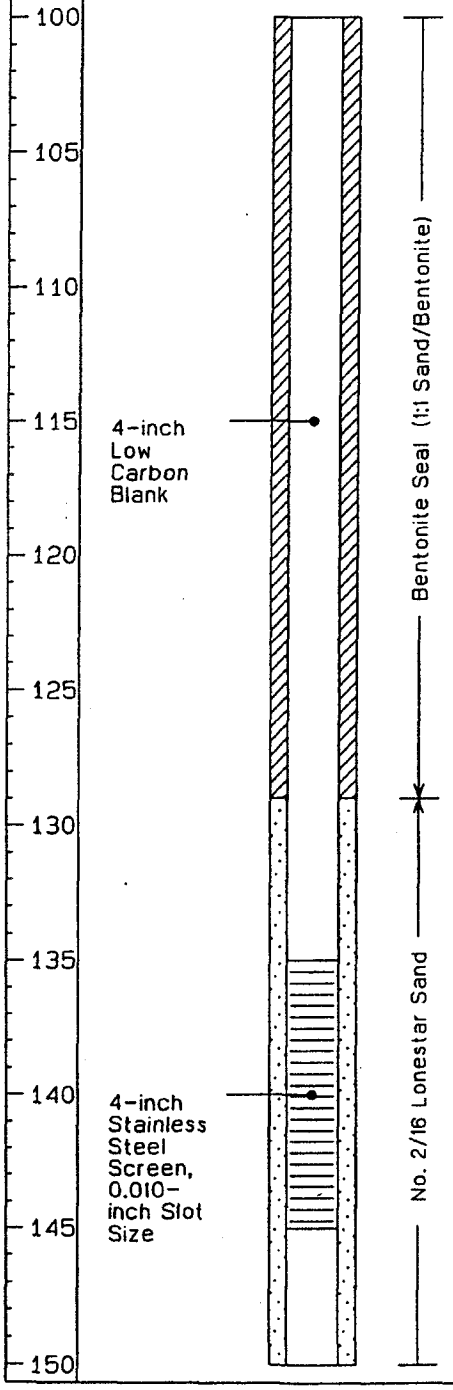
Bentonite Seal (1:1 Sand/Bentonite)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT: Jet Propulsion Laboratory
LOCATION: Southeast corner building 302
GEOLOGIST: S. Arav
DRILLING CO: Beylik
DATE (start/finish): 02/23/94 - 02/23/94

DRILLING METHOD: Mud Rotary (12.25-inch boring)
SAMPLING METHOD: 2 1/2" x 24" Split Spoon Sampler
SURFACE ELEVATION: Approximately 1102 feet
TOTAL DEPTH (ft): 672
DEPTH TO WATER (ft): Approximately 113 feet



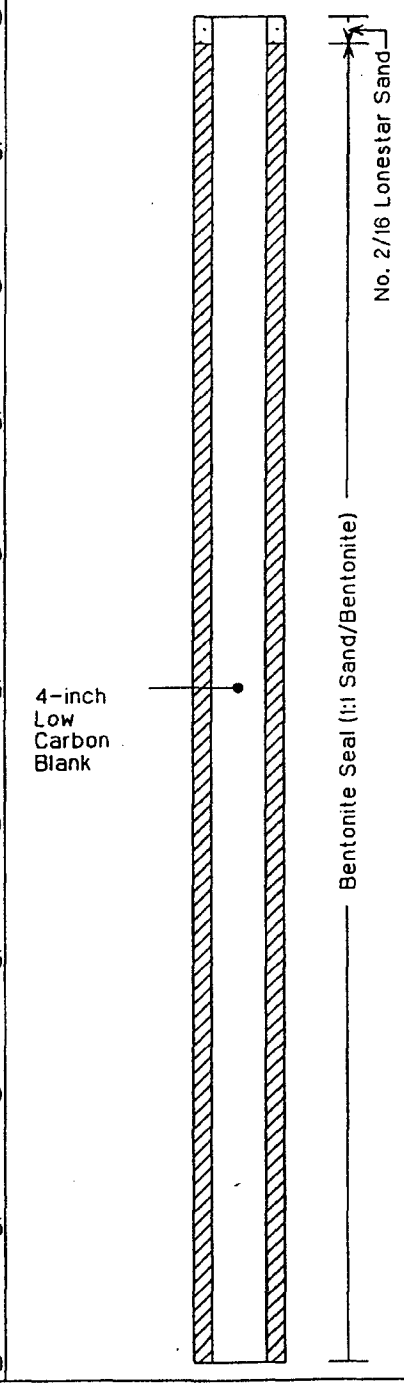
Depth (ft)	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100								SP	As above. Collected grab sample of soil cuttings ("SC-04") at 100 feet. Difficult and slow drilling.
105								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 70% fine to coarse sand, poorly graded and subangular; approximately 10% nonplastic fines; approximately 20% fine to coarse gravel, subangular; no odor; trace cobbles and boulders.
110									As above; difficult drilling.
115									
120									POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 65% fine to coarse sand, poorly graded, subangular; approximately 10% fines, nonplastic; approximately 25% fine to coarse gravel, subangular; trace cobbles; difficult drilling; no odor.
125									As above; difficult drilling.
130								SP	POORLY GRADED SAND. Light brown; approximately 85% fine to coarse poorly graded, subangular sand; approximately 5% fines, nonplastic; approximately 10% fine to coarse gravel, subangular; trace cobbles; no odor.
135									
140									As above.
145									Drilling mud: Weight: 66 lbs/cu.ft. Viscosity: 36 seconds Sand Content: 4.5 percent
150								SP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*



Depth (ft)	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
150								SP SM	POORLY GRADED SAND WITH SILT Light brown; approximately 15% fine, 45% medium and 20% coarse sand, poorly graded, subangular; approximately 10% nonplastic fines; approximately 10% fine to coarse subangular gravel; no odor; trace cobbles.
155									
160									As above.
165									As above.
170								SP	POORLY GRADED SAND Light brown; approximately 20% fine, 55% medium and 15% coarse subangular to angular, poorly graded sand; approximately 5% nonplastic fines; approximately 10% fine to coarse subangular to angular gravel; no odor; trace cobbles.
175									
180									As above with less gravel; easier drilling.
185								SP	POORLY GRADED SAND. Light gray brown; approximately 15% fine, 55% medium; and 15% coarse subangular to angular, poorly graded sand; approximately 5% nonplastic fines; approximately 10% fine to coarse gravel, subangualr to angular; no odor; trace cobbles.
190									
195									Drilling mud: Weight: 67.5 lbs/cu.ft. Viscosity: 44 seconds Sand Content: 8 percent
200									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
200									SP	Collected grab sample of soil cuttings ("SC-04") at 200 feet.
205										As above with increase in amount of cobbles.
										As above.
210										POORLY GRADED SAND. Light brownish gray; approximately 15% fine, 70% medium, 10% coarse poorly graded, subangular to angular sand; approximaetly 5% nonplastic fines; trace subangular to angular gravel; trace cobbles; no odor.
215										
220										As above.
225	4-inch Low Carbon Blank								SP SM	POORLY GRADED SAND WITH SILT Light brown; approximately 80% fine to coarse sand, subrounded to subangular, poorly graded; approximately 10% nonplastic fines and 10% fine to coarse subrounded granitic gravel; no odor.
230									SP SM	POORLY GRADED SAND WITH SILT Light brown to gray; approximately 10% fine, 70% medium, and 5% coarse poorly graded, subangular sand; 10% nonplastic fines; 5% subangular to angular gravel; trace cobbles; no odor.
235										Difficult drilling.
240										
245	4-inch Stainless Steel Screen, 0.010-inch Slot Size									As above.
250										

Bentonite Seal (1:1 Sand/Bentonite)

No. 2/16 Lonestar Sand

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
250									SP SM	Drilling Mud: Weight: 67.5 lbs/cu.ft. Viscosity: 33 seconds Sand Content: 2 percent
255	No. 2/16 Lonestar Sand									POORLY GRADED SAND WITH SILT Light brown to gray; approximately 10% fine, 70% medium, 5% coarse poorly graded, subangular sand; 10% nonplastic fines; approximately 5% subangular to angular gravel; trace cobbles; no odor.
260										
265										As above.
270										As above.
275	4-inch Low Carbon Blank; Bentonite Seal									POORLY GRADED SAND WITH SILT Light brown to gray; approximately 15% fine, 70% medium, and 5% coarse, poorly graded, subangular sand; 10% nonplastic fines; trace subangular to angular gravel; trace cobbles; no odor.
280										As above, easier drilling.
285									SP	POORLY GRADED SAND Light brown; approximately 85% fine to coarse poorly graded sand, subangular to subrounded; approximately 10% fine to coarse granitic gravel and 5% nonplastic fines; no odor.
290										
295									SP SM	POORLY GRADED SAND WITH SILT Light brown to gray; approximately 15% fine, 70% medium, and 5% coarse, poorly graded, subangular sand; approximately 10% nonplastic fines; trace subangular to angular fine gravel; trace cobbles; no odor.
300										Slow drilling.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
300									SP SM	Collected grab sample of soil cuttings ("SC-04") at 300 feet. Drilling Mud: Weight: 68.3 lbs/cu.ft. Viscosity: 35 seconds Sand Content: 1.5 percent
305	Bentonite Seal									POORLY GRADED SAND WITH SILT Light brown to gray; approximately 15% fine, 70% medium, and 5% coarse, poorly graded, subangular sand; approximately 10% nonplastic fines; trace subangular to angular fine gravel; trace cobbles; no odor.
310	No. 2/16 Lonestar Sand									
315										As above with increase in amount of gravel and/or cobbles from 315 feet to 321 feet. Very difficult drilling.
320	4-inch Stainless Steel Screen, 0.010-inch Slot Size									Directional survey at 320 feet: 0.0 degrees from vertical.
325										POORLY GRADED SAND WITH SILT Light brown to gray; approximately 15% fine, 70% medium, and 5% coarse, poorly graded subangular sand; approximately 10% nonplastic fines; trace subangular fine gravel; trace cobbles; no odor.
330										
335									SM	SILTY SAND. Light brown; approximately 85% fine to medium subrounded to subangular sand; approximately 15% nonplastic fines; trace fine granitic gravel; no odor.
340	4-inch Low Carbon Blank									
345	Bentonite Seal (1:1 Sand/Bentonite)									
350										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

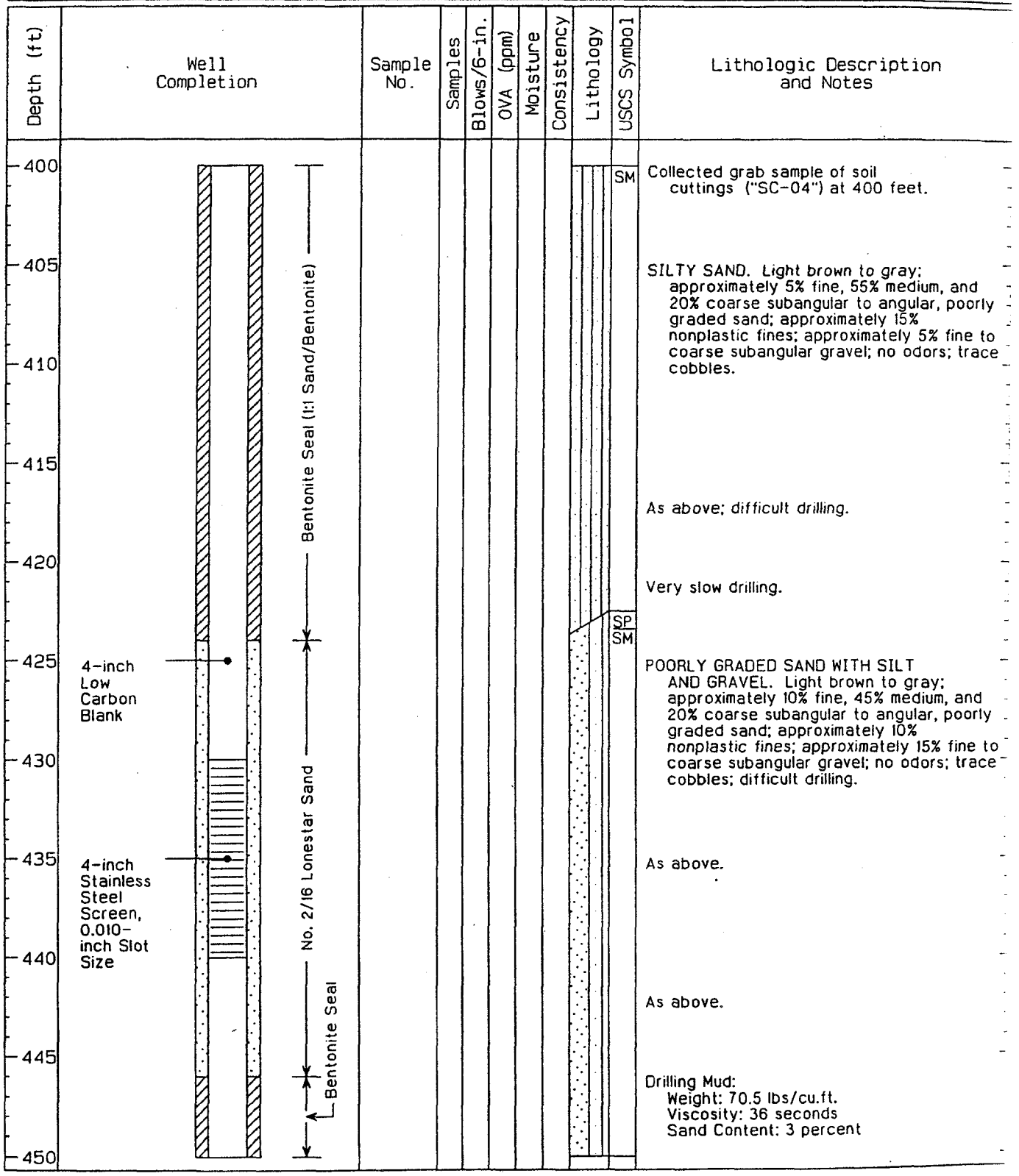
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
350									SM	Drilling mud: Weight: 71 lbs/cu.ft. Viscosity: 38 seconds Sand Content: 3 percent
355										As above.
360										As above.
										Easy drilling.
365										SILTY SAND. Light brown to gray; approximately 10% fine, 45% medium, and 25% coarse sand, poorly graded and subangular to angular; approximately 15% nonplastic fines; approximately 5% fine to coarse gravel; no odors.
370										Easy drilling.
375	4-inch Low Carbon Blank									As above.
380	Bentonite Seal (1:1 Sand/Bentonite)									Cobbles encountered at 381 feet.
385										SILTY SAND. Light brown to gray; approximately 10% fine, 50% medium, and 20% coarse sand, subangular to angular, poorly graded; 15% nonplastic fines; approximately 5% fine to coarse subangular gravel; no odors; trace cobbles.
390										
395										Drilling Mud: Weight: 70.5 lbs/cu.ft. Viscosity: 40 seconds Sand Content: 3 percent
400										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*



FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
450									SP SM SM	SILTY SAND. Light brown; approximately 85% fine to medium sand, poorly graded, subangular; approximately 15% nonplastic fines; no odor.
455										
460										Very easy drilling.
465										Easy drilling.
470									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 65% fine to coarse poorly graded sand, subangular; approximately 20% fine to coarse granitic gravel; 15% nonplastic fines; no odor.
									SM	SILTY SAND. Light brown; approximately 80% fine to medium sand, poorly graded; approximately 20% nonplastic fines; no odor.
475	4-inch Low Carbon Blank; Bentonite Seal (1:1 Sand/Bentonite)									
480										Easy drilling.
									SP SM	Directional survey at 480 ft: <0.5 degrees from vertical.
485										POORLY GRADED AND WITH SILT AND GRAVEL. Light brown to gray; approximately 10% fine, 55% medium, and 10% coarse poorly graded, subangular to angular sand; approximately 10% fines, nonplastic; approximately 15% gravel, subangular; no odor; trace cobbles.
490										
495										As above with less gravel and cobbles.
500										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
500									SP SM	Collected grab sample of soil cuttings ("SC-04") at 500 feet.
505										As above with increase in amount of gravel and cobbles.
										Drilling Mud: Weight: 78 lbs/cu.ft. Viscosity: 36 seconds Sand Content: 3 percent
510										As above with decrease in amount of gravel and cobbles.
515										
520										As above.
525	4-inch Low Carbon Blank									POORLY GRADED SAND WITH SILT Light brown to gray; approximately 10% fine, 65% medium, and 15% coarse sand, poorly graded, subangular; approximately 10% nonplastic fines; trace fine gravel, subangular; no odor; easy drilling.
530										
535										As above with increase in amount of gravel and cobbles.
540										POORLY GRADED SAND WITH SILT Light brown; approximately 90% fine to medium sand, subangular to subrounded; approximately 10% fines, nonplastic; no odor; trace coarse sand.
545	4-inch Stainless Steel Screen, 0.010-inch Slot Size									
550										

Bentonite Seal (1:1 Sand/Bentonite)

No. 2/16 Lonestar Sand

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
550									SP SM	Very difficult drilling between 551 feet and 554 feet.
	4-inch Stainless Steel Screen, 0.010-inch Slot Size								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; as above with approximately 20% medium to coarse granitic rock chips from gravels and cobbles; no odor.
555										Drilling Mud: Weight: 79 lbs/cu.ft. Viscosity: 39 seconds Sand Content: 2.5 percent
560	No. 2/16 Lonestar Sand									As above with fewer granitic rock chips in cuttings.
565										Difficult drilling from 564-566 ft.
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 70% fine to medium sand, subangular to subrounded; approximately 10% fines, nonplastic; approximately 20% rock chips from granitic gravel and cobbles; no odor.
570										
									SP SM	POORLY GRADED SAND WITH SILT Light brown; approximately 90% fine to medium sand, subangular to subrounded; approximately 10% fines, nonplastic; no odor; trace coarse sand; trace coarse granitic rock chips from gravels and/or cobbles.
575	4-inch Low Carbon Blank									
580	Bentonite Seal (1:1 Sand/Bentonite)									Rough drilling from 574 to 580 feet.
									ML	SANDY SILT. Medium brown; approximately 55% fines, nonplastic; approximately 45% fine sand, micaceous; no odor.
									SP SM	
585										POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 70% fine to medium sand, subangular to subrounded; approximately 10% fines, nonplastic; 20% coarse to medium rock chips from gravels and cobbles; no odor.
									SP	
590										Very difficult drilling from 588 to 592 ft.
										POORLY GRADED SAND WITH GRAVEL Light brown; approximately 70% fine to medium sand, subrounded; approximately 25% medium granitic rock chips from gravels and cobbles; approximately 5% fines, nonplastic; no odor.
595										Drilling Mud: Weight: 71 lbs/cu.ft. Viscosity: 34 seconds Sand Content: 3 percent
600									SM	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT: Jet Propulsion Laboratory
LOCATION: Southeast corner building 302
GEOLOGIST: S. Arav
DRILLING CO: Beylik
DATE (start/finish): 02/23/94 - 02/23/94

DRILLING METHOD: Mud Rotary (12.25-inch boring)
SAMPLING METHOD: 2 1/2" x 24" Split Spoon Sampler
SURFACE ELEVATION: Approximately 1102 feet
TOTAL DEPTH (ft): 672
DEPTH TO WATER (ft): Approximately 113 feet

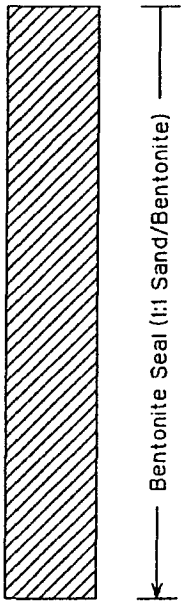
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
600	Bentonite Seal (1:1 Sand/Bentonite)								SM	Collected sample of soil cuttings at 600 feet (SOIL-04). Directional survey: <0.5 degrees from vertical.
605									SP	SILTY SAND. Light brown; Approximately 75% fine to coarse sand, subangular to subrounded; approximately 15% fines, nonplastic; approximately 10% medium to coarse granitic rock chips from gravels and/or cobbles; no odor; some sandy silt in cuttings; brown; approximately 55% fines, nonplastic with approximately 45% very fine sand.
610										POORLY GRADED SAND WITH GRAVEL Multi-colored; approximately 75% fine to medium sand, subangular to subrounded; approximately 20% coarse to medium granitic rock chips from gravels and cobbles; approximately 5% fines, nonplastic; trace coarse sand.
615										Difficult drilling from 613-623 ft.
620										Drilling Mud: Weight: 71 lbs/cu.ft. Viscosity: 38 seconds Sand Content: 2.5 percent
625									SP SM	POORLY GRADED SAND WITH SILT Light brown; approximately 90% fine to medium sand, subangular, poorly graded; approximately 10% nonplastic fines; trace gravel; no odor.
630										As above with increase in amount of gravel and/or cobbles.
635									SM	SILTY SAND. Light brown; approximately 85% fine to medium sand, subangular; approximately 15% nonplastic fines; trace gravel.
640									SP SM	Difficult drilling at 636 to 637 ft. POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 70% medium to coarse subangular to subrounded sand; approximately 20% fine to coarse granitic gravel and 10% nonplastic fines; no odor.
645										GRANITIC ROCK: Cuttings are rock chips of granitic material; approximately 65% feldspar, 30% quartz and 5% mafics; drills relatively easy suggesting weathered horizon.
650										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 12

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southeast corner building 302*
GEOLOGIST *S. Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/23/94 - 02/23/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1102 feet*
TOTAL DEPTH (ft) *672*
DEPTH TO WATER (ft) *Approximately 113 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
650										GRANITIC ROCK. Cuttings are rock chips of granitic material. Approximately 65% feldspar, 30% quartz; and 5% mafic material. Drills relatively easily suggesting possible weathered horizon.
655										Drilling Mud: Weight: 69.5 lbs/cu.ft. Viscosity: 41 seconds Sand Content: 4.5 percent
660										As above, difficult drilling.
665										
670										Very difficult drilling at 668 feet Unweathered material? Collected grab sample of soil cuttings at 671 ft (SC-04). Bottom of hole at 672 feet.
675										
680										
685										
690										
695										
700										

Bentonite Seal (1:1 Sand/Bentonite)

Summary Casing Installation Log

Well No. MW-12
Job No. WB650

Client Enserch Environmental Corp.
Site JPL
Project Description Grounduater Investigation

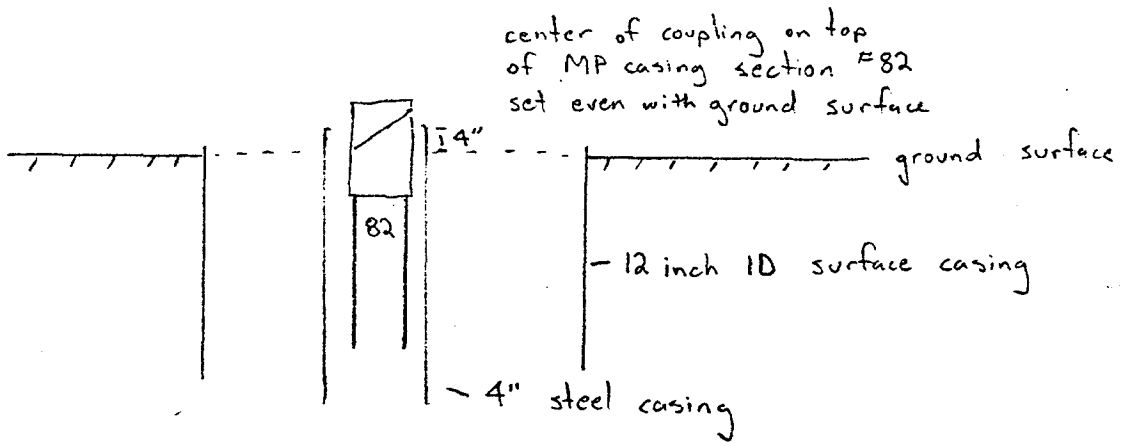
Well Informaton

Reference Datum ground surface
Elevation of Datum 0.00 ft.
Position of MP Casing Top above / below Datum 0.00 ft. above datum
Position of MP Casing Bottom Below Datum 583.14 ft. belou datum
Well Description MP38 in 4-inch steel
Other References

Log Informaton

Designed By DGM **Date** March 29, 1994
Approved By M. Cutler **Date** April 23, 1994
Checked By DGM **Date** May 20, 1994
Computer File No. 650MW12 **Date** Sun May 08 16:44:57 1994

Sketch of Wellhead Completion



tes:
surface completion to be converted to a subgrade vault in near future
annulus between 12 inch and 4 inch casing open to 5 ft below ground at time of installation.

Legend for Casing Installation Log

Well No. MW-12
Job No. WB650

MP Log	Description	Quantity
	MP38 CASING 1 FT. 0225F01	005
	MP38 CASING 2 FT. 0225F02	009
	MP38 CASING 10 FT. 0225F10	044
	MP38 PACKER STIFFENED 0237F05	015
	MP38 CASING 5 FT. 0225F05	009
	MP38 END CAP 0223	001
	MAGNETIC COLLAR	005

MP Log	Description	Quantity
	MP38 REGULAR COUPLING 0221	062
	MP38 MEASUREMENT PORT 0222	015
	MP38 PUMPING PORT 0224	005

Geo 1

Geo 2

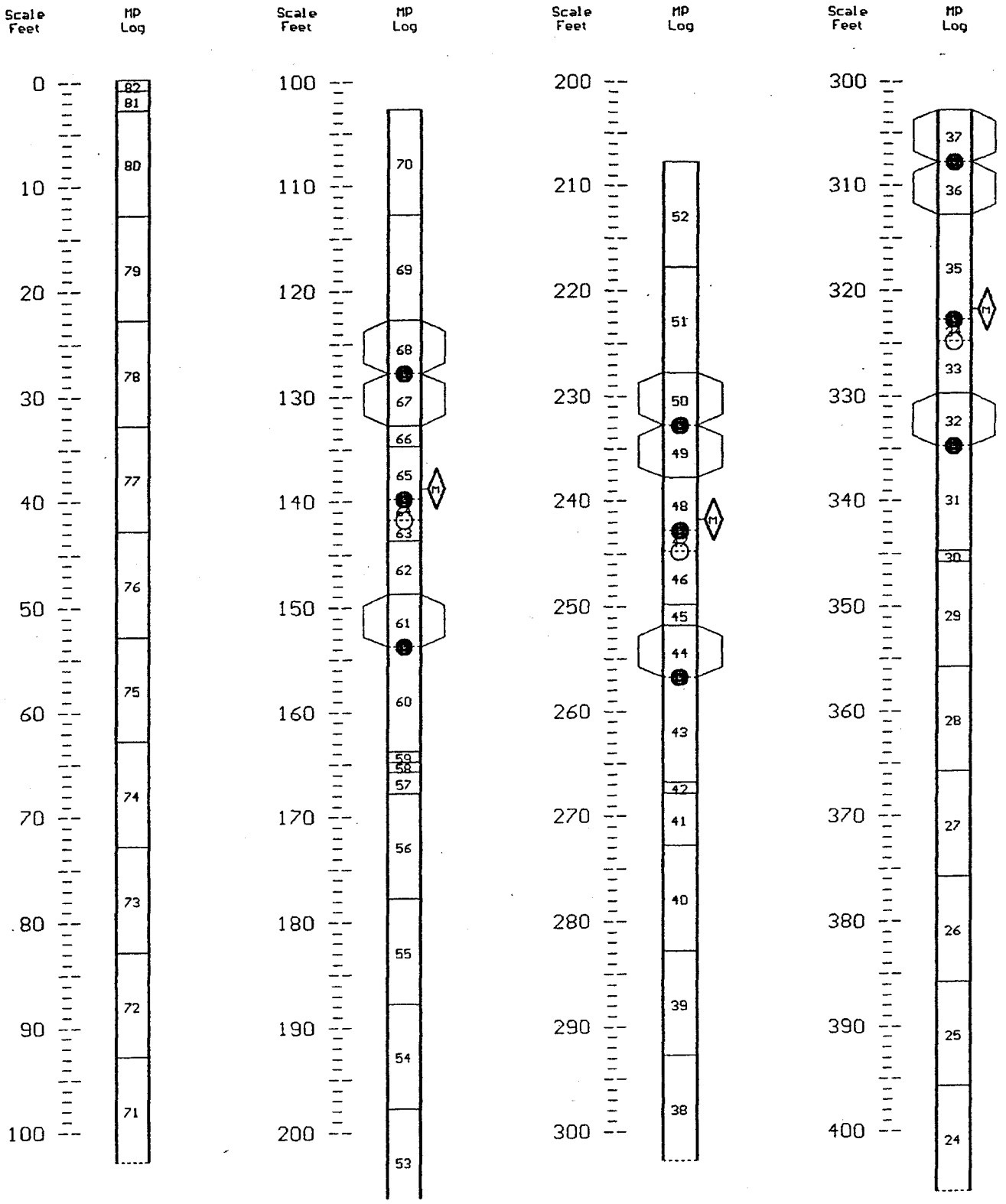
Well Casing

MILD STEEL PIPE

STAINLESS STEEL SCREEN

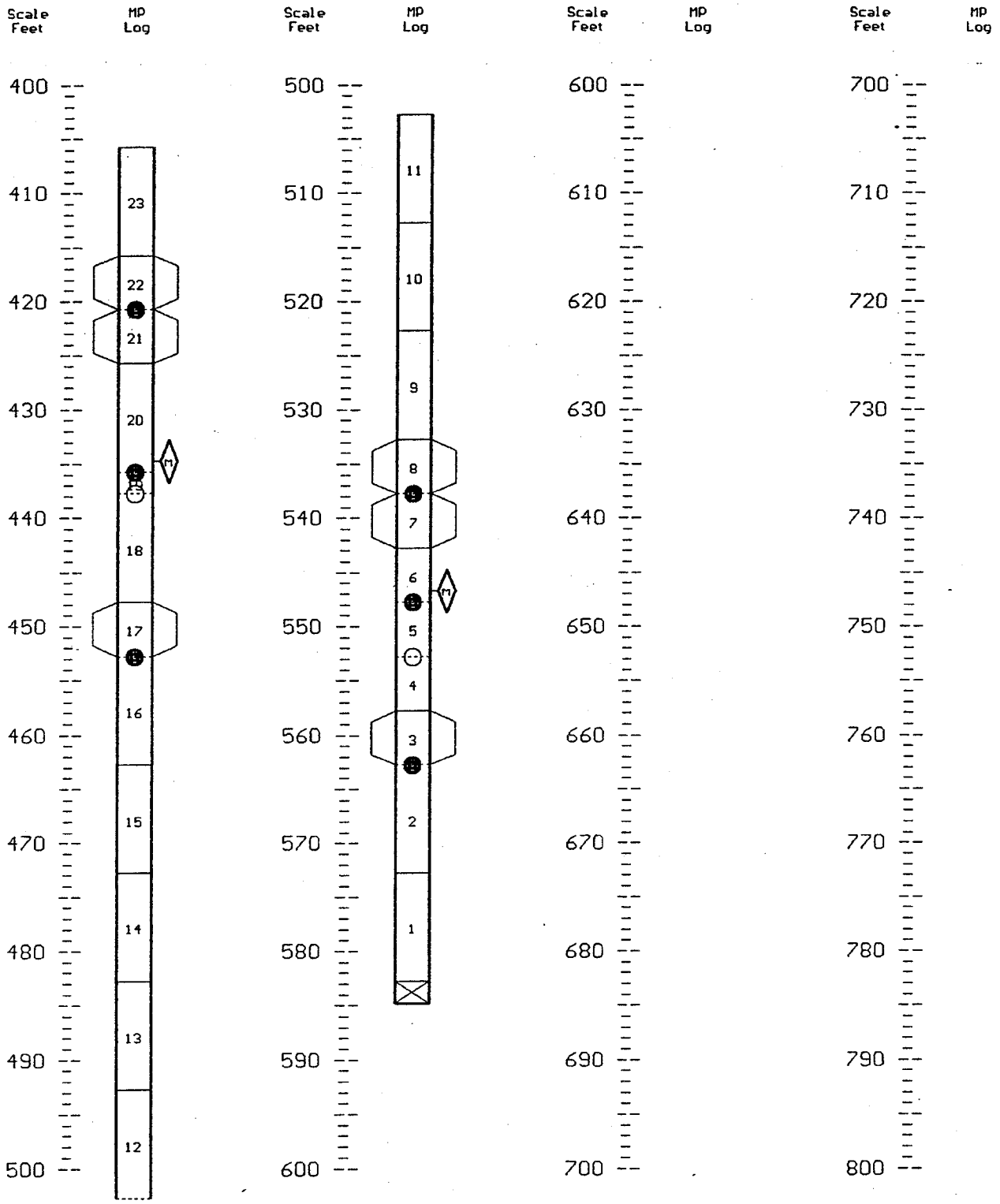
Summary Casing Log Date: Fri May 20 14:08:35 1994 Page: 1

Job No. WB650 Enserch Environmental Corp. Well No. MW-12



Summary Casing Log Date: Fri May 20 14:08:35 1994 Page: 2

Job No. WB650 Enserch Environmental Corp. Well No. MW-12



WELL MW-13

BORING LOG AND WELL COMPLETION DIAGRAM

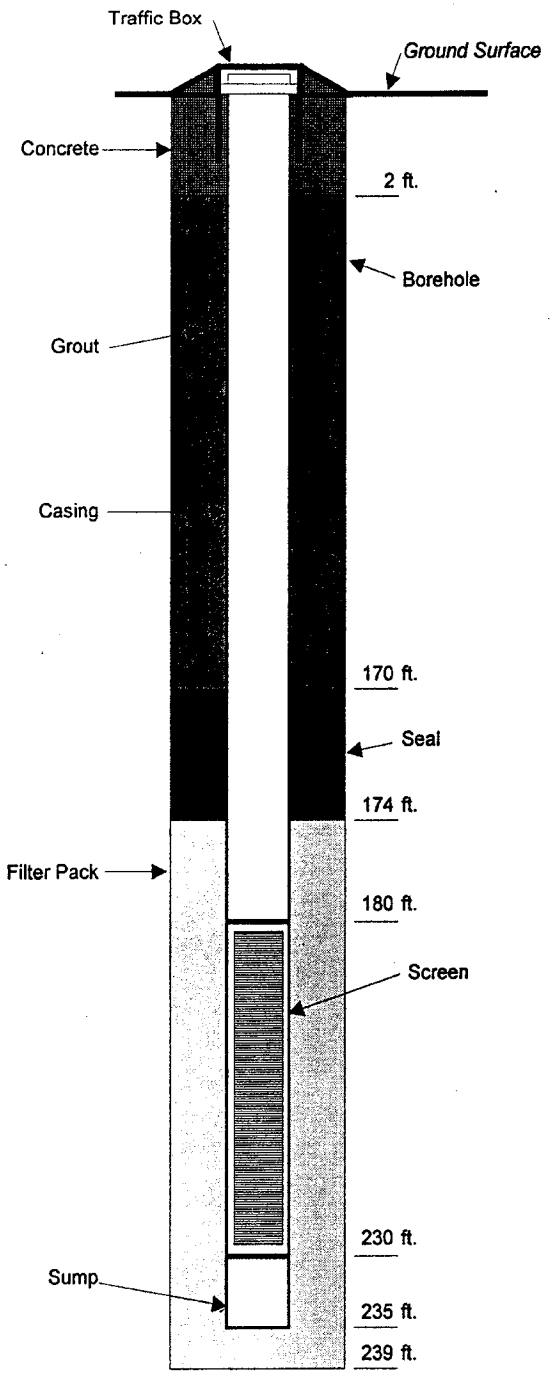
WELL CONSTRUCTION LOG

WELL NUMBER: MW-13

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1184.02

CASING ELEV (ft. above MSL): 1183.47



DRILLING SUMMARY

DATE COMPLETED:	3/19/94 to 4/4/94
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Rotary
TOTAL DEPTH DRILLED:	239 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	235 ft.
BLANK CASING TYPE:	Sch 40 PVC+W1
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	185 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	5 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/16 Sand
COMMENTS:	

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FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Traffic Box; Concrete									ASPHALT - PAVEMENT (0.25 feet thick)
1									SP SM	POORLY GRADED SAND WITH SILT Approximately 85% fine sand; approximately 10% nonplastic fines; approximately 5% coarse sand, trace fine subrounded gravel; maximum particle size 1/2 inch; reddish brown (4/4); slightly moist; no odor; micaceous.
2										
3										
4										
5					0	SM				
6										Soil cutting sample collected at 6 feet (SC-03).
7										
8										
9										
10	Volclay Bentonite Chips									
11										
12										
13										
14										
15					0	SM				As above.
16										
17										
18										
19										
20					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
20									SP SM	POORLY GRADED SAND WITH SILT 80% fine to coarse subrounded sand; 10% nonplastic fines; 10% fine subrounded gravel, maximum particle size 3/4 inch; reddish brown (4/14); slightly moist; no odor; micaceous.
21										
22										
23										
24										
25	4-inch Schedule 40 PVC Casing									As above.
26										
27										
28	Volclay Bentonite Chips								SP	POORLY GRADED SAND 95% fine to coarse subrounded sand; 5% nonplastic fines; maximum particle size 1/4 inch; reddish brown (4/14); slightly moist; no odor; micaceous.
29										
30					0	SM				
31										
32										
33										
34										
35					0	SM				
36										
37										As above.
38										
39										
40					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
40									SP	POORLY GRADED SAND Approximately 90% fine to medium sand; approximately 5% nonplastic fines; trace subrounded coarse sand; maximum particle size 1/4 inch; reddish brown (4/14); slightly moist; no odor; micaceous.
41										
42										
43										
44										
45										
46										As above.
47										
48										
49										
50	4-inch Schedule 40 PVC Casing; Volclay Bentonite Chips				0	SM				POORLY GRADED SAND - as above but slight decrease in amount of medium sand (predominately fine grained sand); no odor; slightly moist. Collected soil cuttings sample at 50 feet (SC-03).
51										
52										
53										
54										
55									SP SM	POORLY GRADED SAND WITH SILT Approximately 80% fine to medium grained sand; approximately 15% nonplastic fines; 5% fine subrounded gravel; maximum particle size 3/4 inch; light reddish brown (4/4); slightly moist; no odor; micaceous.
56										
57										
58										
59										
60					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

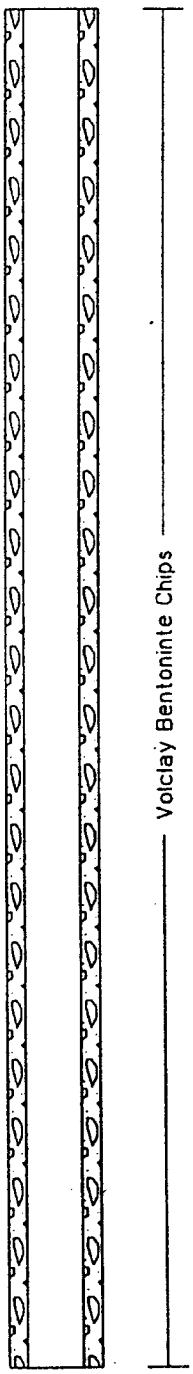
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
60									SP SM	As above.
61										
62										
63									SP	POORLY GRADED SAND WITH GRAVEL Approximately 75% medium to coarse sand, subangular to subrounded; approximately 20% fine to coarse subrounded granitic gravel; approximately 5% nonplastic fines; reddish brown; slightly moist; no odor.
64										
65										
66										
67										Encountered a large cobble at 67 feet. Very hard drilling.
68	Volclay Bentonite Chips									
69									SP SM	
70					0	SM				POORLY GRADED SAND WITH SILT Approximately 80% fine to medium sand, subrounded; approximately 15% nonplastic fines; approximately 5% fine subrounded granitic gravel; light reddish brown; slightly moist; no odor.
71										
72										
73										
74									SP	POORLY GRADED SAND. Approximately 90% fine to medium sand, subangular to subrounded; approximately 5% nonplastic fines, and 5% fine subrounded granitic gravel; light reddish brown; slightly moist; no odor.
75	4-inch Schedule 40 PVC Casing				0	SM				
76										
77										
78										
79										
80					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
80									SP	As above.
81										
82										
83										
84										
85										As above.
86										
87										
88										
89										
90					0	SM				As above.
91										
92										
93										
94										
95										As above.
96										
97										
98										
99										
100					0	SM				

