N00164.AR.000032
NSWC CRANE
5090.3a

DEPARTMENT OF THE NAVY
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA 47522-5000

IN REPLY REFER TO:

5090/H1.4.3
0924

AUG 25 1989

Miss Carol Witt
United States Environmental Protection Agency
Region V
RCRA Permitting - SHR-13
230 South Dearborn Street
Chicago, IL 60604

Dear Miss Witt:

Enclosure (1) is the revised Tracer Test procedure Naval Weapons Support Center (NWSC) Crane is proposing to use to evaluate groundwater aquifers beneath the Ammunition Burning Grounds (ABG).

This is a short term procedure designed to define the groundwater in Karst conditions found at the ABG.

NWSC Crane point of contact is Mr. Jim Hunsicker, Code 0924, telephone 812-854-3114.

Sincerely,

M. L. FREY
By direction

Encl:
(1) Proposal to Conduct Dye Tracer Test at Ammunition Burning Grounds

Copy to:
NORTHNAVFACENGCOM, Philadelphia (Code 14)
COMNAVSEASYSCOM (SEA-6541)

AUG 1989
U. S. EPA, REGION V
SMB — PMS

RECEIVED
AUG 28 1989
OFFICE OF RCRA
WASTE MANAGEMENT DIVISION
EPA, REGION V

517002348

PROPOSAL TO CONDUCT

DYE TRACER TESTS

AT

AMMUNITION BURNING GROUNDS

ENCLOSURE (1)

Proposal to Conduct Dye Tracer Tests of Beech Creek Aquifer, Ammunition Burning Ground, Crane, Indiana

I. Background. A hydrogeological investigation of the Ammunition Burning Ground (ABG) and surrounding area, Naval Weapons Support Center (NWSC), Crane, was conducted by the Waterways Experiment Station (WES) in 1986-87. The report of investigation (Hunt, 1988) identified factors influencing or controlling the flow of potentially contaminated ground water into and out of the ABG. Work included emplacement of 66 exploration borings and monitoring wells in three aquifers, geologic and hydrologic field mapping, literature survey and consultation with State of Indiana geologists. The study area included the area surrounding the ABG, especially that to the south. Figure 1 shows the study area and the locations of monitoring wells and geologic cross sections. Figure 1A is a better-quality topographic map of the study area showing the ABG and the locations of springs.

Figure 2 portrays the subsurface geology of the ABG study area. The geologic formations of Mississippian age (those below the unconformity shown on Figure 2) are persistent and uniform in thickness across the study area and were mapped confidently from boring (continuous cores) and outcrop information. Several borings penetrated cavities in the Beech Creek limestone as evidenced by loss of drilling fluid circulation and by dropping of the drill rods upon penetration. The cavities in the Beech Creek were interpreted to be conduits formed in the soluble limestone by percolation of water infiltrating through joints and along bedding planes. Blocks of the overlying Big Clifty sandstone were noted to have fallen into some of the solution cavities. Direct surface expression of the solution cavities of the limestone and of the collapsed overlying Big Clifty sandstone was noted in the walls of the Little Sulphur Creek valley. The Big Clifty and Beech Creek formation comprise the middle ground water aquifer at the ABG as described in the report of investigation by Hunt.

The approximate limits of solution-widened passages in the Beech Creek are mapped on Figure 1. Solutioning is presumed to occur primarily in the major drainage valleys of Little Sulphur Creek and Johnson Hollow where erosion has subjected the Big Clifty sandstone and Beech Creek limestone to weathering and rapid infiltration of water. Drilling logs and field mapping substantiate that conclusion. The Elwren shale at the base of the Beech Creek prevents further vertical infiltration and forces ground water laterally along the bedding planes. Outlet for the solution conduits is believed to be at springs issuing in Little Sulphur Creek valley (Springs A, B and C of Figure 1A). Other springs in the Beech Creek are Springs D, E, F and Mountain Spring, all located north of the ABG (Figure 1A).

The report by Hunt concluded that flow through solution passages in the Beech Creek is the primary conduit for ground water leaving the ABG and that flow through the conduits can be "rapid". The report recommended that increased emphasis be given to monitoring of springs and that tracers be considered to confirm direction and rate of movement away from the ABG through solution conduits. The Indiana Department of Environmental Management (DEM) also requested further data con-

cerning potential conduit flow and hydraulic connection of the springs. For these reasons the following work is proposed.

II. Description of the ABG Facility. Ordnance and ordnance-contaminated materials from NWSC production areas have been taken to the ABG for disposal by burning since 1945. The burning ground is used extensively for destroying unwanted materials contaminated with explosives, bare explosives, rocket motors, candles, flares, solvents, detonators, and fuse materials. Several separate burning areas are located within the site proper. The largest quantities of materials were destroyed from 1956 to 1960, when 15,000 lbs per day of smokeless powder was destroyed. In the same period, about 46,000 lbs per day of high explosives was burned. The area is also used for flashing the residue from bombs and projectiles after they have been subjected to meltout or drill out operations for removal of the bulk of the explosive.

Three surface impoundments were constructed in 1975 to remove liquids from otherwise combustible sludges resulting from the blending and loading of munitions. The impoundments were modified in 1982 to include a liner and leachate collection system for each. Surface burning of ordnance was formerly conducted on the ground surface, but burning pans are now used to prevent contact with the ground.

Figure 2A is a topographic map of the ABG proper. The area labeled "ASH PILE" is the site of a former stock pile of burn residue. The ash pile has been removed under a closure ~~permit~~ plan. Surface drainage into and from the ABG is via Little Sulphur Creek, which flows from the north to the southeast through the center of the ABG and formed the valley in which the ABG is situated. A small tributary drainage way joins Little Sulphur Creek near the center of the site from the west-southwest.

III. Scope of Work. The Waterways Experiment Station (WES) proposes to conduct dye traces in the Big Clifty/Beech Creek aquifer in areas underlain by solution cavities (conduits). Dye injection would be made in wells screened in and near the solution zone at the ABG. Dye detectors would be placed in all mapped springs issuing from the Beech Creek within the boundaries of the NWSC and in the stream bed of Little Sulphur Creek if sufficient flow is available. Procedures for conducting the tests are those proposed by Quinlan (many references, but see Quinlan, 1986). Procedures are explained in detail in Part III of this proposal. Dye detectors will be collected daily for the first week and once weekly thereafter until results are obtained. Springs A, B and C south of the ABG will be primary detection locations but springs D, E and F and Mountain Spring will also be monitored for potential hydraulic connection with the ABG.

Background readings at all detection points will be made before dye injection to establish the presence or absence of dye compounds in the ground water. Dye will be injected into two wells at the ABG site. Dyes will be fluorescein (also called Uranine and Acid Yellow 73), Direct Yellow (DY) 96, and Phorwite AR, an optical brightener. Optical brighteners and DY 96 are collected on a cotton "bug" and analyzed by fluorescent light. Fluorescein is collected on charcoal, eluted

(extracted) and the liquid examined under intense visible light for telltale color. The use of multiple dyes is necessary because dye properties differ and one may be transportable through a ground water system more effectively than another. Fluorescein is susceptible to adsorption by clays, for example. The use of two types of collectors, cotton and charcoal, further increases the chance of detecting the dye. Toxicity data on the dye types discussed above indicate low toxicity (Atkinson and Smart, 1981; Smart, 1984). Toxicity information from the Material Safety Data Sheets supplied by dye manufacturers/distributors is presented in Appendix 1.

IV. Methods and materials.

Dyes. Quinlan, 1986, established procedures for conducting dye tracings in conduit aquifers. His procedures have proven effective many times in field applications and will be followed for the proposed work. Many tracer materials have been described or proposed for conducting tracer tests. They include dyes, biological agents such as spores or bacteria, ionic compounds such as salts which can be detected using electrical conductivity, temperature variations, radioactive isotopes, acids, sugars and others. Dyes have the advantage of being relatively inexpensive, easy to apply, relatively easily detected and move well in the ground-water conduit.

Biological tracers such as spores are environmentally safe but have several drawbacks as tracers. Spores are denser than water and require considerable turbulence to pass through the conduit system. Spores require much preparation for their use and must be detected by microscope. Ionic compounds present a relatively low health threat and have simple equipment requirements but are easily adsorbed on clays in the ground-water system, require laboratory analysis for detection in small concentrations, and may be masked by background concentrations, a potential problem in the ABG study area.

Dyes vary enough in their properties that several may be used in conjunction, as proposed herein, to increase chances of their detection. Dyes are susceptible to adsorption onto clays and this could be a problem in what is possibly a poorly developed conduit system in the Beech Creek limestone. There may be dye compounds already in the ground-water system from past activities at the ABG and surrounding area. Concentrations, however, should be low through dilution. Background water samples collected in April of 1989 gave no indication of fluorescence under UV light. Background samples will be collected and analyzed again immediately prior to dye injection to check for fluorescence. The advantages of dyes enumerated above make them the materials of choice for conducting tracer tests at the ABG.

Dye injection. Dye injection will be made through wells screened in and near the Beech Creek solution zone because there are no surface exposures of Beech Creek in the ABG. Figure 3 is a geologic and well location map of the ABG proper. The cross-hatches indicate the approximate limits of the solution cavities (the conduit system) in the Beech Creek limestone at the ABG. Dye injection is proposed for two wells, 3-C2P2-86 or 3-C12-86 and 3-C3P2-86 (other Beech Creek wells are available in and near the solution zone if required). Figure 4 is a cross section which includes wells 3-C2P2, 3-C12 and 3-C3P2. Well in-

weight (A) supports a galvanized steel wire (B) to which is attached a tie-down cord (C) and a copper wire (D) holding the surgical cotton "bug". A packet of charcoal can also be attached. The tie-down cord secures the detector to a tree or other anchor near the stream or spring. The "gumdrop" detectors are easily fabricated in the lab.

Detection of the dyes is by recognition of telltale colors characteristic of specific dyes. Fluorescein (Uranine) is a distinct "Kelly-green", Direct Yellow 96 is yellow, and optical brighteners are blue. A semi-qualitative assessment of degree of fluorescein recovery on charcoal, proposed by Aley and Fletcher, ranges from very strongly positive to very weakly positive. Use of several dyes increases the chances of detection. A detector of each type (charcoal and cotton) will be attached to the concrete weight or anchor pin and placed in each monitoring site (spring or stream). Charcoal "bugs" will consist of about 2 tablespoons of activated coconut charcoal in a packet made of aluminum screening. The packets will be approximately 2 to 3 inches square. Cotton "bugs" will consist of surgical cotton tied to the weight with vinyl-clad copper wire. Prior to use, the material purchased for making the cotton bugs will be examined by UV light in the laboratory for the presence of optical brighteners that may have been added by the manufacturer.

Bugs will be placed at the detection points prior to injection of dye and will be collected within 24 hours. New bugs will be attached to the weights at each detection point to replace those collected for analysis. Bugs will be collected once a day for the first week and once per week thereafter until positive results are obtained or until a decision is made to end the test. Excess water will be squeezed from the bugs and the bugs drained when they are collected. Bugs will be sealed in "Zip-loc" plastic bags and the bags labeled with indelible marker for date and detection point. After collection the bugs will be moved into the field laboratory on base and analyzed for presence of dye.

Wells are poor collectors of dye tracings because flow velocity through the screen is generally very low. A simple detector can be constructed of 1-1/2 inch PVC pipe and attached to the outlet of a pump inserted into the well. Water pumped from the well passes through cotton and charcoal collectors in the PVC detector where traces of dye are deposited. Two wells screened in the Beech Creek in Johnson Hollow, southwest of the ABG site (Figure 1) will be sampled for tracers using a pump inserted into the well. The wells are 03C24 and 03C25. The core logs and well installation diagrams for the two wells are presented in Appendix 3. Figure 6 is a geologic profile through Johnson Hollow and wells -C24 and -C25. If the wells recover sufficiently fast, several well volumes will be pumped through the in-line filter to enhance the chances of collecting detectable quantities of dye. The pump and down-lines will be cleaned with nitric acid and rinsed with distilled water before being inserted into each well. Wells 03C24 and -C25 were sampled in April of 1988 and were free of contaminants. Water pumped from the wells will therefore not be contained.

The monitoring wells down-gradient of the ABG in Little Sulphur Creek are screened in alluvium containing clay, sand and gravel, not in

open conduits. Because dyes are susceptible to adsorption on fine grained soils, dye sampling of the alluvial wells is not believed appropriate for the ABG study area, and is not recommended in this proposal.

Detector information will be recorded on a Bug Placement Data Sheet similar to that shown in Appendix 2.

