Hecla
MINING COMPANY
Centennial
1891 - 1991

FINAL RECLAMATION PLAN

DURITA SITE

COLORADO RADIOACTIVE MATERIALS LICENSE NO. 317-02

VOLUME 2

APPENDICES

OCTOBER, 1991

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VOLUME 2 - APPENDICES

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APPENDIX A

HEALTH AND SAFETY AND RADIOLOGICAL SURVEY PROCEDURES

CONTENTS

Health and Safety Radiological Program (sections included by reference)

Field Gamma Survey Standard Operating Procedure

Soil Survey Standard Operating Procedure

HEALTH AND SAFETY RADIATION PROGRAM

The following sections of the *Health and Safety Radiological Program, Durita Project, May 1990* are included in this appendix by reference.

1. ALARA (B-1.0, Health and Safety Plan)
2. Radiation Program (B-1.1, 1.2)
3. Training (B-1.3)
4. Radiation Work Permits (B-1.4)
5. Calibration (B-1.5, 1.6, 1.7, 1.8, 1.9)
6. Radiological Monitoring (B-2.0, 2.1, 2.2, 2.3, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1)
7. Bioassay (B-2.4)
8. Respirator (B-2.5)
9. Material Release Surveys (B-3.2)
10. Emergency Response: Radiation Safety (B-3.3)

Other sections may be added as necessary.

FIELD GAMMA SURVEY

Standard Operating Procedure

EQUIPMENT

1. Eberline PRM-7 microR meter or equivalent
2. Map showing sectors

PROCEDURE

Prior to Survey

1. Meters are calibrated against known standards and a pulse rate meter. Calibration is performed either prior to survey or at minimum of every six months.

2. Check the instrument model, serial number, battery check, high voltage reading and the last date the instrument was calibrated.

3. To verify consistency in the gamma intensity measured, a Cesium-137 gamma check source is used each day prior to surveying. Check and record.

4. A variability check is conducted for each scale of the meter. Between 10 and 20 readings should be obtained for each scale.

Survey

1. Using a land survey point or equivalent as reference, the gamma survey is conducted based on compass directional transects from center of tailing facility.

2. Survey measurements over large areas are taken at a maximum of 100 foot intervals on each of the 16 directional transects from the tailing facility. Shorter intervals, usually of 50 meters are required for definition of isolated areas of contamination.

3. At each survey point, the reading should be taken at 1 meter, resetting the meter prior to each reading and allowing 30 seconds to elapse before recording next reading.

SOIL SAMPLING

Standard Operating Procedure

EQUIPMENT

1. USGS approved Auger or equivalent.
2. Balance and weights
3. Rotary grinder
4. Trays
5. Multichannel analyzer
6. Plastic bags
7. Marking pens
8. Cans
9. Trowel
10. Oven

PROCEDURE

1. Collect soil samples for analyses of the following:

   - Ra-226

2. Collect samples with an Auger or similar device. Approximately 1500 grams (one quart volume) should be collected for analyses from at least 0 - 15 cm additional check samples in some locations to be collected at the following depths:

   - 16 - 30 cm
   - 31 - 46 cm

3. Place samples in a cloth or plastic bag and label with the following information:

   - Date sampled.
   - Sampling location.

4. Transfer sample from sample bag to a metal tray, remove and discard leaves, twigs, roots and other vegetal debris.

5. Place trays in oven and dry for 24 hours at 100° to 125° C.

6. Remove tray from oven. Allow sample to cool to room temperature.

7. Grind soil sample to at least 28 mesh.

8. Weigh empty can and lid, which will hold soil sample, record weight and label sample, approximately 10% of sample is sent to another lab for wet chemistry analysis comparison.

9. Place sample in preweighed can and hand pack. Add additional sample until container is full.

10. Seal container with silicone cocking. Record date and time.

11. Weigh sealed container. Record net weight.

12. Let canned soil sample age for no less than 15 days to reach equilibrium.

13. Ensure that the multi channel analyzer settings are correct before reading samples.

14. Place reference source sample in the well of the detector, close the shield and acquire a spectrum. Read for 1000 seconds. Record reading.

15. Place empty can in the well and read same as source. Record reading.

16. Place sample in the well of the detector and read.

17. Read the region of interest of the peak created by Bi 214 on Channel 122 for Ra-226.

18. $\frac{\text{net Cts}}{\text{Reference Material}} \times \frac{1.711\text{EEX}10^{5}}{\text{Net Wt}} = \frac{\text{pCi}}{1.44 \text{ ad. factor}} = \text{Ra pCi/g}$

APPENDIX B

TECHNICAL SPECIFICATIONS

SPECIFICATION NUMBER	TITLE
B1	MILL DEMOLITION
B2	DEMOLITION DEBRIS BURIAL AND MILL-AREA COVER PLACEMENT
B3	LEACH TANK OUTLSOPE RECONTOURING
B4	LEACH TANK RADON BARRIER ENHANCEMENT
B5	EVAPORATION POND CLOSURE
B6	SURFACE WATER CONTROL STRUCTURE CONSTRUCTION
B7	EROSION PROTECTION - ROCK MATERIALS AND PLACEMENT
B8	SITE GRADING

TECHNICAL SPECIFICATION # B1

TITLE: MILL DEMOLITION

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by mill demolition contractor.

Quality control testing/inspection by Hecla Mill environmental staff and contract soil testing service.

B) STANDARDS

1. Decontaminate all surfaces of buildings, equipment, and materials that have radioactivity higher than the levels permitted for release for unrestricted use. Capture, contain, and transport all cleaning liquids to the on-site location designated by Hecla's Radiation Safety Officer (RSO).

2. Dismantle and place in the designated clean area all equipment, structures, and materials selected by Hecla for salvage. Preserve and label all disassembled components. Provide sketch showing the relative positions and orientation of all components of each disassembled unit.

3. Dismantle and flatten, crush or cut all material designated for on-site disposal and place on ground surfaces at the north outslope toes of leach tanks (LT) 201 and 203. Distribute material to minimize residual void space and eliminate protrusions above or depressions below the surface of the debris material.

4. Dismantle as necessary for in-place burial the components of the ore receiving section located in and above the tunnel in the south-slope toe of the hill on the site.

5. Cut pipe into lengths that permit easy handling and placement for burial in the LT outslopes. Crush pipe with heavy equipment or fill the space inside pipe with cement-sand grout.

6. Machinery, pipe, tanks, and any other equipment that cannot reasonably be dismantled will be placed for burial as-is in the LT outslopes. Such components that contain more than 10% void space will be filled with cement-sand slurry prior to burial. Wood, fiberglass, and other compressible or organic material will be pulverized using a shredder. The pulverized material will be distributed uniformly over the LT outslope burial locations prior to placement of cover soil.

C) TESTING AND INSPECTION

1. Inspection of mill demolition by Hecla personnel designated by the Resident Manager (RM).

2. Testing - one soil classification and one test per ASTM D-698 for determining maximum dry density and optimum moisture for each 5000 c.y. of cover soil placed; one test per ASTM D-1556 for determining in-place compacted density for each 2500 c.y. of cover soil placed.

D) DOCUMENTATION AND REPORTING

1. Radiological health and safety documentation and reporting in accordance with relevant procedures in Appendix A of the Reclamation Plan and the Health and Safety Radiation Program.

2. Soil test results summarized daily in tabular form. Test records maintained on-site by RM. All failing results reported verbally to RM immediately upon completion of test.

3. All other activities and daily work units recorded in daily activity journal maintained at the direction of Hecla Resident Manager, describing methods of demolition and locations of disposal of all major components described in Figures 3 and 4 of the Reclamation Plan.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B2

TITLE: DEMOLITION DEBRIS BURIAL AND MILL-AREA COVER PLACEMENT

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by mill demolition contractor or earthwork contractor.

Quality control testing/inspection by Hecla personnel and contract soil testing service.

B) STANDARDS

1. All fill material used to cover the dismantled mill will be natural soil from on-site sources that contains not more than 5 pCi/g of RA-226 above background. Borrow areas for this material include the surface-water control excavations, the stockpile of soil located on the north edge of the plant area, and leach tank dike soil excavated for outslope reconfiguration.

2. All contaminated soil (containing more than 5 pCi/g Ra-226 above background) will be excavated from the areas shown on Figure 5 of the Reclamation Plan, and other areas identified by Hecla, and placed in the north outslope toes of LT-201 and LT-203 as directed by Hecla. The contaminated soil may be used to fill in and around demolition debris placed in the outslopes.

3. After mill components have been dismantled and placed at burial locations, void spaces that remain under, around and within such components will be filled with soil, cement-sand slurry grout, or other approved method that eliminates void space.

4. Only noncontaminated soil may be used as backfill in the plant and ore preparation areas and as cover material on those areas and contaminated-soil disposal locations in the leach tan outslopes.

5. Fill that will be more than 2.0 feet below final grade of the outslopes and mill areas will be placed in loose lifts not to exceed 12" thickness and compacted to not less than 90% maximum dry density prior to placement of the next lift. Compaction will be achieved by the movement of heavy equipment (scrapers, dozers, etc.). Soil placed in spaces not accessible to heavy equipment (e.g., inside subgrade tanks, against demolition debris) will be compacted with hand-guided tampers.

6. Dismantled mill components and contaminated soil placed in the leach tank outslopes will be covered with at least 2.0 feet of soil containing not more than 5 pCi/g Ra-226 above background. Lifts of not more than 12 inches uncompacted thickness shall be placed, moisture-conditioned and compacted to not less than 90% maximum dry density per ASTM D-698 prior to placement of additional fill lifts on that surface. Any voids that appear in the surface of the initial fill lifts will be filled with soil and compacted until no new voids appear.

7. Concrete pads and subgrade structures that are left in place will be covered with not less than 2.0 feet of uncontaminated soil placed in 12-inch loose lifts and compacted by the movement of heavy equipment. Pits, subgrade tanks, and raffinate pond basins will be backfilled in lifts as described above except that hand-guided tampers may be used for compaction in spaces that will not allow use of larger compaction equipment. Where such tampers must be used, loose lift thickness shall not exceed 6" and each lift shall be compacted by at least two passes of the tamper.

B2 continued

8. The final surface of the covered mill areas and outslopes will be prepared by finished grading to produce the gradients shown in Figure 14 of the Reclamation Plan. The final surface will be compacted to not less than 90% maximum dry density per ASTMD-698 or at least 80% relative density per ASTMD-2049, whichever is appropriate for the fill material being used.

C) TESTING AND INSPECTION

1. Density testing: One test (ASTM D-698 or ASTM D-2049) per 5000 cubic yards of material placed in the topmost lift.

2. In-place density: One test (ASTM D-1556 or ASTM D-2922) per three-acre surface area.

3. Grain size/Soil classification (ASTMD-422): One per 5000 cubic yards.

D) DOCUMENTATION AND REPORTING

1. Visual inspection of fill materials and placement procedures at least once daily by Hecla personnel. All inspections recorded in daily activity log.

2. Soil testing performed and recorded by contract soil testing laboratory, with written test results submitted weekly to Hecla and any results failing specified standards reported immediately to Hecla

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B3

TITLE: LEACH TANK OUTSLOPE RECONTOURING

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by earthwork contractor.

Quality control testing/inspection by Hecla/contract soil testing service.

B) STANDARDS

1. Excavate, haul and place soil to create the lines and grades shown on Figures 6 and 7. Before placement of the initial lift of soil for outslope recontouring, the existing outslope surface shall be stripped of vegetation, compacted to at least 90% maximum dry density per ASTM D-698 and scarified. During subsequent fill placement, the fill surface will be scarified prior to placement of the next lift following a lapse of more than two days in fill placement or after rainfall that has caused ponding on the fill surface.

2. Any in-place soil in the present containment dikes of the leach tanks will be excavated and placed again as fill if it is above or outside of the final reclamation surfaces shown on Figures 6 and 7. This includes outer edges of dikes and the western portion of the LT-203 dike surrounding unused (empty) leach tank space.

3. All borrow material used for fill will be obtained from on-site sources, primarily the surface water control structure excavations. Soil used for fill shall be free of foreign material, plant material other than fine roots, and rocks larger 6 inches average dimension. No soil will be used for fill that has more than 5 pCi/g Ra-226 above background.

4. All fill placed to construct outslopes shall be placed in lifts with loose thickness of not more than 8 inches. Those lifts placed within 2.0 feet of final grade will be compacted to not less than 95% of maximum dry density per ASTM D-698. Lifts greater than 2.0 feet below final grade will be compacted to not less than 90% of the ASTM D-698 maximum. Final slope surfaces created by excavation will be compacted to not less than 95% ASTM D-698 to a depth not less than 8 inches below final grade.

5. Final recontoured outslopes shall have gradients of 0.20 or flatter. Final recontoured surface elevations can vary, depending on the thickness of top cover soil placed for the radon barrier. However, the top of the 0.2-gradient outslope will be not more than 20 feet inboard, or upgradient, from the top of the original outslope.

C) TESTING AND INSPECTION

1. Hecla personnel shall perform daily visual inspections of all recontouring activities.

2. Field in-place density tests shall be performed by a contract soil testing service. A minimum of one in-place density per ASTMD-1556 for each 5,000 cubic yards of fill placed shall be performed.

3. Final recontoured surfaces shall be surveyed by Hecla or a contract surveyor prior to approval of this surface.

4. A minimum of 10 Proctor density tests (ASTM D-698), and at least one test per 10,000 cubic yards of fill soil, shall be conducted prior to and during the excavation and placement of soil in the outslopes. Each test sample will be tested for USCS soil classification.

D) DOCUMENTATION AND REPORTING

1. Hecla personnel shall maintain a daily activity log of outslope recontouring.

2. The contract soil testing service shall document all tests and submit written reports weekly. Failing tests shall be reported immediately to Hecla.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B4

TITLE: LEACH TANK RADON BARRIER ENHANCEMENT

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Construction work under this specification to be performed by earthwork contractor.

Quality control testing/inspection by Hecla and contract soil testing service.

B) STANDARDS

1. Before placement of the initial fill lift of soil for radon barrier enhancement on the top surface of the leach tanks, the existing cover surface shall be stripped of vegetation, compacted to at least 95% maximum dry density per ASTM D-698 and scarified. During subsequent fill placement, the fill surface will be scarified prior to placement of the next lift following a lapse of more than two days in fill placement or after rainfall that has caused ponding of water on the fill surface.

2. A minimum of 2.8 feet of sandy clay or clayey sand (USCS classification of CL, CH, or SC) shall be placed directly over the existing top cover surface. Each lift of soil shall be not more than 8 inches uncompacted thickness, shall be visually free of roots or other plant fiber, and shall contain no particle larger than one-half the uncompacted thickness.

3. Each lift shall be compacted to not less than 95% maximum dry density per ASTM D-698 and with initial moisture contents within 2% of optimum.

4. All fill materials used to construct the impoundment soil covers shall be derived from approved borrow sources in other locations selected or approved by Hecla or its engineer.

5. No fill material shall be placed under adverse weather conditions, including freezing temperatures or during or immediately after heavy precipitation events. Hecla shall determine when these adverse conditions exist.

6. No soil will be used for fill that has more than 5 pCi/g Ra-226 above background.

7. All final fill surfaces shall not vary from the top surface gradients shown on Figures 6 and 7 by more than 5%.

C) TESTING AND INSPECTION

1. Daily visual inspection of the soil cover construction activity shall be performed by Hecla.

2. The contract soil testing service shall perform the following tests:

   a. Soil classification: Not fewer than one per 20,000 c.y. or at least one per each four acres of borrow area, whichever is greater.

b. Standard Proctor Density (ASTM D-698): At least one per 20,000 c.y.

c. In-place density test: At least one per 5,000 c.y. per ASTM D-1556. ASTM Method D-2922 may be used if sufficient correlation with method D-1556 can be established based on not less than 10 comparative tests.

D) DOCUMENTATION AND REPORTING

1. Hecla shall maintain a daily construction activity log, recording the quantities and locations of fill placed and significant events or conditions that affect the placement and properties of the soil cover.

2. Contract soil testing service shall report all tests, in writing, on a weekly basis and shall report all failing tests immediately to Hecla.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B5

TITLE: EVAPORATION POND CLOSURE

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by Hecla or contractor.

Quality control testing/inspection by Hecla.

B) PERFORMANCE STANDARDS

1. Free liquid (i.e., ponded water and interstitial brine within the sloid salts that will drain by gravity) will be collected in sumps dug into the salts of each evaporation pond (EP) and pumped through hoses or pipes to spray heads on the pond surfaces. The liquid will be sprayed into the air over the pond surfaces so that the spray plume is kept within the pond basin. Specific equipment and methods for the spray system will be selected based on field tests performed by Hecla.

2. Dewatered salts in EP-605 and 606 will be completely excavated and deposited over the center portions of EP-601 through EP-604, the EP containment area shown on Figures 8 and 9. Dewatered salts from the western and eastern 300 feet (approximate) of each end of EP-601 through EP-604 will also be excavated and deposited in the containment area. All contaminated soils underlying the excavated salts will also be excavated and placed over the salts in the containment area. The containment area will be surrounded by an earthfill berm constructed of clean soil placed on uncontaminated natural soil. The berm shall have a nominal top width of five feet. The compacted density of the berm fill, determined after field observations of the density of relocated salt and liner soils placed in the containment, will be controlled so that the berm fill is approximately as compressible as the material within the containment.

3. The excavated salts will be deposited across the containment area in lifts with thickness, to be determined by field observation, that provide support for earthmoving equipment and allow adequate compaction. Compaction methods will be selected by field observations of candidate equipment and techniques. After placement of salts, the contaminated soils from the EP's will be placed in lifts of up to 8 inches uncompacted thickness and compacted to at least 90% maximum per ASTM D-698.

4. During salt excavation brine released by the salts will be collected in sumps in all EP's. This brine will be sprayed above the surface of EP-605 and EP-606 after the salts have been excavated from these ponds. If continued evaporation of the brine becomes impossible or impractical, soil or fragmented Mancos Shale from the site might be added to the brine to increase pH or to solidify the brine sufficiently to permit excavation as a solid and disposal in the containment area.

5. After all salts and contaminated soils are placed in the containment area, a soil cover not less than 2.0 feet thick shall be placed over the containment area surface. The cover shall be constructed with on-site soils compacted to not less than 95% maximum density per ASTM D-698. The top 1.0 feet of this cover shall be soil with USCS classification of CL, CH, or SC. All fill materials used to construct the cover shall be derived from approved borrow sources or locations approved by Hecla or its engineer. The borrow soil shall be visually free of roots or other plant fiber, and shall contain no particle larger than one-half the uncompacted lift thickness. No soil will be used for fill that has more than 5 pCi/g Ra-226 above background.

6. No fill material shall be placed under adverse weather conditions, including freezing temperatures or during or immediately after heavy precipitation events. Hecla shall determine when these adverse conditions exist. The fill surface will be scarified prior to placement of the next lift following a lapse of more than two days in fill placement or after rainfall that has caused ponding of water on the fill surface.

7. All final cover surfaces shall not vary from the top surface gradients shown on Figures 8 and 9 by more than 5%.

C) TESTING AND INSPECTION

1. Daily visual inspection of the salt excavation/placement and the soil cover construction activities shall be performed by Hecla.

2. The contract soil testing service shall perform the following tests:

   a. Soil classification: Not fewer than one per 20,000 c.y. or at least one per each four acres of borrow area, whichever is greater.

   b. Standard Proctor Density (ASTM D-698): At least one per 20,000 c.y.

   c. In-place density test: At least one per 5,000 c.y. per ASTM D-1556. ASTM Method D-2922 may be used if sufficient correlation with method D-1556 can be established based on not less than 10 comparative tests.

D) DOCUMENTATION AND REPORTING

1. Hecla shall maintain a daily construction activity log, recording the quantities and locations of excavation and fill placed and significant events or conditions that affect the placement and properties of the salts, brine, and soil cover.

2. Contract soil testing service shall report all tests, in writing, on a weekly basis and shall report all failing tests immediately to Hecla.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B6

TITLE: SURFACE WATER CONTROL STRUCTURE CONSTRUCTION

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by earthwork contractor.

Quality control testing/inspection by Hecla and contract soil testing service.

B) STANDARDS

1. Surface water diversion and control structures shall be constructed in the locations and with the dimensions shown on Figures 12 and 13. The structures consist of normal flow channels within the limits of flood plains. The latter will be protected with bank riprap and scour protection at those locations, shown on Figure 12 of the plan, that are adjacent to containment structures.

2. Except where fill placement is required to eliminate depressions below design grade, the control structures will be constructed by excavation and final grading. Depressions below design grade will be filled with soil placed in successive lifts of not more than 12 inches and compacted by at least three passes of a dozer.

3. The normal flow channels shall be constructed along the alignments and at the gradients shown on Figure 12. The horizontal tolerance of the channel centerline will be +/- 1.0 foot and the vertical tolerance will be +/- 0.1 foot. The channel bed width will be not less than 10 feet, but may be increased at Hecla's discretion to accommodate unexpected conditions or to generate additional soil if needed for fill. Channel bank slope tolerances are +/-10% those shown on Figure 13.

4. The PMF flood plain shall be constructed according to the locations and elevations shown on Figures 12 and 13, using offsets from the normal flow channel shown on Calculation C8, Appendix C. The controlling parameters for construction are the plan positions and minimum depths of the flood plain boundaries (toes of the flood plain banks) and the bottom gradient in the direction of flow. All other parameters are subject to change by Hecla or its engineer during construction if such changes are useful to, or required for, surface water control construction or other reclamation objectives.

5. A lateral slope (perpendicular to primary direction of flow) of not less than 0.01 gradient shall be established between each flood plain bank and the corresponding bank of the normal flow channel along the entire constructed length of each flood plain.

6. The downstream end of each normal flow channel and flood plain shall constructed so that these structures connect to the existing channel and ground surfaces, respectively, through smooth transitions of positive gradient (beds) and continuous curve (banks). Any obstruction in the natural channel or on the natural ground surface that might create backwater or other undesirable hydraulic effects within the reach of the control strucutres will be removed.

C) TESTING AND INSPECTION

1. Hecla shall inspect the excavations and other construction activities at least daily.

2. The surveyor shall set all grade stakes required to guide the contractor's excvation and shall check all excavation boundaries and grades before the contractor's work is approved.

D) DOCUMENTATION AND REPORTING

1. Hecla shall maintain a daily activity log of this construction activity.

2. The surveyor shall report line-and-grade results in writing at least weekly to Hecla and shall immediately report any excavation that is out of tolerance to Hecla.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B7

TITLE: EROSION PROTECTION - ROCK MATERIALS AND PLACEMENT

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by earthwork or rock placement contractor.

Quality control testing/inspection by Hecla and its contract soil testing service.

B) STANDARDS

1. All rock used for erosion protection will be developed by excavating and screening gravel/cobble-size rock material that occurs in the soils on-site or that exists in the flood plain of the San Miguel River off-site. One or more of these sources may be used. The rock material will be processed to produced those sizes and gradations required for outslope rock cover and for flood plain bank riprap and scour protection.

2. The quality of rock, as determined by the scoring procedure shown in Appendix C of the Reclamation Plan, shall be not less than a weighted score of 80 for all applications of outslope, riprap and toe scour protection. Rock that has a durability score of <80 may be used if it is oversized in accordance with the Equations 6.2 and 6.4 of NUREG/CR-4620 and NRC, 1990.

3. The rock cover on the leach tank outslopes shall be not less than 0.5 feet thick, consisting of rock particles with d50 of not less than 1.7 inches, d100 not less than 1.5 times d50, and gradations shown in Calculation C11. If rock with a durability score of less than 80 is used, it will be oversized and the rock cover thickness will be increased, if necessary, to be at least two times the d50 of the rock. This rock cover will extend from the top of the 0.2 grade to not less than 3.0 feet beyond the toe of the 0.2 grade.

4. The rock cover on the reclaimed evaporation pond shall be not less than 0.5 feet thick, consisting of rock particles with d50 of not less than 0.9 inches, d100 not less than 1.5 times d50, and gradations shown in Calculation C11. If rock with a durability score of less than 80 is used, it will be oversized and the rock cover thickness will be increased, if necessary, to be at least two times the d50 of the rock. This rock cover will extend from the upslope (south) edge of the soil cover to the top of the scour protection rock placed around the west, north, and east sides of the reclaimed pond.

5. Riprap shall be placed along the 2H:1V banks of the PMF flood plain of the Central and East channels at locations shown on Figure 12. The riprap shall be have a thickness not less than 1.5 feet or 1.5 times the d50 of the rock, whichever is greater. The d50 of the rock used for the riprap along each segment of bank requiring protection shall be not less than that listed in Calculation C10, Appendix C of the Reclamation Plan, and the d100 shall be not less than 1.5 times d50. Gradations must fall within the limits shown on Calculation C11, Appendix C. The riprap shall extend from the top of the flood plain bank to the toe of the bank.

6. The scour protection shall contain rock with the same sizes and gradations as that used for the riprap and shall extend from the bottom of the riprap to a depth below the flood plain equal to the calculated scour depth (Appendix C). The configuration of this scour protection is shown on Figure 12 and 13. The scour protection shall be constructed by first excavating a trench to at least the calculated scour depth at each location below the flood plain bank toe elevation with an outboard slope of 2H:1V. After the excavation of this trench, it shall be backfilled initially by dumping rock on the 2H:1V slope to form a rockfill on which the normal width is at least 1.5 feet, as shown on Figure 13. The construction of the scour protection shall be completed by backfilling the remaining open space of the trench with the soil that was excavated to form this trench. No specific compaction of this soil is required; however, the soil will be placed and compacted by dozer.

C) TESTING AND INSPECTION

1. Visual inspection of quarrying operations and rock placement will be performed by Hecla at least once daily.

2. The contract soil testing service shall perform the following tests:

   a. Rock quality testing (sulfate soundness, specific gravity, and absorption): One test per 2000 c.y.

   b. Rock size and gradation: One test per 1000 c.y. at the quarry screening plant using the appropriate screen stack and one gradation test using a portable screen stack for every 2000 c.y. of rock placed on the leach tank outslopes.

   c. Rock layer thickness:
      Outslope cover: One measurement for each 40000 ft^2
      Evaporation Pond cover: One measurement for each 40000 ft^2
      Riprap and scour protection: One measurement for each 200 ft of length

D) DOCUMENTATION AND REPORTING

1. Hecla will maintain a daily field activity log (journal) of all screening and placement activities, including volumes processed and placed.

2. The contract testing service shall report all test results, in writing, at least weekly and shall immediately report failing tests to Hecla.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

B7 continued

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

TECHNICAL SPECIFICATION # B8

TITLE: SITE GRADING

RECLAMATION OF DURITA SITE, HECLA MINING COMPANY

A) RESPONSIBILITIES

Work under this specification to be performed by earthwork contractor.

Quality control testing/inspection by Hecla.

B) PERFORMANCE STANDARDS

1. With the exception of the leach tanks and evaporation pond covers, each portion of the mill site that is disturbed by reclamation activities, including any borrow areas not part of the surface water control structures, shall be graded after all other construction activities have been completed and before revegetation activities on each portion of the affected site.

2. Final site grading shall be performed to establish those gradients that will assure positive drainage of surface water runoff in directions away from leach tanks, the evaporation pond, and burial areas. To the extent possible the final regraded contours will reestablish or maintain the directions and gradients of ground surfaces that existed prior to the development of the Durita mill site.

3. The line and grade control for final grading will be established after the completion of other reclamation work and before each portion of the site is regraded. The final lines and grades will be determined after the completion of those activities that directly affect ground surfaces, such as contaminated soil cleanup, excavation of borrow areas, and burial of demolished mill components.

C) TESTING AND INSPECTION

1. Hecla will visually inspect each discrete area after it has been regraded. During Phase V of reclamation (long-term care) Hecla will inspect all regraded surfaces at least annually to locate and measure any depressions or other surface features that could prevent positive drainage. Such areas will be regraded and reinspected until final grades have been demonstrated by extended visual observation to maintain positive drainage.

D) DOCUMENTATION AND REPORTING

1. All activities conducted under Section C above will be recorded, in writing and as appropriate, by photography. If considered appropriate or necessary to complete documentation, an aerial photography survey will be performed of the entire site after all reclamation activities and final site grading have been completed. The resulting topographic map will be submitted as a documentation of the adequacy of final lines and grades.

E) NONCONFORMANCES, CORRECTIVE ACTIONS, AND STOP-WORK ORDERS

1. Nonconformances will be identified or verified by the Hecla task manager (TM) designated by the Resident Manager (RM), who will direct the contractor to stop work or take specific corrective action. The TM or RM will consult with the appropriate technical consultant as needed to identify the importance of the nonconformance and the necessary corrective action.

2. The designated corrective action will be implemented by the contractor before additional related work is permitted. The TM will verify the corrective action by appropriate measurements, tests, or other permanent documentation.

3. Stop-work orders may be issued by the TM for any nonconformance that, in the TM's judgment, may jeopardize subsequent work that depends for its quality on the nonconforming work.

F) RECORDS

1. A daily project journal will be maintained by each TM. It will document the work accomplished, contract quantities for measurement and payment, nonconformances, corrective actions, stop-work orders, and conditions affecting the work. The daily journals will become a part of the permanent reclamation and contract records.

2. The RM will maintain a permanent file of all testing, measurements, and other records of the work performed under this specification.

APPENDIX C

CALCULATIONS

CALCULATION NO.	SUBJECT
C1	Slope Stability Analysis
C2	RADON Analysis for Leach Tank Cover
C3	RADON Analysis for Evaporation Pond Cover
C4	Hydrologic Parameters and Equations
C5	Pre-Reclamation Surface Water Channel Gradients
C6	PMP/PMF Event Hydrologic Analysis
C7	Tributary-Area Surface Water Discharges from PMP within the Site
C8	Diversion Channel and Flood Plain Line, Grade, and Dimension Control
C9	Calculation of Depth of Scour at Toe of Flood Plain Banks Due to PMF Flow
C10	PMF Erosion Protection Analysis
C11	Rock Gradations for Erosion Protection Applications
C12	Leach Tank and Evaporation Pond Cover Erosion Protection

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

PROBLEM DESCRIPTION DURITA LT STABILITY

BOUNDARY COORDINATES

4 Top Boundaries
8 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	10.00	90.00	12.00	1
2	90.00	12.00	198.00	33.50	1
3	198.00	33.50	216.00	37.00	2
4	216.00	37.00	320.00	37.50	2
5	198.00	33.50	320.00	33.50	1
6	210.00	31.50	320.00	31.50	3
7	210.00	31.50	230.00	11.00	1
8	230.00	11.00	320.00	11.00	1

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	114.0	127.0	500.0	20.0	.00	.0	1
2	121.0	130.0	500.0	20.0	.00	.0	1
3	92.0	111.0	200.0	29.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	10.00
2	90.00	12.00
3	216.00	37.00
4	320.00	37.50

A Horizontal Earthquake Loading Coefficient
Of .100 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of .100 Has Been Assigned

Cavitation Pressure = .0 psf

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

4 Surfaces Initiate From Each Of 50 Points Equally Spaced Along The Ground Surface Between X = .00 ft. and X = 90.00 ft.

Each Surface Terminates Between X = 216.00 ft. and X = 320.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = .00 ft.

5.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -30.0 And 1.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

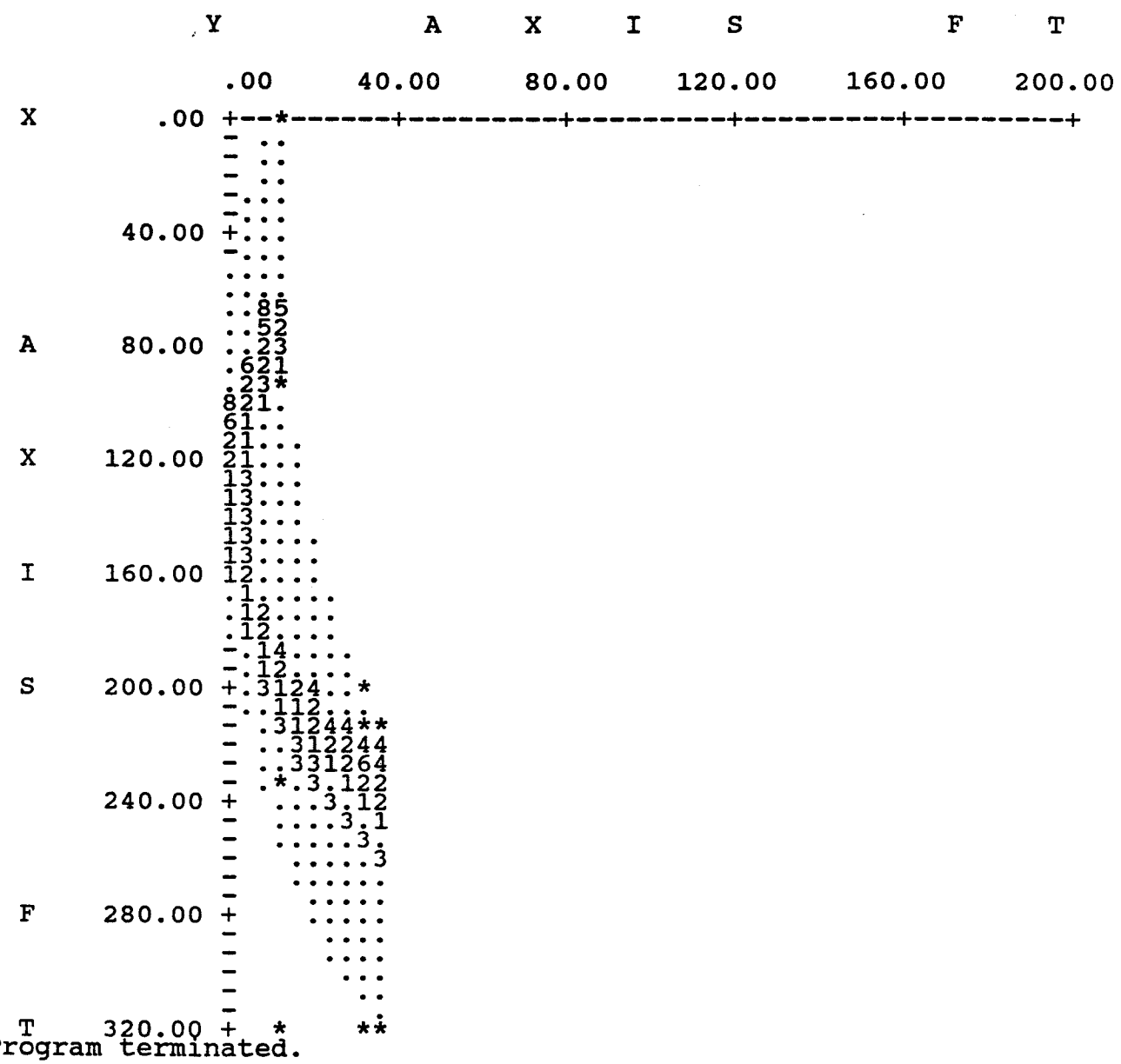
* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.16	11.96
2	92.83	10.16
3	97.55	8.51
4	102.32	7.02
5	107.14	5.68
6	112.00	4.51
7	116.89	3.49
8	121.82	2.63
9	126.77	1.93
10	131.74	1.39
11	136.73	1.01
12	141.72	.80
13	146.72	.74
14	151.72	.86
15	156.71	1.13
16	161.69	1.57
17	166.66	2.16
18	171.60	2.92
19	176.52	3.84
20	181.40	4.92
21	186.24	6.16
22	191.04	7.55
23	195.80	9.10
24	200.50	10.80
25	205.14	12.65
26	209.72	14.66
27	214.24	16.81
28	218.68	19.11
29	223.04	21.55
30	227.32	24.13
31	231.52	26.85
32	235.62	29.71
33	239.63	32.70
34	243.54	35.81
35	245.10	37.14

Circle Center At X = 145.8 ; Y = 154.5 and Radius, 153.7

*** 1.613 ***



Stop - Program terminated.

C>

CALCULATION C2

----------*****! RADON !*****----------

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RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

DURITA SITE - ADDITIONAL COVER NEEDED USING C MATERIAL

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	3	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	3	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 TAILINGS

THICKNESS	521	cm
POROSITY	.52	
CALCULATED MASS DENSITY	1.272	g cm^-3
MEASURED RADIUM ACTIVITY	432	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.32	
CALCULATED SOURCE TERM CONCENTRATION	7.101D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	16.2	%
MOISTURE SATURATION FRACTION	.396	
CALCULATED DIFFUSION COEFFICIENT	2.118D-02	cm^2 s^-1

LAYER 2 PRESENT COVER

THICKNESS	76	cm
POROSITY	.39	
MEASURED MASS DENSITY	1.59	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	10.36	%
MOISTURE SATURATION FRACTION	.422	
CALCULATED DIFFUSION COEFFICIENT	1.583D-02	cm^2 s^-1

LAYER 3 ADDITIONAL COVER WITH "C" MATERIAL

THICKNESS	60	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.77	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	9.98	%
MOISTURE SATURATION FRACTION	.552	
CALCULATED DIFFUSION COEFFICIENT	7.858D-03	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 3.687D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.210D+02	1.350D+02	2.150D+05
2	7.600D+01	4.260D+01	1.063D+05
3	8.493D+01	2.001D+01	0.000D+00

= 2.79 ft.

CALCULATION C3

----------! RADON !----------

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U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS ARE CALCULATED FOR MULTIPLE LAYERS

EVAPORATION POND COVER

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
DESIRED RADON FLUX LIMIT	20	pCi m^-2 s^-1
NO. OF THE LAYER TO BE OPTIMIZED	2	
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 POND SALTS

THICKNESS	183	cm
POROSITY	.35	
MEASURED MASS DENSITY	1.51	g cm^-3
MEASURED RADIUM ACTIVITY	13.22	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.406	
CALCULATED SOURCE TERM CONCENTRATION	4.863D-05	pCi cm^-3 s^-1
WEIGHT % MOISTURE	6	%
MOISTURE SATURATION FRACTION	.259	
CALCULATED DIFFUSION COEFFICIENT	2.809D-02	cm^2 s^-1

LAYER 2 COVER

THICKNESS	60	cm
POROSITY	.32	
MEASURED MASS DENSITY	1.77	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	9.98	%
MOISTURE SATURATION FRACTION	.552	
CALCULATED DIFFUSION COEFFICIENT	7.858D-03	cm^2 s^-1

BARE SOURCE FLUX FROM LAYER 1: 1.531D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	1.830D+02	1.531D+01	1.089D-02
2	0.000D+00	1.531D+01	0.000D+00

HYDROLOGIC PARAMETERS AND EQUATIONS USED FOR SITE RUNOFF AND EROSION PROTECTION CALCULATIONS

DESIGN STORM PRECIPITATION — see Figure 11 for rainfall tabulations and plot

1-HR LOCAL PMP: 8.4 inches unadjusted for elevation above 5000 ft (Fig. 4.5, HMR 49)
7.8 inches adjusted for ave. elev. of 6454 in west watershed
8.4 - (8.4 x (6454-5000)/1000 x 0.05) (Section 4.3.2, HMR 49)

RUNOFF PARAMETERS

C, runoff coeff.: 0.6 for sloping terrain (10-15% along channels), forested shale/sandstone
0.7 for sloping site surfaces, 0.5 for site surfaces of <.01 grade
(Table 4.6, NUREG/CR-4620)

n, Manning coeff.,

channels, upstream watersheds =	0.05	(Tables 4.2, 4.3; NUREG/CR-4620)
diversion in soil =	0.030	(Tables 4.2, 4.3; NUREG/CR-4620)
of soil cover	0.020	(Tables 4.2, 4.3; NUREG/CR-4620)
of rock cover	n=0.0456(d50 x S)^0.159	(Eqn. 4.8, NUREG/CR-4651)

Ta, allowable shear stress, in psf, of:
alluvial sand = 0.02 for SP with d75 < 0.05" or 1.27mm (USDA Ag. Handbook 667, Table 3.3)
sandy clay, SC = Tab * Ce^2 = 0.09504 psf, USDA Handbook #667, p.56
where Tab = 0.066 psf for PI= 18.2 and Ce = 1.2 for void ratio = 0.437

F, flow concentration factor, assumed to be 3 (worst case)

ROCK RIPRAP/COVER PARAMETERS

P, rock cover porosity =	0.44	(Table B.1, NUREG/CR-4651)
G, rock spec. gravity =	2.60 based on tests on San Miguel river rock	(see App.D)
Cs, Stephenson factor =	0.25 for rounded river cobbles	(p. 48, NUREG/CR-4620)
FA, friction angle of large rock =	38 degrees, 0.6632 radians	(Figure 4.8, NUREG/CR-4620)
of 1 to 10" rock	35 degrees, 0.6109 radians	

SLOPE AND GRADIENT PARAMETERS

SA, slope angle (design values)

pile top, max.	2 degrees,	0.0349 radians
outslope	11.31 degrees,	0.1974 radians
channel banks	11.31 degrees,	0.1974 radians

N, stability number for particles on plane bed = 21*y*s/(G-1)*d50 (Stevens et al, 1976)
B, angle between gravity vector along slope and particle movement vector on slope
= arctan(N*tanFA / (2*sinSA)) (Eqn 4.23, NUREG/CR 4620)
N', stability number for particles on slope = (N/2)*(1+sinB) for horizontal flow
(Stevens et al, 1976)
Ss, critical slope (limiting value for erosional stability) = ((65*Ta^(5/3))/(i*L*F*n))^(6/7)

EQUATIONS OF FLOW

q, unit discharge = C*i*a

Q, total runoff = C*i*A for peak discharge from area A, = V*A in channel with flow section area A and velocity V

y, max. flow depth = (q*n/1.486*S^.5)^0.6

v, max. flow velocity = (1.486/n)*y^.667*S^.5

SIZING OF ROCK FOR EROSION PROTECTION

d50, mean rock diameter (per rationale of NRC Staff Technical Position on Erosion Protection...)
For slopes with gradients < 0.1 by Safety Factors Method,
Safety Factor, SF = (cos SA)*(tan FA)/((21*y*S/(G-1)*d50)*(tan FA)+sin SA)

For slopes with gradients > 0.1
by Stephenson Method, d50 = [(q*(tan SA)^7/6*P^1/6)/(Cs*g^.5*((1-P)*(G-1)
(cosSA)(tanFA-tanSA))^1.667]^.667*12

For rock on slope with horizontal flow
SF = cos SA * tan FA / (N'*tan FA + sin SA * cos B)

CHANNEL DESIGN ANALYSIS EQUATIONS

Q = AV = wh * (1.486/n)*R^.67*S^.5 where w = channel width, h = water water depth
R = hydraulic radius = wh/(w+2h), S = hydraulic gradient ~ channel gradient
A(R)^2/3 = (Qn)/(1.486*S^1/2)

********* CALCULATION C5 *********

ORIGINAL (PRE-1977) SITE SURFACE-WATER CHANNEL GRADIENTS

	Channel Elev.	Segment Length l	Segment Slope s	Cum. Length L	Ave. S for L S	
WEST CHANNEL	5620	(starting point for analysis)				
	5610	285	0.035	285	0.035	
	5600	345	0.029	630	0.032	
	5598	40	0.050	670	0.033	property fence
	5590	250	0.032	920	0.033	
	5580	420	0.024	1340	0.030	
	5570	360	0.028	1700	0.029	
	5566	140	0.029	1840	0.029	West/ Mid channels merged
	5560	220	0.027	2060	0.029	
	5550	500	0.020	2560	0.0273	0.0264 below 5610
MID 1 CHANNEL	5620	(starting point for analysis)				
	5610	300	0.033	300	0.033	
	5603	215	0.033	515	0.033	property fence
	5600	45	0.067	560	0.036	
	5590	270	0.037	830	0.036	
	5585.5	95	0.047	925	0.037	Mid 1/ Mid 2 confluence
MID 2 CHANNEL	5614	(starting point for analysis)				
	5610	100	0.040	100	0.040	
	5600	390	0.026	490	0.029	property fence
	5590	280	0.036	770	0.031	
	5585.5	150	0.030	920	0.031	Mid 1/ Mid 2 confluence
	5580	230	0.024	1150	0.030	
	5570	350	0.029	1500	0.029	
	5566	100	0.040	1600	0.030	Mid /West confluence
EAST 1 CHANNEL	5620					
	5610	300	0.033	300	0.033	
	5602	195	0.041	495	0.036	property fence
	5600	25	0.080	520	0.038	
	5590	360	0.028	880	0.034	
	5580	235	0.043	1115	0.036	
	5570	365	0.027	1480	0.034	
	5560	200	0.050	1680	0.036	
	5557	70	0.043	1750	0.036	East 1 /East 2 confluence
	5550	260	0.027	2010	0.035	
EAST 2 CHANNEL	5630					
	5620	155	0.065	155	0.065	
	5610	185	0.054	340	0.059	
	5607	70	0.043	410	0.056	property fence
	5600	155	0.045	565	0.053	
	5590	225	0.044	790	0.051	
	5580	225	0.044	1015	0.049	
	5570	175	0.057	1190	0.050	
	5560	250	0.040	1440	0.049	
	5557	100	0.030	1540	0.047	East 1 /East 2 confluence

PRESENT (PRE-RECLAMATION) SITE SURFACE-WATER CHANNEL GRADIENTS

	Channel Elev.	Segment Length l	Segment Slope s	Cum. Length L	Ave. S for L S	Delta vs Original s	Delta vs Original S
WEST CHANNEL	5620	(starting point for analysis)					
	5610	425	0.024	425	0.024	-0.012	-0.012
	5600	520	0.019	945	0.021	-0.010	-0.011
	5590	270	0.037	1215	0.025	0.005	-0.008
	5585	90	0.056	1305	0.027		
	5580	220	0.023	1525	0.026	-0.001	-0.004
	5570	370	0.027	1895	0.026	-0.001	-0.003
	5560	440	0.023	2335	0.026	-0.005	-0.003
	5550	420	0.024	2755	0.025	0.004	-0.002
MID 1 CHANNEL	5620	(starting point for analysis)					
	5610	300	0.033	300	0.033	0.000	0.000
	5600	200	0.050	500	0.040	-0.017	0.004
	(joins west channel at ~elev. 5600)						
MID 2 CHANNEL	5620	(starting point for analysis)					
	5610	250	0.040	250	0.040	0.000	0.000
	5600	430	0.023	680	0.029	-0.002	0.001
	5590	205	0.049	885	0.034	0.013	0.003
	5585	175	0.029	1060	0.033	-0.001	0.002
	(joins WEST channel)						
EAST CHANNEL	5630						
	5620	400	0.025	400	0.025	NA	NA
	5610	250	0.040	650	0.031	0.007	-0.003
	5600	220	0.045	870	0.034	-0.035	-0.004
	5590	290	0.034	1160	0.034	0.007	0.000
	5580	230	0.043	1390	0.036	0.001	0.000
	5570	160	0.063	1550	0.039	0.035	0.005
	5560	270	0.037	1820	0.038	-0.013	0.003
	5557	40	0.075	1860	0.039	0.032	0.003
	5550	315	0.022	2175	0.037	-0.005	0.002

********* CALCULATION C6 *********

PMP/PMF EVENT HYDROLOGIC ANALYSIS

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WATERSHED ELEMENT	ELEMENT LENGTH L	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc hours	RAINFALL WITHIN tc (1)	i in/hr	Runoff Area, A acres(2)	Q cfs	PMF Flood Plain: Width ft b	Gradient ft/ft s	Trial Depth, ft Qn/ 1.49S^.5	Trial Depth, ft y	Trial Depth, ft A(R)^.67	Velocity fps v	Shear Stress Peak psf Tp	Shear Stress Allow psf Ta
CENTRAL CHANNEL DRAINAGE																		
West	14500	7306	5601	0.1176	6.71	0.47	6.85	14.44	494.0	4280	100	0.020	611	3.03	612	14.13	3.78	0.09504
Mid 1	3950	6070	5601	0.1187	6.77	0.17	4.70	27.07	32.5	528	23	0.033	59	1.85	58	12.41	3.81	0.09504
Combined West and Mid 1 Channel									526.5	4808	200	0.025	610	1.95	602	12.33	3.08	0.09504
Mid 2	6900	6505	5601	0.1310	7.46	0.26	5.85	22.78	122.0	1667	30	0.018	251	3.92	251	14.18	4.40	0.09504
Combined West, Mid 1 and Mid 2 Channels (Central Channel)									648.5	6475	300	0.027	796	1.80	794	11.99	3.03	0.09504
Central including runoff from tributaries and channel surfaces (See Calc. C7)																		
Sta. 0+00, Start of diversion, to 5+22									494.0	4280	50	0.028	516	4.31	516	19.86	7.53	0.09504
5+22, West/Mid 1 channels junction, to 6+78									526.5	4808	110	0.028	580	2.76	580	15.84	4.82	0.09504
6+78, South edge of site, to 9+79									653.5	6663	300	0.022	907	1.96	915	11.33	2.69	0.09504
9+79 to 13+25, Between LT202 & LT 203									674.8	7264	300	0.022	989	2.05	986	11.81	2.81	0.09504
13+25 to 15+43									693.3	7729	310	0.025	987	2.00	978	12.47	3.12	0.09504
15+43 to 22+43, at NE corner of plant area									712.0	8263	310	0.015	1362	2.43	1351	10.97	2.27	0.09504
22+43 to 26+43									754.0	9209	370	0.015	1518	2.33	1507	10.68	2.18	0.09504
EAST																		
Upstream Watershed	9150	6660	5610	0.1148	6.55	0.34	6.40	19.05	155.7	1780								
East including runoff from tributaries and channel surfaces																		
Sta. 0+00 to 2+05, south edge of site									155.7	1780	100	0.0500	161	1.35	162	13.18	4.21	0.09504
2+05 to 4+62									160.5	1897	100	0.0350	205	1.55	204	12.24	3.39	0.09504
4+62 to 7+12									170.9	2227	100	0.0350	240	1.71	240	13.02	3.73	0.09504
7+12 to 10+89, NE corner of LT203									179.4	2446	100	0.0350	264	1.82	265	13.44	3.97	0.09504
10+89 to 14+82, NE corner of ore prep area									189.9	2714	250	0.0350	293	1.11	296	9.78	2.42	0.09504
14+82 to 20+92, SE corner of evap. pond area									202.0	3031	300	0.0200	433	1.25	433	8.08	1.56	0.09504
20+92 to NE corner of site									213.1	3803	300	0.0200	543	1.42	535	8.93	1.77	0.09504

********* CALCULATION C7 *********

TRIBUTARY-AREA SURFACE WATER DISCHARGES FROM PMP WITHIN THE SITE

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CHANNEL/ TRIBUTARY AREA	ELEMENT LENGTH L ft	ELEMENT WIDTH W ft	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE degrees	tc (minimum is 0.042) hours	RAINFALL WITHIN tc (1) inches	i in/hr	Runoff Area, A acres(2)	PMF Runoff from A Q cfs	Unit Discharge q cfs/ft
CENTRAL/												
Floodplain Surface Between LT 202,203	510	530	5601	5587	0.0275	1.57	0.06	2.25	35.67	6.21	155	0.29
Floodplain Surface East of LT 201	590	530	5587	5571	0.0271	1.55	0.07	2.60	36.67	7.18	184	0.35
M1 - ore area	155 ave	500	5585	5579	0.0387	2.22	0.042	1.73	41.19	1.78	51	0.10
Hill SW	455 max.	420 ave.	5669	5570	0.2176	12.28	0.042	1.73	41.19	4.39	127	0.30
Plant area	340	835 ave.	5572	5557 ave.	0.0441	2.53	0.042	1.73	41.19	6.52	188	0.23
Floodplain Surface East of Plant Area	525 median	530	5571	5557	0.0267	1.53	0.07	2.00	30.66	4.87	105	0.20
Hill NW1	515 median	n/a	5669	5560	0.2117	11.95	0.042	1.73	41.19	1.67	48	
Hill NW2	515 median	n/a	5669	5560	0.2117	11.95	0.042	1.73	41.19	1.19	34	
Hill NE1	470	n/a	5669	5560	0.2319	13.06	0.042	1.73	41.19	1.14	33	
West half cover on Evap. ponds	440	415	5562	5540	0.0500	2.86	0.042	1.73	41.19	3.62	104	0.25
NW quadrant	1600	n/a	5557	5514	0.0269	1.54	0.15	4.80	31.29	38.4	841	
EAST/												
Floodplain East of LT203	600	170 ave.	5607.3	5586	0.0355	2.03	0.06	2.25	34.75	2.34	57	0.33
Trib. East 1	500 max.	n/a	5692	5586	0.2120	11.97	0.042	1.73	41.19	3.3	95	
M2 - ore area east to east fence line	850	n/a	5592	5560	0.0376	2.16	0.08	3.00	36.24	10.56	268	
Trib. East 2	1200	n/a	5617	5540	0.0642	3.67	0.09	3.25	36.96	8.47	219	
Hill SE	375 median	n/a	5669	5560	0.2907	16.21	0.042	1.73	41.19	4.62	133	
Floodplain East of hill	700	n/a	5585	5550	0.0500	2.86	0.06	2.25	35.21	7.44	183	
Hill NE2	470 median	n/a	5669	5560	0.2319	13.06	0.042	1.73	41.19	1.55	45	
East half cover on Evap. ponds	440	370	5562	5540	0.0500	2.86	0.042	1.73	41.19	3.72	107	0.29
Floodplain East of EP cover	440	460	5559	5530	0.0659	3.77	0.08	5.00	60.84	4.28	290	0.63
Trib. East 3	600	100	5540	5530	0.0167	0.95	0.09	3.25	37.51	1.58	331	3.31

********* CALCULATION C8 *********

DIVERSION CHANNEL LINE, GRADE, AND DIMENSION CONTROL - CENTRAL CHANNEL

START POINT COORD.	FROM STATION	TO STATION	SEGMENT PLAN FORM	CENTER AND RADIUS	CURVE ANGLE degrees	WIDTH feet	LENGTH feet	GRADIENT	ELEVATION START	ELEVATION END
E46508 N34333	0+00	6+78	st.line	n/a	n/a	10	678	0.030	5620.0	5599.7
E47121 N34620	6+78	9+79	circ. curve	E47008 N34861 266'	64.8	10	300.8	0.030	5599.7	5590.6
E47274 N34861	9+79	13+25	st. line	n/a	n/a	10	346	0.029	5590.6	5580.6
E47274 N35207	13+25	15+43	circ. curve	E46722 N35207 552'	22.6	10	218	0.029	5580.6	5574.3
E47232 N35419	15+43	22+43	st. line	n/a	n/a	10	700	0.027	5574.3	5555.4
E46963 N36065	22+43	26+43	circ. curve	E46534 N35887 464.3'	49.3	10	400	0.020	5555.4	5547.4

PMF FLOOD PLAIN LINE, GRADE, AND DIMENSION CONTROL - CENTRAL FLOOD PLAIN

STATION (1)	SEGMENT LENGTH feet	OFFSET FROM CHANNEL CENTERLINE TO BANK, FT LEFT	RIGHT	TOTAL WIDTH feet	MIN. DEPTH feet	GRADIENT	MAX ELEV AT TOE OF BANK	MIN.ELEV. AT TOP OF BANK FOR PMF Q	CH ELEV
0+00		30	20	50	4.31		5620.25	5624.6	5624.6
	600					0.028			
6+00		55	55	110	4.31		5603.5		
	78					0.028			
6+78		65	75	140	2.76		5601.3	5604.0	5603.1
	412 (2)					0.022			
9+79		50	250	300	2.05		5592.2	5594.3	5594.2
	346					0.022			
13+25		50	250	300	2.00		5584.6	5586.6	5584.1
	256 (2)					0.025			
15+43		50	260	310	2.00		5578.2	5580.2	5577.8
	700					0.025			
22+43		50	260	310	2.43		5560.7	5563.1	5559.4
	482 (2)					0.015			
26+43		100	270	370	2.43		5553.5	5555.9	5551.7

NOTES: 1) Stationing is along centerline of channel (not flood plain)
2) Segment length is calculated using average of radii at start and end of segment in formula for length of circular arc.