Volclay Bentoninte Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100	4-inch Schedule 40 PVC Casing								SP	POORLY GRADED SAND. Approximately 85% medium to coarse sand, subrounded to subangular; approximately 10% fine subrounded granitic gravel; approximately 5% nonplastic fines; light reddish brown; slightly moist; no odor.
101										
102										
103										
104										
105										
106										
107										
108	Volclay Bentonite Chips									
109										
110					0	SM				As above.
111										
112										
113										
114										
115										
116										
117										
118										
119										As above.
120					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
120									SP	POORLY GRADED SAND as above.
121										
122										
123										
124									SP	POORLY GRADED SAND WITH GRAVEL Approximately 55% medium to coarse sand, subangular to subrounded; approximately 40% fine to coarse subrounded granitic gravel; approximately 5% nonplastic fines; light brown.
125	4-inch Schedule 40 PVC Casing									
126										
127										Difficult drilling.
128										
129									SP SM	POORLY GRADED SAND WITH SILT Approximately 90% fine to medium sand, subangular to subrounded; approximately 10% nonplastic fines; light reddish brown; slightly moist; no odor.
130					0	SM				
131										Drilling much easier.
132										
133										
134										
135					0	SM				
136										
137										
138										As above.
139										
140					0	SM				

Volclay Bentonite Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
140									SP SM	POORLY GRADED SAND WITH SILT 90% fine grained sand; 10% nonplastic fines; trace subrounded medium to coarse sand; light reddish brown; slightly moist; no odor.
141										
142										
143										Encountered trace course gravel from approximately 143 ft to 146 ft.
144										
145					0	SM				
146										As above.
147										
148										
149										Collected sample of soil cuttings at 150 feet (SC-03).
150	4-inch Schedule 40 PVC Casing				0	SM				POORLY GRADED SAND WITH SILT 85% fine to medium sand; 10% nonplastic fines; 5% fine subrounded gravel; grayish brown (10YR 4/2); very slightly moist; no odor.
151	Volclay Bentonite Chips									
152										
153										
154									SP	POORLY GRADED SAND WITH GRAVEL Approximately 75% fine to medium sand; approximately 25% fine subangular granitic gravel; light gray (10YR 7/1); dry; no odor.
155					0	D				
156										
157										
158					0	SM				Encountered abundant boulders/cobbles at 158 feet.
159										
160					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
160									SP	POORLY GRADED SAND WITH GRAVEL Approximately 70% medium to coarse sand; approximately 5% nonplastic fines; approximately 25% fine to coarse subrounded gravel; reddish brown (5YR 4/4); slightly moist; no odor.
161										
162										
163										
164										
165										
166										
167										As above.
168										
169										
170	4-inch Stainless Steel Blank; Voiclay Bentonite Chips				0	SM				
171	Bentonite Pellets									
172										Difficult drilling. As above but increase in amount of gravels.
173										
174	No. 2/16 Lonestar Sand									
175					0	SM				
176										
177										
178										
179										As above.
180					0	SM				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
180									SP	As above.
181										
182										
183						▽				Encountered groundwater at 183 feet.
184										
185										
186										
187									SP	POORLY GRADED SAND. Approximately 95% fine to coarse sand; approximately 5% nonplastic fines; trace fine subrounded granitic gravel; reddish brown; wet; no odor.
188										
189										
190	0.010-inch Slot Size, 4-inch Stainless Steel Screen; No. 2/16 Lonestar Sand				0	W				
191										
192										
193										As above with approximately 10% fine to coarse subrounded granitic gravel (193 feet).
194										
195					0	W				
										Difficult drilling
196									GP	POORLY GRADED GRAVEL WITH SAND Approximately 55% fine to coarse subrounded to subangular granitic gravel; approximately 40% medium to coarse subrounded to subangular sand; approximately 5% nonplastic fines; reddish brown; wet; no odor.
197										
198					0	W				
199										
200					0	W			SP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*

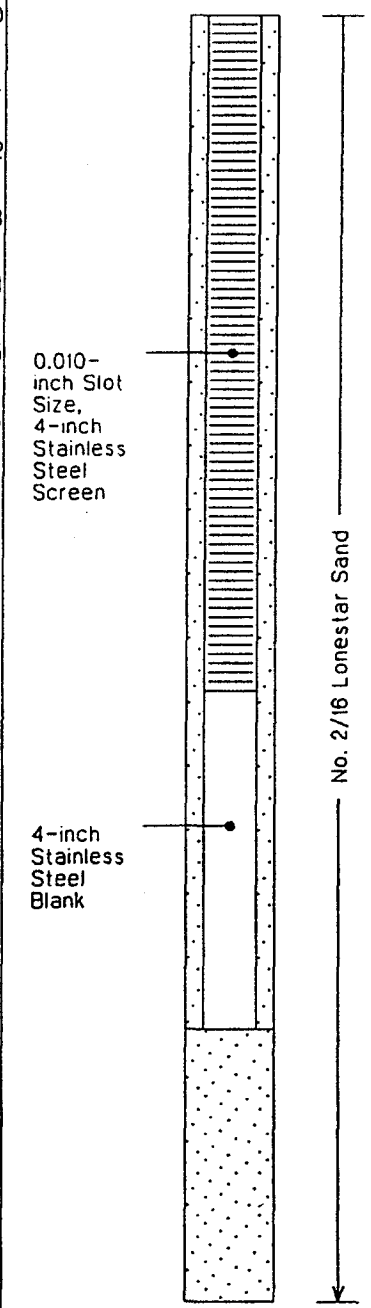
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
200									SP	Collected sample of soil cuttings at 200 feet (SC-03).
201										POORLY GRADED SAND. Approximately 90% medium to coarse sand; approximately 5% nonplastic fines; 5% fine subrounded gravel; gray-brown; wet; no odor; maximum particle size 3/4 inch.
202										
203										
204										
205										
206										
207										
208										
209										
210	0.010-inch Slot Size, 4-inch Stainless Steel Screen; No. 2/16 Lonestar Sand				0	W				As above.
211										
212									SP	Difficult drilling.
213										POORLY GRADED SAND WITH GRAVEL Approximately 75% medium to coarse sand, subangular to subrounded; approximately 20% gravel (fine to coarse), subrounded; approximately 5% nonplastic fines; light brown; wet; no odor.
214										
215					0	W				
216										
217										
218										
219										
220					0	W			SP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 13

PROJECT *Jet Propulsion Laboratory*
LOCATION *South of Building 111.*
GEOLOGIST *C. Kreller*
DRILLING CO *Beylik*
DATE (start/finish) *3/19/94 - 4/4/94*

DRILLING METHOD *Air Rotary with Casing Advance*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1185 feet*
TOTAL DEPTH (ft) *239*
DEPTH TO WATER (ft) *183*



Depth (ft)	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
220							SP	POORLY GRADED SAND. Approximately 90% medium to coarse sand, subrounded to subangular; approximately 5% nonplastic fines and 5% fine subrounded granitic gravel; light brown; wet; no odor.
221								
222								
223								
224							SP	POORLY GRADED SAND WITH GRAVEL Approximately 70% medium to coarse subrounded to subangular sand; approximately 25% fine to coarse subrounded granitic gravel; approximately 5% nonplastic fines; light brown; wet; no odor.
225			0	W				
226								
227							GP	POORLY GRADED GRAVEL. Approximately 55% fine to coarse subrounded granitic gravel; approximately 45% medium to coarse subangular sand; light brown; wet; no odor.
228								
229							SP	POORLY GRADED SAND. Approximately 90% medium to coarse sand, subangular to subrounded; approximately 5% fine subrounded granitic gravel and 5% nonplastic fines; light brown; wet; no odor.
230			0	W				
231								
232								Collected grab sample of soil cuttings (SC-03) at 232 feet.
233								
234								
235			0	W				
236								
237								As above.
238								
239								Total Depth Drilled 239 feet.
240								

WELL MW-14

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

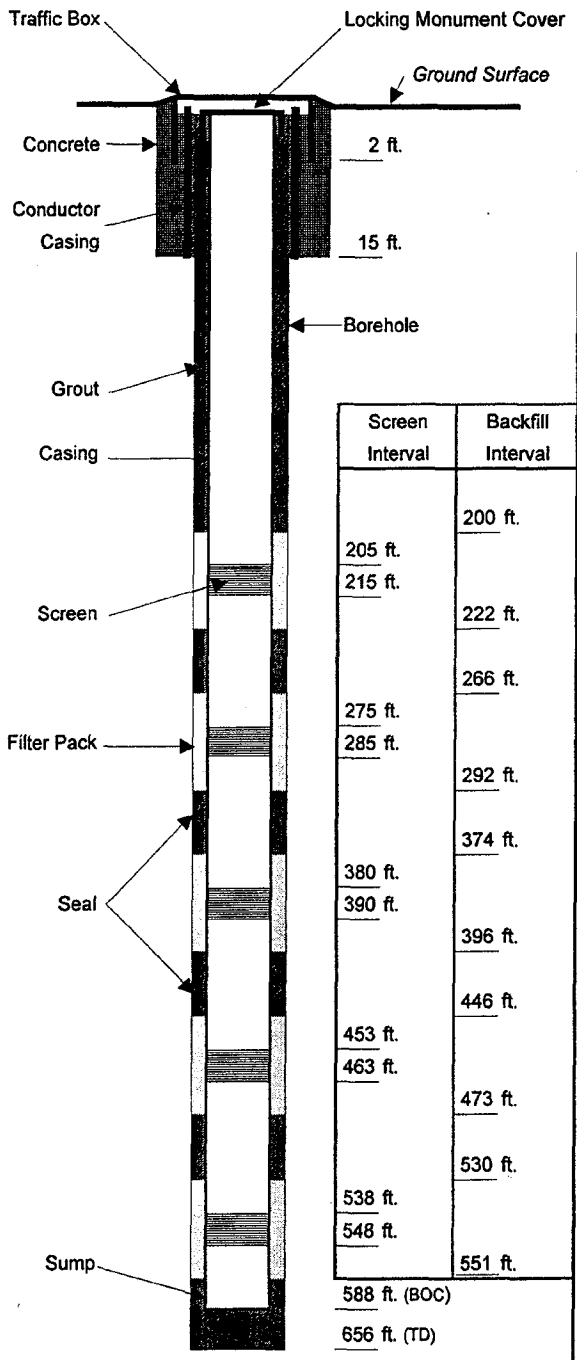
WELL CONSTRUCTION LOG

WELL NUMBER: MW-14

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1174.05

CASING ELEV (ft. above MSL): 1173.42



Screen Interval	Backfill Interval
	200 ft.
205 ft.	
215 ft.	
	222 ft.
	266 ft.
275 ft.	
285 ft.	
	292 ft.
	374 ft.
380 ft.	
390 ft.	
	396 ft.
	446 ft.
453 ft.	
463 ft.	
	473 ft.
	530 ft.
538 ft.	
548 ft.	
	551 ft.

588 ft. (BOC)

656 ft. (TD)

DRILLING SUMMARY

DATE COMPLETED:	3/14/94 to 3/25/94
DRILLING COMPANY:	Belik
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	656 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER: (CONDUCTOR CASING)	18.5 in.
CONDUCTOR CASING DIAMETER:	16 in
CONDUCTOR CASING LENGTH:	15 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	588
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	538 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Traffic Box				0	SM			SM	ASPHALT PAVEMENT (0.25 feet thick)
5										SILTY SAND. Yellowish brown (10YR 5/6), approximately 75-80% fine to medium grained sand, subangular to subrounded, slightly moist, no odor, approximately 15-20% fines with no plasticity, approximately 5% fine gravel that is granitic in composition and subangular to subrounded.
10	16-inch Low Carbon Conductor Pipe									
15										(Upper 15-feet of boring initially drilled with 22-inch auger to install 16-inch conductor casing.)
										Conducter casing set to 15 feet below grade.
20					0	NA				Grab sample of soil cuttings collected at 20 feet (SC-05).
										Drilling Mud: Weight: 64 lbs/cu.ft. Viscosity: 35 seconds Sand Content: 3 percent
25	4-inch Low Carbon Blank									As above with slight coarsening in grain size.
30										
35										
40					0	NA				
45									SP SM	POORLY GRADED SAND WITH SILT. Light yellowish brown (10YR 6/4), approximately 90% medium to coarse grained sand, subangular to subrounded, no odor, trace fine gravel with diameter approximately .75 inch, approximately 10% nonplastic fines.
50										

Concrete

Volclay Bentonite Chips (Medium)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

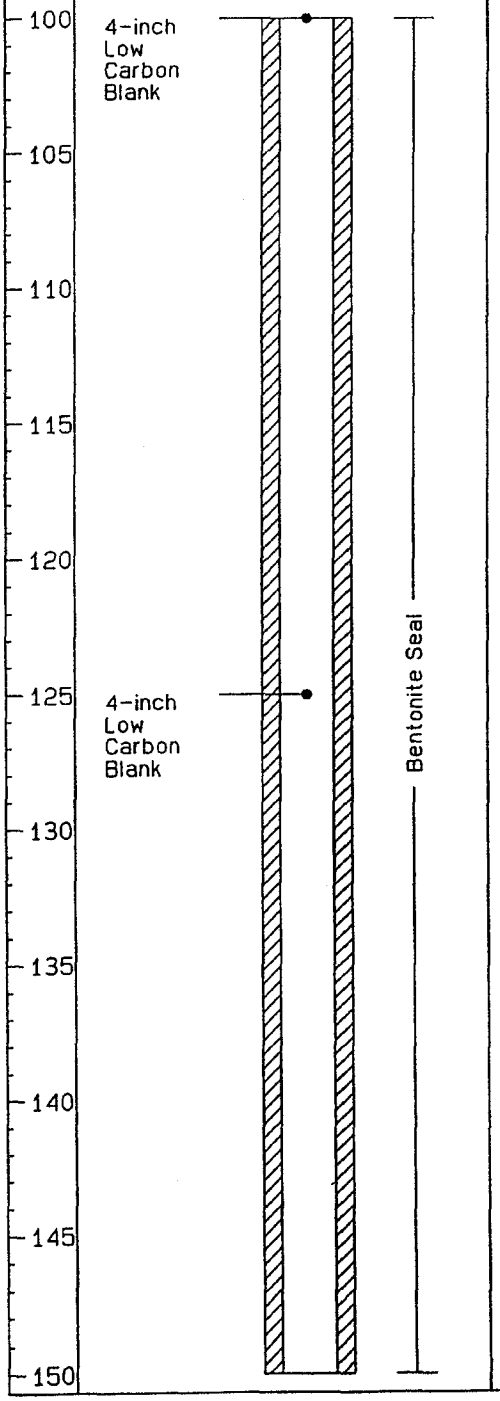
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50	4-inch Low Carbon Blank; Bentonite Seal								SP, SM	Drilling Mud: Weight: 83 lbs/cu.ft. Viscosity: 31 seconds Sand Content: 1.5 percent
55										As above but slight coarsening in grain size.
60					0	NA				As above with trace (<2%) broken rock fragments from drill bit (ie. fresh surfaces), lithology of fragments is aphanitic metasediments.
65										
70										
75	4-inch Low Carbon Blank								SP	As above with slight coarsening of sand size. POORLY GRADED SAND. Light yellowish brown (10YR 6/4), approximately 95% medium to coarse grained sand, subrounded to angular, approximately 5% fines, nonplastic, no odor.
80					0	NA				Drilling Mud: Weight: 54 lbs/cu.ft. Viscosity: 45 seconds Sand Content: NA
85										
90									SP	POORLY GRADED SAND WITH GRAVEL. Light brown, approximately 75% medium to coarse grained sand, subangular to subrounded; 20% fine granitic gravel, subrounded; approximately 5% fines, nonplastic; no odor.
95									SP	POORLY GRADED SAND. Light brown, approximately 95% medium to coarse sand, subangular to subrounded; approximately 5% nonplastic fines; trace fine gravel; no odor.
100					0	NA			SP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*



Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
							SP	POORLY GRADED SAND WITH GRAVEL. Light brown, approximately 70% medium to coarse sand, subangular to subrounded; approximately 25% fine to coarse granitic gravel; about 5% nonplastic fines; no odor.
								Grab sample of soil cuttings collected at 100 feet (SC-05).
								Drilling Mud: Weight: 62 lbs/cu.ft. Viscosity: 41 seconds Sand Content: <1 percent
								As above with slight decrease in average sand size.
							SP	POORLY GRADED SAND. Light brown, approximately 95% fine to medium sand, subangular to subrounded; approximately 5% nonplastic fines; no odor.
			0	NA				
								As above.
							SP	POORLY GRADED SAND WITH GRAVEL Light brown; approximately 80% medium to coarse sand, subrounded to subangular; approximately 15% fine to coarse granitic gravel; 5% nonplastic fines; no odor.
			0	NA				Drilling Mud Viscosity: 42 seconds.
							SP	POORLY GRADED SAND Light brown; approximately 85% medium sand; 10% fine to coarse granitic gravel; 5% nonplastic fines; no odor.
							SM	SILTY SAND. Light yellowish brown (90YR 6/4); approximately 85% fine to medium sand; trace coarse sand and fine gravel, subangular to subrounded; approximately 15% nonplastic fines; no odor.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
150	4-inch Low Carbon Blank								SM	
										150ft-153ft - Very fast drilling, drill bit went down 3 feet within 20 seconds; no drill chatter; material unknown; some fine and medium sand in cuttings.
155										
										Drilling Mud: Weight: NA Viscosity: 50 seconds Sand Content: 3 percent
160					0	NA				
										Directional survey at 160 feet: <1 degree from vertical.
										Same as above.
165										
										Drilling Mud: Weight: 66.6 lbs/cu.ft. Viscosity: 33 seconds Sand Content: 1.5 percent
170										
										Same as above.
175	4-inch Low Carbon Blank; Bentonite Seal									
										Same as above.
180					0	NA			SP	POORLY GRADED SAND. Light brown; approximately 95% medium to coarse sand, subangular to subrounded; approximately 5% nonplastic fines; trace fine granitic gravel; no odor.
185										Decrease in grain size; predominately fine to medium grained.
									SM	SILTY SAND Light brown; approximately 85% fine to medium sand; trace coarse sand; approximately 15% nonplastic fines; no odor.
190										
195										Drilling Mud: Weight: 67 lbs/cu.ft. Viscosity: 30 seconds Sand Content: 1.5 percent
200					0	NA				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

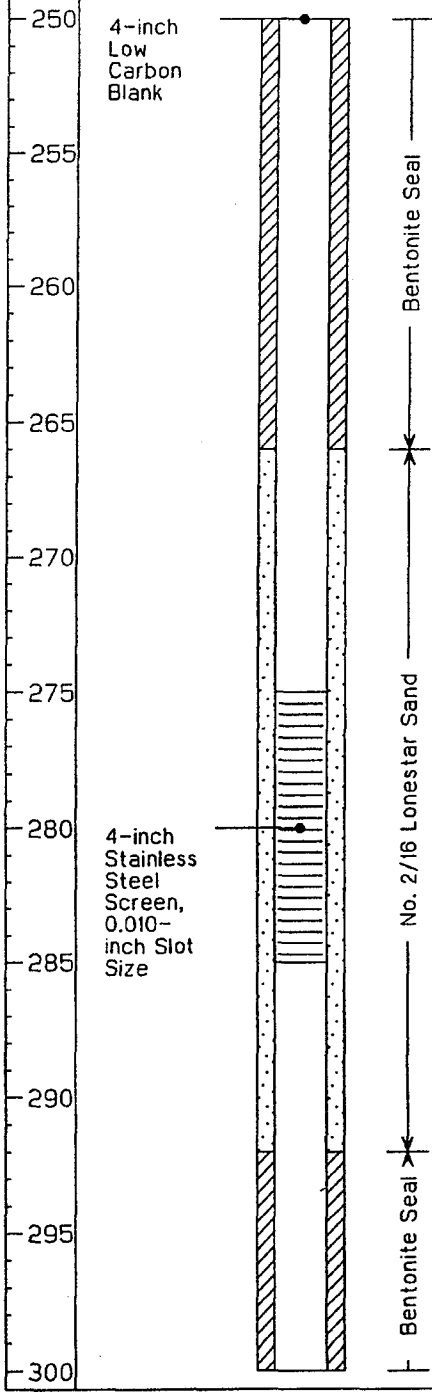
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
200									SM	Grab sample of soil cuttings collected at 200 feet (SC-05).
										Slight decrease in sand size; predominately fine with some medium grained sand.
205									SP SM	POORLY GRADED SAND WITH SILT. Light brown; approximately 90% fine to medium sand, subangular to subrounded; trace coarse sand; approximately 10% nonplastic fines; no odor.
210	4-inch Stainless Steel Screen, 0.010-inch Slot Size									
215										
220	No. 2/16 Lonestar Sand				0	NA				Drilling Mud Viscosity: 33 seconds.
225	4-inch Low Carbon Blank								SM	SILTY SAND. Light brown; approximately 85% fine to medium sand; trace coarse sand; approximately 15% nonplastic fines; no odor; micaceous.
230										
235	Bentonite Seal									
240					0	NA				
245										As above.
250										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*



Depth (ft)	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
250								SM	Drilling Mud: Weight: 70.3 lbs/cu.ft. Viscosity: 32 seconds Sand Content: NA
255									As above.
260				0	NA				Direction survey at 260 feet: <0.5 degrees from vertical.
									Drilling Mud: Weight: 70.3 lbs/cu.ft. Viscosity: 31 seconds Sand Content: NA
265								SP	POORLY GRADED SAND. Light brown; approximately 95% medium to coarse sand, subangular to subrounded; trace fine sand; approximately 5% nonplastic fines; trace fine granitic gravel. No odor.
270									
275									
280				0	NA				Same as above
								SM	SILTY SAND. Light brown; approximately 80% fine to medium subangular to subrounded sand; approximately 20% nonplastic fines; no odor.
285				0	NA				
290				0	NA				
									As above but with predominately fine grained sand.
295									
300									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

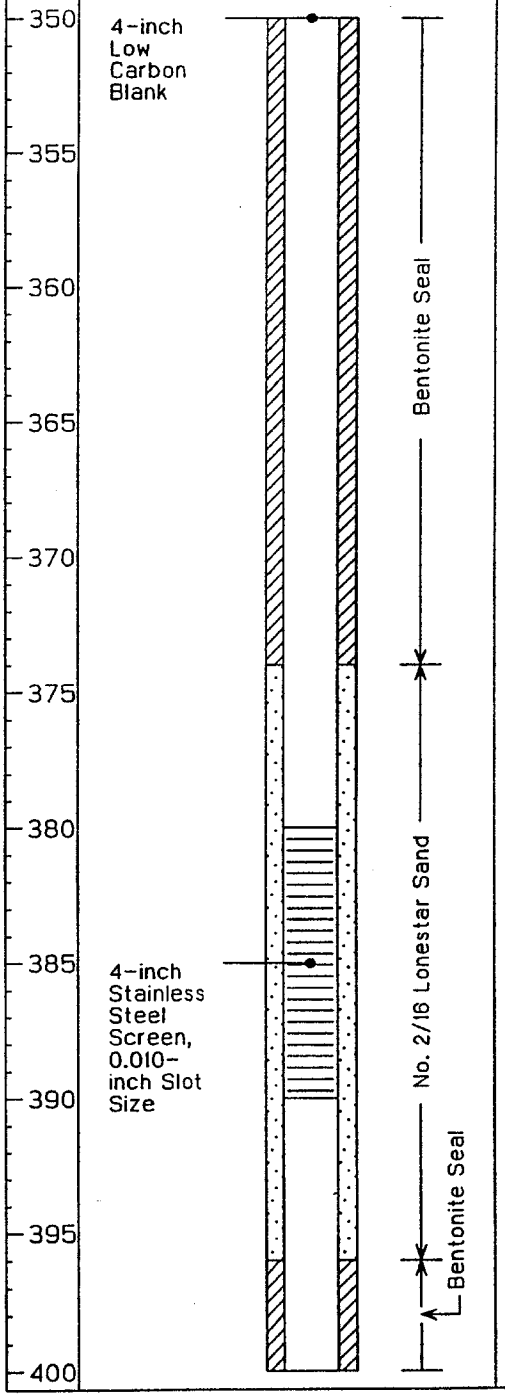
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
300	4-inch Low Carbon Blank								SM	Grab sample of soil cuttings collected at 300 feet (SC-05).
										Same as above.
										Drilling Mud: Weight: 69.6 lbs/cu.ft. Viscosity: 35 seconds Sand Content: NA
305										
310									SP SM	POORLY GRADED SAND WITH SILT. Light brown; approximately 55% fine sand, 15% medium sand, 10% coarse sand; approximately 10% nonplastic fines and 10% fine to coarse granitic gravel; no odor.
315										
320					0	NA				Drilling Mud: Weight: 70.3 lbs/cu.ft. Viscosity: 33 seconds Sand Content: 0.75 percent
									SM	SILTY SAND. Light brown; approximately 80% fine to medium subrounded to subangular sand; approximately 20% nonplastic fines; no odor.
325	4-inch Low Carbon Blank; Bentonite Seal									
330										
335										
340					0	NA				Same as above.
345										
350										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*



Depth (ft)	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
350								SM	
355									
360				0	NA				Same as above.
365									
370									
375									
380				0	NA			SP SM	Drilling Mud: Weight: 71.06 lbs/cu.ft. Viscosity: 40 seconds Sand Content: 1.6 percent POORLY GRADED SAND WITH SILT. Light brown; approximately 85% medium to coarse sand, subangualr to subrounded; approximately 10% nonplastic fines; 5% fine to coarse granitic gravel; no odor.
385									
390									Direction survey at 390 feet: <1 degree from vertical.
395									As above.
400				0	NA				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
400	4-inch Low Carbon Blank								SP SM	Grab sample of cuttings collected at 400 feet (SC-05). POORLY GRADED SAND WITH SILT AND GRAVEL. light brown; approximately 75% medium sand; trace fine and coarse sand; approximately 15% fine to coarse granitic gravel and 10% nonplastic fines; no odor.
405										
410										
415										Drilling Mud: Weight: 72.6 lbs/cu.ft. Viscosity: 40 seconds Sand Content: <1 percent
420	Bentonite Seal				0	NA				
425	4-inch Low Carbon Blank								SM	SILTY SAND WITH GRAVEL. Light brown; approximately 70% fine to medium sand; approximately 15% fine to coarse granitic gravel; 15% nonplastic fines; no odor.
430										
435									SP SM	POORLY GRADED SAND WITH SILT. Light brown; approximately 85% medium to coarse sand, subangular to subrounded; approximately 10% nonplastic fines; 5% fine to coarse granitic gravel; no odor.
440					0	NA				
445	No. 2/16 Lonestar Sand									
450										

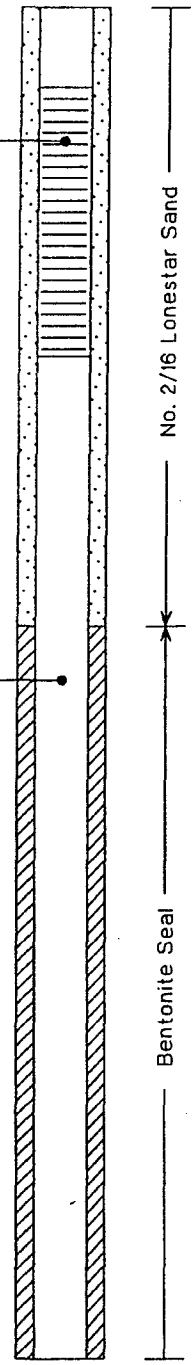
FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
450									SP SM	Encountered boulder from 451'-452'. Drilling Mud: Weight: 74.4 lbs/cu.ft. Viscosity: 40 seconds Sand Content: 2 percent
455	4-inch Stainless Steel Screen, 0.010-inch Slot Size									As above with increase in amount of fine to coarse granitic gravel.
460					0	NA				
465										
470										
475	4-inch Low Carbon Blank									
480					0	NA				Same as above.
485										
490										
495										
500					0	NA				



FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
500	4-inch Low Carbon Blank								SP SM	Grab sample of soil cuttings collected at 500 feet (SC-05).
									SM	SILTY SAND. Light brown; approximately 80% fine to medium sand; approximately 20% nonplastic fines; trace fine to coarse granitic gravel; no odor.
505										Drilling Mud: Weight: 71.8 lbs/cu.ft. Viscosity: 41 seconds Sand Content: 1 percent
									SP SM	
510										POORLY GRADED SAND WITH SILT AND GRAVEL. Light brown; approximately 70% predonimately medium sand; approximately 20% fine to coarse granitic gravel and 10% nonplastic fines; no odor.
									SM	
515	Bentonite Seal									SILTY SAND WITH GRAVEL. Light brown; approximately 70% fine to medium sand; approximately 15% fine to coarse granitic gravel and 15% nonplastic fines; no odor.
520					0	NA				
525	4-inch Low Carbon Blank									
530										
535										As above but sand becomes finer grained, possibly siltier with decrease in amount of gravel.
540	No. 2/16 Lonestar Sand				0	NA				Drilling Mud: Weight: 74.8 lbs/cu.ft. Viscosity: 40 seconds Sand Content: 1 percent
545	4-inch Stainless Steel Screen, 0.010-inch Slot Size									
550										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
550									SM	
555										
560	No. 2/16 Lonestar Sand; Bentonite Seal				0	NA				Same as above.
565										
570										
575	4-inch Low Carbon Blank									
580					0	NA				Same as above. Directional survey at 580 feet: <0.5 degrees from vertical. Drilling Mud: Weight: 71.8 lbs/cu.ft. Viscosity: 32 seconds Sand Content: <0.5 percent
585										
590	Bentonite Seal									
595										
600					0	NA				

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

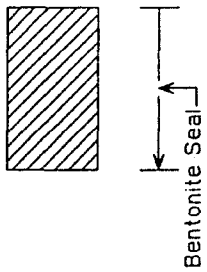
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
600	Bentonite Seal								SM	Grab sample of soil cuttings collected at 600 feet (SC-05).
										Same as above.
605										Drilling Mud: Weight: 71.8 lbs/cu.ft. Viscosity: 40 seconds Sand Content: 1 percent
610										
615									GR	Difficult drilling.
										Granitic rock - medium sized rock chip pieces as cuttings; surfaces on all pieces angular, fresh breakage, 50% K-feldspar; 30% quartz; 15% plagioclase; 5% other (mafics).
620					0	NA				
625										
630										
635										As above.
640					0	NA				
645										Drilling Mud: Weight: 74.8 lbs/cu.ft. Viscosity: 34 seconds Sand Content: <1 percent
650										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 14

PROJECT *Jet Propulsion Laboratory*
LOCATION *Southwest Corner of the West parking lot.*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik*
DATE (start/finish) *03/14/94 - 03/25/94*

DRILLING METHOD *Mud Rotary (12.25-inch boring)*
SAMPLING METHOD *Not Applicable*
SURFACE ELEVATION *Approximately 1174 feet*
TOTAL DEPTH (ft) *656*
DEPTH TO WATER (ft) *Approximately 166 feet*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
650									GR	
655										Grab sample of soil cuttings collected at 656 feet (SC-05).
										Bottom of boring at 656 feet.
660										
665										
670										
675										
680										
685										
690										
695										
700										

Bentonite Seal

Summary Casing Installation Log

Well No. MW-14
Job No. WB650

Client Enserch Environmental Corp.
Site JPL
Project Description Groundwater Investigation

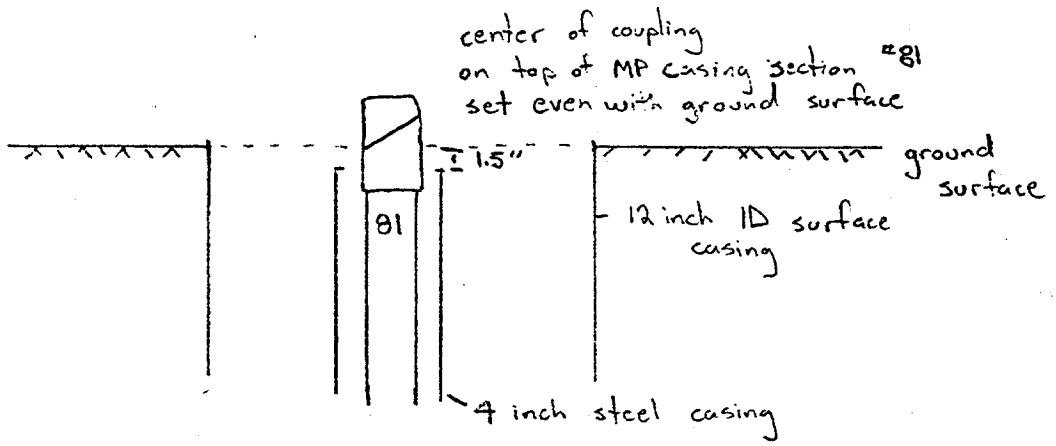
Well Informaton

Reference Datum ground surface
Elevation of Datum 0.00 ft.
Position of MP Casing Top above / below Datum 0.00 ft. above datum
Position of MP Casing Bottom Below Datum 577.14 ft. below datum
Well Description MP38 in 4-inch steel
Other References

Log Informaton

Designed By D. Mercer **Date** Mar. 29, 1994
Approved By M. Cultler **Date** May 4, 1994
Checked By D. Mercer **Date** May 20, 1994
Computer File No. 650MW14 **Date** Tue Mar 29 16:46:22 1994

Sketch of Wellhead Completion



Notes:

1) surface completion to be converted to a subgrade vault in near future.
2) annulus between 12 inch and 4 inch casing open to 6 ft below ground at time of installation

Legend for Casing Installation Log

Well No. MW-14
Job No. WB650

MP Log	Description	Quantity
	MP38 CASING 2 FT. 0225F02	010
	MP38 CASING 10 FT. 0225F10	042
	MP38 PACKER STIFFENED 0237F05	015
	MP38 CASING 5 FT. 0225F05	012
	MP38 CASING 1 FT. 0225F01	002
	MP38 END CAP 0223	001
	MAGNETIC COLLAR	005

MP Log	Description	Quantity
	MP38 REGULAR COUPLING 0221	062
	MP38 MEASUREMENT PORT 0222	014
	MP38 PUMPING PORT 0224	005

Geo 1

Geo 2

Well Casing

MILD STEEL PIPE

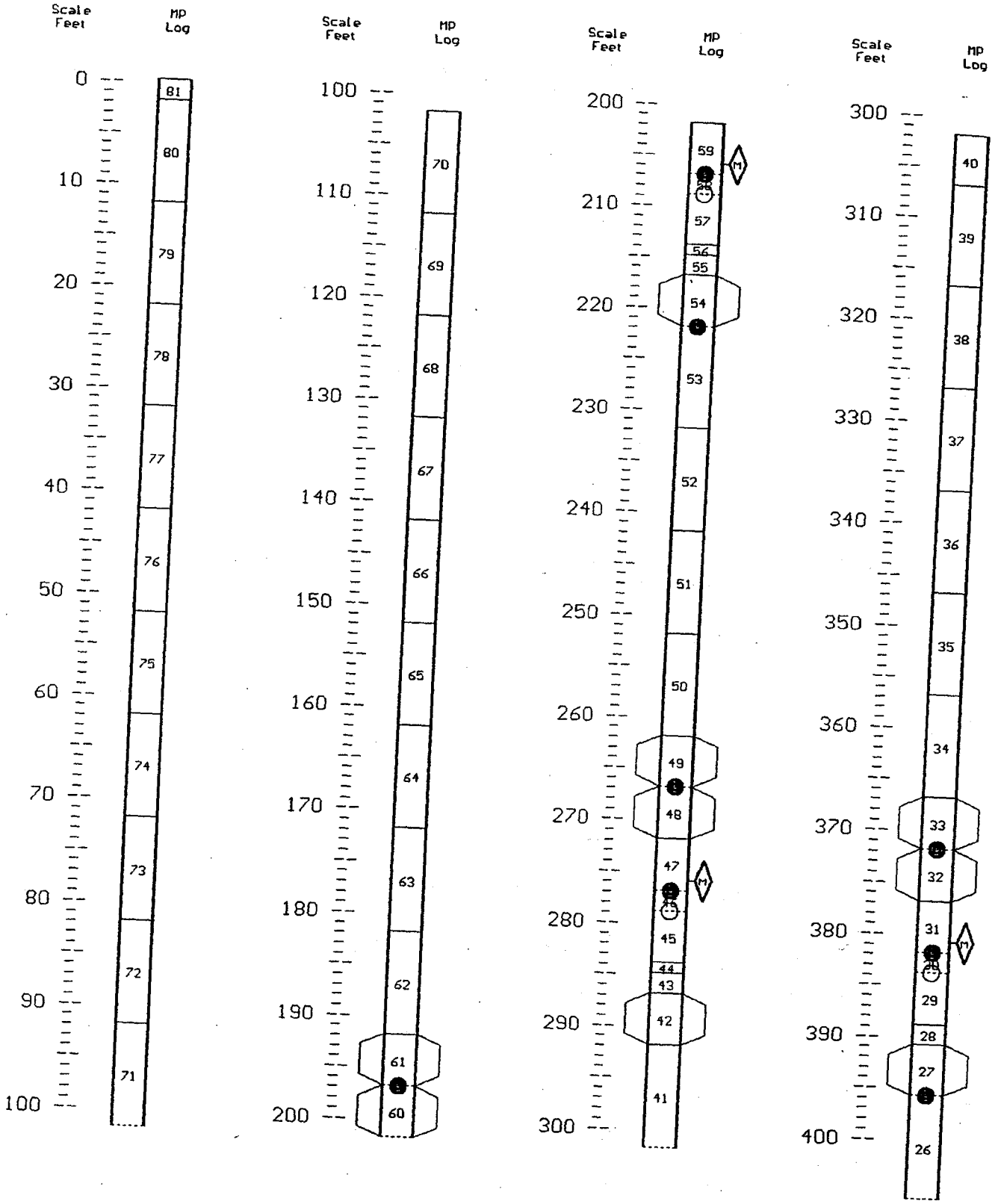
STAINLESS STEEL SCREEN

Summary Casing Log
Job No. WB650

Date: Fri May 20 14:19:23 1994

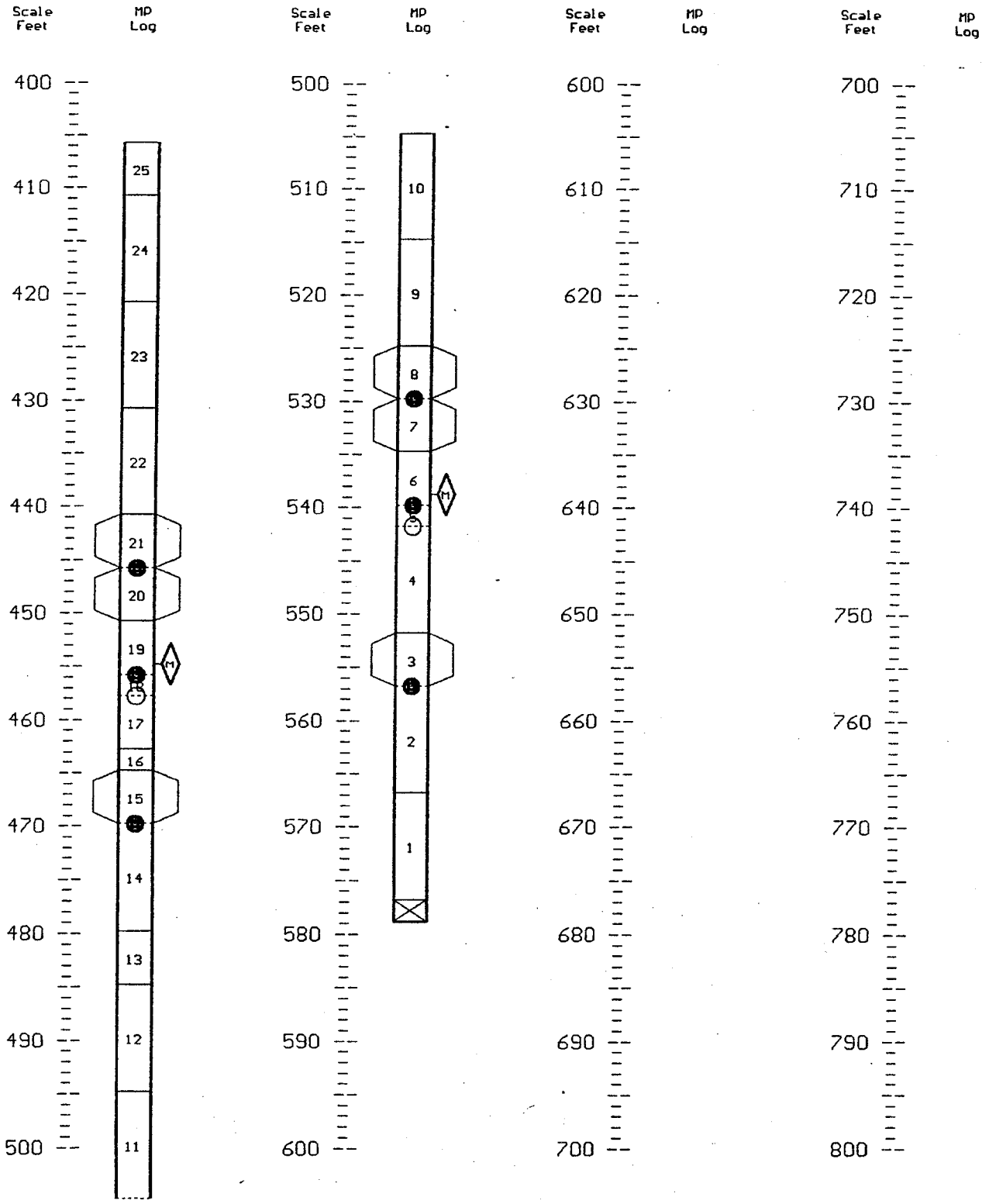
Enserch Environmental Corp.