V. Analysis of Field and Laboratory Data.

Analysis of the dye collectors will be by observation of the cotton and charcoal collectors in fluorescent and visible light as described briefly above. Analysis by these means is qualitative. Quantitative analysis of tracer data can be made but requires the use of special measurement devices known as fluorometers. The filter fluorometer, or fluorimeter, provides a selection of narrow bandwidths of light to permit scanning for particular dyes. The fluorimeter also provides a quantification of fluorescent intensity. The spectrophotofluorometer is a more sophisticated device capable of scanning a sample for an entire range of tracer chemicals, quantifying the results and producing hardcopy printouts of the results. The fluorimeter is a field instrument; the spectrophotofluorometer is a laboratory, research grade instrument. Both instruments are expensive: a field fluorimeter and associated equipment runs around $7500, a spectrophotofluorometer runs around $25,000. Quinlan (1986) and Aley (course notes) state that in most cases adequate ground water tracing can be done qualitatively. We propose to conduct only qualitative tests in this proposal. If results of the tests warrant or if specific quantitative data are desired in the future we can consider purchasing quantitative equipment. Consulting services are also available for running quantitative analysis of dye tracings obtained in the field (for example, Aley, personal communication).

Cotton and charcoal detectors will be collected, washed, stored in "zip-lock" plastic bags and safeguarded for analysis. If the bugs cannot be examined within 12 hrs after collection they will be dried and refrigerated to prevent bacterial growth that can degrade the dyes. When removed from the packets in the laboratory, bugs will be rinsed to remove any accumulated sediment. Cotton "bugs" will be examined under long wavelength ultraviolet (UV) light in a dark viewing chamber. Cotton that has adsorbed Direct Yellow 96 is bright yellow. Phorwite AR (optical brightener) fluoresces blue-white.

Charcoal packets will be eluted with potassium hydroxide (KOH) dissolved in alcohol to determine the presence of fluorescein. The elutant is prepared in the laboratory by dissolving 5% KOH in a 70% solution of isopropyl alcohol (off-the-shelf rubbing alcohol). The solution separates into two layers, a saturated and a supersaturated solution. The lighter saturated elutant is decanted off and poured over the charcoal in a glass container. The elutant is then observed for several hours, or days if necessary, to record a response. The elutant will be observed in the beam from a high-intensity microscope lamp to enhance detection if a strongly positive result is not immediately obtained.

The results of examination of dye elutant and cotton bugs will be assessed for positiveness of dye presence. Results of sample analysis

and conclusions concerning flow paths and outlets in and near the ABG will be presented in a report.

Analytical information will be recorded on a Tracer Analysis Data Sheet similar to that shown in Appendix 2. The data sheet includes a description of the qualitative classification scheme to be followed in describing analysis results.

Questions or comments concerning this proposal should be directed to Bill Murphy at (601)634-3322.

References.

1. Aley, T., and M.W. Fletcher. 1976. The Water Tracer's Cookbook. Missouri Speleology, Vol 16, No. 3, p 1-32.

3. Atkinson, T.C., and P.L. Smart, 1981. "Artificial Tracers in Hydrogeology", in A Survey of British Hydrology, pp 173-190.

2. Hunt, R.W., 1988. Geology and Hydrogeology of the Ammunition Burning Ground, Crane Naval Weapons Support Center. Technical Report GL-88-27, Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi. Prepared for Naval Weapons Support Center, Crane, Indiana.

4. Quinlan, J.F., 1986. "Qualitative Water-Tracing with Dyes in Karst Terranes", in course manual Practical Karst Hydrogeology, with Emphasis on Groundwater Monitoring, presented by National Water Well Association

5. Smart, P.L., 1984. "A review of the toxicity of twelve fluorescent dyes used for water tracing". The NSS Bulletin, No. 46, pp 21-33.