DIVERSION CHANNEL LINE, GRADE, AND DIMENSION CONTROL - EAST CHANNEL

START POINT COORD.	FROM STATION	TO STATION	SEGMENT PLAN FORM	CENTER AND RADIUS	CURVE ANGLE degrees	WIDTH feet	LENGTH feet	GRADIENT	ELEVATION START	ELEVATION END
E48295 N34473	0+00	2+05	circ. curve	E48470 N34473 175'	67	10	204.6	0.06	5620.0	5607.7
E48390 N34634	2+05	4+62	circ. curve	E48316 N34837 220'	67	10	257.3	0.05	5607.7	5594.9
E48536 N34837	4+62	7+12	straight line	n/a	n/a	10	250.0	0.035	5594.9	5586.1
E48536 N35087	7+12	10+89	circ. curve	E48099 N35087 437'	49.5	10	377.5	0.035	5586.1	5572.9
E48383 N35419	10+89	14+82	circ. curve	E48545 N35609 250'	90	10	392.7	0.033	5572.9	5559.9
OR ALTERNATE DESIGN END SEGMENT										
E48383 N35419	10+89	12+91	circ. curve	E48502 N35560 185'	62.5	10	201.8	0.037	5572.9	5565.4

PMF FLOOD PLAIN LINE, GRADE, AND DIMENSION CONTROL - EAST FLOOD PLAIN

STATION (1)	SEGMENT LENGTH feet	OFFSET FROM CHANNEL CENTERLINE TO BANK, FT LEFT	RIGHT	TOTAL WIDTH feet	MIN. DEPTH feet	GRADIENT	MAX ELEV AT TOE OF BANK	MIN.ELEV. AT TOP OF BANK FOR PMF Q	CH ELEV
0+00		70	30	100	1.35		5620.7	5622.1	5621.9
	225 (2)					0.050			
2+05		70	30	100	1.55		5609.5	5611.0	5609.8
	227 (2)					0.035			
4+62		90	20	100	1.71		5601.5	5603.2	5597.1
	250					0.035			
7+12		105	25	100	1.71		5592.8	5594.5	5588.3
	431 (2)					0.035			
10+89		65	100	250	1.71		5577.7	5579.4	5575.9
	351 (2)					0.035			
14+82		115	85	300	1.82		5565.4	5567.2	5563.3
	520					0.020			
20+92		n/a	n/a	300	1.25		5555.0		

Alternate channel-end segment does not affect flood plain past 10+89

NOTES: 1) Stationing is along centerline of channel (not flood plain)
2) Segment length is calculated using average of radii at start and end of segment in formula for length of circular arc.

********* CALCULATION C9 *********

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a1.l70

CALCULATION OF DEPTH OF SCOUR AT TOE OF FLOOD PLAIN BANKS DUE TO PMF FLOW

References: 1) Pemberton, E.L., and J.M. Lara, 1984, "Computing Degradation and Local Scour", Technical Guideline for Bureau of Reclamation

Estimates of scour depth made by methods described in Ref.1 using PMF flood parameters

CHANNEL/ FLOOD PLAIN STATION	FLOW RATE Q cfs	PEAK DEPTH y ft	BOTTOM WIDTH Wb ft	MEAN SIZE OF BED MATERIAL Dm, mm(1)	LACEY BED FACTOR Z (2)	ZERO BED FACTOR Fbo (3)	SCOUR DEPTH, ft. ds1	ds2	ds3	AVERAGE ds
CENTRAL FLOOD PLAIN										
0+00 to 5+22	4280	4.31	50	0.015	0.25	2.8	7.1	3.2	8.3	6.2
5+22 to 6+78	4808	2.76	110	0.015	0.25	2.8	6.1	3.3	5.3	4.9
6+78 to 9+79	6663	1.96	300	0.015	0.75	2.8	5.2	11.0	3.4	6.5
9+79 to 13+25	7264	2.05	300	0.015	0.25	2.8	5.3	3.8	3.6	4.2
13+25 to 15+43	7663	2.00	310	0.015	0.50	2.8	5.3	7.7	3.6	5.5
15+43 to 22+43	8263	2.43	310	0.015	0.25	2.8	5.4	3.9	3.8	4.4
22+43 to 26+43	9209	2.33	370	0.015	0.50	2.8	5.3	8.2	3.6	5.7
EAST FLOOD PLAIN										
0+00 to 2+05	1780	1.35	100	0.015	0.75	2.8	4.9	7.1	2.9	5.0
2+05 to 4+62	1897	1.55	100	0.015	0.75	2.8	5.0	7.3	3.0	5.1
4+62 to 7+12	2227	1.71	100	0.015	0.25	2.8	5.2	2.6	3.4	3.7
7+12 to 10+89	2446	1.82	100	0.015	0.50	2.8	5.3	5.3	3.6	4.7
10+89 to 14+82	2714	1.11	250	0.015	0.75	2.8	4.3	8.2	2.1	4.9
14+82 to 20+92	3031	1.25	300	0.015	0.25	2.8	4.3	2.8	2.0	3.0

NOTES:
1) Mean size of bed material based on grain size analyses of soil samples from C and E test pits. See Appendix D
2) Bed factor Z for Lacey method is 0.25 for straight reach, 0.50 for moderate bend , 0.75 for severe bend; 0.6 for Blench method (Table 7 of reference).
3) Zero bed factor determined from Figure 9 of reference.
4) unit discharge q = Q/Wb

Scour Depth equations from reference, "Computing Degradation and Local Scour", US BuRec Technical Guideline, 1984

ds1 = 2.45*q^0.24, Field Measurements method, Eqn. 24

ds2 = Z*0.47*(Q/(1.76*Dm^0.5))^0.333, Lacey method, Eqns.26 and 29

ds3 = 0.6*((q^0.667)/(fbo^0.333)), Blench method, Eqns.27 and 30

********* CALCULATION C10 *********

PMF EROSION PROTECTION ANALYSIS

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cc2.cn50

FLOOD PLAIN SEGMENT	RIPRAP SIZING Flood Plain Banks					
	Rock Size inches d50	Bank Slope, grade	N	B	N'	Safety Factor SF
CENTRAL						
Sta. 0+00, Start of diversion, to 5+22	18.3	0.5	1.04	1.12	0.99	1.00
5+22, West/Mid 1 channels junction, to 6+78	11.7	0.5	1.04	1.12	0.99	1.00
6+78, South edge of site, to 9+79	6.9	0.5	0.98	1.55	0.98	1.01
9+79 to 13+25, Between LT202 & LT 203	7.2	0.5	0.99	1.55	0.99	1.00
13+25 to 15+43	8.0	0.5	0.98	1.55	0.98	1.01
15+43 to 22+43, at NE corner of plant area	5.8	0.5	0.99	1.55	0.99	1.00
22+43 to 26+43	5.6	0.5	0.98	1.55	0.98	1.01
EAST						
Sta. 0+00 to 2+05, south edge of site	10.2	0.5	1.04	1.12	0.99	1.00
2+05 to 4+62	8.2	0.5	1.04	1.12	0.99	1.00
4+62 to 7+12	9.1	0.5	1.04	1.12	0.98	1.01
7+12 to 10+89, NE corner of LT203	9.6	0.5	1.05	1.12	0.99	1.00
10+89 to 14+82, NE corner of ore prep area	5.9	0.5	1.04	1.12	0.99	1.00
14+82 to 20+92, SE corner evap. pond area	3.8	0.5	1.04	1.12	0.98	1.01
20+92 to NE corner of site	4.3	0.5	1.04	1.12	0.99	1.00

See Calc. C4 for equations, C6 for parameters used is this calculation.

********* CALCULATION C11 *********

ROCK GRADATIONS FOR EROSION PROTECTION APPLICATIONS

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ba1.bi60

Rock Application	Design d50 inches	d50 Range minimum	d50 Range maximum	d100 Range minimum	d100 Range maximum	d25 Range minimum	d25 Range maximum
Leach Tank Outslopes	1.7	1.7	1.9	2.1	2.9	1.2	1.8
Evap. Pond Cover	0.9	0.9	1.0	1.1	1.5	0.6	0.9
Riprap/ Scour Protection	18.3	18.3	20.9	23.1	31.3	12.8	20.8
	11.7	11.7	13.3	14.7	20.0	8.2	13.2
	10.2	10.2	11.6	12.9	17.4	7.1	11.5
	9.6	9.6	10.9	12.1	16.4	6.7	10.8
	9.1	9.1	10.4	11.5	15.6	6.4	10.3
	8.2	8.2	9.3	10.3	14.0	5.7	9.2
	8.0	8.0	9.1	10.1	13.7	5.6	9.0
	7.2	7.2	8.2	9.1	12.3	5.0	8.1
	6.9	6.9	7.9	8.7	11.8	4.8	7.8
	5.9	5.9	6.7	7.4	10.1	4.1	6.6
	5.8	5.8	6.6	7.3	9.9	4.1	6.5
	5.6	5.6	6.4	7.1	9.6	3.9	6.3
	4.3	4.3	4.9	5.4	7.4	3.0	4.8
	3.8	3.8	4.3	4.8	6.5	2.7	4.2

Gradation criteria, per NUREG/CR-4620, p.53, are:

d50 minimum = design d50
d50 maximum = d100 maximum/1.5
d100 minimum = d50 minimum x 1.26
d100 maximum = d50 minimum x 1.71
d25 minimum = d50 minimum x 0.7
d25 maximum < d50 maximum

NOTE: Not all the gradations listed above will be used. The gradation used at each location will meet or exceed the listed sizes and will satisfy the gradations related to the selected d50.

********* CALCULATION C12 *********

LEACH TANK AND EVAPORATION POND COVER EROSION PROTECTION

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A362.0405

SLOPE ELEMENT	ELEMENT LENGTH L	ELEMENT WIDTH W	MAX. ELEV.	MIN. ELEV.	GRADIENT S	SLOPE ANGLE	tc (minimum is 0.042)	RAINFALL WITHIN tc (1)	i	Runoff Area, A	PMF Runoff from A Q	Unit Discharge q	Critical Slope Ss	d50 for S>0.1,
	ft	ft				degrees	hours	inches	in/hr	acres(2)	cfs	cfs/ft	ft/ft	inches
203 S>N	205	600	5618	5617	0.0049	0.28	0.06	2.60	42.75	2.82	60	0.10	0.0058	
203 Nos	130	650	5617	5592	0.1923	10.89	0.07	3.00	42.12	1.94	118	0.18	0.0086	1.7
203 N>S	215	620	5618	5616.9	0.0051	0.29	0.06	2.60	41.98	3.06	64	0.10	0.0056	
203 Sos	25	620	5616.9	5612	0.1960	11.09	0.06	2.60	40.10	0.36	74	0.12	0.0370	1.3
203 Eos	135	440	5617	5590	0.2000	11.31	0.042	1.73	41.19	1.36	39	0.09	0.0085	1.0
203 Wos	120	450	5618	5595	0.1917	10.85	0.042	1.73	41.19	1.24	36	0.08	0.0094	1.0
202 S>N	180	1050	5620	5619.1	0.0050	0.29	0.05	2.00	36.70	4.34	80	0.08	0.0074	
202 Nos	110	1050	5619.1	5598	0.1918	10.86	0.06	2.25	35.34	2.65	145	0.14	0.0116	1.4
202 N>S	190	1020	5620	5619.1	0.0047	0.27	0.06	2.25	38.78	4.45	86	0.08	0.0067	
202 Sos	25	1000	5619.1	5614.5	0.1840	10.43	0.06	2.25	36.89	0.57	101	0.10	0.0398	1.1
202 Eos	150	400	5619.1	5590	0.1940	10.98	0.042	1.73	41.19	1.38	40	0.10	0.0078	1.1
202 Wos	140	420	5619.1	5592	0.1936	10.96	0.042	1.73	41.19	1.35	39	0.09	0.0083	1.1
201 S>N	220	900	5601	5600	0.0045	0.26	0.07	2.60	39.40	4.55	90	0.10	0.0058	
201 Nos	145	1000	5600	5572	0.1931	10.93	0.08	3.00	38.82	3.33	180	0.18	0.0084	1.7
201 N>S	210	900	5601	5600	0.0048	0.27	0.06	2.25	35.98	4.34	109	0.12	0.0066	
201 Sos	24	950	5600	5598	0.0833	4.76	0.042	1.73	41.19	0.52	124	0.13	0.0375	1.3
201 Eos	150	500	5600	5572	0.1867	10.57	0.042	1.73	41.19	1.72	50	0.10	0.0078	1.1
201 Wos,N	155	250	5600	5570	0.1935	10.95	0.042	1.73	41.19	0.89	26	0.10	0.0076	1.1
201 Wos,S	50	250	5600	5590	0.2000	11.31	0.042	1.73	41.19	0.29	34	0.14	0.0200	1.4
EP Cover	430 max.	800 ave.	5562	5540	0.05	2.93	0.044	1.75	40.20	7.90	222	0.28	0.0032	

With S = 0.05 , <0.1, and y = 0.10 ft. and v = 3.72 fps, d50 of 0.90 inches gives safety factor of 1.00 using Safety Factor Method

APPENDIX D

DOCUMENTATION OF FIELD INVESTIGATIONS AND LABORATORY TESTING

CONTENTS

FIELD LOGS

- Boring Logs of Wells MW-8 through MW-14, Applied Environmental
- Logs of Leach Tanks Test Borings, Applied Environmental
- Test Pit Logs (27 pages)

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SOIL, TAILINGS, AND SALT TESTS

- Summary of Laboratory Test Data (Atterberg limits, sieve analysis classification) on C and E Pit Samples, Vinyard and Associates
- Compaction Test Results (11 tests) on C and E Test Pit Samples, Vinyard and Associates
- Particle Size Distribution Chart (12 tests) on C and Sand Cone Samples, Vinyard and Associates
- Field Density Test Results, 9/23/91, Vinyard and Associates
- Pinhole (Dispersivity) Test Results, 8/16/91, Vinyard and Associates
- Permeability Test Results, 8/7/91, Vinyard and Associates
- Test Results on Mancos Shale ("M" Test Pit Samples) - permeability, Atterberg limits, particle size, (5 tests), and compaction (5 tests)
- Report on Moisture Retention Characteristics, 12 pages, Daniel B. Stephens and Associates, 6/7/91
- Results of tests for radium content, emanation, and moisture, 6/12/91, Rogers and Associates

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ROCK TESTS

- Evaluation of Rock Durability - 2 tables
- Laboratory Test Results (on-site rock), 6/7/91, Vinyard and Associates
- Soundness and L.A. Abrasion Test Results, 7/5/91, Vinyard and Associates
- Specific Gravity and Absorption Test Results, 7/8/91, Vinyard and Associates
- Grain Size Analyses of Lone Tree Placer Site Rock, 8/27/91, Vinyard and Associates

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WELL CONSTRUCTION

- Monitor Well Installation - narrative and summary table
- Well Completion Details

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GROUND WATER SAMPLING AND TESTING

- Ground Water Sampling and Testing - narrative and table
- Ground Water Results - narrative and 12 Ground Water Quality tables
- Analytical Report (on ground water samples), 27 pages, Core Laboratories, 9/27/91
- Quality Control Report (on ground water samples), 9 pages, Barringer Laboratories, 9/11/91
- Water Quality Test Results, 10 pages, Barringer Laboratories, 9/11/91

FIGURE D1 - LOCATIONS OF TEST BORINGS AND TEST PITS AND SURFICIAL GEOLOGY

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-8

DATE BEGAN 4/26/91 DATE COMPLETED 4/26/91 UNIT/LOCATION DURITA SITE, SOUTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" temp. casing) GROUND WATER LEVEL/TIME, DATE 35' at 12:31, 4/26/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						light brown	SAND W/CLAY IN CUTTINGS, SOME CLAY BALLS.	sc	dry	
5	MW8-5 10/9/13	15"			soft	light brown	FINE-GRAINED SAND W/CLAY, TRACE GRAVEL, HIGHLY CALCAREOUS.	sc	dry	
10					soft	light brown-mod. brown	FINE-GRAINED CLAYEY SAND, TRACE SMALL GRAVEL, HIGHLY CALCAREOUS.	sc	slm	HARD DRILLING AT 10.5'.
	MW8-10 12/50-4	9"			hard	moderate brown	LARGE GRAVEL AND COBBLES IN CLAYEY SAND MATRIX, CALCAREOUS, ANGULAR TO SUBROUNDED COBBLES.	gp	slm	
15	MW8-15 25/50-6	12"			hard	olive brn. to grey	WEATHERED CLAYSTONE, CALCAREOUS SOME CALCITE CRYSTAL, MOTTLED.	clsn km	dry	WEATHERED MANCOS AT 15'.
20	MW8-20 23/50-6	12"			hard	olive brn.	WEATHERED CLAYSTONE, CALCAREOUS, SOME IRON STAINING VISIBLE, GYPSUM CRYSTALS.	clsn km	slm	
25	MW8-25 27/50-6	12"			hard	olive brn.	SAME AS ABOVE	clsn km	slm	
30						dk. grey to black	UNWEATHERED SHALE, FRAGMENTS IN CUTTINGS (27.5').	clsn km	dry	UNWEATHERED MANCOS AT 27.5'.

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-8

DATE BEGAN 4/26/91 DATE COMPLETED 4/26/91 UNIT/LOCATION DURITA SITE, SOUTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surface) GROUND WATER LEVEL/TIME, DATE 35' at 12:31 pm, 4/26/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30	MW8-30 50-3	3"			hard	white to brn. grey	LIMESTONE W/TRACE INCLUSION OF BLACK SHALE FRAGMENTS, HIGHLY CALCAREOUS.	lmsn km	dry	MARKER BED MB2 AT 30'.
						black to dark grey	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km	dry	
35								ss km/kd	m	HARD DRILLING AT 35' TO 36', SAND GRINDING DOWNHOLE, WATER AT 35'.
						black	CLAYSTONE FRAGMENTS IN CUTTINGS, SOME IN CLAY BALLS, SOME FINE- TO COARSE-GRAINED SAND.			TRANSITIONAL ZONE BETWEEN KD/KM AT 35'.
40	MW8-40 50-3	3"			hard	black	SHALE W/FINE-GRAINED SAND; SOME COARSE- TO MOD-GRAINED SAND IN TOP OF SAMPLE.	sh/ss km/kd	sat	HARD DRILLING AT 41'; SWITCH TO AIR ROTARY.
45										HARD DRILLING AT 48' TO 50', SAND GRINDING DOWNHOLE.
50							MODERATE-TO COARSE-GRAINED SAND W/CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd	sat	
							TD = 51'.			
55										
60										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN. GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY SLM M VM SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-9

DATE BEGAN 4/25/91 DATE COMPLETED 4/25/91 UNIT/LOCATION DURITA SITE, WEST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 44' at 17:53, 4/25/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/ TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						moderate brown	SANDY CLAY FROM CUTTINGS W/SOME CLAY BALLS.	cl	dry	
5	MW9-5 7/9/10	18"			soft	mod. brown	CLAY W/FINE-GRAINED SAND AND SOME SILT, HIGHLY CALCAREOUS.	cl	sim	
10	MW9-10 16/50-3	9"			hard	moderate-light brown	CLAY W/SILT AND FINE-GRAINED SAND, HIGHLY CALCAREOUS, ROCK IN BOTTOM OF SAMPLER.	cl	dry	HARD DRILLING FROM 11' TO 15'.
						mod. brown	SANDSTONE ROCK FRAGMENTS IN CUTTINGS. ANGULAR TO SUB ANGULAR W/LARGE GRAVEL IN CLAYEY SAND MATRIX.	gp	dry	
15	MW9-15 18/50-6	12"			hard	olive brn.-light grey	WEATHERED CLAYSTONE, CALCAREOUS W/ CALCITE CRYSTALS, SOME MED-GRAINED SAND; SEVERAL GRAVEL-SIZED PIECES OF SANDSTONE FRAGMENTS IN TOP OF SAMPLER.	clsn km	dry	15' TO MANCOS WEATHERED CLAYSTONE.
20	MW9-20 50-6	6"			hard	light grey-light brown	SANDSTONE W/CLAY AND SHALE FRAGMENTS, SOME GRAVEL, FINE TO COARSE-GRAINED SAND, CALCAREOUS.	ss km	dry	HARD DRILLING AT 19' AT UNWEATHERED MANCOS.
					hard	dark grey-olive brown	CLAYSTONE, CALCAREOUS IN CUTTINGS.	clsn		SWITCH TO AIR ROTARY AT 19'.
25						grey to brownish grey black	GREY CLAYSTONE FRAGMENTS IN CUTTINGS, BENTONITE, SLIGHTLY CALCAREOUS TO NONCALCAREOUS.	clsm km		HARDER DRILLING AT 24', MARKER BED MB1 FROM 24' TO 25.5'.
							BLACK CLAYSTONE FRAGMENTS BY 25.5', CALCAREOUS IN CUTTINGS.	clsm km		
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-9

DATE BEGAN 4/25/91 DATE COMPLETED 4/25/91 UNIT/LOCATION DURITA SITE, WEST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 44' at 17:53, 4/25/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30						black to dark grey	CALCAREOUS CLAYSTONE FRAGMENTS IN CUTTINGS, SOME W/IRON STAINING VISIBLE WHEN CUTTINGS BROKEN.	clsn km	dry	
35						black to dark grey	CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS TO SLIGHTLY CALCAREOUS.	clsn km	dry	
40						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, NONCALCAREOUS.	clsn km	dry	HARD DRILLING AT 43', HARDER DRILLING AT 44', WATER AT 44', SAND GRINDING DOWNHOLE.
45						dark grey to black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS W/SAND GRAINS, POSSIBLY SANDSTONE BED. LT GREY COLOR AT 44'. SANDSTONE W/CLAYSTONE OR SHALE, COARSE SAND GRAINS.	ss km/kd	slm sat	EASIER DRILLING AT 47'.
						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km/kd	sat	HARDER DRILLING FROM 48' TO 49', W/SAND GRINDING DOWNHOLE.
50								ss km/kd	sat	
						black	CLAYSTONE FRAGMENTS, TRACE SAND IN CUTTINGS. CLAYSTONE FRAGMENTS IN CUTTINGS W/SOME FINE TO MED-GRAINED SAND.	clsn km/kd	sat	TRANSITIONAL ZONE BETWEEN KM AND KD AT 43' CONSISTING OF INTERBEDDED SANDSTONES AND CLAYSTONES.
55								clsn km/kd	sat	
							TD = 55'.			
60										

ST = SHELBY TUBE
S = SPLIT BARREL
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R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN. GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY SLM M VM SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-10

DATE BEGAN 4/23/91 DATE COMPLETED 4/23/91 UNIT/LOCATION DURITA SITE, WEST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Approx. 56' at 11:30, 4/23/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						tan to dark brown	SILTY CLAY FROM CUTTINGS. CHANGE TO DK BROWN.	cl	dry	
5	MW10-5 4/8/9	18"			soft	mod. brown	CLAY W/SOME SILT, CALCAREOUS.	cl	dry	
					soft	tan to mod. brown	FINE-GRAINED SAND W/SOME SILT AND CLAY, CALCAREOUS.	sc	sim	
10	MW10-10 4/12/18	18"			soft	mod. brown	CLAYEY FINE-GRAINED SAND, CALCAREOUS. COARSE-GRADINED SAND AND TRACE GRAVEL, SOME CLAYSTONE FRAGMENTS NEAR BEDROCK CONTACT.	sc	sim	12' TO WEATHERED MANCOS.
							POSSIBLE MARKER BED BM1 AT 12.5'. GREY CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km	dry	HARD DRILLING 12.5' TO 13.5'.
15	MW10-15 50-4	4"			hard	black	WEATHERED CLAYSTONE, CALCAREOUS.	clsn km	dry	15' TO UNWEATHERED MANCOS CLAYSTONE.
20	MW10-20 50-10	10"			hard	black	CLAYSTONE W/GYPSUM SEAMS.	clsn km	dry	
25	MW10-25 16/50-3	9"			hard	black to dark grey	CLAYSTONE W/GYPSUM SEAMS. CALCITE PARTING AT 9" (BOTTOM OF SAMPLE), BALANCE SLIGHTLY CALCAREOUS.	clsn km	dry	
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

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TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-10

DATE BEGAN 4/23/91 DATE COMPLETED 4/23/91 UNIT/LOCATION DURITA SITE, WEST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Approx. 56' at 11:30, 4/23/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30	MW10-30 50-12	16"			hard	black	CLAYSTONE W/TRACE GYPSUM AND IRON STAINING.	clsn	dry	HARD DRILLING AT 31'.
							SHALE FRAGMENTS IN CUTTINGS BELOW 31'.	sh km		
35	MW10-35 50-3	3"			hard	dark grey	SHALE, SLIGHTLY CALCAREOUS, NO GYPSUM OR IRON STAINING VISIBLE.	sh km	dry	
						dark grey to black	DK GREY TO BLACK SHALE FRAGMENTS IN CUTTINGS.			
40										
45						dark grey	DK GREY SHALE FRAGMENTS IN CUTTINGS.	sh km	dry	
50						dark grey	DK GREY SHALE FRAGMENTS IN CUTTINGS.	sh km		
55						dark grey	DK GREY SHALE FRAGMENTS IN CUTTINGS, SOME CLAY BALLS.	sh km	m	HARDER DRILLING AT 56' TO 58'. SOME GRINDING DOWNHOLE. WATER TABLE 55' TO 60' (APPROX. 56')
								sh/ss km/kd	sat	
60							SATURATED DK GREY SHALE/ CLAYSTONE CUTTINGS.	clsn km/kd	vm	

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FINE: VSO, SO, F, H, VH
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TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY SLM M VM SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-10

DATE BEGAN 4/23/91 DATE COMPLETED 4/23/91 UNIT/LOCATION DURITA SITE, WEST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Approx. 56' at 11:30, 4/23/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
60	MW10-60 50-3	3"			hard	dark grey to black	SANDY SHALE, FINE-GRAINED SAND IN SHALE MATRIX.	sh km/kd		WATER LEVEL AT 35' WHEN SAMPLE OUT AT 1440.
65	MW10-65 50-<1	<1"			hard	grey to dark grey	FINE- TO MED-GRAINED SAND W/SHALE, SAND GRAINS ROUNDED TO SUBROUNDED, SANDSTONE W/SOME FINES (SHALE).	ss km/kd		HARDER DRILLING AT 63'. POSSIBLE BASAL MANCOS OR UPPER DAKOTA, BUT PROBABLY TRANSITION ZONE BETWEEN KM/KD AT 56'.
70							AUGER REFUSAL AT 73', BOTTOM OF HOLE IN CLAYEY SANDSTONE-TRANSITIONAL ZONE.			
75							TD = 73'.			
80										
85										
90										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-11

DATE BEGAN 4/24/91 DATE COMPLETED 4/24/91 UNIT/LOCATION DURITA SITE, NORTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 56' at 18:09, 4/24/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						mod. brown	MED-GRAINED SAND WITH CLAY, ANGULAR COBBLES AND LARGE GRAVEL IN CLAYEY SAND MATRIX FROM CUTTINGS, SOME COBBLES >3", HIGHLY CALCAREOUS.	sc	slm	
						mod. brown		gc	slm	HARDER DRILLING AT 3' IN COBBLES.
5										LG ROCK AT 6' W/HARDER DRILLING.
						mod. brown	ANGULAR COBBLES, GENERALLY FROM SANDSTONE ROCK AND LARGE GRAVEL IN SAND MATRIX FROM CUTTINGS, SAND MODERATE TO COARSE-GRAINED, TRACE CLAY.	gp	slm	
10										LG ROCK AT 11' W/HARDER DRILLING.
						light brown to greyish brn.	ANGULAR TO SUBANGULAR COBBLES IN SAND MATRIX WITH SOME CLAY, HIGHLY CALCAREOUS.	gp		GRAB SAMPLE AT 13'.
15	MW11-15 50-8	5"				greyish brn.	LARGE GRAVEL AND COBBLES IN SAND MATRIX WITH REWORKED CLAYSTONE FRAGMENTS.	gp	dry	
					hard	mod. grey	WEATHERED CLAYSTONE, CALCAREOUS.	clsn km	dry	15.3' WEATHERED MANCOS CLAYSTONE. ROCK AT BOTTOM OF HOLE SWITCH TO ROTARY. HARD DRILLING 17'-19'.
20	MW11-20 50-1	1"			hard	dark grey	CLAYSTONE, CALCAREOUS NO GYPSUM OR IRON STAINING VISIBLE.	clsn km	dry	20' TO UNWEATHERED MANCOS CLAYSTONE.
25						dark grey to black	DK GREY CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km	dry	
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-11

DATE BEGAN 4/24/91 DATE COMPLETED 4/24/91 UNIT/LOCATION DURITA SITE, NORTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 56' at 18:09, 4/24/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30						dark grey to black	CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS.	clsn km	dry	
35						dark grey to black	CLAYSTONE FRAGMENTS IN CUTTINGS, MOD CALCAREOUS.	clsn km	dry	
40						black to dark grey	SAME AS ABOVE.	clsn km	dry	
45						black to dark grey	SAME AS ABOVE.	clsn km	dry	
50						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SMALLER DIAMETER FRAGMENTS ON AVERAGE, CAN COMPRESS FRAGMENTS INTO A LOOSE BALL, MOD CALCAREOUS.	clsn km	slm	HARDER DRILLING AT 47'.
							SOME SAND IN WET CUTTINGS (51'-53').			WET CUTTINGS AT 51' BUT DRY TO SLM BY 53'.
55						black	SAME AS ABOVE.	clsn km	slm	
60										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-11

DATE BEGAN 4/24/91 DATE COMPLETED 4/24/91 UNIT/LOCATION DURITA SITE, NORTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 56' at 18:09, 4/24/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
60						black to dark grey	CLAYSTONE FRAGMENTS IN CUTTINGS W/TRACE FINE-GRAINED SAND, MODERATELY CALCAREOUS.	clsn km	slm	FINE-GRAINED SAND COULD BE SLOUGH.
65						black to dark grey	CLAYSTONE FRAGMENTS, W/TRACE FINE-GRAINED SAND IN CUTTINGS, SLIGHTLY CALCAREOUS. SOME LT GREY CUTTINGS AT 67'.	clsn km	slm	
70						black to dark grey	CLAYSTONE FRAGMENTS W/TRACE TO NO FINE- GRAINED SAND, SLIGHTLY CALCAREOUS, FROM CUTTINGS.	clsn km	slm	HARDER DRILLING AT 71'.
75						black to dark grey	CLAYSTONE FRAGMENTS, W/NO SAND GRAINS, SLIGHTLY TO NONCALCAREOUS FROM CUTTINGS.	clsn km	slm	CONTINUED HARDER DRILLING.
80						black	CLAYSTONE FRAGMENTS W/TRACE FINE- GRAINED SAND GRAINS FROM CUTTINGS.	clsn km	m	WATER IN CUTTINGS AT 81', COULD BE FROM 51' TO 53' ZONE.
85						black	SAME AS ABOVE.	clsn km	m	
							TD = 85'.			
90										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-12

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE, NORTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Not Encountered at 20:35, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE 38' at 08:35, 4/29/91

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						light brown	FINE-GRAINED SAND W/CLAY IN CUTTINGS.	sc	dry	
5	MW12-5 8/10/11	18"			soft	light brown	FINE-GRAINED SAND W/CLAY, HIGHLY CALCAREOUS.	sc	dry	
10	MW12-10 7/9/8	18"			soft	light brown – med. brn.	SAME AS ABOVE.	sc	dry	SLIGHTLY HARDER DRILLING AT 14'.
15	MW12-15 14/16/19	18"			stiff	olive brown to dk. grey	WEATHERED CLAYSTONE, MOTTLED, CALCITE CRYSTALS.	clsn km	dry	WEATHERED MANCOS CLAYSTONE AT 14'.
20	MW12-20 13/14/50-5	17"			stiff	olive brown	SAME AS ABOVE.	clsn km	dry	UNWEATHERED MANCOS CLAYSTONE AT 21'.
					hard	dark grey to black	CLAYSTONE W/SOME IRON STAINING, CALCAREOUS.	clsn km	dry	
25						dark grey to black	CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS.	clsn km	dry	HARD DRILLING, SAND GRINDING DOWNHOLE FROM 27.5' TO 29'. SWITCH TO AIR ROTARY AT 29'.
						white to dark grey	FINE-GRAINED SAND W/CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km	m	
30										

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S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-12

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE, NORTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Not Encountered at 20:35, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE 38' at 08:35, 4/29/91

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30						dark grey to black	CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS TO SLIGHTLY CALCAREOUS.	clsn km	dry	
35						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS TO SLIGHTLY CALCAREOUS.	clsn km	dry	SOME WET CUTTINGS BELOW 30' FROM SANDSTONE ZONE AT 29', BUT NOT ENOUGH TO KEEP DUST DOWN.
40						black	SAME AS ABOVE.	clsn km	dry	
45						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SLIGHTLY CALCAREOUS TO NONCALCAREOUS.	clsn km	dry	
50						white to dark grey	FINE-GRAINED SAND W/CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd	dry	HARD DRILLING, SAND GRINDING DOWNHOLE FROM 50' TO 51.5'.
						black	BLACK CLAYSTONE FRAGMENTS W/SOME FINE- GRAINED SAND.	clsn km/kd	dry	TRANSITIONAL KM/KD ZONE AT 50'.
55						white to black	FINE-GRAINED SAND ROUNDED TO SUBROUNDED.	ss km/kd	dry	HARD DRILLING AT 57' TO 63', SAND GRINDING DOWNHOLE.
60										

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S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-12

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE/NORTH SITE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Not Encountered at 20:35, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE 38' at 08:35, 4/29/91

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
60						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS W/FINE-GRAINED SAND, NONCALCAREOUS.	clsn km/kd	dry	SOME WET CUTTINGS BELOW 60' BUT MOST DRY.
65						black	SAME AS ABOVE.	clsn km/kd	dry	
								ss		HARD DRILLING, SAND GRINDING DOWNHOLE FROM 67' TO 67.5', 70' TO 74', AND 76 TO 76.2'.
70						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS W/FINE-GRAINED SAND.	clsn km/kd	dry	
						white to dark grey	FINE-GRAINED, ROUNDED TO SUBROUNDED SAND W/CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd		
75						black	BLACK CLAYSTONE FRAGMENTS W/VERY FINE- GRAINED SAND.	clsn km/kd	dry	
								ss		
						black	BLACK CLAYSTONE FRAGMENTS W/VERY FINE-GRAINED SAND IN CUTTINGS.	clsn km/kd	dry	
80										
85						black	SAME AS ABOVE.	clsn km/kd	dry	
							TD = 85'.			
90										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-13

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE, EAST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 63' at 16:02, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0						light brown	CLAYEY SAND IN CUTTINGS, SOME CLAY BALLS IN CUTTINGS.	sc	slm	
5	MW13-5 12/13/10	18"			soft	light to mod. brown	FINE-GRAINED SAND W/CLAY, HIGHLY CALCAREOUS.	sc	dry	
10	MW13-10 8/11/13	18"			soft	light brown	SAME AS ABOVE.	sc	dry	
15	MW13-15 16/17/21				stiff	lt. brn. to grey brown	WEATHERED CLAYSTONE, CALCITE CRYSTALS, CALCAREOUS, MOTTLED.	clsn km	dry	SLIGHTLY HARDER DRILLING AT 14', WEATHERED MANCOS AT 14'.
20	MW13-20 9/16/50-5	17"			stiff	olive brown	SAME AS ABOVE.	clsn km	dry	UNWEATHERED MANCOS CLAYSTONE AT 21'.
					hard	dark grey	CLAYSTONE W/IRON STAINING AND GYPSUM SEAMS.	clsn km	dry	
25						dark grey to black	CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS.	clsn km	dry	
30										

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J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-13

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE, EAST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 63' at 13:02, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
30						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS.	clsn km	dry	HARD DRILLING, SAND GRINDING DOWNHOLE FROM 32' TO 32.5'.
								ss		
35						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS TO MODERATELY CALCAREOUS.	clsn km	dry	
40	MW13-40 50-1	<1"			hard	light grey	FINE-GRAINED SAND, ROUNDED W/ SOME BLACK CLAYSTONE.	ss	dry	HARD DRILLING, SAND GRINDING DOWNHOLE FROM 37' TO 40.5'. SWITCH TO AIR ROTARY AT 40'. MARKER BED MB1 IN VICINITY OF 43'.
						black	CLAYSTONE FRAGMENTS IN CUTTINGS. SOME WHITE TO LT GREY LIMESTONE FRAGMENTS IN CUTTINGS..	clsn km	dry	
45						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SLIGHTLY CALCAREOUS.	clsn km	dry	
50						black	SAME AS ABOVE.	clsn km	dry	
55						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SLIGHTLY CALCAREOUS TO NONE CALCAREOUS, SOME MOIST CUTTINGS.	clsn km	dry	
						black	SOME FINE-GRAINED SAND W/ CLAYSTONE CUTTINGS.	clsn km	dry	
60										

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S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN. GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-13

DATE BEGAN 4/28/91 DATE COMPLETED 4/28/91 UNIT/LOCATION DURITA SITE, EAST SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE 63' at 13:02, 4/28/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
60						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km	dry	HARD DRILLING, SAND GRINDING DOWNHOLE 63' TO 64'.
						dark grey	FINE-GRAINED SAND W/CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd	sat	WATER AT 65' W/WET CUTTINGS
65						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km/kd	w	TRANSITIONAL KM/KD ZONE AT 63'.
70						dark to light grey	FINE-GRAINED SAND, ROUNDED, W/ CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd	w	HARD DRILLING, SAND GRINDING DOWNHOLE FROM 70' TO 75.1'.
75						white to dark grey	FINE-GRAINED ROUNDED SAND W/ CLAYSTONE FRAGMENTS IN CUTTINGS.	ss km/kd	w	THIN SHALE ZONE AT 73'.
						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km/kd	w	
80							TD = 77'.			
85										
90										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-14

DATE BEGAN 4/27/91 DATE COMPLETED 4/27/91 UNIT/LOCATION HECLA SITE, SOUTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE Not Encountered at 14:07, 4/27/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
0							COBBLES TO LARGE GRAVEL AT SURFACE, ANGULAR TO SUBANGULAR.			COBBLES/LARGE GRAVEL AT SURFACE SIMILAR TO COVER OF TAILINGS VAULTS.
5	MW14-5 13/50-2	8"				dark brown	FINE-GRAINED SAND W/CLAY.	sc	slm	HARD DRILLING AT 5.5'.
						light brown	ROCK IN END OF SAMPLER, COBBLES TO LARGE GRAVEL IN CLAYEY SAND MATRIX, ANGULAR TO SUBROUNDED, CALCAREOUS ROCK/ COBBLE IN DRIVE SAMPLE.	gp	dry	
10	MW14-10 50-1									
15							SANDSTONE COBBLES AND GRAVEL IN CUTTINGS.	gp	dry	HARDER DRILLING FROM 14' TO 15.5', NO DRIVE SAMPLE - AUGER ON BOULDER
20	MW14-20 50-3	3"			hard	dark grey	WEATHERED CLAYSTONE, CALCAREOUS.	clsn km	dry	20' TO WEATHERED MANCOS CLAYSTONE
								ss/km		HARD DRILLING 22' TO 23', SAND GRINDING DOWNHOLE.
25	MW14-25 50-3	3"			hard	dark grey to black	CLAYSTONE, TRACE TO NO FINE-GRAINED SAND, CALCAREOUS.	clsn km	dry	25' TO UNWEATHERED MANCOS CLAYSTONE.
30										

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FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN, GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-14

DATE BEGAN 4/27/91 DATE COMPLETED 4/27/91 UNIT/LOCATION DURITA SITE, SOUTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Not Encountered at 14:07, 4/27/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	DESCRIPTION: USCS	DESCRIPTION: MOISTURE	REMARKS
30	MW14-30				hard	dark grey to black	SAME AS ABOVE.	clsn km	dry	
35						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SOME CLAY BALLS IN CUTTINGS.	clsn km	slm	
40						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, CALCAREOUS.	clsn km	dry	
45						blk.-dk.gry.	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS AND SOME FINE-GRAINED SAND.	ss/km	dry	44' HARDER DRILLING, SAND GRINDING DOWNHOLE. SWITCH TO AIR ROTARY AT 45'. EASIER DRILLING AT 46'.
50						black to dark grey	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SLIGHTLY CALCAREOUS TO CALCAREOUS.	clsn km	dry	
55						black	BLACK CLAYSTONE FRAGMENTS IN CUTTINGS, SLIGHTLY CALCAREOUS.	clsn km	dry	
60										

ST = SHELBY TUBE
S = SPLIT BARREL
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FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-65%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. MW-14

DATE BEGAN 4/27/91 DATE COMPLETED 4/27/91 UNIT/LOCATION DURITA SITE, SOUTH SIDE

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D./AIR ROTARY

HOLE DIAMETER 8" (12" surf. casing) GROUND WATER LEVEL/TIME, DATE Not Encountered at 14:07, 4/27/91

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE _____

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (ft.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	COLOR	MATERIAL TYPE	USCS	MOISTURE	REMARKS
60										
65						black	BLACK CLAYSTONE FRAGMENTS, NONCALCAREOUS, IN CUTTINGS, SOME WHITE TO BROWN-GREY LIMESTONE FRAGMENTS.	clsn km	dry	MARKER BED MB2 IN VICINITY OF 65'.
70						black	BLACK NONCALCAREOUS CLAYSTONE FRAGMENTS IN CUTTINGS.	clsn km	dry	
75						white to dark grey	FINE- TO MED-GRAINED ROUNDED SAND IN CUTTINGS W/BLACK CLAYSTONE FRAGMENTS.	ss km/kd	dry	75' HARD DRILLING, SAND GRINDING DOWNHOLE FROM: 75'-77', 80'-80.5', AND 82'-84.5' KM/KD TRANS. ZONE ENCOUNTERED AT 75' BUT NO WATER.
						black	CLAYSTONE FRAGMENTS IN CUTTINGS W/TRACE SAND.	clsn km/kd	dry	
80								ss	dry	
						black	CLAYSTONE FRAGMENTS IN CUTTINGS W/TRACE SAND.	clsn km/kd	dry	
						white to dark grey	FINE-GRAINED ROUNDED SAND IN CUTTINGS W/CLAYSTONE FRAGMENTS.	ss km/kd	dry	
85						black	CLAYSTONE FRAGMENTS IN CUTTINGS. TD = 85'.			
90										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 201 W

DATE BEGAN 4/30/91 DATE COMPLETED 4/30/91 UNIT/LOCATION DURITA SITE/LEACH TANK 201

DRILLER/RIG GROUND EXPLORATION/CME-850 DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" O.D. GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/ TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	201W: 0-2.5	11"				LIGHT TO MOD. BROWN	CLAY CAP WITH LARGE GRAVEL	CL	DRY	
	201W: 2.5-5	30"				MOD. BROWN TO REDDISH BROWN	TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY	SC	DRY TO M	NOTE: CUTTINGS TURN TO LIGHT BROWNISH GREY WHEN DRY
5										
	201W: 5-10	21"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
10										
	201W: 10-15	18"						SC	M	
15						DARK REDDISH BROWN	SAME AS ABOVE			
	201W: 15-20						TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY, LESS CLAY THAN ABOVE			
						DARK REDDISH BROWN	CLAY LINER AT 19 FT BASED ON DRILLING RATE, LIGHT BROWN CLAY ON BIT OF AUGER	SC / CL	M	
20							TOTAL DEPTH 20 FT			
25										
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, M, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY SLM M VM SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 201 E

DATE BEGAN 4/30/91 DATE COMPLETED 4/30/91 UNIT/LOCATION DURITA SITE/LEACH TANK 201

DRILLER/RIG GROUND EXPLORATION/CME-850 DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/ TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	201E: 0-2.5	6"				LIGHT TO MOD. BROWN	CLAY CAP WITH SOME LARGE GRAVEL AND COBBLES	CL	DRY	COBBLES/LARGE GRAVEL AT BASE OF CLAY CAP, POOR RECOVERY
5	201E: 2.5-5	30"				REDDISH BROWN	TAILINGS: FINE TO MEDIUM GRAINED SAND WITH SOME CLAY	SC	SLM	
	201E: 5-10	27"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
10	201E: 10-15	8"					SAME AS ABOVE	SC	M	
15	201E: 15-20	30"				DARK REDDISH BROWN				COBBLE IN SAMPLER, POOR RECOVERY
20							CLAY LINER AT 19FT BASED ON DRILLING RATE, CLAY ON AUGER	CL		
25							TOTAL DEPTH 20FT			
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 202W

DATE BEGAN 4/30/91 DATE COMPLETED 4/30/91 UNIT/LOCATION DURITA SITE/LEACH TANK 202

DRILLER/RIG GROUND EXPLORATION/CME-850 DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	202W: 0-2.5	14"				LIGHT TO MOD. BROWN	CLAY CAP WITH SOME LARGE GRAVEL	CL	DRY	
	202W: 2.5-5	30"				REDDISH BROWN TO LIGHT BROWN	TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY AND TRACE LARGE GRAVEL	SC	DRY	
5	202W: 5-10	23"								LARGE GRAVEL IN CUTTINGS FOR 5-10 FT RUN
10	202W: 10-15	22"				DARK REDDISH BROWN	SAME AS ABOVE	SC	DRY TO SLM	LARGE GRAVEL IN CUTTINGS FOR 10-15FT RUN
15	202W: 15-20	30"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	SAME AS ABOVE
						LIGHT TO MOD. BROWN	CLAY LINER AT 19 FT BASED ON DRILLING, LIGHT BROWN CLAY ON BIT OF AUGER	CL	M DRY	
20							TOTAL DEPTH 20 FT			
25										
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN. GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 202E

DATE BEGAN 4/30/91 DATE COMPLETED 4/30/91 UNIT/LOCATION DURITA SITE/LEACH TANK 202

DRILLER/RIG GROUND EXPLORATION/CME-850 DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/ TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	202E: 0-2.5	14"				LIGHT TO MOD. BROWN	CLAY WITH SOME SAND	CL	SLM TO DRY	ROCK ENCOUNTERED AT 2 FT AT BASE OF CAP
	202E: 2.5-5	28"				REDDISH BROWN TO LIGHT BROWN	TAILINGS: FINE GRAINED SAND WITH CLAY	SC	SLM TO DRY	
5							TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY AND LARGE GRAVEL		SLM	COBBLES/LARGE GRAVEL IN CUTTINGS FOR 5 TO 10 FT RUN, POOR RECOVERY
	202E: 5-10	3"								
10						DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
	202E: 10-15	3"								COBBLES/LARGE GRAVEL IN CUTTINGS FOR 10 TO 15 FT RUN, POOR RECOVERY
15						DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
	202E: 15-20	28"					SOME CLAY BALLS IN CUTTINGS AT 19 FT			
						LIGHT TO MOD. BROWN	CLAY LINER AT 19 FT BASED ON DRILLING RATE, LIGHT BROWN CLAY ON BIT AUGER	CL	M TO VM	
20							TOTAL DEPTH 20 FT			
25										
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN, GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 203W

DATE BEGAN 4/29/91 DATE COMPLETED 4/29/91 UNIT/LOCATION DURITA SITE/LEACH TANK 203

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/ TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	203W: 0-2.5	13"				LIGHT BROWN TO MOD. BROWN	CLAY CAP WITH SOME GRAVEL	CL	DRY	LARGE GRAVEL IN CUTTINGS FOR 0-5 FT RUN
	203W: 2.5-5	30"				DARK REDDISH BROWN	TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY	SC	SLM	
5	203W: 5-10	12"								SOME TO TRACE LARGE GRAVEL IN CUTTINGS FOR RUNS BELOW 10 FT
10	203W: 10-15	30"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
15	203W: 15-20	17"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
20	203W: 20	13"				DARK REDDISH BROWN / MOD. BRN	SAME AS ABOVE; CLAY LINGER AT 20 FT BASED ON DRILLING RATE, CLAY ON TIP OF AUGER	SC / CL	VM	SOME CLAY BALLS IN CUTTINGS
25							TOTAL DEPTH 21 FT			
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN., GRY., YEL., WH., BLK., BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Applied Environmental

BORING LOG

PROJECT NAME HECLA/AKG PROJECT NO. 9014 PHASE NO. _____ BORING NO. 203E

DATE BEGAN 4/29/91 DATE COMPLETED 4/29/91 UNIT/LOCATION DURITA SITE/LEACH TANK 203

DRILLER/RIG GROUND EXPLORATION DRILLING METHOD HOLLOW STEM AUGER 8" O.D.