Well No. MW-14



Summary Casing Log Date: Fri May 20 14:19:23 1994 Page: 2

Job No. WB650 Enserch Environmental Corp. Well No. MW-14



WELL MW-15

BORING LOG AND WELL COMPLETION DIAGRAM

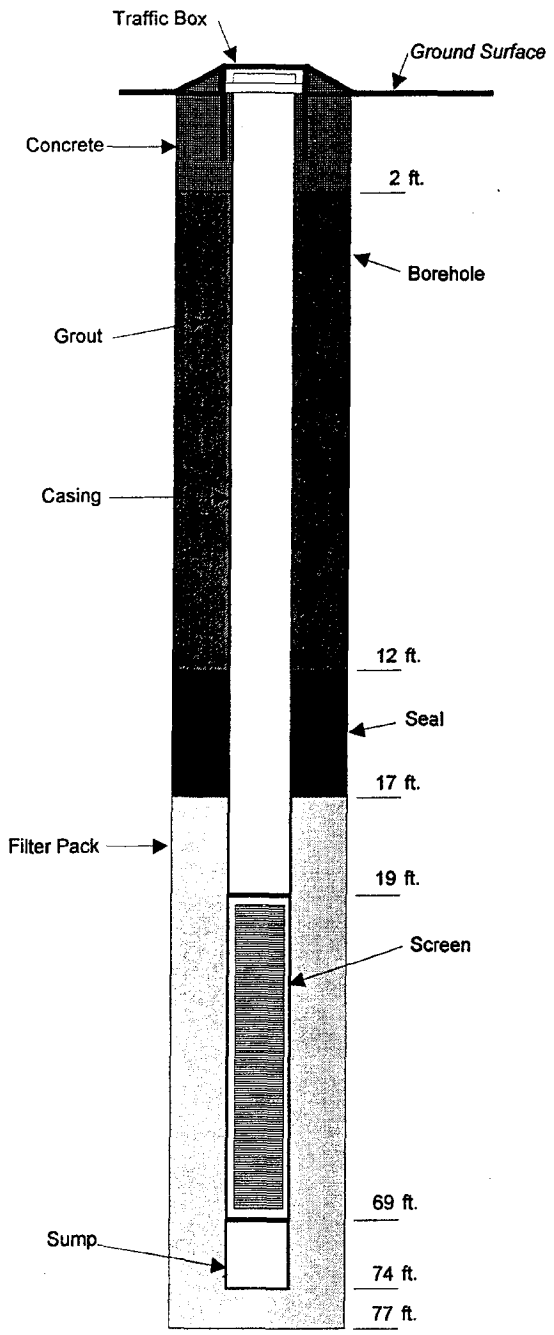
WELL CONSTRUCTION LOG

WELL NUMBER: MW-15

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1121.34

CASING ELEV (ft. above MSL): 1120.66



DRILLING SUMMARY

DATE COMPLETED:	2/26/94 to 2/27/94
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	77 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	74 ft.
BLANK CASING TYPE:	Stainless Steel
BLANK CASING DIAMETER:	4 in.
TOTAL BLANK CASING LENGTH:	24 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	5 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/16 Sand
COMMENTS:	

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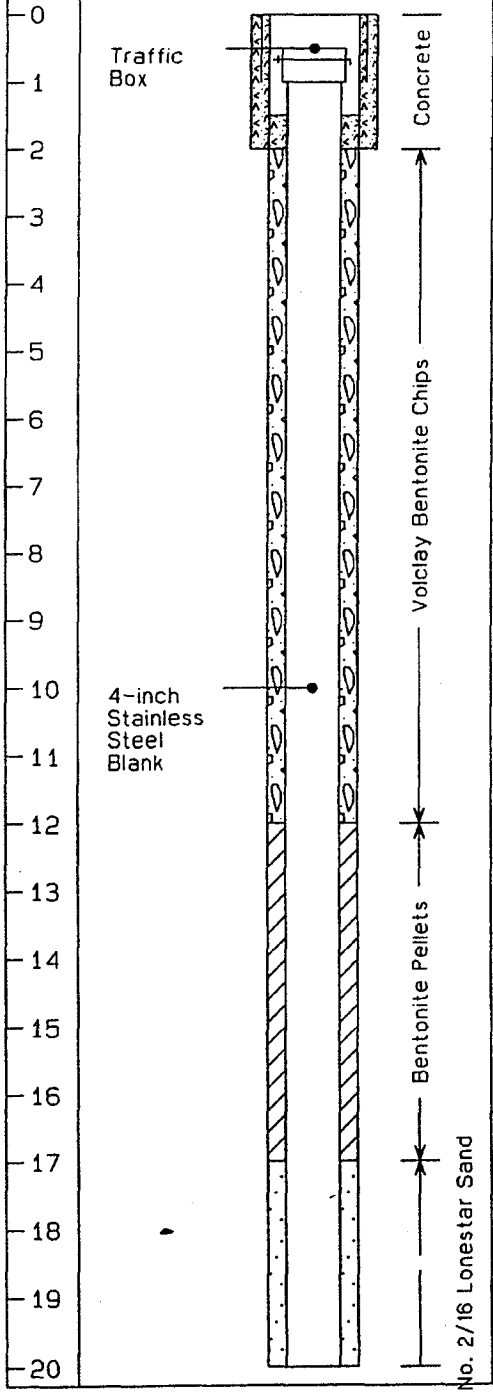
FOSTER WHEELER ENVIRONMENTAL CORPORATION

MW-15

PROJECT	Jet Propulsion Laboratory	DRILLING METHOD	Dual-wall air percussion
LOCATION	Northeast Corner of Building 11	SAMPLING METHOD	2 1/2" x 24" Split Spoon Sampler
GEOLOGIST	Bill Robin	SURFACE ELEVATION	Approx. 1121 ft
DRILLING CO	Beylik	TOTAL DEPTH (ft)	77.0
DATE (start/finish)	02/26/94 - 02/27/94	DEPTH TO WATER (ft)	25.7 ft



Depth (ft)	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0									ASPHALT PAVEMENT (0.25 feet thick)
								SP	GRAVEL ROADBASE (0.25 - 0.50 feet)
1									POORLY GRADED SAND - 80% fine sand, 15% medimum sand, 5% coarse sand, trace fines (nonplastic), maximum size coarse sand; brown, moist; abundant mica.
2									
3									
4									Collected grab sample of cuttings at 4 feet (SC-01).
5									POORLY GRADED SAND 90% fine sand, 5% medium angular to subangular sand, 5% angular to subangular coarse sand, trace fines (nonplastic), maximum size coarse sand; light brown, dry.
6									
7									
8	No Recovery		NA		D			SP	POORLY GRADED SAND WITH GRAVEL AND COBBLES. 40% medium subangular to subrounded sand, 20% fine to coarse subangular to subrounded gravel, 20% coarse angular to subangular sand, 20% fine sand; maximum size coarse gravel; light brown, dry.
9									
10									
11									Attempted to collect soil sample between 8 and 9 feet. No recovery.
12									
13	Soil-3		NA	0	D				Collected soil sample (SOIL-3) at 13 - 13.5 feet.
14									
15									
16									Attempted to collect soil sample at 18 feet. No recovery.
17									POORLY GRADED SAND WITH GRAVEL 35% fine sand, 20% coarse subangular to subrounded gravel, 10% fine subangular to subrounded gravel, 15% coarse angular to subrounded sand, 20% medium subangular to subrounded sand, trace fines (nonplastic); maximum size coarse gravel; light brown, dry.
18	No Recovery		NA		D			SP	
19									
20									Cobbles at 18 feet.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

MW-15

PROJECT *Jet Propulsion Laboratory*
LOCATION *Northeast Corner of Building 11*
GEOLOGIST *Bill Robin*
DRILLING CO *Beylik*
DATE (start/finish) *02/26/94 - 02/27/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approx. 1121 ft.*
TOTAL DEPTH (ft) *77.0*
DEPTH TO WATER (ft) *25.7 ft*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
20									SP	Decreasing coarse sand and increasing fine sand.
21										Attempted to collect soil sample between 23 and 24 feet, no recovery.
22										POORLY GRADED SAND 60% fine sand, 30% medium sand, 10% fine subangular to subrounded gravel, trace coarse angular to subangular sand, maximum size fine gravel; light brown, dry.
23		No Recovery		NA		D				
24									GP	BOULDERS AND COBBLES Fine to coarse subangular to subrounded gravel.
25										
26						▽				Encountered groundwater at approximately 25.7 feet. (Depth to water measured at 13:56 on 2/26/94).
27									SP	
28										POORLY GRADED SAND 70% fine sand, 20% medium sand, 10% fine subangular to subrounded gravel, trace coarse angular to subangular sand, maximum size fine gravel; light grayish brown, wet; abundant biotite.
29		Soil-4		NA	0	W				
		Soil-5		NA	0	W				
30	0.010-inch Slot Size, 4-inch Stainless Steel Screen									Collected soil samples "SOIL-4" and "SOIL-5" from 28.5 to 29.0 feet and 29.0 to 29.5 feet, respectively.
31										
32										POORLY GRADED SAND 55% fine sand, 40% medium sand, 5% coarse angular to subangular sand, trace fine angular to subangular gravel, trace fines (nonplastic); light brown, wet.
33										
34										Boulder at 34 feet.
35										
36										POORLY GRADED SAND 75% medium subangular to subrounded sand, 20% coarse subangular to subrounded sand, 5% fine sand, trace fine gravel; maximum size fine gravel; light brown, wet.
37										
38										As above but with trace coarse subangular to subrounded gravel.
39										
40										

No. 2/16 Lonestar Sand

FOSTER WHEELER ENVIRONMENTAL CORPORATION

MW-15

PROJECT *Jet Propulsion Laboratory*
LOCATION *Northeast Corner of Building 11*
GEOLOGIST *Bill Robin*
DRILLING CO *Beylik*
DATE (start/finish) *02/26/94 - 02/27/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approx. 1121 ft.*
TOTAL DEPTH (ft) *77.0*
DEPTH TO WATER (ft) *25.7 ft*

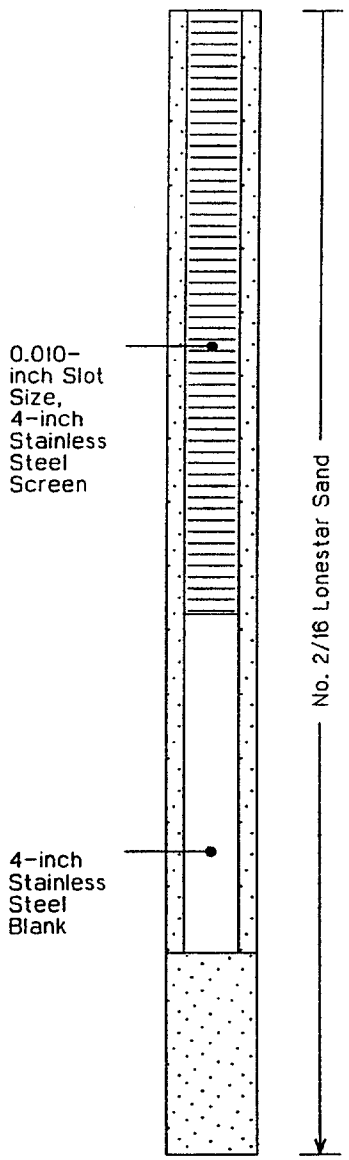
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
40									SP	
41										As above.
42										
43										
44									SW	WELL GRADED SAND WITH GRAVEL 50% fine subangular to subrounded gravel, 30% coarse subangular to subrounded sand, 10% medium sand, 10% fine sand, trace fines (nonplastic), trace coarse subangular to subrounded gravel; maximum size coarse gravel; light brown, wet.
45										
46										Boulder at 46 feet.
47										
48										Collected grab sample of soil cuttings at 46-49 feet.
49										
50	0.010-inch Slot Size, 4-inch Stainless Steel Screen; No. 2/16 Lonestar Sand									
51									SP	
52										POORLY GRADED SAND 70% medium subangular to subrounded sand, 20% coarse subangular to subrounded sand, 10% fine sand, trace fines (nonplastic), trace fine to coarse subrounded to well rouned gravel; maximum size coarse gravel; light brown, wet.
53										
54										
55										POORLY GRADED SAND 45% fine sand, 40% medium sand, 10% coarse subangluar sand, 5% fine to coarse gravel; maximum size coarse gravel; light brown; wet.
56										
57					0	W				
58										
59										
60										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

MW-15

PROJECT *Jet Propulsion Laboratory*
LOCATION *Northeast Corner of Building 11*
GEOLOGIST *Bill Robin*
DRILLING CO *Beylik*
DATE (start/finish) *02/26/94 - 02/27/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approx. 1121 ft*
TOTAL DEPTH (ft) *77.0*
DEPTH TO WATER (ft) *25.7 ft*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
60									SP	
61									SP	POORLY GRADED SAND WITH GRAVEL 40% medium sand, 30% fine angular to subangular gravel, 20% fine sand, 10% coarse angular to subangular sand, trace coarse subrounded gravel, trace fines (nonplastic); maximum size coarse gravel; light brown, wet.
62										
63									SP	
64										
65	0.010-inch Slot Size, 4-inch Stainless Steel Screen									
66										
67										POORLY GRADED SAND 80% fine sand, 20% medium subangular to subrounded sand, trace coarse subangular sand, trace fines (nonplastic); maximum size coarse sand; brown, wet.
68										
69										
70										
71										
72										POORLY GRADED SAND 90% fine sand, 10% medium sand, trace fines (nonplastic); maximum size medium sand; brown, wet.
73	4-inch Stainless Steel Blank									
74										
75										
76					0	W				Collected grab sample of soil cuttings at 76 feet (SC-01).
77										POORLY GRADED SAND 60% fine sand, 30% medium sand, 10% coarse sand, trace fines (nonplastic) trace fine subangular to subrounded gravel; maxiumum size fine gravel; light brown, wet.
78										
79										Bottom of boring at 77 feet.
80										

WELL MW-16

BORING LOG AND WELL COMPLETION DIAGRAM

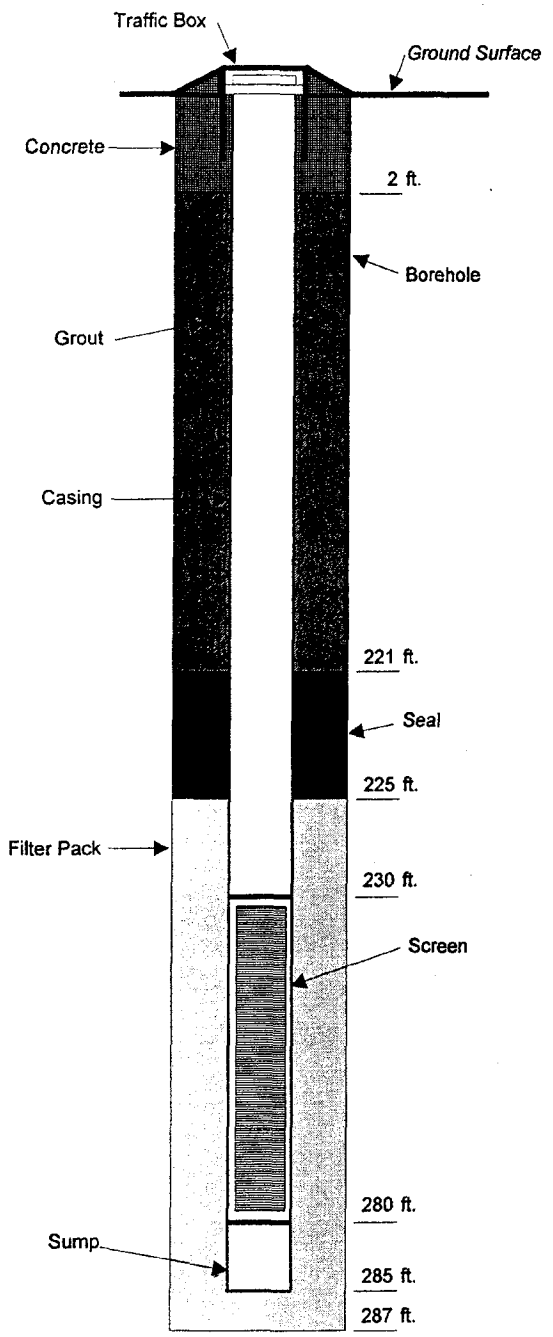
WELL CONSTRUCTION LOG

WELL NUMBER: MW-16

WELL TYPE: Shallow Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1236.66

CASING ELEV (ft. above MSL): 1236.27



DRILLING SUMMARY

DATE COMPLETED:	2/28/94 to 3/19/94
DRILLING COMPANY:	Beylik
DRILLING RIG TYPE:	Air Percussion
TOTAL DEPTH DRILLED:	287 ft.

CONSTRUCTION DETAILS

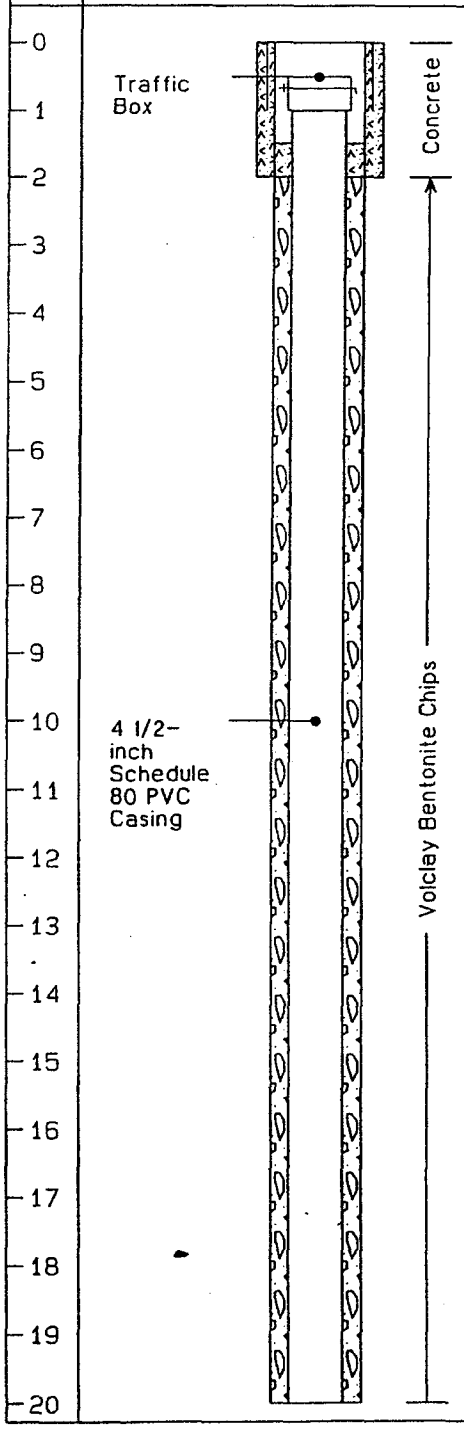
BOREHOLE DIAMETER:	11 in.
TOTAL WELL DEPTH:	285 ft.
BLANK CASING TYPE:	Sch 80 PVC
BLANK CASING DIAMETER:	4.5 in.
TOTAL BLANK CASING LENGTH:	235 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-in.
SCREEN LENGTH:	50 ft.
SUMP LENGTH:	5 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay
SEAL MATERIAL	Bentonite
FILTER MATERIAL:	#2/16 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*



Depth (ft)	Sample No.	Blows/6-in.	OVA (ppm)	Moisture	Consistency	USCS Symbol	Lithologic Description and Notes
0							ASPHALT PAVEMENT (0.25 feet thick)
1						SP	GRAVEL ROADBASE (0.25 ~ 0.50 feet)
2							POORLY GRADED SAND. 90% fine sand, 10% medium subangular to subrounded sand, trace coarse subrounded sand, trace nonplastic fines; maximum size coarse sand; brown, moist.
3							
4							
5							
6							
7							Collected soil sample "SOIL-06" at 9.0 to 9.5 feet.
8							
9	Soil-06	NA	0	M		SM	SILTY SAND. 50% fines, rapid dilatency, low plasticity, low toughness, 30% fine sand, 10% medium sand, 10% coarse subangular sand, trace fine to coarse subangular to subrounded gravel; brown, moist, maximum size coarse gravel.
10							
11						SP	
12							Collected grab sample of soil cuttings at 12 feet "SC-02" (tags 0065 and 0066).
13							
14							POORLY GRADED SAND. 90% fine sand, 10% medium subangular to subrounded sand; maximum size medium sand; brown; moist.
15							
16							
17						SP	POORLY GRADED SAND WITH GRAVEL. 50% fine sand, 20% medium angular to subangular sand, 15% coarse subangular to subrounded sand, 10% fine subrounded gravel, 5% coarse subangular to subrounded gravel; maximum size coarse gravel; trace nonplastic fines; light brown, dry.
18							
19	Soil-07	NA	0	D			Collectd soil sample "SOIL-7" at 19.0 to 19.5 feet.
20							

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
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GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
20									SP	
21										
22									SP	POORLY GRADED SAND. 70% fine sand, 20% medium subangular to well rounded sand, 10% coarse subangular to subrounded sand, trace fine subrounded flat gravel; maximum size fine gravel; light brown, dry.
23										
24										
25										
26										
27										Collected soil sample "SOIL-08" at 28.0 to 28.5 feet.
28		Soil-08		NA	0	D			SW	
29										WELL GRADED SAND WITH GRAVEL 50% fine to coarse subrounded gravel, 25% coarse angular to subangular sand, 15% medium angular to subangular sand, 10% fine sand; maxium size coarse gravel; light brown, dry.
30	4 1/2-inch Schedule 80 PVC Casing									
31										
32										
33										
34										
35									SP	POORLY GRADED SAND WITH SILT. 50% fine 50% fine sand, 25% medium subrounded sand, 15% coarse subangular to subrounded, sand, 10% nonplastic fines, trace fine gravel; maxium size fine gravel; brown; moist.
36										
37										
38										
39										Encountered boulders and cobbles at 39 feet.
40										

Volclay Bentonite Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
40									SP	
41										As above but with abundant fine grained hornblend.
42										
43										Encountered boulders and cobbles at 43 feet.
44										POORLY GRADED SAND. 40% fine sand, 40% medium subangular to subrounded sand, 20% coarse subangular to subrounded sand, trace fine subrounded to well rounded gravel; maximum size fine gravel; light brown, moist; abundant fine to medium hornblend.
45										
46										
47									SP	POORLY GRADED SAND WITH GRAVEL 30% fine subrounded gravel, 40% medium subrounded sand, 20% fine sand, 10% coarse subangular to subrounded sand, trace coarse subrounded gravel, trace nonplastic fines; maximum size coarse gravel; brown, moist.
48										
49										
50	4 1/2-inch Schedule 80 PVC Casing									
51										
52										Collected grab sample of soil cuttings between 48 and 52 feet "SC-02" (tags 0077 and 0078).
53									SP	
54										
55										POORLY GRADED SAND. 50% fine sand, 35% medium subangular to subrounded sand, 10% coarse subangular to subrounded sand, 5% nonplastic fines; maximum size coarse sand; brown; moist.
56										
57										
58										
59										
60										

Volclay Bentonite Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

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TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
60									SP	
61										
62										As above.
63										As above but with abundant fine to medium hornblend.
64									GP	BOULDERS AND COBBLES. With 25% coarse subangular sand.
65										
66									SP	
67										
68					1					POORLY GRADED SAND. 70% fine sand, 30% medium angular to subangular sand, trace coarse subangular sand; maximum size coarse sand; trace fine to coarse subangular to subrounded gravel; brown, moist; abundant fine hornblend.
69										
70	4 1/2-inch Schedule 80 PVC Casing									
71										
72					2					As above.
73										
74									SM	SILTY SAND. 80% fine sand; 20% fines, rapid dilatency, medium plasticity, low toughness; trace coarse subangular sand, trace fine to coarse subrounded gravel; brown, moist; (heaving sands noted during drilling).
75										
76										
77										
78										
79										
80										As above but with 10% medium subangular to subrounded sand.

Volclay Bentonite Chips

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Monitoring Well 16

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GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1296 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
80									SM	
81										
82										
83										
84										As above.
85										
86										
87										
88										
89									SP	POORLY GRADED SAND. 100% fine sand, trace nonplastic fines, trace coarse subrounded to well rounded sand; maximum size coarse sand; brown, moist.
90	4 1/2-inch Schedule 80 PVC Casing; Volclay Bentonite Chips				1					
91										
92										
93										
94										POORLY GRADED SAND. 95% fine sand, 5% medium subrounded sand, trace coarse sand; maximum size coarse sand; light brown, moist.
95										
96										POORLY GRADED SAND. 60% fine sand, 20% medium subangular to subrounded sand, 10% coarse angular to subangular sand, 10% fine subrounded gravel, trace coarse subangular gravel; maximum size coarse gravel; light grayish brown; moist.
97										
98										
99										
100										

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Monitoring Well 16

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DATE (start/finish) *02/28/94 - 03/19/94*

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SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100									SP	
101										
102										Encountered cobbles at 102 feet.
103										
104										POORLY GRADED SAND. 65% fine sand, 30% medium subrounded sand, 5% coase subangular to subrounded sand, trace fine subrounded gravel; maximum size fine gravel; grayish brown.
105										
106										Collected grab sample of soil cuttings "SC-02" between 106 and 108 feet (tags 0079 and 0080).
107										As above.
108										Encountered cobbles at 108.5 feet.
109										
110	4 1/2-inch Schedule 80 PVC Casing									POORLY GRADED SAND. 50% medium subangular to subrounded sand, 45% fine sand, 5% coarse subangular to subrounded sand, trace fine to coarse subrounded gravel; maximum size coarse gravel; grayish brown, moist.
111										
112	Volclay Bentonite Chips									
113									SM	SILTY SAND. 75% fine sand, 15% fines, 10% medium subangular sand, fines have slow dilatency, medium plasticity, low to medium toughness, low dry strength; maximum size medium sand; brown, moist.
114										
115										
116										As above but with trace coarse angular sand.
117										
118									SM	SILTY SAND. 70% fine sand, 30% fines, fines have rapid dilatency, medium plasticity, low toughness; brown; moist.
119										
120										

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SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
120									SM	SILTY SAND. 40% medium subangular sand, 40% fine sand, 20% fines, trace coarse subangular to subrounded sand, trace fine subrounded gravel; maximum size fine gravel; brown; dry.
121										
122										
123										
124										
125									SP	POORLY GRADED SAND. 70% fine sand, 20% medium subangular to subrounded sand, 10% coarse subangular to subrounded sand, trace fine subangular flat gravel, trace nonplastic fines; maximum size fine gravel; brown, dry.
126										
127										
128										As above but incease in fine to coarse subangular flat gravel.
129										
130	4 1/2-inch Schedule 80 PVC Casing; Voiclay Bentonite Chips									POORLY GRADED SAND. 50% medium sand, 30% fine sand, 10% angular to subrounded coarse sand, 10% fine to coarse subangular to subrounded gravel, trace nonplastic fines; maximum size coarse gravel; gravel is flat to flat and elongated; light brown, dry.
131										
132										POORLY GRADED SAND 50% fine sand, 45% medium subangular to subrounded sand, 5% coarse subangular to subrounded sand; maximum size coarse sand; light brown, dry.
133										
134										
135										As above but with trace fine subrounded gravel.
136										Encountered cobbles at 136 feet.
137										As above.
138									GP	POORLY GRADED GRAVEL WITH SAND 60% fine subrounded gravel; 10% coarse subrounded gravel, 30% coarse subangular to subrounded sand, trace fine sand; maximum size coarse gravel; light brown, dry.
139										
140										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

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LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
140									GP	As above.
141										
142									SP	
143										POORLY GRADED SAND. 60% medium subangular to subrounded sand, 20% fine sand, 20% coarse angular to subrounded sand, trace fine subrounded gravel; maximum size fine gravel; light brown, dry.
144										
145										
146										POORLY GRADED SAND. 50% fine sand, 40% medium subangular sand, 10% coarse sand; trace nonplastic fines; maximum size coarse sand; light brown, dry.
147										
148									GP	POORLY GRADED GRAVEL. 60% fine subangular to subrounded gravel, 15% coarse subangular to subrounded gravel, 20% coarse subangular to subrounded sand, 5% medium sand, trace fine sand; maximum size coarse gravel; light brown, dry.
149										
150	4 1/2-inch Schedule 80 PVC Casing									
151									SP	POORLY GRADED SAND. 80% medium subangular to subrounded sand, 20% fine sand, trace coarse subangular to subrounded sand, trace fine subrounded gravel; maximum size fine gravel; trace nonplastic fines; light brown, dry.
152										
153										Encountered gravel at 153 feet.
154										POORLY GRADED SAND. 75% fine sand, 20% medium angular to subrounded sand, 5% coarse angular sand, trace fine gravel; maximum size fine gravel; light brown, dry.
155										
156									SW	Encountered cobbles at 156 feet.
157										WELL GRADED SAND. 40% coarse angluar to subangular sand, 30% medium angular to subangular sand, 20% fine sand, 10% fine subangular to subrounded gravel, trace coarse subrounded gravel, trace nonplastic fines; maximum size coarse gravel; light brown, dry.
158										
159										Collected grab sample of soil cuttings "SC-02" between 154 and 156 feet.
160									SP	

Volclay Bentonite Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
160									SP	POORLY GRADED SAND. 35% medium subangular to subrounded sand, 30% fine sand, 20% coarse subrounded sand, 10% fine to coarse subrounded gravel, 5% nonplastic fines; maximum size coarse gravel; brown, moist.
161										
162										
163										
164										As above but with trace fine to coarse gravel.
165										
166										
167										
168									GW	WELL GRADED GRAVEL WITH SAND, COBBLES AND BOULDERS. 40% coarse subangular to subrounded gravel, 30% fine subangular to subrounded gravel, 20% coarse subangular sand, 5% medium subangular sand, trace fine sand; abundant coarse to medium grained white plagioclase; light gray brown, dry.
169										
170	4 1/2-inch Schedule 80 PVC Casing									
171										
172										
173										As above.
174										
175									SP	POORLY GRADED SAND. 80% coarse subangular to subrounded sand, 20% medium subangular to subrounded sand, trace fine angular to subangular gravel; maximum size fine gravel; light gray brown, moist; abundant k-feldspar and plagioclase as coarse and medium sand.
176										
177										
178										WELL GRADED GRAVEL WITH SAND 50% coarse subangular to subrounded gravel, 30% fine subangular to subrounded gravel, 20% coarse subangular to subrounded sand, trace medium sand; maximum size coarse gravel; light gray brown, dry.
179									GW	
180									SP	

Volclay Bentonite Chips

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

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SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
180									SP	POORLY GRADED SAND WITH GRAVEL 80% fine to coarse sand, 20% fine gravel.
181									GP	POORLY GRADED GRAVEL WITH SAND 60% fine angular to subrounded gravel, 10% coarse subangular to subrounded flat gravel, 30% coarse subangular to subrounded sand, trace medium sand, trace nonplastic fines; maximum size coarse gravel; light brown, dry; abundant k-feldspar and plagioclase.
182									SP	
183									SP SM	
184										POORLY GRADED SAND. 40% coarse subangular to subrounded sand, 40% fine sand, 10% medium sand, 10% fine angular to well rounded gravel, trace coarse subangular to subrounded gravel, trace nonplastic fines; maximum size coarse gravel; light gray brown, dry; abundant hornblend as fine and medium sand, abundant k-feldspar and plagioclase as coarse sand and fine gravel.
185										
186										
187										
188										POORLY GRADED SAND WITH SILT Approximately 80% fine to medium, poorly graded subangular sand; approximately 10-15% nonplastic fines, approximately 5-10% fine to coarse subangular gravel; brown; slightly moist.
189										
190	4 1/2-inch Schedule 80 PVC Casing									
191	Volclay Bentonite Chips									
192										
193									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL. Approximately 75-80% fine to medium poorly graded subangular to angular sand, approximately 5-10% nonplastic fines, 15-20% fine to medium subangular gravel; light brown, moist; no odor; trace cobbles.
194										
195										
196										Difficult drilling, encountered a large boulder from 196 to 202 feet.
197										
198										
199										Collected grab sample of cuttings "SC-02" at 200 feet.
200										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
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DATE (start/finish) *02/28/94 - 03/19/94*

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TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
200									SP SM	As above.
201										
202										
203									SP SM	
204										
205	4 1/2-inch Schedule 80 PVC Casing									POORLY GRADED SAND WITH SILT Approximately 85% fine to medium poorly graded subangular sand; approximately 15% nonplastic fines; trace gravel; no odor.
206										
207										
208	Volclay Bentonite Chips									Encountered cobbles from 207 to 209 feet. Difficult drilling.
209										
210										
211										
212										As above.
213									SP SM	
214										POORLY GRADED SAND WITH SILT AND GRAVEL. Approximately 80% fine to medium poorly graded subangular sand; approximately 15% nonplastic fines; approximately 5% fine to medium subangular to angular gravel; brown, no odor, slightly moist.
215	4-inch Stainless Steel Blank									
216										
217										
218										
219										As above.
220										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
220									SP SM	As above.
221										
222										
223										
224									SP SM	
225	4-inch Stainless Steel Blank									POORLY GRADED SAND WITH SILT AND GRAVEL. Approximately 25% fine, 30% medium, 30% coarse sand, poorly graded, subrounded, subangular to angular; 10-15% nonplastic fines; trace to 5% fine subangular to angular gravel; dry, no odor.
226										
227										
228										
229										Difficult drilling between 229 and 231 feet. Granitic rock chips in cuttings.
230										
231										
232										
233										
234						▽				Encountered groundwater at 234 feet.
235	0.010-inch Slot Size, 4-inch Stainless Steel Screen									
236										
237										
238										As above - difficult drilling, granitic rock chips in cuttings.
239										
240										

Volclay Bentonite Chips

Bentonite Pellets

No 2/16 Lonestar Sand

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
240									SP SM	As above.
241										
242										Difficult drilling, granitic rock chips in cuttings
243										
244									SM	SILTY SAND. Approximately 75% fine to coarse poorly graded and subrounded sand; approximately 20-25% fines with low plasticity, low toughness; approximately 5% to trace fine to medium subangular to subrounded gravel; brown, wet.
245										
246										
247										
248										
249										
250	0.010 -inch Slot Size, 4-inch Stainless Steel Screen; No 2/16 Lonestar Sand									As above. Collected grab sample of soil cuttings ("SC-02") at 250 feet.
251										
252										
253									SP SM	
254										POORLY GRADED SAND WITH SILT AND GRAVEL. Approximately 75% fine to coarse, poorly graded subangular sand; approximately 10% nonplastic fines; approximately 15% fine gravel. Difficult drilling.
255										
256										
257										
258										Encountered a boulder at 258 to 259 feet.
259										
260										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
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GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

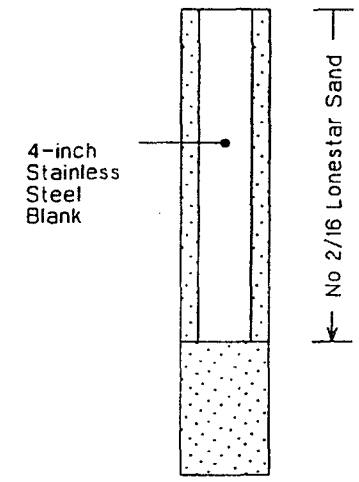
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
260									SP SM	As above.
261										
262										
263										
264										
265										
266									GP GM	POORLY GRADED GRAVEL WITH SILT AND SAND. Approximately 30% medium to coarse subrounded and poorly graded sand, approximately 10% nonplastic fines, appoximately 60% fine to coarse subangular to subrounded gravel; light brown.
267										
268										
269										
270	0.010-inch Slot Size, 4-inch Stainless Steel Screen									Difficult drilling, granitic rock chips in soil cuttings.
271	No 2/16 Lonestar Sand									
272										
273										
274										
275										
276										
277										As above.
278										Collected grab sample of soil cuttings ("SC-02") at 278 feet.
279										
280										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 16

PROJECT *Jet Propulsion Laboratory*
LOCATION *North of Building 138*
GEOLOGIST *Bill Robin / Sara Arav*
DRILLING CO *Beylik*
DATE (start/finish) *02/28/94 - 03/19/94*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2 1/2" x 24" Split Spoon Sampler*
SURFACE ELEVATION *Approximately 1236 feet.*
TOTAL DEPTH (ft) *287*
DEPTH TO WATER (ft) *234*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
280									GP GM	As Above.
281										
282										
283										
284										
285										
286										
287										Total depth of boring: 287 feet.
288										
289										
290										
291										
292										
293										
294										
295										
296										
297										
298										
299										
300										

WELL MW-17

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

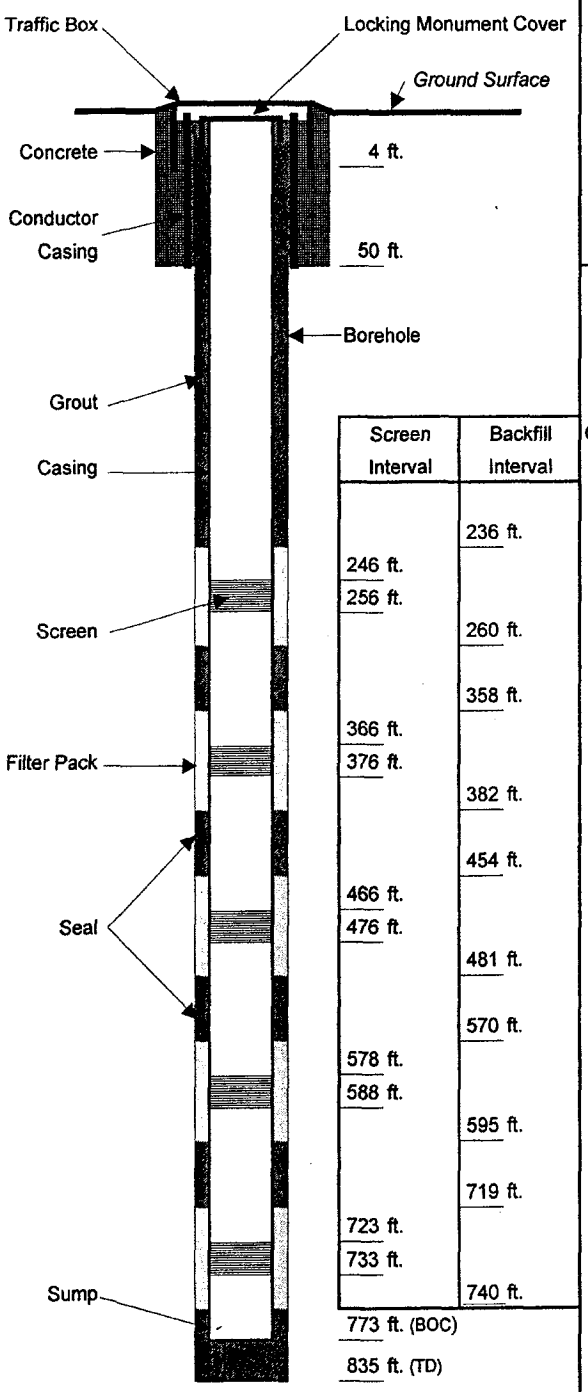
WELL CONSTRUCTION LOG

WELL NUMBER: MW-17

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1191.65

CASING ELEV (ft. above MSL): 1190.99



Screen Interval	Backfill Interval
	236 ft.
246 ft.	
256 ft.	
	260 ft.
	358 ft.
366 ft.	
376 ft.	
	382 ft.
	454 ft.
466 ft.	
476 ft.	
	481 ft.
	570 ft.
578 ft.	
588 ft.	
	595 ft.
	719 ft.
723 ft.	
733 ft.	
	740 ft.

