AMEREN SERVICES

HYDROGEOLOGIC ASSESSMENT FINAL REPORT

HUTSONVILLE POWER STATION
CRAWFORD COUNTY, ILLINOIS

PROJECT NO: 1375

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HYDROGEOLOGIC ASSESSMENT
FINAL REPORT

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EXECUTIVE SUMMARY

This hydrogeologic assessment describes hydrogeology, groundwater flow, and groundwater quality near the AmerenCIPS Hutsonville Power Station ash impoundments. There are two impoundments at this site, an unlined impoundment that has been in operation since 1968 and a lined impoundment that has been in operation since 1986. This assessment was prompted by concentrations of boron and sulfate at several monitoring wells near these impoundments that exceeded Illinois Class I groundwater standards. Boron and sulfate are indicator parameters for coal ash leachate in groundwater.

Two rounds of field work were performed. From August 25-28, 1998, soil, leachate, and groundwater samples were collected at 23 locations across the site using direct-push sampling methods. In addition, two temporary well points were installed and sampled in the lined ash impoundment. From October 5-10, 1998, seven monitoring wells were installed to augment the existing network of nine monitoring wells.

Results of Field Investigation

Coal ash is found predominantly in three areas of the plant site: the two impoundments and an ash laydown area that is between the two impoundments. Ash thickness in the unlined impoundment ranged from about 12 feet at the north end of the impoundment to 31 feet in the central portion of the impoundment. Ash thickness in the laydown area is as much as 12 feet. There is also a coal pile near the impoundments, and some boreholes outside the coal pile area encountered thin seams of spilled coal near the surface.

The stratigraphy encountered at the Hutsonville Power Plant consisted of a relatively thin veneer of unlithified deposits overlying bedrock. Over most of the site, the unlithified units are sandy and less than 20 feet thick; however, thickness abruptly increases to at least 90 feet near the Wabash River, where there is a bedrock valley. Silt was found in the upper portion of the

bedrock valley, and sand and gravel occurs in the lower portions of the valley. The underlying bedrock is comprised mainly of Pennsylvanian-age sandstone and shale.

The groundwater surface throughout most of the plant site occurs within sand and gravel. However, near the river, it occurs within alluvial silt and clay deposits, and near the southern portion of the unlined impoundment the groundwater surface occurs within ash. Groundwater flow through the sand is east toward the Wabash River. Horizontal groundwater flow velocity varies with hydraulic gradient and hydraulic conductivity, and was estimated to range from 150 ft/yr to 240 ft/yr in the sand and gravel deposits.

Groundwater and Leachate Quality

The Hutsonville work plan identified boron, sulfate, manganese, pH, and TDS as parameters of concern (POCs) because they had concentrations in groundwater near the impoundments that exceeded Illinois Class I groundwater standards. Boron and sulfate are indicator parameters of coal ash leachate, while the other POCs are not necessarily indicators. Iron and nickel were also included in this assessment because these parameters sometimes have high concentrations in groundwater near coal piles.

Most ash leachate samples had boron, sulfate, and TDS concentrations that exceeded the Class I groundwater standard. Manganese exceeded the standard in leachate from the unlined ash impoundment and from the former ash laydown area, but not in the lined ash impoundment (lowest concentrations on site); thereby exhibiting its unreliability as an ash indicator parameter. Iron was below the standard in all leachate samples from the impoundments, but exceeded the standard in the leachate sample from the former ash laydown area. Nickel was below the standard in all leachate samples. The pH of the leachate samples was neutral, except in the lined impoundment where it was alkaline.

Direct-push groundwater samples showed concentrations of boron, manganese, sulfate, and TDS higher than Class I standards in most samples near the impoundments and the ash laydown area.

Groundwater samples extracted near the coal pile typically had high concentrations, relative to standards, of iron, nickel, sulfate, TDS, and manganese. Acidic pH values were recorded in groundwater samples throughout the coal pile area, and values were typically lower than the lower Class I standard. There was only one standard exceedance (manganese) in groundwater sampled south of the site.

Groundwater samples from several monitoring wells near the ash laydown area and unlined ash impoundment had high concentrations, relative to Class I standards, of boron, manganese, sulfate, and TDS. There were also two wells with high nickel and low pH, and both of these wells were in areas where coal had been spilled.

Overall, there is a correlation between groundwater quality and potential leachate sources. Groundwater near the unlined coal ash impoundment and ash laydown area had high boron and sulfate concentrations. Groundwater near the coal pile and coal spill areas typically had high nickel, iron, and sulfate concentrations. Groundwater near the coal pile also had very low pH.

Conclusions

Groundwater samples from some on-site monitoring wells and direct-push locations had concentrations of boron, manganese, sulfate, TDS, iron, and nickel higher than Class I standards. High iron and nickel concentrations were found in locations where coal was present. These observations indicated two general sources for groundwater quality impacts: 1) the coal pile and coal spill areas, and 2) the ash laydown area and unlined ash impoundment.

There is no evidence that iron and nickel from the coal pile and coal spill areas is migrating beyond those areas. However, boron and sulfate are migrating east toward the Wabash River.