HOLE DIAMETER 8" GROUND WATER LEVEL/TIME, DATE N/A

ENGINEER J. ENGLAND GROUND WATER LEVEL/TIME, DATE N/A

DEPTH (ft.)	SAMPLING RUN/TYPE	SAMPLE RECOVERY (in.)	ANALYTICAL SAMPLES	JAR HEADSPACE SAMPLES	DESCRIPTION: CONSISTENCY	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL TYPE	USCS	MOISTURE	REMARKS
0	203E: 0-5	30"				MOD. TO DARK BROWN	CLAY CAP WITH SOME LARGE GRAVEL	CL	DRY	LARGE GRAVEL IN CUTTINGS FOR 0 TO 5 FT RUN
						DARK REDDISH BROWN	TAILINGS: FINE TO MEDIUM SAND WITH CLAY	SC	SLM	
5	203E: 5-10	10"				DARK REDDISH BROWN	TAILINGS: FINE TO MEDIUM GRAINED SAND WITH CLAY	SC	M	SOME TO TRACE LARGE GRAVEL IN CUTTINGS FOR RUNS BELOW 10 FT
10	203E: 10-15	30"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	
15	203E: 15-20	7"				DARK REDDISH BROWN	SAME AS ABOVE	SC	M	COBBLE ENCOUNTERED AT END OF 15 TO 20 FT RUN, POOR RECOVERY ON 15 TO 20 FT RUN
20	203E: 20	15"				DARK REDDISH BROWN	SAME AS ABOVE CLAY LINER AT 20.5 FT BASED ON DRILLING RATE, CLAY ON BIT OF AUGER	SC	SAT	CLAY BALLS IN CUTTINGS WATER ON AUGER WHEN REMOVED AT 20 FT
						MOD. BRN		CL		
25							TOTAL DEPTH 21 FT			
30										

ST = SHELBY TUBE
S = SPLIT BARREL
C = CUTTINGS
J = JAR
R = CORE RUN

FINE: VSO, SO, F, H, VH
COARSE: VLO, LO, MD, D, VD

V. LT., DK. BRN., GRN. GRY., YEL. WH., BLK. BLUE

TRACE = 5-12%
SOME = 12-30%
SANDY, GRAVELLY, SILTY or CLAYEY = 30-45%
AND = 45-55%

DRY
SLM
M
VM
SAT

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

September 3, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, New Mexico 87111

Attention: Mr. Alan K. Kuhn, PhD., PE

Subject: Durita Mine,
Vinyard & Associates' Project No.: 91-1-43

Gentlemen:

Please find enclosed the Logs of Test Pits from the Durita Mine.

Should you have any questions regarding the enclosed data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

File: 91-1-43.ltr

AK GeoConsult, Inc.

TEST PIT # E-1

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. E-1 Date 5/2/91 Logged by GM

Location Description 120' E. of tank 203, 140' S. of N. dike crestline
Grid Coordinates 48,480 E, 35,000 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1	B		CL, CLAY, sandy, fine-grained, stiff, moist, gray brown, reworked shale, mancos
2			
3			Medium moist, very stiff to hard, caliche veins
4			
5			
6			
7			
8			
9			
10	B		
11			Bottom of Hole at 11'
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # E-2

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. E-2 Date 5/2/91 Logged by GM

Location Description 100' W. of E. fence, 200' N. of N. dike crestline
Grid Coordinates 48,460 E, 35,350 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			CL, CLAY, sandy, fine-grained, stiff, moist, gray brown
1			
2			Mancos, shale, hard, slightly moist, gray
3			
4	B		Very hard
5			Bottom of Hole at 5'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # E-3

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. E-3 Date 5/2/91 Logged by GM

Location Description NW side of dike at N. end of basin, 550' N. of tank 203
Grid Coordinates 48,460 E, 35,750 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1	B		CL, CLAY, very sandy, fine-grained, stiff, moist, brown
2	B		SM, SAND, very silty, fine-grained, moist, red brown
3			
4			
5	Bk B		Clayey layer
6			
7			
8			
9			
10			
11			Bottom of Hole at 10½'
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # E-4

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. E-4 Date 5/2/91 Logged by GM

Location Description 150' N. of S. fence, 75' W. of E. fence
Grid Coordinates 48,260 E, 34,840 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			CL, CLAY, sandy, fine-grained, uniform, stiff, moist, gray brown
2	B		Caliche veins, medium moist, stiff
3			
4	B		
5	Bk		
6			
7			
8	B		Shale, mancos, hard, slightly moist, maroon gray
9			
10	Bk		
11			Bottom of Hole at 10'
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-1

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-1 Date 4/30/91 Logged by GM

Location Description 75' W. of MW8, 30' N. of S. fence
Grid Coordinates 47,120 E, 34,750 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, clayey, fine-grained, very gravelly, 20% +3", 5% +6", medium moist to moist, dark brown, subangular sandstone
2	B		
3			Light brown color
4	Bk		
5			
6			
7			Mancos, shale, weathered, clay, very sandy, hard, medium moist, dark green gray
8	B		
9			
10			Bottom of Hole at 9'
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # C-2

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-2 Date 4/30/91 Logged by GM

Location Description 110' N. of MW8
Grid Coordinates 47,200 E, 34,850 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, clayey, fine-grained, poorly graded, medium dense, uniform, slightly moist, light brown
2			
3	Bk		<5% gravel
4			
5			
6			
7			Less silty, sand layer
8			Fine to medium-grained sand
9	B		
10			
11			Bottom of Hole at 10'
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-3

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-3 Date 4/30/91 Logged by GM

Location Description 95' NW of MK-5, E. bank of E. channel
Grid Coordinates 47,320 E, 34,825 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			SM, SAND, very silty, fine-grained, moist, brown
1			
2			
3	B		CL, CLAY, sandy, fine-grained, gypsum veins, medium moist, brown
4	Bk		
5			
6			Thin gravelly layer, some cobbles <5%
7			
8			
9			
10			Bottom of Hole at 9'
11			
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-4

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-4 Date 4/30/91 Logged by GM

Location Description South of confluence of stream chnnels between tanks
Grid Coordinates 47,180 E, 34,975 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, uniform, medium dense, moist, brown
2			Slightly moist
3	Bk		
4			
5			
6			Cobbles
7			
8	B		Mancos, shale, weathered, clay, gypsum veins, some s.s. cobbles <5%
9			
10			Bottom of Hole at 9½'
11			
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-5

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-5 Date 4/30/91 Logged by GM

Location Description E. bank of channel between tanks, 75' N. of confluence of 2 channe
Grid Coordinates 47,250 E, 35,090 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, moist, brown
2			
3			Thin layer of gypsum veins, medium moist
4	Bk		
5			
6			
7			
8			
9			
10	B		Very gravelly, fine to coarse, 5% cobbles
11			Bottom of Hole at 11'
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-6

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-6 Date 4/30/91 Logged by GM

Location Description Above west bank of channel, near N. dike of tank 202
Grid Coordinates 47,140 E, 35,230 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			CL, CLAY, weathered shale
1			SM, SAND, very silty, fine-grained, moist, red brown
2			
3	Bk		
	B		GM, GRAVEL, boulders and cobbles, subangular sandstone, 50% +3", 15% +6", very sandy, medium moist, brown
4			
5			SM, SAND, very silty, much gypsum ±30%, medium moist, light brown to white
6	B		
7	B		Gray color
8	B		
9			Mancos, shale, weathered, dark gray
10			Bottom of Hole at 10'
11			
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-7

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-7 Date 4/30/91 Logged by GM

Location Description 100' N. of road, E. of tank 201
Grid Coordinates 47,130 E, 35,535 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, moist, brown
2			
3	B		Slightly moist
4			
5	B		
6	Bk		GM, GRAVEL, silty, coarse to fine, 15% cobbles 5% +6", very sandy, fine to coarse-grained,
7	Bk		slightly moist, brown
8			
9			SM, SAND, very silty, fine-grained, medium moist, brown
10			Bottom of Hole at 10'
11			
12			
13			
14			
15			

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Comments:

AK GeoConsult, Inc.

TEST PIT # C-9

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-9 Date 4/30/91 Logged by GM

Location Description 35' W. of power pole, NE of raffinate ponds
Grid Coordinates 46,870 E, 36,250 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			Boulders on surface
1			SM, SAND, very silty, fine to medium-grained, boulders 30% 6" - 12"
2			
3			
4	Bk		
5			
6	Bk		
7			
8			Less gravelly
9			Bottom of Hole at 8½'
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # C-8

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-8 Date 4/30/91 Logged by GM

Location Description 200' NE of tank 201
Grid Coordinates 47,030 E, 35,845 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, uniform, moist, brown
2			
3			
4	B		CL, CLAY, silty, very sandy, fine-grained, medium moist, brown
5			
6			Very gravelly layer, <5% cobbles
7			
8			
9	B		
10			Bottom of Hole at 9½'
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # C-10

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-10 Date 5/01/91 Logged by GM

Location Description 40' SW of power pole, SW of evaporation ponds
Grid Coordinates 46,950 E, 36,630 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, medium moist, brown
2			CL, CLAY, silty, sandy, fine-grained, uniform, stiff, slightly moist, light brown
3			
4			Mancos, shale, weathered, clayey, sandy, fine-grained, uniform, slightly moist, gray
5	B		Very hard shale Bottom of Hole at 5'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # C-11

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-11 Date 5/01/91 Logged by GM

Location Description 35' SW of power pole, W. of evaporation ponds
Grid Coordinates 47,040 E, 36,950 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			Slight gravel and cobbles on surface
1	B		SM, SAND, silty to very silty, fine-grained, uniform, medium dense, moist, brown
2			
3			
4			Silty, slightly moist, slight medium-grained
5			
6			Moist, more silty
7			Less silty, slightly moist, trace of fine gravel
8	B		
9			Trace of coarse gravel
10			Bottom of Hole at 10'
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # C-12

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. C-12 Date 5/01/91 Logged by GM

Location Description 40' W. of powerline, 80' S. of N. fence
Grid Coordinates 47,090 E, 37,150 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty to silty, fine-grained, poorly graded, uniform, medium dense, moist, brown
2			
3			
4			
5	B		Slightly moist, less silty
6			GM, GRAVEL, cobbly, subangular to subrounded, 60% +3/4", 30% +2", 15% +3", 5+ +6", very sandy, fine to medium-grained, silty, Dakota sandstone, dark green quartzite
7	Bk		
8			
9			
10			SM, SAND, silty, fine to medium-grained, medium moist, light brown
11			Bottom of Hole at 11'
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # M-1

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-1 Date 5/01/91 Logged by GM

Location Description Southeast of hill
Grid Coordinates 47,870 E, 35,860 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, silty, clayey, fine-grained, slightly moist, brown
2			
3	Bk		Mancos, shale, weathered, sandy, fine-grained, medium moist, dark gray, very platy
4			
5			Bottom of Hole at 4'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # M-2

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-2 Date 5/01/91 Logged by GM

Location Description S. slope of hill, 80' W.N.W. of 8 steel tanks
Grid Coordinates 47,440 E, 35,890 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			Mancos, shale, very weathered
1			Mancos, shale, weathered, very clayey, sandy, fine-grained, medium moist, dark gray, breaks into coarse gravel size fragments
2			
3	Bk		
4			
5			Bottom of Hole at 4½'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Comments:

AK GeoConsult, Inc.

TEST PIT # M-3

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-3 Date 5/01/91 Logged by GM

Location Description SW slope of hill, 40' NW of power pole
Grid Coordinates 47,340 E, 35,960 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			CL-ML, CLAY, silt, sandy
1			Mancos, shale, weathered, dark gray, coarse
2			gravel sized fragments
3	Bk		
4			
5			Bottom of Hole at 4½'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # M-4

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-4 Date 4/30/91 Logged by GM

Location Description West of hill, in borrow area
Grid Coordinates 47,110 E, 36,090 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, moist, gray brown
2			
3			
4			Alluvium, offset 40' E Bottom of Hole at 4'
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # M-4A

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-4A Date 4/30/91 Logged by GM

Location Description West of hill, toe of slope
Grid Coordinates 47,180 E, 36,080 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			Mancos, shale, weathered, dark gray
2	Bk		
3			Bottom of Hole at 3'
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # M-5

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. M-5 Date 5/01/91 Logged by GM

Location Description E. end of ditch on N. slope of hill, S. of center of evap. pond
Grid Coordinates 47,660 E, 36,500 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			Mancos, shale, weathered, clayey, sandy, fine-grained, medium moist, dark gray
2			
3	Bk		Less ewathered, breaks into 2" - 3" fragments 1/4" - 1" thick
4			Bottom of Hole at 4'
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # H-1

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. H-1 Date 5/01/91 Logged by GM

Location Description Hilltop, 90' NW of W. corner of pond
Grid Coordinates 47,530 E, 36,130 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1	B		SM, SAND, silty, fine-grained, slightly moist, light brown
2			
3			GM, GRAVEL, coarse to fine, subangular, Dakota sandstone, very cobbly
4	Bk		
5			
6			
7	B		Mancos, shale, weathered, moist, dark gray
8			
9			Bottom of Hole at 8'
10			
11			
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # H-2C

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. H-2C Date 5/01/91 Logged by GM

Location Description 15' NE of N. corner of pond at top of hill
Grid Coordinates 47,650 E, 36,180 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1			SM, SAND, very silty, fine-grained, slightly moist, light brown
2			GRAVEL, silty, 60% +3/8, 40% +3/4, 20% +3" 5% +6", very sandy, fine to coarse-grained,
3	Bk		slightly moist, light gray, weakly cemented
4			
5			
6			
7			
8	B		
9			
10			
11			Mancos, shale, weathered, dark gray Bottom of Hole at 11'
12			
13			
14			
15			

****

Comments:

AK GeoConsult, Inc.

TEST PIT # R-7

TEST PIT LOG

DURITA SITE
HECLA MINING COMPANY

Test Pit No. R-7 Date 5/02/91 Logged by GM

Location Description Bottom of central channel, 75' S. of road
Grid Coordinates 47,180 E, 35,310 N

Depth	Sample B=Bag J=jar	Graphic Log	Description Including USCS Classification
0			
1	B		GM, GRAVEL, sandy, fine-grained, silty, 40% +2" 20% +3", 5% +6", moist, brown
2			SC, SAND, very clayey, fine to coarse-grained, moist, brown
3			
4			Mancos, shale, weathered, dark gray, moist
5			Bottom of Hole at 4½'
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

****

Comments:

Results of investigation by trenching to determine location of tailings material at edges of leach tanks.

T-1: Depth 22", 22′ east of crest of dike

T-2: Depth 23",. 20′ east of crest of dike

T-3: Not found, 20′ east of ramp

T-4: Depth 30", 25′ west of crest of dike

Results of investigation by trenching to determine thickness of evaporite materials.

EP-1: 1.5′ thick, 15′ from northeast corner of EP601

EP-2: 1.5′ thick, 15′ from northwest corner of EP604

EP-3: 3.0′ thick, 15′ from northeast corner of EP603

EP-4: 1.5′ thick, 10′ south of north edge center of EP606

V & A

SUMMARY OF LABORATORY TEST DATA

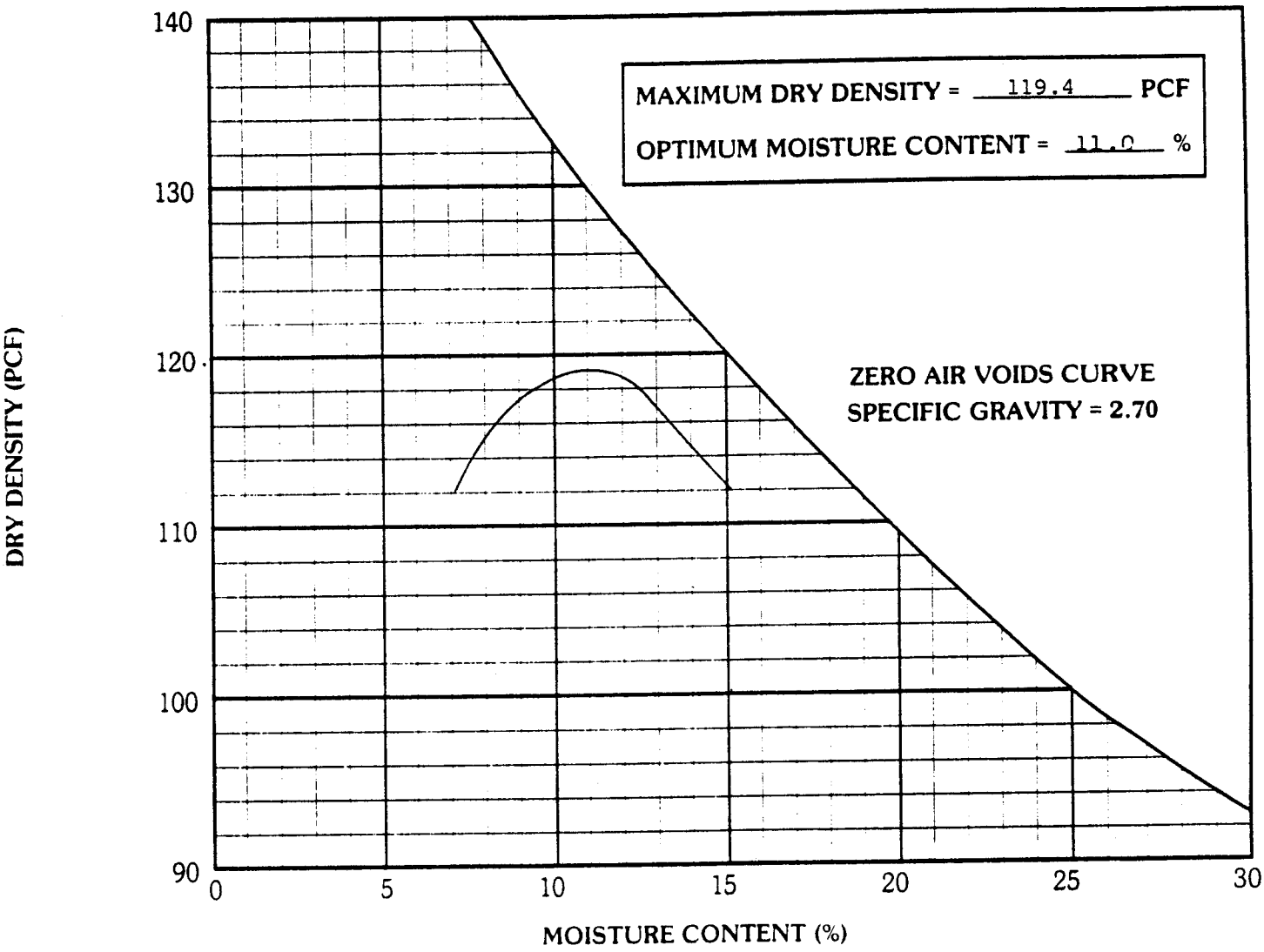
Test Hole No.	Depth (Feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS % PASSING BY WEIGHT										DESCRIPTION
					LL	PI	1½"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
C6	6	-	-	-	-	-	-	100	97	95	92	86	79	72	66	62.0	
C11	8	-	-	-	-	-	-	100	98	97	95	94	92	82	57	33.7	
E1	1	CL	-	-	49	29	-	-	100	99	99	99	98	98	97	95.6	CLAY, trace sand
E3	2	CL	-	-	28	16	-	-	-	100	99	99	99	96	85	62.4	CLAY, very sandy
E3	2-7	CL	-	-	33	20	-	-	-	100	99	99	98	95	88	76.3	CLAY, very sandy
E4	3½	CL-CH	-	-	50	33	-	100	99	99	99	98	98	97	97	95.6	CLAY, trace sand
E4	4	CL	-	-	48	33	-	-	-	-	100	99	99	95	86	79.4	CLAY, very sandy
E4	9	SC	-	-	30	16	-	-	100	98	66	51	43	38	32	24.9	SAND, very clayey

PRELIMINARY

Project No. 91-1-71
Table

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C1 at 3'

SOIL DESCRIPTION: SAND, clay, slightly gravelly

UNIFIED SOIL CLASSIFICATION: (SC)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698 C

ATTERBERG LIMITS: LL 22 % PI 9 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
100	97	92	90	87	84	82	75	47	45.2

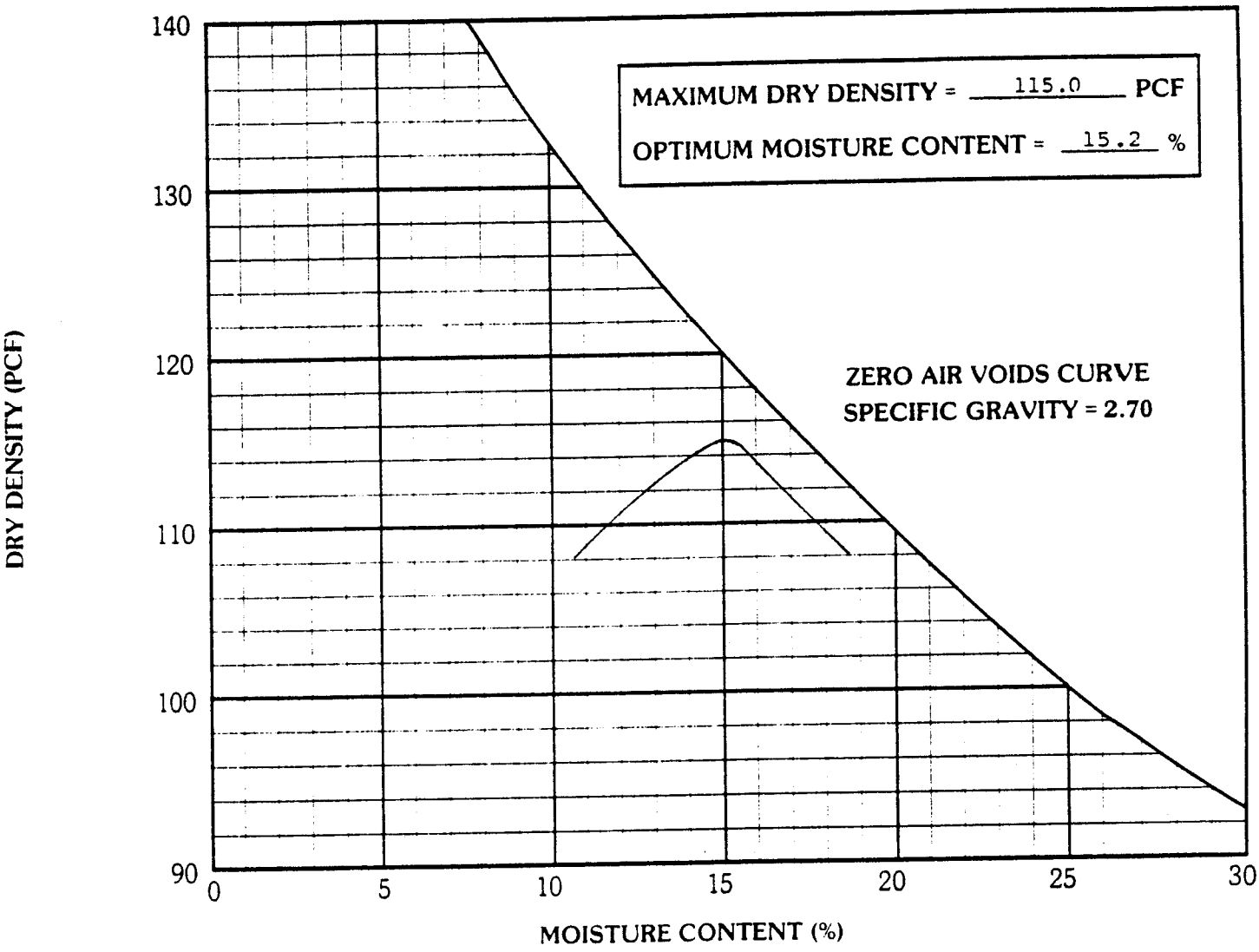
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C2 at 3'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 28 % PI 13 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		100	99	98	96	92	84	83	65.0

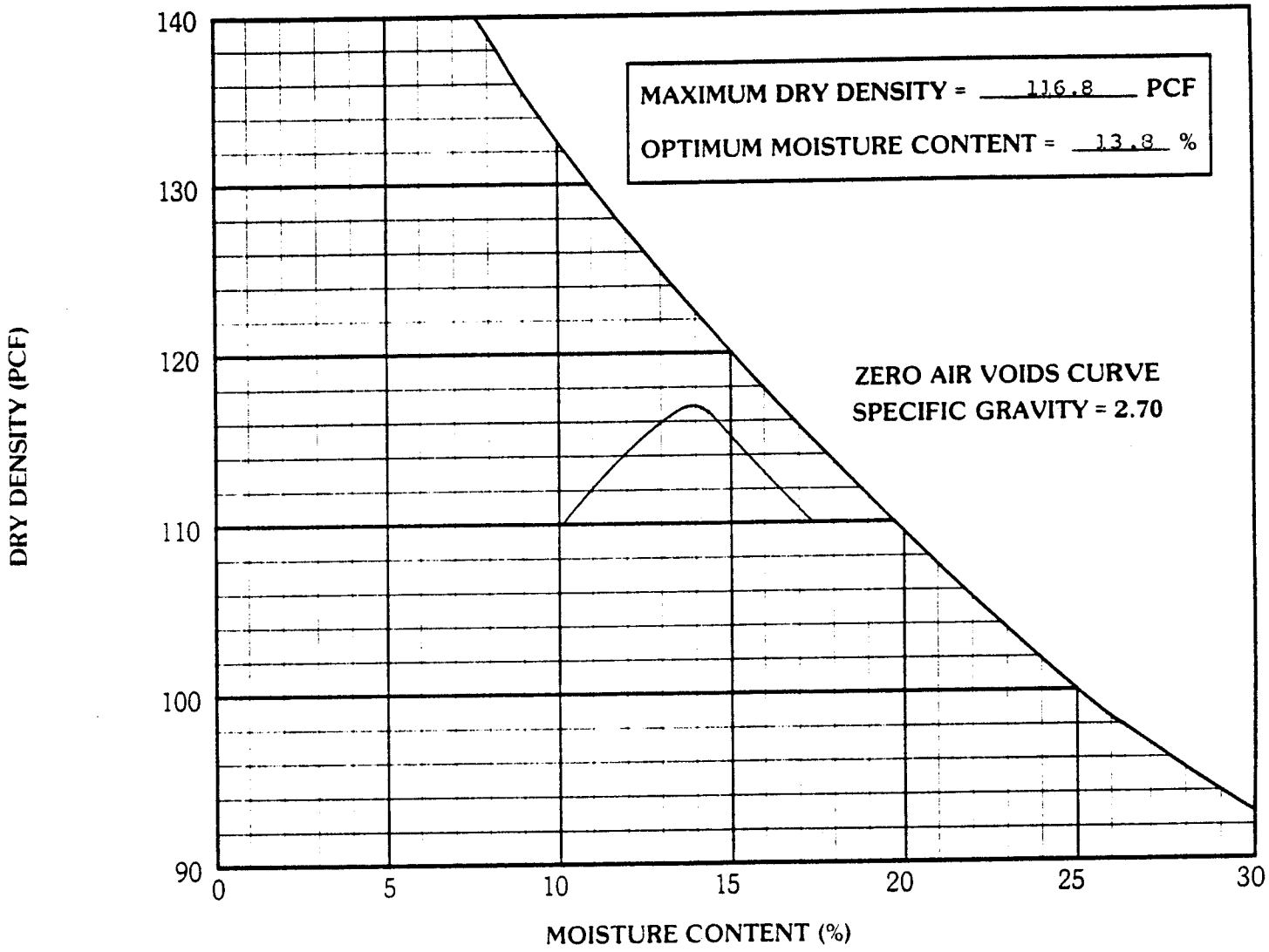
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C3 at 3'

SOIL DESCRIPTION: CLAY, very sandy, trace gravel

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 26 % PI 13 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
	100	98	98	97	96	95	90	76	58.6

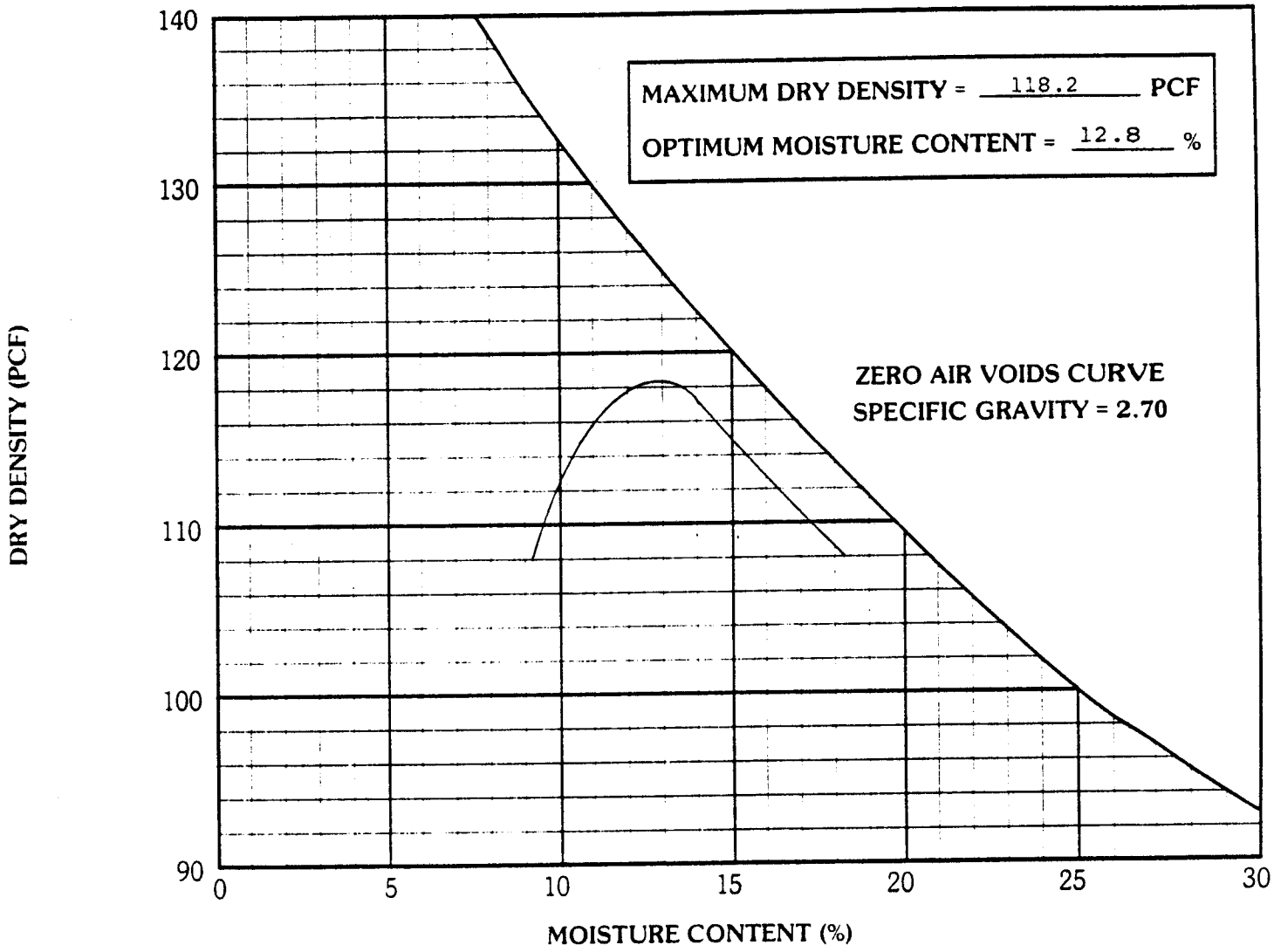
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C4 at 2'

SOIL DESCRIPTION: CLAY, very sandy, trace gravel

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 24 % PI 11 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		100	99	98	96	92	85	75	66.0

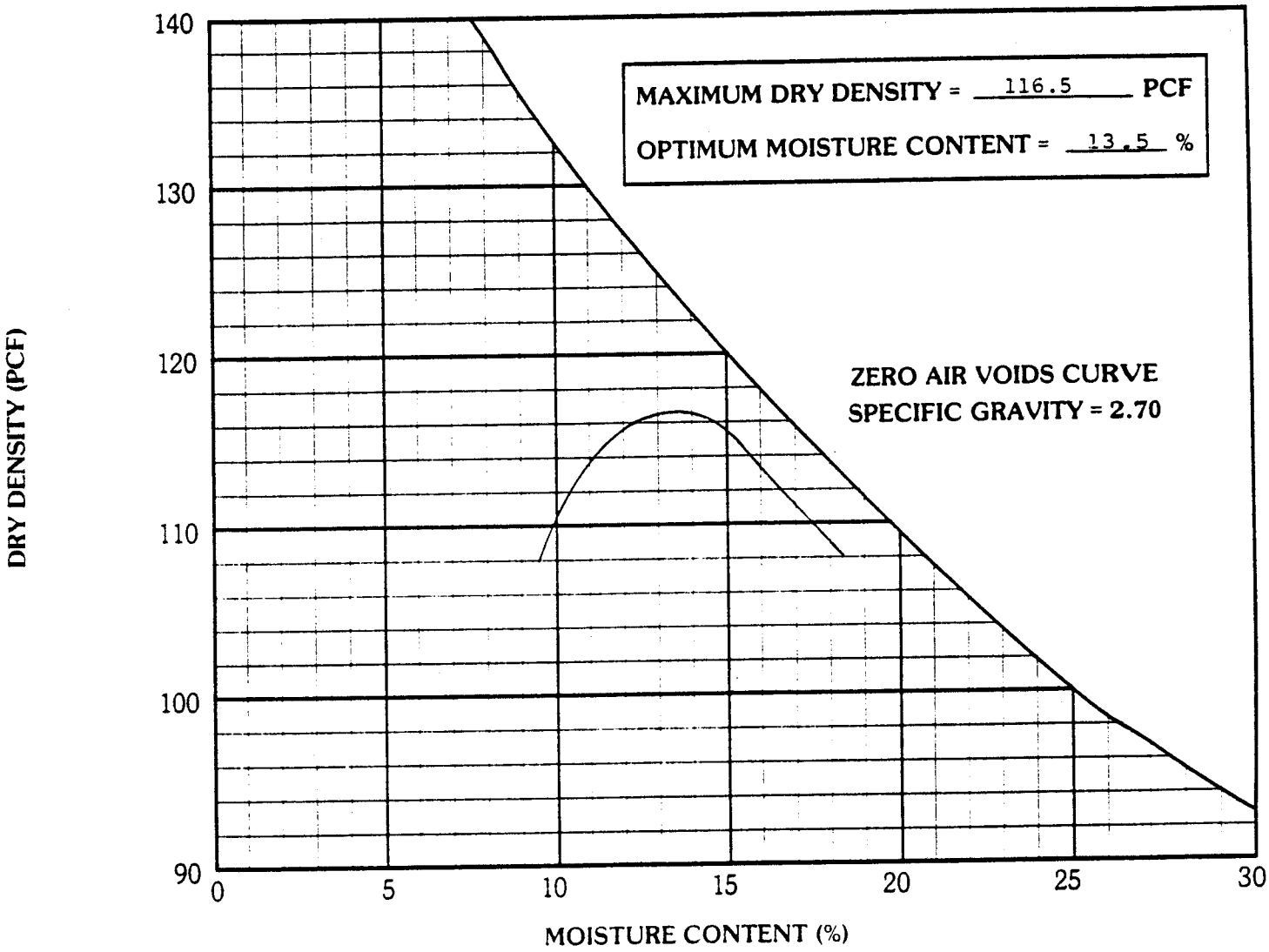
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C5 at 3' - 6'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 26 % PI 12 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
				100	98	97	93	84	74

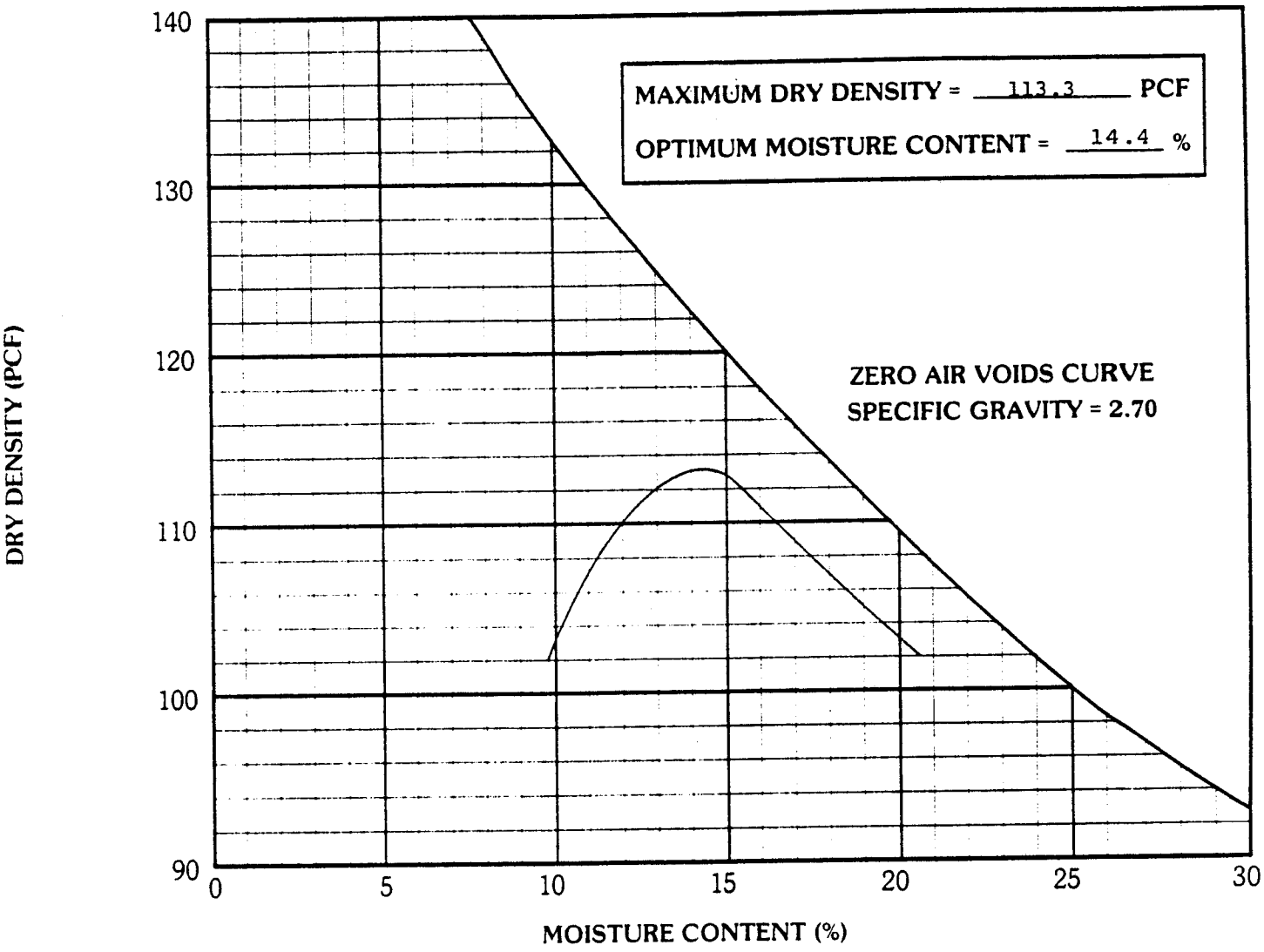
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: C6 at 2½'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 28 % PI 13 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
				100	99	98	94	86	70

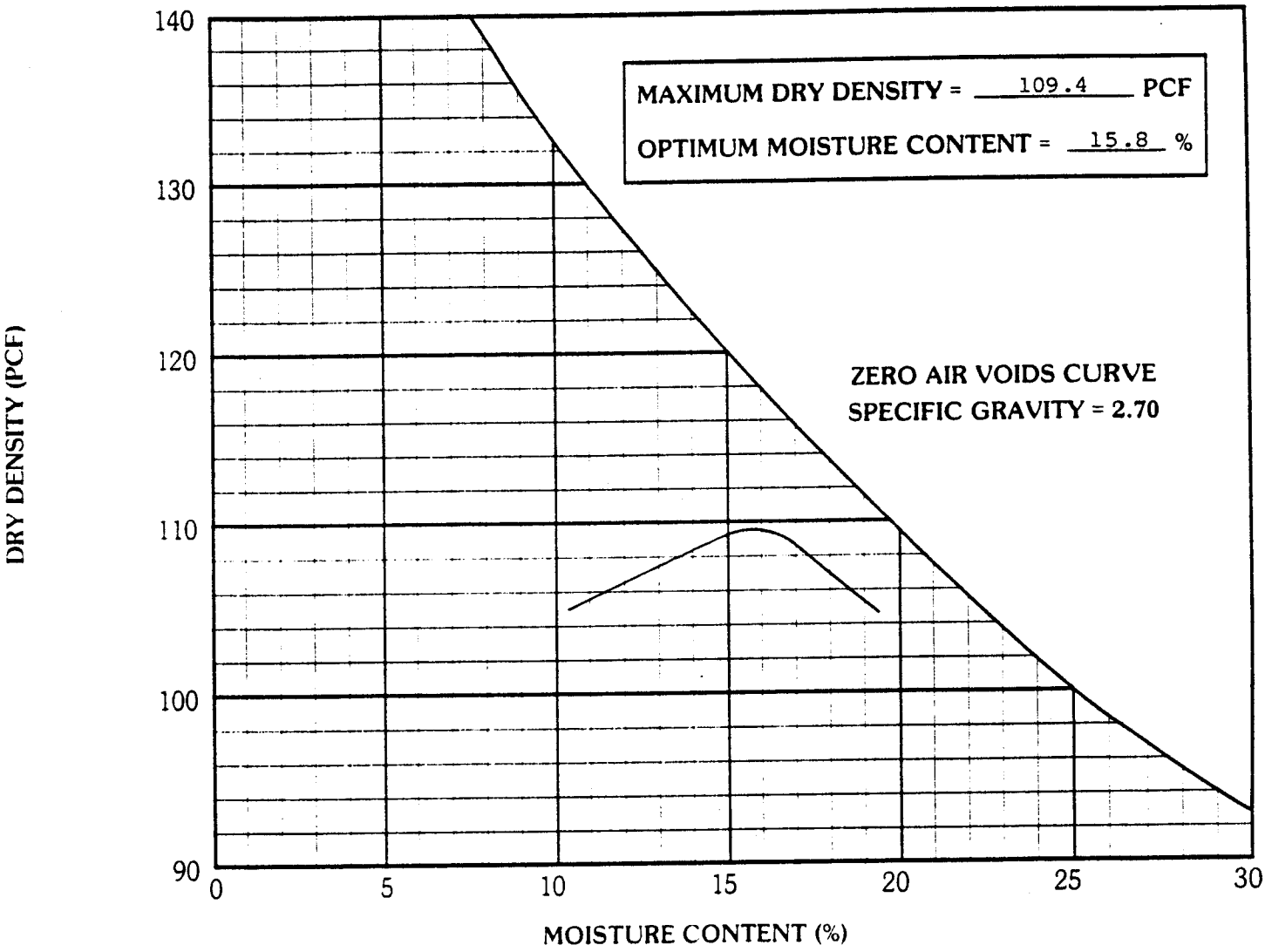
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: Sand Cone Samples 10, 11, 12 Combined

SOIL DESCRIPTION: CLAY, very sandy, slightly gravelly

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698 A

ATTERBERG LIMITS: LL 26 % PI 12 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
	100	95	93	92	91	90	86	78	66.0

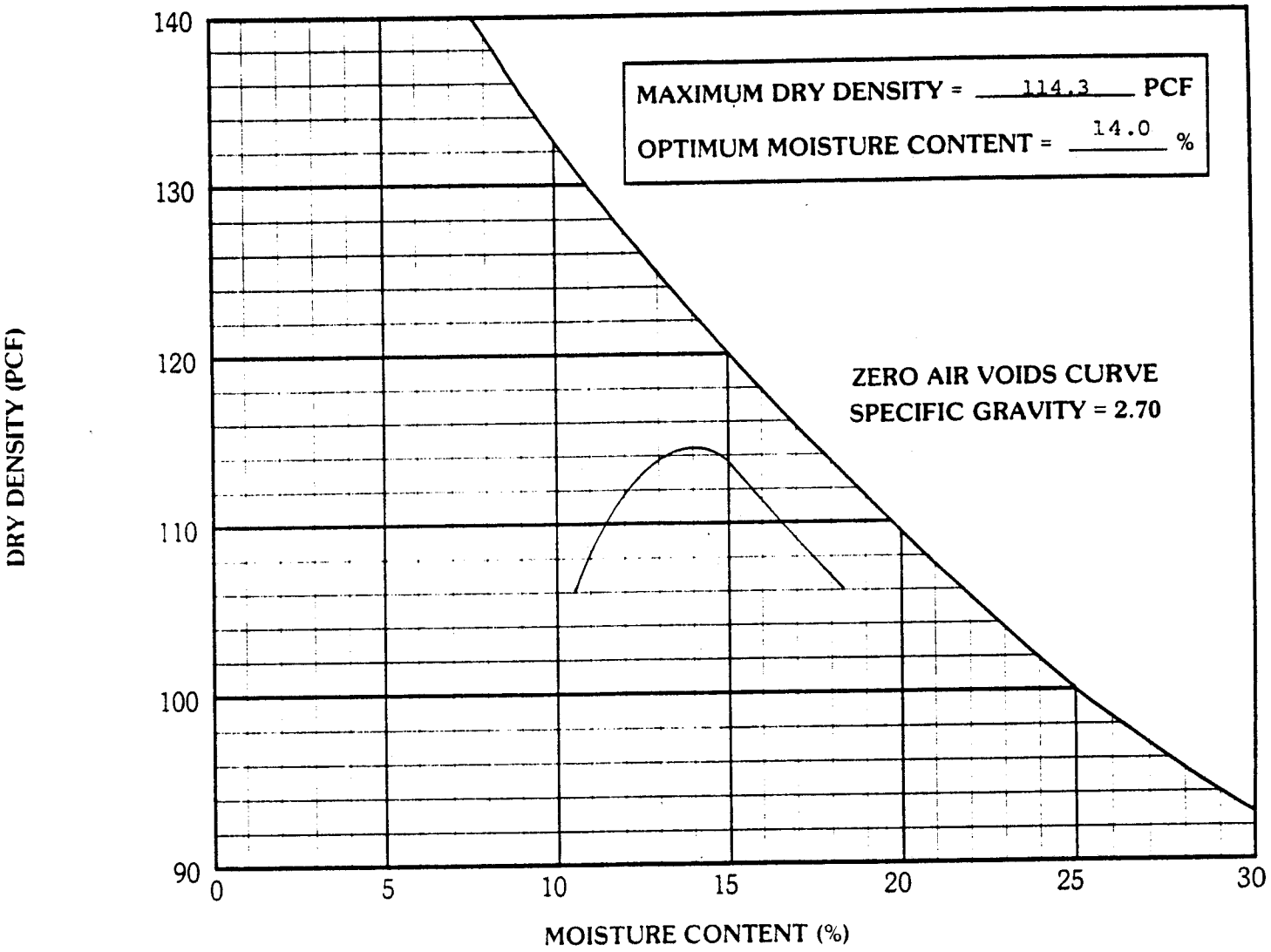
Project No: 91-1-71

Figure

PRELIMINARY

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: Sand Cone Samples Combined 13, 14, 15, 16, 17, 18

SOIL DESCRIPTION: CLAY, very sandy, trace gravel

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698 A

ATTERBERG LIMITS: LL 25 % PI 13 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		100	99	99	97	96	90	76	60.1