DRILLING SUMMARY

DATE COMPLETED:	3/28/95 to 4/7/95
DRILLING COMPANY:	Lang Exploratory Drilling
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	835 ft.

CONSTRUCTION DETAILS

BOREHOLE DIAMETER: (CONDUCTOR CASING)	15.75 in.
CONDUCTOR CASING DIAMETER:	14 in.
CONDUCTOR CASING LENGTH:	50 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	773 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	723 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010-inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL:	1:1 Bentonite & Sand mix
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0	Traffic Box									ASPHALT - Pavement (0.4 feet thick)
										Backfill (0.4-2.0 feet thick)
									SW	WELL GRADED SAND: Light brown; 100% fine to medium grained sand, subrounded.
5										
									SM	SILTY SAND: Brown; Approximately 85% fine to medium sand; 15% non-plastic fines.
									SP	
10				0.0	D	N	0.0		SM	POORLY GRADED SAND WITH GRAVEL: Brown; 80% fine to medium grained sand; 20% fine gravel, subrounded.
				0.0	D	N	0.0		GP	
									SM	SILTY SAND: Dark Brown; Approximately 85% fine to medium grained sand, angular; 15% non-plastic fines.
15										POORLY GRADED GRAVEL WITH SAND: light brown; 85% coarse gravel, rounded; 15% fine to medium grained sand.
20					D	N	0.0			SILTY SAND: 85% fine to coarse grained sand, subrounded; 15% non-plastic fines.
25	14-inch Low Carbon Conductor Casing									
30	Concrete outside 14-inch casing Volclay Grout inside 14-inch casing									
35										
40					D	N	0.0			
45										BOULDER (46.5 to 48 feet bgs) appears to be granitic in origin
										SILTY SAND: 85% fine to coarse grained sand, subrounded; 15% non-plastic fines.
									SM	
50										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
50		SC-501-01	X	0.0	D	N	0.0		SM	SILTY SAND WITH GRAVEL: 60% coarse sand, angular to subrounded; 25% non-plastic fines; 15% fine gravel, angular to subrounded.
55										POORLY GRADED GRAVEL WITH SAND: 55% coarse gravel, subangular to angular; 40% fine to coarse sand; 5% non-plastic fines.
60						N	0.0			SILTY SAND WITH GRAVEL: 60% medium to coarse grained sand,subangular to subrounded; 20% non-plastic fines; 20% fine to coarse gravel, subangular to subrounded.
									GP	
									SM	COBBLE ZONE (66.5 to 67.5 feet bgs)
65										POORLY GRADED SAND WITH SILT AND GRAVEL: 70% medium sand, 20% fine 10% non-plastic fines
										POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 30% fine to coarse sand; <5% non-plastic fines.
									SP SM	
70									GP	
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 65% fine to coarse sand; 25% fine gravel; 10% non-plastic fines.
									GM	SILTY GRAVEL WITH SAND: 65% fine to coarse gravel; 20% fine to coarse sand; 15% non-plastic fines.
75	4-inch Low Carbon Blank								SP SM	
									GP	
									SP	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% fine to coarse sand; 20% fine gravel; 10% non-plastic fines.
80						N	0.0			POORLY GRADED GRAVEL WITH SAND: 70% fine to coarse gravel; 30% fine to coarse sand; trace non-plastic fines.
									SP SM	POORLY GRADED SAND WITH GRAVEL: 60% fine to coarse sand; 40% fine gravel; trace non-plastic fines.
85									GP GM	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% medium to coarse sand; 20% fine to coarse gravel; 10% non-plastic fines.
90									SP SM	POORLY GRADED GRAVEL WITH SILT AND SAND: 50% fine to coarse gravel; 40% fine to coarse sand; 10% non-plastic fines.
									SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% fine to coarse sand; 20% fine gravel; 10% non-plastic fines.
95										SILTY SAND: 70% fine to coarse sand; 20% non-plastic fines; 10% fine gravel.
100										

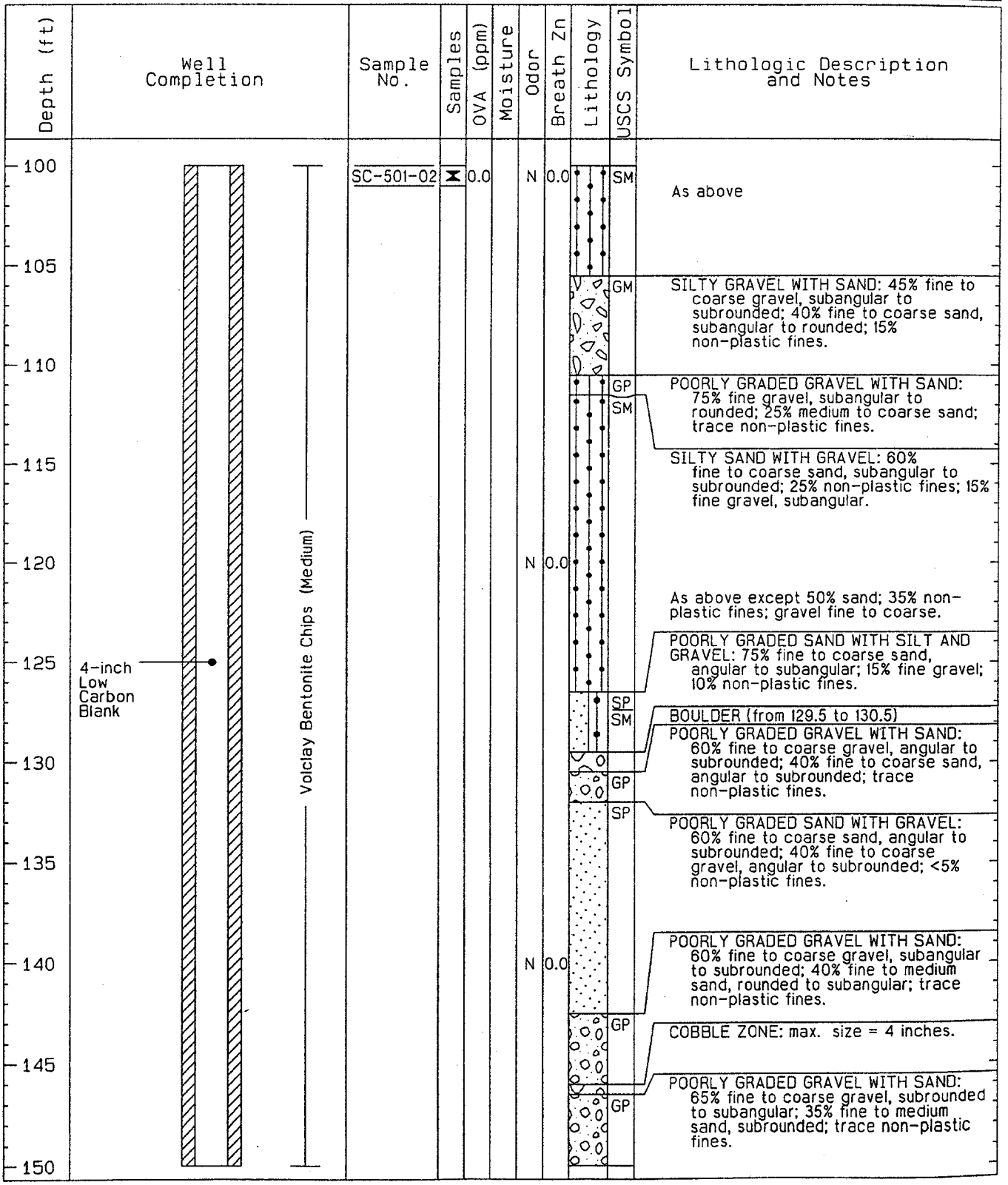
Voiclay Bentonite Chips (Medium)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*



FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
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DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
150									GP	
155										As above
160						N	0.0			
										BOULDER (from 162.0 to 164.5 ft bgs)
165									SP	POORLY GRADED SAND WITH GRAVEL: 70% medium to coarse sand, angular to rounded; 30% fine to coarse gravel, subangular to subrounded; trace non-plastic fines.
									GP	POORLY GRADED GRAVEL: 100% coarse gravel, subrounded to subangular; 15% cobbles by volume.
170										POORLY GRADED GRAVEL WITH SAND: 70% fine to coarse gravel, rounded to subangular; 30% medium to coarse sand, subangular to rounded; trace non-plastic fines; trace cobbles and boulders.
175	4-inch Low Carbon Blank; Volclay Bentonite Chips (Medium)									POORLY GRADED GRAVEL: 100% fine gravel, rounded to subangular; trace cobbles (dioritic).
180						N	0.0			POORLY GRADED GRAVEL WITH SAND: 80% fine to coarse gravel; 20% medium to coarse sand; <5% non-plastic fines; trace cobbles and boulders.
185										BOULDER (from 184.5 to 185.5)
									GP	As above
190										
195										
200										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

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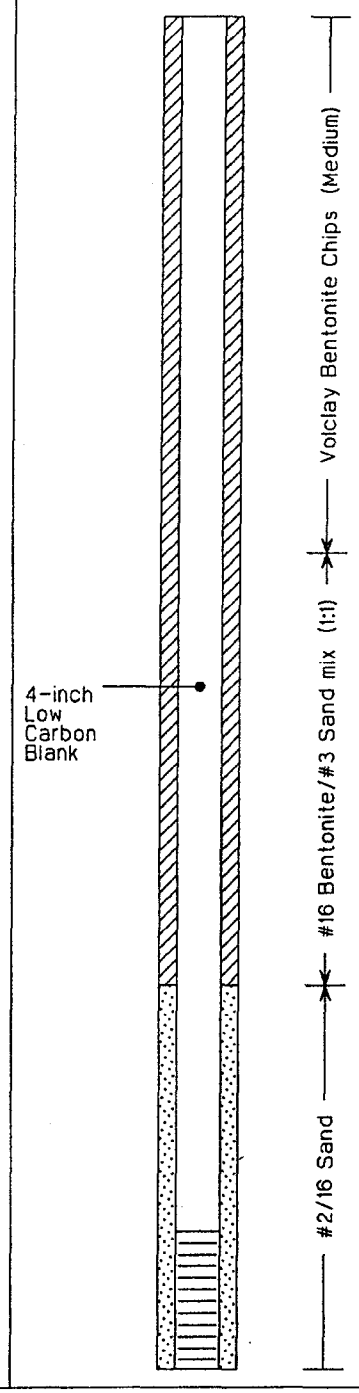
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
200	SC-503-01	⧗	0.0		N	0.0		GP	
205									As above except gravel is fine.
210									As above except gravel is fine to coarse.
215									
220					N	0.0			
225									As above except gravel is fine.
230									As above except 70% fine to coarse gravel and 30% sand.
235									As above except 80% gravel; 20% sand.
240					N	0.0			
245									BOULDER (from 245 to 246 ft bgs)
								GP	POORLY GRADED GRAVEL: 90% coarse gravel; 10% coarse sand, subrounded to subangular; trace cobbles and boulders; gravel is highly oxidized to reddish yellow color.
250									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

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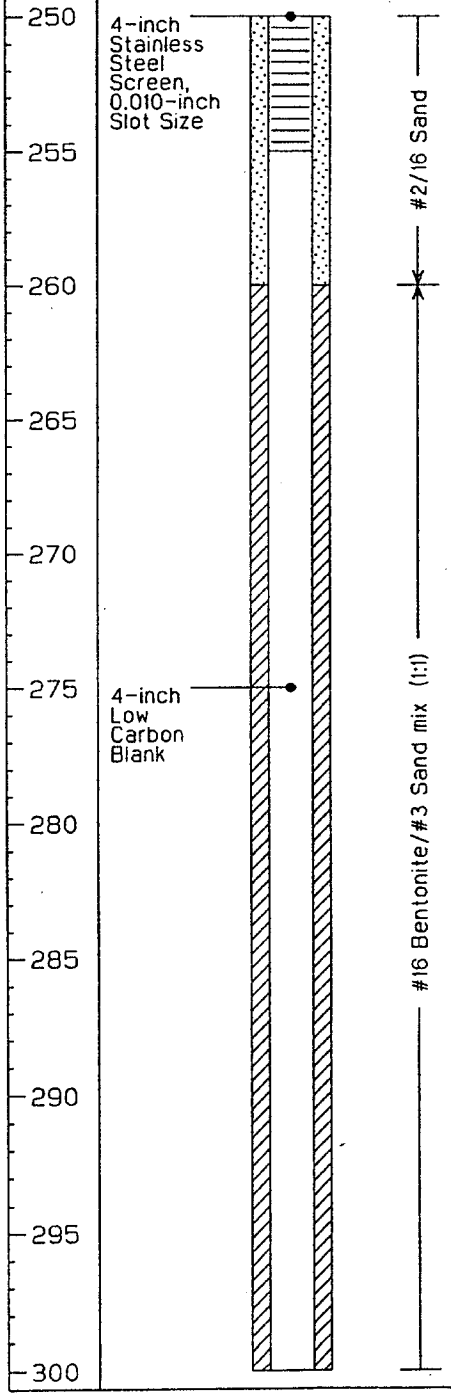
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
250								GP	As above except 85% gravel and 15% sand
									As above except 90% gravel and 10% sand
255								SM	SANDY SILT WITH GRAVEL:60% non-plastic fines; 20% coarse gravel; gravel; 20% coarse sand.
								SP	
								GP	POORLY GRADED SAND WITH GRAVEL: 85% medium to coarse sand; 15% fine gravel.
260					N	0.0		SM	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 35% medium to coarse sand.
								SP	
								SM	SILTY SAND WITH GRAVEL: 65% fine to medium sand; 20% non-plastic fines; 15% fine gravel.
265								ML	POORLY GRADED SAND WITH GRAVEL: 75% fine sand; 25% fine gravel.
270								SM	SILTY SAND WITH GRAVEL: 60% fine to coarse sand; 20% non-plastic fines; 20% fine gravel.
									SANDY SILT WITH GRAVEL: 60% non-plastic fines; 20% fine to to coarse sand; 20% fine gravel.
275								SP	SILTY SAND WITH GRAVEL: 60% medium to coarse sand; 25% non-plastic fines; 20% fine gravel.
								SM	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 20% fine gravel; <5% non-plastic fines.
280					N	0.0		SP	SILTY SAND WITH GRAVEL: 60% medium to coarse sand; 25% non-plastic fines; 15% fine gravel.
285									POORLY GRADED SAND WITH GRAVEL: 60% coarse sand; 40% fine gravel.
								GP	POORLY GRADED GRAVEL WITH SAND:70% fine to coarse gravel; 25% medium to coarse sand; <5% non- plastic fines.
290								SM	SILTY SAND WITH GRAVEL: 60% medium to coarse sand; 25% non-plastic fines; 15% fine to coarse gravel.
								GP	POORLY GRADED GRAVEL WITH SAND: 60% fine to coarse gravel; 40% medium to coarse sand; <5% non- plastic fines.
295								SM	SILTY SAND WITH GRAVEL: 45% fine to medium sand; 40% non-plastic fines; 15% fine gravel.
300									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
300		SC-503-02	⧗	0.0		N	0.0		SM	POORLY GRADED SAND WITH GRAVEL: 75% medium sand; 25% fine gravel.
305									SP	SILTY SAND WITH GRAVEL: 60% medium to coarse sand; 25% non-plastic fines; 15% fine to coarse gravel.
									SM	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 35% medium to coarse sand; trace non-plastic fines.
310									GP	SILTY SAND WITH GRAVEL: 55% fine to medium sand; 30% non-plastic fines; 15% fine to coarse gravel.
315									SM	SILTY GRAVEL WITH SAND: 60% fine to coarse gravel; 20% fine to coarse sand; 20% non-plastic fines.
									GM	SILTY SAND WITH GRAVEL: 45% fine to medium sand; 40% non-plastic fines; 15% fine to coarse gravel.
									SM	
320						N	0.0			POORLY GRADED GRAVEL WITH SAND: 55% coarse gravel; 40% fine to coarse sand; <5% non-plastic fines; trace cobbles.
									GP	SILTY SAND WITH GRAVEL: 45% fine to coarse sand; 40% non-plastic fines; 15% fine gravel.
325	4-inch Low Carbon Blank								SM	POORLY GRADED GRAVEL WITH SAND: 70% fine gravel; 25% medium to coarse sand; <5% non-plastic fines; trace cobbles.
330									GP	
									SM	SILTY SAND WITH GRAVEL: 60% fine to coarse sand; 25% non-plastic fines; 15% fine gravel.
335										POORLY GRADED SAND WITH GRAVEL: 70% medium to coarse sand; 25% fine to coarse gravel; <5% non-plastic fines.
									SP	SILTY SAND: 60% fine to medium sand; 40% non-plastic fines.
340						N	0.0		SM	SILTY SAND WITH GRAVEL: 50% fine to coarse sand; 35% non-plastic fines; 15% fine to coarse gravel.
345										POORLY GRADED SAND WITH GRAVEL: 65% coarse sand; 30% fine to coarse gravel; <5% non-plastic fines.
									SP	
									SM	SILTY SAND: 55% fine to medium sand; 40% non-plastic fines; <5% fine to coarse gravel.
350										

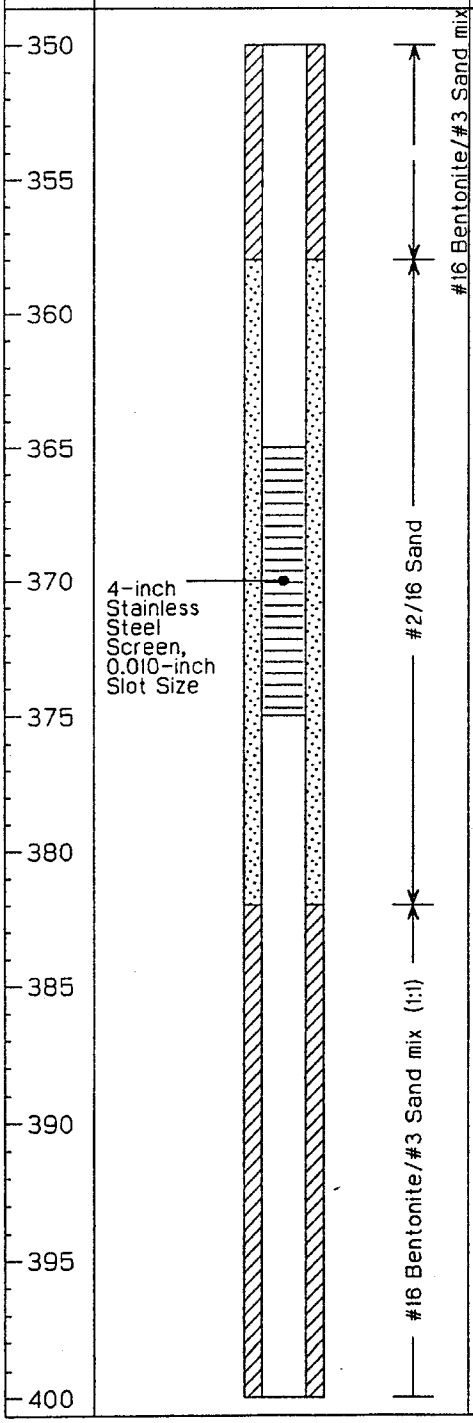
#16 Bentonite/#3 Sand mix (1:1)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
350								SM, SP, SM	SILTY SAND WITH GRAVEL: 65% fine to coarse sand; 20% non-plastic fines; 15% fine to coarse gravel.
355								GP, GM	POORLY GRADED SAND WITH SILT AND GRAVEL: 60% medium to coarse sand, subrounded; 30% fine to coarse gravel, subrounded; 10% non-plastic fines; trace cobbles.
360					N	0.0		SM	POORLY GRADED GRAVEL WITH SILT AND SAND: 65% fine to coarse gravel, subrounded; 25% fine to medium sand, subrounded; 10% non-plastic fines.
								GP	SILTY SAND WITH GRAVEL: 50% fine to coarse sand, subrounded; 35% non-plastic fines; 15% fine to coarse gravel, subrounded.
365									POORLY GRADED GRAVEL WITH SAND: 75% fine to coarse gravel, subrounded; 20% medium to coarse sand, subrounded; <5% non-plastic fines; trace cobbles and boulders.
370									
375									
380					N	0.0			
385									
390									
395									
								SP	POORLY GRADED SAND WITH GRAVEL: 85% medium to coarse sand, subrounded; 15% fine to coarse gravel.
400									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

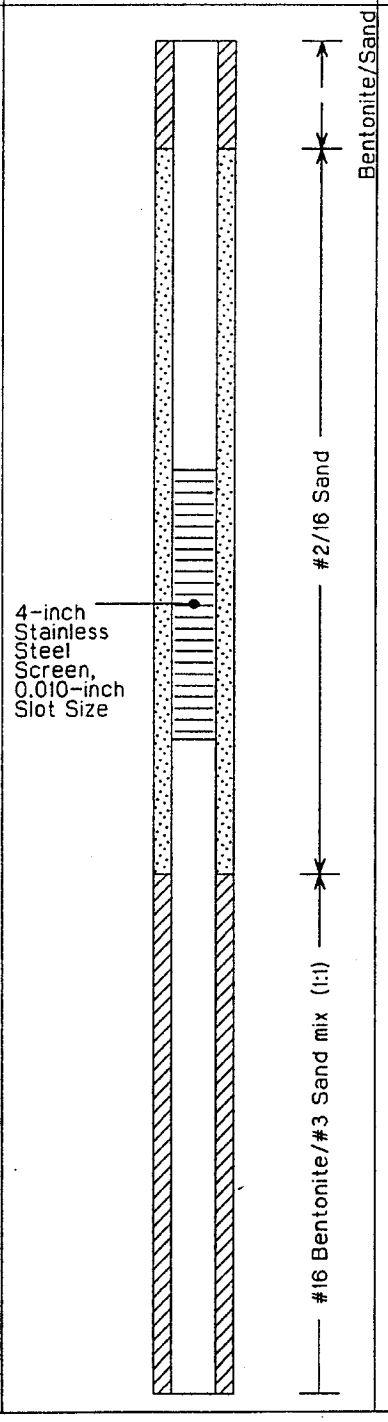
Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
400		SC-505-01	⧗	0.0		N	0.0		SP	
405									GP / GM	POORLY GRADED GRAVEL WITH SILT AND SAND: 55% fine gravel, subrounded; 35% medium to coarse sand; 10% non-plastic fines.
410									SP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand, subrounded; 25% fine gravel, subrounded.
415									GP	POORLY GRADED GRAVEL WITH SAND: 75% fine to coarse gravel, subrounded; 25% coarse sand, subrounded; trace non- plastic fines.
420						N	0.0		SM	SILTY SAND: 60% fine to coarse sand; 40% non-plastic fines;
425	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)									SILTY SAND WITH GRAVEL: 50% fine to coarse sand, subrounded; 30% non-plastic fines; 20% fine gravel, subrounded.
430										As above except 70% sand, 15% gravel, and 15% non-plastic fines.
										As above except 50% sand, 30% non-plastic fines, and 20% gravel.
435									SP / SM	POORLY GRADED SAND WITH GRAVEL: 75% fine to coarse sand; 25% fine to coarse gravel, subrounded.
										SILTY SAND WITH GRAVEL: 50% fine to medium sand; 30% non-plastic fines; 20% fine to coarse gravel.
440						N	0.0		GP	POORLY GRADED GRAVEL WITH SAND: 55% fine to coarse gravel; 40% fine to medium sand; <5% non-plastic fines.
445									SM	SILTY SAND WITH GRAVEL: 45% fine to medium sand, subrounded; 40% non-plastic fines; 15% fine to coarse gravel.
450									GP	POORLY GRADED GRAVEL WITH SAND: 75% coarse gravel, subrounded; 40% fine to coarse sand; <5% non-plastic fines; trace cobbles.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT: Jet Propulsion Laboratory
LOCATION: Corner of El Nido and Harriet
GEOLOGIST: T. Blaney
DRILLING CO: Lang Exploratory
DATE (start/finish): 03/28/95 - 04/07/95

DRILLING METHOD: Reverse Circulation Mud Rotary
SAMPLING METHOD: Grab Sample from Shaker Screen
SURFACE ELEVATION: 1191.2
TOTAL DEPTH (ft): 835
APPROX. DEPTH TO WATER (ft bgs): 175.6



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
450								GP	
								SM	SILTY SAND WITH GRAVEL: 55% fine to coarse sand, subrounded; 30% non-plastic fines; 15% fine to coarse gravel, subrounded.
455									As above except 70% sand, 15% gravel, and 15% non-plastic fines.
								ML	SANDY SILT WITH GRAVEL: 60% non-plastic fines; 25% fine to coarse sand, subrounded; 15% fine gravel.
460					N	0.0		SP	
								SM	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 20% fine gravel, subrounded; <5% non- plastic fines.
465									SILTY SAND WITH GRAVEL: 65% fine to coarse sand; 20% non-plastic fines; 15% fine to coarse gravel.
								SP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand, subrounded; 25% fine gravel, subrounded; trace cobbles.
470									
475								SM	SILTY SAND WITH GRAVEL: 65% fine to coarse sand; 20% non-plastic fines; 15% fine to coarse gravel.
480					N	0.0		ML	SANDY SILT: 75% non-plastic fines; 25% fine to coarse sand, subrounded.
								SM	SILTY SAND WITH GRAVEL: 50% fine to medium sand; 35% non-plastic fines; 15% fine to coarse gravel.
485								ML	SANDY SILT: 75% non-plastic fines; 25% fine to medium sand, subrounded.
490									SILT: Reddish brown; 95% non-plastic fines; 5% fine sand.
495								SM	SILTY SAND: 55% fine to medium sand, subrounded; 45% non-plastic fines; trace gravel.
								GP	POORLY GRADED GRAVEL WITH SAND: 80% fine to coarse gravel; 20% fine to medium sand, subrounded.
500									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
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DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
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SURFACE ELEVATION *1191.2*
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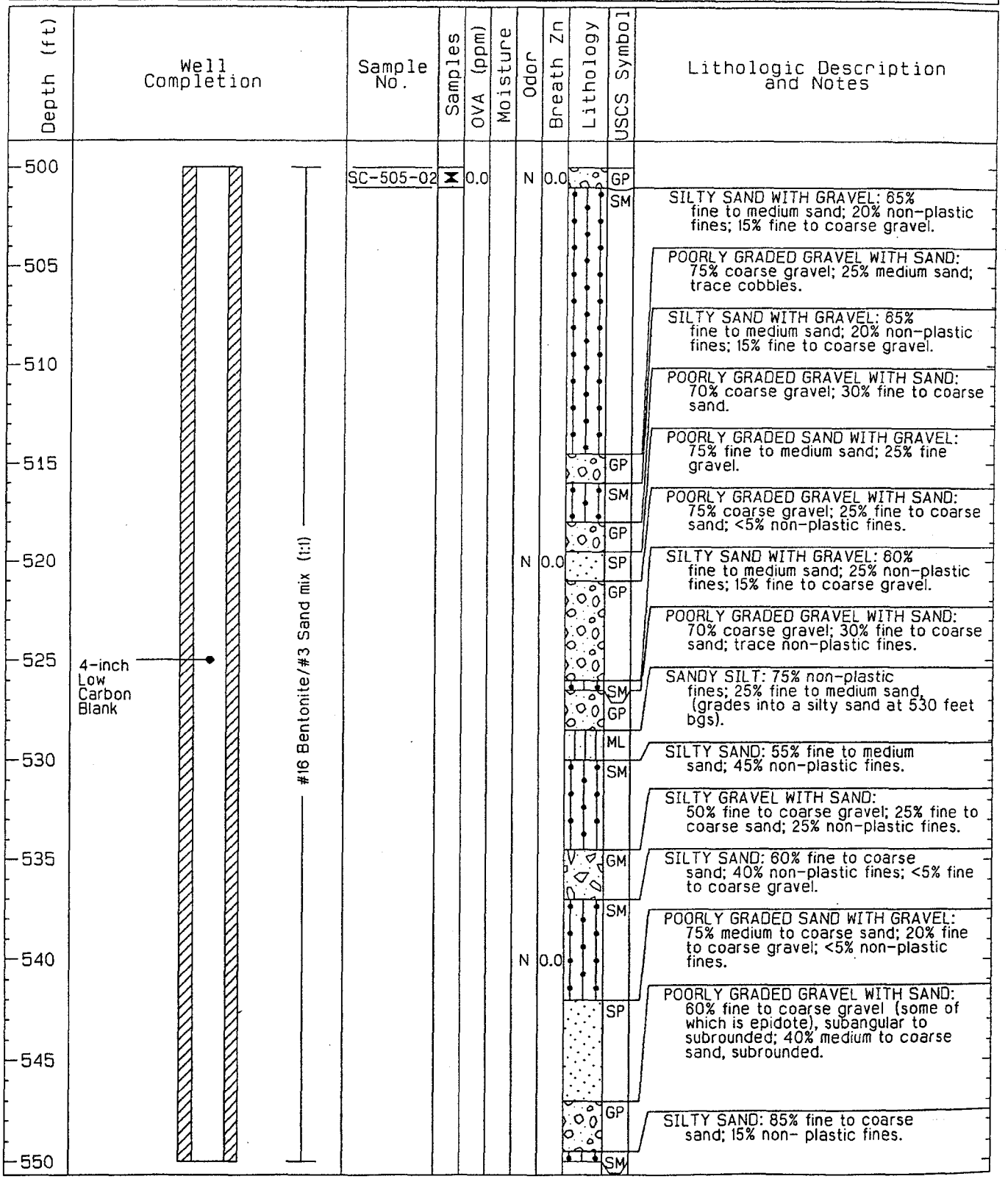
APPROX. DEPTH TO WATER (ft bgs) *175.6*



FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
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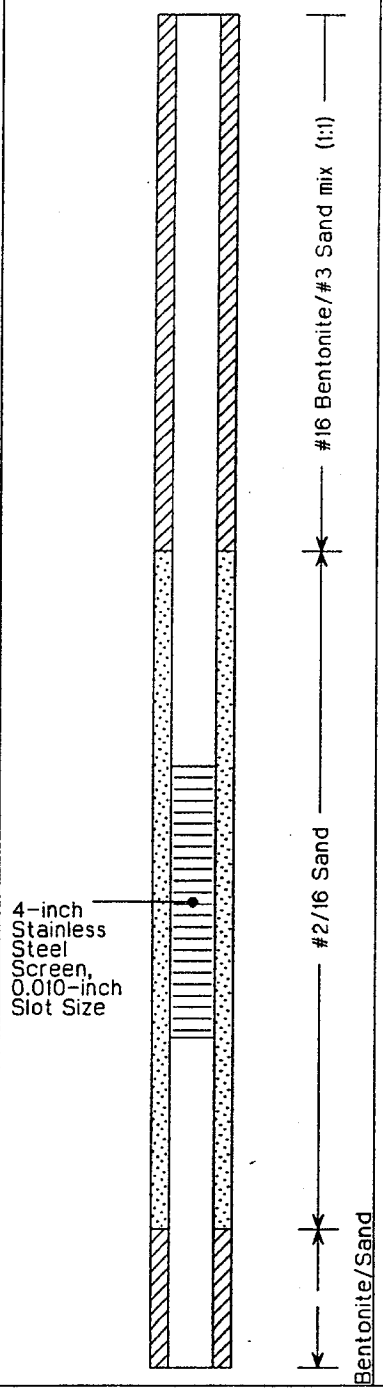
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
550									SM	SILTY SAND WITH GRAVEL: 70% medium to coarse sand; 15% non-plastic fines; 15% fine gravel;
555									SP	SILTY SAND: 60% fine to coarse sand; 40% non- plastic fines.
									SM	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 25% fine gravel.
560						N	0.0		SP	SILTY SAND WITH GRAVEL: 65% fine to medium sand; 25% non-plastic fines; 15% fine to coarse gravel.
									SM	
									SP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 25% fine gravel.
565										SILTY SAND: 75% medium to coarse sand; 20% non-plastic fines; <5% fine gravel.
570									SM	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 25% fine to coarse gravel; trace non-plastic fines.
										SILTY SAND: 65% fine to medium sand; 35% non-plastic fines.
575										SILTY SAND WITH GRAVEL: 60% fine to coarse sand, subrounded; 25% non-plastic fines; 15% fine to coarse gravel, subrounded.
580						N	0.0			
									GP	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel, subrounded; 30% medium to coarse sand, subrounded; 5% non-plastic fines.
585									ML	SANDY SILT: 75% non-plastic fines; 25% fine to medium sand, subrounded.
590									SM	SILTY SAND WITH GRAVEL: 65% fine to coarse sand; 20% non-plastic fines; 15% fine to coarse gravel.
									GP	
									SM	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 30% medium to coarse sand; 5% non-plastic fines.
595									GP	SILTY SAND: 60% fine to medium sand; 40% non-plastic fines.
600									SM	POORLY GRADED GRAVEL WITH SAND: 55% coarse gravel; 45% medium sand; 5% non-plastic fines; trace cobbles and boulders.



FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
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DATE (start/finish) *03/28/95 - 04/07/95*

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SAMPLING METHOD *Grab Sample from Shaker Screen*
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TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
600		SC-508-01	⧗	0.0		N	0.0		SM	SILTY SAND: 80% fine to medium sand; 20% non-plastic fines; <5% fine gravel.
605										SILTY SAND WITH GRAVEL: 55% fine to coarse sand; 30% non-plastic fines; 15% fine to coarse gravel, subangular to subrounded.
610										
615									SP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand, subangular to subrounded; 20% fine to coarse gravel, subrounded; 5% non-plastic fines.
									SM	SILTY SAND WITH GRAVEL: 60% fine to coarse sand, subrounded; 25% non-plastic fines; 15% fine to coarse gravel.
620						N	0.0			
625	4-inch Low Carbon Blank								ML	SANDY SILT: 75% non-plastic fines; 25% fine to medium sand, suburounded;
									SP SM	
									SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% fine to coarse sand, subrounded; 20% fine gravel, subrounded; 10% non-plastic fines.
630	#16 Bentonite/#3 Sand mix (1:1)									SILTY SAND: 55% fine to medium sand; 45% non-plastic fines.
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% medium to coarse sand, subrounded; 20% fine to coarse gravel, subrounded; 10% non-plastic fines.
635										
640						N	0.0			
645									SM	SILTY SAND: 60% fine to medium sand; 35% non-plastic fines; 5% fine gravel.
									GP	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 30% medium sand; 5% non-plastic fines; trace cobbles.
650										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

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DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
650									GP	
									SM	SILTY SAND WITH GRAVEL: 60% fine to coarse sand; 25% non-plastic fines; 15% fine gravel.
655										
									GM	SILTY GRAVEL WITH SAND: 60% fine to coarse gravel; 25% fine to coarse sand, partially cemented; 15% non-plastic fines; trace cobbles.
660						N	0.0			
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 70% fine to coarse sand; 20% fine to coarse gravel, 10% non-plastic fines; trace cobbles.
665										
670										SILTY GRAVEL WITH SAND: 60% coarse gravel; 20% fine to coarse sand; 20% non-plastic fines.
									GM	SILTY SAND WITH GRAVEL: 50% fine to coarse sand; 35% non-plastic fines; 15% fine gravel.
675	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)								SM	
									GM	SILTY GRAVEL WITH SAND: 60% coarse gravel; 20% fine to coarse sand; 20% non-plastic fines; trace cobbles.
680						N	0.0			
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: 60% fine to coarse sand; 30% fine to coarse gravel; 10% non-plastic fines.
685										
									SM	SILTY SAND: 75% fine to medium sand; 25% non-plastic fines.
690									GP GM SM	POORLY GRADED GRAVEL WITH SILT AND SAND: 65% fine to coarse gravel; 25% fine to coarse sand; 10% non-plastic fines.
										SILTY SAND WITH GRAVEL: 60% fine to medium sand; 20% non-plastic fines; 20% fine gravel.
695										SILTY SAND: 65% fine to medium sand; 30% non-plastic fines.
700									GP	POORLY GRADED GRAVEL WITH SAND: 60% fine to coarse gravel; 35% medium to coarse sand; 5% non-plastic fines.