There are no groundwater extraction wells in the shallow sediments between the unlined ash impoundment and the Wabash River. There are four extraction wells within ½ mile of the site, all finished in deep sand and gravel in the Wabash River valley. Two wells are directly east of

the unlined impoundment and are used for plant water, and two wells are southeast of the impoundment and used for irrigation water. Groundwater quality data from monitoring well MW-7D, which is directly downgradient of the unlined ash impoundment and is the deepest on-site monitoring well in the Wabash River valley, indicates no evidence of ash impoundment or coal pile impacts at that depth.

1 INTRODUCTION

AmerenCIPS operates the Hutsonville Power Station in Crawford County Illinois. The Power Station is located on the west bank of the Wabash River between the towns of Hutsonville and York (SW ¼, Section 17, Township 8N, Range 11W). The coal-fired power plant has been in operation since the 1940's. There are currently two units operating at the plant, completed in 1953 (unit 3) and 1954 (unit 4), with a combined generating capacity of 156 MW. Fly ash from the operating units is collected by an electrostatic precipitator and sluiced to a lined ash impoundment. Bottom ash is sluiced to a separate pond and eventually recycled. Sluice water from both the bottom ash pond and lined fly ash impoundment is routed through an unlined ash impoundment, before discharge to the Wabash River via an NPDES permitted outfall. The lined ash impoundment was constructed in 1986, and has an area of about 12 acres. The unlined impoundment was constructed in 1968, and has an area of about 17 acres.

Groundwater quality has been monitored at this facility since 1984. Concentrations of boron and sulfate at several monitoring wells exceed Illinois Class I groundwater standards. Boron and sulfate are indicator parameters for coal ash leachate in groundwater. In response to these findings, Ameren Services contracted Science & Technology Management Inc. (STMI) and Natural Resource Technology Inc. (NRT) to perform a hydrogeologic assessment that will characterize hydrogeology, groundwater flow, and groundwater quality at this facility.[1]

[1] Science & Technology Management Inc. (STMI) ceased operations on January 31, 1999. At that time, the STMI project manager overseeing this investigation took a position at Natural Resource Technology, Inc. (NRT). NRT developed this report based on information in STMI's files and on the project managers past involvement with this project.

2 FIELD PROCEDURES

Two rounds of field work were scheduled and completed. From August 25-28, 1998, soil and groundwater samples were collected at 23 locations across the site (Figure 1) using direct-push sampling methods. In addition, two temporary well points were installed and sampled in the lined ash impoundment. From October 5-10, 1998, seven monitoring wells were installed to augment the existing network of nine monitoring wells. The monitoring wells were installed in a manner consistent with specifications in Section 811.318(d) of the Illinois Waste Management Rules. In addition, hydraulic conductivity tests were performed on selected new and existing monitoring wells. Drilling was performed by American Environmental Corporation of Indianapolis, IN, under subcontract to STMI. Field geology and hydraulic testing were performed by STMI. Water quality analyses were performed by AmerenCIPS central laboratory.

2.1 Direct-Push Sampling

A truck-mounted, GeoProbe™ direct-push sampling system was used to collect coal ash, soil, and groundwater samples from 23 locations across the Hutsonville plant site (Figure 1). The direct-push sampling was conducted to survey groundwater quality around the site, to estimate the depth of ash and obtain leachate samples in the old impoundment, to log the type and extent of geologic and fill materials, and to estimate depth to bedrock. Table 1 lists direct-push sampling data; boring logs are provided in Appendix A.

A Macro-Core® Soil Sampler, consisting of a 52-inch long by 2.2-inch O.D. split-barrel sampler fitted with a replaceable plastic liner, was used to collect a continuous sequence of soil and ash core at each probe hole location. The probe holes were advanced to bedrock, typically encountered at depths of 9.5 feet to 36.5 feet. Bedrock was not encountered at locations GP-14 (total depth 40 feet) and GP-19 (total depth 32 feet) southeast of the plant site. After a probe hole was geologically logged, a Screen Point 15 Groundwater Sampler® was connected to the direct-push rod and driven into the ground to the target sampling depth. The water sample was

collected by retracting the rod several feet to expose the sampler's stainless steel screen, then inserting a section of disposable polyethylene tubing and slowly extracting the sample using a peristaltic pump connected to the tubing.

Water samples were not collected at locations GP-1, GP-19, and GP-22 because of low water yield from the screened materials. No water sample was collected at probe hole GP-8, which was used only to log geology near the southwest corner of the lined ash impoundment.

Concurrent with direct-push sampling, two temporary well points were installed at depths of seven to eight feet in the lined ash impoundment to collect leachate samples (Figure 1, LP locations). Each well point was constructed of 1.25-inch I.D., polyvinyl chloride (PVC) pipe flush-threaded to a four-foot long section of 0.01-inch factory-slotted PVC screen covered by a filter sock. Because the lined impoundment was too soft for truck access, the well points were hand-driven into the ash. The leachate samples were collected by hand pumping a section of disposable high-density polyethylene (HDPE) tubing connected to a stainless steel foot-valve. After sampling, the temporary well points were completely removed and the holes were allowed to collapse.