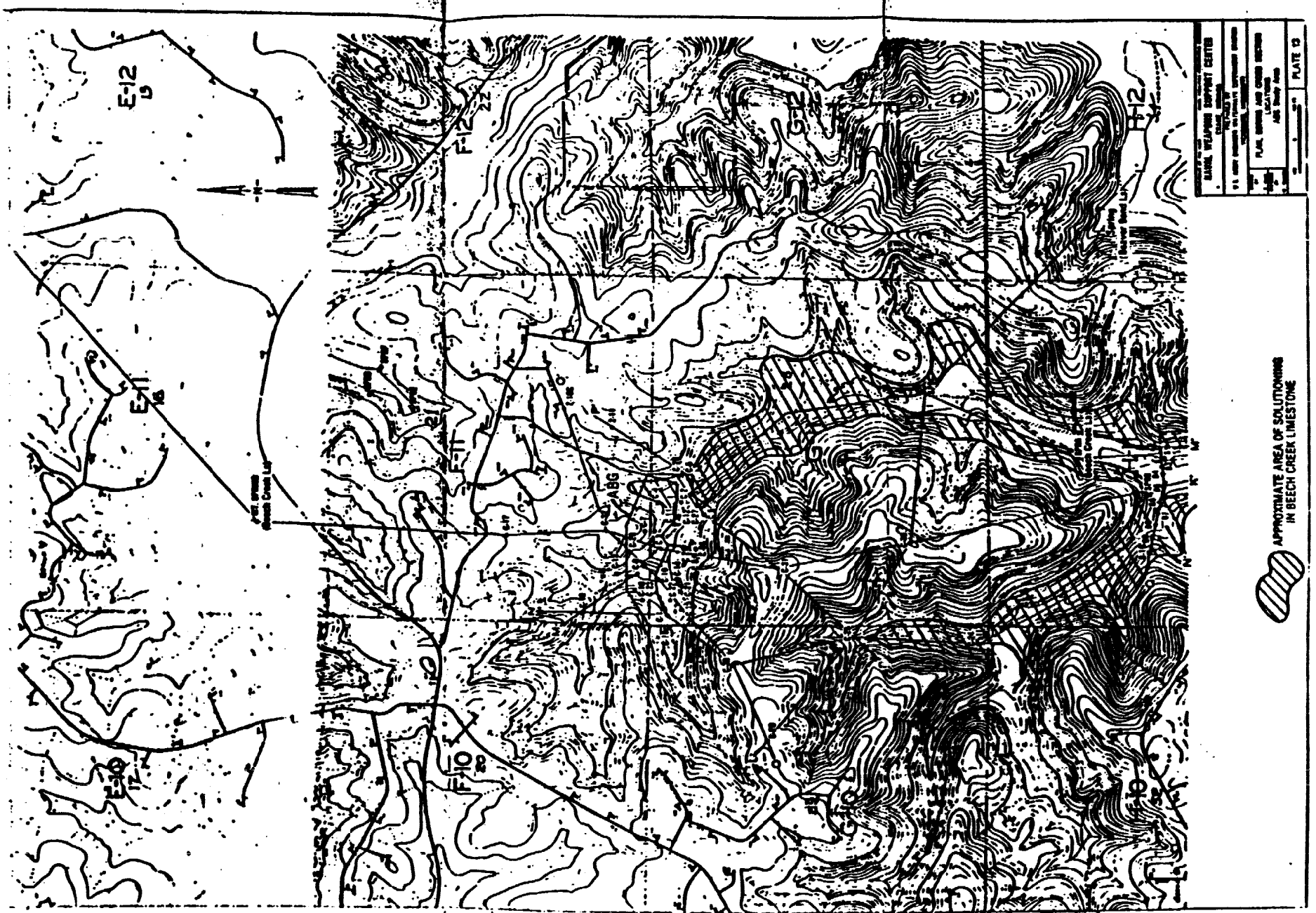

APPROXIMATE AREA OF SOLUTIONING
IN BEECH CREEK LIMESTONE
PLATE 13
E-12
E-11
F-12
F-11
F-10
G-12
H-12
ABG

FIGURE 1

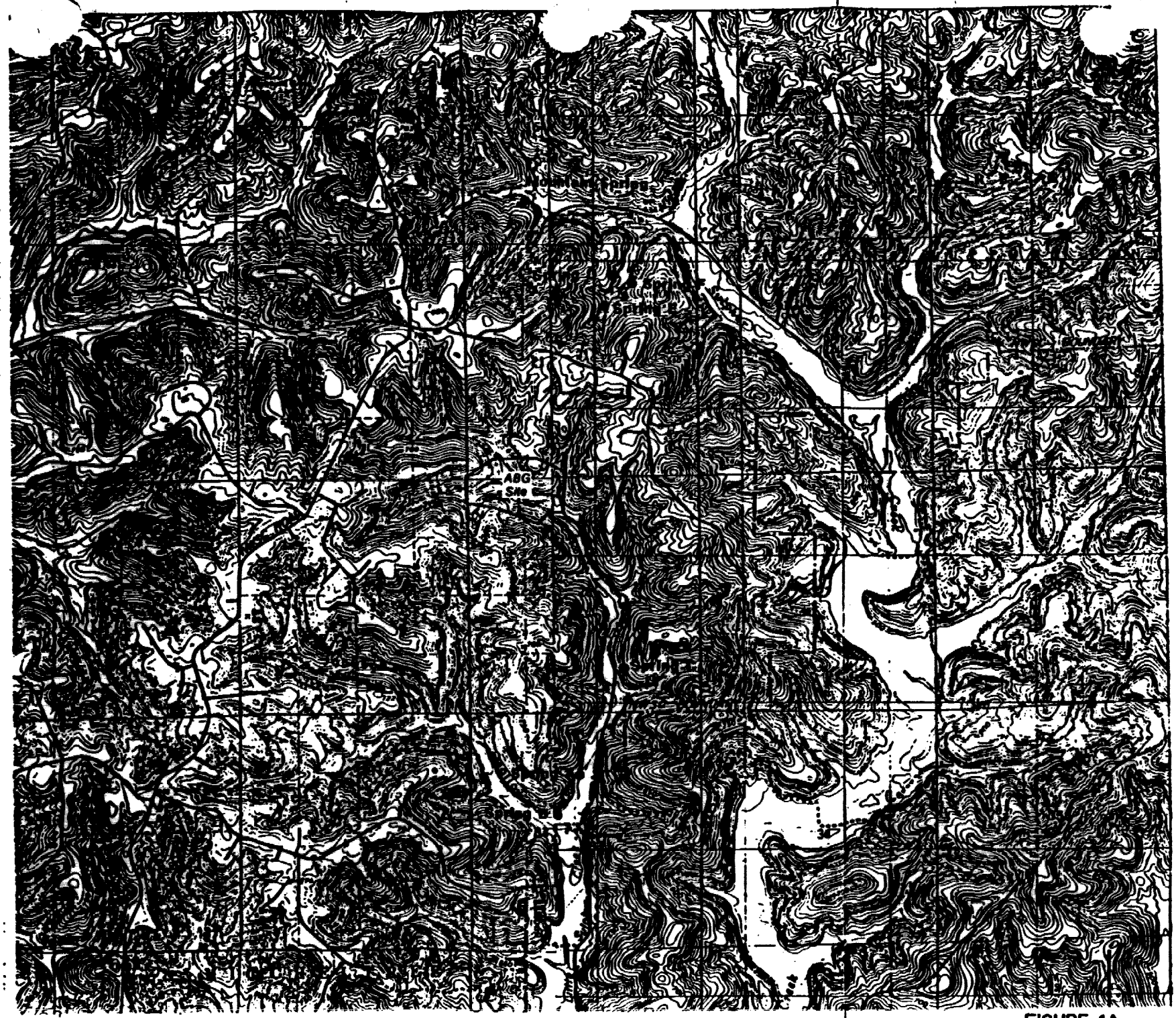


FIGURE 1A

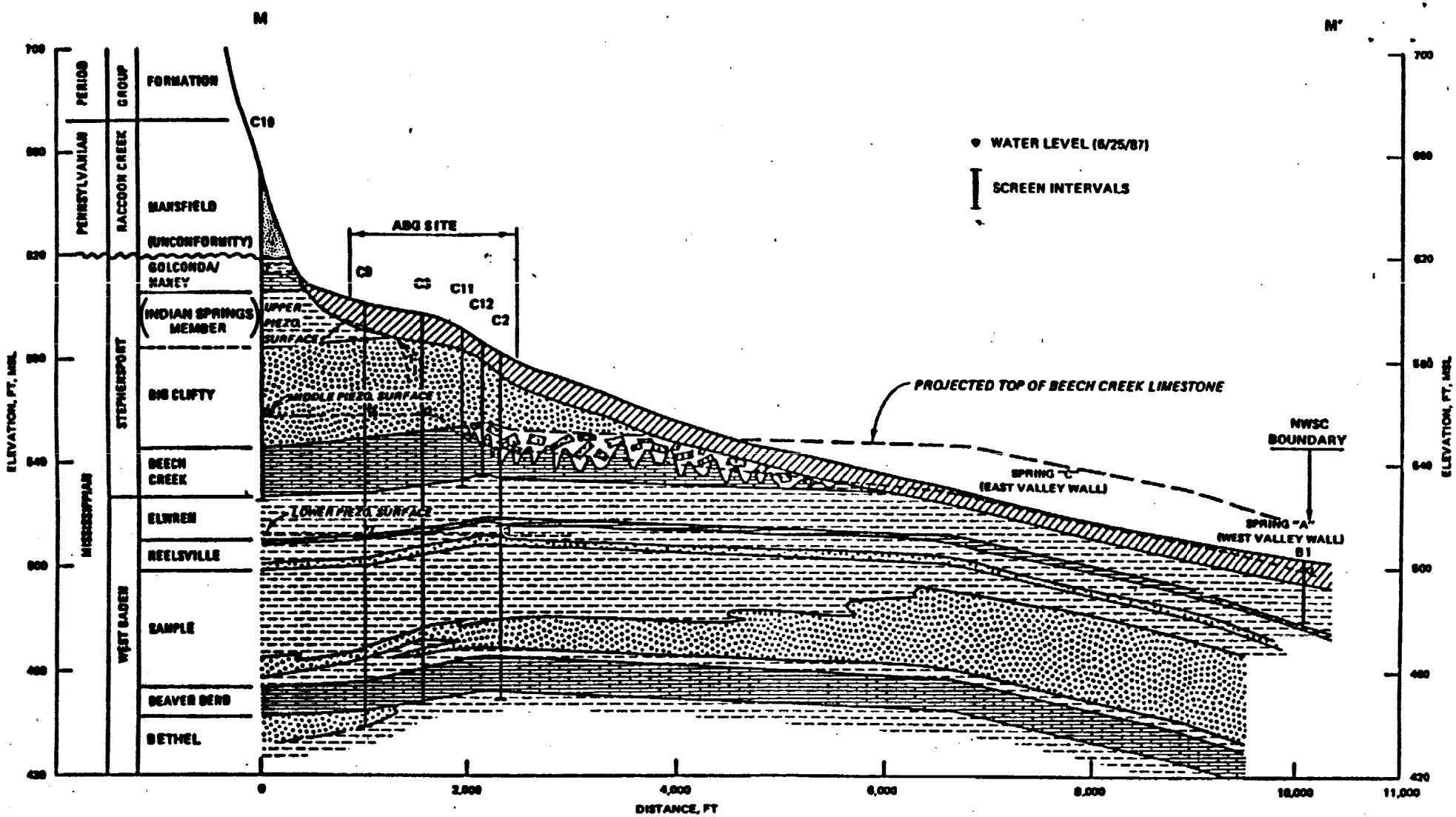

M
M'
PERIOD
GROUP
FORMATION
PENNSYLVANIAN
MISSISSIPPIAN
RACCOON CREEK
STEPHENSPORT
WEST BADEN
MANSFIELD
(UNCONFORMITY)
GOLCONDA/
HANEY
INDIAN SPRINGS
MEMBER
BIG CLIFTY
BEECH
CREEK
ELWREN
REELSVILLE
SAMPLE
BEAVER DEND
BETHEL
ELEVATION, FT, MSL
700
660
620
580
540
500
460
420
C10
ABG SITE
C9
C5
C11
C12
C2
UPPER
PIEZO.
SURFACE
MIDDLE PIEZO. SURFACE
LOWER PIEZO. SURFACE
WATER LEVEL (6/25/87)
SCREEN INTERVALS
PROJECTED TOP OF BEECH CREEK LIMESTONE
NWSC
BOUNDARY
SPRING "C"
(EAST VALLEY WALL)
SPRING "A"
(WEST VALLEY WALL)
B1
0
2,000
4,000
6,000
8,000
10,000
11,000
DISTANCE, FT

FIGURE 2

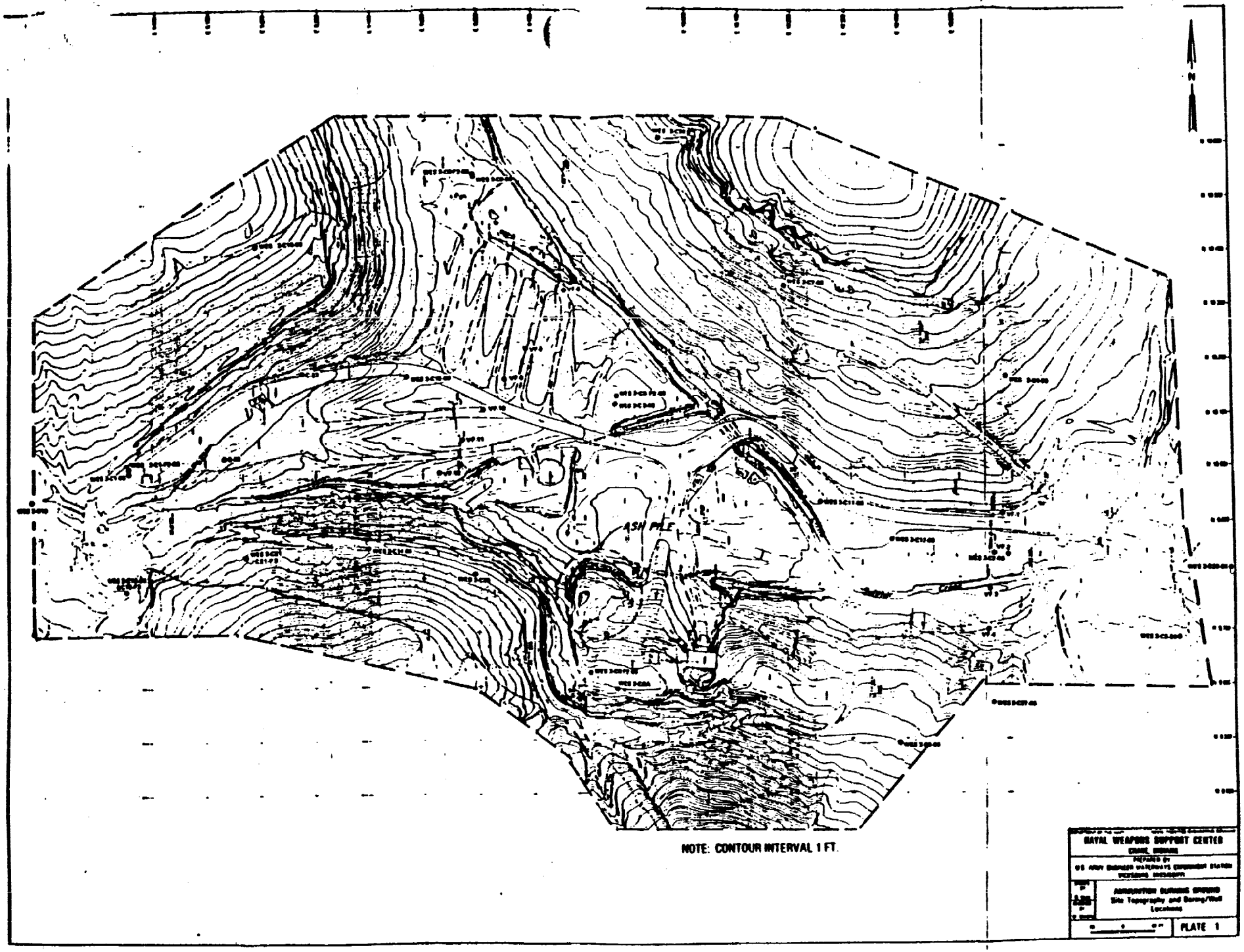

ASH PILE
NOTE: CONTOUR INTERVAL 1 FT.
NAVAL WEAPONS SUPPORT CENTER
PLATE 1

FIGURE 2A

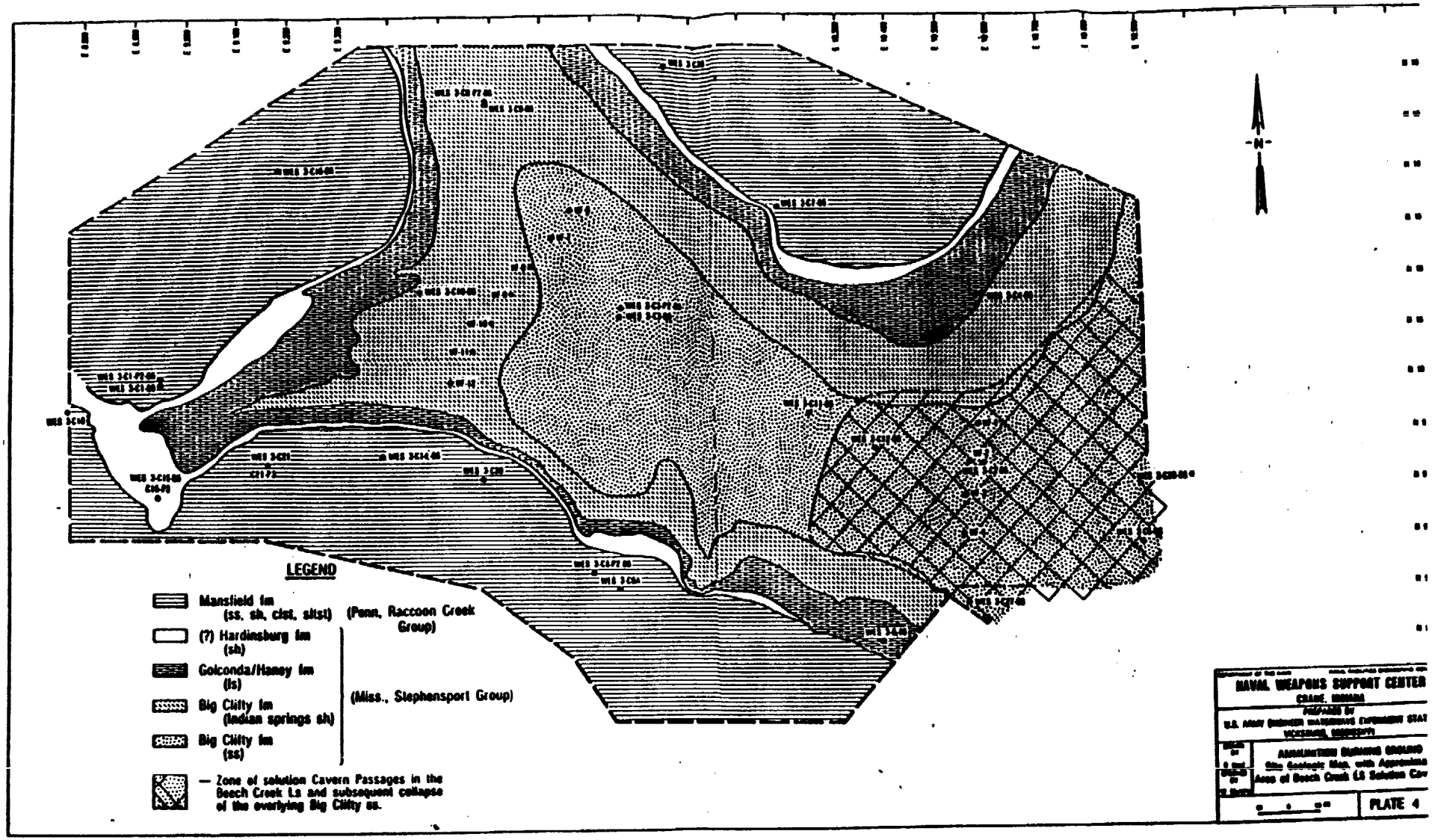

N
LEGEND
Mansfield fm (ss, sh, clst, sltst)
(Penn, Raccoon Creek Group)
(?) Hardinsburg fm (sh)
Golconda/Haney lm (ls)
Big Clifty lm (Indian springs sh)
Big Clifty lm (ss)
(Miss., Stephensport Group)
— Zone of solution Cavern Passages in the Beech Creek Ls and subsequent collapse of the overlying Big Clifty ss.
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA
PREPARED BY
U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STAT
VICKSBURG, MISSISSIPPI
AMMUNITION BURNING GROUND
Site Geologic Map, with Approxima
Area of Beech Creek LS Solution Cav
PLATE 4