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of El Nido and Harriet*
GEOLOGIST *T. Blaney*
DRILLING CO *Lang Exploratory*
DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
700		SC-510-01	✖	0.0		N	0.0		GP	As Above
705	#16 Bentonite/#3 Sand mix (1:1)								SP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 20% fine gravel; <5% non-plastic fines.
									GP	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 35% medium to coarse sand; <5% non-plastic fines.
710									SM	
									SP	
									SM	SILTY SAND WITH GRAVEL: 50% fine to medium sand; 30% fine gravel; 20% non- plastic fines.
715									GP	POORLY GRADED SAND WITH GRAVEL: 75% medium to coarse sand; 20% fine to coarse gravel; <5% non-plastic fines.
									SM	
									GP	
720						N	0.0		GM	SILTY SAND: 70% fine to coarse sand; 30% non-plastic fines.
									GP	POORLY GRADED GRAVEL WITH SAND: 60% fine gravel; 35% medium to coarse sand; 5% non-plastic fines.
725										SILTY SAND WITH GRAVEL: 45% fine to coarse sand; 40% non-plastic fines; 15% fine to coarse gravel.
	4-inch Stainless Steel Screen, 0.010-inch Slot Size									POORLY GRADED GRAVEL WITH SILT AND SAND: 70% fine to coarse gravel; 20% fine to medium sand, 10% non-plastic fines.
730	#2/16 Sand									POORLY GRADED GRAVEL WITH SAND: 60% coarse gravel; 30% medium to coarse sand; <5% non-plastic fines; trace cobbles.
735										
740	#16 Bentonite/#3 Sand mix					N	0.0			BOULDER (from 747 to 748.5 ft bgs)
745										POORLY GRADED GRAVEL WITH SAND: 60% coarse gravel; 30% medium to coarse sand; <5% non-plastic fines; trace cobbles.
									GP	
750										BOULDER (749.5 to 750.5 ft bgs)

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

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DATE (start/finish) *03/28/95 - 04/07/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
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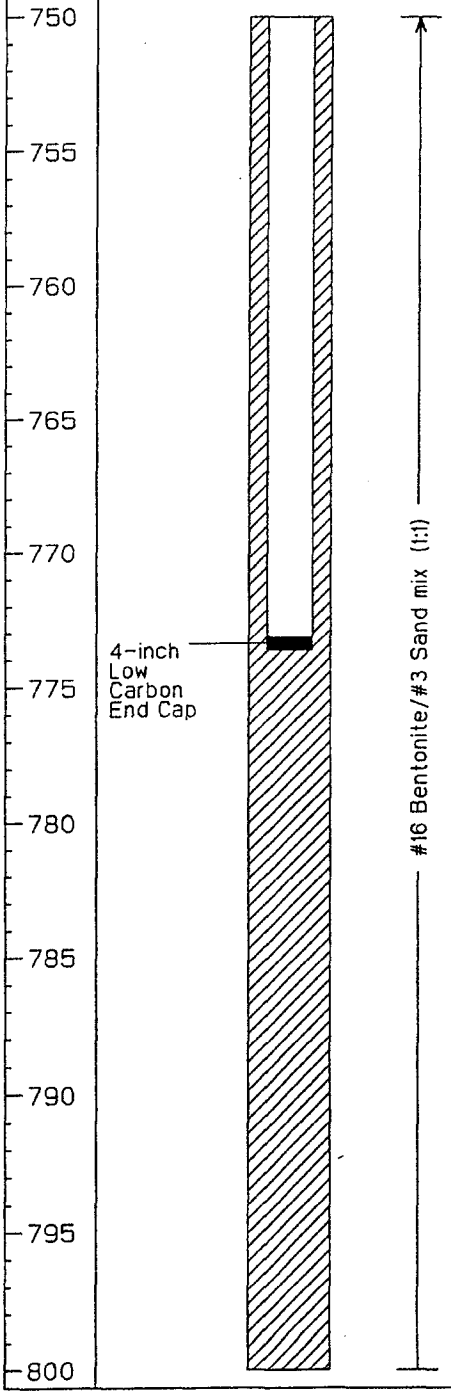
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
750									
								GP	POORLY GRADED GRAVEL WITH SAND: 70% coarse gravel; round; 30% medium to coarse sand, <5% non-plastic fines; trace cobbles and boulders.
755									
								SP	POORLY GRADED SAND WITH GRAVEL: 75% fine to medium sand; 15% fine gravel;10% weathered bedrock.
760					N	0.0			
								GP	POORLY GRADED GRAVEL WITH SAND: 65% fine to coarse gravel; 35% fine to coarse sand, partially cemented; <5% non-plastic fines.
765								GP GM	
									POORLY GRADED GRAVEL WITH SILT AND SAND: 55% fine to coarse gravel; 30% fine to coarse sand, 10% non-plastic fines.
770								ML	SANDY SILT: 65% non-plastic fines; 30% fine to medium sand; 5% fine to coarse gravel.
775								SM	SILTY SAND: 60% fine to medium sand; 35% non-plastic fines; 5% fine gravel.
									SILTY SAND WITH GRAVEL: 60% fine to medium sand; 25% non-plastic fines; 15% fine gravel.
780					N	0.0			SILTY SAND: 60% fine to medium sand; 35% non-plastic fines; 5% fine to coarse gravel.
								GM	SILTY SAND WITH GRAVEL: 60% fine to medium sand; 20% non-plastic fines; 20% fine to coarse gravel.
785									SILTY GRAVEL WITH SAND: 50% fine to coarse gravel; 30% fine to coarse sand; 20% non-plastic fines.
									BOULDER (from 788.5 to 789.5 ft bgs)
790								SM	SILTY SAND WITH GRAVEL: 55% fine to medium sand; 30% non-plastic fines; 15% fine gravel.
								GM	SILTY GRAVEL WITH SAND: 50% fine to coarse gravel, subrounded; 30% fine to coarse sand, subangular; 20% non-plastic fines.
795								SM	SILTY SAND WITH GRAVEL: 60% fine to medium sand, suburounded; 25% non-plastic fines; 15% fine gravel.
800									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 17

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DATE (start/finish) *03/28/95 - 04/07/95*

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SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1191.2*
TOTAL DEPTH (ft) *835*
APPROX. DEPTH TO WATER (ft bgs) *175.6*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
800	#16 Bentonite/#3 Sand mix (1:1)	SC-600-01	⧗	0.0		N	0.0		SM	
805										As Above
810										
815									GP/GM	POORLY GRADED GRAVEL WITH SILT AND SAND: 65% fine to coarse gravel, subangular to subrounded; 25% fine to coarse sand, subrounded; 10% non-plastic fines; trace cobbles.
820						N	0.0			BOULDER (from 820 to 821.5 ft bgs)
									BR	BEDROCK (?): Weathered material appears to be igneous or metamorphic in origin.
825										
830										
835										Total Depth of Borehole = 835 ft bgs
840										
845										
850										

Summary Casing Installation Log

Well No. MW-17
Job No. 650

Client NASA - JPL
Site JPL - OU3
Project Description groundwater investigation

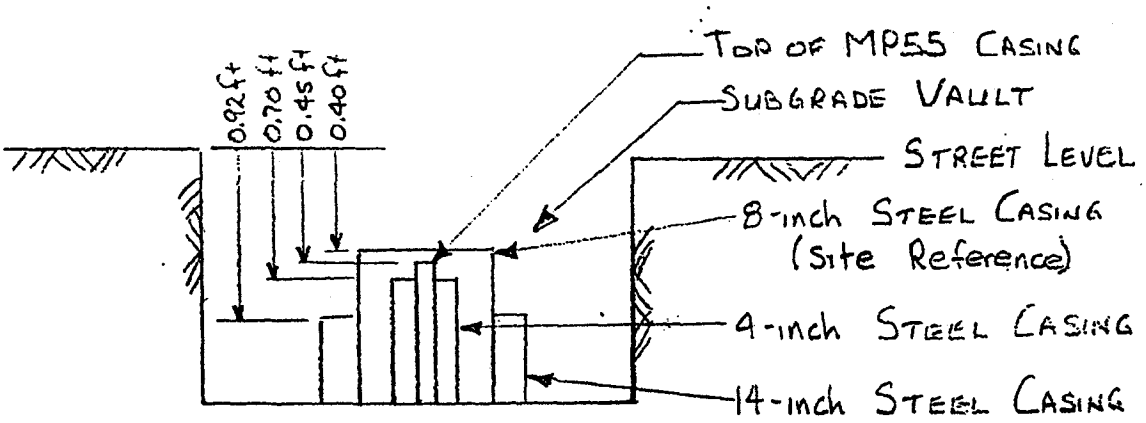
Well Information

Reference Datum ground surface
Elevation of Datum 0.00 ft.
Position of MP Casing Top above / below Datum 0.05 ft. ~~above~~ below datum
Position of MP Casing Bottom Below Datum 760.14 ft. below datum
Well Description MP38 with MP55 top section
Other References

Log Information

Designed By DL Date 25 MAY 95
Approved By TB Date 06 JUNE 95
Checked By DL/TB Date 05 JUNE 95.
Computer File No. MW17 Date Fri Jun 16 07:56:34 1995

Sketch of Wellhead Completion



Legend for Casing Installation Log

Well No. MW-17
Job No. 650

MP Log	Description	Quantity
	MP38 CASING 10 FT. 0225F10	~~061~~ 37
	MP38 PACKER STIFFENED 0237F05	015
	MP38 CASING 5 FT. 0225F05	012
	MP38 CASING 2 FT. 0225F02	009
	MP38 CASING 1 FT. 0225F01	002
	MP38 END CAP 0223	001
	MAGNETIC COLLAR	005
	MPSS CASING -3m 0301M30	24

MP Log	Description	Quantity
	MP38 REGULAR COUPLING 0221	079
	MP38 MEASUREMENT PORT 0222	015
	MP38 PUMPING PORT 0224	005

Geo 1

Geo 2

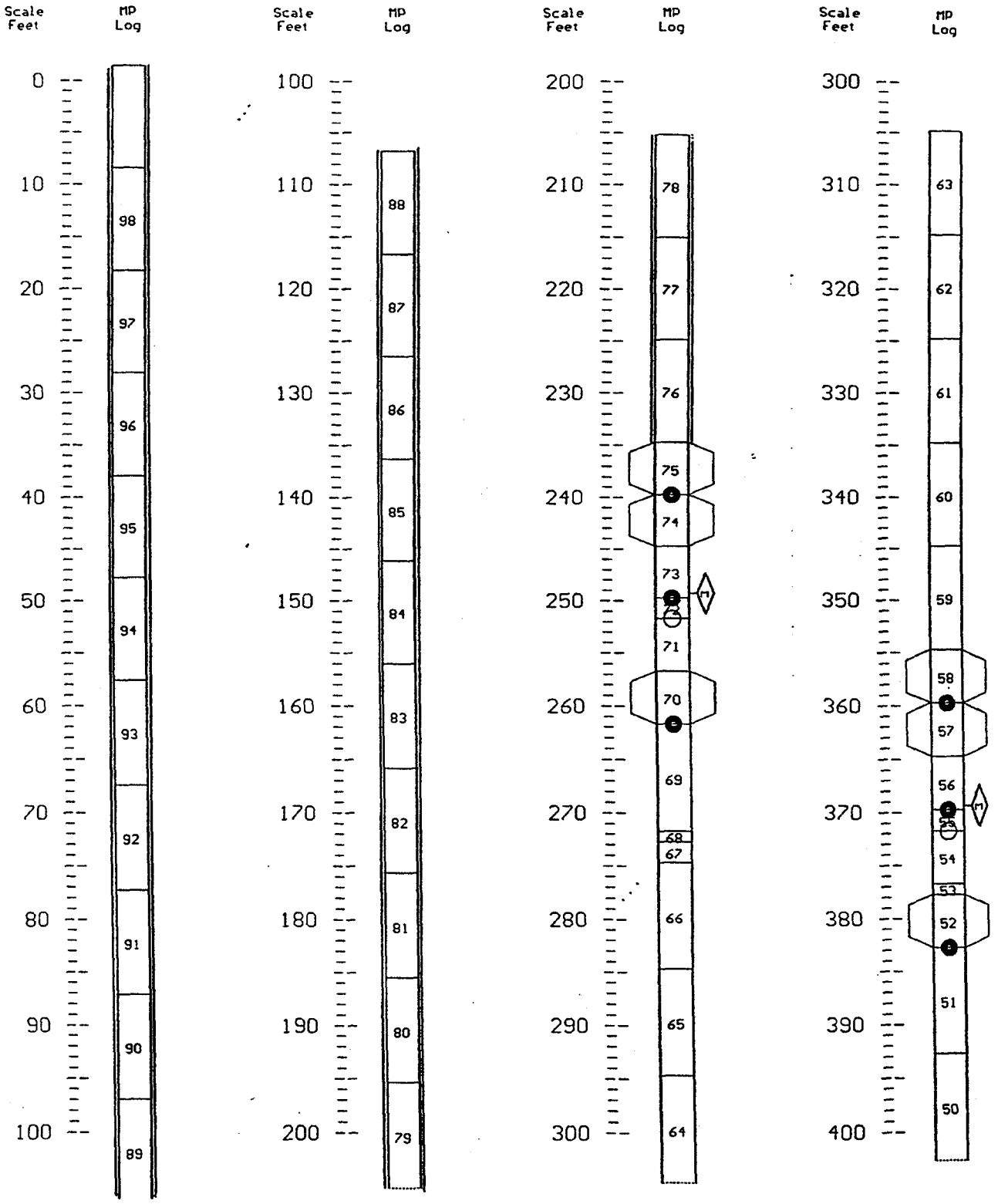
Well Casing

MILD STEEL PIPE

STAINLESS STEEL SCREEI

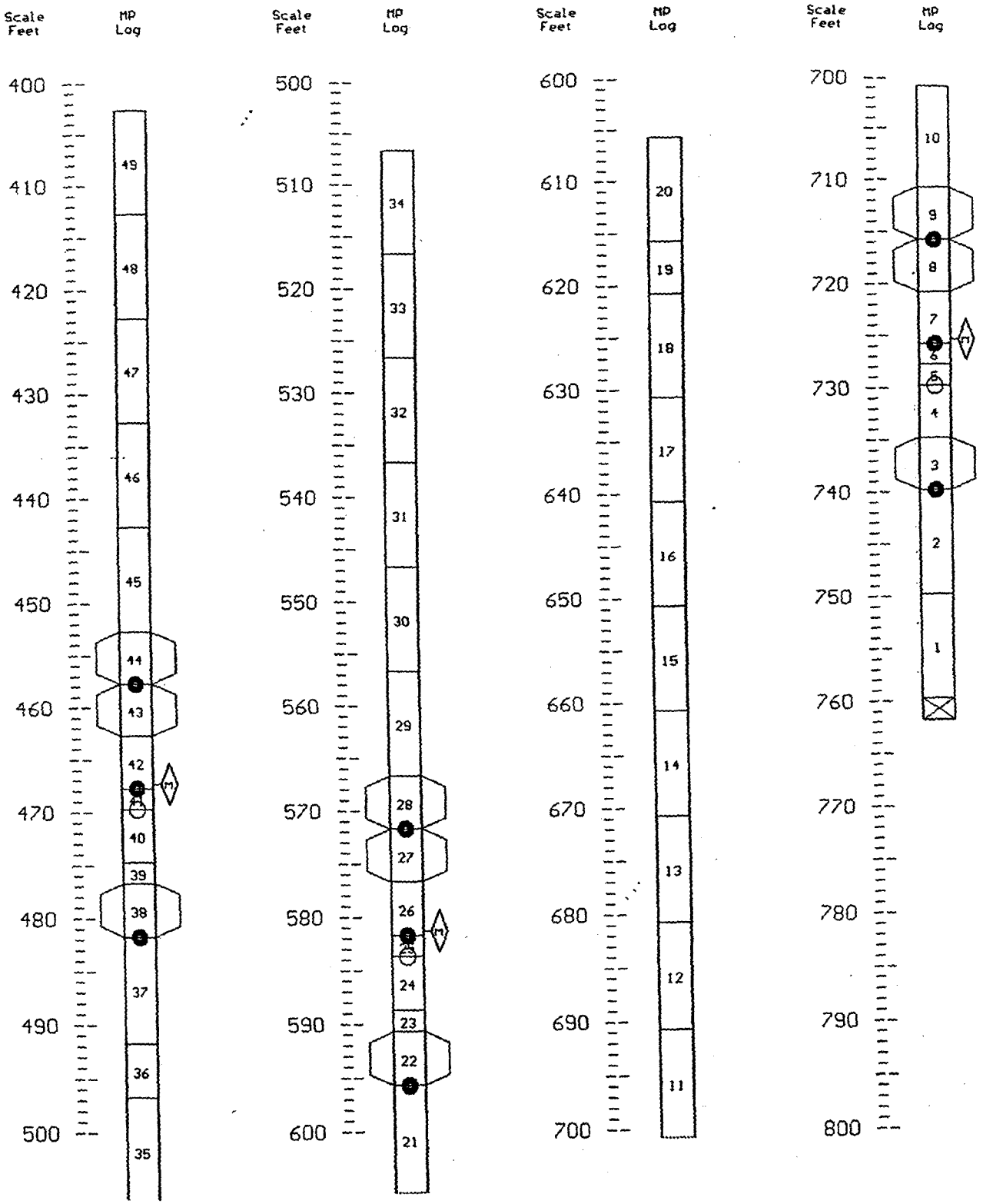
Summary Installation Log **Date:** Fri Jun 16 07:41:58 1995 **Page:** 1

Job No. 650 NASA – JPL **Well No.** MW-17



ımmary Installation Log Date: Fri Jun 16 07:41:58 1995 Page: 2

b No. 650 NASA – JPL Well No. MW-17



WELL MW-18

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

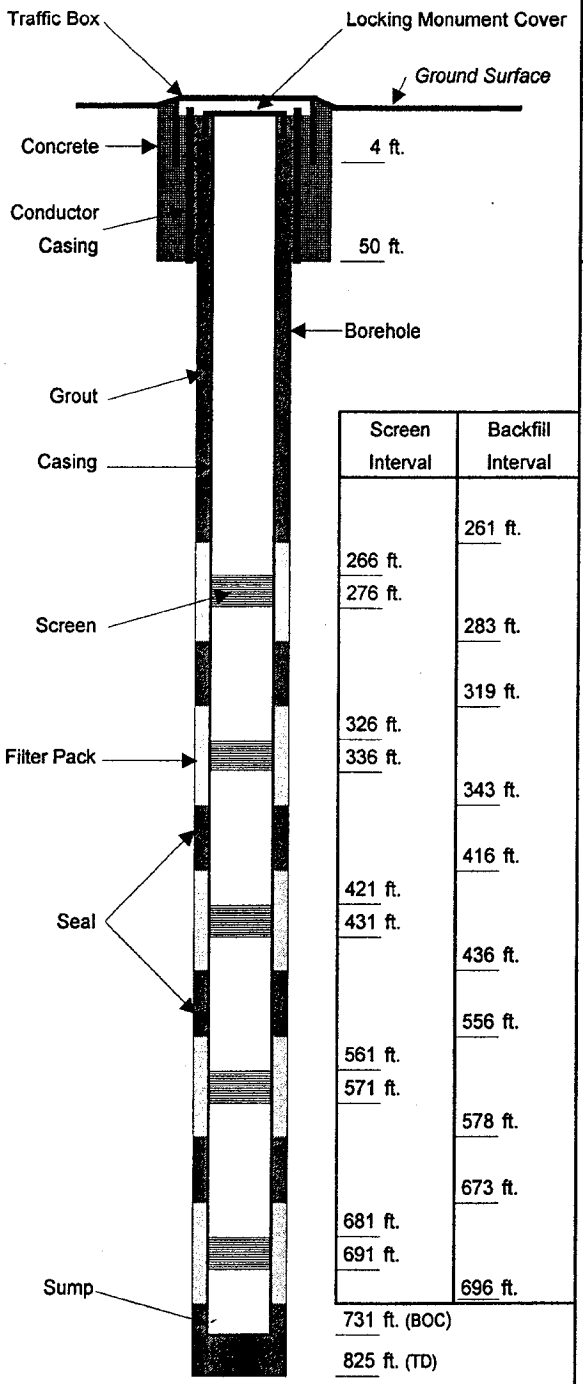
WELL CONSTRUCTION LOG

WELL NUMBER: MW-18

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1225.66

CASING ELEV (ft. above MSL): 1225.34



Screen Interval	Backfill Interval
	261 ft.
266 ft.	
276 ft.	
	283 ft.
	319 ft.
326 ft.	
336 ft.	
	343 ft.
	416 ft.
421 ft.	
431 ft.	
	436 ft.
	556 ft.
561 ft.	
571 ft.	
	578 ft.
	673 ft.
681 ft.	
691 ft.	
	696 ft.

DRILLING SUMMARY

DATE COMPLETED:	4/12/95 to 4/25/95
DRILLING COMPANY:	Lang Exploratory Drilling
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	825 ft.

CONSTRUCTION DETAILS

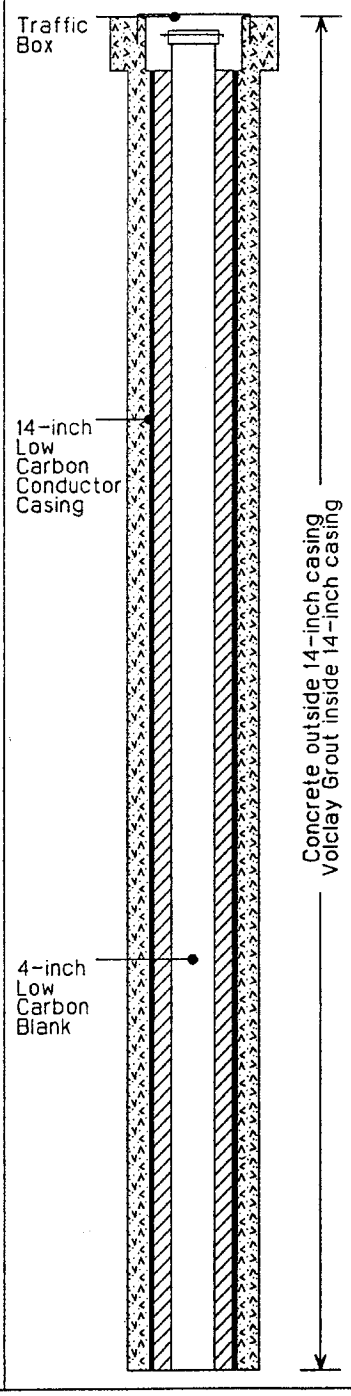
BOREHOLE DIAMETER: (CONDUCTOR CASING)	15.75 in.
CONDUCTOR CASING DIAMETER:	14 in.
CONDUCTOR CASING LENGTH:	50 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	731 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4-inch
TOTAL BLANK CASING LENGTH:	681 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL:	1:1 Bentonite & Sand mix
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 18

PROJECT *Jet Propulsion Laboratory*
LOCATION *W. Altadena Drive West of Florencita*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0									ASPHALT - Pavement (0.5 feet thick)
									BACKFILL (0.5-5.0 feet thick)
5			0.0	D	N	0.0		SM	SILTY SAND WITH GRAVEL: Reddish brown; 75% fine to coarse sand, 15% non- plastic fines; 10% fine gravel, subrounded; miceacous; Volume of sand 90% fine to medium grained and 10% coarse.
10			0.0	D	N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Light red brown; 70% fine to coarse grained sand, subrounded; 15% cobbles and boulders; micaceous; Volume of sand 50% fine and 50% coarse; Volume of gravel 50% fine and 50% coarse
15									
20			0.0	D	N	0.0			BOULDERS/COBBLES
25									COBBLE ZONE: max. size = 10 to 12 inches
30			0.0	D	N	0.0			POORLY GRADED SAND WITH GRAVEL AND COBBLES
35									
40			0.0	D	N	0.0			COBBLES/BOULDERS
									POORLY GRADED SAND WITH GRAVEL: Light brown; About 60% fine to coarse sand, subrounded; 40% fine to gravel, subrounded; trace cobbles; micaceous; Volume of sand 30% fine and 70% medium to coarse; Volume of gravel 50% fine and 50% coarse.
45									
50			0.0	D	N	0.0			

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DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
50		SC-514-01	X						SP	COBBLES/BOULDERS Stop drilling with bucket auger at 50.5 feet below ground surface
55										COBBLES/BOULDERS - very tough drilling
60									GP	POORLY GRADED GRAVEL WITH COBBLES AND BOULDERS: Light gray; about 60% fine to coarse gravel, subrounded; 30% cobbles and boulders; 10% coarse sand, subrounded; micaceous, trace pyrite; Volume gravel 40% fine and 60% coarse.
65										
70				0.0		N	0.0			Drill chatter; tough drilling - large boulder
75	4-inch Low Carbon Blank									
80	Volclay Bentonite Chips (Medium)									*Drilling Mud Parameters: Mud weight: 8.5 lbs/gal; Viscosity: 36 seconds; Sand content: 0.25%*
85										
90				0.0		N	0.0			Becoming finer grained at 93.0 feet bgs.
95										POORLY GRADED GRAVEL WITH SAND: Light gray; About 60% fine to coarse gravel, subrounded to subangular; 30% medium to coarse sand, subrounded; 10% cobbles and boulders; Volume of gravel 50% fine and 50% coarse; Volume of sand 30% fine and 70% coarse.
100										

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SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
100		SC-515-01	X	0.0		N			GP	
105										
110				0.0		N	0.0			
115										
120										Color change to dark gray; BOULDER (from 120 to 121 feet bgs) COBBLES/BOULDERS
125	4-inch Low Carbon Blank; Volclay Bentonite Chips (Medium)									POORLY GRADED GRAVEL WITH SAND: Light orange gray; About 40% fine to coarse gravel, subrounded; 30% fine to coarse sand, subrounded; 30% cobbles and boulders; Volume of gravel 20% fine and 80% coarse ; Volume of sand 10% fine and 90% medium to coarse.
130				0.0		N	0.0			
135										COBBLES/BOULDERS Becoming fine grained POORLY GRADED GRAVEL WITH SAND: Light orange gray; About 50% fine to coarse gravel, subrounded to subangular ; 45% fine to coarse sand, subrounded; 5% cobbles and boulders, Volume of gravel 80% fine and 20% coarse ; Volume of sand 50% fine and 50% medium to coarse.
140										
145										Increase in coarse grained component.
150				0.0		N	0.0			

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DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
150									GP	
155										
160										
165										POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 55% fine to coarse gravel, subrounded to subangular; 45% fine to coarse sand, subrounded; Volume of gravel 80% fine and 20% coarse; Volume of sand 50% fine and 50% medium to coarse.
									GP	COBBLES/BOULDERS - increased drill chatter.
170				0.0		N	0.0			POORLY GRADED SAND WITH SILT: Light reddish brown; 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded, micaceous; Volume of sand 70% fine and 30% medium to coarse.
									SP	
175	4-inch Low Carbon Blank; Volclay Bentonite Chips (Medium)								GP	POORLY GRADED GRAVEL WITH SAND
									SP	POORLY GRADED SAND WITH GRAVEL: Light reddish brown; 70% fine to coarse sand, subrounded; 30% fine gravel, subangular to subrounded, trace non plastic fines; micaceous; Volume of sand 70% fine and 30% medium to coarse.
180									GP	*Drilling Mud Parameters: Mud weight: 8.9 lbs/gal; Viscosity: 40 seconds; Sand content: 1.0%*
185										COBBLES/BOULDERS - increased drill chatter.
190				0.0		N	0.0			POORLY GRADED GRAVEL WITH SAND: Light orange brown;About 55% fine to coarse gravel, subrounded to subangular ; 45% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 80% fine and 20% coarse ; Volume of sand 20% fine and 80% coarse.
195										
200										

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DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
200		SC-517-01	⧗	0.0		N			GP	COBBLES/BOULDERS Directional survey at 200 feet bgs = .88° POORLY GRADED GRAVEL WITH SAND
205										
210				0.0		N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Light orange brown; 65% fine to coarse sand, subrounded; 35% fine to coarse, gravel, subangular to subrounded; micaceous; Volume of sand 10% fine and 90% medium to coarse; Volume of gravel 95% fine and 5% coarse.
215										
220										POORLY GRADED SAND WITH GRAVEL: Light orange brown; 60% fine to coarse sand, subrounded; 40% fine to coarse, gravel, subrounded; trace cobbles; micaceous; Volume of sand 20% fine and 80% medium to coarse.
225	4-inch Low Carbon Blank									
230	Volclay Bentonite Chips (Medium)			0.0		N	0.0			
235										COBBLES/BOULDERS - Increase in gravel content and drill chatter. POORLY GRADED GRAVEL WITH SAND: Light orange brown;About 55% fine to coarse gravel, subrounded to subangular ; 45% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 75% fine and 25% coarse ; Volume of sand 20% fine and 80% medium to coarse.
240									GP	
245										Thin lens of fine grained sand from 246-246.5 feet bgs. POORLY GRADED SAND WITH GRAVEL: Light orange brown; About 70% fine to coarse sand, subrounded; 30% fine to coarse gravel, subangular; micaceous; Volume of sand 15% fine and 85% medium to coarse; Volume of gravel 85% fine and 15% coarse.
250				0.0		N	0.0		SP	

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DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
250									SP	
									GP	POORLY GRADED GRAVEL WITH SAND: Light orange brown;About 55% fine to coarse gravel, subrounded to subangular ; 45% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 80% fine and 20% coarse ; Volume of sand 15% fine and 85% medium to coarse.
255	Bentonite Chips									
260	Bentonite/Sand mix									
265										
270	4-inch Stainless Steel Screen, 0.010-inch Slot Size; #2/16 Sand			0.0		N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Light orange brown; About 85% fine to coarse sand, subrounded; 15% fine gravel; micaceous; Volume of sand 10% fine and 90% medium to coarse.
									GP	POORLY GRADED GRAVEL WITH SAND
275									SP	POORLY GRADED SAND WITH GRAVEL: Light orange brown; About 85% fine to coarse sand, subrounded; 15% fine gravel; micaceous; Volume of sand 10% fine and 90% medium to coarse.
280									GP	POORLY GRADED GRAVEL WITH SAND: Light orange brown; About 60% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; micaceous; Volume of gravel 50% fine and 50% coarse; Volume of sand 80% coarse 20% fine.
285										COBBLES/BOULDERS (from 284-285 feet bgs)
										Directional Survey = 1°
290	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)			0.0		N	0.0			
295										
300										

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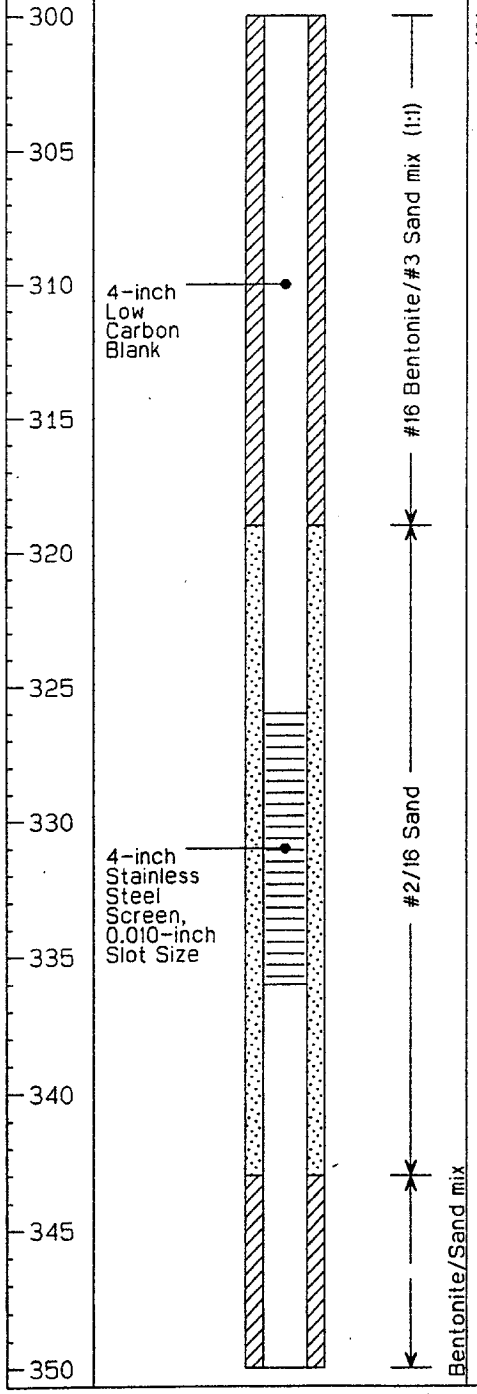
DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
300	SC-519-01	⧗	0.0		N			GP	BOULDER (from 301-305 feet bgs) tough drilling, granitic cuttings.
305									POORLY GRADED GRAVEL WITH SAND: Light orange brown; About 55% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 85% fine and 15% coarse; Volume of sand 15% fine and 85% medium to coarse.
310			0.0		N	0.0			COBBLES/BOULDERS - increased drill chatter.
315									Increase in fine grained sand; Volume of sand 40% fine and 60% medium to coarse; color change to reddish brown.
320								SM	SILTY SAND: Reddish brown; about 80% fine to coarse sand, subrounded; 15% non-plastic fines; 5% fine gravel, subrounded; micaceous; Volume of sand 80% fine and 20% medium to coarse.
325								GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel, subangular to subrounded; 45% fine to coarse sand, subrounded; micaceous; Volume of gravel 85% fine and 15% coarse; Volume of sand 15% fine and 85% medium to coarse.
330			0.0		N	0.0			SILTY SAND WITH GRAVEL: Reddish brown; About 75% fine to coarse sand, subrounded; 15% non-plastic fines; 10% fine gravel, subangular; micaceous; Volume of sand 70% fine and 30% medium to coarse.
335									POORLY GRADED GRAVEL WITH SAND
								SM	SILTY SAND WITH GRAVEL: Reddish brown; About 75% fine to coarse sand, subrounded; 15% non-plastic fines; 10% fine gravel, subangular; micaceous; Volume of sand 70% fine and 30% medium to coarse.
340								GP	
								SM	
								GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 60% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 80% fine and 20% coarse; Volume of sand 20% fine and 80% medium to coarse.
345									
350			0.0		N	0.0			

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Monitoring Well 18

PROJECT: Jet Propulsion Laboratory
LOCATION: W. Altadena Drive West of Florencita
GEOLOGIST: C. Kreller
DRILLING CO: Lang Exploratory Drilling
DATE (start/finish): 04/12/95 - 04/25/95

DRILLING METHOD: Reverse Circulation Mud Rotary
SAMPLING METHOD: Grab Sample from Shaker Screen
SURFACE ELEVATION: 1225.4
TOTAL DEPTH (ft): 825
APPROX. DEPTH TO WATER (ft bgs): 230.0

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
350									GP	
355										
360										POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 60% fine to coarse gravel, subangular to subrounded; 40% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel 80% fine and 20% coarse; Volume of sand 20% fine and 80% medium to coarse.
365										Thin lens of fine grained sand from 365-366 feet bgs.
370				0.0		N	0.0			Interbedded GP + SM with Gravel from 365-371 feet bgs.
375	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)								SM	SILTY SAND: Dark reddish about 80% fine to coarse sand, subrounded; 20% non-plastic fines; micaceous; Volume of sand 90% fine and 10% medium to coarse.
380										As above except volume of sand is 80% fine and 20% medium to coarse
385										Color change to orange brown from 386-388 feet bgs. Directional survey = 1.5°
390				0.0		N	0.0			
395										
400									GP	

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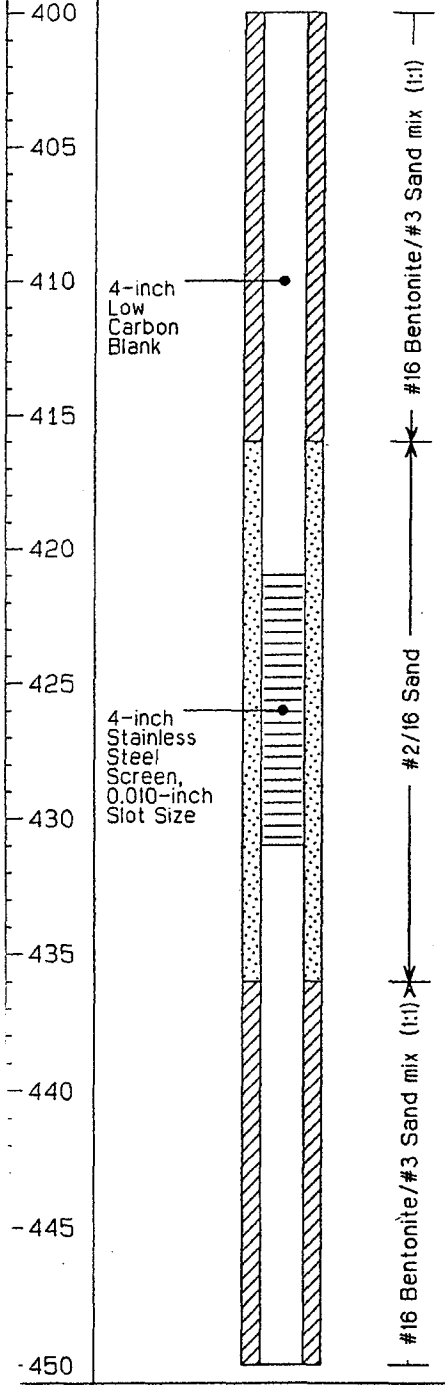
DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
400	SC-520-01	⧗	0.0		N			GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 55% fine to coarse gravel, subangular to subrounded; 45% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel is 80% fine and 20% coarse; Volume of sand is 15% fine and 85% medium to coarse.
405									
410			0.0		N	0.0			
415									
420									Slow drilling – drill chatter. POORLY GRADED GRAVEL WITH SAND: Light brown; About 60% fine to coarse gravel, subangular to subrounded; 40% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel is 70% fine and 30% coarse; Volume of sand is 20% fine and 80% coarse.
425									
430			0.0		N	0.0		SP SM	POORLY GRADED SAND WITH SILT: Reddish brown; About 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded; micaceous; Volume of sand is 80% fine and 20% medium to coarse.
435								GP SP SM	POORLY GRADED GRAVEL WITH SAND: Light brown; About 60% fine to coarse gravel, subangular to subrounded; 40% fine to coarse sand, subrounded; trace cobbles; micaceous; Volume of gravel is 70% fine and 30% coarse; Volume of sand is 20% fine and 80% coarse.
440									POORLY GRADED SAND WITH SILT: Dark reddish brown; About 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded; micaceous; partial cementation; Volume of sand is 80% fine and 20% medium to coarse.
445									
450			0.0		N	0.0			

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TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
450									SP SM	
455										
460										POORLY GRADED SAND WITH SILT: Dark reddish brown; About 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded; micaceous; partial cementation; Volume of sand is 80% fine and 20% medium to coarse.
465										
470	#16 Bentonite/#3 Sand mix (1:1)			0.0		N	0.0			
475	4-inch Low Carbon Blank									
480										Color change - very dark red/brown and cemented (481-482 ft bgs)
485										Color change to orange brown Directional Survey = 1.25°
490				0.0		N	0.0			POORLY GRADED SAND WITH SILT: Dark orange brown; About 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded; micaceous; Volume of sand is 85% fine and 15% medium to coarse.
495										
500										

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SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
500		SC-520-02	X	0.0		N			SP SM	
505										
510				0.0		N	0.0			
515										
520										
525	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)									POORLY GRADED SAND WITH SILT: Reddish brown; About 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine gravel, subrounded; micaceous; Volume of sand is 85% fine and 15% medium to coarse.
530				0.0		N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Light reddish brown; About 70% fine to coarse sand, subrounded; 25% fine to coarse gravel; 5% non plastic fines; micaceous; Volume of sand 40% fine and 60% medium to coarse.
535										
540									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Reddish brown; about 60% fine to coarse sand, subrounded; 10% non- plastic fines; 30% fine to coarse gravel, subangular to subrounded; 10% non plastic fines; micaceous; Volume of sand 40% fine and 60% medium to coarse; Volume of gravel 80% fine and 20% coarse.
545										Increase in gravel content 50% fine to coarse sand; 40% fine to coarse gravel; 10% non plastic fines.
550				0.0		N	0.0			

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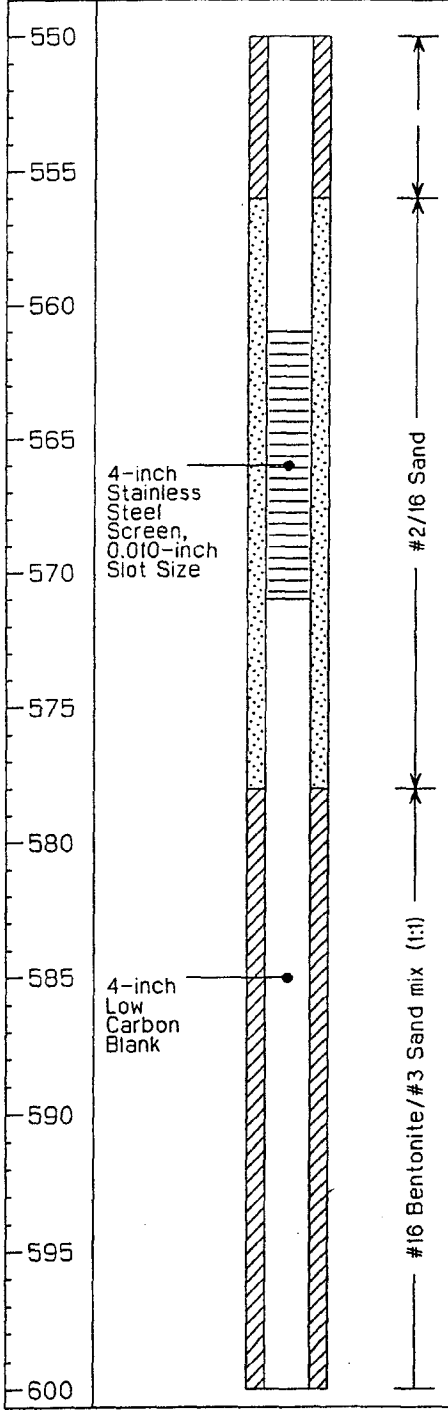
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