2.1.1 Laboratory Samples

All direct-push water samples were collected in laboratory transfer containers and transported to the Hutsonville plant's on-site laboratory for measurement of temperature, electrical conductivity, pH, dissolved oxygen, and oxidation-reduction potential. Samples for metals analysis were then passed through a 0.45 micron cellulose nitrate filter membrane (one per sample) into 250-ml polyethylene containers and preserved with concentrated nitric acid. The remaining sample volume was transferred into 1000-ml polyethylene containers (without preservatives). All sample aliquots were stored at a temperature below 39°F (4°C) prior to analysis at AmerenCIPS laboratory. Parameters analyzed and analytical methods used are listed in Table 2.

2.1.2 Probe Hole Abandonment

Upon completion of sampling, probe holes that encountered coal or coal ash were backfilled with bentonite grout that was injected as the probe or sampler was withdrawn, while probe holes that did not encounter ash were backfilled with granular bentonite. Pump tubing was discarded after collection of each water sample and all reusable direct-push sampling equipment was decontaminated to prevent cross-contamination between sampling locations.

2.2 Installation of New Monitoring Wells

2.2.1 Rationale

Seven new groundwater monitoring wells were installed at locations determined after analysis of previous groundwater sampling and the direct-push sampling. Well location, elevation, and completion details are listed in Tables 3 and 4. Boring logs and well completion reports are provided in Appendix A.

Four shallow wells were installed. One shallow well (MW-10) was installed to provide additional background groundwater quality data. Three shallow wells (MW-11, MW-12, and MW-13) were installed to characterize aquifer properties and groundwater flow at the site, and to delineate the extent of groundwater impacts associated with the ash impoundments. Wells MW-10, MW-12, and MW-13 were screened predominantly in unlithified materials, although MW-10 extended into the very shallow bedrock (Figure 2). Shallow monitoring well MW-11 was screened mostly within shallow bedrock, where the water table was encountered.

Three deep wells were installed. Deep well MW-7D was nested with existing well MW-7 to evaluate the vertical groundwater quality distribution and vertical flow conditions between the unlined ash impoundment and the Wabash River. Wells MW-3D and MW-10D were installed completely within bedrock to measure hydraulic properties and groundwater quality in the sandstone. The two wells were nested with existing shallow wells to determine vertical gradient

between the sandstone and the overlying unlithified sediments, and to evaluate whether the sandstone is a potential pathway for solute transport.

2.2.2 Drilling

A truck-mounted drill rig with 4¼-inch inside diameter (I.D.) hollow-stem augers was used to advance eight-inch diameter borings into the unlithified materials. Hollow-stem augers were also used to advance the boreholes for MW-3D, MW-10/10D, and MW-11 into bedrock. At MW-3D, the augers were used to drill the upper five feet of bedrock. A rotary air-hammer was then used to extend the bedrock borehole, at a four-inch diameter, to the depth of completion. At MW-10D, fine-grained materials in the bedrock caused the rotary air-hammer to bind internally; therefore, the augers were used to advance the borehole until bedrock composition halted further augering.

During drilling, the unlithified materials were sampled with a split-spoon and described in the field by STMI's geologist. The split-spoon samples were collected at five-foot intervals in previously investigated areas (near existing wells or direct-push borings) and were collected at two-foot intervals in newly drilled areas. Bedrock was characterized by examining drill cuttings.

2.2.3 Construction

All new well boreholes were drilled to their intended screen depths – except MW-7D, which was drilled five feet deeper than originally proposed to provide 15 feet of vertical offset from nested well MW-7. The new monitoring wells were constructed with two-inch I.D., schedule 40 PVC pipe flush-threaded to a section of 0.01-inch, factory-slotted PVC screen. The four shallow wells, which were screened across the water table, were constructed with either five-foot or ten-foot screens, depending on water table and bedrock depths. The deep monitoring wells were constructed with five-foot screens.

From bottom to top, the annulus for wells MW-3D, MW-10D, MW-12, and MW-13 was filled with: 1) filter pack consisting of uniform silica (#5) sand to at least one-half foot above the

screen; 2) about one to three feet of fine (#7) sand; 3) about one foot of bentonite chips; and 4) a Portland cement-bentonite (5:1 weight ratio) grout mixture to near ground surface. Wells MW-10 and MW-11 were completed in a similar manner, except that fine sand was not used in order to maximize the annular (bentonite) seal thickness. Conversely, because of the depth of water in the MW-7D borehole, three feet of fine sand was installed (in lieu of bentonite chips) to separate the filter pack and grout seal. The bentonite chips had a tendency to swell and bridge inside the auger instead of settling to the top of the filter pack.

The grout was pumped into the boreholes, using a tremie hose inserted to the base of the hollow-stem augers. The tremie hose was then removed from the augers, and the augers were gradually withdrawn from the borehole, allowing the grout to settle. The grout was brought up to a depth of three feet to allow for construction of concrete well pads, or up to the ground surface at shallow well locations to maximize the annular seal.

After grouting, all of the new monitoring wells were finished with a stick-up style, locking steel well protector, surrounded by a set of two to three steel bumper posts for additional protection. The steel protectors for MW-3D, MW-7D, and MW-13 were set in three feet of concrete, and the protectors for the other four wells were set into the bentonite-cement grout that was brought up to the ground surface and topped with native soil.