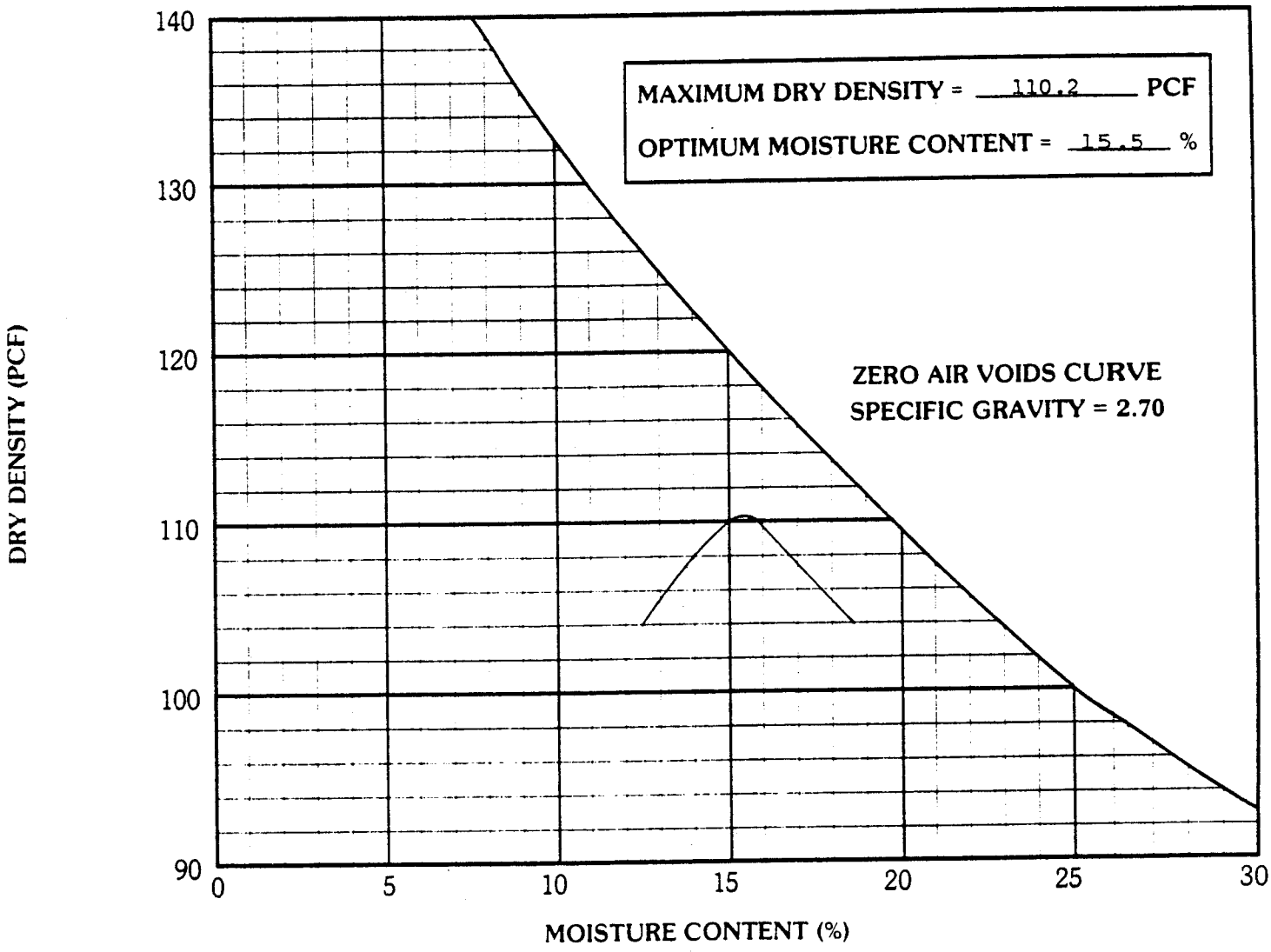
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: E3 2' - 7'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 33 % PI 20 %

SIEVE ANALYSIS - % PASSING									
1 1.2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
			100	99	99	98	95	88	76.3

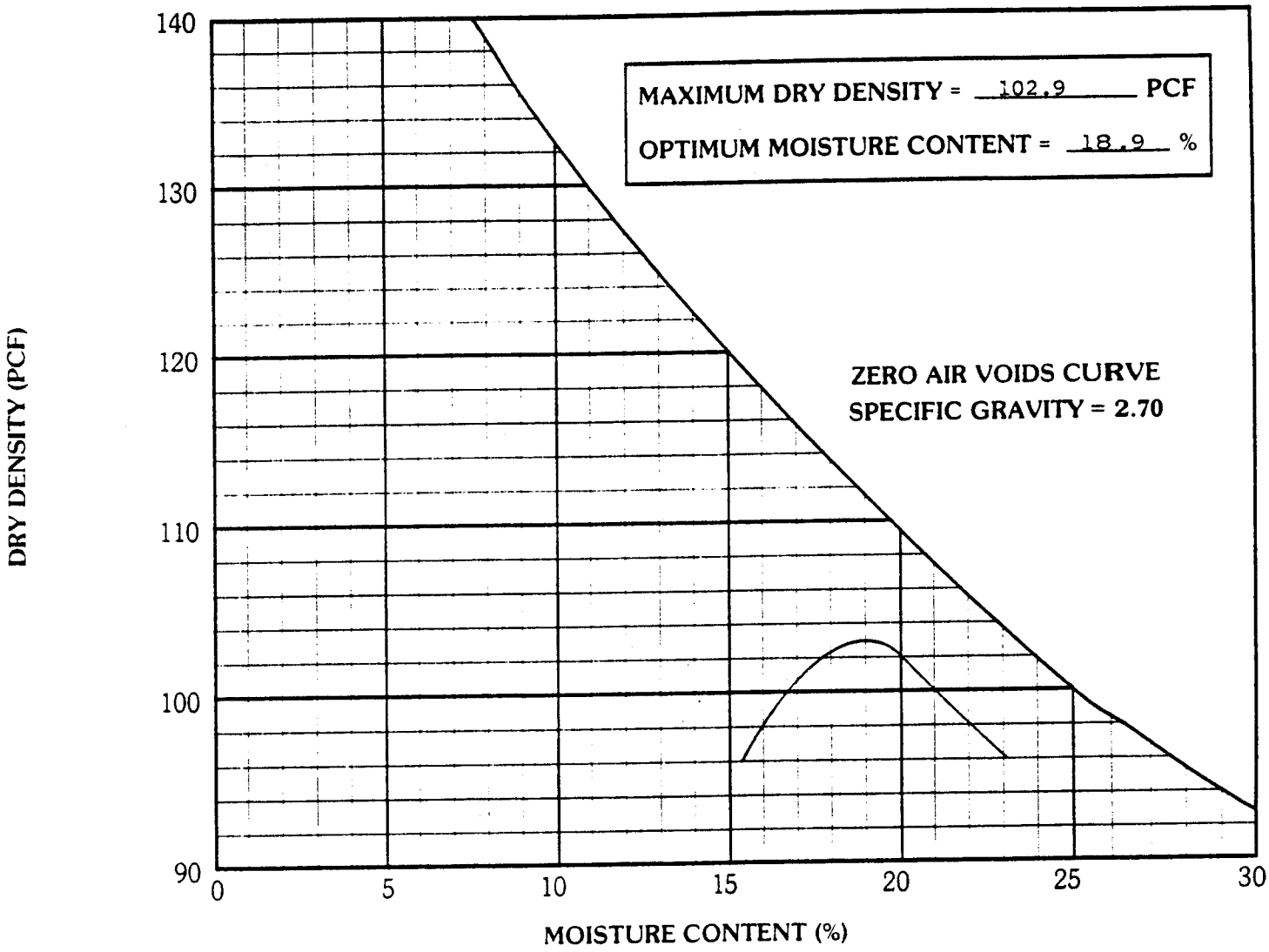
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: E4 at 4', cover material

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 48 % PI 33 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
				100	99	99	95	86	79.4

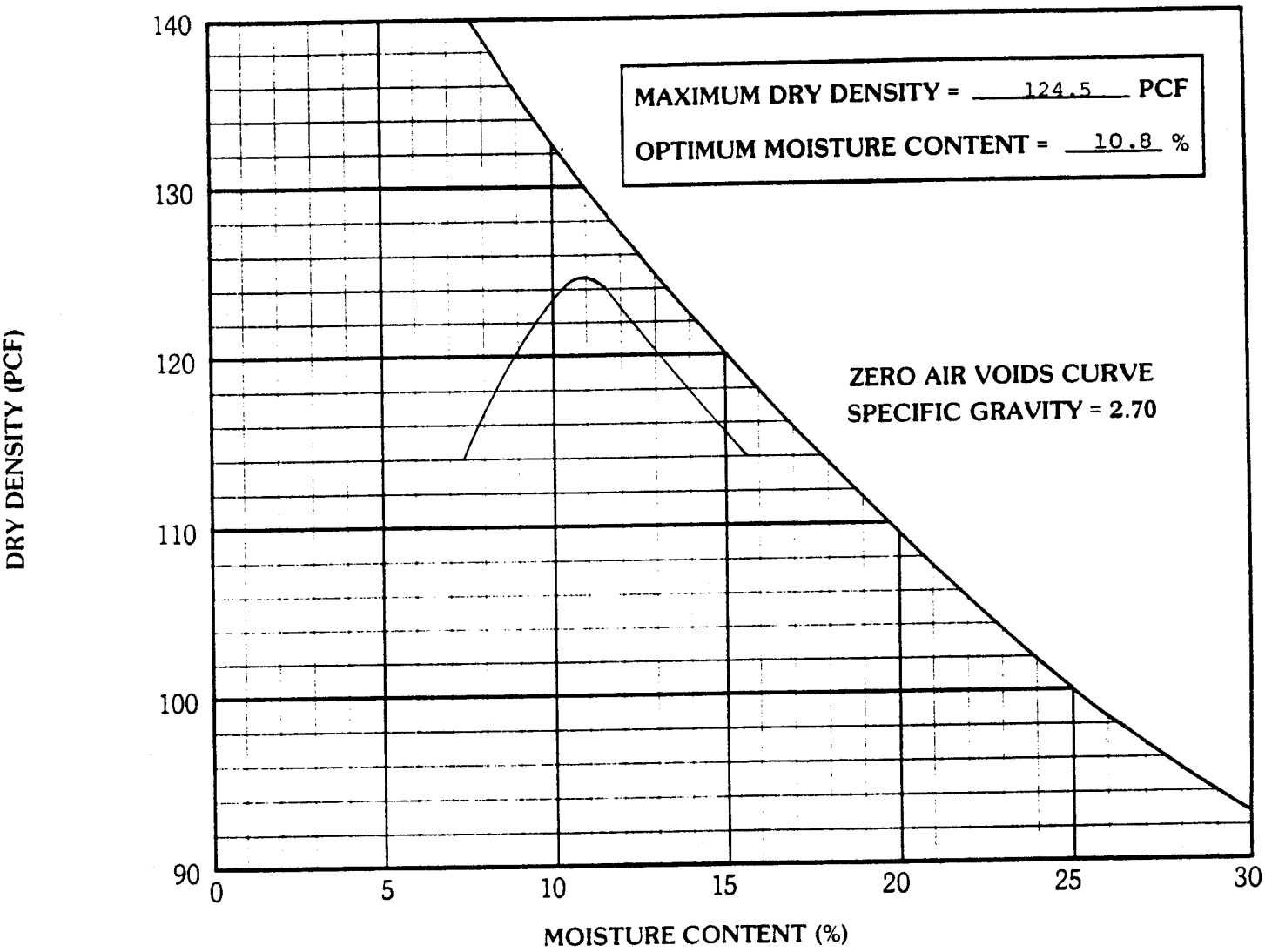
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: E4 at 9'

SOIL DESCRIPTION: SAND, very clayey, trace gravel

UNIFIED SOIL CLASSIFICATION: (SC)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 30 % PI 16 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		100	98	66	51	43	38	32	24.9

PRELIMINARY

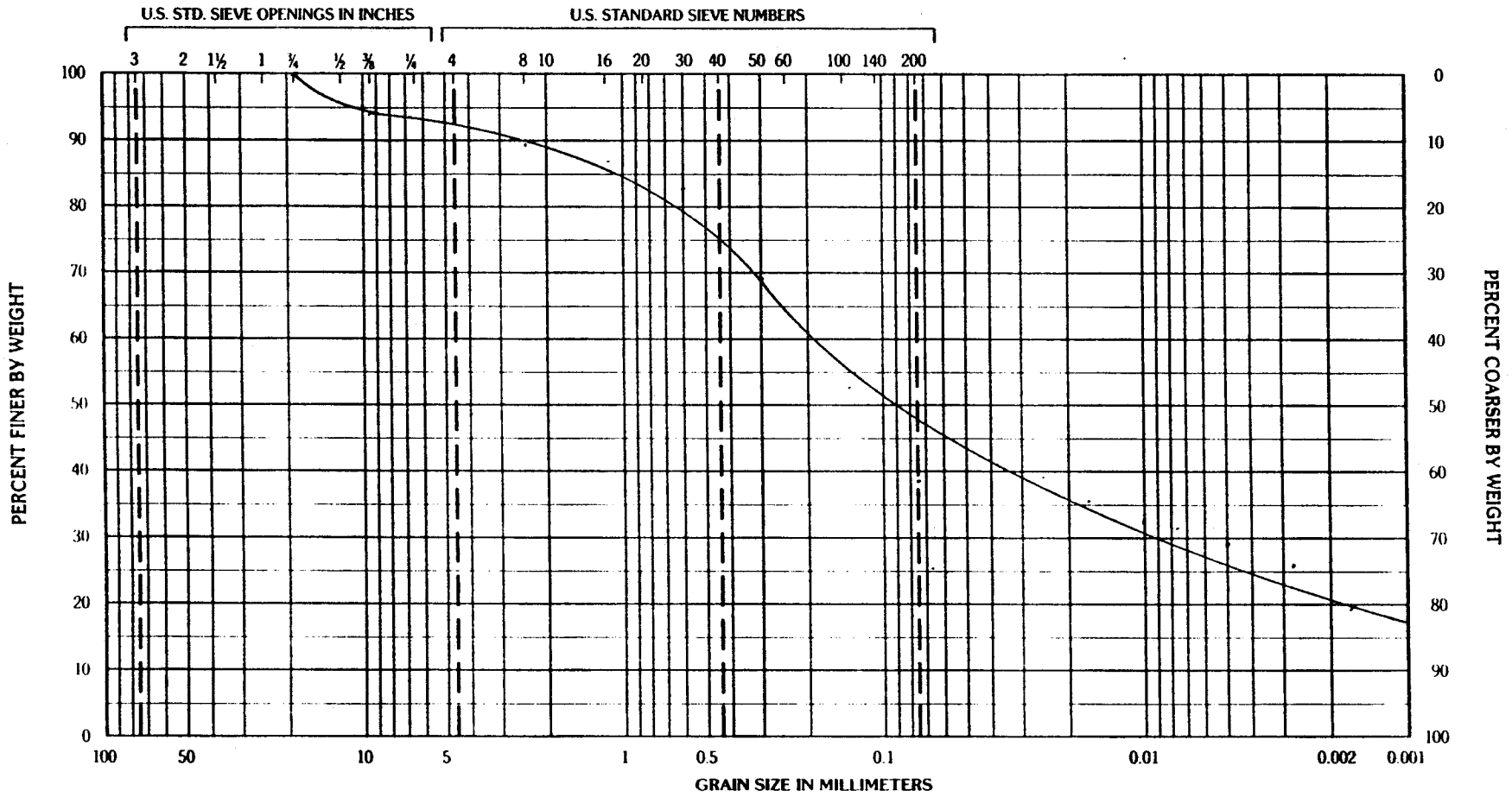
Project No: 91-1-71

Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C-1 at 3'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: SAND, very clayey, slightly gravelly CLASSIFICATION: SC

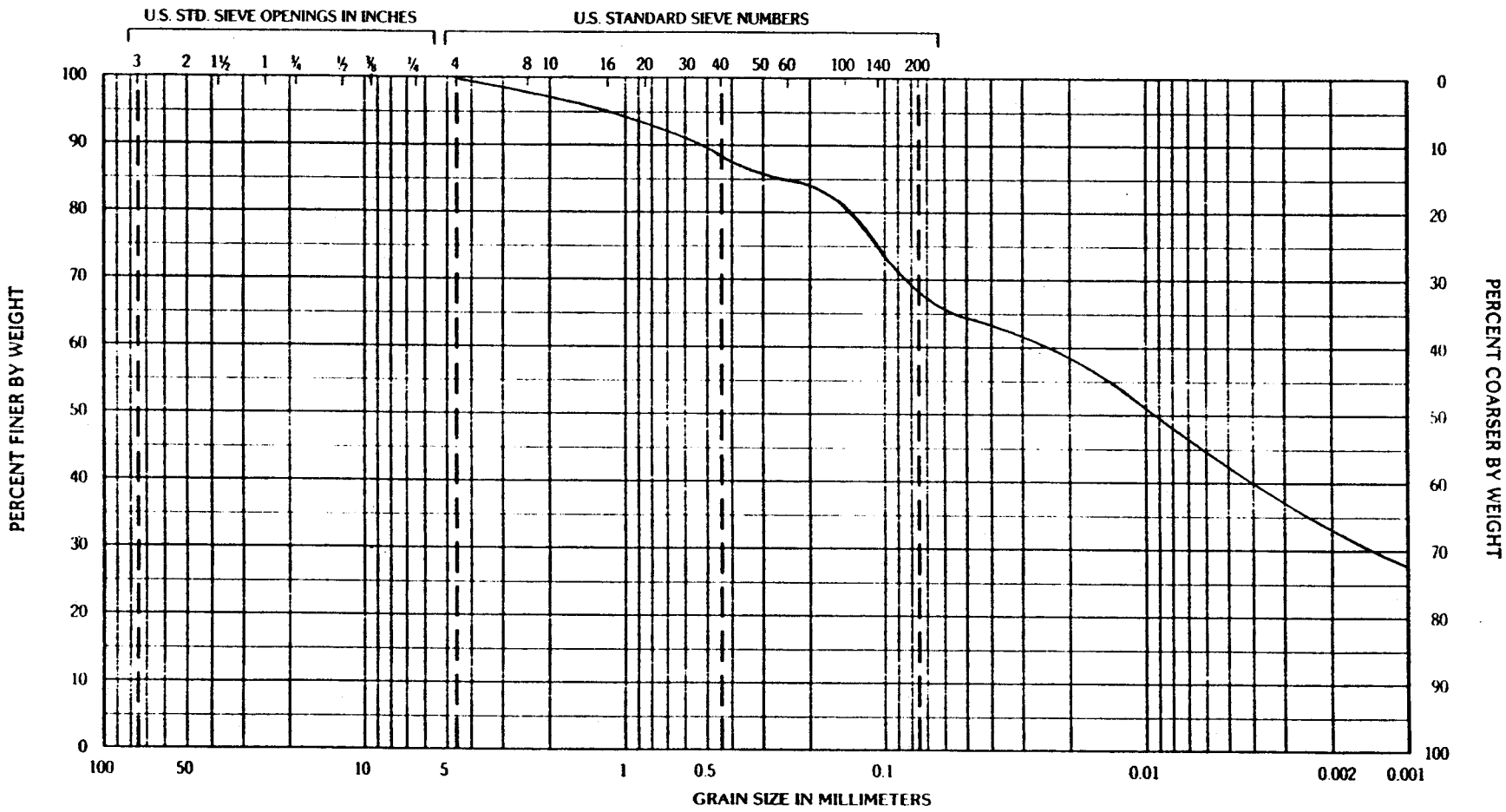
Project No. 91-1-71
Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C-2 at 3'

PRELIMINARY



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

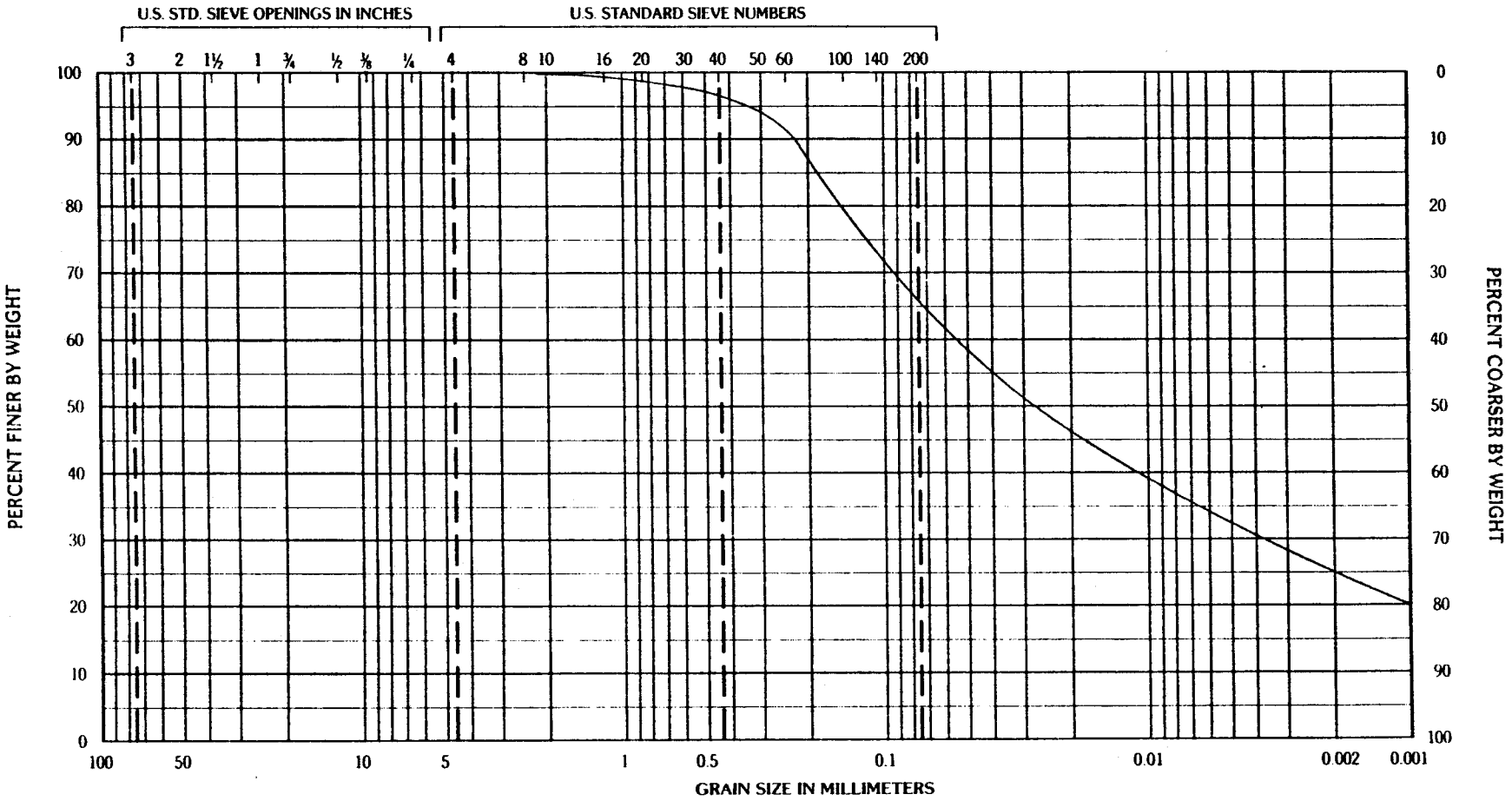
Project No. 91-1-71

Figure

V
&
A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C-3 at 3'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

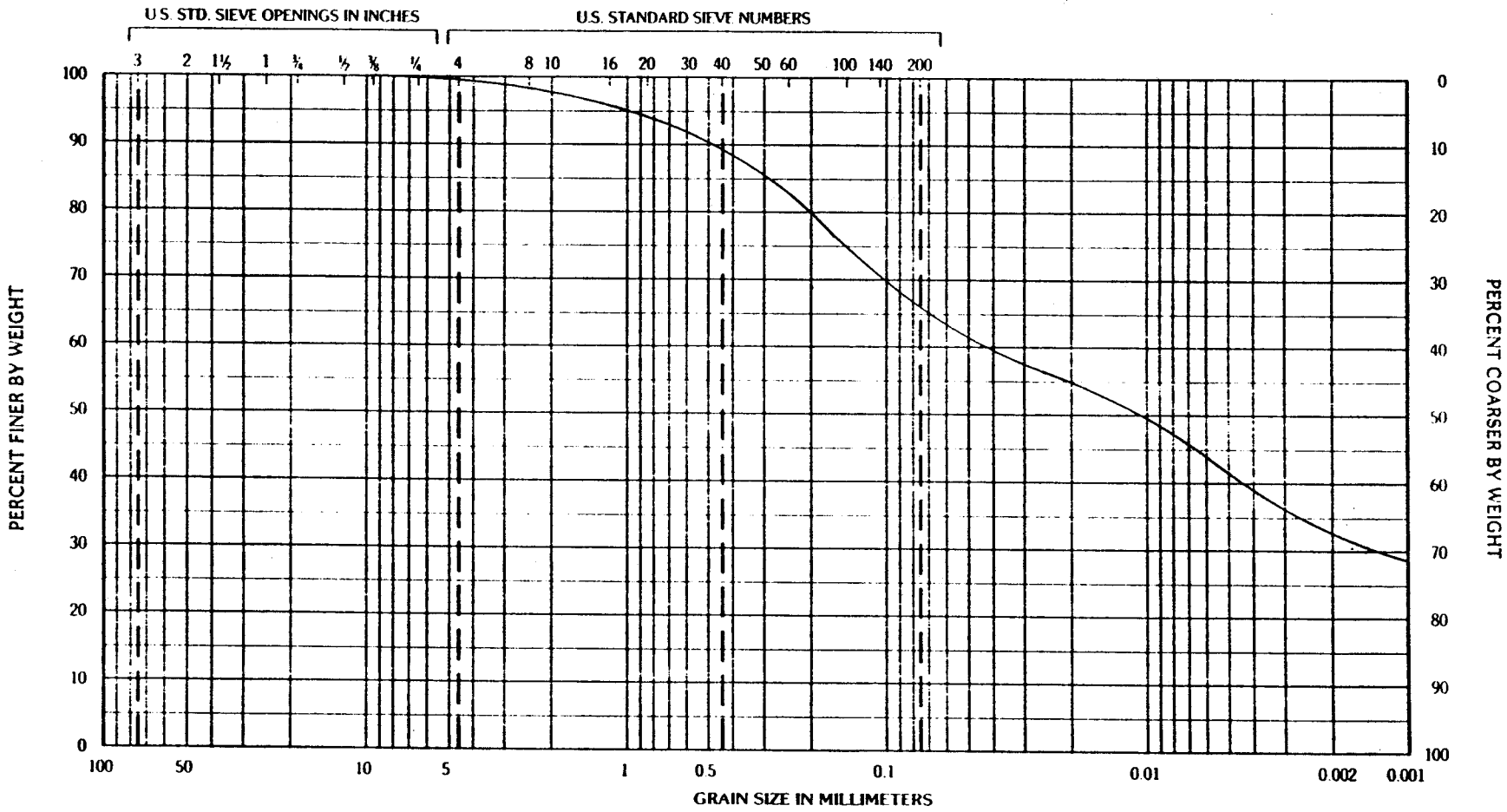
Project No. 91-1-71
Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C-4 at 2'

PRELIMINARY



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

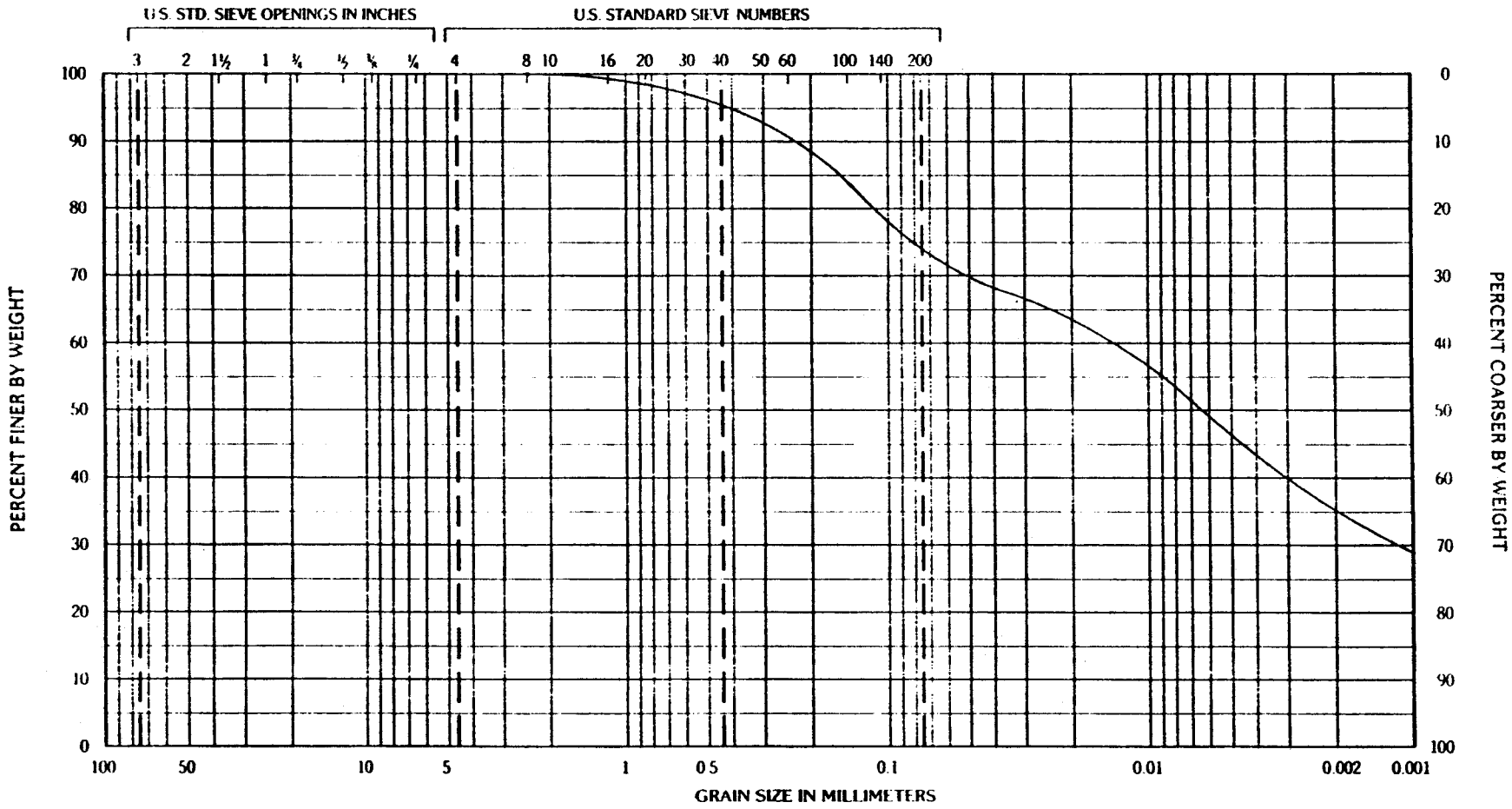
Project No. 91-1-71

Figure

V
&
A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C5 at 3' - 6'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71

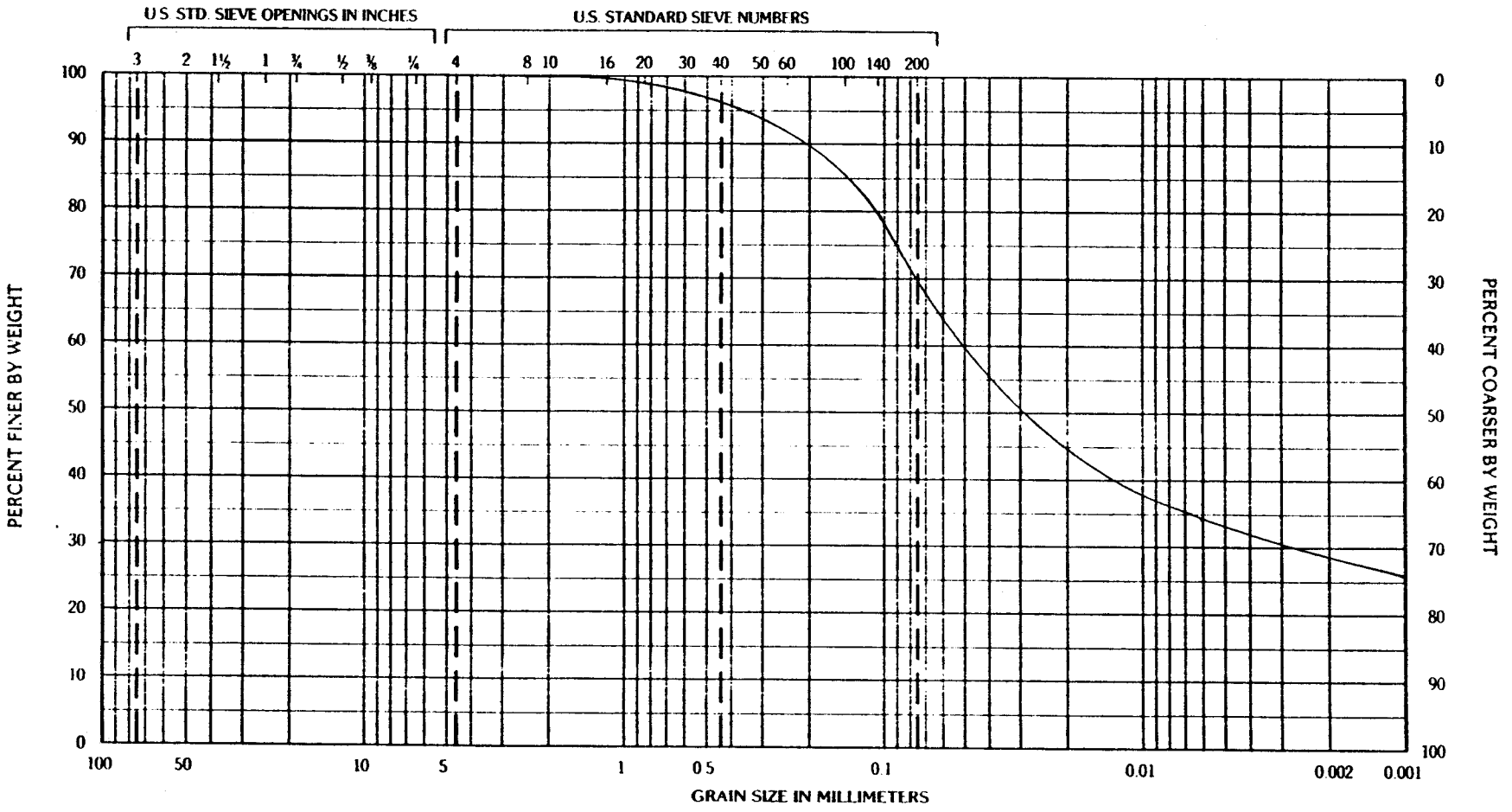
Figure

PRELIMINARY

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C6 at 2½'



PRELIMINARY

Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

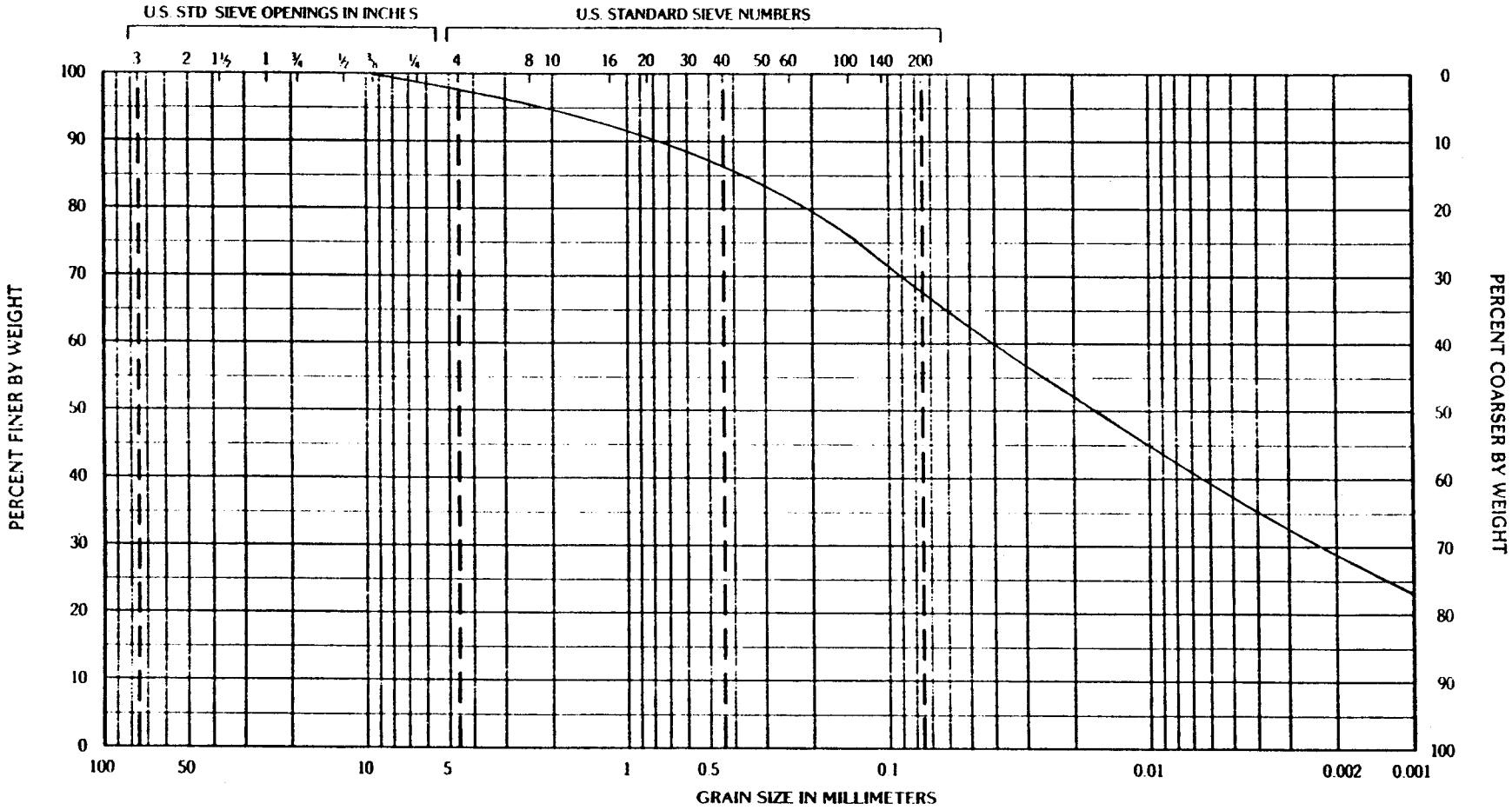
Project No. 91-1-71

Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C7 at 3'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71

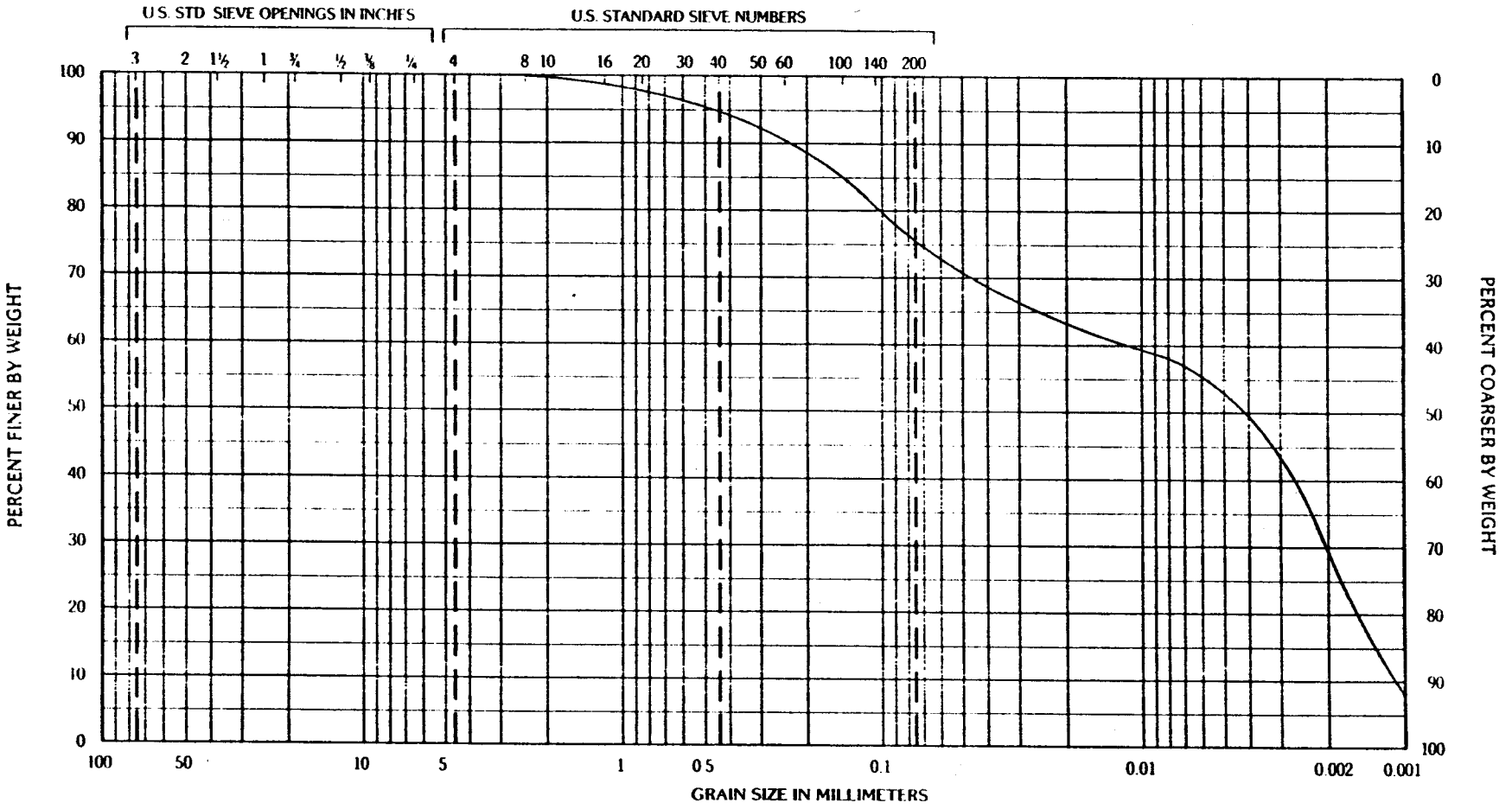
Figure

PRELIMINARY

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: C8 at 4'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71

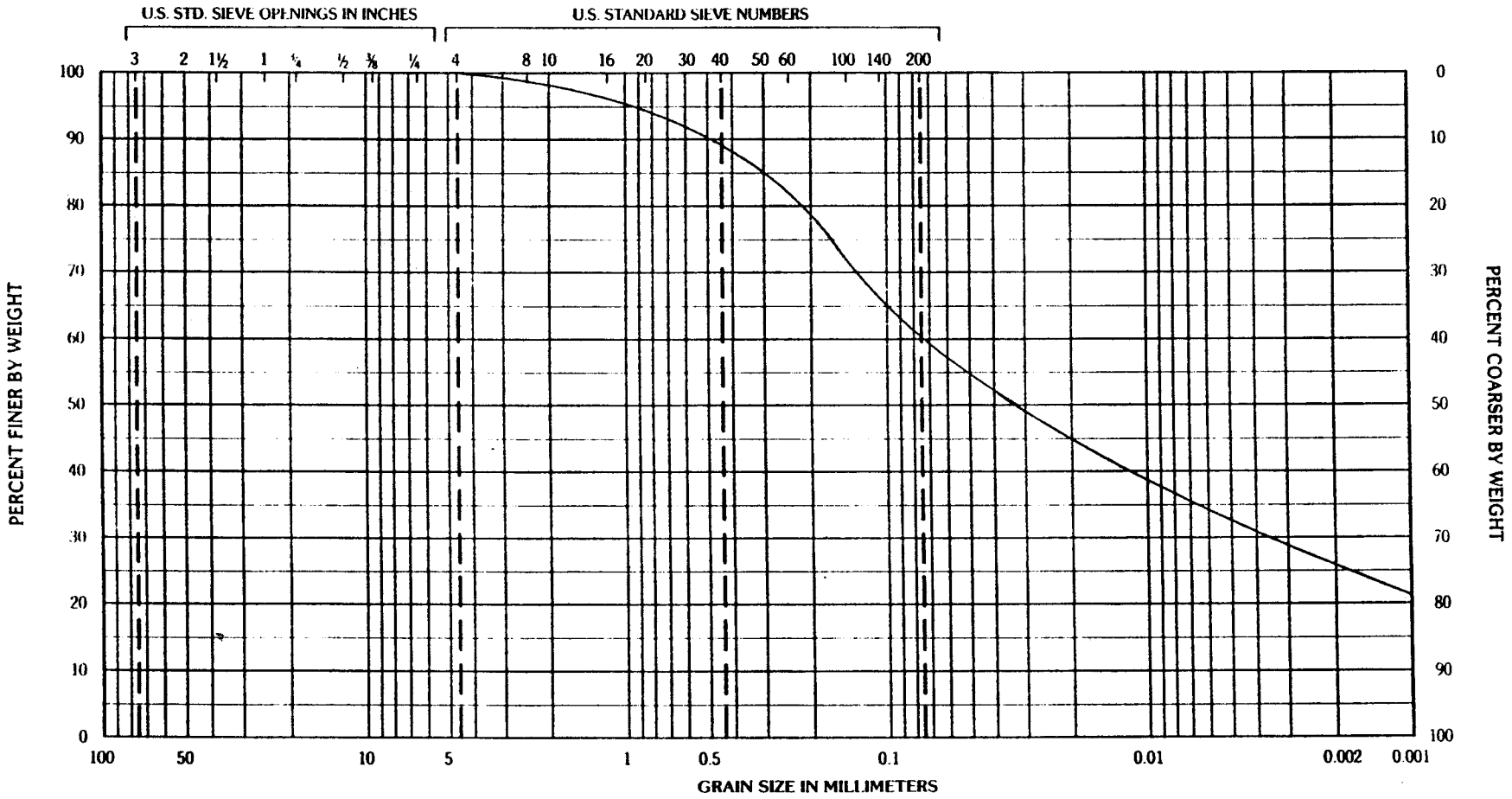
Figure

PRELIMINARY

V & A

PARTICLE SIZE DIS RIBUTION CHART

SAMPLE LOCATION: Sand Cone #10



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

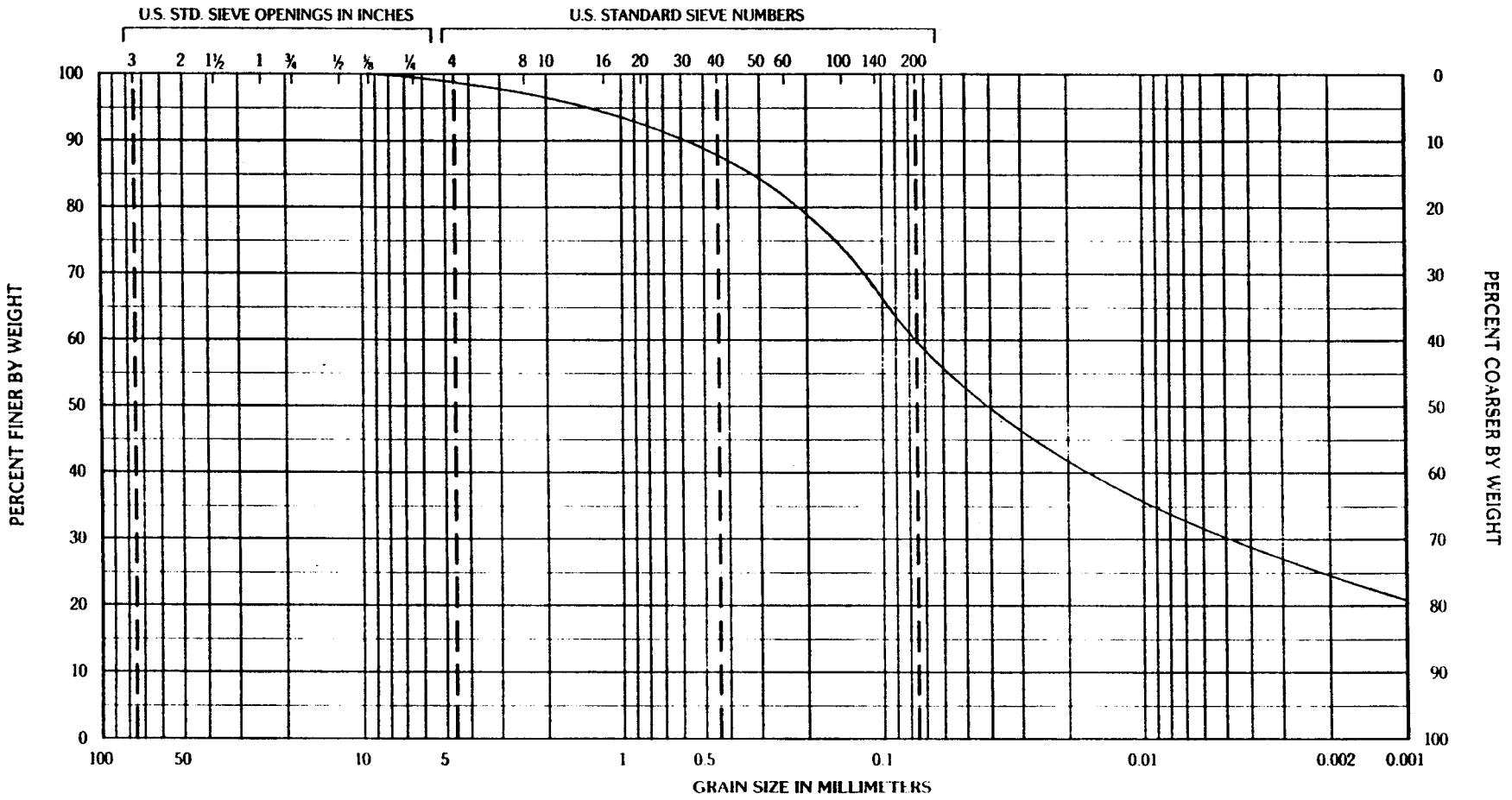
SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71
Figure