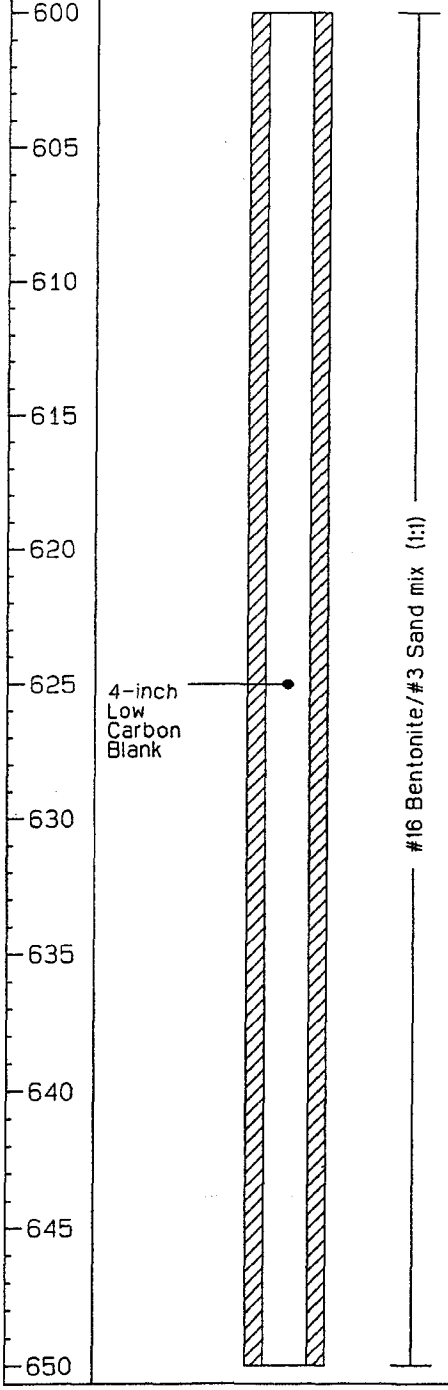
Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
550								SP SM	
555									
560									
565								GP	POORLY GRADED GRAVEL WITH SILT AND SAND: Reddish brown; About 55% fine to coarse gravel, subangular; 35% fine to coarse sand, subrounded; 10% non plastic fines; micaceous; Volume of gravel 70% fine and 30% coarse; Volume of sand 30% fine and 70% medium to coarse.
570			0.0		N	0.0			
575								SM	SILTY SAND: Reddish brown; about 65% fine to medium sand, subrounded; 35% low plastic fines; micaceous; Volume of sand 85% fine and 15% medium.
580									Decrease in fine content to 20% non-plastic fines; 75% fine to coarse sand; 5% fine gravel.
585								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Red brown; about 75% fine to coarse sand, subrounded; 15% fine gravel, subangular to subrounded; 10% non plastic fines; micaceous; Volume of sand 40% fine and 60% medium coarse.
								GP	Directional Survey = 1°
590			0.0		N	0.0			POORLY GRADED GRAVEL WITH SAND: Light red brown; about 50% fine to coarse gravel, subangular to subrounded; 45% fine to coarse sand, subrounded; 5% non- plastic fines; Volume of gravel 85% fine and 15% coarse; Volume of sand 40% fine and 60% medium to coarse.
595								SM	SILTY SAND: Reddish brown; About 80% fine to medium sand, subrounded; 20% non-plastic fines; micaceous.
600								GP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 18

PROJECT *Jet Propulsion Laboratory*
LOCATION *W. Altadena Drive West of Florencita*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
600	SC-521-01	✖	0.0		N			GP GM	POORLY GRADED GRAVEL WITH SILT AND SAND: Reddish brown; About 50% fine to coarse gravel, subangular; 35% fine to coarse sand, subrounded; 10% non-plastic fines.
								SP SM	POORLY GRADED SAND WITH SILT: Reddish brown; About 80% fine to coarse sand, subrounded; 10% non-plastic fines; 10% fine gravel, subrounded; micaceous;
605								SM	
								GP GM	SILTY SAND: Reddish brown; about 80% fine to medium sand, subrounded; 20% non-plastic fines; micaceous.
610			0.0		N	0.0			POORLY GRADED GRAVEL WITH SILT AND SAND: Reddish brown; About 50% fine to coarse gravel, subangular to sub- rounded; 40% fine to coarse sand, subrounded; 10% non-plastic fines; micaceous; Volume of gravel 60% fine and 40% coarse; Volume of sand 25% fine and 75% coarse.
615									
620								SM	Increase drill chatter - becoming more coarse grained
								GP GM	SILTY SAND: Reddish brown; about 80% fine to medium sand, subrounded; 20% non-plastic fines; micaceous.
625								GP	POORLY GRADED GRAVEL WITH SILT AND SAND: As Above
									POORLY GRADED GRAVEL WITH SAND: Light red brown; about 60% fine to coarse gravel, subangular to subrounded; 45% fine to coarse sand, subrounded; 5% non- plastic fines; Volume of gravel 45% fine and 55% coarse; Volume of sand 20% fine and 80% coarse.
630			0.0		N	0.0		GP GM	
								SM	
635									POORLY GRADED GRAVEL WITH SAND AND SILT: As above
									SILTY SAND WITH GRAVEL: Dark reddish brown; About 65% fine to coarse sand, subrounded; 20% non-plastic fines; 15% fine gravel, subangular; partially cemented; micaceous.
640									Color change to light red brown.
									Becoming coarser grained/decrease in silt content.
645									POORLY GRADED GRAVEL WITH SILT AND SAND: Light reddish brown; About 50% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; 10% non-plastic fines; micaceous; Volume of gravel 70% fine and 30% coarse; Volume of sand 50% fine and 55% medium to coarse.
								GP GM	
650			0.0		N	0.0			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 18

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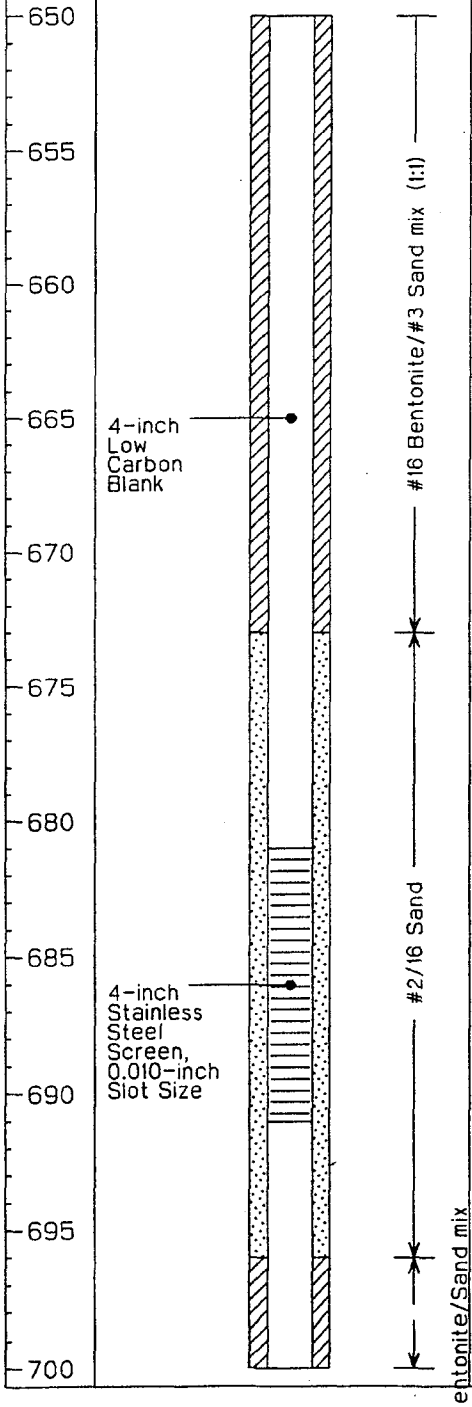
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
650								GP GM	
655								SM	SILTY SAND: Reddish brown; about 65% fine to coarse sand, subrounded; 25% non-plastic fines; 10% fine gravel; micaceous; Volume of sand 80% fine and 20% medium to coarse.
660								GP GM	POORLY GRADED GRAVEL WITH SILT AND SAND: Light reddish brown; About 50% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; 10% non-plastic fines; micaceous; Volume of gravel 70% fine and 30% coarse; Volume of sand 50% fine and 55% medium to coarse.
665								SM	SILTY SAND WITH GRAVEL: Reddish brown; about 65% fine to coarse sand, subrounded; 20% non- plastic fines; 15% fine gravel, subrounded; micaceous; Volume of sand 30% fine and 70% medium to coarse.
670			0.0		N	0.0		GP GM SM	Increased drill chatter
675									POORLY GRADED GRAVEL WITH SILT AND SAND: Light reddish brown; About 50% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; 10% non-plastic fines; micaceous; Volume of gravel 80% fine and 20% coarse; Volume of sand 30% fine and 70% coarse.
680								GP GM	SILTY SAND: Reddish brown; about 75% fine to medium sand, subrounded; 25% non-plastic fines; partially cemented, micaceous; Volume of sand 85% fine and 15% medium to coarse.
685									POORLY GRADED GRAVEL WITH SILT AND SAND: Light reddish brown; About 50% fine to coarse gravel, subangular; 40% fine to coarse sand, subrounded; 10% non-plastic fines; micaceous; Volume of gravel 80% fine and 20% coarse; Volume of sand 30% fine and 70% coarse.
690			0.0		N	0.0		SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Reddish brown; About 60% fine to coarse sand, subrounded; 30% fine to coarse gravel, subrounded; micaceous; Volume of sand 50% fine and 50% medium to coarse; Volume of gravel 90% fine and 10% coarse.
695									
700								SM	

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Monitoring Well 18

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DATE (start/finish) *04/12/95 - 04/25/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
700		SC-521-02	⧗	0.0		N			SM	SILTY SAND: Reddish brown; about 70% fine to medium sand, subrounded; 25% non-plastic fines; 5% fine gravel; micaceous; Volume of sand 70% fine and 30% medium.
705										Increase in fines: 65% fine to medium sand; 35% non-plastic fines.
710	4-inch Low Carbon Blank			0.0		N	0.0			
715										
720	#16 Bentonite/#3 Sand mix (1:1)									
725										
730				0.0		N	0.0			As above except 85% sand and 15% non-plastic fines.
735	4-inch Low Carbon End Cap									As above except 60% sand and 40% non-plastic fines.
740									SP SM	POORLY GRADED SAND WITH GRAVEL AND SILT: Orange brown; About 75% fine to coarse sand; 15% fine to coarse gravel ; 10% non-plastic fines; (some weathered bedrock that is blue-gray to black); trace cobbles.
745										POORLY GRADED SAND WITH GRAVEL: Orange brown; About 75% fine to coarse sand, subrounded; 20% coarse gravel, subangular to subrounded; 5% non-plastic fines.
750				0.0		N	0.0		SP SP	

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
750	#16 Bentonite/#3 Sand mix (1:1)								SP SM	POORLY GRADED SAND WITH GRAVEL AND SILT: Orange brown; about 70% fine to coarse sand; 20% fine to coarse gravel; 10% non-plastic fines; finer sand is partially cemented.
755										
760									SM SM	SILTY SAND: Orange brown; About 75% fine to medium sand, subrounded; 25% non-plastic fines; micaceous; Volume of sand 80% fine and 20% medium to coarse.
765									SM	SILTY SAND WITH GRAVEL: Orange brown; About 60% fine to coarse sand, subrounded; 20% non-plastic fines; 20% fine to coarse gravel, subrounded.
770				0.0		N	0.0		SP SM	SILTY SAND: Orange brown; About 75% fine to medium sand, subrounded; 25% non-plastic fines; micaceous. As above except 80% sand and 20% non-plastic fines.
775									SM SP SM	POORLY GRADED SAND WITH SILT: Orange brown; About 85% fine to coarse sand, subrounded to rounded; 10% non-plastic fines; 5% fine gravel, subrounded.
780									SM	SILTY SAND: Orange brown; About 65% fine to medium sand, subrounded; 30% non-plastic fines; 5% fine gravel.
785										POORLY GRADED SAND WITH GRAVEL AND SILT: Orange brown; about 70% fine to coarse sand, soft to; 20% fine to coarse gravel, subrounded; 10% non-plastic fines.
790				0.0		N	0.0			SILTY SAND: Orange brown; About 70% fine to medium sand, subrounded; 30% non-plastic fines. As above except 60% sand; 40% non-plastic fines; trace gravels.
795										
800										

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DATE (start/finish) *04/12/95 - 04/25/95*

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SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1225.4*
TOTAL DEPTH (ft) *825*
APPROX. DEPTH TO WATER (ft bgs) *230.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
800	#16 Bentonite/#3 Sand mix (1:1)	SC-524-01	⧗	0.0		N			SM	
805										As above except 75% sand; 25% non-plastic fines.
810				0.0		N	0.0			
815										As above except 55% sand; 45% non-plastic fines.
820				0.0		N	0.0			
825										Total Depth of Borehole = 825 ft bgs
830										
835										
840										
845										
850										

Summary Casing Installation Log

Well No. MW-18
Job No. 650

Client Foster Wheeler Environmental Corp.
Site JPL
Project Description groundwater investigation

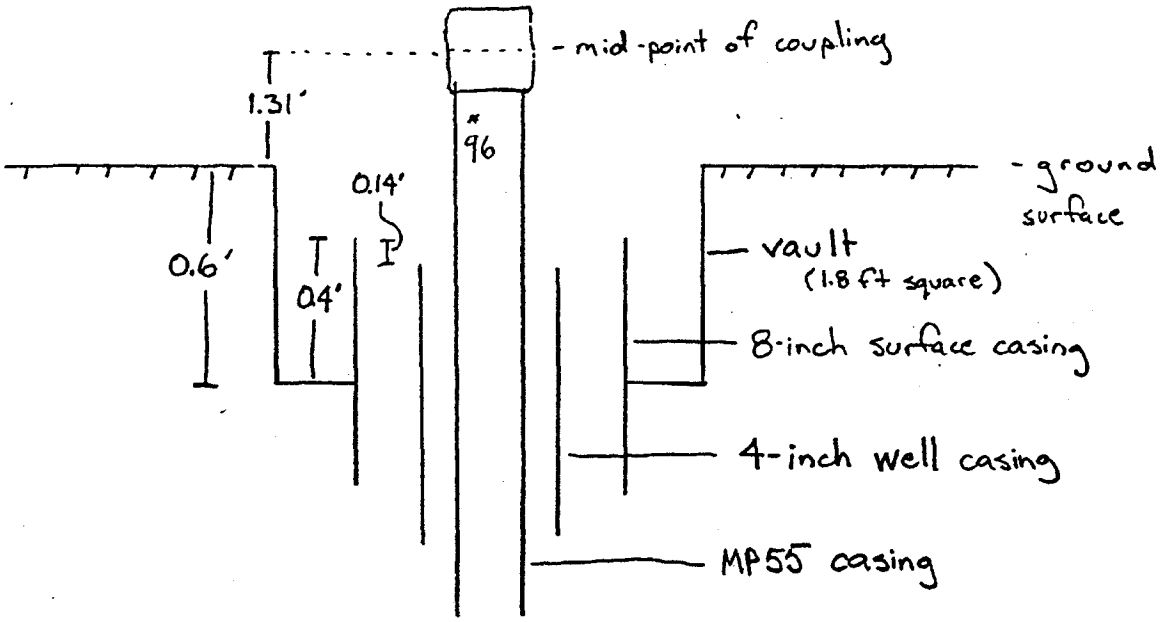
Well Information

Reference Datum ground surface
Elevation of Datum 0.00 ft. 1.31 above
Position of MP Casing Top above / below Datum ~~1.16~~ ft. ~~below~~ above datum
Position of MP Casing Bottom Below Datum 718.14 ft. below datum
Well Description MP38 with MP55 top section
Other References

Log Information

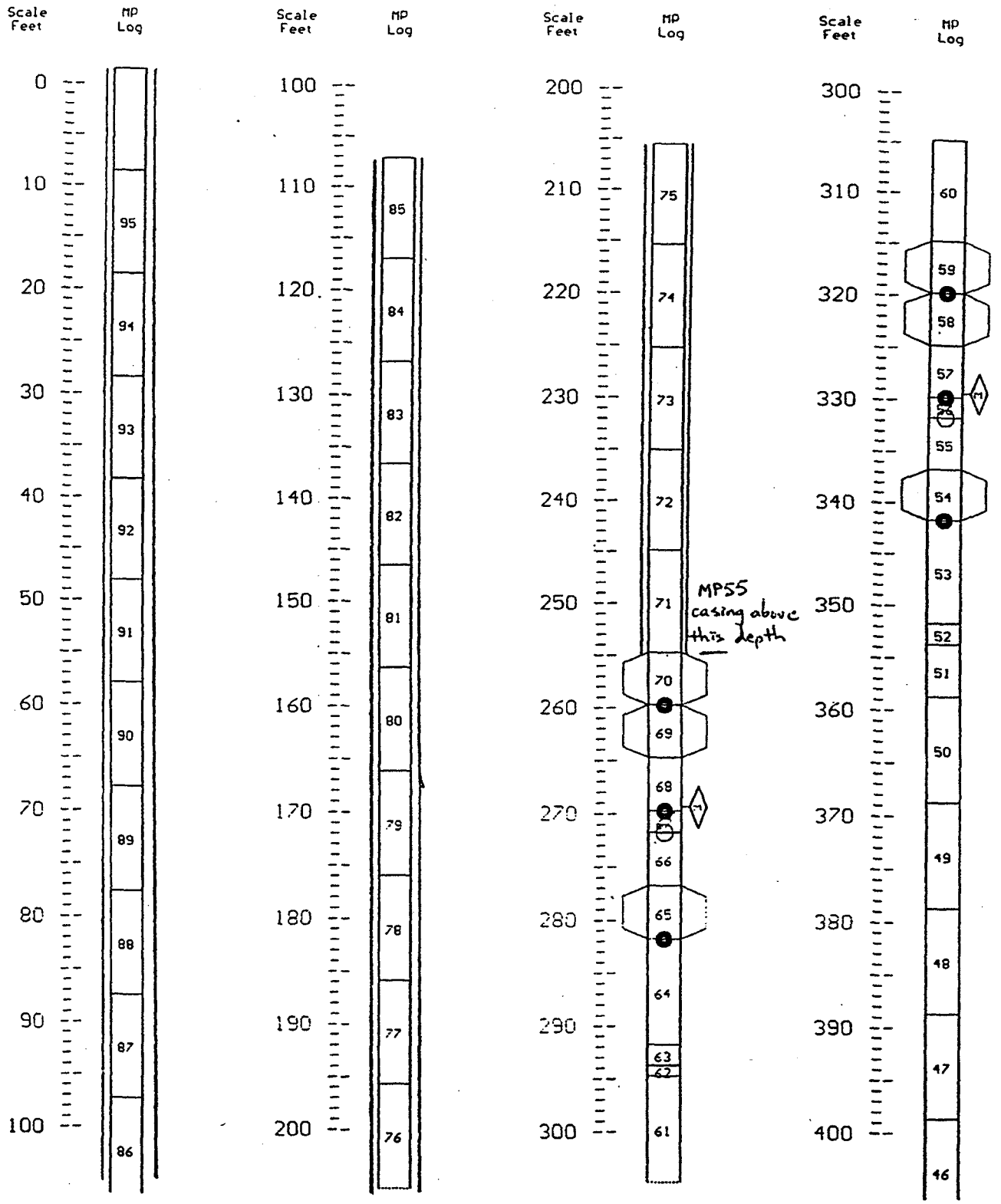
Designed By D. Larssen Date May 4, 1995
Approved By C. Kreller Date May 30, 1995
Checked By D. Mercer Date May 31, 1995
Computer File No. MW18 Date Thu May 04 15:19:52 1995

Sketch of Wellhead Completion



Summary Casing Inst. Log Date: Tue Jun 06 12:22:17 1995 Page: 1

Job No. 650 Foster Wheeler Environmental Corp. Well No. MW-18



WELL MW-19

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

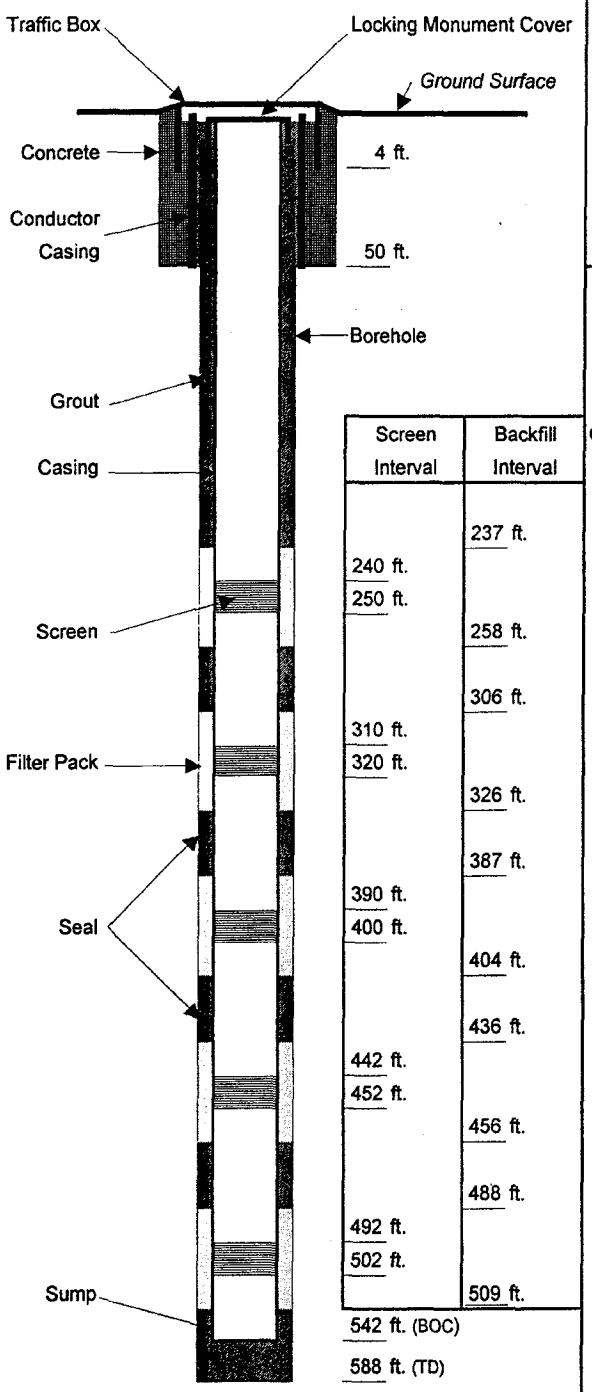
WELL CONSTRUCTION LOG

WELL NUMBER: MW-19

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1143.68

CASING ELEV (ft. above MSL): 1143.20



Screen Interval	Backfill Interval
	237 ft.
240 ft.	
250 ft.	
	258 ft.
	306 ft.
310 ft.	
320 ft.	
	326 ft.
	387 ft.
390 ft.	
400 ft.	
	404 ft.
	436 ft.
442 ft.	
452 ft.	
	456 ft.
	488 ft.
492 ft.	
502 ft.	
	509 ft.

DRILLING SUMMARY

DATE COMPLETED:	2/8/95 to 2/28/95
DRILLING COMPANY:	Lang Exploratory Drilling
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	588 ft.

CONSTRUCTION DETAILS

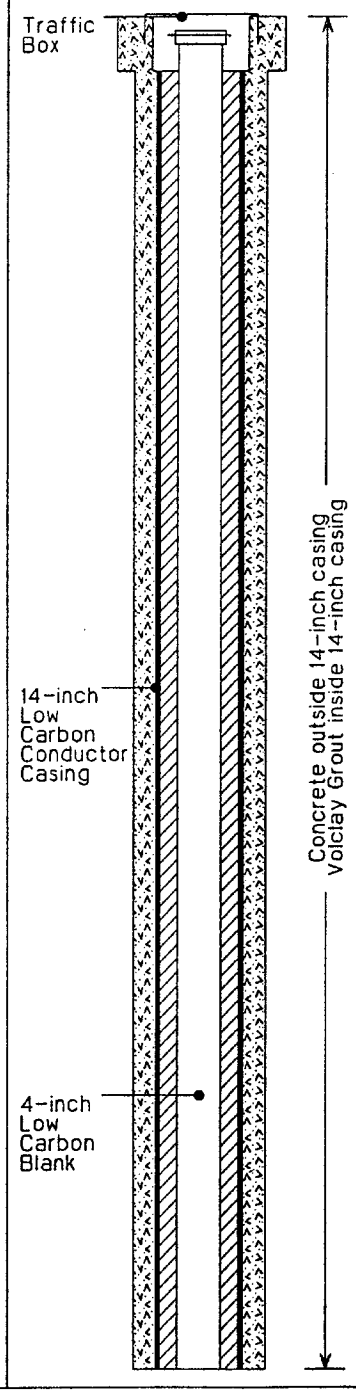
BOREHOLE DIAMETER: (CONDUCTOR CASING)	15.75 in.
CONDUCTOR CASING DIAMETER:	14 in.
CONDUCTOR CASING LENGTH:	50 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	542 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	492 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL:	1:1 Bentonite & Sand mix
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Dark brown; 85% fine to medium sand, 10% non-plastic fines; 5% fine gravel, subangular to subrounded; some roots present.
5									Color change to light brown; coarse gravel, cobbles and boulders increase.
								SP	Cobble zone, max. size = 1 foot
									SAND WITH GRAVEL, COBBLES AND BOULDERS: Light brown; 75% fine to coarse sand; 20% fine to coarse gravel, subangular to subrounded; 5% non-plastic fines; difficult to auger due to boulders; trace boulders.
10			0.0	D	N	0.0			
15									Hard drilling; Gravel % increasing to approximately 30%; 65% fine to coarse sand, 30% coarse gravel, subangular to subrounded; 5% non-plastic fines.
20			0.0	D	N	0.0			SAND WITH GRAVEL AND COBBLES: Light tan; 60% fine to coarse sand; 30% fine to coarse gravel, subangular to subrounded; 5% non-plastic fines, 5% by volume of cobbles, 99% 3-5 inches, 1% 5-12 inches.
25									Very coarse zone from 22-23 feet below ground surface.
									POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS: Light tan; 60% fine to coarse sand; 30% fine to coarse gravel, sub- angular to subrounded; 5% non-plastic fines; 5% by volume of cobbles and boulders, 99% 3-5 inches, 1% 5-12 inches; trace boulders >12 inches.
30			0.0	D	N	0.0			
35									Cobble zone
									POORLY GRADED SAND WITH GRAVEL AND COBBLES: Light brown to tan; 60% fine to coarse sand; 30% fine to coarse gravel, subangular to subrounded; 5% non-plastic fines; 5% by volume of cobbles and boulders, 99% 3-5 inches, 1% 5-12 inches; trace boulders; dry.
40			0.0	D	N	0.0			
45									Cobbles size increasing, 5-12 inch cobbles now comprise 5% of matrix.
									SILTY SAND: Reddish brown; About 80% fine sand; 20% non-plastic fines; trace gravel; slightly moist.
50								SM GP	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

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DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
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TOTAL DEPTH (ft) *588*
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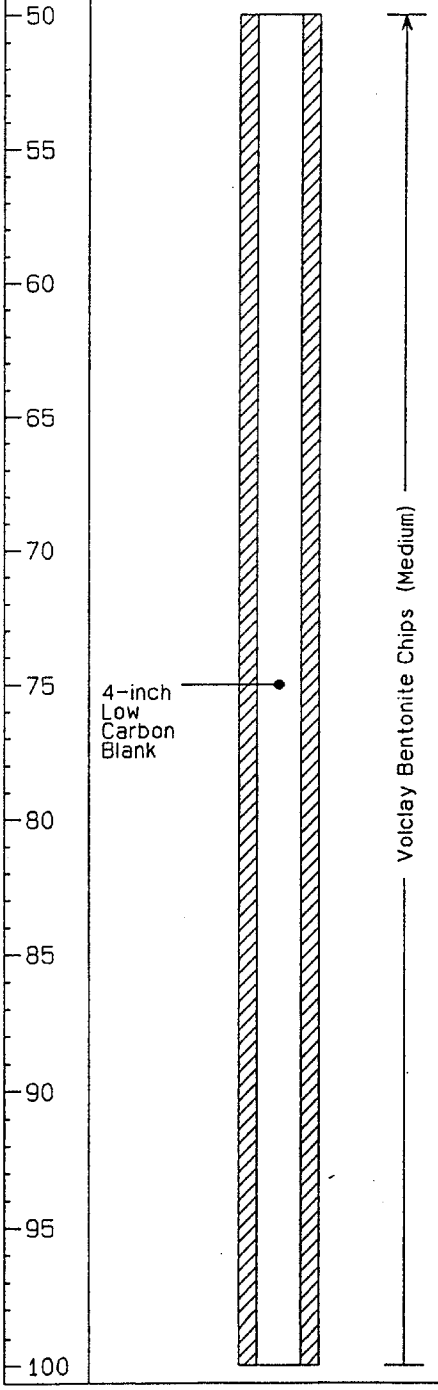

Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
50	SC-476-01	⧗	0.0	D	N			GP	POORLY GRADED GRAVEL WITH SAND: Light brown; about 85% fine to coarse gravel, subangular to subrounded; 15% medium to coarse sand; little or no fines; trace cobbles.
55									Increased drill chatter; increase in cobbles and trace boulders.
60									
65									
70			0.0		N	0.0			As above
75								SM	SILTY SAND: Medium brown; 80% fine to coarse sand, subangular to subrounded; 20% non-plastic fines; trace gravel.
								GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; about 70% fine to coarse gravel, subangular to sub-rounded; 30% fine to coarse sand, subrounded; little or no fines; trace cobbles.
80									
85								SM	SILTY SAND: Light reddish brown; 75% fine to coarse sand, subangular to subrounded; 20% non- plastic fines; <5% fine gravel, subangular.
90			0.0		N	0.0		GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; about 70% fine to coarse gravel, subangular to sub-rounded; 30% fine to coarse sand, subrounded; little or no fines.
95									*Drilling Mud Parameters: Mud Weight = 8.8 lbs/gal Viscosity = 35 seconds Sand Content = 1.25%*
100									Increased drill chatter; cobble/boulder zone.

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
100		SC-476-02	X	0.0		N			GP	
105										
110				0.0		N	0.0			As above
115										
120										*Drilling Mud Parameters: Mud Weight = 8.8 lbs/gal Viscosity = 35 seconds Sand Content = 2.5%*
125	4-inch Low Carbon Blank; Volclay Bentonite Chips (Medium)								SP, GP	POORLY GRADED SAND WITH GRAVEL: Light reddish brown; About 70% fine to coarse sand, subangular to sub-rounded; 30% fine gravel, subangular.
130				0.0		N	0.0			POORLY GRADED GRAVEL WITH SAND: Light reddish brown; about 70% fine to coarse gravel, subangular; 30% medium to coarse sand, subrounded; little or no fines.
135										Increase in coarse-grained material; 85% fine to coarse subangular gravel; 15% medium to coarse sand; slow drilling and increased drill chatter (trace cobbles).
									SM	Increased drill chatter
										Easier drilling - noticeable decrease in grain size.
140									SP	SILTY SAND: Light reddish brown; 75% to coarse sand, subrounded; 20% non-plastic fines; 5% fine gravel, subangular.
145										POORLY GRADED SAND: Light reddish brown; About 95% fine to coarse sand, subangular to subrounded; 5% fine gravel, subangular; trace fines; micaceous.
150				0.0		N	0.0			

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
150									SP	Increase in particle size
155									GP, GM, GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; about 70% fine to coarse gravel, subangular; 30% medium to coarse sand, subrounded; little or no fines.
160										SILTY GRAVEL WITH SAND: 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand; 20% low plastic fines.
165										POORLY GRADED GRAVEL WITH SAND, COBBLES AND BOULDERS: Brown; about 50% fine to coarse gravel, subangular to subrounded; 35% medium to coarse sand, subangular;trace fine sand, 5% non-plastic fines; 10% by volume of cobbles and boulders, 90% 3-5 inches, 10% >5 inches.
170				0.0		N	0.0			Abundant mafic cuttings mixed with lighter quartzofeldspathic rich material. >50% Cobbles and boulders. Abundant augen gneissic material, mafic, angular to subangular.
175	4-inch Low Carbon Blank; Voiclay Bentonite Chips (Medium)									
180									GM, GP	SILTY GRAVEL WITH SAND: 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand; 20% low plastic fines.
185										POORLY GRADED GRAVEL WITH SAND, COBBLES AND BOULDERS: Brown; about 60% fine to coarse gravel, subangular to subrounded; 35% medium to coarse sand, trace fine sand, subangular; 5% non-plastic fines; 10% by volume of cobbles and boulders, 90% 3-5 inches, 10% >5 inches.
190				0.0		N	0.0			Abundant mafic-rich gravels and coarse sand materials; formation rich in granites, granodiorites, and gneisses. Drill through a boulder of augen gneiss - 80% of the cuttings gravel, angular to subangular, mostly mafic cuttings.
195										Hard drilling - probably a boulder
200										

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LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
200		SC-478-01	⧗	0.0		N			GP	
205									GM	SILTY GRAVEL WITH SAND: 50% fine to medium gravel, subangular; 35% fine to coarse sand, subangular to subrounded; 15% non-plastic fines; 100% by volume of cobbles and boulders 3-5 inches.
210				0.0		N	0.0			
215									SM	SILTY SAND: Reddish brown; 70% fine to medium sand, subrounded; 30% low plastic fines; trace gravel; micaceous.
220										
225	4-inch Low Carbon Blank; Volclay Bentonite Chips (Medium)									SILTY SAND: Brown with reddish brown matrix; 70% fine to medium sand, subangular; 25% low plastic fines; 5% fine gravel, subangular.
										Gravel content increasing
230				0.0		N	0.0		GM	SILTY GRAVEL WITH SAND: 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular; 20% low plastic fines; 100% by volume of cobbles and boulders 3-5 inches.
									GP	
235										POORLY GRADED GRAVEL WITH SAND, COBBLES AND BOULDERS: Brown with reddish brown matrix; About 60% fine to coarse gravel, subangular to subrounded; 35% fine to coarse sand, subangular; 5% non-plastic fines; 10% by volume of cobbles and boulders, 90% 3-5 inches, 10% >5 inches.
240	#2/16 Sand									
245	4-inch Stainless Steel Screen, 0.010-inch Slot Size									
									SM	SILTY SAND WITH GRAVEL: Reddish brown; About 55% fine to coarse sand, subangular; 25% low plastic fines; 20% fine to coarse gravel, subangular to subrounded.
250				0.0		N	0.0			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*

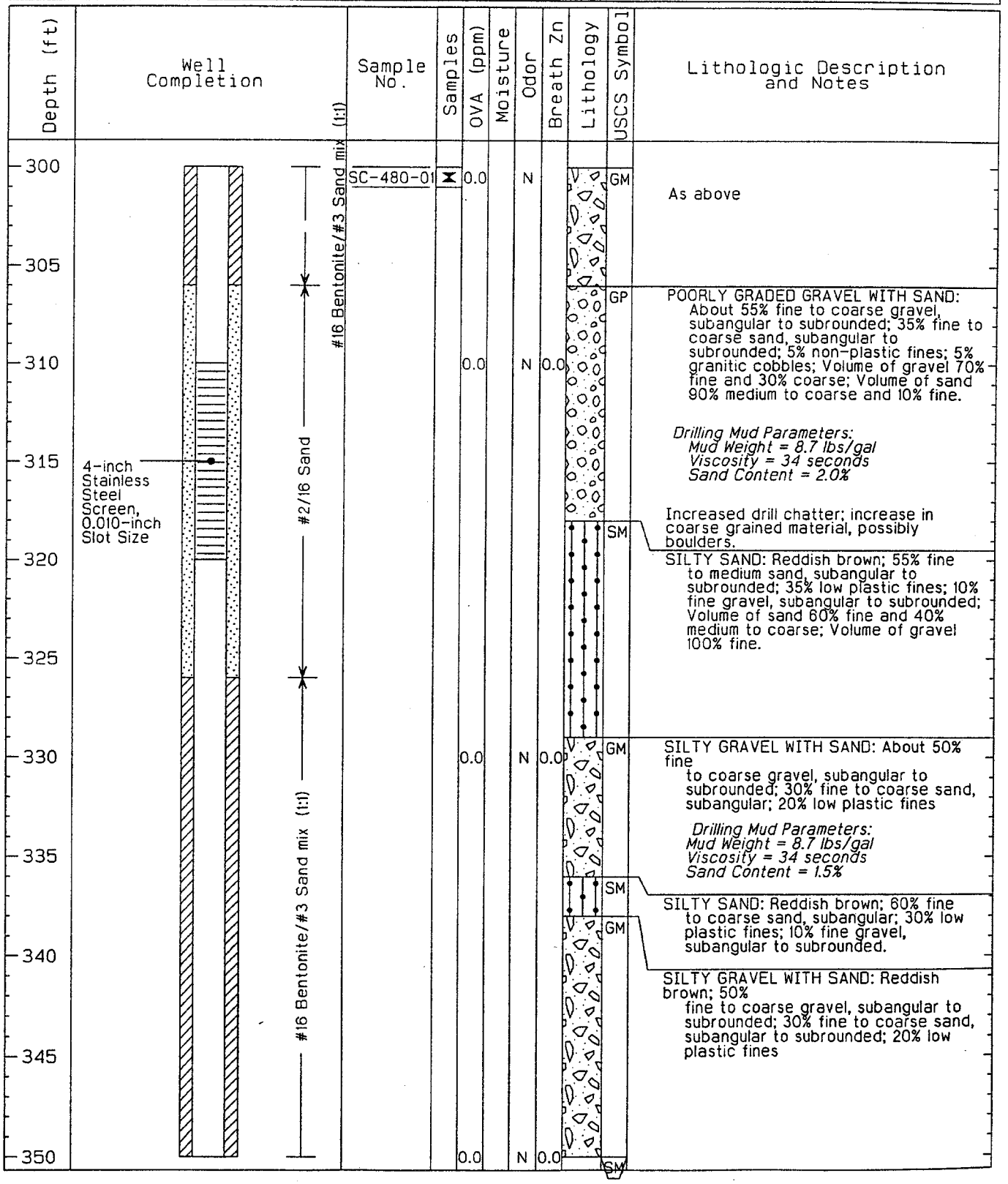
Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
250									SM	Gravel % increasing, now about 40-45% of matrix.
									GP	As Above
255	#2/16 Sand									SILTY SAND WITH GRAVEL: Reddish brown; About 60% fine to coarse sand, subangular; 25% low plastic fines; 15% fine to coarse gravel, subangular to subrounded.
260									SM	SILTY GRAVEL WITH SAND: 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular; 20% low plastic fines; 100% by volume of cobbles and boulders 3-5 inches.
265										POORLY GRADED GRAVEL WITH SAND, COBBLES AND BOULDERS: About 55% fine to coarse gravel.
									GM	SILTY GRAVEL WITH SAND: Reddish brown; 50% gravel, subangular to subrounded; 30% fine to coarse sand; 20% low plastic fines; 90% of gravel <0.75 inches.
270				0.0		N	0.0		GP	
									GM	SILTY SAND WITH GRAVEL: About 55% fine to coarse sand, subangular; 30% low plastic fines; 15% fine to coarse gravel, subangular to subrounded.
275	4-inch Low Carbon Blank								SM	Clay-rich seam, medium plasticity.
280	#16 Bentonite/#3 Sand mix (1:1)									SILTY GRAVEL WITH SAND: Reddish brown, 50% fine to coarse gravel, subangular; 30% fine to coarse sand, angular; 20% low plastic fines; 90% of gravel <0.75 inch.
									GM	
									GP	POORLY GRADED GRAVEL WITH SAND: About 50% fine to coarse gravel; 40% fine to coarse sand; 5% non-plastic fines.
285									GM	
										SILTY GRAVEL WITH SAND: Reddish brown; 50% fine to coarse gravel, subangular; 30% fine to coarse sand, angular; 20% low plastic fines; 90% of gravel <0.75 inch.
290				0.0		N	0.0		SM	SILTY SAND: Reddish brown; 70% fine to medium (trace coarse) sand; 35% low plastic fines; 5% fine gravel.
295									GM	SILTY GRAVEL WITH SAND: Reddish brown; 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular; 20% low plastic fines; 90% gravel <0.75 inch.
300										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*