2.2.4 Development

New wells were developed to remove sediment from within the wells and to restore the natural flow of groundwater around the wells. Except for MW-11, development was accomplished using a surge and pump technique (using a Geosquirt™ pump) until extracted water achieved visual clarity and at least 1.5 borehole volumes (defined as the volume of water in the well and filter pack) were removed (Table 4). Monitoring well MW-11 readily bailed dry and continued to produce turbid, silty water after removal of 22 gallons of water (2.7 borehole volumes) over a two-day period. The well borehole was augered into sandstone bedrock that has a high silt/fine

sand content, and substantial amounts of these materials may continue to pass through the filter pack.

2.2.5 Hydraulic Testing

Single well recovery tests were performed per STMI standard operating procedure (see Hutsonville Work Plan, STMI/249/98-01) using a five-foot long by one-inch diameter solid PVC slug, which has a displacement volume of 0.027 ft^3 (0.20 gallons). An In-Situ Troll™ SP4000 pressure transducer with on-board datalogger was used to monitor groundwater levels during the testing. The tests were programmed utilizing a portable PC loaded with software designed for the Troll™ unit. After measuring static water level, the Troll™ was inserted into the well to approximately one foot above the bottom, and the water level was allowed to return to static level.

For wells with screen and filter pack completely below the water table, the Troll™ was activated from a portable PC and the PVC slug was quickly lowered below the water level in the well. For wells screened across the water table, the slug was lowered below the water level at the same time the Troll™ was positioned. After the water level stabilized, the test was initiated and the slug was quickly removed from the water.

The tests were manually terminated when a check of water levels, via the Troll™ software, indicated that recovery was at least 90 percent complete. Data were then downloaded to the portable PC for analysis using commercial aquifer test analysis software.

2.3 Decontamination

The GeoProbe™ truck and the drill rig arrived at the site in visibly clean condition. The drilling tools, rods, augers, and sampling equipment were steam-cleaned before use at the site, between drilling/sampling locations, and before leaving the site. The Screen Point 15® groundwater

sampler, and the Macro-Core® and split-spoon soil samplers were cleaned between individual samples.

The groundwater sampler was decontaminated by spraying with a solution of nitric acid and deionized water. Approximately one-half liter of solution was used after each sample collection, followed by a spray rinse using approximately one liter of deionized water. The nitric acid solution and deionized water were provided by the plant's on-site laboratory.

Soil samplers were decontaminated by washing with an Alconox™-water solution and then rinsing with clean water. Water used during both the direct-push sampling and monitoring well installation activities was collected from a potable water faucet east of the coal crusher house.

2.4 Waste Handling

Auger cuttings from on-site boreholes were spread on the ground surface, including ash cuttings brought up in ash disposal areas. Auger-cuttings from the two upgradient, off-site boreholes, which did not contain ash, were spread on the ground surface in a way that minimized visual impact and would allow reestablishment of native vegetation. Disposable soil and groundwater sampling materials (e.g., water sample tubing, soil core liners) were discarded in the plant's waste dumpsters.

3 RESULTS OF FIELD INVESTIGATION

3.1 Site Geology

In order to illustrate the spatial variability of the unlithified deposits and bedrock, three geologic cross-sections were constructed (Figure 3). Section A-A' and the northern one-half of Section B-B' are oriented roughly parallel to groundwater flow; while the southern (off-site) section of Section B-B' is oriented perpendicular to flow to the south of the plant site. Section C-C' is oriented along the river and perpendicular to groundwater flow.

3.1.1 Stratigraphic Units

The stratigraphy of natural materials encountered at the Hutsonville Power Plant consists of a relatively thin veneer of unlithified deposits overlying bedrock. Three textural units were identified within the unlithified deposits: 1) river-laid silt, clay, and fine-grained sand, classified as Cahokia Alluvium; 2) poorly sorted sand and gravel, deposited by glacial meltwaters and classified as Henry Formation; and 3) a stiff to hard silt and clay diamicton unit. Across most of the plant site, the unlithified units are less than 20 feet thick; however, they abruptly increase to at least 90 feet thick near the Wabash River, where there is a bedrock valley (Sections A-A' and C-C'; Figure 3). The location of this bedrock valley was defined by monitoring well and direct-push boreholes in the southern portion of the site; however, it was not defined in the northern portion of the site where it probably occurs beneath the river, east of the plant buildings. The underlying bedrock is comprised mainly of Pennsylvanian-age sandstone and shale.

The Cahokia Alluvium is derived from eroded loess and till, and occurs in the flood plains and channels of modern rivers and streams (Berg and Kempton, 1987). Locally, the alluvium is found in the Wabash River bedrock valley and is composed of silt, clay, and clayey sand, with wood and shell fragments. Lenses of poorly sorted, silty sand and gravel occur locally within the

alluvium. In the study area, the unit is 0 to 15 feet thick beneath portions of the plant site and abruptly thickens to at least 25 feet near the Wabash River.