FIGURE 3

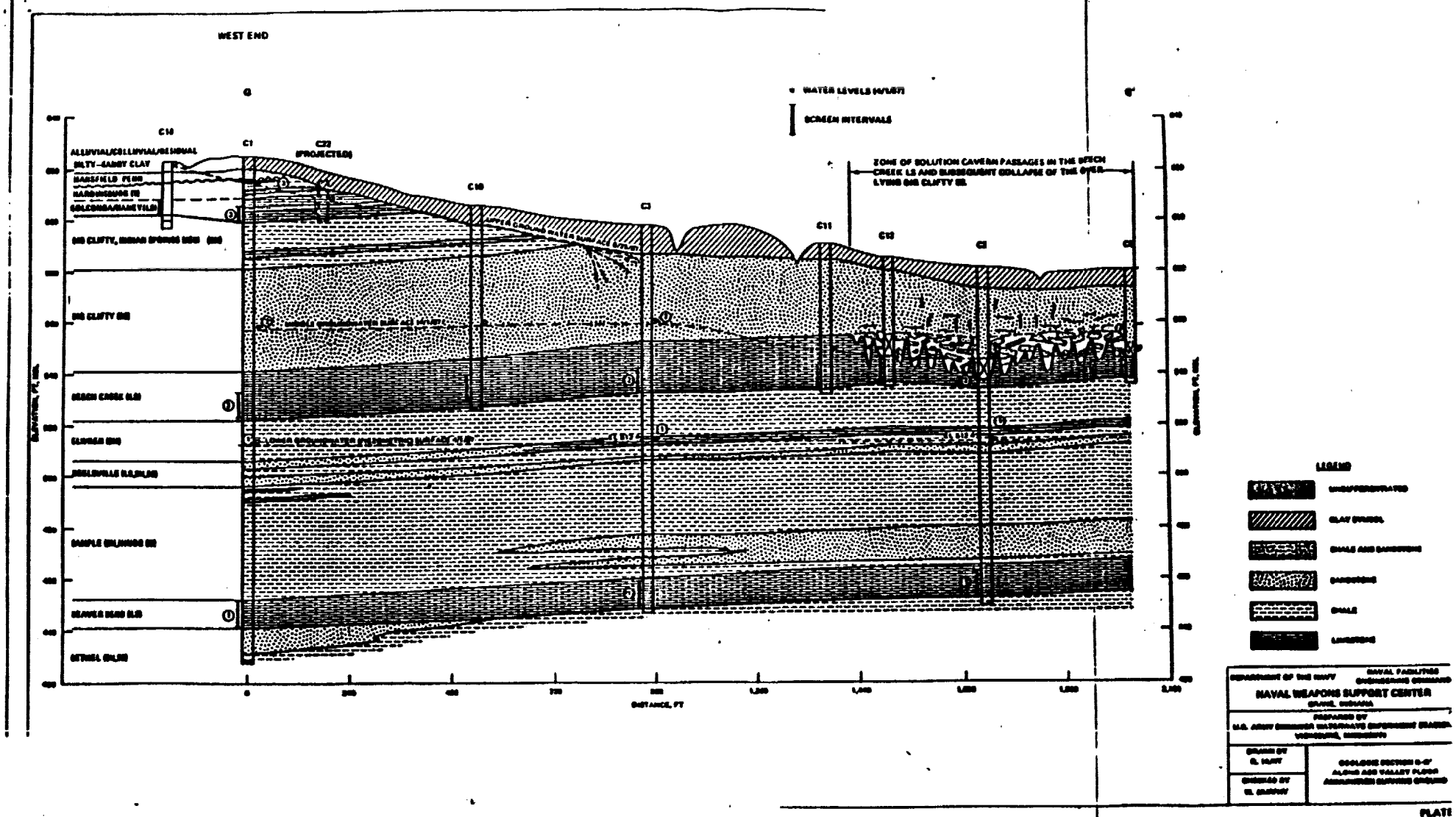
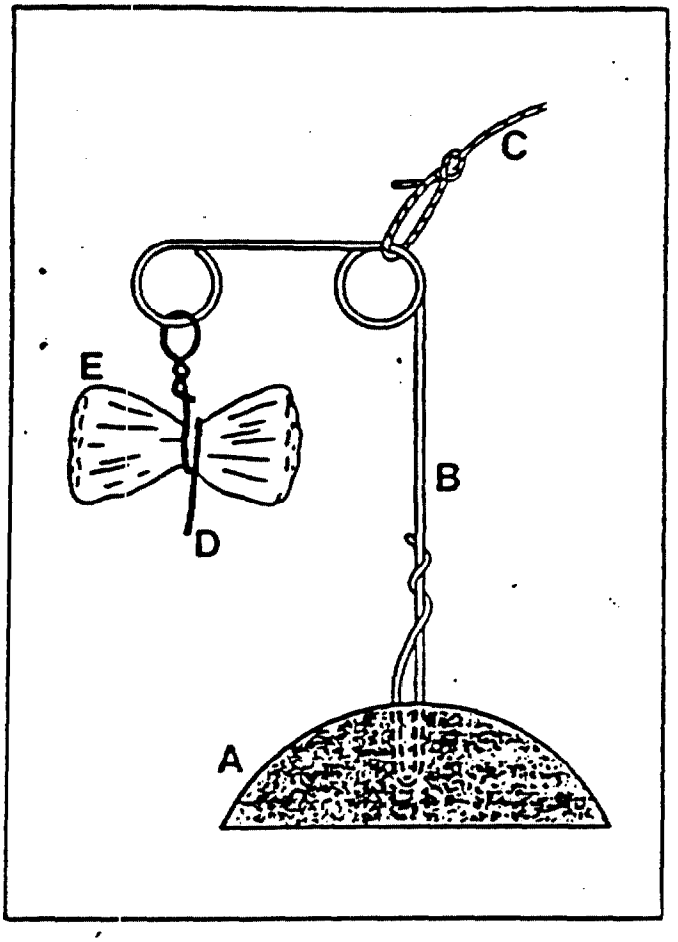
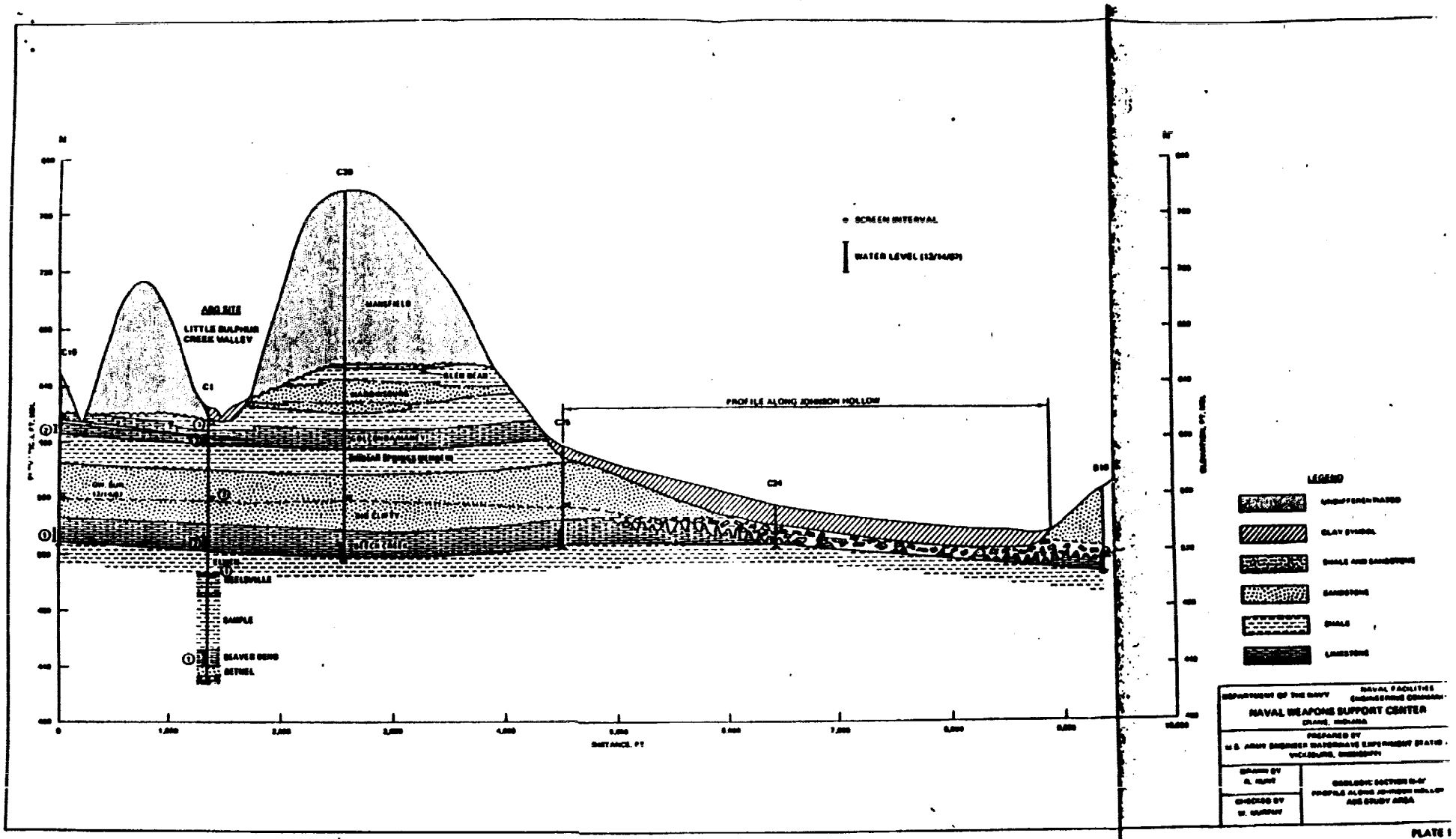

WEST END
WATER LEVELS
SCREEN INTERVALS
ZONE OF SOLUTION CAVERN PASSAGES IN THE BEECH CREEK LS AND SUBSEQUENT COLLAPSE OF THE OVER-LYING BIG CLIFTY SS.
C1
C22 (PROJECTED)
C10
C11
C12
ALLUVIAL/COLLUVIAL/RESIDUAL
SILTY-SANDY CLAY
HARSFIELD PENN
HARDINSBURG (S)
GOLCONDA/HANEY (LS)
BIG CLIFTY, INDIAN SPRINGS MBM (SS)
BIG CLIFTY (SS)
BEECH CREEK (LS)
CLIFTON (SS)
BEELEVILLE (LS,SH,SS)
SAMPLE (SH,SH,SS)
BEAVER BEND (LS)
BETHEL (SH,SS)
DISTANCE, FT
LEGEND
UNSUPPORTED
CLAY SYMBOL
SHALE AND SANDSTONE
SANDSTONE
SHALE
LIMESTONE
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL WEAPONS SUPPORT CENTER
PREPARED BY
U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION
VICKSBURG, MISSISSIPPI
DRAWN BY
CHECKED BY
GEOLOGIC SECTION G-G'
ALONG ASH VALLEY FLOOR
ASSUMPTION SURVEYING GROUND
PLATE

FIGURE 4



A Concrete weight
B Galvanized steel wire
C Tie-down cord
D Copper wire
E Cotton "bug"

Figure 5. Gumdrop used to suspend dye detectors (bugs) above stream or spring beds. Height about 12 inches.



SCREEN INTERVAL
WATER LEVEL (12/14/87)
ABG SITE
LITTLE SULPHUR CREEK VALLEY
MANSFIELD
GLEN BEAR
PROFILE ALONG JOHNSON HOLLOW
C30
C1
C24
SAMPLE
BEAVER BEND
BETHEL
INSTANCE, FT
LEGEND
UNDIFFERENTIATED
CLAY SYMBOL
SHALE AND SANDSTONE
SANDSTONE
SHALE
LIMESTONE
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NAVAL WEAPONS SUPPORT CENTER
CRANE, INDIANA
PREPARED BY
U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION
VICKSBURG, MISSISSIPPI
DRAWN BY
CHECKED BY
GEOLOGIC SECTION N-N'
PROFILE ALONG JOHNSON HOLLOW
ABG STUDY AREA
PLATE 1

FIGURE 6

APPENDIX 1.

Material Safety Data Sheets for Dye Tracers.