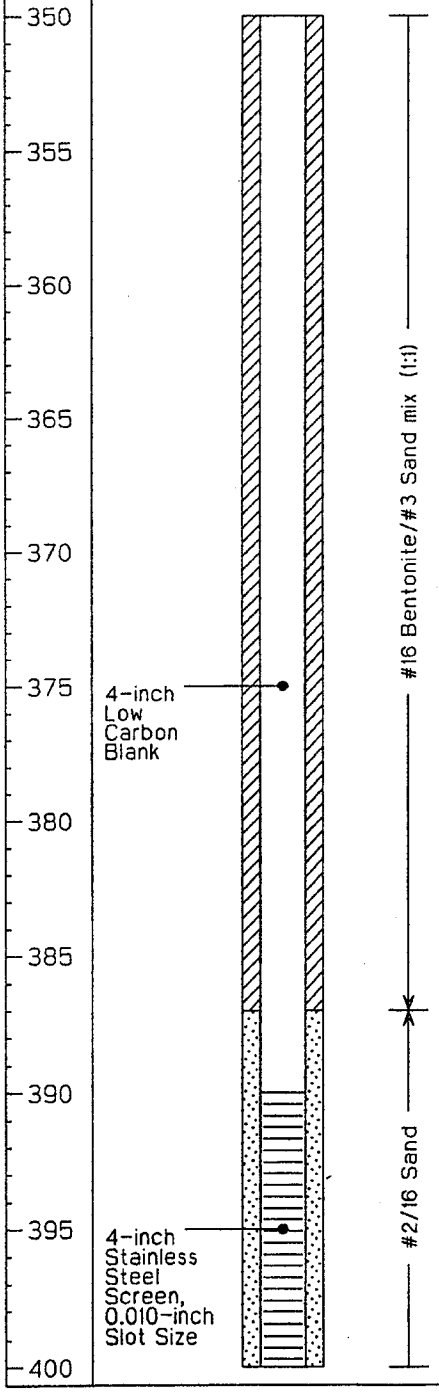


FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*



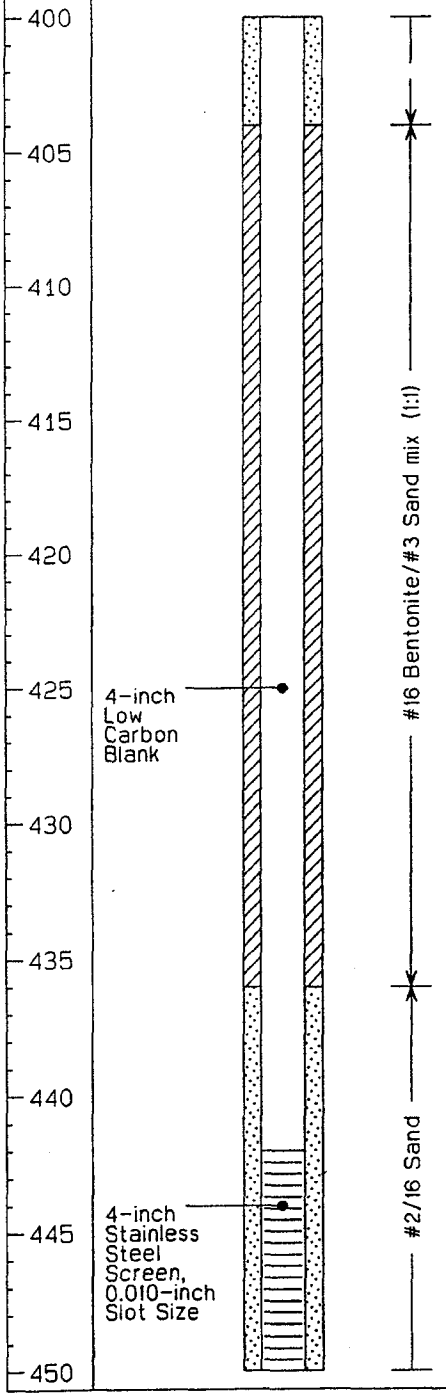
Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
350								SM	SILTY SAND: Reddish brown; 65% fine to medium sand, subangular to subrounded; 35% low plastic fines; micaceous; Volume of sand 60% fine and 40% medium to coarse
355								GM	SILTY GRAVEL WITH SAND: Reddish brown; 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 20% low plastic fines; Volume of gravel 95% fine and 5% coarse; Volume of sand 10% fine and 20% medium to coarse.
360								SM	*Drilling Mud Parameters: Mud Weight = 8.7 lbs/gal Viscosity = 34 seconds Sand Content = 1.5%*
365								GM	SILTY SAND: Reddish brown; 65% fine to medium sand, subangular to subrounded; 35% low plastic fines; micaceous; Volume of sand 60% fine and 40% medium to coarse
370			0.0		N	0.0			SILTY GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 20% low plastic fines; Volume of gravel 95% fine and 5% coarse; Volume of sand 60% fine and 40% medium to coarse.
375									SILTY SAND: As Above
380								SM	SILTY GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 20% low plastic fines; Volume of gravel 95% fine and 5% coarse; Volume of sand 60% fine and 40% medium to coarse.
385								GM	
								SM	SILTY SAND: As Above
390			0.0		N	0.0		GP	POORLY GRADED GRAVEL WITH SAND: About 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 20% non-plastic fines; Volume of gravel 70% fine and 30% coarse; Volume of sand 60% fine and 40% coarse.
395								GM	SILTY GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 20% low plastic fines; Volume of gravel 70% fine and 30% coarse; Volume of sand 60% fine and 40% coarse.
400									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*



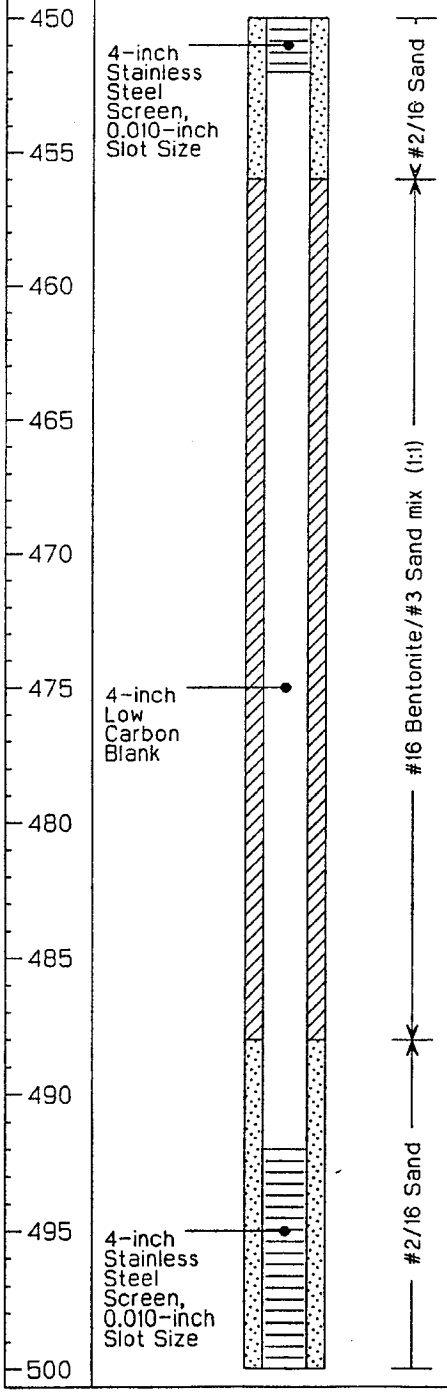
Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
400	SC-481-01	X	0.0		N			GM	*Drilling Mud Parameters: Mud Weight = 8.7 lbs/gal, Viscosity = 36 seconds, Sand Content = 1.5%*
405									Directional Survey = 1°
410			0.0		N	0.0			Drill chatter - possible cobble/boulder Color dark reddish brown from 411-413 feet bgs.
415									Increase drill chatter - increase in coarse grained component; Volume of gravel 50% fine and 50% coarse; Volume of sand 50% fine and 50% coarse; trace cobbles.
420									Predominantly coarse grained material *Drilling Mud Parameters: Mud Weight = 8.7 lbs/gal, Viscosity = 36 seconds, Sand Content = 1.5%*
425								SM	SILTY GRAVEL WITH SAND: Reddish brown; About 60% fine to coarse gravel, subangular to subrounded; 25% fine to coarse sand, subangular to subrounded; 15% low plastic fines; trace cobbles; Volume of gravel 75% coarse and 25% fine; Volume of sand 75% coarse and 25% fine to medium.
430			0.0		N	0.0			SILTY SAND: Reddish brown; About 55% fine to medium sand; 45% low plastic fines; some interbedded silty material (ML?) present.
435									Material appears interbedded fine and coarse grained silty sand.
440								GM	Interbedded very fine grained material (ML) and coarse grained SM. *Drilling Mud Parameters: Mud Weight = 8.0 lbs/gal, Viscosity = 37 seconds, Sand Content = 2.0%*
445									SILTY GRAVEL WITH SAND: About 55% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 15% non-plastic fines; trace cobbles; Volume of gravel 80% 1-2 inches and 20% 2-3 inches; Volume of sand 50% fine and 50% medium to coarse.
450			0.0		N	0.0			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*



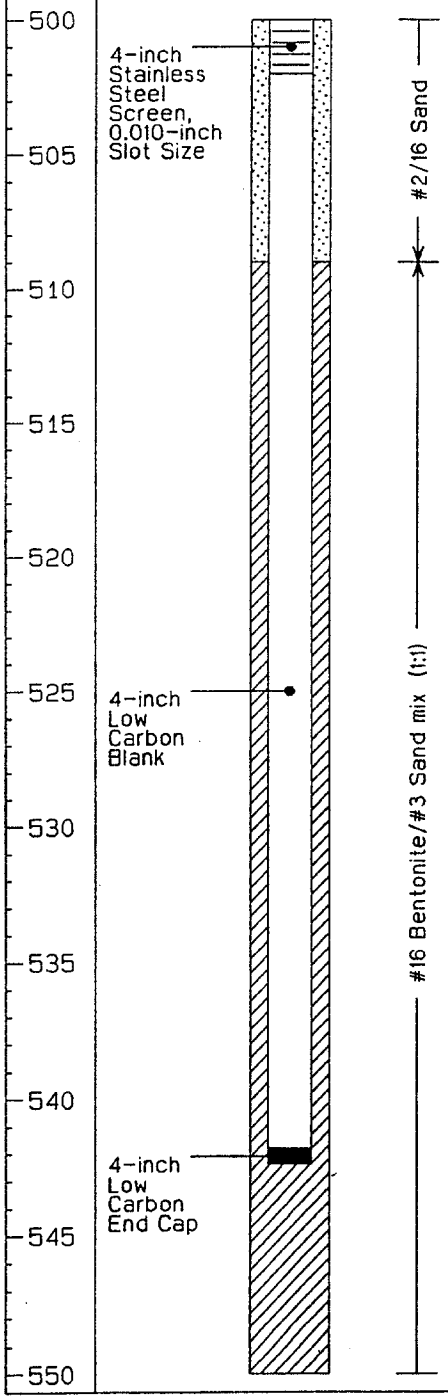
Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
450								GM	*Drilling Mud Parameters: Mud Weight = 8.9 lbs/gal Viscosity = 39 seconds Sand Content = 2.5%*
455									Drill chatter
460								SM	SILTY SAND
								GM	SILTY GRAVEL WITH SAND: Reddish brown; About 55% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 15% non-plastic fines; trace cobbles; Volume of gravel 80% 1-2 inches and 20% 2-3 inches; Volume of sand 60% fine and 40% medium to coarse.
465									
470			0.0		N	0.0			
									SILTY SAND: Reddish brown; About 65% fine to coarse sand, subrounded to subangular; 30% non-plastic fines; trace gravel; Volume of sand 65% fine and 35% medium to coarse.
475									SILTY GRAVEL WITH SAND: Reddish brown; About 55% fine to coarse gravel, subangular to subrounded; 30% fine to coarse sand, subangular to subrounded; 15% non-plastic fines; trace cobbles; Volume of gravel 80% 1-2 inches and 20% 2-3 inches; Volume of sand 60% fine and 40% medium to coarse.
								SM	
480								GM	
485									Material becoming finer grained - Volume of sand 80% fine and 20% medium to coarse; Volume of gravel 95% 0.75-1 inch and 5% 2-3 inches.
									POORLY GRADED GRAVEL WITH SILT AND SAND: About 50% fine gravel, subangular to subrounded; 40% fine to coarse sand, subangular to subrounded; 10% non-plastic fines; Volume of sand 60% fine and 40% medium to coarse; Volume of gravel 100% fine and trace coarse.
490			0.0		N	0.0		GP	
									SILTY GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded; 35% fine to medium sand, subangular to subrounded; 15% non-plastic fines; trace cobbles; Volume of gravel 50% coarse and 50% fine; Volume of sand 60% fine and 40% medium to coarse.
495								GM	
500									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*



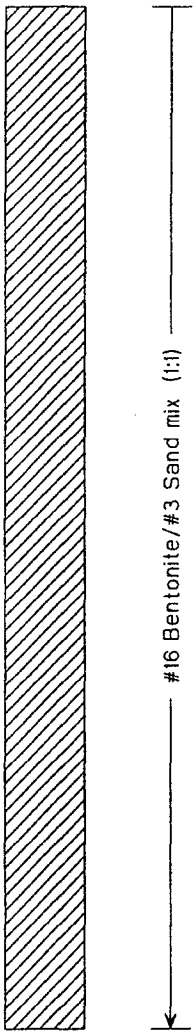
Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
500	SC-581-02	⧗	0.0		N			GM	Increase in non-plastic fines to 20%; 55% fine to coarse gravel; 25% fine to coarse sand; Volume of gravel 50% fine and 50% coarse; Volume of sand 50% fine and 50% medium to coarse.
505									
510			0.0		N	0.0			
515								GP GM	POORLY GRADED GRAVEL WITH SILT AND SAND: About 55% fine to coarse gravel, subangular to subrounded; 35% fine to coarse sand, subangular; 10% low plastic fines.
								GM	SILTY GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded; 30% fine to medium sand, subangular to subrounded; 20% non-plastic fines.
520									
525									Increase in coarse-grained material - 55% gravel; 35% sand; 10-15% low plastic fines.
									Drill chatter - trace cobbles and boulders.
530			0.0		N	0.0			
535									
540									Slow drilling - drill bit is worn down
545								BR	Decomposed Bedrock: Gray; low plastic fine matrix with sand and gravel material composed of granodiorite; majority of gravel material exhibits relic fabric of the bedrock.
550			0.0		N	0.0			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 19

PROJECT *Jet Propulsion Laboratory*
LOCATION *Windsor Reservoir on Arroyo Blvd.*
GEOLOGIST *V. Richards/C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *02/08/95 - 02/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1142.9*
TOTAL DEPTH (ft) *588*
APPROX. DEPTH TO WATER (ft bgs) *166.95*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
550									BR	
555										
560										
565										
570										
575										
580				0.0		N	0.0			
585										BEDROCK: Well indurated granodiorite
590										Total Depth of Borehole = 588 ft bgs
595										
600										

Summary Casing Installation Log

Well No. MW-19
Job No. WB650

Client Jet Propulsion Laboratory
Site JPL
Project Description Grounduater Investigation

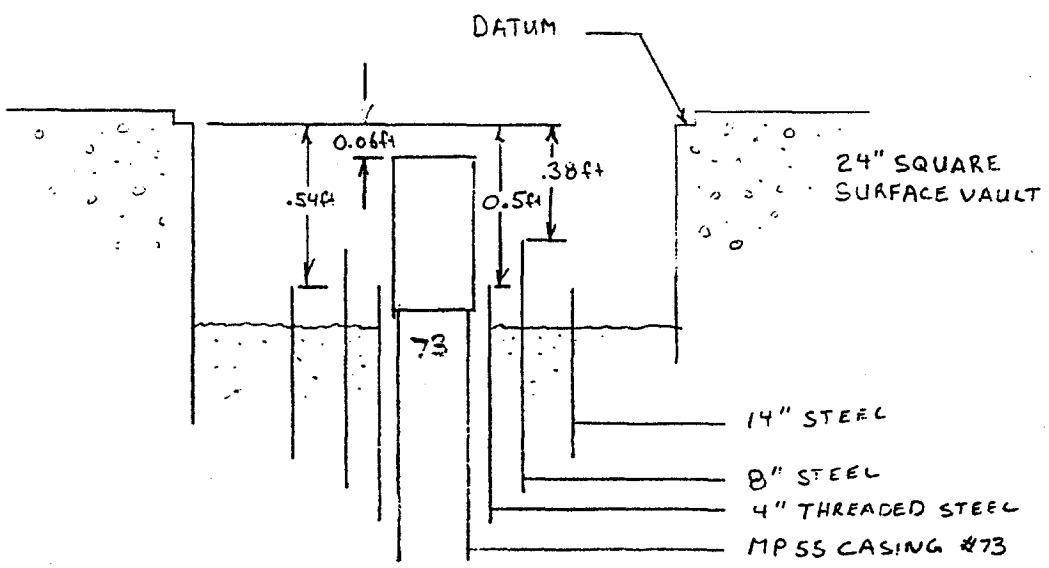
Well Informaton

Reference Datum ground surface
Elevation of Datum 0.00 ft.
Position of MP Casing Top above / below Datum 0.08 ft. above datum
Position of MP Casing Bottom Below Datum 530.14 ft. belou datum
Well Description MP38 in 4-inch steel
Other References
Installed March 29/30, 1995
Packers inflated March 30, 1995
MP55 riser to 227 ft

Log Informaton

Designed By D LARSSEN **Date** MARCH 2 1995
Approved By V RICHARDS **Date** MARCH 29 1995
Checked By K SEEDHOUSE V RICHARDS **Date** MARCH 29 1995
Computer File No. 650MW19 **Date** Thu Mar 30 22:40:59 1995

Sketch of Wellhead Completion



Legend for Casing Installation Log

Well No. MW-19
Job No. WB650

MP Log	Description	Quantity
	MP38 END CAP 0223	002
	MP38 CASING 10 FT. 0225F10	040
	MP38 CASING 2 FT. 0225F02	010
	MP38 PACKER STIFFENED 0237F05	015
	MP38 CASING 5 FT. 0225F05	008
	MAGNETIC COLLAR	005

MP Log	Description	Quantity
	MP38 REGULAR COUPLING 0221	053
	MP38 MEASUREMENT PORT 0222	015
	MP38 PUMPING PORT 0224	005

Geo 1

Back Fill

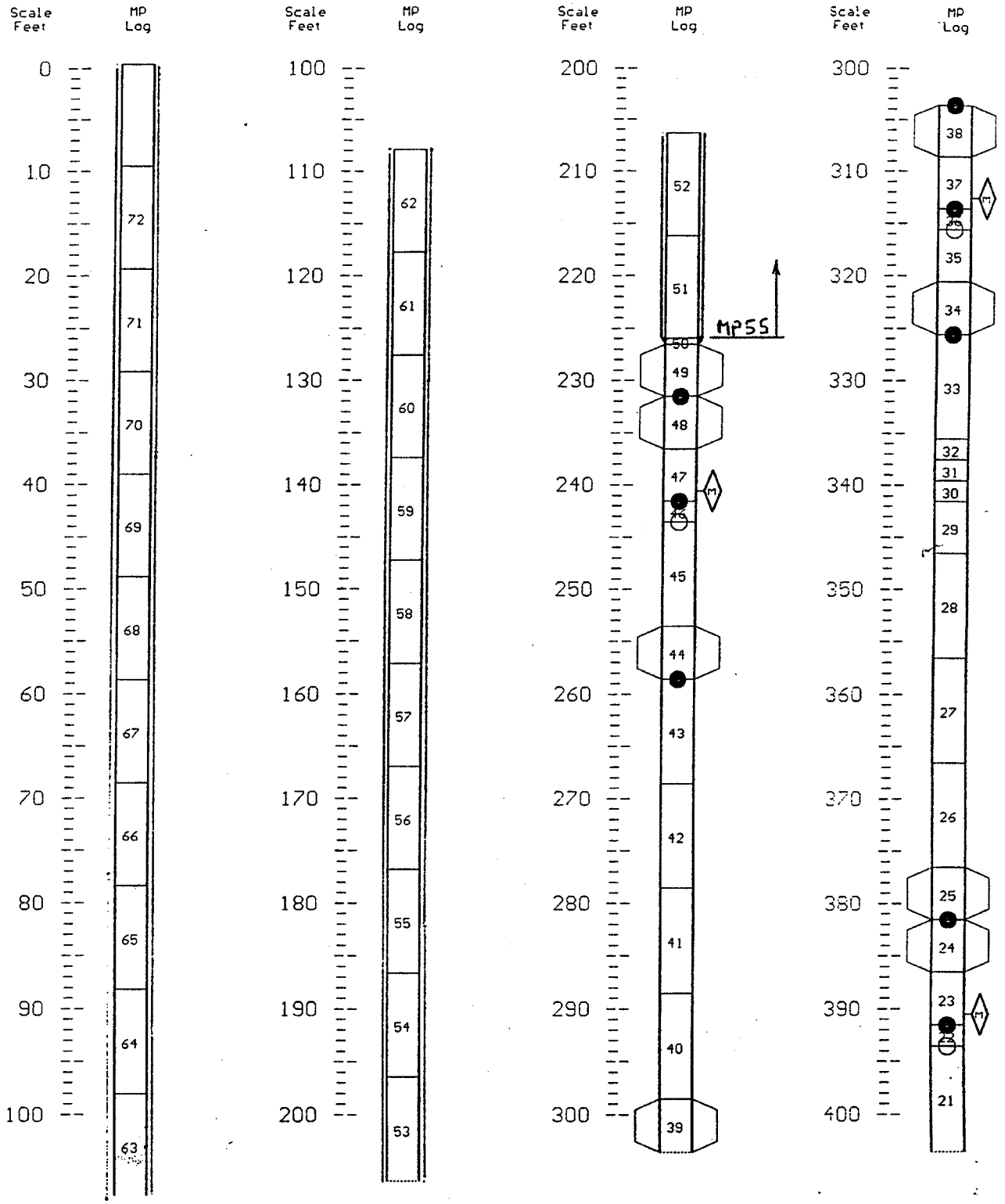
Well Casing

MILD STEEL PIPE

STAINLESS STEEL SCREEN

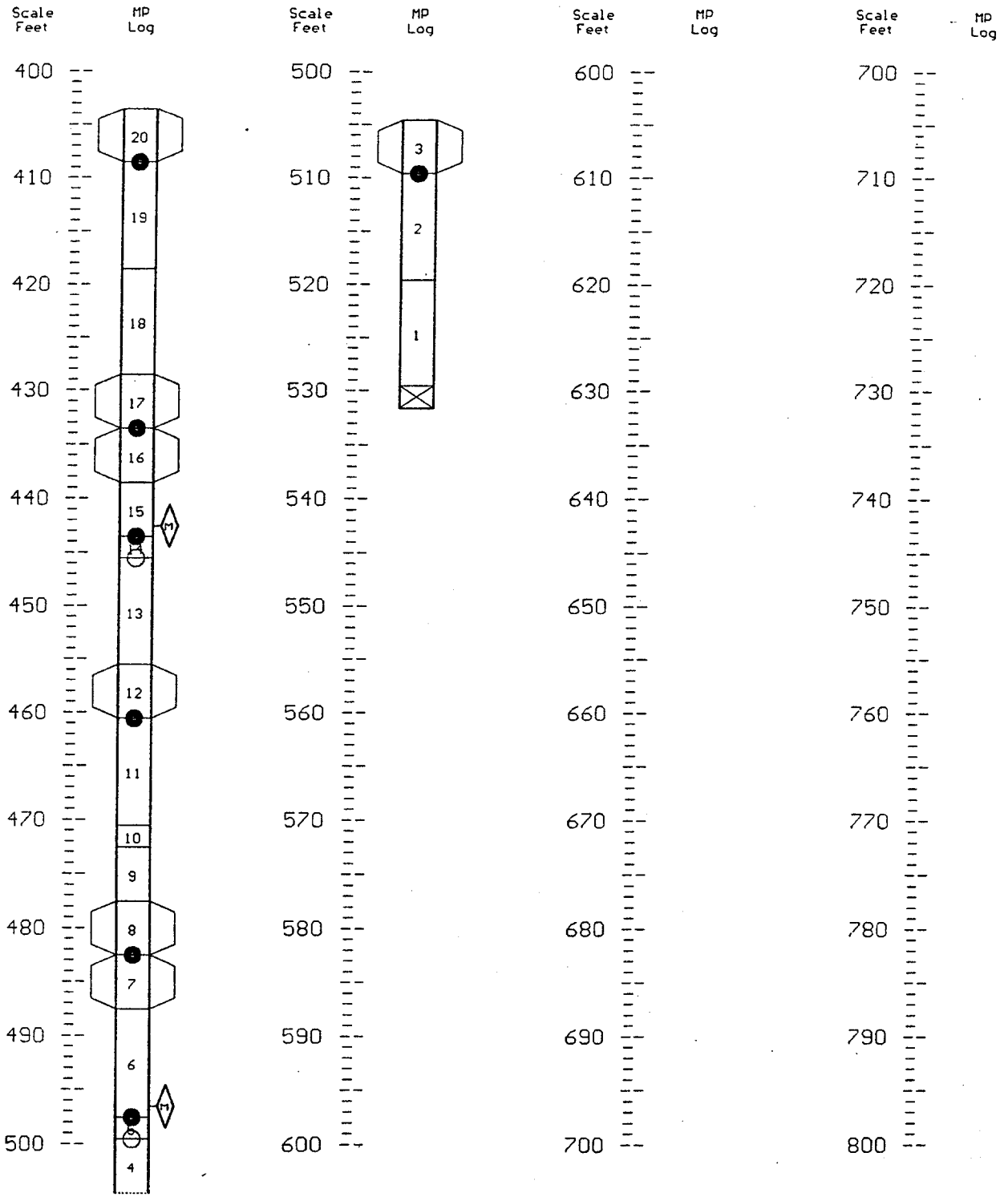
Summary MP Casing Log Date: Fri Apr 28 08:52:58 1995 Page: 1

Job No. WB650 Jet Propulsion Laboratory Well No. MW-19



Summary MP Casing Log Date: Fri Apr 28 08:52:58 1995 Page: 2

Job No. WB650 Jet Propulsion Laboratory Well No. MW-19



WELL MW-20

BORING LOG AND WELL COMPLETION DIAGRAM
WESTBAY MP CASING INSTALLATION LOG

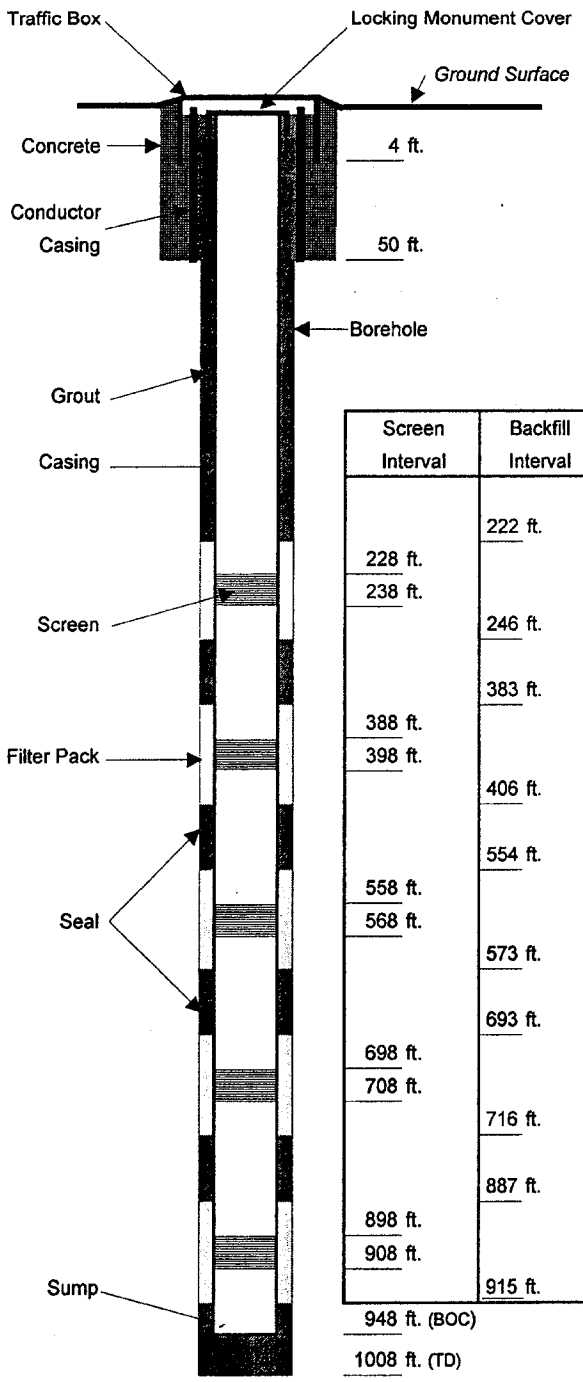
WELL CONSTRUCTION LOG

WELL NUMBER: MW-20

WELL TYPE: Deep Multiport Groundwater Monitoring Well

SURFACE ELEV (ft. above MSL): 1165.51

CASING ELEV (ft. above MSL): 1164.89



Screen Interval	Backfill Interval
	222 ft.
228 ft.	
238 ft.	
	246 ft.
	383 ft.
388 ft.	
398 ft.	
	406 ft.
	554 ft.
558 ft.	
568 ft.	
	573 ft.
	693 ft.
698 ft.	
708 ft.	
	716 ft.
	887 ft.
898 ft.	
908 ft.	
	915 ft.

948 ft. (BOC)

1008 ft. (TD)

DRILLING SUMMARY

DATE COMPLETED:	3/6/95 to 3/28/95
DRILLING COMPANY:	Lang Exploratory Drilling
DRILLING RIG TYPE:	Mud Rotary
TOTAL DEPTH DRILLED:	1008 ft.

CONSTRUCTION DETAILS

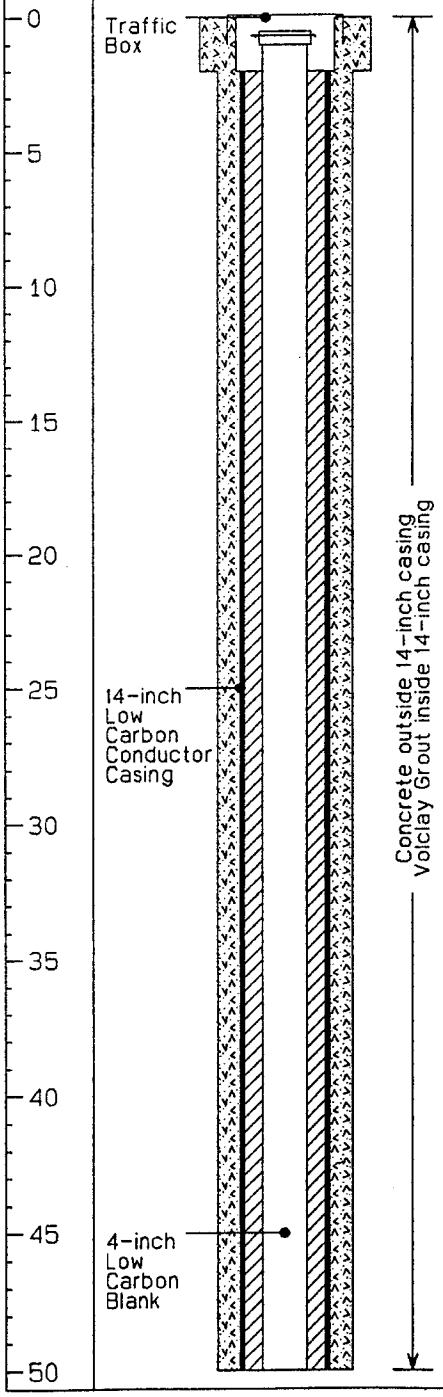
BOREHOLE DIAMETER: (CONDUCTOR CASING)	15.75 in.
CONDUCTOR CASING DIAMETER:	14 in.
CONDUCTOR CASING LENGTH:	50 ft.
BOREHOLE DIAMETER:	9.875 in.
TOTAL WELL DEPTH:	948 ft.
BLANK CASING TYPE:	Low Carbon Steel
BLANK CASING DIAMETER:	4 inch
TOTAL BLANK CASING LENGTH:	898 ft.
SCREEN TYPE:	Stainless Steel
SCREEN SLOT SIZE:	0.010 inch
INDIVIDUAL SCREEN LENGTH:	10 ft.
SUMP LENGTH:	40 ft.
PROTECTIVE CASING STICKUP:	None
GROUT MATERIAL:	Volclay Grout
SEAL MATERIAL:	1:1 Bentonite & Sand mix
FILTER MATERIAL:	#2 Sand
COMMENTS:	

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 20

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of Mountain View & Lincoln*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *03/06/95 - 03/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1165.1*
TOTAL DEPTH (ft) *1008*
APPROX. DEPTH TO WATER (ft bgs) *187.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
0									ASPHALT - Pavement (0.5 feet thick)
								SM	SILTY SAND: Reddish brown; 85% fine to medium sand, subangular to subrounded; 15% non-plastic fines; trace coarse gravel; micaceous; slightly moist; no odor.
5									Increase in grain size - fine to coarse sand, subangular to subrounded 5% fine gravel.
10			0.0	S	N	0.0			Appearance of weathered coarse gravel.
15									
20			0.0	S	N	0.0			
25									
30			0.0	S	N	0.0			
35								SP/SM	SAND WITH SILT: Reddish brown; 85% fine to coarse sand, subrounded; 10% non-plastic fines; 5% fine to coarse gravel, subrounded, max. size = 3-5 inches; micaceous; slightly moist; no odor.
40			0.0	S	N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Reddish brown; About 70% fine to coarse sand; subrounded; 20% fine to coarse gravel, subrounded, max. size = 3-5 inches; 5% non-plastic fines; 5% cobbles; micaceous; slightly moist; no odor.
45									Increase in max. size to 6-8 inches.
									Boulder/cobble zone
50									

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 20

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of Mountain View & Lincoln*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *03/06/95 - 03/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1165.1*
TOTAL DEPTH (ft) *1008*
APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
50		SC-486-01	⧗	0.0	S	N	0.0		SP	
									GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to sub-rounded, max. size = 5-8 inches; 45% fine to coarse sand, subangular to subrounded; 5% non-plastic fines; micaceous, no odor.
55										Increase drill chatter
60										60% fine to coarse gravel; subangular to subrounded; 40% fine to coarse, subangular to subrounded; trace fines.
65										
70				0.0		N	0.0			
75	4-inch Low Carbon Blank									*Drilling Mud Parameters: Mud weight: 8.5 lbs/gal; Viscosity: 34 seconds; Sand content: 0.15%* in
80	Volclay Bentonite Chips (Medium)									
85										POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 55% fine to coarse gravel; subrounded to sub-angular, max. size = 5-8 inches; 45% fine to coarse sand, subangular to subrounded; trace non-plastic fines; micaceous; no odor; Volume of gravel 50% >0.75 inches and 50% 3-4 inches; Volume of sand 80% medium to coarse and 20% fine.
90				0.0		N	0.0			
95										
100										

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 20

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of Mountain View & Lincoln*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *03/06/95 - 03/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1165.1*
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APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
100		SC-486-02	⧗	0.0		N	0.0		GP	
									SM	SILTY SAND
									GP	Formation becoming slightly finer grained - presence of thin (6-10 inches) silty interbeds (SM/SP)in gravels.
105									SM	SILTY SAND: Reddish brown; 60% fine to medium sand; 40% non-plastic fines; micaceous; no odor.
									GP	As Above
									SM	As Above
									GP	As Above
110				0.0		N	0.0			
									SM	SILTY SAND
									GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 60% fine to coarse gravel; subrounded to sub angular, max. size = 5-8 inches; 40% fine to coarse sand, subangular to subrounded; trace non-plastic fines; micaceous; no odor; Volume of gravel 50% >0.75 inches and 50% 3-2 inches; Volume of sand 80% medium to coarse and 20% fine.
115										
120										
125	4-inch Low Carbon Blank									
130				0.0		N	0.0			Increased drill chatter - encounter a cobble/boulder zone. *Drilling Mud Parameters: Mud weight: 8.7 lbs/gal; Viscosity: 34 seconds; Sand content: 0.75%*
135										
140										
145										
150				0.0		N	0.0			

Volclay Bentonite Chips (Medium)

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APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
150									GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 60% fine to coarse gravel; subrounded to sub-angular, max. size = 12-15 inches; 40% fine to coarse sand, subangular to subrounded; trace cobbles/boulders; micaceous; no odor; Volume of gravel 50% fine 50% coarse; Volume of sand 80% medium to coarse and 20% fine. Very tough drilling - on a large boulder
155										
160										
165									GM	SILTY GRAVEL WITH SAND: Reddish brown; About 45% fine to coarse gravel, subangular to subrounded, max. size = 3 inches; 35%fine to coarse sand, subangular to subrounded; 20% non-plastic fines; micaceous; no odor; Volume of gravel 30% coarse and 70% fine; Volume of sand 50% fine and 50% medium to coarse.
170				0.0		N	0.0		SM	SILTY SAND WITH GRAVEL: Reddish brown; About 65% fine to coarse sand, subangular to subrounded, 20% 20% non-plastic fines; 15% fine to coarse gravel, subangular to subrounded; max. size = 0.75 inches; micaceous; no odor.
175	4-inch Low Carbon Blank								GP	Increase in gravel content - formation is becoming coarser grained Increase in drill chatter.
180	Volclay Bentonite Chips (Medium)									POORLY GRADED GRAVEL WITH SAND: Light brown; About 50% fine to coarse gravel; subrounded to subangular max. size = 6-8 inches; 45% fine to coarse sand, subangular to sub rounded; 5% cobbles; micaceous; no odor; Volume of gravel 50% fine and 50% coarse; Volume of sand 70% medium to coarse and 30% fine.
185										Large Boulder Very slow drilling - large cobble/boulder interval.
190				0.0		N	0.0			
195										
200										