The Henry Formation is composed of glacial outwash sand and gravel and is locally the predominant unit in the upland areas upon which the plant and impoundments were constructed (Berg and Kempton, 1987). The Henry Formation sands are also found in the Wabash River bedrock valley where thickness ranges to at least 65 feet.

The diamicton was encountered in several isolated areas (MW-2, GP-13, and GP-20/21) in the southern portion of the study area (Sections A-A' and B-B'; Figure 3). The unit is stiff to hard, nonplastic to moderately plastic, and is at least five feet thick beneath the southern portion of the unlined ash impoundment. The unit was not encountered beneath the northern portion of the impoundment, where ash fill is underlain by bedrock or alluvial sands (Section C-C'; Figure 3).

Bedrock was drilled at three locations (MW-3D, MW-10D, and MW-11). Shallow bedrock at these locations is composed of siltstone and fine-grained sandstone. The boreholes were augered between 5 feet and 13.5 feet into bedrock, with generally little difficulty, indicating that the bedrock is weathered and/or moderately friable. At MW-10D, the borehole was advanced 13.5 feet into bedrock before bedrock composition prevented further auger drilling. A sample of bedrock retrieved in the tip of a split-spoon was composed of well cemented, fine- to medium-grained quartz sandstone with occasional coarse sand to fine gravel sized shale clasts.

3.1.2 Subsurface Ash/Coal Distribution

Fill is present across much of the site, based on the boring log data for the direct-push borings and all monitoring well boreholes. In general, the fill consists of sandy silt and silty sand that was likely generated from on-site excavations and site grading. The fill is underlain by native materials that often contain evidence of the former ground surface (e.g., root fibers, topsoil) and in some areas, such as near the coal storage area and along the former railroad spur, contains

trace amounts to thin layers of coal. Where encountered, the fill ranges from about two feet to eight feet thick.

Coal ash is found predominantly in three areas of the plant site. Most of the ash that has been generated by the Hutsonville Plant is located in the two ash impoundments. In addition, ash was placed in the area between the southern portions of the impoundments, in what was one of two cells that originally made up the unlined ash impoundment. Some ash from this area, called the former ash laydown area, was reportedly used in the construction of the berm for the lined ash impoundment. The former ash laydown area is roughly triangular in shape and covers an area of about six acres (Figure 1). Ash in this area was encountered to a depth of 19 feet (GP-2 location) near the southwest corner of the unlined ash impoundment; however, this probe location was subsequently identified as being in an area where the ash and underlying soil had been excavated for a pipeline repair. The excavation was back-filled with a soil-ash mixture, as identified on the GP-2 boring log (Appendix A). Plant personnel report that maximum ash thickness in the laydown area is about 12 feet (Section A-A'; Figure 3).

Four direct-push probe holes (GP-20 – GP-23) were advanced through the ash in the unlined impoundment. Ash thickness ranged from about 12 feet at the north end of the impoundment (GP-22 location) to 31 feet in the central portion of the impoundment (GP-23 location) (Section C-C'; Figure 3).

Prior to the 1980s, coal was shipped to the plant by railroad following a spur that ran south of the lined ash impoundment and then between the impoundments to the coal unloading area. The spur was removed in the 1980s. Currently, coal is delivered to the plant by trucks. Most of the coal is stored in the coal storage area north of the aboveground fuel oil storage tank. At one time, there was reportedly a small coal pile (approximately 150 yd^2) located south of the lined ash impoundment area. This pile was moved to the current coal pile in December 1952. In addition, coal spillage occasionally occurred along the railroad spur when the bottom discharge doors on a coal train car accidentally opened. The spilled coal was reportedly cleaned up periodically with a shovel and wheelbarrow and added to a reclamation pit.

During this field study, minor amounts of coal were observed in borings near the southeast corner of the lined ash impoundment. Coal amounts ranged from a trace in near-surface soils (GP-5, GP-6 locations) to an approximate one-foot thick layer beneath the southwest corner of the ash laydown area (GP-3 location) (Section B-B'; Figure 3). A four-inch thick, surficial layer of coal refuse was logged during installation of MW-2 and MW-3 (HEI, 1984); however, this layer was reportedly removed when scrap metals and other refuse were removed from this area in the 1980s. No coal or other refuse were observed at the surface, outside of the coal pile, during the 1998 field activities.

3.1.3 Bedrock Topography

The bedrock surface beneath the upland areas slopes gently toward the Wabash River; however, that slope steepens abruptly at the Wabash River bedrock valley (Figure 4). Bedrock elevation is about 445 feet above mean sea level (MSL) along the west side of the plant property and about 435 feet MSL beneath the power house, the lined ash impoundment, and the western portion of the unlined ash impoundment. Bedrock elevation is less than 350 feet MSL in the Wabash River bedrock valley, which lies beneath the eastern half of the unlined ash impoundment. A broad bedrock rise occurs in the area between the two ash impoundments, extending from south of the plant site to about the coal storage pile. Bedrock elevation of nearly 445 feet MSL was encountered at the southeast corner of the lined ash impoundment (MW-3). To the northeast, an elevation of about 447 feet MSL was observed beneath the north end of the unlined ash impoundment (GP-22). Bedrock along this high appears to protrude above the water table, at least during periods of low groundwater elevation (Section C-C'; Figure 3).