MATERIAL SAFETY DATA SHEET

15174 Uranine Conc. (Fluorescein Dye)

SECTION I - IDENTIFICATION

MANUFACTURER/DISTRIBUTOR. CHEMCENTRAL/Detroit
EMERGENCY PHONE NUMBER... (313) 941-4800
EFFECTIVE DATE..... 11-05-85
.....
CHEMICAL NAME..... Acid Yellow 73 (Color Index name)
TRADE NAME..... 15174 Uranine Conc.
CHEMICAL FAMILY..... Xanthene
CHEMICAL FORMULA..... 45350 (Color Index formula)

SECTION II - HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENTS	HAZARDOUS %	TLV (Units)	PROD. CAS #
None as per part 29 CFR .910.1200			

SECTION III - PHYSICAL DATA

BOILING Point(F)..... N/A
FREEZING POINT (F)..... N/A
VOLATILITY/VOL(%)..... N/A
MELTING POINT..... N/A
VAPOR PRESSURE (mm Hg)... N/A
VAPOR DENSITY (Air=1).... N/A
SOLUBILITY IN H2O..... Moderate
APPEARANCE/ODOR..... Orange powder, no characteristic odor
SPECIFIC GRAVITY (H2O=1). Approximately 1
EVAPORATION RATE..... N/A
pH..... N/A

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT..... N/A
LOWER FLAME LIMIT..... N/A
HIGHER FLAME LIMIT..... N/A
EXTINGUISH MEDIA..... Water fog, CO_2, or Dry chemical.
FOR FIRE..... Fire fighters should be equipped with self contained breathing apparatus and turnout gear.
UNUSUAL FIRE HAZARD..... Adequate ventilation and clean up must be maintained to minimize dust accumulation. May form explosive dust/air mixture.

SECTION V - HEALTH HAZARD DATA

MATERIAL SAFETY DATA SHEET

15174 Uranine Conc.

THRESHOLD LIMIT VALUE.... Ingestion in rats LD 50>6,800 mg/kg
OVER EXPOSURE EFFECTS.... Contact with eyes may result in severe irritation. Contact with skin may result in irritation. Ingestion may result in gastric disturbances. Inhalation of dust may irritate respiratory tract.
FIRST AID PROCEDURES..... Flush eyes with flowing water at least 15 minutes. If irritation develops, consult a physician. Wash affected skin areas thoroughly with soap and water. If irritation develops, consult a physician. Remove and launder contaminated clothing before reuse. If swallowed, dilute with water and induce vomiting. Get immediate medical attention. If inhaled, move to fresh air. Aid in breathing, if necessary, and get medical attention.
NEVER GIVE FLUIDS OR INDUCE VOMITING IF PATIENT IS UNCONSCIOUS OR HAS CONVULSIONS.

SECTION VI - REACTIVITY DATA

CHEMICAL STABILITY..... Stable
CONDITIONS TO AVOID..... N/A
INCOMPATIBLE MATERIALS... Unknown
DECOMPOSITION PRODUCTS... Carbon monoxide,Carbon dioxide,and oxides of Nitrogen.

HAZARDOUS POLYMERIZATION. Does not occur
POLYMERIZATION AVOID..... N/A

SECTION VII - SPILL OR LEAK PROCEDURE

FOR SPILL ..... Spills should be contained and placed in suitable containers.
WASTE DISPOSAL METHOD.... Do not discharge into sewers or waterways. Dispose of in accordance with local regulations.

SECTION VIII - SPECIAL PROTECTION

RESPIRATORY PROTECTION... NIOSH/OSHA approved dust respirator as necessary.
VENTILATION..... Local exhaust to control dusts.
PROTECTIVE GLOVES..... To prevent skin contact.
EYE PROTECTION..... Goggles.
PROTECTIVE EQUIPMENT..... Eye wash fountains should be easily accessible.
HANDLING AND STORAGE..... Keep away from excessive heat and moisture. Keep containers closed.

SECTION IX - SPECIAL PRECAUTIONS

HAZARD CLASS..... N/A
DOT SHIPPING NAME..... Coal Tar Dyestuff

MATERIAL SAFETY DATA SHEET

15174 Uranine Conc.

EPORTABLE QUANTITY (RQ). N/A
JN NUMBER..... N/A
IA #..... N/A
ACKAGING SIZE..... Various

OOT NOTES
his information is furnished without warranty, representation, or license of ny kind, except that it is accurate to the best of CHEMCENTRAL Corporation's nowledge or obtained from sources believed by CHEMCENTRAL Corporation to be ccurate. The CHEMCENTRAL Corporation does not assume any legal responsibility or use or reliance upon same. Customers are encouraged to conduct their own ests. Before using any product, read its label.

I/A = Not applicable

EFERENCES

PYLAM Products Company, Inc.

MATERIAL SAFETY DATA SHEET

I. MATERIAL IDENTIFICATION

NAME: DIRECT YELLOW 96
MANUFACTURER/DISTRIBUTOR: PYLAM PRODUCTS COMPANY INC.
1001 STEWART AVE.
GARDEN CITY, N.Y. 11530

TELEPHONE NUMBER: (516) 222-1750

COLOR INDEX NAME/NUMBER: DIR. YELLOW 96 CAS NUMBER:

DATE PREPARED: 2/89 TYPE:STILBENE

II. HAZARDOUS COMPONENTS NONE AS PER 29CFR PART 1919.1200

III. PHYSICAL DATA

ODOR	NONE
FORM	POWDER
COLOR	YELLOW
SOLUBILITY IN H20	GOOD

IV. HAZARDOUS REACTIVITY

INSTABILITY : STABLE. POLYMERIZATION: NOT OCCUR
INCOMPATIBILITY: OXIDIZING AND REDUCING AGENTS
DECOMPOSITION PRODUCTS: OXIDES OF NITROGEN AND OXYGEN

V. FIRE AND EXPLOSION DATA

DUST MAY FORM EXPLOSIVE MIXTURE WITH AIR.
EXTINGUISHING MEDIA: WATER. DRY CHEMICAL. CO2.
SPECIAL FIRE FIGHTING INSTRUCTIONS: NONE

VI. SPECIAL PROTECTION

GENERALLY APPLICABLE CONTROL MEASURES AND PROCEDURES

USE ONLY WITH ADEQUATE VENTILATION. KEEP CONTAINER TIGHTLY CLOSED. AVOID DUST GENERATION. DO NOT CONSUME FOOD, DRINK OR TOBACCO IN THE AREAS WHERE THEY MAY BECOME CONTAMINATED WITH THIS MATERIAL.

PERSONAL PROTECTIVE EQUIPMENT

EYE/FACE: COVERALL CHEMICAL SPLASH GOGGLES.
PROTECTIVE GLOVES: RUBBER

VII. HEALTH HAZARD DATA

TLV UNITS: ~~NOT ESTABLISHED~~
OVER EXPLOSURE EFFECTS: ~~NOT ESTABLISHED~~
LD50 GREATER THAN - 15,000 MG/KG

EYE - NON-IRRITATING
SKIN " "

VIII. EMERGENCY FIRST AID

INHALATION – IF LARGE AMOUNTS ARE INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN, AND CALL A PHYSICIAN.

SKIN CONTACT – FLUSH SKIN WITH WATER AFTER EXCESSIVE CONTACT. WASH THOROUGHLY WITH HANDCREAM OR HANDCLEANER.

EYE CONTACT – FLUSH EYES IMMEDIATELY WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES. CALL A PHYSICIAN.

INGESTION – INDUCE VOMITING IMMEDIATELY BY GIVING TWO GLASSES OF WATER ALSO STICKING FINGER DOWN THROAT. NEVER GIVE FLUIDS TO AN UNCONSCIOUS PERSON. CALL A PHYSICIAN.

IX. DISPOSAL AND LEAK INFORMATION

USE AN ABSORBENT TO PREVENT DUSTING. SWEEP OR SHOVEL INTO A CONTAINER. WASH DOWN THE AREA WITH WATER.

WASTE DISPOSAL METHOD

BURY OR INCINERATE ACCORDING TO FEDERAL, STATE, AND LOCAL REGULATIONS.

DRUM DISPOSAL

CONTAINERS SHOULD BE TRIPLE RINSED WITH WATER BEFORE DISPOSAL.

X. SHIPPING DATA

DOT PROPER SHIP – NOT REGULATED

XI. STORAGE DATA

STORE IN COOL, DRY PLACE.

THE DATA AND INFORMATION GIVEN IN THIS MATERIAL SAFETY DATA SHEET ARE ACCURATE ON THE DATE OF PREPARATION. IT DOES NOT INDICATE ANY WARRANTY OR REPRESENTATION. WE DISCLAIM ALL LIABILITY RELATING TO USE OF THIS MATERIAL SINCE THIS IS BEYOND OUR CONTROL.

MATERIAL SAFETY DATA SHEET

MANUFACTURING DIV. ADDRESS

MOBAY CHEMICAL CORPORATION-Dyes and Pigments Division
PO Box 385 Union Metropolitan Park
Union, New Jersey 07083

DATA SHEET NO.
DIVISION
ISSUE DATE Aug 1983
ISSUED BY
SUPERSEDES ISSUE OF Nov 1980

CHEMTREC CHEMICAL TRANSPORTATION EMERGENCY TELEPHONE NO: 800-424-9300; DISTRICT OF COLUMBIA: 202-483-7616	MOBAY NON-TRANSPORTATION EMERGENCY NO.: (803) 553-3155
PRODUCT NAME: PHORWITE AR Solution	PRODUCT CODE NUMBER: 70129, 09
CHEMICAL FAMILY: Stilbene	CHEMICAL NAME & SYNONYMS: Fluorescent whitening agent
CHEMICAL FORMULA: Proprietary	TRADE NAME & SYNONYMS: Same as product name

HAZARDOUS INGREDIENTS

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS OR GASES	%	CURRENT TLV
None as per 29 CFR section 1910.1000 subpart Z		

PHYSICAL DATA

APPEARANCE (SOLID, LIQUID, GAS): Liquid	MOLECULAR WEIGHT: NA	MELT POINT: NA	SPECIFIC GRAVITY: NE
VAPOR DENSITY (AIR=1): NE	COLOR: Yellow	BULK DENSITY: NA	BOILING POINT: NE
VAPOR PRESSURE: NE	SOLUBILITY (WATER): Soluble	ODOR: Characteristic	% VOLATILE BY VOLUME: NE

FIRE & EXPLOSION DATA

FLASH POINT °F (METHOD USED): NA	FLAMMABLE LIMIT: Lel NA Uel NA	EXTINGUISHING MEDIA: Water, dry chemical, CO_2, foam

SPECIAL FIRE FIGHTING PROCEDURES, UNUSUAL FIRE OR EXPLOSION HAZARDS

Firefighters should be equipped with self-contained breathing apparatus to protect against potentially toxic and irritating fumes.

TOXICITY DATA

LD50, ORAL (INGESTION): NE	LD50, DERMAL (SKIN CONTACT): NE	INHALATION (LC50): NE
FISH, LC50 (LETHAL CONCENTRATION): NE	TLV (LIMITS) (THRESHOLD LIMIT VALUE): NE	SKIN IRRITATION: NE
EFFECTS TO EYE: NE	EFFECTS TO LUNG: NE	OTHER:

EMERGENCY AND FIRST AID PROCEDURES, EFFECTS OF OVER EXPOSURE

For eyes: Flush thoroughly with water. Get prompt medical attention.

For skin: Flush with water.

Effects of overexposure: Prolonged contact may cause irritation.

APPENDIX 2.

Dye Trace Data Sheets

BUG PLACEMENT DATA SHEET

TEST SITE: INVESTIGATOR:

Date Bug Placed	Monitoring Loc.	Bug Type Cotton	Bug Type Charcoal	Date Bug Collected	Jar #	Comments

TRACER ANALYSIS DATA SHEET

TEST SITE: INVESTIGATOR:

DATE ANALYZED	BUG TYPE	ELUTANT	RESULTS*

1. Very strongly positive: Dye can be seen distinctly with the naked eye in sunlight or in an artifically lighted room within 15 minutes of the time that KOH and alcohol are added to the charcoal.
2. Strongly positive: Same as above, but after 15 minutes and before 3 hours.
3. Moderately positive: Dye can be seen with the naked eye in sunlight or in an artificially lighted room, but not until 3 to 24 hours after adding KOH and alcohol. The dye is indistinct, and the observer feels it is necessary to verify the results by beaming a light into the sample jar.
4. Weakly positive: Dye cannot be detected by the naked eye in sunlight or in an artificially lighted room until more than 24 hours after adding KOH and alcohol. Dye can be distinctly seen by the naked eye when a light is beamed through the sample jar.
5. Very weakly positive: The appearance of the dye is similar to weakly positive tests, but the dye cannot be seen until more than one but less than 10 days after adding KOH and alcohol. The dye can be distinctly seen by the naked eye when a light is beamed through the sample jar.

From Aley, T. and M.W. Fletcher, 1976. The Water Tracer's Cookbook, Missouri Speleology , Vol 16, no. 3, p 16.

DYE INJECTION DATA SHEET

TEST SITE: INVESTIGATOR:

DATE INJECTED	INJECTION SITE	TRACER(S) USED	COMMENTS

APPENDIX 3.

Well Installation Diagrams and Boring Logs.