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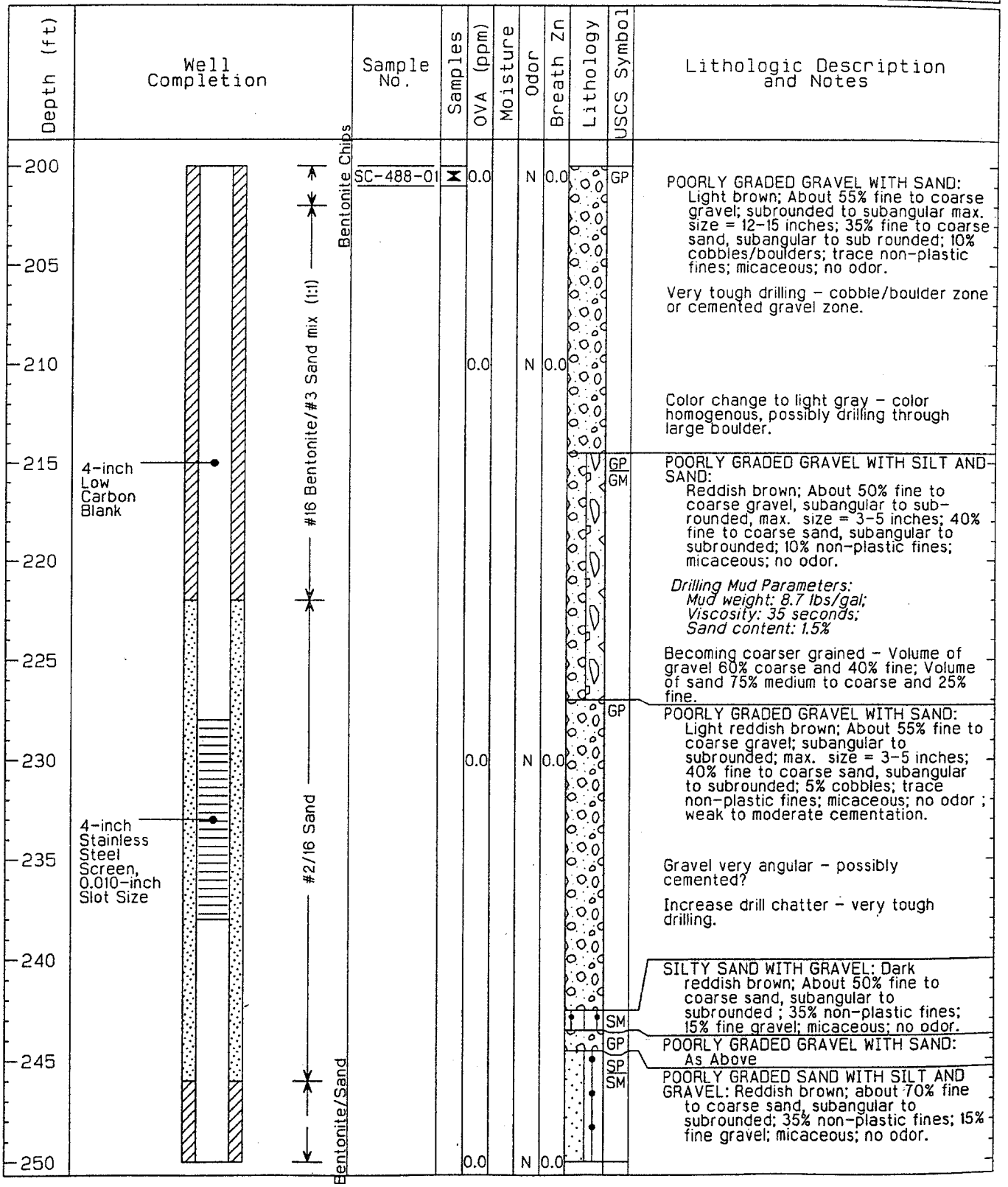

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
250									SP, SM, SP	Slow drilling and virtually no water loss may indicate that the form formation is cemented to some extent; Drill bit may need to be changed.
									GP	POORLY GRADED SAND: Decrease in silt content (5%), increase in coarse grained component
255										POORLY GRADED GRAVEL WITH SAND, COBBLES/BOULDERS: Light reddish brown; About 55% fine to coarse gravel; suangular to subrounded, hard, max. size=2 inches; 45% fine to coarse sand, sub angular; 5% non-plastic fines; 5% by volume cobbles and boulders, 90% 3-5 inches and 10% >5 inches.
260										
265										Drill rig chatter.
270				0.0		N	0.0			
275	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)								SM	SILTY SAND WITH GRAVEL: Reddish brown; About 50% fine to medium sand, subangular; 30% fine gravel, hard, subangular to subrounded; max.size = 0.75 inches.
									GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel; subangular to subrounded, max. size = 3 inches; 40% fine to coarse sand, subangular to subrounded; 5% non-plastic fines.
280										*Drilling Mud Parameters: Mud weight: 8.7 lbs/gal; Viscosity: 35 seconds; Sand content: 0.25%*
285										
									GM, GP	SILTY GRAVEL WITH SAND: Dark reddish brown; About 40% fine to coarse gravel; subangular to subrounded, max. size = 3 inches; 35% fine to coarse sand, subrounded; 25% non-plastic fines; micaceous; no odor.
290				0.0		N	0.0			
										POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel; subangular to subrounded, max. size = 5-6 inches; 35% fine to coarse sand; 5% cobbles; 5% non-plastic fines; micaceous; no odor.
295										
300										

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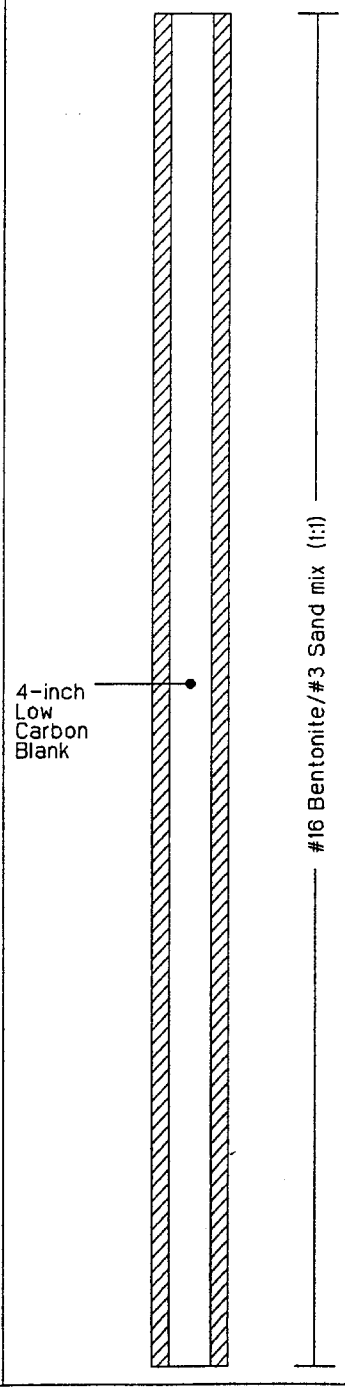

Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	USCS Symbol	Lithologic Description and Notes
300	SC-490-01	✖	0.0		N	0.0	GP	
305								As above
310			0.0		N	0.0		
315							GM	SILTY GRAVEL WITH SAND: Light reddish brown; About 45% fine to coarse gravel; subangular to subrounded, max. size = 3 inches; 40% fine to coarse sand; 15% non-plastic fines; micaceous; no odor; Volume of gravel 50% fine and 50% coarse; Volume of sand 50% fine and 50% medium to coarse.
320							SM	SILTY SAND: Dark reddish brown; about 65% fine to medium sand, subrounded; 35% non-plastic fines; micaceous; no odor; Volume of sand 80% fine and 20% coarse.
325								Increase in coarse-grained component; 10% fine to coarse gravel, subangular to subrounded; Volume of gravel 90% fine and 10% coarse; Volume of sand 70% fine and 30% medium to coarse.
330			0.0		N	0.0		POORLY GRADED GRAVEL WITH SILT AND SAND: Light reddish brown; about 40% fine to coarse gravel, subangular to subrounded, max.size = 3 inches; 30% fine to coarse sand, subrounded; 30% non-plastic fines; micaceous; no odor; Volume of gravel 50% fine and 50% coarse; Volume of sand 70% medium to coarse and 30% fine.
335							GM	
340							ML	SANDY SILT: Dark reddish brown; About 60% low plastic fines; 35% fine sand; 5% elastic fines; micaceous; no odor; Volume of sand 100% fine.
							SM	SILTY SAND WITH GRAVEL: Reddish brown; About 60% fine to coarse sand, subrounded; 25% non-plastic fines; 15% fine to coarse gravel, subangular to subrounded; max. size = 3 inches.
345								POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 60% fine to coarse gravel, subangular to subrounded, max. size = 3 inches; 35% fine to coarse sand, subrounded; 5% non-plastic fines; micaceous, no odor.
350			0.0		N	0.0	GP	

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Monitoring Well 20

PROJECT	Jet Propulsion Laboratory	DRILLING METHOD	Reverse Circulation Mud Rotary
LOCATION	Corner of Mountain View & Lincoln	SAMPLING METHOD	Grab Sample from Shaker Screen
GEOLOGIST	C. Kreller	SURFACE ELEVATION	1165.1
DRILLING CO	Lang Exploratory Drilling	TOTAL DEPTH (ft)	1008
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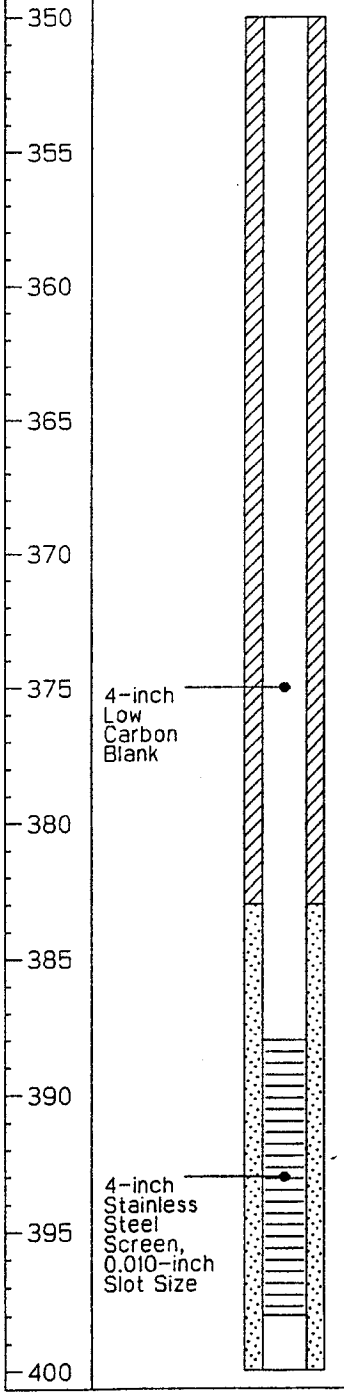

Depth (ft)	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	USCS Symbol	Lithologic Description and Notes
350						GP	
355							SILTY SAND: Dark reddish brown; about 70% fine to medium sand, subrounded; 30% non-plastic fines; trace fine gravel; micaceous; no odor; Volume of sand 80% fine and 20% medium to coarse.
360							Volume of sand 60% fine and 40% medium to coarse.
						SM	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; 45% fine to coarse sand, subrounded; micaceous, no odor; Volume of gravel 90% fine and 10% coarse; Volume of sand 90% medium to coarse and 10% fine.
365							
						GP	
370		0.0		N	0.0		SILTY GRAVEL WITH SAND: About 45% fine to coarse gravel, subangular to subrounded; 40% fine to coarse sand; 15% non-plastic fines.
						GM	
375						GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; 45% fine to coarse sand, subrounded; micaceous, no odor; Volume of gravel 90% fine and 10% coarse; Volume of sand 90% medium to coarse and 10% fine.
380						SM	SILTY SAND: Reddish brown, about 70% fine to coarse sand; subangular to subrounded; 30% non-plastic fines; trace gravel; micaceous; no odor; Volume of sand 60% fine and 40% medium to coarse.
385							
						SP	POORLY GRADED SAND WITH GRAVEL: Light reddish brown; about 60% fine to coarse sand, subangular to subrounded; 35% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; micaceous; no odor; Volume of sand 90% medium to coarse and 10 % fine; Volume of gravel 95% fine and 5% coarse.
390		0.0		N	0.0		
							Material becoming coarse grained.
395							Increase in drill chatter - on a large boulder.
						GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 50% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; 45% fine to coarse sand, subrounded; 5% non-plastic fines; micaceous; no odor.
400						SM	

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Monitoring Well 20

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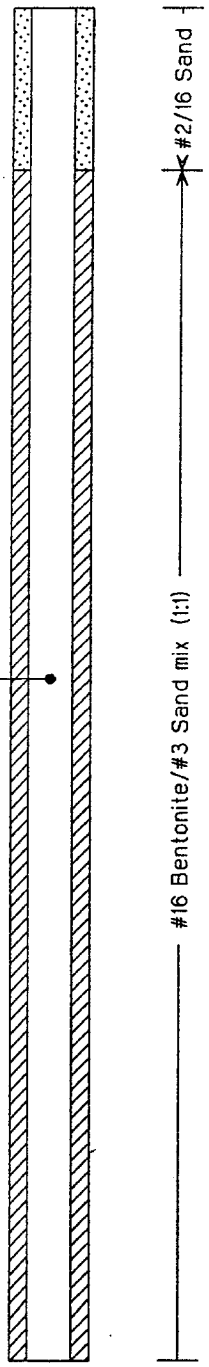
APPROX. DEPTH TO WATER (ft bgs) *187.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
400	SC-491-01	X						SM	POORLY GRADED SAND: Dark reddish brown; 100% fine to medium sand, micaceous, no odor; Volume of sand 90% fine and 10% medium.
405								GM	SILTY GRAVEL WITH SAND: Light reddish brown; About 45% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; 40% fine to coarse sand, subrounded; 15% non-plastic fines.
								GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded, max. size = 2-3 inches; 45% fine to coarse sand, subangular to sub rounded; 5% non-plastic fines; micaceous; no odor; Volume of gravel 70% fine and 30% coarse; Volume of sand 80% fine and 20% medium to coarse.
410			0.0		N	0.0			
415								GM	SILTY GRAVEL WITH SAND: Light reddish brown; About 40% fine gravel, subangular to subrounded; 30% fine to coarse sand, subrounded; 30% non-plastic fines.
420								GP	POORLY GRADED GRAVEL WITH SAND: Reddish brown; About 50% fine to coarse gravel, subangular to subrounded, max. size = 2-3 inches; 45% fine to coarse sand, subangular to sub rounded; 5% non-plastic fines; micaceous; no odor; Volume of gravel 70% fine and 30% coarse; Volume of sand 80% fine and 20% medium to coarse.
425								SM	SILTY SAND WITH GRAVEL: About 50% fine to coarse sand, subrounded; 30% fine gravel, subangular subrounded; 20% non-plastic fines.
430			0.0		N	0.0		SP	POORLY GRADED SAND WITH GRAVEL: Reddish brown; about 55% fine to coarse gravel, subangular to subrounded; 40% fine to coarse sand, subrounded; 5% non-plastic fines; max size 2"; no odor.
435								GP	POORLY GRADED GRAVEL WITH SAND: Light reddish brown; About 55% fine to coarse gravel, subangular to subrounded, max. size = 2-3 inches; 40% fine to coarse sand, subrounded; 5% non-plastic fines; micaceous; no odor.
440								SM	SILTY SAND WITH GRAVEL: Reddish brown; About 60% fine to coarse sand, subrounded; 25% fine to coarse gravel, subangular to subrounded, max. size = 2 inches; micaceous; no odor.
445								SP	POORLY GRADED SAND WITH GRAVEL: Light reddish brown; About 60% fine to coarse sand, subrounded; 35% fine to coarse gravel, subangular to subrounded; max size = 2 inches; 5% non-plastic fines; micaceous; no odor.
450			0.0		N	0.0			

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Monitoring Well 20

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DATE (start/finish) *03/06/95 - 03/28/95*

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TOTAL DEPTH (ft) *1008*
APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
450									SP	
455									SM	SILTY SAND: Light reddish brown, about 80% fine to medium sand; 20% non-plastic fines; trace coarse sand; micaceous; no odor; Volume of sand 90% fine and 10% medium.
460										
465									SM	SILTY SAND WITH GRAVEL: Orange brown; About 70% fine to coarse sand, subrounded; 15% fine gravel, subangular, max. size = 1-2 inches; 15% non-plastic fines; micaceous; no odor; Volume of sand 75% fine and 25% medium to coarse; Volume of gravel 100% fine.
470				0.0		N	0.0			
475	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)									
480										As above
485										SILTY SAND: Dark reddish brown; about 70% fine to medium sand, subrounded; 30% non-plastic coarse sand; micaceous; no odor; Volume of sand 80% fine and 20% medium.
490				0.0		N	0.0			
495										As above
500										Becoming coarser grained

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500		SC-491-02	X	0.0		N	0.0		SM	
										Becoming finer grained
505										
510				0.0		N	0.0			
515										SILTY SAND WITH GRAVEL: Light reddish brown; 65% fine to medium sand, subrounded; 20% non-plastic fines; 15% fine gravel, subangular to subrounded, max. size = 0.5 inch ; micaceous; no odor; Volume of sand 50% fine and 50% medium.
520										
525	4-inch Low Carbon Blank									SILTY SAND: Reddish brown; about 70% fine to coarse sand, subangular to subrounded; 20% non-plastic fines; 10% fine gravel, max. size=0.25 inches; micaceous; no odor; Volume of sand 70% fine and 30% medium to coarse.
530	#16 Bentonite/#3 Sand mix (1:1)			0.0		N	0.0			
535										
									SP/SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light brown; about 70% fine to coarse sand, subangular to subrounded; 15% non-plastic fines; 15% fine to coarse gravel, subangular to subrounded, max. size=2 inches; micaceous; no odor; Volume of sand 50% fine and 50% medium to coarse; Volume of gravel 90% fine and 10% coarse.
540									SM	SILTY SAND: Reddish brown; about 75% fine to medium sand, subrounded; 25% non-plastic fines; trace coarse sand; micaceous; no odor; Volume of sand 85% fine 15% medium to coarse.
545										
550				0.0		N	0.0			

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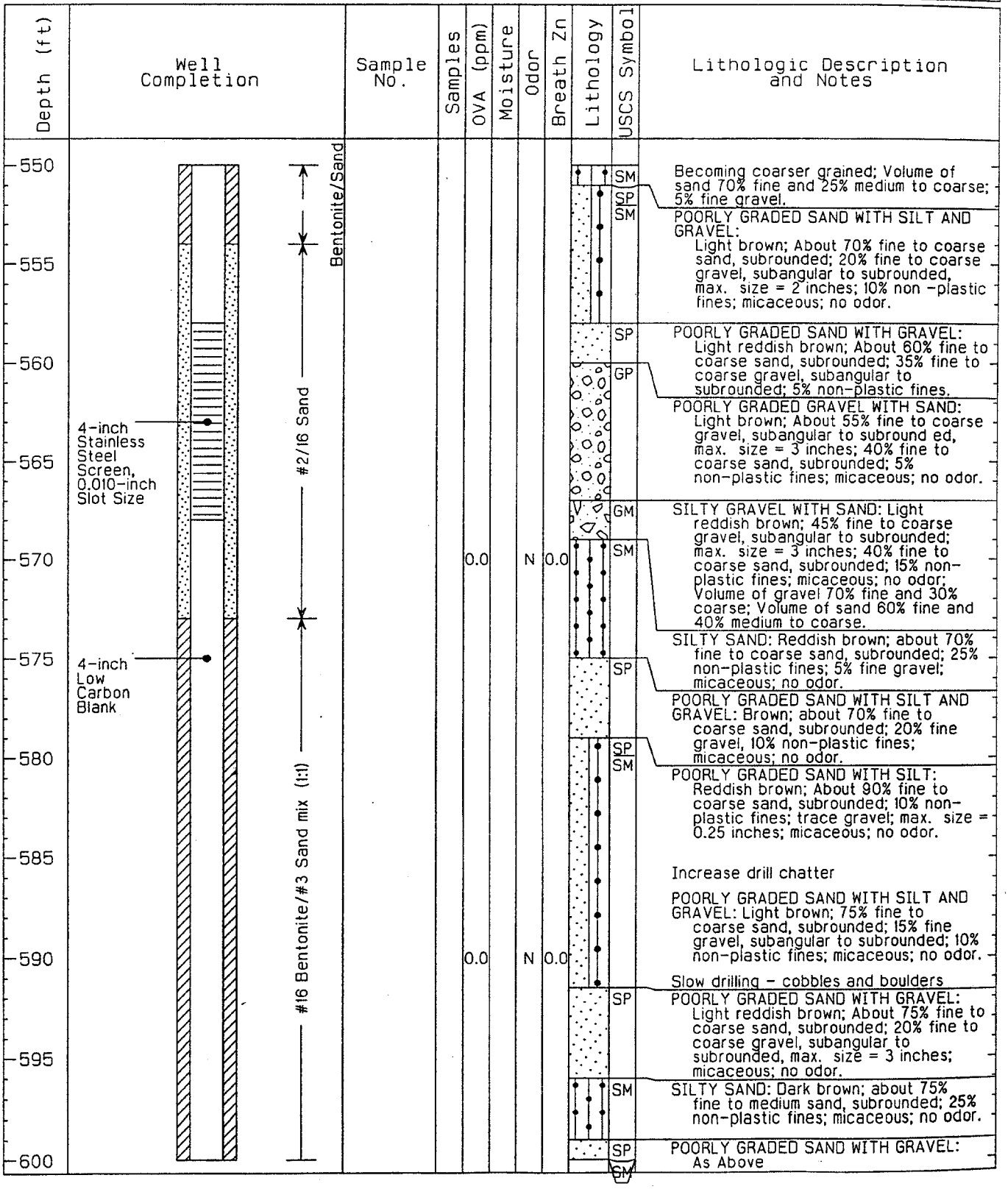

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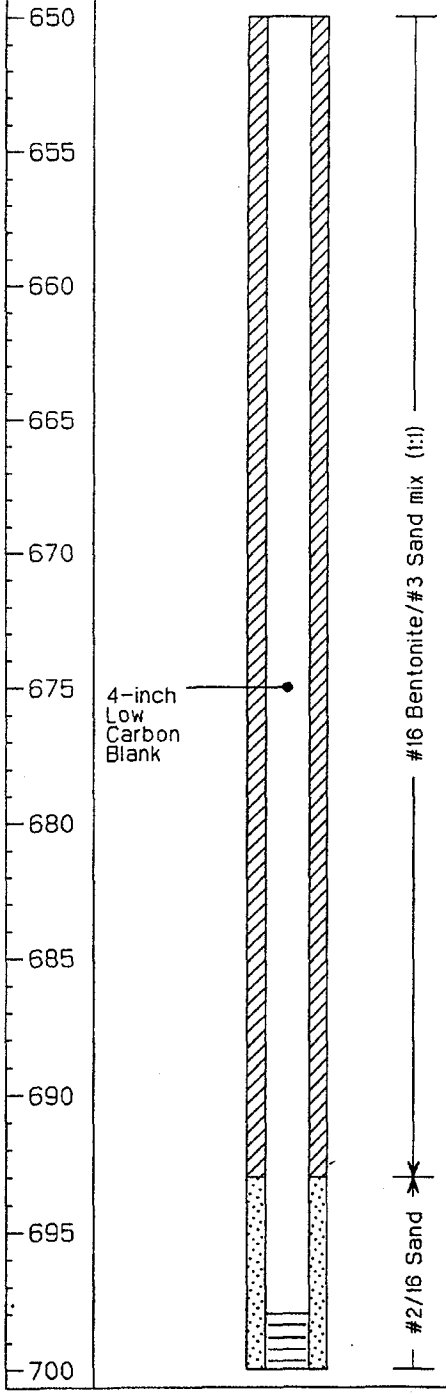

Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
650								SP SM	
655									
660									As above
665									Becoming finer grained
670			0.0		N	0.0		SM	SILTY SAND: Brown; about 55% fine sand; 45% low plastic fines; trace coarse sand; micaceous; no odor.
675									
680									As above
685								SP SM	POORLY GRADED SAND WITH SILT: Reddish brown; About 80% fine to coarse sand, hard; 10% fine gravel, hard, subangular to subrounded, max. size = 0.5 inches; 10% non-plastic fines; no odor.
690			0.0		N	0.0		SM	SILTY SAND: Brown; about 55% fine sand; 55% low plastic fines; trace coarse sand; micaceous; no odor.
695								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; 75% fine to coarse subrounded sand; 15% fine gravel, max. size = 2-3 inches; 10% non-plastic fines; micaceous; no odor; Volume sand 50% fine and 50% medium to coarse; Volume of gravel 100% fine.
700									

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APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
600		SC-493-01	✖	0.0		N	0.0		SM	SILTY SAND: Dark brown; about 80% fine to coarse sand, subrounded; 20% non-plastic fines; micaceous; no odor; Volume of sand 80% fine and 20% medium to coarse.
605										Increase drill chatter – cobbles/boulders
610				0.0		N	0.0			
615										As above
620										Increase in coarse-grained material – color change to light gray brown
625	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)								SP SM SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light gray/brown; 75% fine to coarse sand, subrounded; 15% fine gravel subangular to subrounded; 10% non-plastic fines; micaceous; no odor; Volume of sand 70% fine and 30% medium to coarse; Volume of gravel 100% fine.
630				0.0		N	0.0			SILTY SAND: Dark reddish about 60% fine sand; 40% low plastic fines, (siltstone?); no odor; slightly cemented.
635										Highly cemented Color change to light reddish brown – texture less consolidated; 80% fine sand; 20% non-plastic fines.
640									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; 75% fine to coarse subrounded sand; 15% fine gravel, max. size = 2-3 inches; 10% non-plastic fines; micaceous; no odor; Volume sand 50% fine and 50% medium to coarse; Volume of gravel 100% fine.
645										
650				0.0		N	0.0			

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Monitoring Well 20

PROJECT *Jet Propulsion Laboratory*
LOCATION *Corner of Mountain View & Lincoln*
GEOLOGIST *C. Kreller*
DRILLING CO *Lang Exploratory Drilling*
DATE (start/finish) *03/06/95 - 03/28/95*

DRILLING METHOD *Reverse Circulation Mud Rotary*
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1165.1*
TOTAL DEPTH (ft) *1008*
APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
750									SM	
755										Appearance of fine gravel at 756-757'.
760										SILTY SAND: Dark reddish brown; about 60% fine to medium sand, subrounded; 40% low-plastic fines; max. size = 0.125 inches; micaceous; no odor; partially cemented material; Volume of sand 90% fine and 10% medium.
765										
770				0.0		N	0.0			
775	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subrounded; 15% fine gravel, subangular to subrounded, max. size = 1 inch; 10% non-plastic fines; micaceous; no odor; Volume of sand 80% medium to coarse and 20% fine.
									SM	SILTY SAND: Dark reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; max. size = 0.125 inches; micaceous; no odor; partially cemented material; Volume of sand 90% fine and 10% medium.
780										Increase drill chatter.
785										Increase in coarse grained component; Volume of sand 60% fine and 40% medium.
790				0.0		N	0.0			SILTY SAND WITH GRAVEL: Light reddish brown; About 65% fine to coarse sand, subrounded; 20% fine to coarse gravel, subangular to subrounded, max. size 3-4 inches; 15% non-plastic fines; trace cobbles; micaceous; no odor; Volume of sand 80% medium to coarse and 20% fine; Volume of gravel 50% fine and 50% coarse.
795										
800										

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DATE (start/finish) *03/06/95 - 03/28/95*

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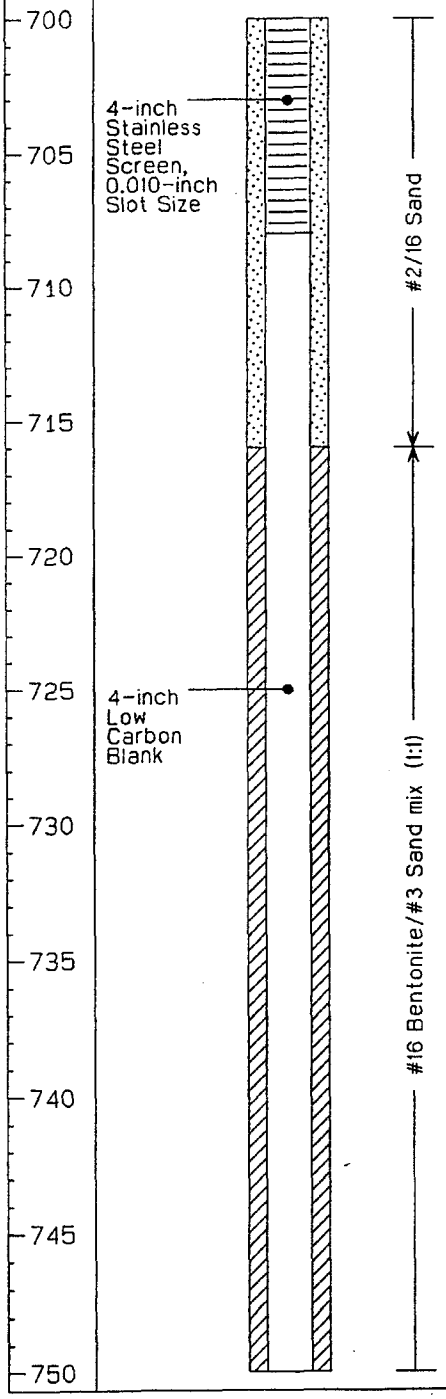
SAMPLING METHOD *Grab Sample from Shaker Screen*
SURFACE ELEVATION *1165.1*
TOTAL DEPTH (ft) *1008*
APPROX. DEPTH TO WATER (ft bgs) *187.0*



Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
700	SC-494-01	⧗	0.0		N	0.0		SP SM	
								SM	SILTY SAND: Reddish brown; 80% fine to medium sand, subrounded; 20% non-plastic fines; Micaceous; no odor; Volume of sand 80% fine and 20% medium.
705									Partially cemented; very dark reddish brown. 707-713'.
710			0.0		N	0.0			
									SILTY SAND: Reddish brown; 80% fine to coarse sand, subrounded; 15% non-plastic fines; 5% fine gravel, subrounded, max. size = 0.25 inches; micaceous; no odor; Volume of sand 75% fine and 25% medium to coarse.
715									Partially cemented; very hard material; very dark reddish brown.
720									SILTY SAND: Dark reddish brown; 60% fine to coarse sand, subrounded; 40% low-plastic fines; max. size = 0.25 inches; micaceous; no odor; Volume of sand 90% fine and 10% medium to coarse.
725									
730			0.0		N	0.0			
									As above except 35% non-plastic fines; unconsolidated.
735									
740									
									As above except 80% fine to coarse sand; 20% non-plastic fines.
745									As above except 65% fine to coarse sand; 35% low-plastic fines.
750			0.0		N	0.0			

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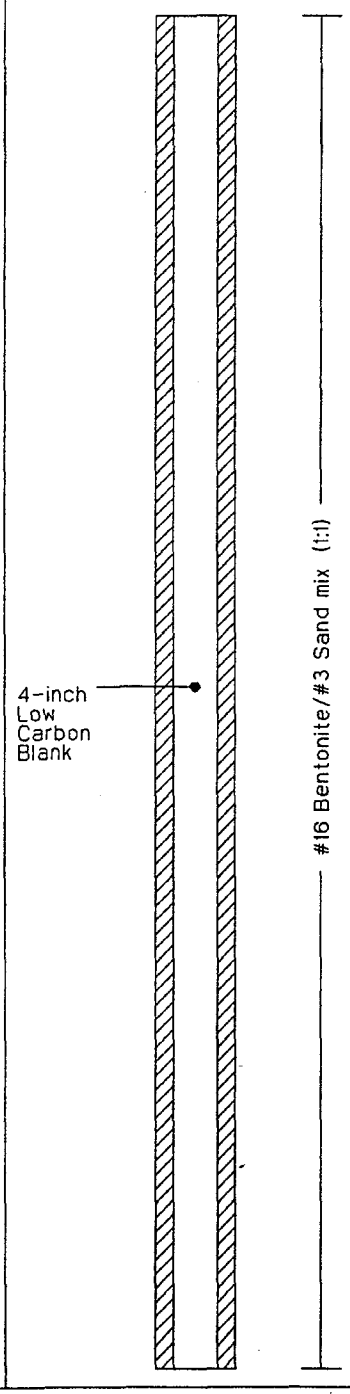

Depth (ft)	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
800	SC-494-02	X	0.0		N	0.0		SM	SILTY SAND: Reddish brown; about 65% fine to medium sand, subrounded; 35% low-plastic fines; max. size = 0.125 inches; micaceous; no odor; partially cemented material; Volume of sand 80% fine and 20% medium.
805									
810			0.0		N	0.0			
815									As above
									Increase in drill chatter
820								SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subrounded; 15% fine gravel, subangular to subrounded, max. size = 1 inch; 10% non-plastic fines; micaceous; no odor; Volume of sand 10% fine and 90% medium to coarse.
								SM	
825								SP SM	SILTY SAND: Dark reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; Volume of sand 80% fine and 20% medium.
830			0.0		N	0.0			POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subrounded; 15% fine gravel, subangular to subrounded, max. size = 1 inch; 10% non-plastic fines; micaceous; no odor; Volume of sand 60% fine and 40% medium.
								SM	
835									SILTY SAND: Dark reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; Volume of sand 80% fine and 20% medium.
840									As above except 65% sand and 35% fines; Volume of sand 90% fine and 10% medium.
									Becomming coarser grained; 85% fine to coarse sand; 15% non-plastic fines.
845									Fine grained; 70% fine to medium sand; 30% low-plastic fines.
850			0.0		N	0.0			

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APPROX. DEPTH TO WATER (ft bgs) *187.0*

Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
850									SM	Drill chatter.
855									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 70% fine to coarse sand, subrounded; 20% fine to coarse gravel, subangular to subrounded; 10% non-plastic fines; micaceous; no odor; predominantly fine grained, iron stained, weathered material.
860										Increase in coarse grained component; 30% fine gravel and 5% cobbles.
										Very coarse grained.
865										Very hard drilling; large cobbles/boulders.
870				0.0		N	0.0		SM	SILTY SAND: Reddish brown; about 80% fine to coarse sand, subrounded; 20% non-plastic fines; max. size = 1 inch; micaceous; no odor; fine-grained weathered material present; iron staining.
										Drill chatter; material becomming coarser-grained; 65% fine to coarse grained sand; 20% fine to coarse gravel; 15% non-plastic fines.
875	4-inch Low Carbon Blank									SILTY SAND: Reddish brown; about 70% fine to coarse sand, subrounded; 25% non-plastic fines; 5% fine gravel; micaceous; no odor; fine-grained weathered material present.
880									SP SM	POORLY GRADED SAND WITH SILT: Light reddish brown; About 80% fine to coarse sand, subrounded; 10% fine gravel; 10% non-plastic fines; micaceous; no odor; weathered material present.
									SM	SILTY SAND: Reddish brown; about 70% fine to coarse sand, subrounded; 25% non-plastic fines; 5% fine gravel; micaceous; no odor; fine grained weathered material present.
885									SP SM	POORLY GRADED SAND WITH SILT: Light reddish brown; About 80% fine to coarse sand, subrounded; 10% fine gravel; 10% non-plastic fines; micaceous; no odor; weathered material present.
890				0.0		N	0.0		SM	SILTY SAND: Reddish brown; about 70% fine to coarse sand, subrounded; 25% non-plastic fines; 5% fine gravel; micaceous; no odor; fine-grained weathered material present.
895									SP SM	POORLY GRADED SAND WITH SILT: Light reddish brown; About 80% fine to coarse sand, subrounded; 10% fine gravel; 10% non-plastic fines; micaceous; no odor; weathered material present.
900										

#16 Bentonite/#3 Sand mix (1:1)

#2/16 Sand

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Monitoring Well 20

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
900		SC-496-01	⧗	0.0		N	0.0		SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 70% fine to coarse sand, subangular to subrounded; 20% fine to coarse gravel, subangular to subrounded; 10% non-plastic fines; trace cobbles; micaceous; no odor; fine weathered material; Volume of sand 50% medium to coarse and 50% fine; Volume of gravel 90% fine and 10% coarse.
905	4-inch Stainless Steel Screen, 0.010-inch Slot Size; #2/16 Sand									
910				0.0		N	0.0			
915										
920									SM SP SM	SILTY SAND: Reddish brown; about 70% fine to coarse sand, subrounded; 25% non-plastic fines; 5% fine gravel; micaceous; no odor; fine-grained weathered material present; Volume of sand 80% fine and 20% medium to coarse.
925	4-inch Low Carbon Blank; #16 Bentonite/#3 Sand mix (1:1)									POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 70% fine to coarse sand, subangular to subrounded; 20% fine to coarse gravel, subangular to subrounded; 10% non-plastic fines; trace cobbles; micaceous; no odor; fine weathered material; Volume of sand 50% medium to coarse and 50% fine; Volume of gravel 90% fine and 10% coarse.
930				0.0		N	0.0		SM	Cobble/Boulder zone
935										SILTY SAND: Reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; micaceous; no odor; Volume of sand 90% fine and 10% medium. Increase in fine grained material from 933-934 feet; 55% fine sand; 45% low-plastic fines.
940										POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subangular to subrounded; 15% fine gravel, subangular to subrounded; 10% non-plastic fines; micaceous; no odor; some fine-grained weathered material; Volume of sand 60% fine and 40% medium to coarse.
945									SP SM	Cobbles and Boulders at 945 feet.
950	4-inch Low Carbon End Cap			0.0		N	0.0		SM	SILTY SAND: Reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; micaceous; no odor; Volume of sand 90% fine and 10% medium.

Continue

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Depth (ft)	Well Completion	Sample No.	Samples	OVA (ppm)	Moisture	Odor	Breath Zn	Lithology	USCS Symbol	Lithologic Description and Notes
950	#16 Bentonite/#3 Sand mix (1:1)								SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subangular to subrounded; 15% fine gravel, subangular to subrounded; 10% non-plastic fines; micaceous; no odor; some fine grained weathered material.
									SP SM	Cobbles and Boulders at 954 feet.
955										
									SM	SILTY SAND: Reddish brown; about 70% fine to medium sand, subrounded; 30% low-plastic fines; micaceous; no odor.
960										POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 75% fine to coarse sand, subangular to subrounded; 15% fine gravel, subangular to subrounded; 10% non-plastic fines; micaceous; no odor; some fine-grained weathered material.
965									SP SM	Cobbles and Boulders at 954 feet.
				0.0		N	0.0			SILTY SAND: Light reddish brown; about 85% fine to coarse sand, subrounded; 15% non-plastic fines; micaceous; no odor; fine grained weathered material.
970										POORLY GRADED SAND WITH GRAVEL, COBBLES AND BOULDERS: Light reddish brown; About 55% fine to coarse sand, subrounded; 25% fine to coarse gravel, subangular to subrounded; 15% cobbles/boulders; 5% non-plastic fines; micaceous; no odor; partially cemented; weathered material present.
975									SM	
									SP	SILTY SAND: Light reddish brown; about 80% fine to coarse sand, subrounded; 20% non-plastic fines; micaceous; no odor; fine weathered gravel.
980									SM	
									SP SM	POORLY GRADED SAND WITH SILT AND GRAVEL: Light reddish brown; about 70% fine to coarse sand, subrounded; 20% fine to coarse gravel, max. size = 3-5 inches; 10% non-plastic fines; micaceous; no odor; predominantly weathered matrix; (Weathered material is mostly granitic).
985									SM	
				0.0		N	0.0			SILTY SAND: Light reddish brown; about 80% fine to coarse sand, subrounded; 20% non-plastic fines; micaceous; no odor; fine weathered gravel.
990										SILTY SAND: Very dark red; about 60% fine to medium sand, subrounded; 40% non-plastic fines; no moisture; micaceous; no odor; partially cemented; trace coarse- grained angular sand.
995									ML	SANDY SILT: Dark reddish brown; about 85% low to medium plastic fines; 15% fine sand; slightly moist; micaceous; no odor.
1000										