3.2 Site Hydrogeology

3.2.1 Hydraulic Conductivity

Values for horizontal hydraulic conductivity (K_h) were calculated for six new and five pre-existing monitoring wells using the Bouwer and Rice (1976) data analysis method for unconfined aquifers. Data and analysis plots are listed in Appendix B. Horizontal hydraulic conductivity values for the alluvial and outwash units ranged from 2.2×10^{-1} ft/min (1.1×10^{-1} cm/s) to 5.1×10^{-4} ft/min (2.6×10^{-4} cm/s) (Table 5). The screen for MW-7 (lowest K_h value) was installed mostly in alluvial sandy silt, while the screen for MW-12 (highest K_h value) was positioned in a sand zone relatively free of silt and clay. The geometric mean K_h of the unlithified materials is 1.5×10^{-2} ft/min (7.6×10^{-3} cm/sec). Bedrock K_h was relatively uniform at about 9.4×10^{-4} ft/min (4.8×10^{-4} cm/s).

3.2.2 Groundwater Flow

Groundwater flow conditions at the Hutsonville Plant site were assessed using water level data collected on November 16-18 and April 29-30, 1999; generalized groundwater flow directions for the unlithified units are illustrated in Figures 5 and 6.

The groundwater surface contour map for Nov. 16-18, 1998 was constructed using the water level data from 10 shallow monitoring wells screened in the unlithified deposits and the pool elevation for the Wabash River (428.4 feet MSL). Water level data from 9 shallow monitoring wells screened in unlithified deposits and the pool elevation for the Wabash River (438.0) were used to construct the April 29-30 groundwater surface contour map. Horizontal hydraulic gradients in the unlithified deposits and vertical gradients between the deposits and underlying bedrock were determined from the water level data. Elevations generally decreased toward the east in the direction of the Wabash River, a regional groundwater sink.

The groundwater surface throughout most of the plant site occurs within sand and gravel. However, near the river, it occurs within alluvial silt and clay deposits, and near the southern

portion of the unlined impoundment the groundwater surface occurs within ash (Section A-A'; Figure 3). Unconfined conditions occur in the areas where the water table occurs within the sand and gravel deposits; whereas, semi-confined conditions likely occur in the areas where the groundwater surface is in the alluvial silts and clays. The coarse-grained deposits are the most-likely pathways for migration of coal ash leachate from the impoundments.

Horizontal gradients varied across the site Based on the November 16-18, 1998 groundwater elevation data, the horizontal hydraulic gradient ranged from about 0.0041 ft/ft to 0.0065 ft/ft across the site. Gradients were as steep as 0.020 ft/ft in the former ash laydown area and 0.053 ft/ft, between the plant generating building and the Wabash River. A slight, but historically persistent, groundwater high was apparent near the southeast corner of the lined ash impoundment, based on water level data from new well MW-13 and nearby pre-existing wells (MW-2, 3, and 4), all of which were surveyed in October 1998.

Horizontal groundwater flow velocity varies with hydraulic gradient and hydraulic conductivity. Assuming a geometric mean hydraulic conductivity of 1.5×10^{-2} ft/min (7.6×10^{-3} cm/s), and an assumed effective porosity of 0.20, groundwater velocity ranges from 150 ft/yr to 240 ft/yr in the sand and gravel deposits across the site.

While groundwater flow over most of the site is east toward the Wabash River, groundwater elevations at MW-2 have historically been lower than at MW-3 (Figure 5), suggesting potential for westward (reverse) flow between these wells. Head differential between these wells was several feet from 1986 through 1996 (Figure 7), approximately corresponding to the time during which the sluicewater pipe connecting the two impoundments was leaking. The abrupt decrease in elevation at MW-3 in 1996 is likely due to repair of the pipe leak. However, since 1996, groundwater elevation in MW-3 has usually been slightly higher than MW-2, possibly suggesting residual effects from the pipe leak. The November 16-18, 1999 groundwater elevation data suggest a westward hydraulic gradient of 0.00047 ft/ft between MW-3 and MW-2. Given the much larger eastward gradient observed across this site, it is likely that any reverse (westward) flow in this area will wrap around this anomaly and discharge to the Wabash River.

Groundwater velocity was calculated for the area of reverse flow using the hydraulic conductivity value of 5.2 x 10^{-2} ft/min calculated for MW-3, a gradient of 0.00047 ft/ft, and an estimated effective porosity value of 0.2, with a resulting value of about 64 ft/year.

Vertical gradients at piezometers are depicted visually in graphs on Figure 8. Vertical gradients between the unlithified deposits and shallow bedrock were estimated from monitoring well nests MW-10/10D and MW-3/3D. The MW-10 well nest had a fairly consistent downward vertical gradient, while there was no consistent upward or downward vertical gradient at the MW-3 well nest. The lack of consistent vertical gradient at MW-3/3D does not suggest high potential for flow into bedrock; however, vertical gradients may have been stronger downward prior to repair of the sluicepipe in 1996. Vertical gradients at MW-7/7D were typically downward; however gradients at this well nest are expected to be influenced by fluctuations in Wabash River stage, and the short period of observation (November 1998 – April 1999) does not provide sufficient data to evaluate these effects.