Boring Log Legends

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			ROCK CORE BORING LOGS			
			ROCK SYMBOLS			
			SANDSTONE			
			LIMESTONE			
			SHALE OR CLAYSHALE			
			SHALE W/ CLAYEY LIMESTONE			
			CALCAREOUS SANDSTONE, SANDY LIMESTONE			
			SHALE W/ SANDSTONE LENSES			
			COAL			
			CLAYSTONE			
			SOIL SYMBOLS			
			CRUSHED LIMESTONE ROAD FILL			
			SILT (ML)			
			CLAY (CL OR CH) OR CLAYEY SILT (ML-CL)			
			CLAY (CL) WITH ROCK FRAGMENTS			
			CLAYEY SAND (SC)			
			SILT (ML) WITH ROCK FRAGMENTS			
			JOINT SYMBOLS			
			CLOSED HORIZONTAL JOINT			
		10	CLOSED JOINT DIPPING 10°			
		10	OPEN JOINT DIPPING 10°			
			CLOSED OR INCIPIENT JOINT DIPPING 80°			
		35	INTERSECTING JOINTS W/ DIPS AS SHOWN			
			STYLOLITES			
			ROUGH, IRREGULAR JOINT			
			CORE LOSS ZONE			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2P2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Well No: WES-3-C2P2-86 (Beech Creek Ls)			Date well screen was set: 10/29/86
583.6			+2.5			
581.1			0.0' Ground surface			
			Grout mixture (Bentonite & cement)			Water level just Prior to setting screen - 36.0'
			14.0'			
			Bentonite Pellets (Sand-Pea Gravel mixture)			Teflon pipe between 27.6 to 49.0'
			17.0'			
			Filter Pack			
543.1			38.0'			
			Well Screen			
533.1			48.0'			
			Trap			
			49.0'			
			49.0' Boring Depth			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION: US Navy	INSTALLATION: Grane In	SHEET 1 of 14 SHEETS

1. PROJECT: NWSC Groundwater Study	10. SIZE AND TYPE OF BIT: HQ wireline
2. LOCATION (Coordinates or Station): (ABG)(Burning Grounds), Geologic Study	11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
3. DRILLING AGENCY: WES	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): WES-C2-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: Dan Taylor	14. TOTAL NUMBER CORE BOXES: 10
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER:
	16. DATE HOLE: STARTED Aug 28 1986 / COMPLETED Sept 4, 1986
7. THICKNESS OF OVERBURDEN: 8.5'	17. ELEVATION TOP OF HOLE: ~ 581.5'
8. DEPTH DRILLED INTO ROCK:	18. TOTAL CORE RECOVERY FOR BORING: %
9. TOTAL DEPTH OF HOLE: 132.7'	19. SIGNATURE OF INSPECTOR: Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silt (ML) dBr, clayey, w/ small ss frags, becomes sdy w/ depth, firm, moist in upper 1½' becoming sli-moist w/ depth.			Drilled from 0.0 to 10.2' with an 8" dia. folding auger
	1					
	2					
	3					
	4					
	5		Silt (mL) drBr + yBr sdy, num ss frags w/ Fe crusting (rounded-angular), firm, sli-moist-dry.			
	6					
	7					
	8					
	9		Silty Sand, (soft ss) (Big clifty ss), lyTan vf, firm, oxidized weathered			
	10					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, other if significant) g
	10		Grades to SS	Run 1		Set Temporary Surface Casing to ~10.0'.
	11	20	Sandstone, lg Tan w/lg tones, of uniform grain, thk bd w/shallow cross bd'ing + ripples (bed dip 8-10°), oxidized, mod hard, friable; blk mn stain + limonite along jts.			Started coring w/ HQ wireline bbl at 10.2' w/clean water.
	12	45				Lost all water return at ~11.5'
				4.8 / 5.3	Run 1	
	13	40		(-0.5)		
	14					
	15	40				
		30		15.5		
	16	50		Run 2		
	17	30	concentration of Blk Fe grains.			
	18	20	thin clay lens	8.2 / 8.9		
			dcBr. highly oxidized zone (Limonite concentration) soft rk.	(-0.7)		
	19	10				
	20	30				

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (PROJECT) (HOLE NO.)

DRILLING LOG	DIVISION	INSTALLATION	SHEET 8 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		SS, (Cont)			
			(20.3 - 22.2') slightly coarser, 1Br oxidized Num Fe grains. (vf-m)			
	21					
			Joints have Blk min stains + limonite coating, generally rough + planar to sli irregular.			
	22					
			Color becomes 1 ton-Gr below 22.2 - 25.0'			
	23					
	24			24.4 / Run 3		
	25		(25.0 - 26.4') slightly coarser (vf m), 1-d Br num oxidized Fe grains, 1Br + dBr			
	26					
	27					
			Color 1ton-Gr below 26.4' to ~32.5'	8.1 / 9.1		~27 to 28'
	28			(~10')		Projected Top of Beech Creek Ls prior to Solutioning processes. Big Clifty SS below ~28' has settled into Solution Cavities in upper Beech Creek Ls
	29					
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF 14 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		SS, (cont) (Big cliffy)			
			Blk mn stn along jts.			
	31					
	32					
	33		open (clay filled?)			
			(33.5-36.5') ≈ 15 dBr + 1Br, vf-m grain w/ minor coarse grains mom oxidized Fe grains + small Fe nodules up to ~ ¼" size.	33.5' Run 4		
	34					
	35		Lim + Blk mn stn along jts.			
	36					
	37		Note: The core loss zone represents solutioning in the upper Beech creek Ls. The overlying Big cliffy SS has dropped down, or settled into the cavities created by the solutioning. Joints and bedding planes in the lower Big cliffy SS have opened in proportion to the degree of settlement	2.0/8.0 (-8.0)		
	38					
	39					
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 5 OF 14 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number) 03C2
5. NAME OF DRILLER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED — COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40					
	41			41.5 Run 5		8/29/86 water level – 36.0'
	42					
	43					
	44		solution surface	3.0/6.0'		
	45		Limestone (Beech Cr. – lower zone) mbrGr + brn in top 1½', YdGr tuscan in bot 1½', f.-m. crystalline, shard fossiliferous; slightly shaty, w/ pyrite inclus at contact w/ underlying Elwren shale. Joints are coated w/ white substance & thin Fe...	(3.0')		– Beech Creek Ls. (Lower zone)
	46					
	47		Pyrite crystals at contact	87.5 Run 6		Top Elwren Fm 47.5'
	48		Shale (Elwren Fm) dgr Gn, mass. th bd, mod hard, crumbly-flaky, occ c'sides			
	49			3.1/4.7 (1.6')		
	50					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. ~ (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 6 OF 19 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	50		Shale (cont.)			In an effort to set 4" casing - ran a 5 3/4" RR Bit to ~ 45.0'. Rods broke off at top of 10' Guide above bit. Retrived tools from hole and went back in with a 6 3/4" RR Bit. Bit was "grabbing" so bad in cavity zone that the possibility of breaking off in hole over-shadowed continuing w/RR Bit. Using a diamond shoe on end of 6" casing - reamed hole to 54.8' and set 4" PVC casing to 54.8'. Sealed casing in the Elwren sh w/ Grout. 9/3/86 - started back coring w/HQ wireline bbl
	51					
	52		Shale, dgrGn w/alter drBr layering, thlct, platey, hard	52.2' Run 7		
	53			2.1/2.6		
	54			-0.5		
			num drBr veinlets (like healed frac's) in Gn Sh.	54.8'		
	55		claystone, drBr, mass, hd, blocky, s'sides dip ~5°.	Run 8		
	56		Shale, dgrGn, mass, highly frac w/ occ angular GnGr Ls(?) and drBr claystone inclus, hard, blocky, (zone has somewhat of a brecciated appearance)			Getting most of water return thr. 4" casing.
	57		mottled w/ drBr clst.	7.9/8.3		
	58			-0.4		
	59					
	60		See next sheet			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 7 OF 11 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	60		Shale dGr, w/other lts + partings of mGr, vf silty sandstone (v thinly laminated sh + SS), hard			
	61					
	62					
				62.7		Full depth
	63			62.1		
				Run 9		
			Top Reelsville Fm 63.8'			Top Reelsville Fm 63.8'
	64		Limestone, v hard, brittle olive grBr, sdy, ferruginous; lGr, vf granular - crystalline sdy; alternating olive grBr + lGr ls (calcareous), cross bedding (breaks appear fresh); lGr ls (calcareous)			
	65					
	66			10.4 / 10.0		
	67		(66.4-70.0) Shale dGr laminated w/mGr silty ss/ls (similar to above), small angular ls frags are included in the top 0.3'	+0.4		
	68					
	69					
	70					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 8 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	70		(70.0 - 73.1) Sandstone, mgr Br, fine grained, mass w/ mm grGn shale partings + flattened inclusions, v hard, brittle (Jt's are rgh, irreg, part filled w/ Gr clay)			
	71		Ls, lGr, w/occ Gn sh pts, v hard, brittle			
	72		Ls (as above)			
	73		Top of Sample fm	73.1 / Run 10		Top of Sample fm 73.1
			Shale, dGr, th bd. w/ mm to occ lGr, v fine thin ss / Ls lens, hard, Platey - flakey			
	74					
	75					
	76			10.0 / 10.0		
	77					
	78					
	79		Ls, lGr, v fine, granular, brittle, v hard, occ sh pts.			
	80					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 9 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	80		Shale (Cont.)			
	81					
	82					
	83			83.1 / Run 11		PLW 9/4/86
	84					
			Ls, olive Gr, v hd, v fine.			
	85					
	86					
				8.8 / 13.0		
	87					
				I/c		
	88			100%		
	89					
	90					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 10 OF 19 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	90		Shale (cont.)			
	91					
				91.9		Pull depth
	92					
	93			93.1		
				Run 12		
	94					
	95			100%		
	96			10.1 / 9.4		
	97			(+0.7 +0.5 +1.2)		
	98					
	99					
	100					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (PROJECT) (HOLE NO.)

DRILLING LOG	DIVISION	INSTALLATION	SHEET 11 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	100		Shale (cont.)			
	101		Sandstone, m Gr, Fine grained (uniform rounded qtz sd grains), mm vdGr-Blk wavey shale partings, hard, sli friable. (101.0-114.5')			
	102			102.0 / 102.5 Run 13		Pull depth
	103	5				
		5				Good water Ret.
	104	60	It's rough, irregular, Fresh (v tight insitu)	100%		
	105	80				
	106		lighter Gr + less friable SS than above and below, calcareous (sd. Ls?)	10.4 / 10.3 (+0.1 / +0.1) (+0.5)		
	107					
	108					
	109	70				
	110					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSMITTED)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 14 OF 14 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED 9/4/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	130		disc shaped lens, hard, platey.			
	131					
	136					
	133		Bottom of hole 132.7'			water level 9/5/86 68.7' (water in Beaver Band Ls)
	134					
	135					
	136					
	137					
	138					
	139					
	140					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C 3 P2	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Well No.: WES-3-C3P2-86 (Beech Creek Ls)			Date well screen was set: 10/23/86
610.2			+2.5'			
597.7			0.0' Ground surface			
			Grout mixture (Bentonite & cement)			Water level just Prior to setting screen - 39.0'
			12.0'			
			Bentonite Pellets			
			20.0'			Teflon pipe between 25.8 - 56.8'
			Filter Pack (Sand-Pea Gravel mixture)			
541.9			55.8			
			Well Screen			
531.9			65.8			Lost air-drill water near Base of Ls
			Trap			
			66.8			
			67.0 Boring Depth			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

WES-C3-86

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane, In	SHEET 1 OF 15 SHEETS
PROJECT WSC Groundwater Study		10. SIZE AND TYPE OF BIT HQ wireline core-BBL	
LOCATION (Coordinates or Station) (ABG) (Burning Grounds), Geologic Std.		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
2. DRILLING AGENCY WES		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
3. HOLE NO. (As shown on drawing title and file number) WES-C3-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
4. NAME OF DRILLER Dan Taylor		14. TOTAL NUMBER CORE BOXES 11	
5. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
6. THICKNESS OF OVERBURDEN 14.0		16. DATE HOLE: STARTED 9/5/86; COMPLETED 9/13/86	
7. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE ~ 598.5' (Temp Bench)	
8. TOTAL DEPTH OF HOLE 150.7'		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR Geologist Richard W. Hunt	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Clayey Silt (ML), Tan, w/small to large rk frags, v firm, moist.			Drilled from 0.0 to ~8.0' w/ 8" folding auger; 8.0 to 12.2 w/ pitcher sampler using water; 12.2 to 18.5 w/ 6" RR bit; + 18.5 to Bot. w/ HQ wire line core bbl using water. (Bot Depth 150.7')
	1					
	2					
	3		Silty clay (CL) olive Br-Br, w/rk frags, v firm, moist.			
	4					
	5					
	6					
	7		Silty Clay (CL), rBr, v firm, moist			
	8		Clay (CL) rusty Br, w/ abundant rk frags (mostly sub-rounded to angular wea SS frags), v firm, moist.			
	9					
	10					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

WES 2 ...