V
&
A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: Sand Cone #13



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

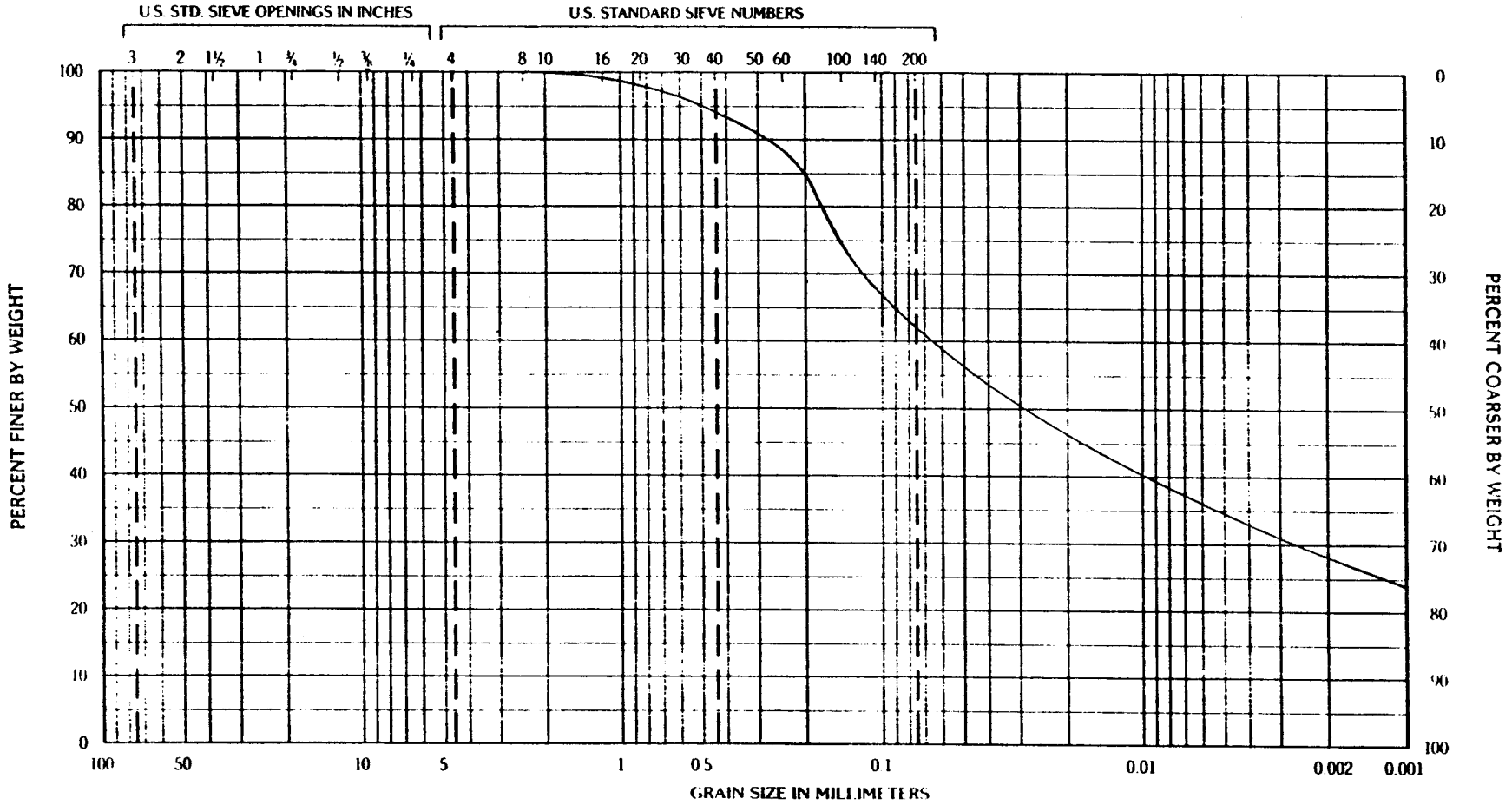
SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71
Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: Sand Cone #15



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

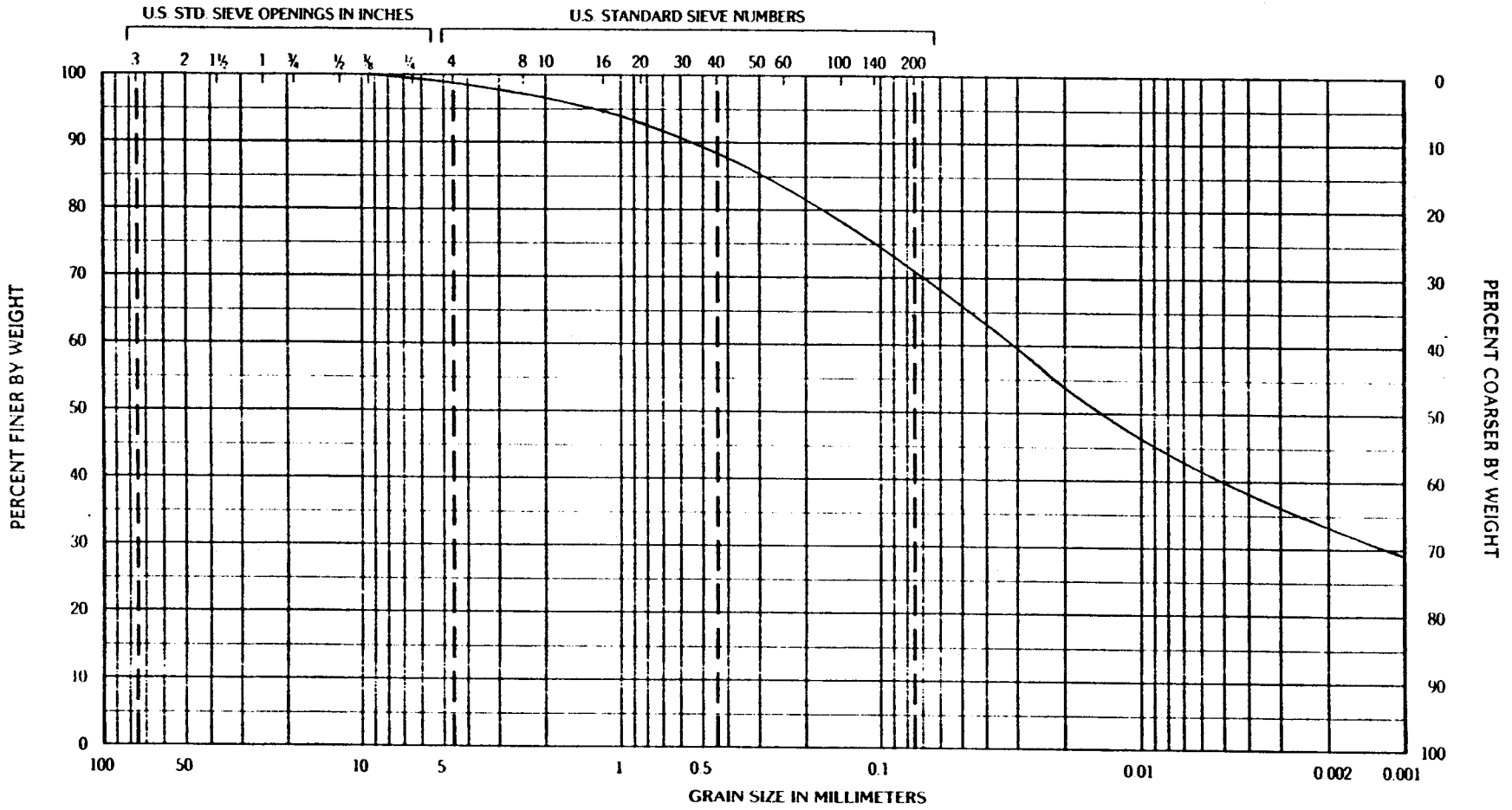
Project No. 91-1-71

Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: Sand Cone #17



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

September 23, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, New Mexico 87111

Attention: Mr. Alan K. Kuhn, PhD., PE

Subject: Durita Mine - Project No.: 9014
Vinyard & Associates' Project No.: 91-1-71

Gentlemen:

Attached are copies of the Field Density Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,

Gordon Mossberg

MARTIN D. VINYARD
NEW MEXICO
9291
REGISTERED PROFESSIONAL ENGINEER

Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

cc: Addressee (2)

V & A

COMPACTION TEST RESULTS

PROJECT: Durita Mine CLIENT: AK GeoConsult, Inc.

TECHNICIAN: Gordon Mossberg

PROJECT NO.: AKG 9014 REPORT NO.: _____ DATE: May 1, 1991

Test No.	Location	Elevation	Proctor Number	Field Moisture (%)	Field Dry Density (pcf)	Relative Compaction (%)	Specified Compaction (%)
1	120' north of south fence, 155' east of west top edge, southeast tank		River cobbles not tested				
2	130' north of south fence, 280' east of west top edge, southeast tank	-50" F. G.		11.1	94.2		
3	75' west of east top edge, 75' south of north top edge, southeast tank	-54" F. G.		8.6	98.5		
4	60' east of west top edge, 80' north of south fence, southwest tank	-48" F. G.		8.8	109.3		
5	85' east of TH-202 west on centerline, southwest tank	-68" F. G.		8.1	107.1		
6	90' northeast of TH-202 east	-71" F. G.		9.7	101.5		
7	200' west of east top edge on centerline of northwest tank, 205' east of TH-201E	-65" F. G.		9.4	99.0		
8	70' east of TH-201 west on centerline of northwest tank	-59" F. G.		9.3	102.2		
9	155' east of west top edge, 40' south of centerline of northwest tank	-54" F. G.		8.1	101.3		

Proctor Tests Utilized

Proctor No.	Soil Description	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	Remarks

WEATHER: Very windy

EQUIPMENT: Backhoe

REMARKS: Tests 4 and 5 were tailings mixed with cover soil.

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

August 16, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, New Mexico 87111

Attention: Mr. Alan K. Kuhn, PhD., PE

Subject: Durita Mine - Pinhole Test Results
Vinyard & Associates' Job No.: 91-1-71

Gentlemen:

Please find enclosed "Pinhole" test results performed on samples obtained from the Durita Mine. Testing was performed as detailed in ASTM D-4647.

Should you have any questions regarding the enclosed data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

File: 91-1-71.pin

V
&
A

PINHOLE TEST RESULTS

Sample Location	Depth	Dispersive Classification
C-4	2′	ND1
C-5	3′ - 6′	ND1
C-6	2-1/2′	ND1
E-3	2′ - 7′	ND1
E-4	4′	ND1

NOTE: Tests performed on remolded samples compacted to 95% of standard proctor density at a near optimum moisture content.

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

August 7, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, NM 87111

Attention: Mr. Alan K. Kuhn, PhD., PE

Subject: Durita Mine - Permeability Test Results
Vinyard & Associates' Job No.: 91-1-71

Gentlemen:

Please find enclosed Permeability Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

Attachment: Data Sheet (1)

cc: Addressee (2)

PERMEABILITY TEST RESULTS

Location	Depth (Ft.)	Permeability (CM/SEC)	Remolded Dry Density* (pcf)	Remolded Moisture Content (%)	-#200 Sieve (%)
C-4	2	5.0×10^{-7}	112.3	12.9	66.0
C-5	3-6	3.7×10^{-8}	110.7	13.4	74.0
C-6	2½	7.5×10^{-8}	107.6	14.2	70.0
E-3	2-7	1.6×10^{-7}	104.7	15.5	76.3
E-4	4	1.8×10^{-7}	97.8	18.6	79.4

* 95% of Standard Proctor

Project: Durita Mine

Project No.: 91-1-71

PERMEABILITY TEST RESULTS

Location	Depth (ft.)	Permeability (CM/SEC)
M-1	2 - 4	7.3×10^{-8}
M-3	2 - 4	1.1×10^{-6}
M-4	1 - 3	1.9×10^{-7}

Project No.: 91-1-71

PRELIMINARY

ATTERBERG LIMITS TEST RESULTS
(Samples Soaked > 1 Month)

Location	Depth Depth (ft.)	Liquid Limit (%)	Plasticity Index
M-1	2 - 4	37	19
M-2	2 - 4	43	26
M-3	2 - 4	62	46
M-4	1 - 3	34	18
M-5	2 - 4	43	24

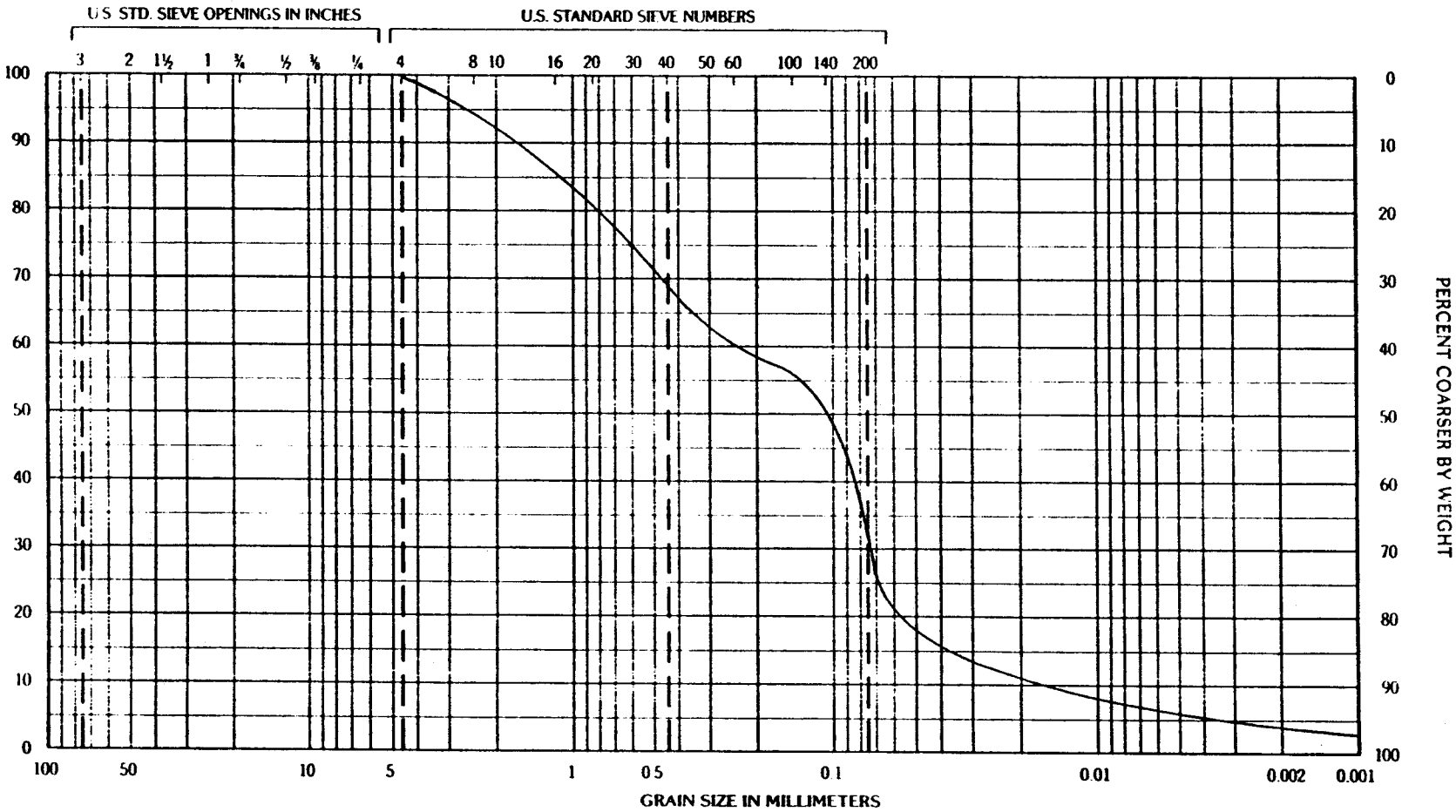
Project No.: 91-1-71

PRELIMINARY

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: M-5 at 2' - 4'



PRELIMINARY

Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: SAND, very clayey CLASSIFICATION: SC

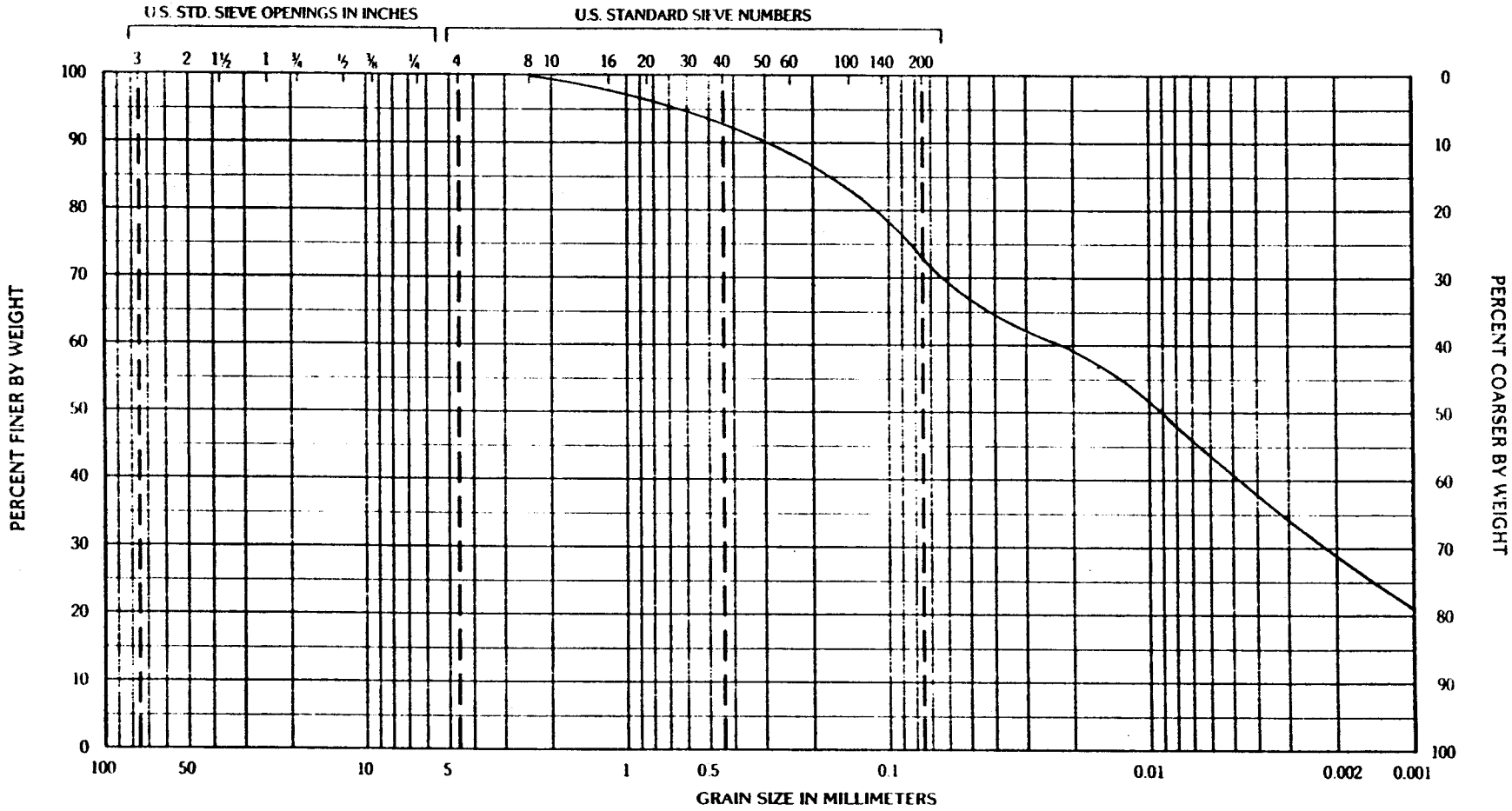
Project No. 91-1-71

Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: B-4 at 1'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71

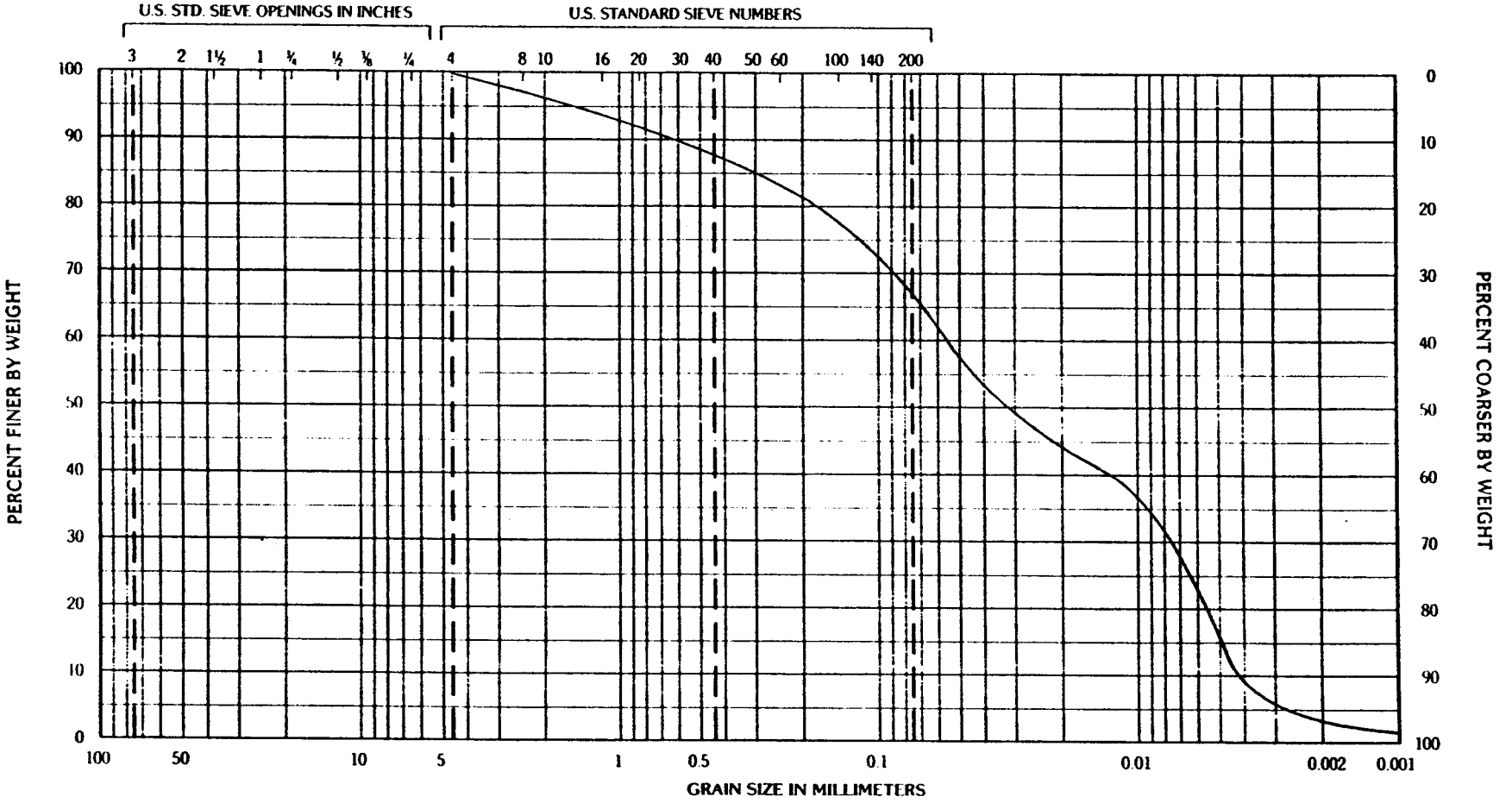
Figure

PRELIMINARY

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: B-1 at 2' - 4'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71
Figure

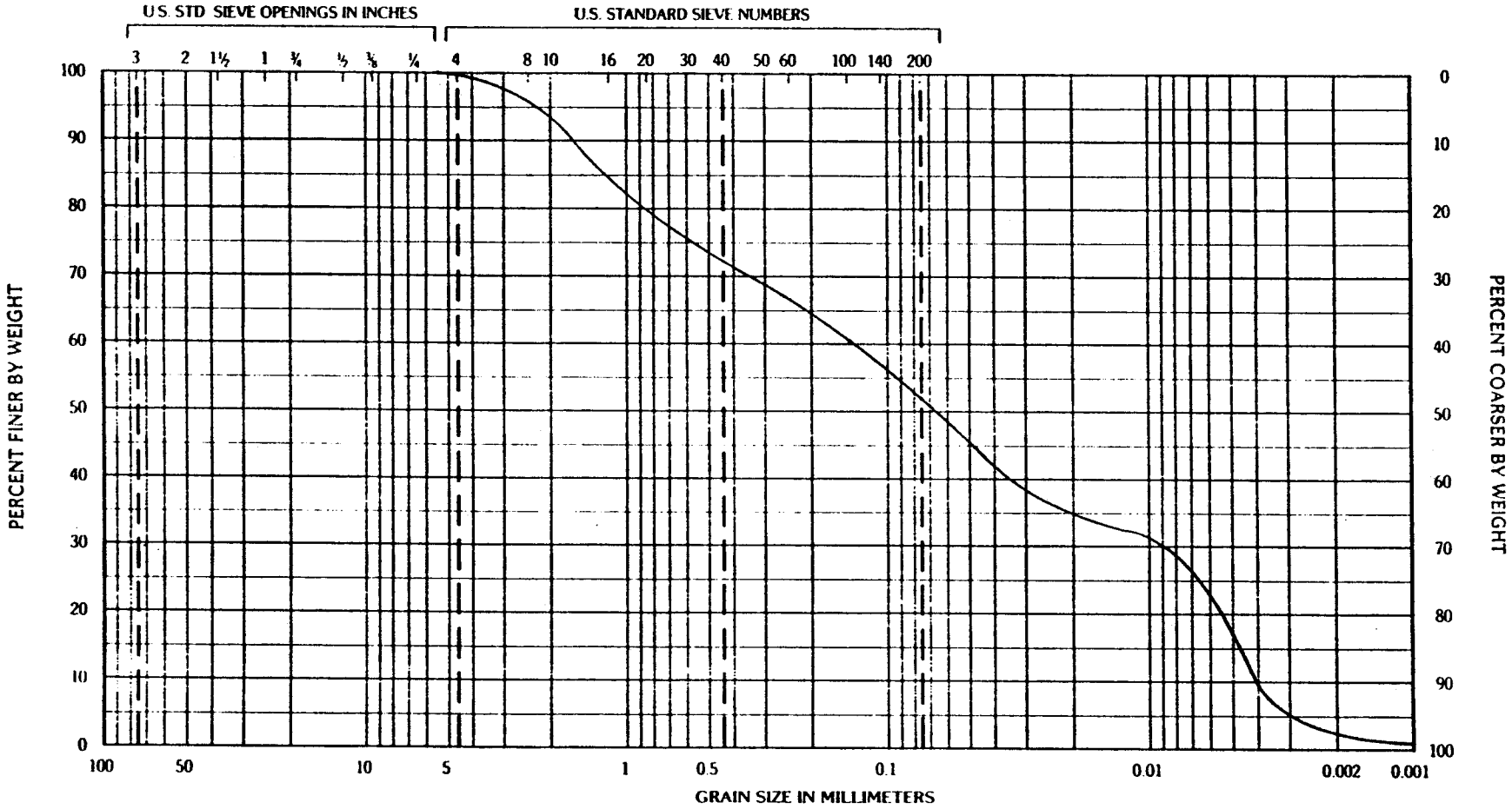
PRELIMINARY

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: M-3 at 2' - 4'

PRELIMINARY



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

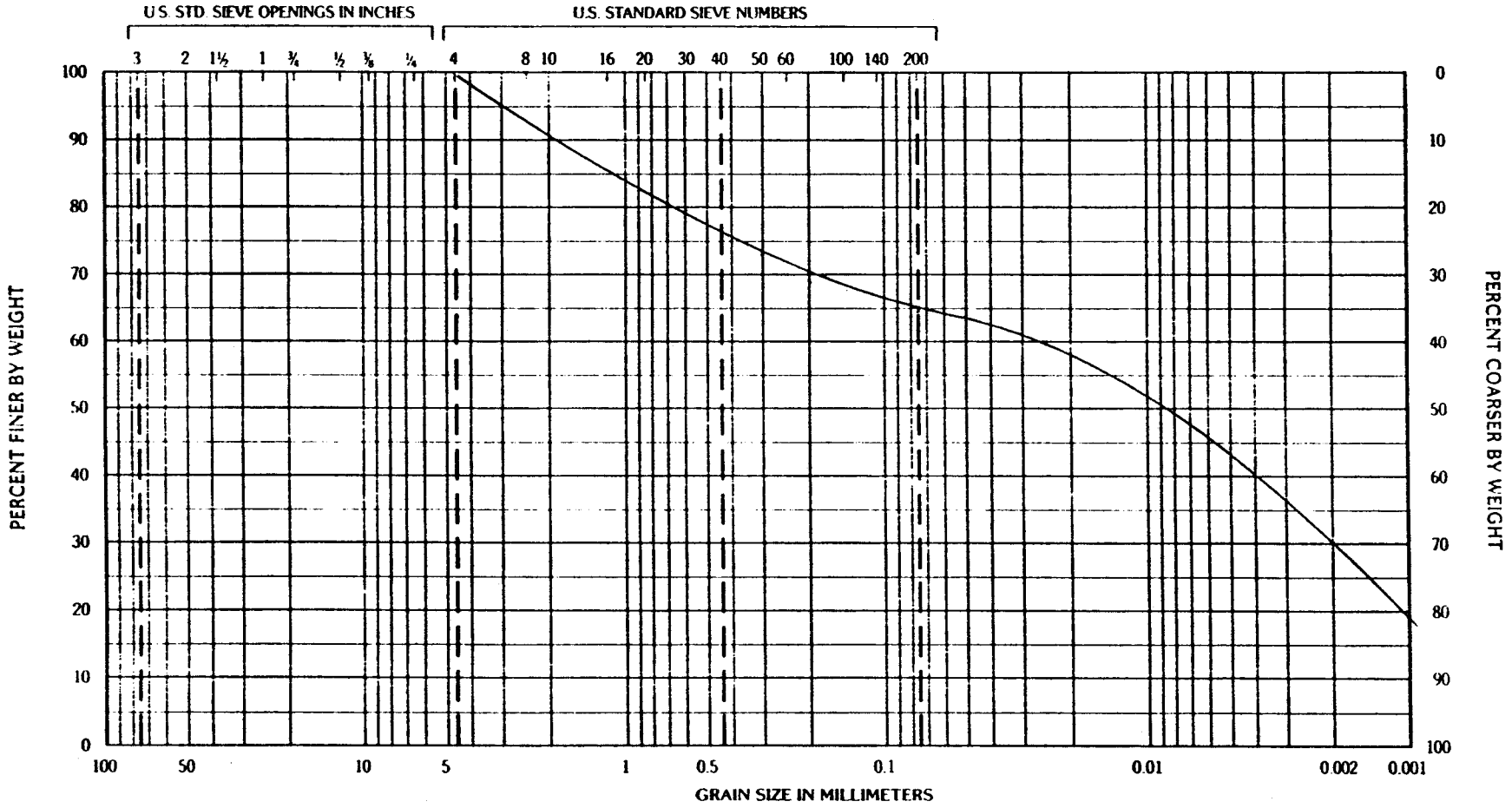
SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

Project No. 91-1-71
Figure

V & A

PARTICLE SIZE DISTRIBUTION CHART

SAMPLE LOCATION: B1-2 at 2' - 4'



Unified	Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt or Clay
AASHTO	Gravel		Coarse Sand	Fine Sand	Silt or Clay

SOIL DESCRIPTION: CLAY, very sandy CLASSIFICATION: CL

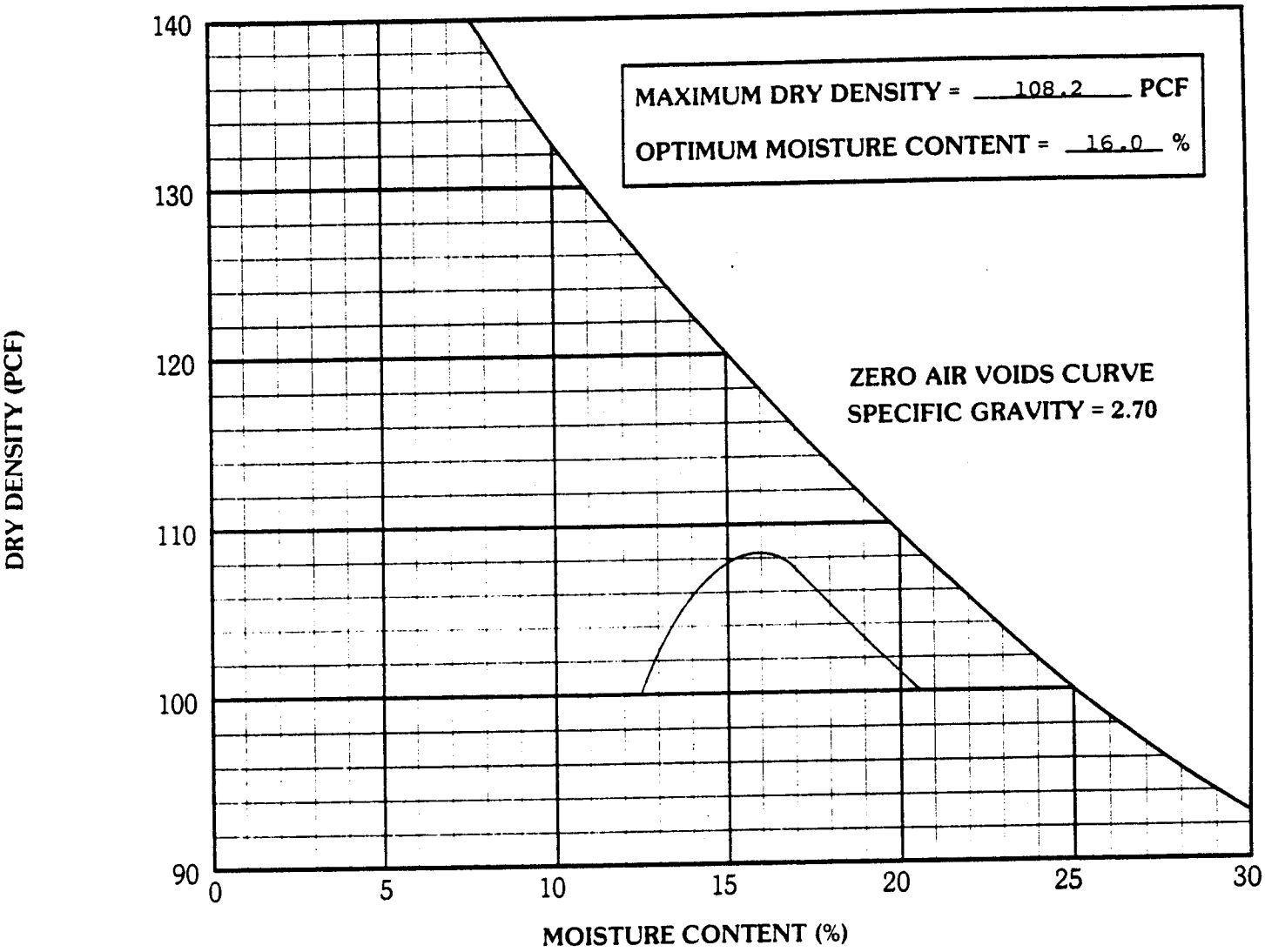
Project No. 91-1-71

Figure

PRELIMINARY

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: M-5 at 2' - 4'

SOIL DESCRIPTION: SAND, very clayey

UNIFIED SOIL CLASSIFICATION: (SC)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 40 % PI 22 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
			100	95	86	75	61	56	31.7

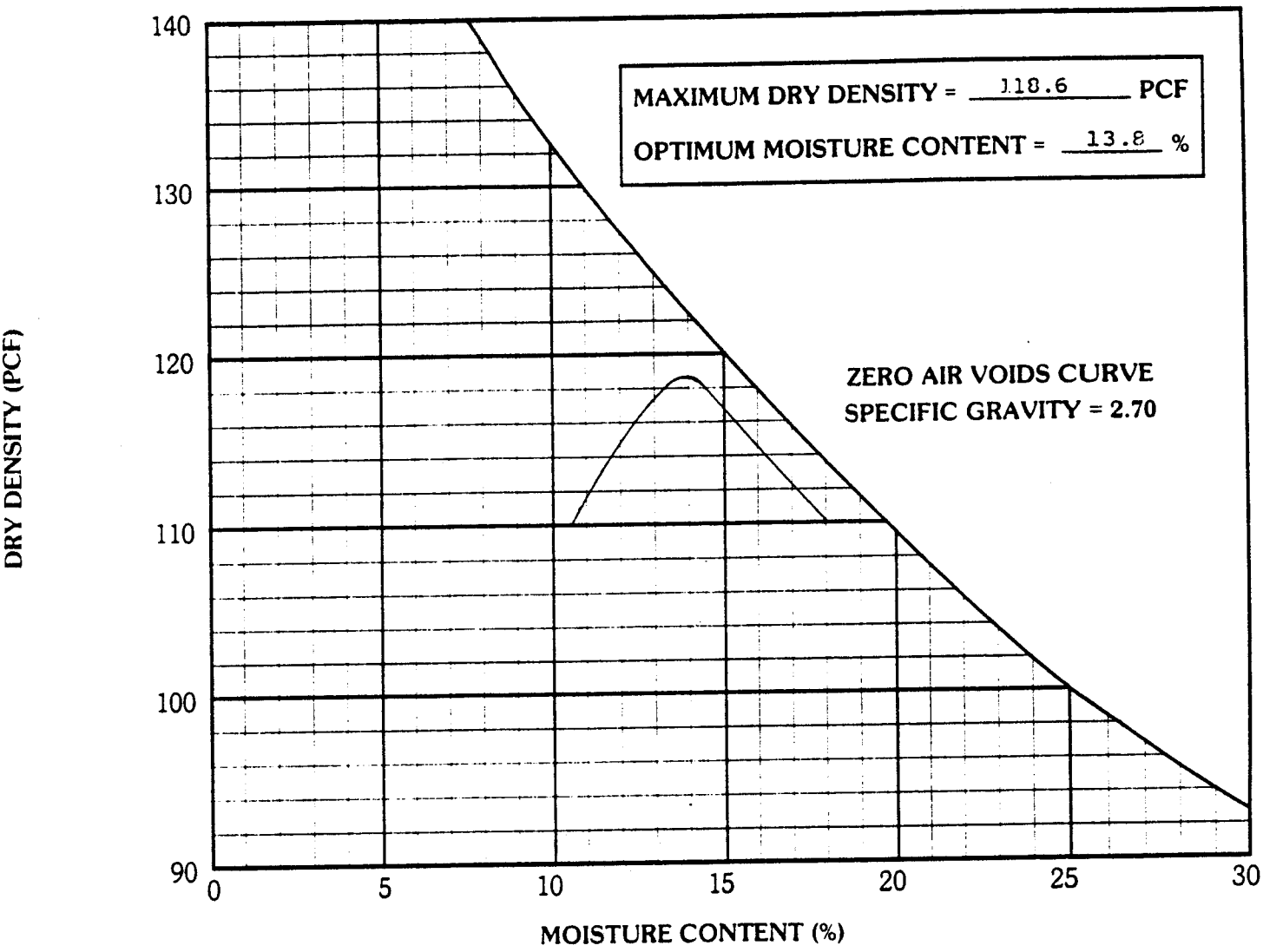
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: M-4 at 1'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 32 % PI 16 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
				100	98	95	91	83	72.5

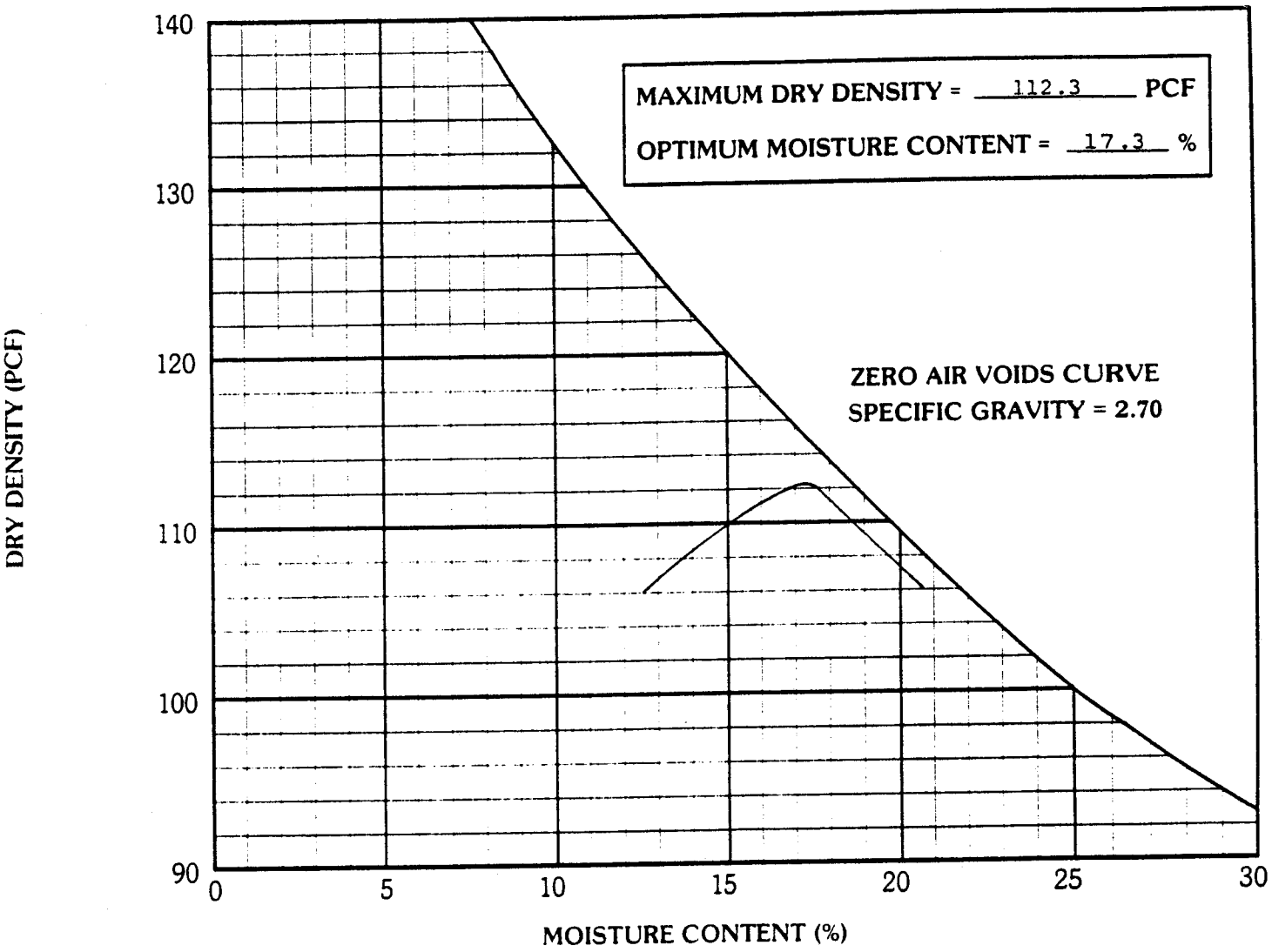
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: M-1 at 2' - 4'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698 A

ATTERBERG LIMITS: LL 33 % PI 15 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
			100	97	93	89	85	80	68.1

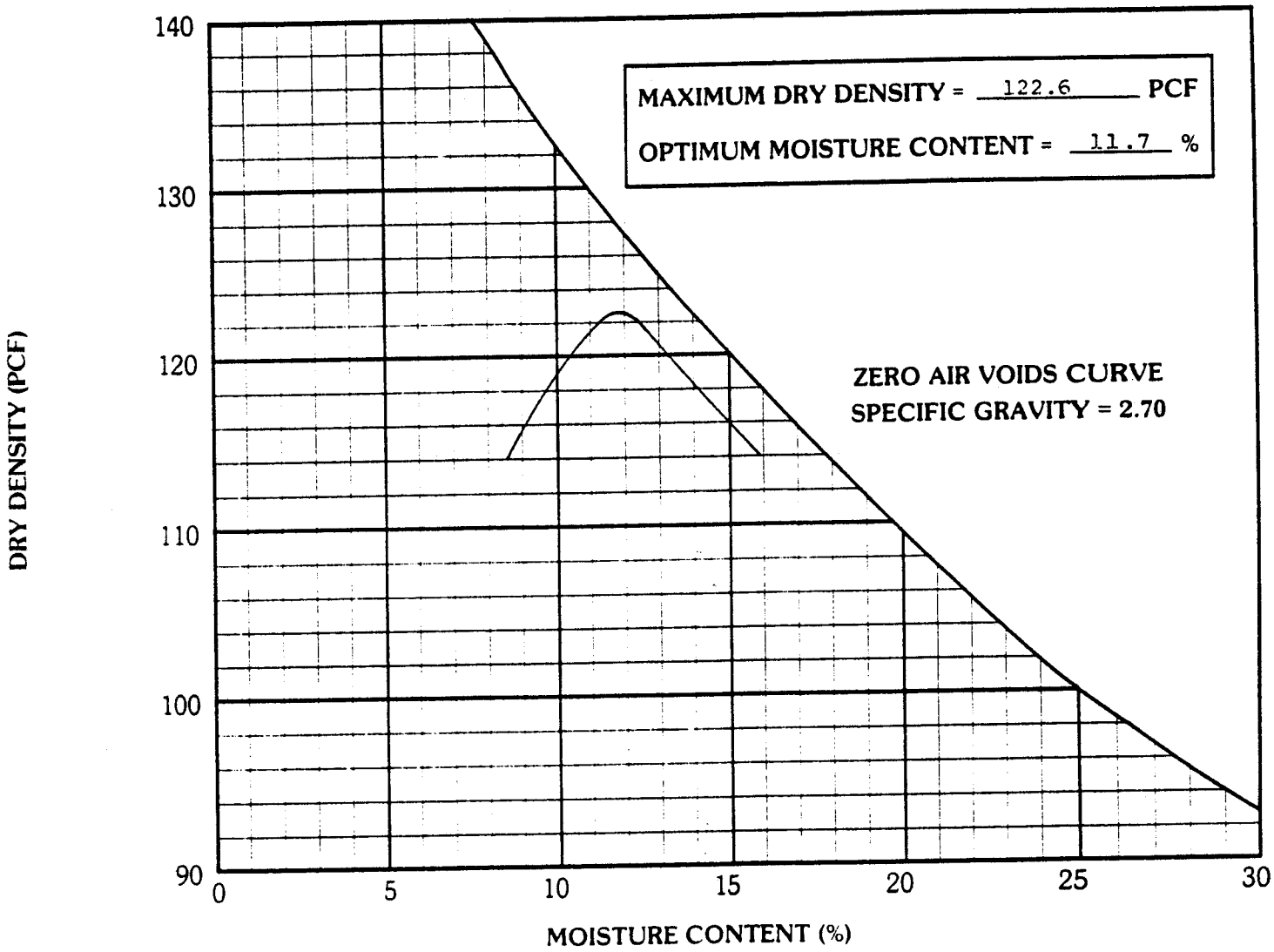
Project No: 91-1-71

Figure

PRELIMINARY

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: M-3 at 2' - 4'

SOIL DESCRIPTION: CLAY, very sandy, trace gravel

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698 A

ATTERBERG LIMITS: LL 25 % PI 9 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
		100	99	92	82	75	69	60	51.9

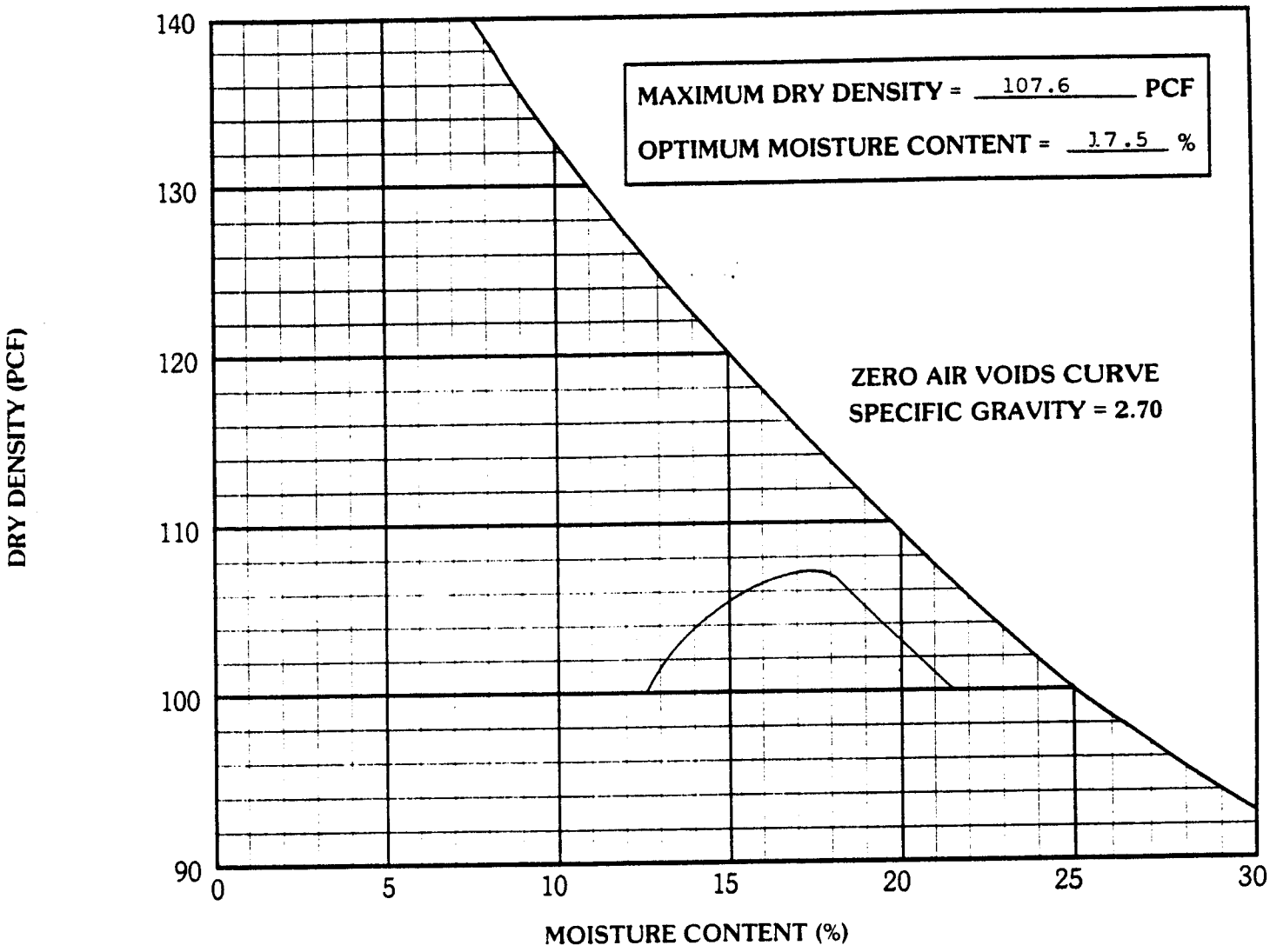
PRELIMINARY

Project No: 91-1-71

Figure

V & A

COMPACTION TEST RESULTS



SAMPLE LOCATION: M-2 at 2' - 4'

SOIL DESCRIPTION: CLAY, very sandy

UNIFIED SOIL CLASSIFICATION: (CL)

AASHTO SOIL CLASSIFICATION: -

TEST METHOD: ASTM D-698

ATTERBERG LIMITS: LL 36 % PI 17 %

SIEVE ANALYSIS - % PASSING									
1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
			100	96	87	79	73	68	64.9

PRELIMINARY

Project No: 91-1-71

Figure

9014

DANIEL B. STEPHENS & ASSOCIATES, INC.
ENVIRONMENTAL SCIENTISTS AND ENGINEERS

June 7, 1991

Mr. Alan K. Kuhn, Ph.D, PE
AK GeoConsult Inc.
13212 Manitoba NE
Albuquerque, NM 87111-2955

Dear Mr. Kuhn:

Attached is the hydraulic properties report on Durita subsurface geologic samples. This work was performed under the terms of Project No. 9014. Also enclosed is an invoice for this work.