3.2.3 Elevation of Groundwater Relative to Ash

Ash was encountered in seven direct-push probe holes (GP-1, 2, 3, 20, 21, 22, 23) and in one monitoring well boring (MW-12), located within the unlined ash impoundment and former ash laydown area (Figure 1). Ash in the central and southern portions of the unlined ash impoundment extended as much as 16 feet below the groundwater surface. The thickness of saturated ash is dependent on the elevation of the water table, which varies seasonally and with changes in Wabash River stage. The values for ash thickness listed here are based on water table elevation in November 1998, when it was near average based on observations at MW-6, MW-7, and MW-8.

3.3 Nearby Groundwater Users

Water well logs for all wells in the sections surrounding Township 8N, Range 11W, Section 17 of the West Union, Illinois-Indiana USGS quadrangle were queried from the Illinois State Groundwater Survey (Figure 9). Water well logs are included in Appendix D for reference. The two water supply wells located in Section 17 are plant extraction wells EW-1 and EW-2. The closest off-site wells are south of the site (Section 20), where two irrigation wells for the Dement and Wampler farms draw groundwater from depths of 64 and 32 feet, respectively, near the Wabash River, in the northeast ¼ of the section.[2] Further to the south in the southwest ¼ of the southeast ¼ of Section 20, City of Hutsonville public water supply Well #4, draws groundwater from a maximum depth of 61 feet below ground surface. No recent groundwater quality data is available for any of the aforementioned supply wells. All of these wells are screened in the deep sand and gravel in the Wabash River valley.

[2] Well locations described on the well records appear incorrect, because the lithologic description on the logs is of alluvial sediments while the indicated locations are outside the Wabash River valley. Based on knowledge of the site, these wells are assumed to be in the northeast corner of the section.

4 GROUNDWATER QUALITY IN DIRECT-PUSH SAMPLES

4.1 Parameters of Concern

The Hutsonville work plan identified boron, sulfate, manganese, pH, and TDS as parameters of concern (POCs) because they had concentrations in groundwater near the impoundments that exceeded Illinois Class I groundwater standards. These POCs historically exhibited the highest frequency of exceedances in monitoring well MW-3, at the southeast corner of the lined ash impoundment, and in MW-6 and MW-8, located south and east of the unlined impoundment, respectively. Boron and sulfate are indicator parameters of coal ash leachate. Manganese is ubiquitous in soils, and may have higher concentrations in soil than in coal ash; therefore, it is not a reliable indicator of coal ash leachate. The pH of coal ash can be high, neutral, or low, depending on the geochemistry of the ash; therefore, pH is not always a good indicator of coal ash leachate migration. High TDS may be observed at sites where coal ash leachate migration occurs because high TDS concentrations reflect elevated concentrations of soluble ash constituents such as calcium, potassium, sodium, and sulfate; however, other natural and anthropogenic sources can cause high TDS concentrations. The following discussion focuses on results from the direct-push water samples, and includes iron and nickel because these parameters sometimes have high concentrations in groundwater near coal piles. Complete results of the direct-push water quality sample analyses are provided in Appendix C.

4.2 Direct-Push Leachate Samples

Ash leachate samples were collected from the lined impoundment (LP-1 and LP-2), from the unlined impoundment (GP-20, GP-21, and GP-23), and from the former ash laydown area (GP-2). Boron, sulfate, and TDS concentrations ranged from about 1.5 to 27 times the groundwater standards (2 mg/L, 400 mg/L, and 1200 mg/L, respectively) in most of the leachate

samples; however, sulfate and TDS were slightly below the standards at location GP-20 in the unlined ash impoundment (Table 6).

Manganese was between 18 and 165 times the standard (0.15 mg/L) in leachate from the unlined ash impoundment and from the former ash laydown area, but was less than one-tenth the standard in the lined ash impoundment (lowest concentrations on site), thereby exhibiting its unreliability as an ash indicator parameter. Iron was below the standard in all leachate samples from the impoundments, but exceeded the standard in the sample from the former ash laydown area. Nickel was less than one-third the standard (0.10 mg/L) in all of the leachate samples.

The pH of the coal ash leachate was neutral to alkaline. The pH of the "fresh" leachate in the lined ash impoundment was above 9.0, while the pH in the unlined ash impoundment was slightly elevated at 7.3 to 7.6. The pH at location GP-2, in the former ash laydown area, was near neutral at 6.8.

4.3 Direct-Push Groundwater Samples

Boron and sulfate concentrations in groundwater between the ash impoundments were higher than the Class I groundwater standards. Boron concentrations ranged from 4.6 mg/L to 28.2 mg/L and sulfate concentrations from 398 mg/L to 1531 mg/L near the southeast corner of the lined ash impoundment (see GP-3 through GP-6, Table 6). Boron also exceeded the standard in one sample near the coal pile, while three samples, including GP-11 directly beneath the coal pile, had boron concentrations below the standard, and generally lower than near the ash impoundments. Sulfate concentrations were highest near the coal storage pile, ranging from 867 mg/L to 7143 mg/L. Off-site (south of the impoundments) boron concentrations were less than one-fifth the groundwater standard, and sulfate concentrations were less than one-third the standard.