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 15 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10		Clay w/rk frags (cont.)			
			Base of stream cut			
	11		Clayey Sand (SC) rusty Br & lGr (mottled) mass, firm, moist, highly wea SS frags occur w/depth. (Zone is weo residual on top of Big clifty sandstone)			
	12					
	13					
	14		Sand to soft sandstone, (highly wea SS) w/ mod hd SS frags, oxidized, vf-f moist, yBr			
	15		Big clifty SS			
	16					
	17		Top of True Rk (17.2')			
			Sandstone, lyBr, vf-f, uniform grained, rounded qtz sd, Hd bd, hard, friable, oxidized, shallow cross bedding + ripples.			
	18					Set 6" dia PVC surface casing to 18.5'.
			(weak sandstone)	Run 1		9/8/86 started coring w/ HQ wire line bbl, using water.
	19		Big clifty SS			
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. 03-5-28-6

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 15 SHEETS

AGENCY	10. SIZE AND TYPE OF BIT
	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
2. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		SS (cont)			
	21					
	22					
		10		9.5 / 9.5	Rec. / Run	
		15				
	23					
		20	Sts are tight, lightly stn. sl. rough, planar			
		20				
	24	15				
		20				
	25					
	26					
	27					
	28			28.0 / Run 2		
	29					
			Br, highly oxidized + dim stn, occ fine nodules, softer than above & below			Zone Shaded Outside w/18.2-19.3' in WES-C2-86
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF 15 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		SS (cont.)			
	31					
	32	15 20 30				good water return
	33			33.2 Run 8		
	34	10 10 30				
	35					
	36		← 35.7' probable high ground water level in zone confined above the Elwren Shale fm.			
	37		(35.7-42.5') SS is pale or + less oxidized than above	18.2 / 10.2		
	38					
	39					
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 5 OF 15 SHEETS

PROJECT	10. SIZE AND TYPE OF BIT
	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
...ION (Coordinates or Station)	12. MANUFACTURER'S DESIGNATION OF DRILL
3. DRILLING AGENCY	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
4. HOLE NO. (As shown on drawing title and file number) 03C3	14. TOTAL NUMBER CORE BOXES
5. NAME OF DRILLER	15. ELEVATION GROUND WATER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		SS (Cont.)			
	41	0				
	42	0				
	43					Flange
		0	dBr, coarse grained oxidized num small oxidized Fe grains	Run 4		
	44	60	(Base of Big Clifty SS) 45.1'			
	45	5	dGr shale lam			Top of Beech Creek Ls – 45.1'
			slight solutioning at Ls contact (open jt)			
	46		Limestone (Beech Cr) 1-m gr Br, m-coarse crystalline, mass, fossiliferous, v hard, v dense, Brittle,			
	47	0	Open jts along bedding have tan-y Br clay coating or stains (oxidized)	10.0/10.0		Loosing slight amount of drill water
		3				
	48	70	Tight			
		5	Tight			
	49	70				
	50					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 6 OF 15 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	50		Ls (cont.)			
	51	0	Tan clay stn			
	52					
	53	0	Tan clay along jt			
		0	53.4' - probable low ground water level (?) in zone above the Elwren shale fm. No oxidation along Jts below 54.4'	53.4 / Run 5		good water Return
	54					
		5	Limestone Below 53.1' is dGr, fm crystalline, mass, fossiliferous w/ occ to num blk wavy shaley pts and or poorly to well formed stylolites (similar to above otherwise)			
	55					
	56			9.9/10.0		
	57			-0.1		
	58					
	59					
	60					

PROJECT | HOLE NO.

DRILLING LOG

DIVISION

INSTALLATION

SHEET 7 OF 15 SHEETS

1. PROJECT

2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY

4. HOLE NO. (As shown on drawing title and file number) 03C3

5. NAME OF DRILLER

6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.

7. THICKNESS OF OVERBURDEN

8. DEPTH DRILLED INTO ROCK

9. TOTAL DEPTH OF HOLE

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN (TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED

14. TOTAL NUMBER CORE BOXES

15. ELEVATION GROUND WATER

16. DATE HOLE | STARTED | COMPLETED

17. ELEVATION TOP OF HOLE

18. TOTAL CORE RECOVERY FOR BORING %

19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	60		Ls (Cont.)			
	61					
	62					
	63			63.3 / 55.4 Run 6		Art Depth
	64					Good water Return
	65		Num dgrGn sh inclus in bot 0.5'.			
			Base Beech Creek Ls (65.5') Elwren Fm (Top)			Top Elwren fm-65.5'
	66		Shale dgrGn, thbd, mod hd, highly frac. (random) w/ 3 sides			
	67			10.1 / 10.0		
	68		drBr + grGn mottled			
	69					
	70		Shale or Claystone drBr mass hard			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 8 OF 15 SHEETS
PROJECT		10. SIZE AND TYPE OF BIT	
		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
2. LOCATION (Coordinates or Station)		12. MANUFACTURER'S DESIGNATION OF DRILL	
3. DRILLING AGENCY		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
4. HOLE NO. (As shown on drawing title and file number)	03C3	14. TOTAL NUMBER CORE BOXES	
5. NAME OF DRILLER		15. ELEVATION GROUND WATER	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	70		Blocky - Flakey, num random frac. w/s'sides			
			Shale (cont)			
	71					Reamed hole w/6" RR Bit to 71.5' + set 4" PVC Casing Grouted the casing w/ seal set 6' into the Elwren Sh.
	72					
	73					
	74			73.4 / Run 7		Flange 9/11/86
	75					Good water Return
	76					
	77		Shale, dgrGn, mass at top w/occ sub-rounded to subangular Gr Ls(?) inclus ranging From 3/4" to >2" ... size. Grades into th bd w/depth, mod hard-hard,	9.7 / 10.0		
	78			-0.1		
	79		thinly laminated w/silty sand pts + lens below ~79', shallow cross bd + ripples			
	80					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF 15 SHEETS
CT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number) 03C3		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Including loss, water loss, depth of weathering, etc., if significant) g
	80		Shale (Cont)			
	81		Sandstone, m gr Br, vf grained, w/gr Gn shaley pts, hard, cross bd, shallow ripples.			
	82		Base of Elwren			Top of Reeksville - 82.3'
			Top Reeksville from 82.3' Limestone, lgr Br, sdy, f granular - crystalline, v hard, brittle, cross bd (?)			
	83			83.2' / 83.4 / Run 8		Full depth
	84		num wavy Gn shaley pts.			
	85		conglomeratic - fossiliferous (?)			good water return.
	86		Shale, vd gn Gr, cross th bd, blocky-flakey, occ ls inclus up to ~3/4" size, num random frac w/ss side, hd - mod hd.	10.2/13.0		Note from 85.4 to 85.9' frac's are coated w/ Blk Crude oil.
	87		laminated w/lGr ss lens.			
	88		laminated w/lGr ss lens			
	89					
	90		Sandstone, m Gr, vf grained, w/num dGr			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 10 OF 15 SHEETS
1. LOCATION (Coordinates or Station)		10. SIZE AND TYPE OF BIT	
		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
2. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
3. HOLE NO. (As shown on drawing title and file number)	03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
4. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
		15. ELEVATION GROUND WATER	
5. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN		18. TOTAL CORE RECOVERY FOR BORING %	
8. DEPTH DRILLED INTO ROCK		19. SIGNATURE OF INSPECTOR	
9. TOTAL DEPTH OF HOLE			

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	90		wavy shale pts, shallow cross bd, hard, brittle.			
	91		Base of Reelsville			Top of Sample fm - 91.4'
			Top Sample Fm (91.4')			
	92		Shale, vdGr-Blk, th bd, w/occ to num thin lGr ss lens and pts (from 91.4 to 95.0'), hard platey-blocky, occ pyrite inclus.	93.4 Run 9		
	93					
	94		- Ls len			
						Good water Return
	95					
	96			9.7/10.0		
	97			-0.3		
	98					
	99					
			From 95.0' to 110.2' occ thin ss lens,			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 11 OF 15 SHEETS

1. LOCATION (Coordinates or Station)	10. SIZE AND TYPE OF BIT
2. DRILLING AGENCY	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. HOLE NO. (As shown on drawing title and file number) 03 C3	12. MANUFACTURER'S DESIGNATION OF DRILL
4. NAME OF DRILLER	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	14. TOTAL NUMBER CORE BOXES
6. THICKNESS OF OVERBURDEN	15. ELEVATION GROUND WATER
7. DEPTH DRILLED INTO ROCK	16. DATE HOLE: STARTED / COMPLETED
8. TOTAL DEPTH OF HOLE	17. ELEVATION TOP OF HOLE
	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	100		Shale (Cont.)			
	101					
	102					
	103			103.1		Full depth
				103.4		
				Run 10		9/12/86
	104					
						Good water Return
	105					
	106					
	107			10.3 / 10.0		
				10.3		
	108					
	109					
	110					

DRILLING LOG	DIVISION	INSTALLATION	SHEET 12 OF 15 SHEETS

1. LOCATION (Coordinates or Station)	10. SIZE AND TYPE OF BIT
	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
2. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
3. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
4. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
5. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	16. DATE HOLE — STARTED — COMPLETED
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN	18. TOTAL CORE RECOVERY FOR BORING %
8. DEPTH DRILLED INTO ROCK	19. SIGNATURE OF INSPECTOR
9. TOTAL DEPTH OF HOLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	110		Sh (Cont) (110.2 to 111.3) - num SS/LS lens; LS lens			
	111					
	112					
	113			113.4 Run 11		
	114		(113.5 to 120.5') num 16 SS lens + pts.			
	115					
	116					
	117			10.2 / 10.2		
	118					
	119					
	120					

Hayden WES, [illegible]

DRILLING LOG	DIVISION	INSTALLATION	SHEET 13 OF 15 SHEETS
CT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	120		Shale (Cont.)			
	121		Sandstone, 1-m grBr, vf-f grained, w/num vd Gr wavy shaley pts, Cross bd, hd sli friable - brittle.			
	122					
	123		calc ss / sdy Ls, v hd, brittle, occ fossils, 1 grBr	123.6 Run 12		
	124					
	125					
	126					
	127		Shale, Blk, th bd w/ 1Gr ss lens + pts, occ pyrite inclus, hd, platey - flakey	9.7 / 10.0		
	128			~~0.3~~ 0.1		0.1' core ground away in shale
	129					
	130		see next sheet			

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 14 OF 15 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	130		Sandstone, 1-m gr Br, (as above)			
	131					
	132					
	133		Shale, dGr-Blk, thin bd, hd, platey, flakey	133.4 / 133.6		Full Depth
	134					
	135					water return left a Blk "earthy", "flat" film on water in mud pan; noticed no lower zone of shale; possibly near top of Ls.
	136			10.2 / 10.0		
	137		Base of Sandstone			Top of Beaver Bend Ls - 137.2'
	138		Limestone (Beaver Bend fm), m gr Br, f-m granular-crystalline, fossiliferous, occ stylolites v hard, v dense, brittle, joints along bedding as shown are most probably open	102		losing ~25% of drill water.
	139					Lost all drill water at ~139.5'

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 5 SHEETS

1. LOCATION (Coordinates or Station)	10. SIZE AND TYPE OF BIT
2. DRILLING AGENCY	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. HOLE NO. (As shown on drawing title and file number) 03C12	12. MANUFACTURER'S DESIGNATION OF DRILL
4. NAME OF DRILLER	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	14. TOTAL NUMBER CORE BOXES
6. THICKNESS OF OVERBURDEN	15. ELEVATION GROUND WATER
7. DEPTH DRILLED INTO ROCK	16. DATE HOLE — STARTED — COMPLETED
8. TOTAL DEPTH OF HOLE	17. ELEVATION TOP OF HOLE
	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		SS (Cont.)			
	21			21.0' Run 2		
	22					
			limonite crust + clay coating			
	23					
			Coarser grained (f-m)			
	24			7.7/8.4		
	25			-0.7'		
			mag + clay coating			
	26					
			mag stn			
	27					
	28					
	29			29.4 Run 3		
	30					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 7 OF 5 SHEETS
CY		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number) 03C12		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30					
	31		30.5 - 39.0 - very soft drilling w/no core recovery. Zone is largely a cavity created by solutioning in the Beech Creek Ls. The cavity is partially filled w/ wea SS blocks, clay + sd ?	1.1/9.6'		
	32					
	33					
	34		Lighter colored upper portion of the Beech Creek Ls is missing (A total of ~9-10' of Ls is missing or nearly equal to the cavity thickness)	-8.5'		
	35					
	36					
	37					
	38		Sgl planar surface at top of Beech Creek Ls	39.0		
	39		Beech Creek Lmst 39.0 Limestone, dk gr, fine crystalline, fossiliferous, blk shaly ptcs, occ chert nodules, v hd!	Rand		
	40					