All testing results were evaluated subjectively for consistency and reasonableness. The results of the pressure plate data appear to be reasonably representative of the material tested. The thermocouple psychrometer data does not appear to be acccurate. The psychrometer method relies on testing of small sample sizes (≈ 1-1.5 grams); the potential for significant moisture loss in the sandy samples tested is high, placing the results in doubt. AKG was not charged for the psychrometer testing due to the suspect data.

DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

We are pleased to provide this service to AK GeoConsult, Inc. and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data report and invoice, please do not hesitate to call.

Yours truly,

DANIEL B. STEPHENS & ASSOCIATES, INC.

Mark D. Ankeny
Senior Scientist/Laboratory Manager

MDA/et
Enclosures

DISK: 91-L-130

SUMMARY OF MOISTURE RETENTION CHARACTERISTICS

PRESSURE PLATE

Sample Number	Pressure Head (-cm water)	Moisture Content (%,cm^3/cm^3)
201E		
~~2 OLE~~ 2.5-5.0	0	47.93
	15400	22.57
201 E 15.0-20.0	0	42.10
	15400	13.55
201 W 5.0-10.0	0	45.46
	15400	7.12
202 E 2.5-5.0	0	49.22
	15400	29.23
202 E 15.0-20.0	0	43.38
	15400	10.55
202 W 5.0-10.0	0	44.57
	15400	6.60
203 E 0.0-5.0	0	36.64
	15400	15.30
203 E 10.0-15.0	0	29.95
	15400	24.12
203 W 5.0-10.0	0	42.27
	15400	21.02
203 W 15.0-20.0	0	41.34
	15400	11.57

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: ~~2 CHE~~ 2.5-5 2015
RING NUMBER: ~~2 CHE~~ 2.5-5 2015
DEPTH: 2.5-5.0 FT.
SAMPLE VOLUME: 86.08 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 208.08 (g)
TARE RING: 23.84 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.26 (g)
DRY WEIGHT OF SAMPLE: 115.72 (g)
SATURATED MOISTURE CONTENT: 47.93 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.26 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	208.08	--	--	47.93
05/30	1420	15.1	186.25	21.83	21.83	22.57

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 201 E 15-20
RING NUMBER: 201 E 15-20
DEPTH: 15.0-20.0 FT.
SAMPLE VOLUME: 106.90 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 253.12 (g)
TARE RING: 29.20 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.87 (g)
DRY WEIGHT OF SAMPLE: 151.04 (g)
SATURATED MOISTURE CONTENT: 42.10 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 45.01 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	253.12	--	--	42.10
05/30	1420	15.1	222.59	30.53	30.53	13.55

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 201 W 5-10
RING NUMBER: 201 W 5-10
DEPTH: 5.0-10.0 FT.
SAMPLE VOLUME: 125.24 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 319.22 (g)
TARE RING: 39.48 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 30.57 (g)
DRY WEIGHT OF SAMPLE: 192.24 (g)
SATURATED MOISTURE CONTENT: 45.46 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 56.93 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	319.22	--	--	45.46
05/30	845	15.1	271.21	48.01	48.01	7.12

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 202 E 2.5-5
RING NUMBER: 202 E 2.5-5
DEPTH: 2.5 -5.0 FT.
SAMPLE VOLUME: 95.51 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 239.12 (g)
TARE RING: 26.64 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.65 (g)
DRY WEIGHT OF SAMPLE: 137.82 (g)
SATURATED MOISTURE CONTENT: 49.22 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 47.01 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	239.12	--	--	49.22
05/30	845	15.1	220.03	19.09	19.09	29.23

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER (PORE SIZE DISTRIBUTION)

JOB NAME:	AKG - DURITA PROJECT # 9014
JOB NUMBER:	91-L-130
SAMPLE NUMBER:	202 E 15-20
RING NUMBER:	202 E 15-20
DEPTH:	15.0-20.0 FT.
SAMPLE VOLUME:	108.17 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP, RING, CLAMP & SCREEN):	256.47	(g)
TARE RING:	29.63	(g)
TARE CAP:	0.00	(g)
TARE WEIGHT OF SCREEN AND CLAMP:	27.42	(g)
DRY WEIGHT OF SAMPLE:	152.50	(g)
SATURATED MOISTURE CONTENT:	43.38	(% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	46.92	(cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	256.47	--	--	43.38
05/30	1420	15.1	220.93	35.54	35.54	10.52

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 202 W 5-10
RING NUMBER: 202 W 5-10
DEPTH: 5.0-10.0 FT.
SAMPLE VOLUME: 91.15 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 238.65 (g)
TARE RING: 28.10 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.25 (g)
DRY WEIGHT OF SAMPLE: 142.67 (g)
SATURATED MOISTURE CONTENT: 44.57 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 40.63 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	238.65	--	--	44.57
05/30	1420	15.1	204.04	34.61	34.61	6.60

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

DANIEL B. STEPHENS & ASSOCIATES, INC.
ENVIRONMENTAL SCIENTISTS AND ENGINEERS

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 203 E 0-5
RING NUMBER: 203 E 0-5
DEPTH: 0.0-5.0 FT.
SAMPLE VOLUME: 113.05 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 297.88 (g)
TARE RING: 32.66 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.67 (g)
DRY WEIGHT OF SAMPLE: 196.13 (g)
SATURATED MOISTURE CONTENT: 36.64 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 41.42 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	297.88	--	--	36.64
05/30	845	15.1	273.76	24.12	24.12	15.30

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER (PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 203 E 10-15
RING NUMBER: 203 E 10-15
DEPTH: 10.0-15.0 FT.
SAMPLE VOLUME: 118.10 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP, RING, CLAMP & SCREEN): 316.67 (g)
TARE RING: 32.69 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 28.14 (g)
DRY WEIGHT OF SAMPLE: 220.47 (g)
SATURATED MOISTURE CONTENT: 29.95 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 35.37 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	316.67	--	--	29.95
05/30	845	15.1	309.78	6.89	6.89	24.12

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER (PORE SIZE DISTRIBUTION)

JOB NAME:	AKG - DURITA PROJECT # 9014
JOB NUMBER:	91-L-130
SAMPLE NUMBER:	203 W 5-10
RING NUMBER:	203 W 5-10
DEPTH:	5.0-10.0 FT.
SAMPLE VOLUME:	113.20 (cc)

SATURATED WEIGHT AT 0 CM TENSION (WITH CAP, RING, CLAMP & SCREEN):	276.94	(g)
TARE RING:	31.23	(g)
TARE CAP:	0.00	(g)
TARE WEIGHT OF SCREEN AND CLAMP:	27.21	(g)
DRY WEIGHT OF SAMPLE:	170.65	(g)
SATURATED MOISTURE CONTENT:	42.27	(% vol)
INITIAL VOLUME OF WATER IN SAMPLE:	47.85	(cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	276.94	--	--	42.27
05/30	845	15.1	252.89	24.05	24.05	21.02

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY:	R. Hill/S. Kannan
CALCULATION MADE BY:	K. Evans
CHECKED BY:	M. Ankeny

MOISTURE RETENTION DATA - 15 BAR PRESSURE PLATE/THERMOCOUPLE PSYCHROMETER
(PORE SIZE DISTRIBUTION)

JOB NAME: AKG - DURITA PROJECT # 9014
JOB NUMBER: 91-L-130
SAMPLE NUMBER: 203 W 15-20
RING NUMBER: 203 W 15-20
DEPTH: 15.0-20.0 FT.
SAMPLE VOLUME: 126.12 (cc)

SATURATED WEIGHT AT 0 CM TENSION
(WITH CAP, RING, CLAMP & SCREEN): 313.33 (g)
TARE RING: 35.17 (g)
TARE CAP: 0.00 (g)
TARE WEIGHT OF SCREEN AND CLAMP: 27.38 (g)
DRY WEIGHT OF SAMPLE: 198.64 (g)
SATURATED MOISTURE CONTENT: 41.34 (% vol)
INITIAL VOLUME OF WATER IN SAMPLE: 52.14 (cc)

DATE (1991)	TIME	PRESSURE PLATE PRESSURE (Bar)	WEIGHT W/RING (g)	WEIGHT CHANGE (g)	CUMM. WEIGHT CHANGE (g)	MOISTURE CONTENT (%, cm3/cm3)
05/24	930	0.0	313.33	--	--	41.34
05/30	845	15.1	275.78	37.55	37.55	11.57

COMMENTS: Assume density of water is 1.0 g/cc

LABORATORY ANALYSIS PERFORMED BY: R. Hill/S. Kannan
CALCULATION MADE BY: K. Evans
CHECKED BY: M. Ankeny

9014

Rogers & Associates Engineering Corporation

Post Office Box 330
Salt Lake City, Utah 84110-0330
(801) 263-1600

June 12, 1991

Dr. Alan K. Kuhn, President
AK Geoconsult, Inc.
13212 Manitoba Drive, N.E.
Albuquerque, NM 87111-2955

C9100/12

Dear Dr. Kuhn:

Attached are the results of our radium, emanation and moisture measurements on your 16 tailings samples. These tests utilized the closed-can gamma assay method, as described in the U.S. Bureau of Mines Open File Report OFR-184-82, 1982. We will invoice for $1,200.00 for testing plus shipping and container costs to return your samples. The samples will be returned for disposal as you requested to the Dorita Site in care of Doc Moore at 155 Adams, Naturita, CO 81422.

Please contact me if there are any questions.

Sincerely yours,

Kirk K. Nielson
Vice President

KKN/b

Sample No.	Moisture dry wt.%	Radium pCi/g	± pCi/g	Emanation fraction	±
201E 5-10	10.5	658.1	5.3	0.34	0.01
201W 2.5-5	9.1	256.7	3.2	0.37	0.02
201W10-15	7.7	608.5	5.1	0.34	0.01
202E 5-10	9.0	217.7	2.8	0.30	0.02
202E10-15	9.8	453.2	5.2	0.25	0.02
202W 2.5-5	7.0	1.3	0.3	0.15	0.30
202W 10-15	8.0	445.5	4.4	0.26	0.01
203E 5-10	13.7	372.3	3.8	0.40	0.01
203E 15-20	15.6	368.8	3.7	0.34	0.01
203W 2.5-5	10.7	464.6	4.3	0.33	0.01
203W10-15	15.4	431.2	4.3	0.28	0.01
EP1 1-1.5	57.5	5.0	0.7	0.62	0.20
EP2 0-12"	60.7	12.0	1.2	0.22	0.14
EP3 1-2	61.5	3.7	0.6	0.29	0.22
EP3 @3'	105.6	46.9	2.0	0.33	0.06
EP4 0-1	100.7	7.1	0.9	0.57	0.17

ave of 10 tailings analysis 427.7 pCi Ra-226/g
(Figure 1.3 and)

EVALUATION OF ROCK DURABILITY - SAN MIGUEL RIVER ROCK

Type (Group)	Sulfate Soundness % Loss	L.A. Abrasion % Loss	Specific Gravity	Absorption
Extrusives (2)	0.21	13.7	2.67	0.242
Sandstone (3)	5.31	34.7	2.41	1.337
Intrusives (1)	0.10	18.2	2.70	0.215
Limestone (3)	0.88	21.1	2.60	0.211
Average (2.25)	1.63	21.9	2.60	2.005

Weighted Scores (per NRC, 1990, Table D1)

Extrusives	10x11	3.52x1	8.4x9	9.29x2
Sandstone	7.82x3	0x8	3.2x6	4.33x5
Intrusives	10x11	2.36x1	9x9	9.42x2
Limestones	10x4	1.78x1	7x12	9.44x13
Raw Averages	70.9	1.83	64.9	45.44

Weighted by % of Rock Type in Total Sample

Igneous (66%)	72.6	3.88	51.68	12.3
Sandstone (17%)	4.0	0	3.26	3.7
Limestone (17%)	6.8	0.30	14.38	20.9
	83.4	4.18	69.22	36.95

Weighted Total = 193.75

Maximum Total possible with 2/3 igneous, 1/6 sandstone, 1/6 limestone:

igneous = 0.66 (9x10+2x10+11x10+1x10) = 151.8

sandstone = 0.17 (6x10+5x10+3x10+8x10) = 37.4

limestone = 0.17 (12x10+13x10+4x10+1x10) = 51.0

maximum total possible = 240.2

Overall Durability Score, % of maximum possible = 0.81, or 81%

EVALUATION OF ROCK DURABILITY - ON-SITE ROCK
(11 tests on sandstones by Vinyard and Associates, 6/7/91)

Property	Average	Weighted Factor	Score	Weighted Score
Bulk spec. gravity	2.49	6	4.8	28.8
Absorption, %	2.189	5	2.62	13.1
L.A. abrasion, %loss	47.6	8	0	0
Sodium Sulfate Soundness, %loss	13.1	3	3.76	11.28
			Total Score =	53.2

Maximum Possible Score = (6x10+5x10+8x10+3x10) = 220

Rock Durability Score, % of maximum possible = 53.2/220 = 24.2%

For use in "seldom-saturated" areas only, including PMF flood plain bank riprap and scour protection, oversize by:

design d_{50} x (80-24.2)/100, or 56%

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

June 7, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, New Mexico 87111

Attention: Mr. Alan Kuhn, PE

Subject: Hecla/Durita Mine - Vinyard & Associates'
Project No.: 91-1-43

Gentlemen:

Attached are copies of the Laboratory Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

Attachment: Data Sheet (2)

c: Addressee (2)

SUMMARY OF LABO JRY TEST DATA

Location	Bulk Specific Gravity	Bulk Specific Gravity (Saturated Surface Dry)	Apparent Specific Gravity	Absorption Percent	L. A. Abrasion	Sodium Sulfate Soundness Total Percent Loss
C-7 @ 5½' - 6'	2.443	2.501	2.593	2.370	52.6	20.4
C-7 @ 6' - 8'	2.283	2.367	2.491	3.664	55.3	2.8
C-9 @ 3' - 8'	2.498	2.547	2.626	1.952	44.1	6.44
C-9 @ 4'	2.409	2.478	2.588	2.880	51.5	11.4
C-12 @ 5'	2.550	2.575	2.615	.962	23.6	1.13
H-1 @ 3' - 6'	2.392	2.469	2.592	3.232	49.3	15.9
H-2 @ 2' - 6'	2.462	2.516	2.604	2.216	43.2	13.4
R-2 @ 0'	2.349	2.398	2.470	2.076	82.0	36.9
R-3 @ 0'	2.403	2.458	2.542	2.253	43.1	11.9
R-5 @ 0'	2.496	2.525	2.569	1.138	29.7	1.8
R-8 @ 0'	2.520	2.548	2.593	1.121	34.8	6.02
R-9 @ 3'	2.490	2.540	2.622	2.010	55.9	32.3
R-10 @ 2'	2.406	2.468	2.565	2.577	53.9	9.7

SIEVE ANALYSIS TEST RESULTS

Location	Sieve Analysis % Passing by Weight										
	3"	1½"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
C-7 @ 5½'	100	91.0	81.7	75.9	71.5	67.2	63.3	60.5	52.7	42.5	36.1
C-9 @ 4'	100	80.6	70.5	61.0	55.6	50.8	46.3	41.8	29.0	16.2	10.4
H-1 @ 3' - 6'	100	75.0	62.4	56.3	51.2	45.7	41.0	37.6	31.5	23.6	16.9
H-2 @ 2' - 6'	66.4	55.7	47.9	42.3	34.3	26.1	21.0	18.6	15.3	11.6	8.4

Project No.: 91-1-43

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

July 5, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, New Mexico 87111

Attention: Mr. Alan K. Kuhn, PhD., PE

Subject: Durita Mine, Vinyard & Associates'
Project No.: 91-1-71

Gentlemen:

Attached are copies of the Soundness and L. A. Abrasion Test Results for the subject project.

Should you have any questions regarding this data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

cc: Addressee (2)

SUMMARY OF LABORATORY TEST RESULTS

Durita Project

Sample Type	Soudium Sulfate soundness Loss (%)[1]	Los Angeles Abrasion Loss (%)[2]
Extrusive Igneous River Run	0.21	13.7
Sandstone River Run	5.31	34.7
Intrusive Igneous River Run	0.10	18.2
Limestone	0.88	21.1

[1] Five cycles.

[2] 500 Revolutions.

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

July 8, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, NM 87111

Attention: Mr. Alan K. Kuhn, PHD., PE

Subject: Durita Mine - Moore Property Rock
Vinyard & Associates' Job No: 91-1-71

Gentlemen:

Please find enclosed Specific Gravity and Absorption Test Results for the subject project.

Should you have any questions regarding the enclosed data, please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

MARTIN D. VINYARD NEW MEXICO 8261 REGISTERED PROFESSIONAL ENGINEER

Martin D. Vinyard, P. E.

Attachment: Data Sheet (1)

cc: Addressee (2)

SUMMARY OF LABORATORY TEST RESULTS

Durita Project

Rock Type	Bulk Specific Gravity	Bulk Specific Gravity SSD	Apparent Specific Gravity	Absorption (%)
Extrusive Igneous River Run	2.670	2.676	2.687	0.242
Sandstone River Run	2.406	2.438	2.486	1.337
Intrusive Igneous River Run	2.701	2.707	2.717	0.215
Limestone River Run	2.600	2.605	2.614	0.211

Vinyard & Associates, Inc.

4415-D Hawkins, NE
Albuquerque, New Mexico 87109
(505) 345-1937

Geotechnical Engineering • Materials Testing • Environmental Engineering

August 27, 1991

AK GeoConsult, Inc.
13212 Manitoba Drive, NE
Albuquerque, NM 87111

Attention: Mr. Alan K. Kuhn, PhD

Subject: Durita Mine - Vinyard & Associates'
Project No.: 91-1-71

Gentlemen:

Attached are copies of the Sieve Analysis Test Results for the subject project.

Should you have any questions please do not hesitate to call.

Sincerely,
Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

Attachment: Data Sheet (2)

cc: Addressee (2)

Project:	Durita Mine	**Client:**	AK GeoConsult, Inc.
Project Number:	91-1-71	**Sample Location:**	Lone tree placer site fine split rock

SIEVE ANALYSIS TEST RESULTS

Sieve Size	Percent Passing
3"	100
2½"	96.0
2"	88.7
1½"	78.4
1"	47.5
3/4"	26.5
1/2"	10.0
3/8"	5.0
No. 4	0.3

Project: Durita Mine

Client: AK GeoConsult, Inc.

Project Number: 91-1-71

Sample Location: Lone tree placer site, coarse split rock

SIEVE ANALYSIS TEST RESULTS

Sieve Size	Percent Passing
6"	100
5"	82.7
4"	36.6
3"	14.8
2½"	1.4
2"	0

MONITOR WELL INSTALLATION

This section describes the drilling, construction and development of seven wells (MW-3 through MW-14) at the Durita facility. These wells were installed due to the uncertainty regarding the integrity of the historical monitoring wells. The historical wells were drilled 1976 and have been sampled on a quarterly basis. The construction of these wells (MW-2 through MW-7) did not entail the installation of a sand pack or a surface seal, thereby raising questions regarding the integrity of the wells. The well locations for the historical wells and the monitor wells installed under this program are shown on Figure D2 along with the location of the historical wells. Several of the wells installed under this program were located near the historical wells in order to evaluate the integrity of the historical wells.

DRILLING PROCEDURES

The general drilling and sampling procedures are outlined in this section, and the variations from these general procedures are described in subsequent sections. Monitor wells MW-8 through MW-14 were drilled from April 23 to April 28, 1991. The boring logs for these wells are presented in _____. the wells were drilled by Ground Exploration, Inc. using a combination of hollow stem auger and air rotary techniques. A track-mounted CME drilling rig was utilized which was capable of drilling by either method. The 8-inch OD diameter hollow stem auger was utilized to drill through both unconsolidated soils and weathered bedrock, and an 8-inch diameter air rotary bit was utilized to drill the remainder of the well. Prior to switching between auger and air rotary methods, 12-inch OD augers were drilled through the unconsolidated soils in order to prevent sloughing when the 8-inch OD augers were removed and borehole was drilled with air rotary.

The total depth of the well was based on the requirment of screening the well in the first water-bearing zone. The wells were drilled approximately 15 feet below the top of the first water bearing-zone in order to allow the construction of a sand pack and a 10 feet well screen. The maximum depth drilled was 85 feet below ground surface.

A field engineer was present during all drilling activities in order to log the geologic conditions encountered. While drilling with the hollow stem auger, soil samples were collected on five-foot centers. Soil samples were also collected at depths determined by the field engineer in order to identify lithologic contacts. The samples were collected with a split-spoon sampler which was driven with a 140-pound hammer falling from a distance of 30 inches, in accordance with the standard penetration test. The number of blows required to drive the sampler a distance of 1.5 feet was recorded on the log. The soil sample was removed from the split-spoon and the core recovery was recorded. The field engineer logged the core in accordance with the Unified Soils Classification System (USCS). The cuttings from the auger were also logged in order to identify lithologic contacts. Split-spoon samples were not collected when drilling with the air rotary, but the cuttings were logged. The cuttings and the drilling rate were utilized in order to determine the geologic conditions and locations or lithologic contacts encountered while drilling with air rotary.

GEOLOGIC CONDITIONS ENCOUNTERED

The geologic conditions encountered in the well drilling are summarized in table form on the following page. The boring logs are included in this appendix. An average of 15 feet of alluvial/colluvial soils were encountered during drilling, and the thickness of the soils varied from 12 to 20 feet. The composition of these soils varied from sandy clays to clayey gravel. Several of the wells encountered coarse grain sizes up to cobbles in the soils.

The soils were underlain by the Mancos Formation, which predominantly consisted of shales and claystones. A sandstone layer was encountered in the Mancos Formation in all of the wells except for well MW-8 which is located along the south side of the property. This sandstone layer consisted of fine-grained sand particles, and the thickness of this layer varied from 1.5 feet to less than 1 foot. A zone of interbedded

sandstones and claystones was encountered during drilling at depths ranging from 35 feet in MW-8 to greater than 85 feet in MW-11. The sandstone layers within this zone were fine grained and averaged several feet thick. The interbedded sandstone zone was not encountered while drilling MW-11 to the total depth of 85 feet. The elevations of the interbedded sandstone zone are consistent with the overall geology of the basin. The elevations of the top of this zone indicate that the synclinal axis of the basin trends northwest to southeast across the north one-third of the site.

The first water-bearing zone was generally encountered in the interbedded sandstone zone. The Mancos sandstone zone was saturated in MW-11 and MW-12; however, this sandstone was not saturated in the other wells. MW-11 and MW-12 were drilled deeper than the Mancos sandstone in order to determine the depth of the interbedded sandstone zone across the facility. MW-12 encountered the interbedded sandstone zone, but the interbedded sandstone zone was not encountered in MW-11 to a depth of 85 feet.

MONITOR WELL CONSTRUCTION

The seven monitor wells were installed from April 24 through April 29, 1991 and were designed to monitor the first water-bearing zone. The well construction logs are included in this appendix for MW-8 through MW-14, and the well construction details are also summarized in this appendix. The monitor wells were constructed to monitor and sample the first water-bearing zone which consisted of either the Mancos sandstone or the interbedded sandstone zone.

The cuttings were blown out of the boreholes before the wells were installed with the air rotary bit. In order to remove the cuttings from the wells, approximately 20 to 60 gallons of water were added to the boreholes for each of the wells, except for MW-14. The water was required due to the low flow rates associated with the water-bearing zones. Water was not added to MW-14 because the flow from the first water-bearing zone did not saturate the cuttings. The added water was removed during the development of the wells.

The wells were constructed of 4-inch diameter PVC with a 10-foot screened interval of 0.020 slotted well screen. A filter sock was placed over the screened section to prevent fine-grained material from clogging the well screen. A protective metal casing was placed on top of the well and equipped with a locking cap.

The tops of the well screens were placed to correspond with the top of the first water-bearing zone. MW-11 and MW-12 were screened at the Mancos sandstone, and the remaining wells were screened in the interbedded sandstone zone. The boreholes for MW-11 and MW-12 were backfilled with cuttings and sand from their total depth to approximately two feet below the well screen.

A sand pack of 10-20 silica sand was placed between the well and the borehole from a few feet below the bottom of the well to the bentonite seal. The bentonite seal was located several feet above the top of the well screen, and the thickness of the bentonite seal in each well was greater than five feet, as shown on the well construction diagrams. The space between the well and the borehole was filled with cuttings and bentonite pellets from the bentonite seal to approximately five feet of the ground surface. A surface plug of a concrete grout was then placed in the ground surface.

WELL DEVELOPMENT

The wells were developed to purge the fines from the sand pack and the first water-bearing zone in the immediate vicinity of the well. The removal of cuttings with air rotary bit prior to installing the well removed most of the fines before the sand pack was installed. As a result the wells were pumped with a submersible pump until the water became clear, with the exception of MW-14. MW-14 was not developed because the recovery of the well was estimated not to be high enough to allow recovery in time to collect a sample based on the small amount of water encountered during drilling. The volume of water added to remove the cuttings was then pumped from the well. The well yields were estimated during the well development based on the recovery rates. The yields from MW-8 through MW-10 were approximately one gallon per minute (gpm), and the yields from MW-11 through MW-13 were well below one gpm.

WELL CONSTRUCTION SUMMARY FOR MONITOR WELLS AT DURITA SITE.

Well	Elevation of Ground (ft MSL)	Stickup of Casing (ft)	Depth of Well (ft)	Depth of Borehole (ft)	Screened Internal (ft)	Geological Zone Screened[1]
MW-8	5608	2.5	50	51	40-50	Km/Kd Transition[2]
MW-9	5549	3.0	53	57	43-53	Km/Kd Transition
MW-10	5534	3.0	69	75	59-69	Km/Kd Transition
MW-11	5526	3.0	60.5	85	50.5-60.5	Km Sandstone
MW-12	5530	3.0	37	85	27-37	Km Sandstone
MW-13	5558	3.0	73	77	63-73	Km/Kd Transition
MW-14	5612	3.7	80	85	70-80	Km/Kd Transition

[1] Km - Mancos Formation consisting primarily of claystones and shales
Kd - Dakota Formation consisting primarily of sandstones

[2] Km/Kd Transitional Zone consists of interbedded sandstones and sandy claystones

GEOLOGIC CONDITIONS ENCOUNTERED FOR MONITORING WELLS.

Well	Depth to (ft) Mancos Formation	Depth to Interbedded Zone (ft) Sandstone/Claystone	Elevation of Interbedded Zone (ft MSL) Sandstone/Claystone	Depth of Mancos Sandstone (ft)	Thickness of Mancos Sandstone (ft)
MW-8	15	35	5573	--	--
MW-9	15	43	5506	19	1.3
MW-10	12	56	5470	31[2]	<1
MW-11	15.3	>85	<5441	51[2]	<1
MW-12	14	50	5508	27.5	1.5
MW-13	14	63	5495	39	1.5
MW-14	20	75	5537	44	1

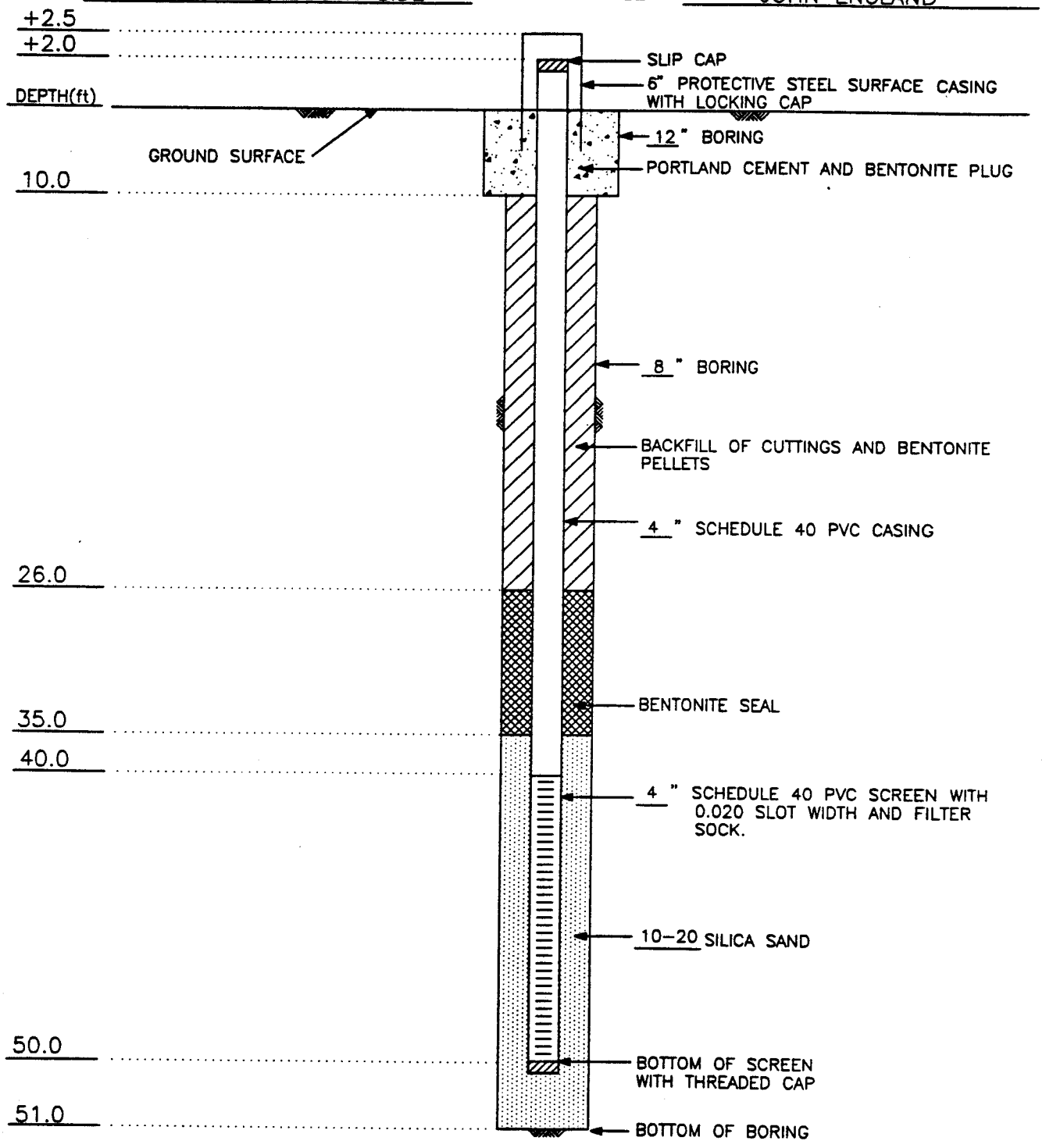
[1] Mancos Formation consisting primary of claystones and shales

[2] Sandy claystones encountered in wells MW-10 and MW-11 with harder drilling than claystones

WELL MW-8

WELL COMPLETION DETAILS

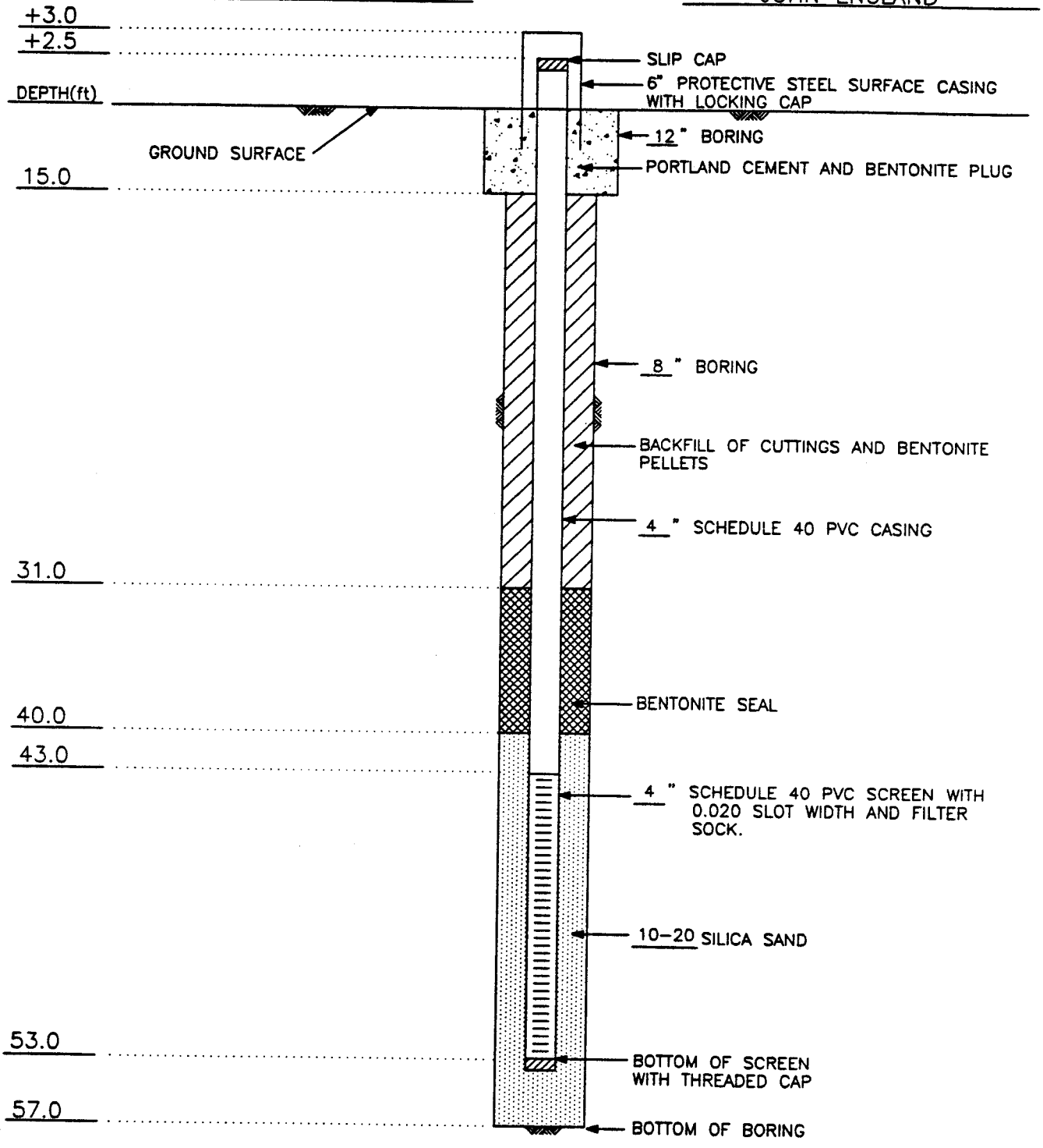
PROJECT NAME HECLA – DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/26/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, SOUTH SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-9
WELL COMPLETION DETAILS

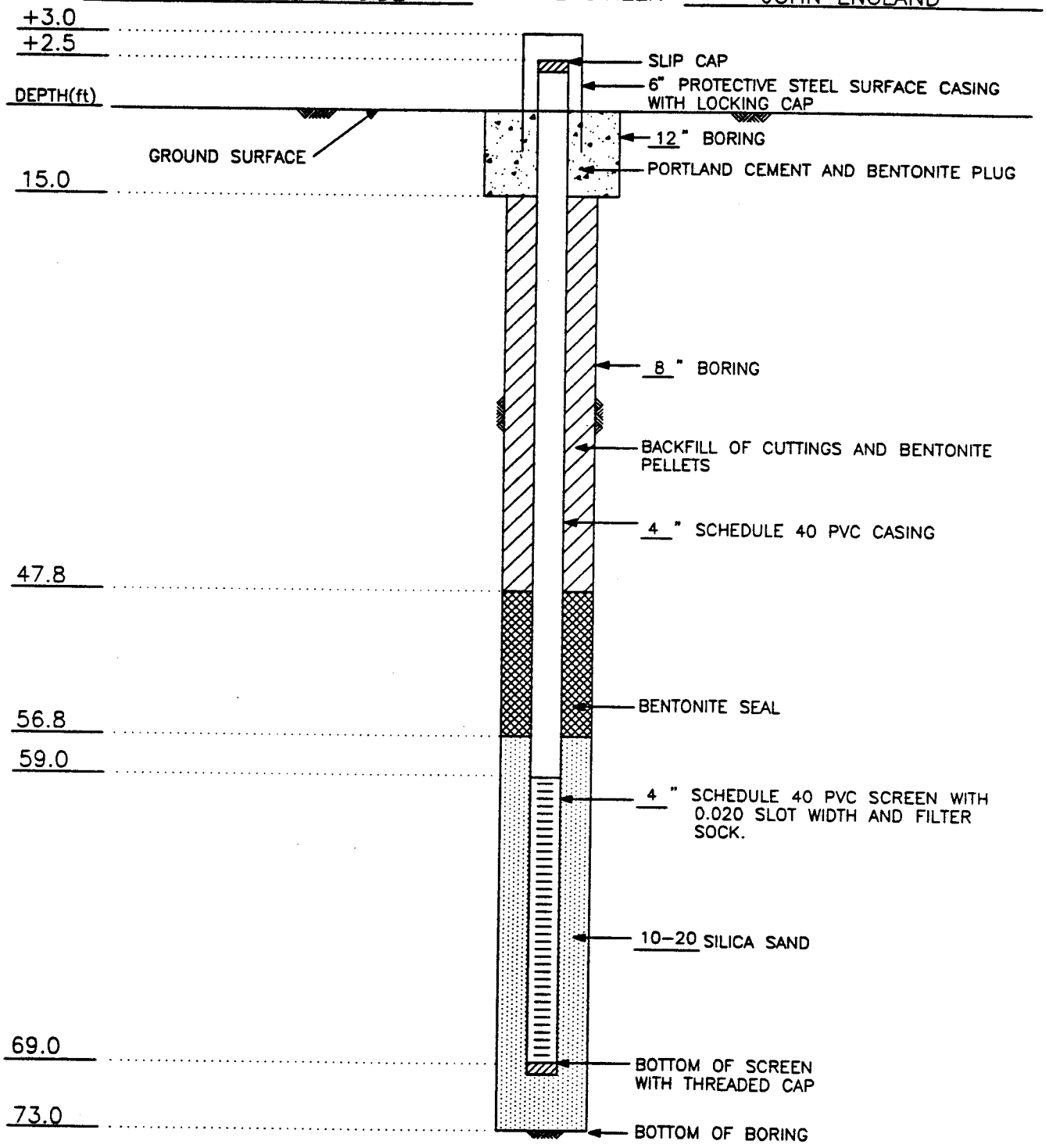
PROJECT NAME HECLA – DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/25/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, WEST SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-10
WELL COMPLETION DETAILS

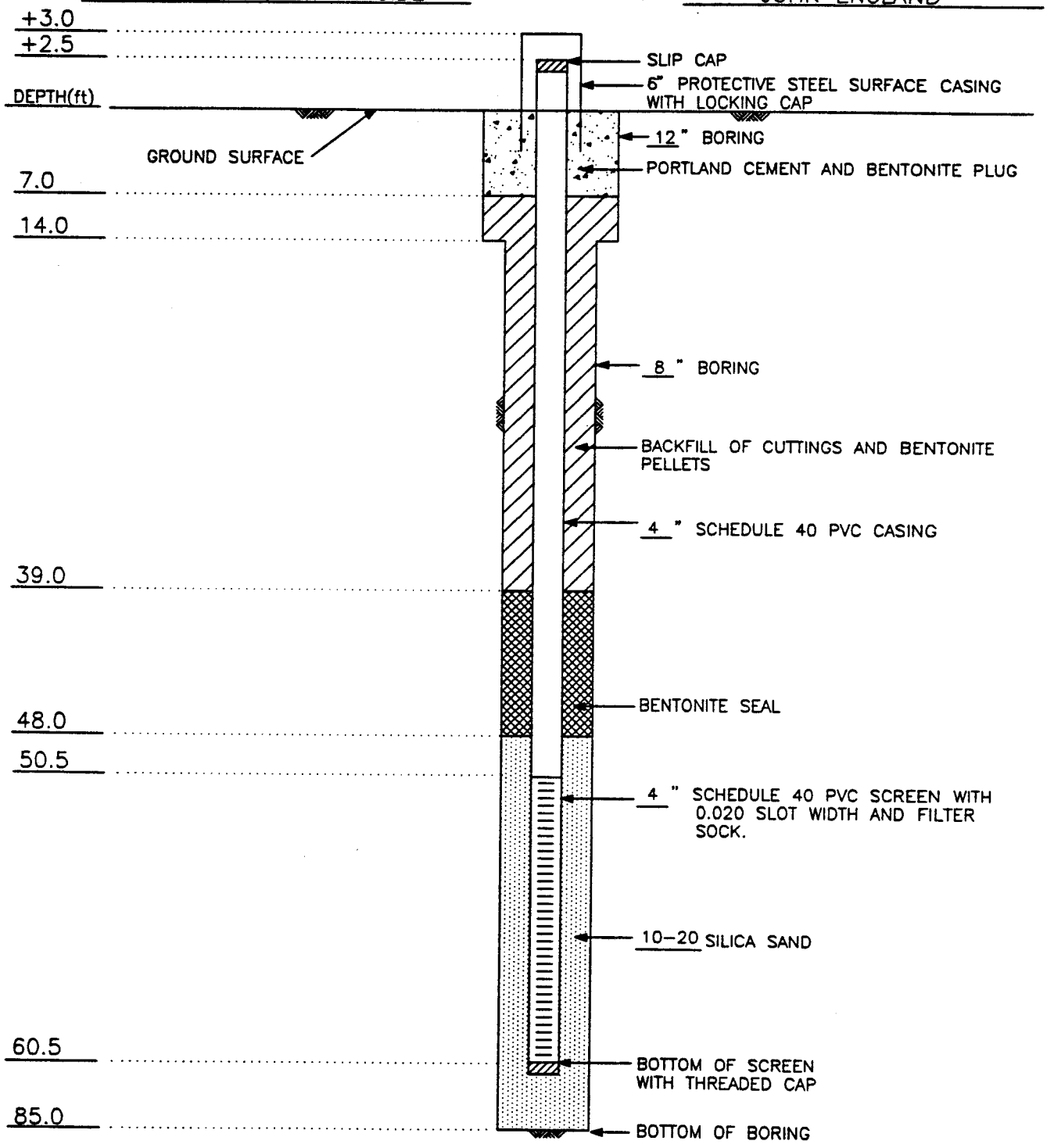
PROJECT NAME HECLA - DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/23/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, EAST SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-11
WELL COMPLETION DETAILS

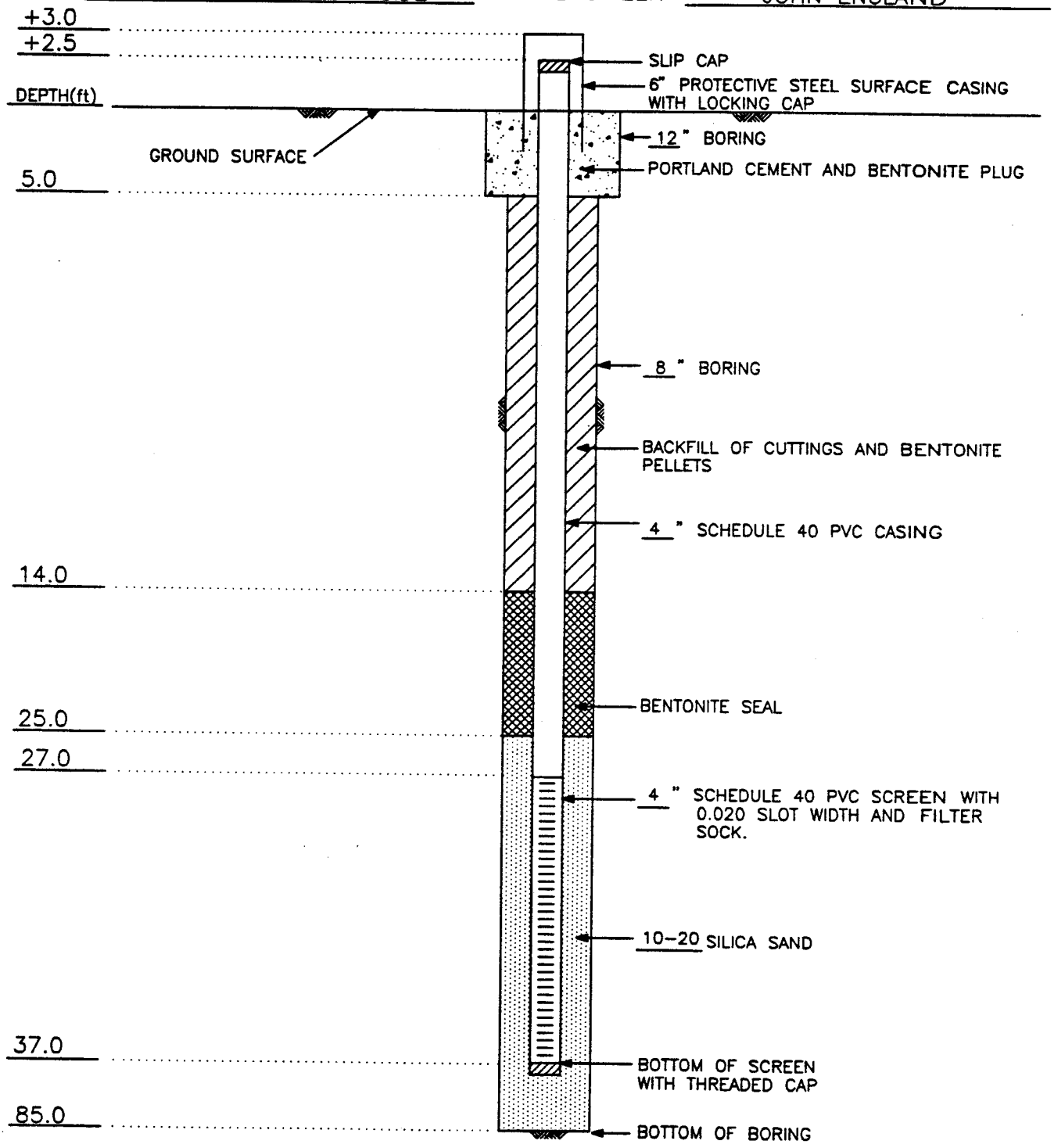
PROJECT NAME HECLA – DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/24/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, NORTH SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-12
WELL COMPLETION DETAILS

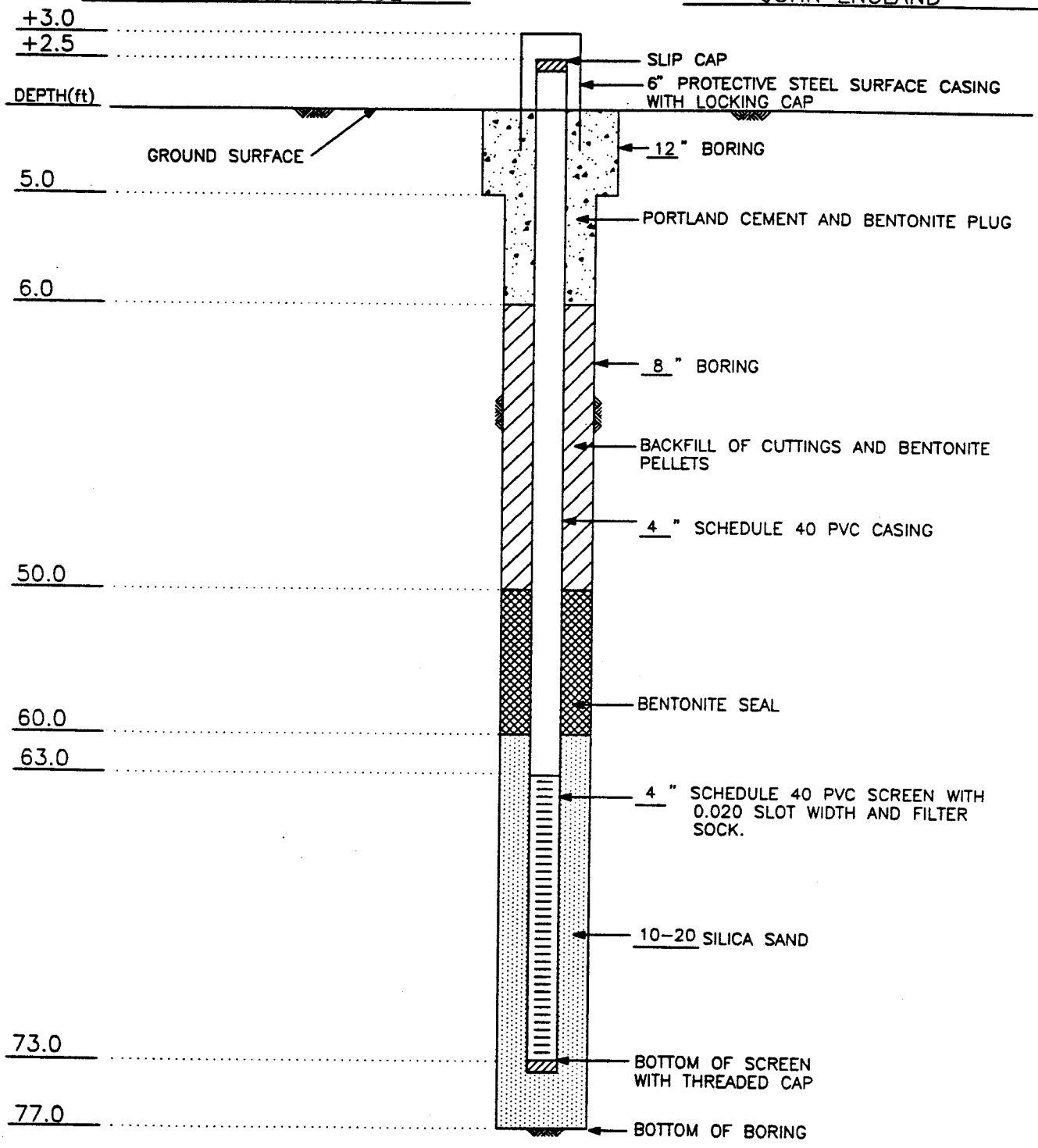
PROJECT NAME HECLA - DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/28/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, NORTH SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-13
WELL COMPLETION DETAILS

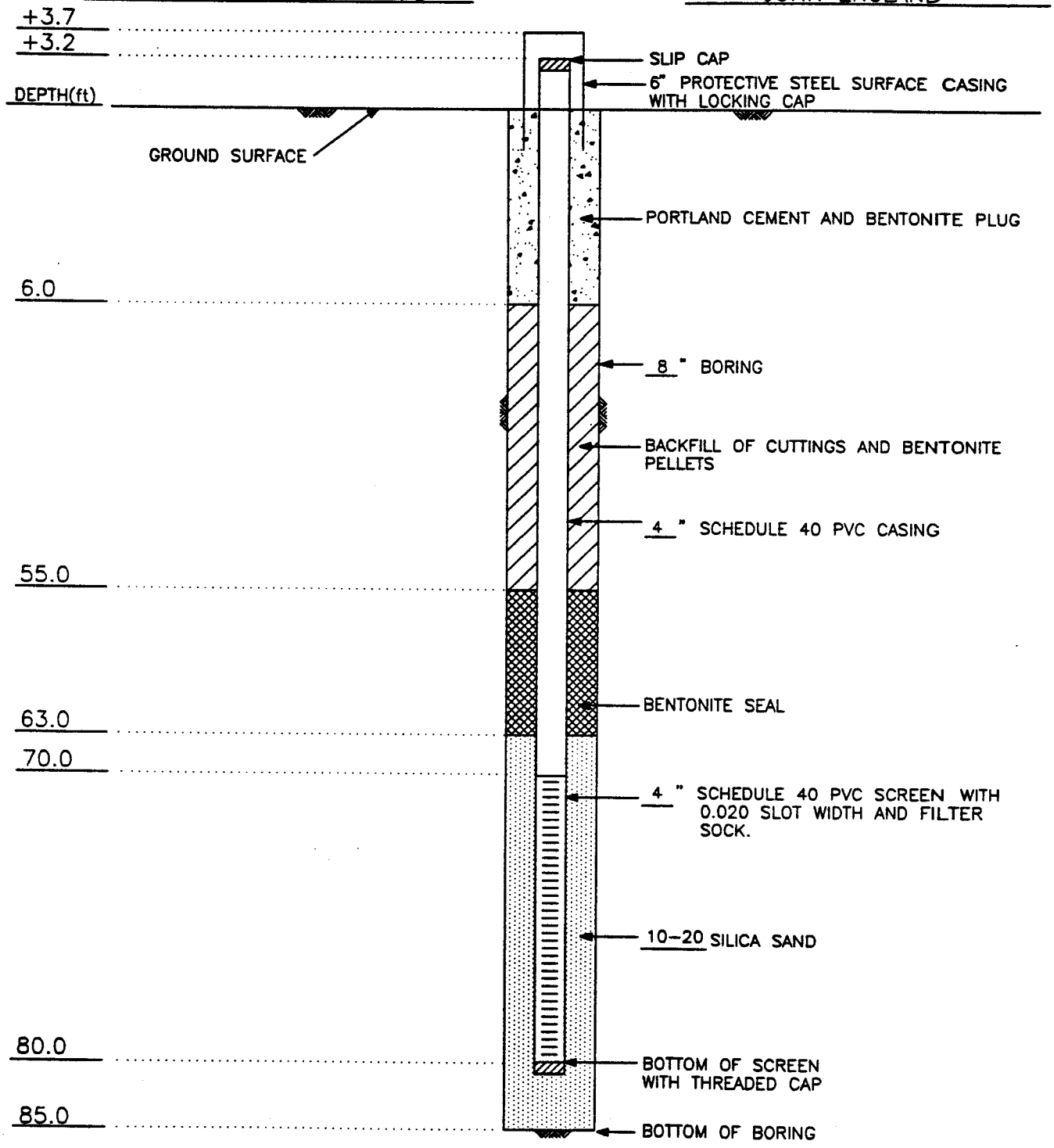
PROJECT NAME HECLA – DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/28/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, EAST SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

WELL MW-14
WELL COMPLETION DETAILS

PROJECT NAME HECLA - DURITA SITE
DRILLING METHOD H. STEM AUGER/AIR ROTARY
DATE COMPLETED 04/29/91
DRILLING COMPANY GROUND EXPLORATION
LOCATION DURITA SITE, SOUTH SIDE
FIELD ENGINEER JOHN ENGLAND



NOT TO SCALE

GROUND WATER SAMPLING AND TESTING

This narrative describes procedures used for the collection of ground water samples at the Durita site. Ground water samples were collected during three sampling events which were roughly six weeks apart. Brief descriptions of specific procedures followed for these three sampling events are also included.