DRILLING LOG	DIVISION	INSTALLATION	SHEET 5 OF 5 SHEETS
...ECT		10. SIZE AND TYPE OF BIT	
...ATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
		12. MANUFACTURER'S DESIGNATION OF DRILL	
3. DRILLING AGENCY		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
4. HOLE NO. (As shown on drawing title and file number)	03C12	14. TOTAL NUMBER CORE BOXES	
5. NAME OF DRILLER		15. ELEVATION GROUND WATER	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
		17. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN		18. TOTAL CORE RECOVERY FOR BORING %	
8. DEPTH DRILLED INTO ROCK		19. SIGNATURE OF INSPECTOR	
9. TOTAL DEPTH OF HOLE			

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		Base of oxidation ~40.0			
		0	Ls (cont.)	2.0/2.8		
	41					
		10		41.8 Run 5		Blocked
	42					
		5				
	43					
	44					
		0		7.1/7.2		
	45					
		0		-0.1		
	46					
	47					
	48	0				
		0	Base of [illegible] crack 48.9	49.0 Run 6		
	49		Top of Elwren fm Shale [illegible] mass hd	1.0/1.0		The boring was drilled to 51.2' however 1.2' of core was left in hole
	50					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C24	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Well No: WES-9-C24-86 (Beech Creek Fm)			Date well screen was set: 6/14/87
553.8			+2.6			
551.2			0.0' Ground surface			
			Grout mixture			Water level just Prior to setting screen – 13.8
			10.0'			
			Bentonite Pellets			
			15.0'			
			Filter Pack			12.0 to 22.0' – Teflon pipe
			22.0			
			Well Screen			
			27.0			
			Trap			
			28.0			
			28.2' Boring Depth			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (Continued) PROJECT HOLE NO.

Name LWES-4? 16

DRILLING LOG	DIVISION	INSTALLATION	SHEET 15 OF 15 SHEETS
1. LOCATION (Coordinates or Station)		10. SIZE AND TYPE OF BIT	
		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
2. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
3. HOLE NO. (As shown on drawing title and file number)	03C3	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
4. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
		15. ELEVATION GROUND WATER	
5. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
6. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
7. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
8. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	140		Limestone (Cont.)			
	141					
	142	o				
		o				
	143	o				
				143.6 Run 14		
	144					
	145			3.7/3.7		
	146					
	147		LS has num shaly pts/or num stylolites containing insoluble residue (Blk)	147.3 Run 15		Blocked
	148	o		1.7/1.7		
	149		Bot of Beaver Bend. Ice soft clay	149.0 Run 16		Blocked Top of Bethel Fm - 149.0'
			Shale, v dk gr, sdy in top 0.5', mass, num random frac, hd, blocky, flat...	1.7/1.7 150.7		Bot. Depth - 150.7'
	150					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Well No.: WES-3-C12-E6 (Brock Creek Ls)			Date well screen was set: 2/3/87
587.6			+2.5'			
585.1			0.0' Ground surface			
			Grout mixture (Bentonite & cement)			Water level just Prior to setting screen - 37.0
			10.0			
			Bentonite Pellets			
			12.0			Teflon pipe between 34.0 to 50.0'
			Filter Pack (Sand-Pea Gravel mixture)			
546.1			39.0			
			Well Screen			
536.1			49.0			
			Trap			
			50.0			
			51.2' Boring Depth			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (PROJECT) (HOLE NO.)

DRILLING LOG	DIVISION US Navy	INSTALLATION Crane In.	SHEET 1 OF 5 SHEETS

PROJECT NWSC Groundwater Studies	10. SIZE AND TYPE OF BIT NQ Wireline Core
1. LOCATION (Coordinates or Station) 1-HG (Geologic Studies	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
2. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
3. HOLE NO. (As shown on drawing title and file number) WES-3-C12-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
4. NAME OF DRILLER Dan Taylor	14. TOTAL NUMBER CORE BOXES
5. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
6. THICKNESS OF OVERBURDEN 5.4 ?	16. DATE HOLE — STARTED 2/2/87 — COMPLETED 2/3/87
7. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE ~ 595.5
8. TOTAL DEPTH OF HOLE 51.7'	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Silty clay (CL), Br, becomes sdy w/depth occ SS frags + sub-rounded SS pebbles mod firm.			Drilled w/8" folding Auger from 0.0 to 5.4'. Steam cleaned all tools before starting
	1					
	2					
	3					
	4		rBr - yBr in bot.			
	5		?			
	6		Sandstone, yBr, highly wea, w/clay along Jts ? No core recovery (Big Clifty Fm)			Attempted to core w/ 2" NX bl from 5.4 to 10.0; No Recovery. Water return ranged between 0 & 50% during drilling. Cleaned hole out w/a 7 3/8" 2 3/8 bit to 11.0' & set 6" PVC Casing.
	7					
	8					
	9					
	10		Less wea SS at ~10.0'.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE — PROJECT — HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 5 SHEETS

1. TITLE	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10		Sandstone, yellow, v f uniform grained, wea, friable, lim + manga along jts, occ lim nodules.			Set 6" PVC to 11.0' + grouted around outside.
	11			11.0' Run 1		2/3/87
	12					
	13					Lost all water return at ~13'.
	14					
	15			8.4/10.0 ~.6		
	16					
	17		slightly oxidized, weathered, rust, Fe			
	18					
	19					
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE

PROJECT | HOLE NO.

Hole No. WES-3-C24-E6

DRILLING LOG	DIVISION US Navy	INSTALLATION NWSC Crane In	SHEET 1 OF 3 SHEETS

1. PROJECT Hydrogeologic Studies	10. SIZE AND TYPE OF BIT NQ wireline
2. LOCATION (Coordinates or Station) ABG (Johnson Hollow	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY WES	12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500
4. HOLE NO. (As shown on drawing title and file number) WES-3-C24-E6	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER Don Taylor	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED Jun 15, 1987 — COMPLETED Jun 16 1987
7. THICKNESS OF OVERBURDEN ~15.0' ?	17. ELEVATION TOP OF HOLE 551.2'
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 28.2'	19. SIGNATURE OF INSPECTOR Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Sandy silt (ML), Br-rBr, w/oxidized friable sandstone frags, cobbles + pebbles, mod firm, sli moist. (Alluvium)			Dozer cut down ~2' from original ground surface in leveling drill site. 0.0 to 11.8' drilled w/a 7" dia folding auger + RR bit.
	1					
	2					
	3					
	4					
	5		more sdy + dBr below ~5.0' to ~7.5'			
	6					
	7					
	8		(7.5-15.0') sdy silt, yBr-rBr w/ mom ss frags, cobbles + pebbles.			
	9					
	10					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

Hole No. WES-3-C24-C4

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 3 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C24	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10					
	11					
				11.8		started coring w/ NQ wireline at 11.8'
	12					
	13					
	14					
	15		? Big clifty ss formation Sandstone Blocks, y tan, oxidized, v fine grained, hard, friable, highly jt'd w/ lim + mang. coating jts. (Zone represents sandstone blocks that have collapsed into solution cavities in the underlying Beech Creek Ls. Cavities that are partially open + partially soil filled account for the poor core recovery)	4.0/10.0		Lost all water, return at 15.0'
	16			6.0'		
	17					
	18					
	19					
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

Hole No. WES-3-C24-B-

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 3 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	03C24	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		Sandstone Blocks (Cont.			
	21					
				21.8 Run 2		
	22					
	23					
	24			1.8/5.2		
	25			-3.4		
			solution surface			
	26		Beech Creek Limestone (bent zone) dGr, crystalline fossiliferous.			
			- small Eleven shale inclusions in bent c.3'	27.0		Blocked
	27		Eleven Shale, m-dGr massive, hard.	1.2/1.2		
	28					
			Bottom depth - 28.2'			
	29					
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET OF SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number) 03C25
5. NAME OF DRILLER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED — COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Well No.: WES-3-CLS-06 (Beech Creek Ls)			Date well screen was set: 6/18/06
597.5			+2.5			
595.0			0.0' Ground surface			
			Grout mixture			Water level just Prior to setting screen – 44.4'
			7.5			
			Bentonite Pellets			
			10.5			
			Filter Pack			Tolles Pipe – 39.4 to 70.7'
			59.7			
			Well Screen			
			69.7			
			Trap			
			70.7			
			70.7 Boring Depth			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION: U S Navy	INSTALLATION: NWSC Crane In	SHEET 1 OF 8 SHEETS

1. PROJECT: Hydrogeologic Studies	10. SIZE AND TYPE OF BIT: NQ wireline
2. LOCATION (Coordinates or Station): ABG (Johnson Hollow)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
3. DRILLING AGENCY: WES	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): WES-3-C25-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: Dan Taylor	14. TOTAL NUMBER CORE BOXES:
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER:
	16. DATE HOLE: STARTED 6/17/87 COMPLETED 6/18/87
7. THICKNESS OF OVERBURDEN: 8.0'	17. ELEVATION TOP OF HOLE: 595.0'
8. DEPTH DRILLED INTO ROCK:	18. TOTAL CORE RECOVERY FOR BORING: %
9. TOTAL DEPTH OF HOLE: 70.7'	19. SIGNATURE OF INSPECTOR: Geologist Richard W. Hunt

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Sandy silt - Silty Sand (ML-SM), yBr-rBr, w/num oxidized ss frags, cobbles & pebbles, mod soft, moist. (Alluvium)			Drilled 0.0 to 10.5' w/7" folding Auger
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8		Base of Valley Fill 8.0'			
			Shale, olive-olive gray, moss, v fine slightly moist, weathered. (Indian springs member of Big Clifty fm)			
	9					
	10		Base of Shale - 10.0'			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 8 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10		(Top of Big Clifty SS – 10.0')	10.5' Run 1		Started coring w/ HQ wireline at 10.5
	11		Sandstone, 1 yel-olive Tan, v fine uniform grained, th bd with shallow ripples mod hard, friable, oxidized w/ Lim stn along Jts.			
	12					
	13					
	14					
	15			9.2/10.0		
	16			-0.7		
	17					
	18					
	19					
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT — HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 2 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		SS (cont.)	20.5		
				Run 2		
	21	0				
		0				
	22				22.4	
		0				
	23					
		0			Box	
		60				
	24				2	
		45			of	
	25			9.7/10.0	6	
		0		-0.3		
	26					
	27					
	28	30				
		30				
	29					
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT [redacted] HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 9 OF 6 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		GS (Cont.)			
				30.5		
				Run 3		
	31					
	32					
	33	39				
	34				34.3	
		U	Calcareous SS	10.1 / 10.2		
	35	U				
				-0.1	Box	
	36	S			3	
	37				of	
					6	
	38					
	39					
		D				
	40	D				

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 5 OF 8 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		SS (Cont)			
				40.7 / Run 4		
	41					
	42					
	43	20				Lost all drill water at ~42.6'
	44					
	45			10.2 / 10.2	45.7	
	46				Box	
	47					
		0				
		0				
	48				of 6	
			Shaly pts in bot few feet of ss.			
	49	0				
	50	0				

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 6 OF 8 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number) 03C25
5. NAME OF DRILLER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	50		SS (Cont.)			
				50.9		
	51			Run 5		
			Base of Big Cliffy SS - 51.6'			
			Top of Beech Creek Ls			
	52		Limestone, lt-mg gr Br, m-c crystalline, fossiliferous, v hard, v dense, occ stylolites.			
	53					
	54					
	55			10.1 / 10.1		
	56					
					56.9	
	57				Box	
	58		Ls becomes dGr below ~58'		5	
	59				of	
					6	
	60					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 7 OF 8 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED — COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	60		Ls (cont)			
	61			61.0 Run 6		
	62					
	63					
	64					
	65		occ wavy shaley pts in lower zone			
	66					
	67					
	68					
	69					
	70					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 6 OF 8 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number) 03C25	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	70		Base of Bench Crest Ls. 70.5			
			Top of Elwren Shale, dGn			
			Bottom Depth - 70.7'			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT | HOLE NO.