GENERAL SAMPLING PROCEDURES

The procedures used for purging, sampling and preparation of sample collection were consistent with RCRA Ground Water Monitoring Technical Enforcement Guidance Document (TEGD), September, 1986. Sample preservation requirements were derived from Test Methods for Evaluating Solid Waste Physical/Chemical Methods, Third Edition (SW-846). The specific procedures followed during the three rounds of ground water sampling are discussed in the following sections.

Well Purging Methods

Ground water monitoring wells were purged prior to the collection of ground water samples in order to replace stagnant water within the well bore with fresh water from the formation. The procedure used for well purging differed between wells depending on the hydraulic yield characteristics of the well. The designation of a high yield well versus a low yield well was based on the U.S. Environmental Protection Agency (EPA) recommendation, that three casing volumes be purged before sample collection (TEGD, 1986). By definition, low yield wells were unable to efficiently recover and produce three casing volumes of water.

A static water level reading was taken upon arrival at each well and recorded to the nearest 0.01 foot. The water levels for the newly installed wells (MW-8 through MW-14) were measured with a water level indicator from the top of the protective metal casing to the nearest 0.01 ft. The water levels in the historical monitoring wells (MW-2 through MW-7) were measured only during the third sampling round and were measured from the top of the PVC casing. The probe of the water level indicator was rinsed with distilled water after measuring each well.

The field parameters were measured with a flow cell fitted with pH, temperature, and specific conductance probes. The pH meter was calibrated against two standards of known pH which bracketed the anticipated ground water pH. The specific conductance cell was calibrated using a standard which approximated the anticipated groundwater specific conductance.

High yield wells were purged continuously using a 3-5 gpm submersible pump until three well volumes were purged or until field parameters stabilized. Field parameters which included pH, temperature and specific conductance were measured after each casing volume was removed from the well. In general, the high yield wells were purged until three volumes of water had been removed.

Low yield wells were evacuated to dryness using a submersible pump and were allowed to recover until the amount of water required to fill the sample containers was present in the well casing. The low yield wells were allowed to recovery between two and ten hours. In some cases, the wells were fully recovered to the point that the water level returned to the static water level.

Sample Collection Procedures

The primary concern while collecting samples for analyses was to minimize physical alteration or chemical contamination of the sample during the withdrawal process. Once the wells were properly purged, samples were collected according to the following procedures.

A submersible pump was used in both high yield and low yield wells to obtain groundwater samples; however some of the required laboratory analyses dictated sampling with a bailer. Sampling low yield wells was completed in some instances with a bailer when the water level in the well dropped below the intake for the submersible pump. Both the pump and the bailer were thoroughly cleaned with distilled water and trisodium phosphate soap after each sampling event. Additionally, sampling personnel wore clean surgical gloves for purging and sampling at each well to eliminate the possibility of cross contamination.

Field measurements of pH, temperature, and specific conductance were obtained prior to collection of samples for laboratory analysis using the same instruments which were utilized during well purging. The probes were removed from the sample stream, and samples for laboratory analysis were collected. The probes were than cleaned with distilled water and trisodium phosphate soap.

Two laboratories were used during the program in order to obtain duplicate analyses. Core Laboratories was utilized to analyze the ground water samples from each well, and Barringer Laboratories was retained to analyze duplicate samples. Sampling procedures for both primary ground water and duplicate samples were identical. Duplicate samples were obtained from at least two wells during each of the sampling events.

All of the sample containers were precleaned and were supplied by the laboratories. The samples were sent to the laboratory in an unfiltered and unpreserved state. Upon arrival at the laboratory, the samples were filtered and preserved in accordance with EPA test methods where applicable. The containers were clearly marked for sample identification and with analytical parameters for which the sample was to be analyzed.

The samples were packed into iced coolers and transported by the sample collector to the laboratory. A tamper-proof custody seal was placed on the shipping container as verification that the samples had not been disturbed during transportation. Sufficient ice was added to the cooler to ensure that the samples were maintained at 4 degrees celsius (°C). Completed chain-of-custody forms were placed in a plastic bag and taped to the inside of the cooler lid to accompany the samples to the laboratory.

FIRST ROUND SAMPLING PROCEDURES

The first round sampling took place on May 1, 1991 and consisted of sampling ground water wells MW-8 through MW-14 after the wells had been developed. The wells were purged and ground water samples were collected with a 3-5 gpm submersible pump, with the exception of well MW-14. A bailer was used to purge and sample well MW-14 because the tubing connecting the submersible pump and the pump controller was not long enough to purge and sample the well. Wells MW-11 through MW-14 were purged dry during the first sampling event. Therefore, recommended evacuation of 3 casing volumes for these wells was not possible, and these wells were sampled upon their recovery. The following analyses were performed during this sampling round:

- Inorganics: pH, TDS, chloride, sulfate;
- Metals: arsenic, barium, calcium, iron, potassium, molybdenum, sodium, lead; and
- Radionuclides: gross alpha, gross beta, thorium-230, radium-226, isotopic uranium.

During the first round of sampling of the newly installed wells, an isotopic analysis of uranium was performed. This analysis consisted of analyzing uranium-234, uranium 235 and uranium-238. Duplicate samples were collected from well MW-8 and MW-10 as these wells exhibited yields which were sufficient to obtain the required sample volumes. A blank sample of distilled water was also submitted to Core Laboratory. Laboratory results and the chain-of-custody forms specifying the analytical methods are included in this Appendix.

SECOND ROUND SAMPLING PROCEDURES

The second round of sampling took place on June 20, 1991 and involved sampling ground water from MW-8 through MW-14. All purging and sampling activities were accomplished with a submersible pump. Wells MW-11 through MW-14 were purged dry, and therefore 3 casing volumes could not be removed prior to sampling. The following analyses were performed during the second round of sampling:

- Inorganics: pH, TDS, chloride, alkalinity, sulfate;
- Metals: arsenic, barium, calcium, iron, potassium, molybdenum, magnesium, sodium, lead, selenium, vanadium; and
- Radionuclides: gross alpha, gross beta, thorium-230, radium-226, total uranium.

Duplicate samples were collected from wells MW-8 and MW-10 and were submitted to Barringer Laboratory. A blank sample of distilled water was also submitted to Core Laboratory. The analytical methods specified and the chain-of-custody forms are presented with the laboratory results in this appendix.

THIRD ROUND SAMPLING PROCEDURES

The third round of sampling took place on August 1, 1991 and involved the sampling of ground water from MW-8 through MW-14 and also from wells MW-2 through MW-7 for quarterly monitoring. Purging was completed with a 3-5 gpm submersible pump in all wells except MW-5 which was bailed due to a minor problem with the generator which was later corrected. Wells MW-2, MW-4, MW-6, MW-9 and MW-11 through MW-14 were purged dry.

The majority of the sample collection was completed with the 3-5 gpm submersible pump; however, sample fractions for organic analyses from wells MW-8 through MW-14 were collected with a bailer. The samples collected for organic analyses were collected with a bailer to minimize sample aeration/volatilization. Additionally, no head space was left in the sample bottles intended for volatile organic compound analysis. The samples from wells MW-5, MW-6 and MW-14 were collected with a bailer. A bailer was used in MW-5 because of the previously-mentioned generator problem. Wells MW-6 and MW-14 were sampled with a bailer because the wells did not recover enough to allow adequate samples to be collected with the submersible pump.

The analytical schedule for the historical monitoring wells (MW-2 through MW-7) was based on previous quarterly sampling. The following analyses were performed on wells MW-2 through MW-7 during the third round of ground water sampling:

- Inorganics: TDS, chloride, ammonia as nitrogen;
- Metals: zinc; and
- Radionuclides: radium-226, lead-210, total uranium.

During the third round of sampling, additional analytical procedures were performed on wells MW-8 through MW-14. This included additional inorganic and metal parameters as compared to the other rounds and volatile and semivolatile organics analysis. The following analyses were performed on wells MW-8 through MW-14:

- Inorganics: pH, TDS, chloride, ammonia as nitrogen, alkalinity, sulfate;
- Metals: arsenic, barium, beryllium, cadmium, calcium, chromium, iron, potassium, molybdenum, magnesium, mercury, nickel, sodium, lead, selenium, vanadium;

- Radionuclides: gross alpha, gross beta, thorium-230, radium-226, total uranium;
- Semivolatile Organics: diethyl phthalate, 2-methylnapthalene, napthalene; and
- Volatile Organics: acetone, 2-butanone, chloroform, carbon disulfide, 1,2-dichloroethane, methylene chloride.

The organic fractions of these samples were analyzed by mass spectrography in order to identify any organic compounds present in the samples which resulted from operations at the facility. As such, the nontarget fractions of the organic analyses were specifically evaluated for the following compounds which were used at the facility: decyl alcohol and tributylphsophate.

Duplicate samples were collected from wells MW-5, MW-8 and MW-10 and were submitted to Barringer Laboratory. The preservatives for the duplicate samples for the third round of sampling were added to the containers in the laboratory; however, the samples were not filtered in the field. As a result, the metals and radiochemical analyses for the duplicate samples were not analyzed on a dissolved basis, but rather on a total basis. The inorganic fraction, with the exception of cyanide, was not preserved in the field and was filtered in the laboratory. The inorganics parameters for the duplicate sample were analyzed on a dissolved basis, with the exception of cyanide. Two blank samples of distilled water were also submitted to Core Laboratory. The laboratory results and the chain-of-custody forms specifying the analytical methods are presented with the laboratory results in this appendix.

GROUND WATER MEASUREMENTS FOR MONITOR WELLS.

Well Number	April 30, 1991		June 19, 1991		August 1, 1991	
	Depth of Water (ft)	Elevation of Water (ft)	Depth of Water (ft)	Elevation of Water (ft)	Depth of Water (ft)	Elevation of Water (ft)
MW-2	--	--	--	--	37.42	5490.6
MW-3	--	--	--	--	24.90	5528.1
MW-4	--	--	--	--	22.60	5504.4
MW-5	--	--	--	--	10.80	5595.2
MW-6	--	--	--	--	20.30	5550.7
MW-7	--	--	--	--	27.63	5503.4
MW-8	18.39	5590.6	18.60	5590.4	18.89	5590.1
MW-9	27.47	5521.5	28.94	5520.1	29.98	5519.0
MW-10	26.19	5516.8	28.71	5514.3	29.45	5504.5
MW-11	25.06	5500.9	27.26	5498.7	27.84	5498.2
MW-12	26.08	5503.9	26.37	5503.6	26.32	5503.7
MW-13	49.52	5507.5	11.90	5545.1	11.95	5545.1
MW-14	68.90	5544.1	68.70	5544.3	69.87	5543.1

Notes:

1. Depth to water measured from top of protective casing (TWP) for wells MW-8 through MW-14, but expressed as depth below ground surface.
2. Depth to water measured from top of PVC (TOC) for wells MW-2 through MW-7, but expressed as depth below ground surface.
3. Ground water elevation in feet above mean sea level (MSL).

GROUND WATER RESULTS

This section describes the results of the three ground water measurement and sampling rounds at the Durita site. The results were compared to applicable ground water standards, and the results of nearby wells were compared to each other. The following sections evaluate the results and characterize the ground water with respect to impacts that might be caused by the mill facility.

WATER LEVEL MEASUREMENTS

Water level elevations during each of the three sampling events indicate that the ground water flow direction is to the north-northwest. The water level elevations across the facility vary from 5590 to 5498 from the southern to northern sides of the facility. Ground water was less than 30 ft below ground surface in these wells, with the exception of well MW-14 located in the southeast corner of the facility. These measurements indicate that the flow gradient is steeper along the western and southern portion of the facility.

With the exception of the initial measurement in well MW-13, the water levels in the newly installed wells were within a variance of 0.5 ft between each of the sampling rounds. The difference in the water level in well MW-13 between initial sampling operations and the second round of sampling appears to be related to the well not fully recovering before the initial sampling effort after well installation. This well exhibits a low yield and was dewatered during each of the sampling episodes further indicating the well may not have fully recovered prior to initial sampling. The water levels during the second and third measurements were approximately the same at 11.9 ft below ground surface.

The water level measurements from the three sampling episodes for the newly installed wells were above the screened interval in the well. The water levels in wells MW-12 and MW-14 were less than one foot above the screened interval. The water levels in the remaining wells were 10 to 50 ft above the screened interval. As discussed in section D2.3, the well screens were placed with the top of the screened interval corresponding to the uppermost water bearing sandy zone. As such, the water levels are generally measurements of a potentiometric surface located at a shallower depth than the screened watering bearing zone.

During the third round of sampling, water levels at all of the wells at the facility were measured. The measurements from the historical monitoring wells and monitor wells MW-8 through MW-14 were compared to wells located within 400 ft of each other. The comparisons of water levels for the five groups of historic and newly installed wells were as follows:

- MW-8/MW-5: water elevation in historic well (MW-5) 5 ft higher;
- MW-9/MW-3: water elevation in historic well (MW-3) 9 ft higher;
- MW-10/MW-4: water elevations within one ft but wells are more than 200 ft apart;
- MW-11/MW-2: water elevation in historic well (MW-2) 8 ft deeper but screened interval of MW-2 is 70 ft deeper; and
- MW-12/MW-7: water elevations within one ft but wells are more than 200 ft apart.

The water levels in the historic monitoring wells appear to be less than 10 ft higher than the levels in the corresponding 4-in. diameter wells located within 200 ft. This discrepancy would probably arise from the lack of a surface seal at the historic monitoring wells (MW-2 through MW-7).

FIRST ROUND SAMPLING RESULTS

The inorganic, metal and radiochemical results from wells MW-8 through MW-14 are discussed in the following sections. The results of the duplicate samples from wells MW-8 and MW-10 correspond with results of the ground water samples for these two wells, and the parameters in the blank sample generally were below or slightly above their detection levels.

The TDS levels in the wells were all greater than the EPA drinking water standard of 500 ppm. The highest TDS concentration was 5980 ppm in well MW-12, and the average TDS level was 3700 ppm. The sulfate concentrations in the wells were also above the drinking water standard with the exception of well MW-13. The highest sulfate concentration from the first round samples was 3690 ppm in well MW-12, and the sulfate concentrations in wells MW-9 and MW-10 were greater than 2500 ppm. The pH levels ranged from 7.38 to 8.56, and were slightly above the drinking water standard of 8.5 in wells MW-13 and MW-14. The chloride concentrations in these wells varied from 22 to 65 ppm and were well below the secondary drinking water standard.

Arsenic, iron, lead, and molybdenum were generally below detection levels in the first round ground water samples. Iron was detected at a concentration slightly above the detection level in well MW-12 but was an order-of-magnitude below the secondary drinking standard. Arsenic was detected at 0.11 ppm in well MW-14 above the drinking water standard of 0.05 ppm; however, this well is an upgradient well located at the southeast portion of the facility. Barium was detected at concentrations ranging from 0.02 to 0.08 ppm, well below drinking water standard. The highest calcium, potassium, and sodium concentrations in the first round samples were 326, 20, and 1510 ppm, respectively. The calcium concentrations were greater than 100 ppm in wells MW-8, MW-9, MW-10 and MW-12, but were approximately 10 ppm in the other wells.

The gross alpha, gross beta, and thorium-230 activity levels were generally below the lower level of detection in the first round samples, with the exception of the gross alpha activity in well MW-14. The activity in this well (45.1 pCi/L) was greater than the drinking water standard, of 15 pCi/L but was slightly above the lower level of detection. Well MW-14 is an upgradient well located in the southeast corner of the facility. The Radium-226 activity levels were less than 1 pCi/L, also below the drinking water standard of 5 pCi/L. The highest uranium activity level was 9.9 pCi/L in well MW-13, and the activities in the wells in the eastern portion of the facility are higher than the remainder of the wells.

The uranium results for the first round samples are based on the total uranium present. The first round samples were analyzed for the individual uranium isotopes. The isotopes of Uranium-243 and Uranium-238 were detected at roughly equal activities, but Uranium-235 was generally below the lower level of detection.

SECOND ROUND SAMPLING RESULTS

The inorganic, metal and radiochemical results from wells MW-8 through MW-14 for the second round of sampling are discussed in the following sections. The results of the duplicate samples from wells MW-8 and MW-10 correspond with levels of the ground water samples for these two wells, and the parameters in the blank sample generally were below or slightly above their detection levels.

As with the first round of samples, the TDS levels in the wells were all greater than the EPA drinking water standard of 500 ppm, with a maximum TDS concentration of 5240 ppm in well MW-12. The average TDS level of wells MW-8 through MW-14 was 3700 ppm for the second round of ground water samples. The sulfate concentrations in all of the wells were also above the drinking water standard of 250 ppm during the second sampling round. The sulfate concentrations ranged from 444 to 3320 ppm in wells MW-13 and MW-12, respectively. The sulfate concentrations are highest in wells MW-9 through MW-12 which are located on the eastern and northern edges of the property; however, these levels are not significantly higher than in the upgradient well MW-14. The pH levels ranged from 7.43 to 8.69, and the pH levels in wells MW-13 and MW-14 were above the drinking water standard during the second round. The chloride concentrations

in these wells varied from 20 to 56 ppm and were well below the secondary drinking water standards. The alkalinity level varied from 346 to 1550 ppm, with the highest concentration in well MW-13.

Arsenic, lead, molybdenum, selenium, and vanadium were below detection levels in the second round ground water samples. Barium and iron were detected at concentrations ranging from 0.01 to 0.04 ppm and 0.03 to 0.15 ppm, but the concentrations of both of these metals were below drinking water standards. The highest calcium, potassium, sodium and magnesium concentrations in the second round samples were 354, 19, 1450 and 200 ppm, respectively. The calcium concentrations were distributed similarly in the second round samples compared to the first round of sampling. The magnesium concentrations exhibited a similar distribution as the calcium levels in that the concentrations in well MW-8, MW-9, MW-10, and MW-12 were an order of magnitude higher than in the remaining wells.

The elevated arsenic concentration identified in well MW-14 during the first round sample was not confirmed during the second round of sampling as the arsenic level in well MW-14 was below detection limits. The TDS and sulfate concentrations in well MW-11 each increased by approximately 1000 ppm.

The ratios of major anions to cations are similar for wells MW-13 and MW-14 due to the preponderance of calcium and relatively high levels of carbonate compared to sulfate. Wells MW-11 and MW-12 exhibit similar geochemical characteristics based on their preponderance of calcium and sulfate as well as the relatively low levels of carbonate. The geochemical characteristic of the three remaining wells are also similar in that the predominant compounds are calcium and sulfate with higher levels of sodium and magnesium than other wells.

The gross alpha, gross beta, and thorium-230 activity levels were below the lower level of detection in the second round samples, with the exception of the thorium-230 gross alpha activity in well MW-9. The thorium activity level in this well was less than the drinking water standard, and was slightly above the lower level of detection. The Radium-226 activity levels were less than the drinking water standard of 5 pCi/L, as were the first round samples. The highest uranium activity level was 9.2 pCi/L in well MW-14. The activities in the wells in the eastern portion of the facility were higher than the remainder of the wells.

THIRD ROUND SAMPLING RESULTS

As with the first and second rounds of samples, the TDS levels in the wells were all greater than the EPA drinking water standard of 500 ppm. The highest TDS concentration was 4900 ppm in well MW-9, and the average TDS level of the wells was 3700 ppm for ground water samples. The sulfate concentrations in all of the wells were also above the drinking water standard of 250 ppm during the third sampling round. The sulfate concentrations ranged from 1040 to 3030 ppm in wells MW-14 and MW-9, respectively. The average sulfate concentration during the third round was 2100 ppm. The pH levels ranged from 7.41 to 8.63. The pH levels in wells MW-13 and MW-14 were above the drinking water standard during the third round, as with the previous two sampling rounds. The chloride concentrations in these wells varied from 20 to 51 ppm and were well below the secondary drinking water standards. The alkalinity level varied from 348 to 1120 ppm, with the highest concentration in well MW-13.

Ammonia was analyzed during the third sampling round as nitrogen in accordance with the procedures for the quarterly sampling program. The nitrogen/ammonia concentrations varied from 0.76 to 4.11 ppm, but generally were approximately 1 ppm. Cyanide was not detected in wells MW-8 through MW-14 during the third round sampling.

Arsenic, beryllium, cadmium, chromium, iron, lead, mercury, nickel, selenium, silver and vanadium were below detection levels in the third round of ground water samples. Molybdenum was generally below detection levels but was detected at 0.08 ppm in well MW-13. Barium concentrations ranged from 0.01 to 0.03 ppm, but the concentrations of both of were well below drinking water standards. The highest calcium, potassium, sodium and magnesium concentrations in the third round samples were 386, 21, 1530 and 218 ppm, respectively. The calcium and magnesium concentrations exhibited a similar distribution as the calcium levels in that the concentrations in well MW-8, MW-9, MW-10, and MW-12 were an order of

magnitude higher than in the remaining wells.

The elevated iron concentration identified in well MW-11 during the second round of sampling was not confirmed in well MW-11 during the third or first round of sampling. The TDS levels in Well MW-12 have decreased approximately 500 ppm between each of the sampling periods, while the TDS and carbonate levels in well MW-13 have been increasing by approximately the same amount during each sampling event. The TDS level in well MW-14 also have been decreasing throughout the sampling time frame.

The duplicate samples for the third round were analyzed on a total dissolved basis for some of the analytes. The metal, radiochemical and cyanide methods were analyzed on a total basis. As such, the duplicate samples exhibit higher levels for most of the metals and for cyanide; however, the inorganic analyses are generally comparable between the duplicate and ground water samples.

The geochemical characteristics of the ground water based on the third round samples are similar to those identified during the second round. The ratios of major anions to cations are similar for wells MW-13 and MW-14 due to the preponderance of calcium and relatively high levels of carbonate compared to sulfate. The ratio of carbonate to sulfate is higher for these wells during this round of sampling. Wells MW-11 and MW-12 exhibit similar geochemical characteristics based on their preponderance of calcium and sulfate as well as the relatively low levels of carbonate, although the carbonate levels increased during the third round of sampling. The geochemical characteristic of the three remaining wells are also similar in that the predominant compounds are calcium and sulfate with higher levels of sodium and magnesium than other wells. The actual concentrations of the anions and cations are lower in well MW-8 than in wells MW-9 and MW-10, although the percentages are similar between the three wells.

The gross alpha and gross beta activity levels were below the lower level of detection in the third round samples. The thorium-230 activity levels were higher during the third round of sampling than in the previous sampling events; however, the activity levels were only slightly above the lower level of detection and were well below drinking water standard of 60 pCi/L. The Radium-226 activity levels were slightly above the lower level of detection and were less than the drinking water standard of 5 pCi/L. The highest uranium activity level was 20.0 pCi/L in well MW-13. As with the previous two sampling rounds, the uranium activities in the wells in the eastern portion of the facility were higher than the wells in remainder of the facility.

The third round samples were analyzed for volatile and semivolatile organic compounds, and the nontarget compounds identified during mass spectrography were subjected to a library search to identify the compound. The library search was specially geared to the compounds which had been used at the facility during operations. The target volatile and semivolatile organics were below detection levels in all of the samples, and none of the compounds utilized in the ore processing operations at the Durita facility were found above detection limits. The duplicate samples did not contain target organic compounds, but the duplicate sample for MW-8 did contain a nontarget compound identified as decyl alcohol at trace levels. Decyl alcohol was not identified in the MW-8 sample or in any of the other ground water samples.

The TDS levels in the historical wells were all greater than the EPA drinking water standard of 500 ppm. The highest TDS concentration was 5510 ppm in well MW-6, and the average TDS level of the historic wells was 3700 ppm. The sulfate concentrations in all of the wells were also above the drinking water standard of 250 ppm with an average sulfate concentration of 2400 ppm. The sulfate concentrations ranged from 1170 to 3420 ppm in wells MW-2 and MW-6, respectively. The chloride concentrations in these wells varied from 25 to 125 ppm and were well below the secondary drinking water standards. Ammonia was analyzed during the historical monitoring wells in accordance with the procedures for the quarterly sampling program. The nitrogen/ammonia concentrations varied from 0.5 to 13.3 ppm. The zinc concentrations were below the detection level or when above the detection level were well below the secondary drinking water standard.

The Radium-226 activity levels in the historical wells were slightly above the lower level of detection and were less than the drinking water standard of 5 pCi/L. The highest uranium activity level was 11.3 pCi/L in well MW-13. The uranium levels in the remaining wells were below 5 pCi/L. The lead-210 activity levels were generally below the lower level of detection.

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-8	pH	unit	6.3-8.5	7.56	7.65	7.51
	TDS	mg/L	500[1]	2300	2280	2300
	Alkalinity	mg/L	--	--	346	348
	Chloride	mg/L	250[2]	22	20	20
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	1.12
	Sulfate	mg/L	250[2]	1300	1280	1280
	Arsenic	mg/L	0.05	<0.01	<0.01	<0.1
	Barium	mg/L	1.0	0.02	0.01	0.01
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	200	186	181
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	0.15	<0.03
	Lead	mg/L	0.05	<0.005	<0.005	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	102	98
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	10	10.6	10.1
	Selenium	mg/L	0.01	--	<0.01	<0.01
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	396	381	396
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	16.1±16.6[5]	6.8±21.4[5]	0.0±15.4[5]
	Gross Beta	pCi/L	--	27.7±12.4	17.2±13.4[5]	17±11.8[5]
	Th-230	pCi/L	60	0.1±0.2[5]	0.0±0.4[5]	0.7±0.5
	Ra-226	pCi/L	5	0.9±0.4	0.7±0.3	0.8±0.4
	U-Total	pCi/L	--	5.4±3.6	0.7±0.7[5]	0.7±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-8d[6]	pH	unit	6.3-8.5	7.66	7.74	7.54
	TDS	mg/L	500[1]	2180	2030	2130
	Alkalinity	mg/L	--	--	344	377
	Chloride	mg/L	250[2]	23	24	19
	Cyanide	mg/L	0.20	--	--	0.13
	Ammonia (Nitrogen)	mg/L	--	--	--	1.1
	Sulfate	mg/L	250[2]	1300	1280	1280
	Arsenic	mg/L	0.05	<0.01	<0.001	<0.001
	Barium	mg/L	1.0	0.02	0.01	0.01
	Beryllium	mg/L	0.1	--	--	0.15
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	187	152	142
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	0.02	<0.01	<0.02
	Lead	mg/L	0.05	0.00	<0.02	0.004
	Mercury	mg/L	0.002	--	--	<0.0002
	Magnesium	mg/L	--	--	89	72.3
	Molybdenum	mg/L	--	<0.01	<0.01	0.04
	Nickel	mg/L	0.20[3]	--	--	<0.01
	Potassium	mg/L	--	12	11	12
	Selenium	mg/L	0.01	--	<0.002	<0.001
	Silver	mg/L	0.05	--	--	0.02
	Sodium	mg/L	--	357	348	438
	Vanadium	mg/L	--	--	<0.01	0.02
	Gross Alpha	pCi/L	15	0.0±17.0[5]	0.0±15.0[5]	7±15[5]
	Gross Beta	pCi/L	--	10±16.0[5]	14.0±8.0	11±9
	Th-230	pCi/L	60	2.7±1.0	0.0±0.8[5]	0.0±0.6[5]
	Ra-226	pCi/L	5	0.2±0.2	0.5±0.3	0.4±0.4
	U-Total	pCi/L	--	2.1±3.4	0.8±0.2	0.2±0.2

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).
[6] Duplicate sample analyzed by separate laboratory. The metals and radiochemical parameters analyzed on a total basis in August 1, 1991 duplicate samples.

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-9	pH	unit	6.3-8.5	7.38	7.43	7.41
	TDS	mg/L	500[1]	4600	4850	4900
	Alkalinity	mg/L	--	--	393	471
	Chloride	mg/L	250[2]	27	35	36
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	4.11
	Sulfate	mg/L	250[2]	2790	2980	3030
	Arsenic	mg/L	0.05	<0.01	<0.05	<0.01
	Barium	mg/L	1.0	0.02	0.01	0.02
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	326	354	386
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	0.03	<0.03
	Lead	mg/L	0.05	<0.005	<0.005	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	200	218
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	20	19	21.0
	Selenium	mg/L	0.01	--	<0.01	<0.01
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	811	787	771
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	0.0±27.5[5]	0.0±35.7[5]	0.0±29.4[5]
	Gross Beta	pCi/L	--	37.0±20.2[5]	17.2±25.4[5]	10.0±21.7[5]
	Th-230	pCi/L	60	0.1±0.4[5]	1.3±0.6	0.9±0.6
	Ra-226	pCi/L	5	0.2±0.2	0.9±0.4	0.4±0.3
	U-Total	pCi/L	--	0.3±1.6[5]	0.7±0.7[5]	0.7±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-10	pH	unit	6.3-8.5	7.79	7.69	7.62
	TDS	mg/L	500[1]	4260	4230	4180
	Alkalinity	mg/L	--	--	529	525
	Chloride	mg/L	250[2]	46	56	51
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	1.52
	Sulfate	mg/L	250[2]	2440	2560	2480
	Arsenic	mg/L	0.05	<0.01	<0.1	<0.1
	Barium	mg/L	1.0	0.02	0.01	<0.01
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	154	169	147
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	0.04	<0.03
	Lead	mg/L	0.05	<0.005	<0.005	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	105	90
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	12	11	9.3
	Selenium	mg/L	0.01	--	<0.1	<0.05
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	1250	1300	1100
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	2.3±28.6[5]	0.0±38.9[5]	0.0±28.2[5]
	Gross Beta	pCi/L	--	25.7±19.6[5]	11.0±14.0[5]	11.3±18.8[5]
	Th-230	pCi/L	60	0.2±0.5[5]	0.0±0.4[5]	0.6±0.7[5]
	Ra-226	pCi/L	5	0.6±0.4	0.7±0.4	1.4±0.5
	U-Total	pCi/L	--	3.8±4.1	2.5±0.7	4.0±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-10d[6]	pH	unit	6.3-8.5	7.68	7.73	7.54
	TDS	mg/L	500[1]	4170	4050	4070
	Alkalinity	mg/L	--	--	553	562
	Chloride	mg/L	250[2]	53	58	58
	Cyanide	mg/L	0.20	--	--	<0.01
	Ammonia (Nitrogen)	mg/L	--	--	--	1.9
	Sulfate	mg/L	250[2]	2420	2439	2680
	Arsenic	mg/L	0.05	0.07	<0.001	<0.001
	Barium	mg/L	1.0	0.03	<0.01	0.16
	Beryllium	mg/L	0.1	--	--	0.02
	Cadmium	mg/L	0.01	--	--	0.26
	Calcium	mg/L	--	144	96	138
	Chromium	mg/L	0.05	--	--	1.92
	Iron	mg/L	0.3[2]	<0.01	<0.01	0.14
	Lead	mg/L	0.05	0.004	<0.02	0.006
	Mercury	mg/L	0.002	--	--	<0.0002
	Magnesium	mg/L	--	--	76	85
	Molybdenum	mg/L	--	<0.01	<0.01	<0.01
	Nickel	mg/L	0.20[3]	--	--	<0.01
	Potassium	mg/L	--	14	10	11
	Selenium	mg/L	0.01	--	<0.002	<0.001
	Silver	mg/L	0.05	--	--	0.02
	Sodium	mg/L	--	1040	992	1060
	Vanadium	mg/L	--	--	<0.01	0.02
	Gross Alpha	pCi/L	15	0.0±24.0[5]	7.0±24.0[5]	29±30[5]
	Gross Beta	pCi/L	--	13.0±18.0[5]	11.0±14.0[5]	18±16
	Th-230	pCi/L	60	0.2±0.8[5]	0.0±0.4[5]	0.2±0.6[5]
	Ra-226	pCi/L	5	0.6±0.4	0.7±0.4	0.6±0.4
	U-Total	pCi/L	--	3.8±4.1	0.2±0.2	0.2±0.2

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).
[6] Duplicate sample analyzed by separate laboratory. The metals and radiochemical parameters analyzed on a total basis in August 1, 1991 duplicate

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-11	pH	unit	6.3-8.5	8.24	8.44	8.29
	TDS	mg/L	500[1]	3510	4580	4490
	Alkalinity	mg/L	--	--	746	764
	Chloride	mg/L	250[2]	34	42	43
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	1.54
	Sulfate	mg/L	250[2]	1790	2580	2560
	Arsenic	mg/L	0.05	<0.01	<0.1	<0.1
	Barium	mg/L	1.0	0.04	0.04	0.03
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	10.0	9.6	10.0
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	<0.03	<0.03
	Lead	mg/L	0.05	<0.005	0.012	<0.03
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	4.0	4.1
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	4.0	4.3	4.0
	Selenium	mg/L	0.01	--	<0.1	<0.1
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	1320	1450	1530
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	0.0±33.3[5]	30.2±50.2[5]	0.0±31.8[5]
	Gross Beta	pCi/L	--	18.9±24.5[5]	11.3±32.4[5]	0.0±22.2[5]
	Th-230	pCi/L	60	0.0±0.2[5]	0.1±0.5[5]	1.0±0.7
	Ra-226	pCi/L	5	0.5±0.3	0.5±0.3	0.3±0.3
	U-Total	pCi/L	--	2.0±1.5	0.7±0.7[5]	1.3±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-12	pH	unit	6.3-8.5	7.73	8.31	8.16
	TDS	mg/L	500[1]	5980	5240	4820
	Alkalinity	mg/L	--	--	456	472
	Chloride	mg/L	250[2]	65	43	25
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	1.41
	Sulfate	mg/L	250[2]	3690	3320	2920
	Arsenic	mg/L	0.05	<0.1	<0.1	<0.1
	Barium	mg/L	1.0	0.03	0.03	0.03
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	308	177	108
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	0.04	0.05	<0.03
	Lead	mg/L	0.05	<0.005	<0.005	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	78	35
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	16	9.3	6.4
	Selenium	mg/L	0.01	--	<0.2	<0.1
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	1510	1340	1340
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	12.1±39.4[5]	11.4±52.3[5]	0.0±37.1[5]
	Gross Beta	pCi/L	--	38.6±26.4[5]	36.2±32.9[5]	0.0±21.4[5]
	Th-230	pCi/L	60	0.0±0.2[5]	0.0±0.4[5]	1.1±0.07
	Ra-226	pCi/L	5	0.5±0.3	0.4±0.3	0.1±0.2[5]
	U-Total	pCi/L	--	9.4±2.0	2.4±0.7	2.0±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-13	pH	unit	6.3-8.5	8.53	8.69	8.52
	TDS	mg/L	500[1]	1940	2310	2860
	Alkalinity	mg/L	--	--	1550	1120
	Chloride	mg/L	250[2]	34	37	42
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	1.13
	Sulfate	mg/L	250[2]	167	444	1130
	Arsenic	mg/L	0.05	<0.01	<0.01	<0.1
	Barium	mg/L	1.0	0.08	0.04	0.03
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	17	8.0	9.0
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	0.03	<0.03
	Lead	mg/L	0.05	<0.005	<0.005	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	5.2	5.4
	Molybdenum	mg/L	--	<0.05	<0.05	0.08
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	3.8	4.4	4.5
	Selenium	mg/L	0.01	--	<0.01	<0.1
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	799	873	991
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	0.0±15.4[5]	3.0±27.2[5]	0.0±23.7[5]
	Gross Beta	pCi/L	--	8.5±13.5[5]	16.5±17.3[5]	5.6±14.8[5]
	Th-230	pCi/L	60	0.2±0.3[5]	0.3±0.5[5]	0.9±0.6
	Ra-226	pCi/L	5	0.3±0.3	0.2±0.2	0.5±0.3
	U-Total	pCi/L	--	9.9±2.4	1.2±0.7	20.0±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991[4]
MW-14	pH	unit	6.3-8.5	8.56	8.61	8.63
	TDS	mg/L	500[1]	3520	2740	2510
	Alkalinity	mg/L	--	--	907	1060
	Chloride	mg/L	250[2]	36	32	37
	Cyanide	mg/L	0.20	--	--	<0.02
	Ammonia (Nitrogen)	mg/L	--	--	--	0.76
	Sulfate	mg/L	250[2]	1890	1140	1040
	Arsenic	mg/L	0.05	0.11	<0.1	<0.1
	Barium	mg/L	1.0	0.05	0.03	0.03
	Beryllium	mg/L	0.1	--	--	<0.005
	Cadmium	mg/L	0.01	--	--	<0.005
	Calcium	mg/L	--	11	6.6	6.6
	Chromium	mg/L	0.05	--	--	<0.01
	Iron	mg/L	0.3[2]	<0.03	0.05	<0.03
	Lead	mg/L	0.05	<0.005	0.012	<0.005
	Mercury	mg/L	0.002	--	--	<0.0003
	Magnesium	mg/L	--	--	2.4	2.3
	Molybdenum	mg/L	--	<0.05	<0.05	<0.05
	Nickel	mg/L	0.20[3]	--	--	<0.04
	Potassium	mg/L	--	3.8	5.2	4.6
	Selenium	mg/L	0.01	--	<0.1	<0.1
	Silver	mg/L	0.05	--	--	<0.01
	Sodium	mg/L	--	1300	1050	871
	Vanadium	mg/L	--	--	<0.05	<0.05
	Gross Alpha	pCi/L	15	45.1±31.6	32.2±34.5[5]	7.0±22.0[5]
	Gross Beta	pCi/L	--	9.3±19.2[5]	19.8±21.8[5]	0.0±14.1[5]
	Th-230	pCi/L	60	0.3±0.4[5]	0.0±0.4[5]	0.6±0.4
	Ra-226	pCi/L	5	0.4±0.3	0.5±0.3	0.1±0.2[5]
	U-Total	pCi/L	--	6.9±2.2	9.2±0.7	9.3±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[3] CDH Agricultural Standards.
[4] Organic analytes below detection limits in August 1, 1991 sample
[5] Activity level below lower level of detection (LLD).

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991
MW-2	TDS	mg/L	500[1]	--	--	3120
	Chloride	mg/L	250[2]	--	--	75
	Ammonia (Nitrogen)	mg/L	--	--	--	0.99
	Sulfate	mg/L	250[2]	--	--	1170
	Zinc	mg/L	5[2]	--	--	0.02
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	0.2±0.2
	U-Total	pCi/L	--	--	--	4.0±0.7
MW-3	TDS	mg/L	500[1]	--	--	4870
	Chloride	mg/L	250[2]	--	--	62
	Ammonia (Nitrogen)	mg/L	--	--	--	13.3
	Sulfate	mg/L	250[2]	--	--	2820
	Zinc	mg/L	5[2]	--	--	<0.01
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	1.3±0.2
	U-Total	pCi/L	--	--	--	1.3±0.7
MW-4	TDS	mg/L	500[1]	--	--	4340
	Chloride	mg/L	250[2]	--	--	70
	Ammonia (Nitrogen)	mg/L	--	--	--	0.67
	Sulfate	mg/L	250[2]	--	--	2650
	Zinc	mg/L	5[2]	--	--	<0.01
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	0.3±0.3
	U-Total	pCi/L	--	--	--	3.3±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[5] Activity level less than lower level of detection.

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991
MW-5	TDS	mg/L	500[1]	--	--	2590
	Chloride	mg/L	250[2]	--	--	25
	Ammonia (Nitrogen)	mg/L	--	--	--	0.05
	Sulfate	mg/L	250[2]	--	--	1480
	Zinc	mg/L	5[2]	--	--	0.02
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	1.5±0.6
	U-Total	pCi/L	--	--	--	5.3±0.7
MW-6	TDS	mg/L	500[1]	--	--	5510
	Chloride	mg/L	250[2]	--	--	125
	Ammonia (Nitrogen)	mg/L	--	--	--	0.25
	Sulfate	mg/L	250[2]	--	--	3420
	Zinc	mg/L	5[2]	--	--	0.11
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	0.4±0.3
	U-Total	pCi/L	--	--	--	11.3±0.7
MW-7	TDS	mg/L	500[1]	--	--	4190
	Chloride	mg/L	250[2]	--	--	22
	Ammonia (Nitrogen)	mg/L	--	--	--	0.28
	Sulfate	mg/L	250[2]	--	--	2730
	Zinc	mg/L	5[2]	--	--	0.32
	Pb-210	pCi/L	--	--	--	±
	Ra-226	pCi/L	5	--	--	0.5±0.2
	U-Total	pCi/L	--	--	--	4.7±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[5] Activity level less than lower level of detection.

GROUND WATER QUALITY

Well Number	Sample Analyte	Units	CDH Human Health Standards	Date Well Sampled		
				May 1, 1991	June 20, 1991	August 1, 1991
MW-5d[6]	TDS	mg/L	500[1]	--	--	2350
	Chloride	mg/L	250[2]	--	--	28
	Ammonia (Nitrogen)	mg/L	--	--	--	0.3
	Sulfate	mg/L	250[2]	--	--	1560
	Zinc	mg/L	5[2]	--	--	0.24
	Pb-210	pCi/L	--	--	--	0.±3.2[5]
	Ra-226	pCi/L	5	--	--	2.1±1.0
	U-Total	pCi/L	--	--	--	4.9±0.7

[1] EPA secondary MCL listed for TDS, CDH Drinking Water Standard based on 1.25 times background concentration.
[2] CDH secondary Drinking Water Standard.
[5] Activity level less than lower level of detection.
[6] Duplicate sample analyzed by separate laboratory. The metals and radiochemical parameters analyzed on a total basis in the August 1, 1991 duplicate sample

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CORE LABORATORIES

ANALYTICAL REPORT

911474

FOR

APPLIED ENVIRONMENTAL
John England
6143 S. Willow Drive
ENGLEWOOD, CO 80111

09/27/91

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/30/91
TIME SAMPLED.....: 17:45
WORK DESCRIPTION...: MW-2

LABORATORY I.D...: 911474-0001
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES. IN LAB (1 GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	75	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	0.99	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
Solids, Total Dissolved (TDS)	3120	10	mg/L	160.1 (1)	08/06/91	DTJ
Sulfate (Filt.)	1170	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.006	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	0.02	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	0.8		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	2.0		pCi/l		09/19/91	CA
Lead 210, diss., LLD	3.4		pCi/l		09/19/91	CA
Radium 226, dissolved	0.2		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.2		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Naggar

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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 19:15
WORK DESCRIPTION...: MW-3

LABORATORY I.D...: 911474-0002
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	62	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	13.3	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
Solids, Total Dissolved (TDS)	4870	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	2820	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.002	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	0.8		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	0.9		pCi/l		09/19/91	CA
Lead 210, diss., LLD	1.4		pCi/l		09/19/91	CA
Radium 226, dissolved	1.3		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.5		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Hagger

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 17:00
WORK DESCRIPTION...: MW-4

LABORATORY I.D...: 911474-0003
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	70	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	0.67	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
Solids, Total Dissolved (TDS)	4340	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	2650	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.005	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	1.0		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	0.9		pCi/l		09/19/91	CA
Lead 210, diss., LLD	1.4		pCi/l		09/19/91	CA
Radium 226, dissolved	0.3		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Naggar

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 20:00
WORK DESCRIPTION...: MW-5

LABORATORY I.D...: 911474-0004
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	25	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	0.05	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
Solids, Total Dissolved (TDS)	2590	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	1480	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.008	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	0.02	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	0.9		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	0.9		pCi/l		09/19/91	CA
Lead 210, diss., LLD	1.4		pCi/l		09/19/91	CA
Radium 226, dissolved	1.5		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.6		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Moggs

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 17:45
WORK DESCRIPTION...: MW-6

LABORATORY I.D...: 911474-0005
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	125	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	0.25	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
Solids, Total Dissolved (TDS)	5510	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	3420	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.017	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	0.11	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	1.2		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	1.6		pCi/l		09/19/91	CA
Lead 210, diss., LLD	2.5		pCi/l		09/19/91	CA
Radium 226, dissolved	0.4		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Mapper

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 16:15
WORK DESCRIPTION...: MW-7

LABORATORY I.D...: 911474-0006
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	22	1	mg/L	325.2 (1)	08/12/91	DTJ
Nitrogen, Ammonia (Filt.)	0.28	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
Solids, Total Dissolved (TDS)	4190	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	2730	10	mg/L	375.3 (1)	08/21/91	KJZ
Uranium, Diss. (U)	0.007	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	0.32	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	0.7		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	0.9		pCi/l		09/19/91	CA
Lead 210, diss., LLD	1.4		pCi/l		09/19/91	CA
Radium 226, dissolved	0.5		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen J. Noggle

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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 08/02/91
TIME SAMPLED.....: 16:15
WORK DESCRIPTION...: MW-BLANK B

LABORATORY I.D...: 911474-0007
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Chloride (Filt.)	<1	1	mg/L	325.2 (1)	08/12/91	MW
Nitrogen, Ammonia (Filt.)	0.03	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
Solids, Total Dissolved (TDS)	<10	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	<10	10	mg/L	375.2 (1)	08/16/91	DTJ
Uranium, Diss. (U)	0.001	0.001	mg/L	908.1 (1)	09/03/91	CA
Zinc, Diss. (Zn)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/28/91	TLK
Lead 210, dissolved	0.2		pCi/l		09/19/91	CA
Lead 210, diss., error, +/-	0.9		pCi/l		09/19/91	CA
Lead 210, diss., LLD	1.4		pCi/l		09/19/91	CA
Radium 226, dissolved	0.1		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.2		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA

APPROVED BY: Ellen G. Taylor

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(303) 751-1780

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/30/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW-8

LABORATORY I.D...: 911474-0008
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	348	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	20	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	1.12	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
pH (Filt.)	7.51	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	2300	10	mg/L	160.1 (1)	08/06/91	DTJ
Sulfate (Filt.)	1280	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	181	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/07/91	AEB
Magnesium, Diss. (Mg)	97.5	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	10.1	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.01	0.01	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	396	5	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Magner

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09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/30/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW-8

LABORATORY I.D...: 911474-0008
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.001	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	15.4		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	27.3		pCi/l		08/30/91	CA
Gross Beta, dissolved	17.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	11.8		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	18.3		pCi/l		08/30/91	CA
Radium 226, dissolved	0.8		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.4		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.7		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.5		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.6		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/08/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/26/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

APPROVED BY: Ellen J. Hagger

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09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 10:00
WORK DESCRIPTION...: MW-9

LABORATORY I.D...: 911474-0009
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	471	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	36	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	4.11	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
pH (Filt.)	7.41	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	4900	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	3030	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.02	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	386	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/07/91	AEB
Magnesium, Diss. (Mg)	218	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	21.0	0.05	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.01	0.01	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	771	5	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Rodgers

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09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 10:00
WORK DESCRIPTION...: MW-9

LABORATORY I.D...: 911474-0009
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.005	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	29.4		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	53.1		pCi/l		08/30/91	CA
Gross Beta, dissolved	10.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	21.7		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	35.6		pCi/l		08/30/91	CA
Radium 226, dissolved	0.4		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.9		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.6		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.6		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/08/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/26/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 08:30
WORK DESCRIPTION...: MW-10

LABORATORY I.D...: 911474-0010
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	525	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	51	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	1.52	0.01	mg/L (as N)	350.1 (1)	08/13/91	MW
pH (Filt.)	7.62	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	4180	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	2480	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	147	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/07/91	AEB
Magnesium, Diss. (Mg)	89.5	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	9.3	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.05	0.05	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	1100	20	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Hoffer

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LABORATORY I.D...: 911474-0010
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TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.006	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	28.2		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	54.1		pCi/l		08/30/91	CA
Gross Beta, dissolved	11.3		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	18.8		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	30.5		pCi/l		08/30/91	CA
Radium 226, dissolved	1.4		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.5		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.6		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.5		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.7		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/08/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/26/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

APPROVED BY: Ellen J. Naffah

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 10:50
WORK DESCRIPTION...: MW-11

LABORATORY I.D...: 911474-0011
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	764	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	43	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	1.54	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
pH (Filt.)	8.29	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	4490	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	2560	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.03	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	10.0	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/09/91	AEB
Magnesium, Diss. (Mg)	4.1	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	4.0	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.1	0.1	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	1530	20	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Naylor

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09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 10:50
WORK DESCRIPTION...: MW-11

LABORATORY I.D...: 911474-0011
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.002	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	31.8		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	56.2		pCi/l		08/30/91	CA
Gross Beta, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	22.2		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	37.7		pCi/l		08/30/91	CA
Radium 226, dissolved	0.3		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	1.0		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.7		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.6		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/09/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/27/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

APPROVED BY: Ellen J. Noggle

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/30/91
TIME SAMPLED.....: 14:00
WORK DESCRIPTION...: MW-12

LABORATORY I.D...: 911474-0012
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	472	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	25	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	1.41	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
pH (Filt.)	8.16	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	4820	10	mg/L	160.1 (1)	08/06/91	DTJ
Sulfate (Filt.)	2920	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.03	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	108	0.5	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/07/91	AEB
Magnesium, Diss. (Mg)	34.8	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	6.4	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.1	0.1	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	1340	20	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Hoffgen

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/30/91
TIME SAMPLED.....: 14:00
WORK DESCRIPTION...: MW-12

LABORATORY I.D...: 911474-0012
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.003	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	37.1		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	63.6		pCi/l		08/30/91	CA
Gross Beta, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	21.4		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	35.9		pCi/l		08/30/91	CA
Radium 226, dissolved	0.1		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.2		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	1.1		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.7		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.5		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/08/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/27/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

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LABORATORY TESTS RESULTS
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JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 14:45
WORK DESCRIPTION...: MW-13

LABORATORY I.D...: 911474-0013
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	1120	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	42	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	1.13	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
pH (Filt.)	8.52	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	2860	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	1130	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.03	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	9.0	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/09/91	AEB
Magnesium, Diss. (Mg)	5.4	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	0.08	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	4.5	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.1	0.1	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	991	5	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Ellen J. Naggar

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 14:45
WORK DESCRIPTION...: MW-13

LABORATORY I.D...: 911474-0013
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.030	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	23.7		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	43.3		pCi/l		08/30/91	CA
Gross Beta, dissolved	5.6		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	14.8		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	24.4		pCi/l		08/30/91	CA
Radium 226, dissolved	0.5		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.3		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.9		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.6		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.6		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/09/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/27/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	35	10	ug/L			
Naphthalene	27	10	ug/L			

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LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW-14

LABORATORY I.D...: 911474-0014
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	1060	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	37	1	mg/L	325.2 (1)	08/12/91	DTJ
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	0.76	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
pH (Filt.)	8.63	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	2510	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	1070	10	mg/L	375.3 (1)	08/21/91	KJZ
Arsenic, Diss. (As)	<0.1	0.1	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	0.02	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	6.6	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/09/91	AEB
Magnesium, Diss. (Mg)	2.3	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	4.6	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.1	0.1	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	871	5	mg/L	200.7/6010 (1,2)	08/23/91	TLK

APPROVED BY: Eileen J. McGregor

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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 07/31/91
TIME SAMPLED.....: 18:00
WORK DESCRIPTION...: MW-14

LABORATORY I.D...: 911474-0014
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.014	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	7.5		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	22.0		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	35.4		pCi/l		08/30/91	CA
Gross Beta, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	14.1		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	23.7		pCi/l		08/30/91	CA
Radium 226, dissolved	0.1		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.2		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.6		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.4		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.5		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/09/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/27/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

APPROVED BY: Ellen J. Mayer

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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 08/02/91
TIME SAMPLED.....: 16:00
WORK DESCRIPTION...: MW-BLANK A

LABORATORY I.D...: 911474-0015
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Alkalinity, Total (Filt.)	<5	5	mg/L CaCO3	310.1 (1)	08/12/91	MRC
Chloride (Filt.)	<1	1	mg/L	325.2 (1)	08/12/91	MW
Cyanide, Total (Filt.)	<0.02	0.02	mg/L	335.2 (1)	08/08/91	DTJ
Nitrogen, Ammonia (Filt.)	0.06	0.01	mg/L (as N)	350.1 (1)	08/08/91	DTJ
pH (Filt.)	6.19	0.01	pH Units	150.1 (1)	08/12/91	MRC
Solids, Total Dissolved (TDS)	<10	10	mg/L	160.1 (1)	08/07/91	MRC
Sulfate (Filt.)	<10	10	mg/L	375.2 (1)	08/16/91	DTJ
Arsenic, Diss. (As)	<0.01	0.01	mg/L	206.2 (1)	08/30/91	WGL
Barium, Diss. (Ba)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Beryllium, Diss. (Be)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Cadmium, Diss. (Cd)	<0.005	0.005	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Calcium, Diss. (Ca)	0.2	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Chromium, Diss. (Cr)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Iron, Diss. (Fe)	<0.03	0.03	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Lead, Diss. (Pb)	<0.005	0.005	mg/L	239.2 (1)	08/23/91	WGL
Mercury, Diss. (Hg)	<0.0003	0.0003	mg/L	245.1 (1)	08/09/91	AEB
Magnesium, Diss. (Mg)	<0.1	0.1	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Molybdenum, Diss. (Mo)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Nickel, Diss. (Ni)	<0.04	0.04	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Potassium, Diss. (K)	0.07	0.01	mg/L	258.1 (1)	09/11/91	TLK
Selenium, Diss. (Se)	<0.01	0.01	mg/L	270.2 (1)	08/20/91	GG
Silver, Diss. (Ag)	<0.01	0.01	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Sodium, Diss. (Na)	0.30	0.01	mg/L	273.2 (1)	08/28/91	TLK

APPROVED BY: Ellen J. Noyes

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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: 08/02/91
TIME SAMPLED.....: 16:00
WORK DESCRIPTION...: MW-BLANK A

LABORATORY I.D...: 911474-0015
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....: FILT & PRES IN LAB (1-1GAL PE)

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
Uranium, Diss. (U)	0.003	0.001	mg/L	908.1 (1)	09/03/91	CA
Vanadium, Diss. (V)	<0.05	0.05	mg/L	200.7/6010 (1,2)	08/23/91	TLK
Gross Alpha, dissolved	0.0		pCi/l	EPA 900.0	08/30/91	CA
Gross Alpha, diss., error, +/-	0.9		pCi/l		08/30/91	CA
Gross Alpha, diss., LLD	1.7		pCi/l		08/30/91	CA
Gross Beta, dissolved	0.1		pCi/l	EPA 900.0	08/30/91	CA
Gross Beta, diss., error, +/-	1.6		pCi/l		08/30/91	CA
Gross Beta, diss., LLD	2.7		pCi/l		08/30/91	CA
Radium 226, dissolved	0.0		pCi/l	EPA 903.1	09/10/91	CA
Radium 226, diss., error, +/-	0.1		pCi/l		09/10/91	CA
Radium 226, diss., LLD	0.2		pCi/l		09/10/91	CA
Thorium 230, dissolved	0.4		pCi/l		09/10/91	CA
Thorium 230, diss., error, +/-	0.5		pCi/l		09/10/91	CA
Thorium 230, diss., LLD	0.5		pCi/l		09/10/91	CA
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/09/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			
8270 - BASE/NEUTRAL ORGANICS		*1		8270 (2)	08/27/91	DFM
Diethyl phthalate	ND	10	ug/L			
2-Methylnaphthalene	ND	10	ug/L			
Naphthalene	ND	10	ug/L			

APPROVED BY: Ellen J. Moyers

1300 S. Potomac St., Suite 130
Aurora, CO 80012
(303) 751-1780

Western Atlas International
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CORE LABORATORIES

LABORATORY TESTS RESULTS
09/27/91

JOB NUMBER: 911474 CUSTOMER: APPLIED ENVIRONMENTAL ATTN: John England

CLIENT I.D.....: 20223.00.300 HELLA-3RD ROUND
DATE SAMPLED.....: / /
TIME SAMPLED.....: :
WORK DESCRIPTION...: TRIP BLANK

LABORATORY I.D...: 911474-0016
DATE RECEIVED....: 08/02/91
TIME RECEIVED....: 17:30
REMARKS.....:

TEST DESCRIPTION	FINAL RESULT	LIMITS/*DILUTION	UNITS OF MEASURE	TEST METHOD	DATE	TECHN
8240 - VOLATILE ORGANICS		*1		8240 (2)	08/09/91	PCM
Acetone	ND	100	ug/L			
2-Butanone	ND	100	ug/L			
Carbon disulfide	ND	5	ug/L			
Chloroform	ND	5	ug/L			
1,2-Dichloroethane	ND	5	ug/L			
Methylene chloride	ND	5	ug/L			

APPROVED BY: Ellen J. Naggar

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№ 01545

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Analysis Request and Chain of Custody Record

Project no.	Client/Project Name	Project Location
20223.00.300	APPLIED ENVIRONMENTAL / HECLA - 3RD ROUND	NATURITA, DENTA MINE

Lab ID No.	Field Sample No./ Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
1	MW-2	7/30/91 5:45 PM	X		1 gal jug	ground water	HNO3 to pH<2	Ammonia (N), chloride, sulfate, TDS, zinc (ICP), Ra-226, radium (fluorimetric)	
2	MW-3	7/31/91 7:15 PM	X						
3	MW-4	7/31/91 5:00 PM	X						
4	MW-5	7/31/91 9:00 PM	X						
5	MW-6	7/31/91 5:45 PM	X						
6	MW-7	7/31/91 4:15 PM	X						
7	MW-BLANK	8/2/91 4:15 PM	X						

Samplers: (Signature)	Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	COC Seal No.
			Date: Time:	Received by: (Signature)	Date: Time:	
		Relinquished by: (Signature)	Date: Time:	Received by Laboratory; (Signature) Timothy L. Kellogg	Date: 8-2-91 Time: 17:30	Intact:

REMARKS:
See analytical request letter to Dave McCharter

Data Results To: (Name/Address)
1. John England
6143 S. Willow Dr., Suite 200
2.

Laboratory No.

White - Return With Results Of Analysis Yellow - Lab Copy Pink - Samples Copy

№ 01546

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CORE LABORATORIES

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Analysis Request and Chain of Custody Record

Project no.	Client/Project Name	Project Location
20223.00.300	APPLIED ENVIRONMENTAL / HECLA 3RD Round	NATURITA / DURITA MINE

Lab ID No.	Field Sample No./Identification	Date and Time	Grab	Comp	Sample Container (Size/Mat'l)	Sample Type (Liquid Sludge, Etc.)	Preservative	ANALYSIS REQUESTED	LABORATORY REMARKS
8	MW-8	7/30/91 6:00 PM	✓		1 gal jug, 2 VOA vials, 1 KEE ml jar	ground water	unfiltered	Ammonia (.1) Cl, SO4, Alkalinity, CN (total), pH, TDS, Ba, Be, Cd, Cr, Cu, Fe, K, Mo, Mg, Na, Ni, Ag, V, As (.1), Pb (.1), Se (.1), Hg (.1), Gross Alpha/Beta, Th-230, Ra-226, U (Fluorometric), Vol. GC/MS, Semivol. GC/MS	
9	MW-9	7/31/91 10:00 AM	↓		↓	↓	↓	↓	
10	MW-10	7/31/91 8:30 AM	↓		↓	↓	↓	↓	
11	MW-11	7/31/91 10:50 AM	↓		↓	↓	↓	↓	
12	MW-12	7/30/91 2:00 PM	↓		↓	↓	↓	↓	
13	MW-13	7/31/91 2:45 PM	↓		↓	↓	↓	↓	
14	MW-14	7/31/91 6:00 PM	↓		↓	↓	↓	↓	
15	MW-Blank	8/2/91 4 PM	↓		↓	↓	↓	↓	

Samplers: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Date / Time	
[signature]	[signature]	Date: 4:40pm Time: 8/2/91		Date: Time:	COC Seal No.
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	
	Relinquished by: (Signature)	Date: Time:	Received by Laboratory; (Signature) [signature]	Date: 8/2/91 Time: 17:30	Intact:

REMARKS:
see analytical request letter to Dave McWharter
2 VOA vials as trip blank

Data Results To: (Name/Address)
1. John England
6143 S. Willow Dr., Suite 200
2.

Laboratory No.

White - Return With Results Of Analysis   Yellow - Lab Copy   Pink - Samples Copy

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11-Sep-91

APPLIED ENVIRONMENTAL
6143 S. Willow Drive, Suite 200
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Page: 1
Copy: 1 of 2
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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	NH4 as N mg/l	Cl mg/l	SO4 mg/l	Alkalinity as CaCO3 mg/l	CN mg/l
Duplicate	1.1	58	1920	194	0.13
Duplicate	1.0	59	1980	186	0.14
Duplicate % diff.	9.5	1.7	3.1	4.2	7.46
Std (actual value)	2.0	55.2	1060	320	0.52
Std (expected value)	2.0	57.6	1000	320	0.50
Std % diff.	---	---	---	---	---
Std % rec.	100	107	106	100	104
Blank	<0.1	<1	<4	---	<0.01
Spike % rec.	90	100	---	---	88

Sample Id	pH unit	TDS mg/l	Ba Dissolved mg/l	Be Dissolved mg/l	Cd Dissolved mg/l
Duplicate	6.50	258	0.16	0.02	4.49
Duplicate	6.78	258	0.16	<0.02	4.53
Duplicate % diff.	4.2	0.0	0.0	(4)	0.8
Std (actual value)	7.04	1450	---	---	---
Std (expected value)	7.00	1480	---	---	---
Std % diff.	---	---	---	---	---
Std % rec.	104	98	---	---	---
Blank	---	<4	<0.01	<0.01	<0.01
Spike % rec.	---	---	---	---	---

Sample Id	Cr Dissolved mg/l	Ca Dissolved mg/l	Fe Dissolved mg/l	K Dissolved mg/l
Duplicate	4.63	138	0.04	11.0
Duplicate	4.68	138	0.02	11.0
Duplicate % diff.	1.1	0.0	(4)	0.0

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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Cr Dissolved mg/l	Ca Dissolved mg/l	Fe Dissolved mg/l	K Dissolved mg/l
Std (actual value)	---	---	---	---
Std (expected value)	---	---	---	---
Std % diff.	---	---	---	---
Std % rec.	---	---	---	---
Blank	<0.01	<0.05	<0.02	<0.5
Spike % rec.	---	---	---	---

Sample Id	Mo Dissolved mg/l	Mg Dissolved mg/l	Na Dissolved mg/l	Ni Dissolved mg/l
Duplicate	<0.01	84.0	1030	<0.01
Duplicate	<0.01	85.1	1060	<0.01
Duplicate % diff.	0.0	1.3	2.8	0.0
Std (actual value)	---	---	---	---
Std (expected value)	---	---	---	---
Std % diff.	---	---	---	---
Std % rec.	---	---	---	---
Blank	<0.01	<0.05	<0.05	<0.01
Spike % rec.	---	---	---	---

Sample Id	Ag Dissolved mg/l	V Dissolved mg/l	As Dissolved mg/l	Pb Dissolved mg/l
Duplicate	0.02	0.02	<0.001	0.001
Duplicate	0.04	0.02	0.001	0.001
Duplicate % diff.	(4)	0.0	(4)	0.0
Std (actual value)	---	---	0.108	0.101
Std (expected value)	---	---	0.100	0.100
Std % diff.	---	---	---	---

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Page: 3
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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	Ag Dissolved mg/l	V Dissolved mg/l	As Dissolved mg/l	Pb Dissolved mg/l
Std % rec.	---	---	108	101
Blank	<0.01	<0.01	<0.001	<0.001
Spike % rec.	---	---	80	88

Sample Id	Se Dissolved mg/l	Hg Dissolved mg/l	Zn Dissolved mg/l	Gross Alpha Dissolved pCi/l	Error 2σ
Duplicate	<0.001	<0.0002	1.55	25	±32
Duplicate	<0.001	<0.0002	1.58	9	±29
Duplicate % diff.	0.0	0.0	1.9	47	---
Std (actual value)	0.027	0.0006	---	188	±5
Std (expected value)	0.025	0.0007	---	206	---
Std % diff.	---	---	---	8.7	---
Std % rec.	108	86	---	---	---
Blank	<0.001	<0.0002	<0.005	0.1	±0.2
Spike % rec.	80	104	---	---	---

Sample Id	Gross Beta Dissolved pCi/l	Error 2σ	Ra-226 Dissolved pCi/l	Error 2σ	Th-230 Dissolved pCi/l	Error 2σ
Duplicate	12	±19	0.4	±0.4	0.0	±4.1
Duplicate	24	±19	0.4	±0.3	0.0	±3.8
Duplicate % diff.	33	---	0.0	---	0.0	---
Std (actual value)	107	±2	102	±4	102	±3
Std (expected value)	106	---	101	---	98	---
Std % diff.	0.9	---	1.0	---	4.1	---
Std % rec.	---	---	---	---	---	---
Blank	0.5	±0.3	0.0	±0.1	0.0	±0.2
Spike % rec.	---	---	---	---	---	---

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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

Sample Type: Water

Sample Id	U Dissolved mg/l	Pb-210 Dissolved pCi/l	Error 2σ	U Dissolved pCi/l(1)
Duplicate	0.0239	0.8	±3.3	---
Duplicate	0.0236	0.0	±3.2	---
Duplicate % diff.	0.6	100	---	---
Std (actual value)	36	106	±2	---
Std (expected value)	34	99	---	---
Std % diff.	5.9	7.1	---	---
Std % rec.	---	---	---	---
Blank	<0.0003	0.1	±0.5	---
Spike % rec.	104	---	---	---

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Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

Abbreviations:

Parameters:

NH4 as N	: Ammonia
Cl	: Chloride
SO4	: Sulfate
CN	: Cyanide
TDS	: Total Dissolved Solids
Ba	: Barium
Be	: Beryllium
Cd	: Cadmium
Cr	: Chromium
Ca	: Calcium
Fe	: Iron
K	: Potassium
Mo	: Molybdenum
Mg	: Magnesium
Na	: Sodium
Ni	: Nickel
Ag	: Silver
V	: Vanadium
As	: Arsenic
Pb	: Lead
Se	: Selenium
Hg	: Mercury
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium
Pb-210	: Lead-210

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Status: Final

QUALITY CONTROL REPORT

Units:

mg/l	: milligrams per liter
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ
pCi/l(1)	: picoCuries per liter based upon equilibrium cond.
µg/l	: micrograms per liter

Quality codes:

(4)	: Sample < 5 times LLD

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Status: Final

QUALITY CONTROL REPORT

Library Search Results:
Search Compounds:

1. Decyl alcohol
2. Tributylphosphate

Results:
Low trace levels of Decyl alcohol were identified in sample MW-8 (less than 20 mg/l). The concentration of the Decyl alcohol can only be estimated since no standards for this compound were analysed.
No Decyl acohol was found in sample MW-10.
No Tributylphosphate was found in sample MW-8 or MW-10.

Job approved by:

Signed:

.....

Approved
Quality Assurance Department

BARRINGER LABORATORIES INC.
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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

QUALITY CONTROL REPORT

QUALITY CONTROL DATA SHEET

Received by: gr

Via: Hand Delivered

Sample Container Type: Lg cu, 1L cu, brn gl L btl, vials
Sample Type: Water
Preservative When Received: 1)HNO3 2)H2SO4 3)None 4)NaOH
Additional Lab Preparation: None

Parameter	Method	LLD	Preservative	Analyst	Date(s) of Analysis
NH4 as N	350.1	0.1 mg/l	2	Brooks	8/ 8
Cl	325.1	1 mg/l	3	Brooks	8/20
SO4	375.3	4 mg/l	3	Jackson	8/20
Alkalinity	310.1	1 mg/l	3	Sprague	8/12
CN	7.3	0.01 mg/l	4	Jackson	8/ 3
pH	150.1	0.01 unit	3	Jackson	8/14
TDS	160.1	4 mg/l	3	Jackson	8/12
Ba	200.7	0.01 mg/l	1	Huffman Lb	8/16
Be	200.7	0.01 mg/l	1	Huffman Lb	8/16
Cd	200.7	0.01 mg/l	1	Huffman Lb	8/16
Cr	200.7	0.01 mg/l	1	Huffman Lb	8/16
Ca	200.7	0.05 mg/l	1	Huffman Lb	8/16
Fe	200.7	0.02 mg/l	1	Huffman Lb	8/16
K	200.7	0.5 mg/l	1	Huffman Lb	8/16
Mo	200.7	0.01 mg/l	1	Huffman Lb	8/16
Mg	200.7	0.05 mg/l	1	Huffman Lb	8/16
Na	200.7	0.05 mg/l	1	Huffman Lb	8/16
Ni	200.7	0.01 mg/l	1	Huffman Lb	8/16
Ag	200.7	0.01 mg/l	1	Huffman Lb	8/16
V	200.7	0.01 mg/l	1	Huffman Lb	8/16
As	206.2	0.001 mg/l	1	Sprague	8/ 8
Pb	239.2	0.001 mg/l	1	Sprague	8/ 8

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Status: Final

QUALITY CONTROL REPORT

Se	270.2	0.001 mg/l	1	Sprague	8/ 8
Hg	245.1	0.0002 mg/l	1	Moder	8/ 9
Zn	200.7	0.005 mg/l	1	Huffman Lb	8/16
Gross Alpha	900.0	2 pCi/l	1	Noel	8/16- 8/19
Gross Beta	900.0	1 pCi/l	1	Noel	8/16- 8/19
Ra-226	SM-705	0.2 pCi/l	1	Howard	8/20- 8/22
Th-230	---	0.2 pCi/l	1	Ortiz	8/13- 8/20
U	ASTMD2907	0.0003 mg/l	1	Meyer	8/29- 8/30
Pb-210	---	1 pCi/l	1	Kidwell	8/27- 9/ 5

Signed: .....

Mark Burkhardt, Ph.D.
Laboratory Director

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11-Sep-91

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Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

Sample Type: Water

Sample	NH4 as N mg/l	Cl mg/l	SO4 mg/l	Alkalinity as CaCO3 mg/l	CN mg/l	pH unit	TDS mg/l
MW-8	1.1	19	1210	377	0.13	7.54	2130
MW-10	1.9	58	2680	562	<0.01	7.54	4070
MW-5	0.3	28	1560	---	---	---	2350

Sample	Ba Dissolved mg/l	Be Dissolved mg/l	Cd Dissolved mg/l	Cr Dissolved mg/l	Ca Dissolved mg/l	Fe Dissolved mg/l
MW-8	<0.01	0.15	<0.005	<0.01	142	<0.02
MW-10	0.16	0.02	0.26	1.92	138	0.14
MW-5	---	---	---	---	---	---

Sample	K Dissolved mg/l	Mo Dissolved mg/l	Mg Dissolved mg/l	Na Dissolved mg/l	Ni Dissolved mg/l	Ag Dissolved mg/l
MW-8	12.0	0.04	72.3	438	<0.01	0.02
MW-10	11.0	<0.01	85.1	1060	<0.01	0.02
MW-5	---	---	---	---	---	---

Sample	V Dissolved mg/l	As Dissolved mg/l	Pb Dissolved mg/l	Se Dissolved mg/l	Hg Dissolved mg/l	Zn Dissolved mg/l
MW-8	0.02	<0.001	0.004	<0.001	<0.0002	---
MW-10	0.02	<0.001	0.006	<0.001	<0.0002	---
MW-5	---	---	---	---	---	0.24

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Attn: John England
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Job: 911439E

Status: Final

Sample Type: Water

Sample	Gross Alpha Dissolved pCi/l	Error 2σ	Gross Beta Dissolved pCi/l	Error 2σ	Ra-226 Dissolved pCi/l	Error 2σ
MW-8	7	±15	11	±9	0.4	±0.4
MW-10	29	±30	18	±16	0.6	±0.4
MW-5	---	---	---	---	2.1	±1.0

Sample	Th-230 Dissolved pCi/l	Error 2σ	U Dissolved mg/l	Pb-210 Dissolved pCi/l	Error 2σ	U Dissolved pCi/l(1)
MW-8	0.0	±0.6	0.0003	---	---	0.2
MW-10	0.2	±0.6	0.0003	---	---	0.2
MW-5	---	---	0.0072	0.4	±3.2	4.9

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VOLATILE ORGANIC COMPOUNDS EPA METHOD 624

Parameter		MW-8 Water	MW-10 Water
chloromethane	µg/l	<10.00	<10.00
vinyl chloride	µg/l	<10.00	<10.00
bromomethane	µg/l	<10.00	<10.00
chloromethane	µg/l	<10.00	<10.00
trichlorofluoromethane	µg/l	<5.00	<5.00
acetone	µg/l	<5.00	<5.00
1,1-dichloroethene	µg/l	<5.00	<5.00
methylene chloride	µg/l	<5.00	<5.00
carbon disulfide	µg/l	<5.00	<5.00
trans-1,2-dichloroethene	µg/l	<5.00	<5.00
1,1-dichloroethane	µg/l	<5.00	<5.00
2-butanone	µg/l	<5.00	<5.00
chloroform	µg/l	<5.00	<5.00
1,1,1-trichloroethane	µg/l	<5.00	<5.00
carbon tetrachloride	µg/l	<5.00	<5.00
1,2-dichloroethane	µg/l	<5.00	<5.00
benzene	µg/l	<5.00	<5.00
trichloroethene	µg/l	<5.00	<5.00
1,2-dichloropropane	µg/l	<5.00	<5.00
bromodichloromethane	µg/l	<5.00	<5.00
2-chloroethylvinyl ether	µg/l	<5.00	<5.00
2-hexanone	µg/l	<5.00	<5.00
trans-1,3-dichloropropene	µg/l	<5.00	<5.00
toluene	µg/l	<5.00	<5.00
cis-1,3-dichloropropene	µg/l	<5.00	<5.00
1,1,2-trichloroethane	µg/l	<5.00	<5.00
4-methyl-2-pentanone	µg/l	<5.00	<5.00
tetrachloroethene	µg/l	<5.00	<5.00
dibromochloromethane	µg/l	<5.00	<5.00
chlorobenzene	µg/l	<5.00	<5.00

BARRINGER LABORATORIES INC.
15000 W. 6TH AVE., SUITE 300 Ggolden, CO 80401 (303) 277-1687 FAX (303) 277-1689

11-Sep-91

APPLIED ENVIRONMENTAL
6143 S. Willow Drive, Suite 200
Englewood, CO 80111

Attn: John England
Project: Hecla/Durita

Received: 5-Aug-91 12:33
PO #: 20223.00300

Job: 911439E

Status: Final

VOLATILE ORGANIC COMPOUNDS EPA METHOD 624

Parameter		MW-8 Water	MW-10 Water
ethylbenzene	µg/l	<5.00	<5.00
o-xylene	µg/l	<5.00	<5.00
styrene	µg/l	<5.00	<5.00
bromoform	µg/l	<5.00	<5.00
1,1,2,2-tetrachloroethane	µg/l	<5.00	<5.00
1,3-dichlorobenzene	µg/l	<5.00	<5.00
1,4-dichlorobenzene	µg/l	<5.00	<5.00
1,2-dichlorobenzene	µg/l	<5.00	<5.00

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SEMIVOLATILE ORGANIC COMPOUNDS EPA MEHTOD 625

Parameter		MW-8 Water	MW-10 Water
phenol	µg/l	<10.0	<10.0
bis(2-chloroethyl)ether	µg/l	<10.0	<10.0
2-chlorophenol	µg/l	<10.0	<10.0
1,3-dichlorobenzene	µg/l	<10.0	<10.0
1,4-dichlorobenzene	µg/l	<10.0	<10.0
benzyl alcohol	µg/l	<10.0	<10.0
1,2-dichlorobenzene	µg/l	<10.0	<10.0
2-methylphenol	µg/l	<10.0	<10.0
bis(2-chloroisopropyl)ether	µg/l	<10.0	<10.0
4-methylphenol	µg/l	<10.0	<10.0
N-nitroso-di-n-propylamine	µg/l	<10.0	<10.0
hexachloroethane	µg/l	<10.0	<10.0
nitrobenzene	µg/l	<10.0	<10.0
isophorone	µg/l	<10.0	<10.0
2-nitrophenol	µg/l	<10.0	<10.0
2,4-dimethylphenol	µg/l	<10.0	<10.0
bis(2-chloroethoxy)methane	µg/l	<10.0	<10.0
benzoic acid	µg/l	<10.0	<10.0
2,4-dichlorophenol	µg/l	<10.0	<10.0
1,2,4-trichlorobenzene	µg/l	<10.0	<10.0
naphthalene	µg/l	<10.0	<10.0
4-chloroaniline	µg/l	<10.0	<10.0
hexachlorobutadiene	µg/l	<10.0	<10.0
4-chloro-3-methylphenol	µg/l	<10.0	<10.0
2-methylnaphthalene	µg/l	<10.0	<10.0
hexachlorocyclopentadiene	µg/l	<10.0	<10.0
2,4,6-trichlorophenol	µg/l	<10.0	<10.0
2,4,5-trichlorophenol	µg/l	<10.0	<10.0
2-chloronaphthalene	µg/l	<10.0	<10.0
2-nitroaniline	µg/l	<10.0	<10.0

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SEMIVOLATILE ORGANIC COMPOUNDS EPA MEHTOD 625

Parameter		MW-8 Water	MW-10 Water
dimethyl phthalate	µg/l	<10.0	<10.0
acenaphthylene	µg/l	<10.0	<10.0
2,6-dinitrotoluene	µg/l	<10.0	<10.0
3-nitroaniline	µg/l	<10.0	<10.0
acenaphthene	µg/l	<10.0	<10.0
2,4-dinitrophenol	µg/l	<10.0	<10.0
4-nitrophenol	µg/l	<10.0	<10.0
dibenzofuran	µg/l	<10.0	<10.0
2,4-dinitrotoluene	µg/l	<10.0	<10.0
diethyl phthalate	µg/l	<10.0	<10.0
4-chlorophenyl phenyl ether	µg/l	<10.0	<10.0
fluorene	µg/l	<10.0	<10.0
4-nitroaniline	µg/l	<10.0	<10.0
4,6-dinitro-2-methylphenol	µg/l	<10.0	<10.0
N-nitrosodiphenylamine	µg/l	<10.0	<10.0
4-bromophenyl-phenylether	µg/l	<10.0	<10.0
alpha-BHC	µg/l	<10.0	<10.0
hexachlorobenzene	µg/l	<10.0	<10.0
beta-BHC	µg/l	<10.0	<10.0
pentachlorophenol	µg/l	<10.0	<10.0
gamma-BHC	µg/l	<10.0	<10.0
phenanthrene	µg/l	<10.0	<10.0
anthracene	µg/l	<10.0	<10.0
delta-BHC	µg/l	<10.0	<10.0
heptachlor	µg/l	<10.0	<10.0
di-n-butyl phthalate	µg/l	<10.0	<10.0
aldrin	µg/l	<10.0	<10.0
heptachlor epoxide	µg/l	<10.0	<10.0
fluoranthene	µg/l	<10.0	<10.0
pyrene	µg/l	<10.0	<10.0

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SEMIVOLATILE ORGANIC COMPOUNDS EPA MEHTOD 625

Parameter		MW-8 Water	MW-10 Water
endosulfan I	µg/l	<10.0	<10.0
4,4-DDE	µg/l	<10.0	<10.0
dieldrin	µg/l	<10.0	<10.0
endrin	µg/l	<10.0	<10.0
4,4-DDD	µg/l	<10.0	<10.0
endosulfan II	µg/l	<10.0	<10.0
endrin aldehyde	µg/l	<10.0	<10.0
butylbenzylphthalate	µg/l	<10.0	<10.0
4,4-DDT	µg/l	<10.0	<10.0
endosulfan sulfate	µg/l	<10.0	<10.0
methoxychlor	µg/l	<10.0	<10.0
3,3'-dichlorobenzidine	µg/l	<10.0	<10.0
endrin ketone	µg/l	<10.0	<10.0
benzo(a)anthracene	µg/l	<10.0	<10.0
bis(2-ethylhexyl)phthalate	µg/l	<10.0	<10.0
chrysene	µg/l	<10.0	<10.0
di-n-octyl-phthalate	µg/l	<10.0	<10.0
benzo(b)fluoranthene	µg/l	<10.0	<10.0
benzo(k)fluoranthene	µg/l	<10.0	<10.0
benzo(a)pyrene	µg/l	<10.0	<10.0
indeno(1,2,3-cd)pyrene	µg/l	<10.0	<10.0
dibenzo(a,h)anthracene	µg/l	<10.0	<10.0
benzo(ghi)perylene	µg/l	<10.0	<10.0

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SEMIVOLATILE ORGANIC COMPOUNDS EPA MEHTOD 625

Abbreviations:

Parameters:

NH4 as N	: Ammonia
Cl	: Chloride
SO4	: Sulfate
CN	: Cyanide
TDS	: Total Dissolved Solids
Ba	: Barium
Be	: Beryllium
Cd	: Cadmium
Cr	: Chromium
Ca	: Calcium
Fe	: Iron
K	: Potassium
Mo	: Molybdenum
Mg	: Magnesium
Na	: Sodium
Ni	: Nickel
Ag	: Silver
V	: Vanadium
As	: Arsenic
Pb	: Lead
Se	: Selenium
Hg	: Mercury
Zn	: Zinc
Ra-226	: Radium-226
Th-230	: Thorium-230
U	: Uranium
Pb-210	: Lead-210

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SEMIVOLATILE ORGANIC COMPOUNDS EPA MEHTOD 625

Units:

mg/l	: milligrams per liter
pCi/l	: picoCuries per liter
2σ	: Counting error at the 95% confidence level, 2σ
pCi/l(1)	: picoCuries per liter based upon equilibrium cond.
µg/l	: micrograms per liter

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Library Search Results:
Search Compounds:

1. Decyl alcohol
2. Tributylphosphate

Results:
Low trace levels of Decyl alcohol were identified in sample MW-8 (less than 20 mg/l). The concentration of the Decyl alcohol can only be estimated since no standards for this compound were analysed.
No Decyl acohol was found in sample MW-10.
No Tributylphosphate was found in sample MW-8 or MW-10.

Job approved by:

Signed: Lyle Ryman .. Ellen La Riviere .. Richard Burrows

Lyle Ryman / Ellen La Riviere
Richard Burrows, Ph.D. - Laboratory Managers

APPENDIX E

RECLAMATION COST ESTIMATE DETAILS AND BACKUP

FIG 5 2.5cm² = 160,000 sq ft
1 1cm² = 6400 sq ft 711 sq yds

contours
1.5 x 0.4 0.6cm²
1.5 x 0.4 0.6
0.7 x 0.5 0.35
0.6 x 0.8 0.48
0.4 x 3.3 1.32
13.5 x 0.5 6.75
1.2 x 0.5 0.6
10.7 x 8.5 90.95
TOTAL 101.65cm² 72,284 sq yd
12" excavation 24,094 cu yd

APPENDIX E - RECLAMATION COST ESTIMATE DETAILS AND BACKUP
DURITA MILL SITE

PLANT AREA COVER

Assume $1.09 /c.y. to spread and compact soil thi
excavated and hauled (cost under diversion excav.) fro
1000'. Cover thickness ave. 2.0 ft.

Plant area = 550'x300', x2'/27= 12222 c.y.
Ore prep. area, receiving
section only, 100x180', x 6' ave. to fill grizzly, b
and tunnel= 4000 c.y.

Estimated cost is 1.09 /c.y. x 16222 c.y. =

CONTAMINATED SOIL CLEANUP

15 acres x ave. 1.0' excavation = 21300 c.y.
x $1.03/c.y. by scraper = $21,939
Service and supervision for 5 days $75.18/hr x 8 hr/day = $3,000

Total for soil cleanup = $24,939

SITE REGRADING

Fill placement to achieve rough grade, using soil excavated from surface water channels and flood plains, compaction by dozer while spreading soil. $1.23/ c.y. (R.S. Means, 1991, p.35) x 283000 c.y. = $348,090

Finish grading with CAT 14G, 62 acres/ 10 acres per day
6 days x 8 hrs/day x $69/hr = $3,312
Surveyor/grade checker, $37.83/hr x 6 x 8 = $1,816

Total for regrading = $353,218

WELL PLUGGING

Rig time 2 hrs. x $120/hr. + one bag readi-mix at $5.00 +
one bag bentonite at $25 x 6 wells = $1,620

EVAPORATION POND DEWATERING AND EXCAVATION/RELOCATION OF SALTS

a) Complete pump and spray circuit around ponds, moved as necessary during dewatering:

2000 ft. Drisco 3" diam. pipe x 0.88/ft = $1760 $1,760
One spray head per 25 ft, $3.73/(head+riser) x 80 = $300
Two pumps and electric service, x $5000 = $10,000
Labor, 1000 hrs @, x $12.63/hr = $12,630

Total for spray systems = $24,690

b) Excavation and relocation of salts
Assume D-8 dozer and CAT 633 scraper each moving half the salts. 19533 cy of salt and about 22229 cy contaminated clay liner to be moved, for total of 42000 c.y.

Scraper at $1.03 x 21000 c.y. = $21,630
D8L at $120/hr x 420 cy/hr, or $0.29/ c.y. x 21000 c.y. = $6,090
Supervision, health protection and monitoring, $50/hr x 120hr $6,000

total for evap. pond excavation $33,720

a) Strip and remove vegetation - 25 acres

CAT D8L dozer to strip and windrow vegetation and topsoil
Each pass 10 ft wide, giving 4362 ft/acre travel x 25 acres
= 109050 ft., / [2.0 mph (Rust Tractor Co., 1990)
x 5280 ft/mi.] = 10.5 hrs, x 120/hr= $1,260
CAT 633D scraper to pick up, haul, and dump
25 acres x 0.5 ft cut x 43560/27 = 20170 c.y.
20170cy x 0.53/cy = $10,690

Total $11,950

b) Excavate, haul ave. 500 ft, and dump soil using CAT 633D

452000 c.y. x $1.03 = $466,690
plus D8L ripping and excavation of 10%, or
45200 c.y. x $0.29 = $13,108

c) Finish grading with CAT 14G
24 acres / 5 acres per day x 8 hr x $69/hr = $2,650

d) Supervision, grade control, and maintenance
($37.35+$37.83)/hr x 8hr/day x 452000 /8000 $33,981

$516,429

CONSTRUCTION OF RADON BARRIERS (SOIL COVERS) AND OUTSLOPES

a) Excavation to flatten outslopes, 25000 c.y. using
D8L at 420 c.y./hr, at $120/hr, or $0.29/ c.y. $7,250

b) Spread and compact cover soil (soil excavated from
diversion channels, hauled, and spread under that cost item)

Leach Tanks	192000 c.y. x	$2.51 =	$482,400
Evaporation Ponds	29000 c.y. x	$2.51 =	$72,863
Totals =	221000 c.y.		$562,513

CONSTRUCTION OF ROCK COVER AND RIPRAP
Assumes that all rock is excavated locally from San Miguel River valley
Rock is screened, then hauled by truck 3 mi., dumped and spread

a) Rock excavation -
Assume rock excavated by D8L ($120/hr) at 420 cy/hr,
loaded into screen plant by CAT 988 ($101/hr) at 270 cy/hr
Excavation cost is then $0.66/cy
Evap. pond vol. = 6000 c.y.
Outslope vol. = 12000 c.y.
Bank riprap + scour protection vol.= 4640 c.y.

Total vol 22640 c.y. x 0.66 = $14,942

b) Rock Screening 270 cy/hr capacity
Plant rental and operating costs per month
grizzly $4,000
cone and screen $15,000
conveyors, generators, etc. $30,000
fuel and maintenance $15,000
Total $64,000 /mo

At 80% availability and 20 days/mo., monthly
output in c.y. is 34560
cost/c.y. = $1.85
For 22640 c.y., estimated cost is $41,884

c) Hauling

Assume highway haulers with 15 cy boxes, 50 min/hr,
6 mi roundtrip at 20mph ave. for 0.3 hr cycle time
Cost per truck = $45
2.8 cycles per 50 min = 42 cy/hr
Hauling cost per c.y. = $1.07

Total Cost to haul and dump 22640 c.y. of rock = $24,257

Unit Cost to excavate, screen, haul and dump= $3.58
Total cost to supply 22640 c.y. rock to placement location = $81,084

d) Spread Outslope Rock

Assume CAT 14G grader at $69/hr and 270 cy/hr, = $0.26/cy
For 12000 c.y. of rock cover, total cost = $3,120

e) Spread Evaporation Pond Cover Rock

Assume CAT 14G grader at $69/hr and 270 cy/hr, = $0.26/cy
For 6000 c.y. of rock cover, total cost = $1,560

f) Floodplain riprap and scour protection

Scour trench excavation and backfill - "V" trench using D8L
at $120/hr and 470 cy/hr

Central floodplain - ave. bank ht. 2.25',
trench depth 5.2', cut at 2:1 outside
0.5:1 inside, for 1700 feet west bank
1100 feet east bank, for total excav.= 3505 c.y.
East floodplain - ave. bank ht. 1.5'
trench depth 4.6', cut same as
central trench, for 1100 west bank only
for total excav.= 1080 c.y.
Evaporation Pond - trench 5.7' deep on west
and 3.0' deep on north and east
480'x40.6 ft^2 + (350+330+480)x11.25 ft^2 = 1205 c.y.

Total excav. 5790 c.y. at 470 cy/hr and $120/hr = $1,478
Total backfill 1585 c.y. at 470 cy/hr and $120/hr = $405

Riprap Placement

Assume riprap on bank and in scour trench is 1.5 ft thick,
on 2H:1V slope. placement rate of 50 c.y./hr

Central/west side = 16.7'x1.5'x1700'/27= 1577 c.y.
Central/east side = 16.7'x1.5'x1100'/27= 1021 c.y.
East/west side = 13.7'x1.5'x1100'/27= 837 c.y.
Evaporation Pond perimeter = 480'x1.5'x12.7'
+(350+330+480)'x1.5'x6.7' = 770

Placed with D8L at $120/hr and 50cy/hr 4205 c.y. = $10,092

Total riprap and scour protection placement cost $11,975

REVEGETATION

Estimate 89 acres x $550/acre (1986 cost x 1.1) = $48,950

Facility or Equipment	Map Location Number	--- Dimensions in feet --- Width/ Diameter	Length	Height	Dismantled Volume (1) ft^3	Tonnage (2)	Demolition Cost (3)	Foot Note Reference
PROCESS (PLANT) AREA								
Quonset Building	1	30	50		109	27	salvage	1a,2a,3a
Pumps (14)	1a					2.5	salvage	3c
Motors (25)	1b					3.0	salvage	3c
Valves (50)	1c					1.9	salvage	3c
Grating	2	6	8	0.5	14	4	salvage	1c,2a,3b
Tanks (2)	3	12		14	11	3	salvage	1c,2a,3b
Process (Plant) Building	4							
Structure		40	165	28	10739	2636	salvage	1a,2a,3b
Concrete Floor		40	165	0.5	3300	248	bury in place	3e
Boilers (2)		5.5		14.5	103	25	salvage	1b,3b
Heat Exchangers (7)								
					54	13	$10	1b,3b
					34	8	$6	1b,3b
					64	16	$12	1b,3b
					51	13	$10	1b,3b
					68	17	$13	1b,3b
					20	5	$4	1b,3b
					41	10	$8	1b,3b
Grating with Chute		20	40	0.25	32	8	$841	1c,2a,3b
Carbon Filter Press		5.5	15	5	124	30	salvage	1b,2a,3c
Plates (58)						4	salvage	1b,2a,3c
Tanks, below grade (2)	5	7.5	37	9	250	61	$722	1c,2a,3b
Concrete Pads with Columns	6							
Pads (2)		37	64	1	4736	355	bury in place	3e
Columns (70)		1.5	8	1	840	63	$3,469	3e
Tank	7	12		16	181	44	$900	1c,2a,3b
Tank/Agitator	8	6		5.5	16	4	salvage	1c,2a,3b
Water Storage Tank	9	4		11.5	14	4	$180	1c,2a,3b
Concrete Pad	10	14.5	33	1	479	36	bury in place	3e
Concrete Pad	11	15	49	0.5	368	28	bury in place	3e
Sodium Chloride Tank	12	8		8	40	10	salvage	1c,2a,3b
Sodium Chloride Tank	13	8		16	80	20	salvage	1c,2a,3b
Tank/Agitator	14	3		8	6	1	salvage	1c,2a,3b
Tank	15	4		25	31	8	$360	1c,2a,3b
Concrete Pad	16	11	20	0.5	110	8	bury in place	3e
Concrete Barriers (2)	17	3	26	0.67	105	8	$644	3e
Concrete Pad	18	26	26	0.5	338	25	bury in place	3e
Concrete Pad	19	30	76	0.5	1140	86	bury in place	3e
Concrete Pad	20	20	36	0.5	360	27	bury in place	3e
Laboratory Trailer	21	10	40	8	294	72	salvage	1a,3b
Metal Shed		10	10	6	67	16	salvage	1a,3b
Pad		11	11	0.5	61	5	$500	3e
Concrete Pad	22	20	20	0.5	200	15	bury in place	3e
Concrete Tank	23	8	24	3	112	8	$30	2b,3a
Concrete Pads (5)	24	12		1	565	42	bury in place	3e
Raffinate Pond Liners (4)	44	80	80	0.05	1280	51	$768	3f

Facility or Equipment	Map Location Number	--- Dimensions in feet --- Width/ Diameter	Length	Height	Dismantled Volume (1) ft^3	Tonnage (2)	Demolition Cost (3)	Foot Note Reference
ORE PREPARATION AREA								
Transformers	1	(to be salvaged)					salvage	
Ore Bin	2	11		26	247	61	$1,183	1c,2a,3b
Agglomerator	3	10		30	236	58	$1,446	1c,2a,3c
Steel Support Structure	4	8	30	30	72	18	$380	1e,2a,3g
Feeder Bin	5	11	18	5	99	24	$795	1c,2a,3b
Concrete Support	6							
one wall		18.5	8	1	148	11	$40	2b,3a
two walls		20	8	1	160	12	$43	2b,3a
Acid Tanks (8)	7	12		30	4072	1000	salvage	1c,2a,3b
Fuel Storage Tank	8	24		16	724	178	salvage	1c,2a,3b
Dryer	9							
(all components have been decontaminated and certified for release from site. Dryer will be salvaged.)								
Ore Receiving Section								
Grizzly	10a	10	30	0.5	45	11	bury in place	3b
Storage Bin	10b	10	15	7	50	12	bury in place	3a
Corrugated Metal Tunnel	10c	14	24		11	3	bury in place	
Grating	11	6	21	0.5	6	2	bury in place	1c,2a,3a
Crushing and Scale Section								
Concrete Pad	12	10	22	0.5	110	8	bury in place	3e
Crusher Pad	13	10	22	0.5	110	8	bury in place	3e
Crusher	14	3	2.5		5	1	$33	1b,3c
10 - 55 gal drums w/tailing	15				74	5	$50	4
Scale Pads (2)	16a	6	4	1	48	4	bury in place	3e
Scale Pads (3)	16b	6	1.5	1	27	2	bury in place	3e
Shop		5	5	4	30	7	$71	1b,3b
Building	17	42	42	18	1985	487	salvage	1a,3b
Trailers (2)	17a	8	40	8	364	89	salvage	1a,3b
Concrete Floor	17b	25	40	1	1000	75	bury in place	3e
Miscellaneous								
Concrete Barriers (11)	18	3	26	0.67	575	43	$3,544	3e
Pipe, 6"		0.5	600		9	2	$4,800	3d
Pipe, 4"		0.33	800		5	1	$4,480	3d
Pipe, 1-3"		0.25	400		2	0.4	$2,240	3d
Electrical Poles		(to be salvaged)						

ESTIMATED TOTAL COST OF DEMOLITION, INCLUDING $5000 FOR MOBILIZATION = $32,584

NOTES:

1) Estimates of dismantled volumes based on a) buildings - dimensions x 0.05 for interior, + steel wall area x 0.1 or concrete wall area x 0.5, + 0.1 x 1.1 x roof dimensions; b) heavy equipment - volume x 0.3;
2) c) light equipment - volume x 0.1; d) concrete bins - volume x 0.2: e) 0.01 x volume for light frames
3) Tonnage = volume x a) 490/2000 for steel; b) 150/2000 for concrete and other materials
Demolition cost = a) $0.27/ft^3 for concrete; b) $0.19/ ft^3 for steel plus $2.61/ft x 40 ft/100 ft^2 of surface area for torch cutting of tanks and other large steel equipment; c) $25/T for machinery removal; d) $5.60 to 11.20/ft. for steel pipe; e) $4.13/ft^2 for concrete slabs; f) $0.12/ft^2 for removal and disposal of liner membranes and other fabrics; g) $95/hr for removal by dozer
4) To be buried under radon barrier in outslope of LT-201.

All unit prices except 3f from Means Site Work Cost Data, 1991, pp.19-22

See Figure 3 for plant facilities locations, Figure 4 for ore preparation facility locations.