Manganese concentrations were above the Class I groundwater standard in all of the direct-push groundwater samples from the plant site. The highest concentration occurred in coal pile area

boring GP-10 (26.7 mg/L). Manganese was less than one-tenth the standard at the five off-site probe hole locations south of the impoundments, but was above the standard in off-site boring GP-14 (0.93 mg/L), located southeast of the impoundments.

Iron concentrations only exceeded the standard in groundwater samples from the coal pile area. A concentration of about 3,300 mg/L was repeated in all three replicate samples from GP-10. However, iron concentrations were very low at GP-9, which was downgradient of the coal pile, suggesting limited migration. The limited observed iron migration may be due to geochemical changes, which are evidenced by a pH change from less than 5.0 beneath the coal pile to 6.8 at GP-9.

Nickel concentrations ranged from below detection (<0.005 mg/L) to 3.2 mg/L, and exceeded the Class I groundwater standard in the coal pile storage area (GP-10, GP-11, and GP-12) and near the southeast corner of the lined ash impoundment (GP-5). Elevated nickel concentrations occurred in areas currently used for coal storage or in which coal spillage occurred in the past, such as along the former railroad spur near locations GP-3, GP-5, and GP-6. However, nickel concentration in GP-9, which was downgradient of the coal pile, was below the standard, suggesting that nickel migration is limited. Nickel was below detection in the five off-site probe hole locations south of the impoundments, and was detected at a concentration lower than the standard in off-site boring GP-14 (0.014 mg/L), located southeast of the impoundments.

Exceedances of pH in groundwater were for values lower than the Class I standard of 6.5. Values of pH, ranging from 2.8 to 6.3, occurred in all probed areas on the plant site. These values were lower than off-site pH values (7.4 to 8.0) and ash pond/leachate pH values (6.8-10.0).

TDS exceedances generally exhibited a distribution similar to that of the sulfate exceedances, and probably reflect that distribution. Off-site TDS concentrations were less than 1000 mg/L.

Overall, the direct-push results suggest a correlation between groundwater quality and potential leachate sources. Groundwater near the coal ash impoundments generally had high boron and sulfate concentrations. Groundwater near the coal pile typically had high nickel, iron, and sulfate concentrations. Groundwater near the coal pile also had very low pH.

5 GROUNDWATER QUALITY IN MONITORING WELLS

5.1 Parameters of Concern

As stated in the previous section, the POCs in groundwater include boron, sulfate, maganese, pH and TDS. Iron and nickel were also included as POCs, because they were detected in direct-push samples. Boron and sulfate are the primary indicator parameters for coal ash due to their consistent occurrence at coal ash sites. Groundwater results are included as a Microsoft® Excel spreadsheet on a diskette attached to the back of this report. The following discussion focuses on groundwater results collected since new monitoring wells were installed (October 26, 1998 through May 24, 1999).

5.2 Groundwater Results

A review of groundwater trends by POC and area of the site, is included in this section. Figures 10 and 12 through 17 present a graphical interpretation of the extent of groundwater exceeding Illinois Class I groundwater standards for each compound, based on median groundwater concentrations from October 26, 1998 through May 24, 1999. Median and maximum results are shown in the drawings. Concentration references are to the data shown in the Figures and Table 7, which summarizes the upper 95% prediction limit for each POC shown, calculated using the inclusive sampling data from October 26, 1998 to May 24, 1999.

The distribution of recent boron concentrations is illustrated in Figure 10. Boron concentrations exceed the Class I groundwater standard at eight monitoring wells, but concentrations are highest in the former ash laydown area (MW-13) and unlined ash impoundment area (MW-6, MW-8). Boron is present in bedrock piezometer MW-3D; however, that concentration is likely due to leakage from the sluicepipe. Similarly, boron concentration in MW-2 appears to be related to the pipe leak. The concentration of boron over time in MW-2 and MW-3 is presented in Figure 11.

Boron concentrations in MW-3 prior to the construction of the lined ash impoundment are likely due to the proximity of the well to the former ash laydown area. Assuming groundwater velocity calculated in Section 3.2 for MW-3 toward MW-2, the appearance of boron in elevated concentrations in MW-2, coincides with the travel time for boron transport from MW-3 to MW-2, or approximately 10 years, assuming a boron retardation factor of 1.5. Boron concentrations in both wells have been decreasing since their peak, suggesting that the effects of the pipe leak are diminishing since it was repaired in 1996. The extent of Class I groundwater standard exceedences shown on Figure 10 correlates with direct-push sample data.

Sulfate concentrations exceeded the Class I groundwater standard in and downgradient of the coal storage area, the old ash impoundment, and the old ash laydown area (MW-2, MW-3, MW-3D, MW-8, MW-9, MW-11, and MW-13). Direct-push samples indicate results consistent with monitoring well observations, presented on Figure 12.

Maganese concentrations exceed the site Class I groundwater standard in upgradient wells (MW-1, MW-10D), the former ash laydown area (MW-3, MW-3D, MW-11, MW-12 and MW-13), and in the unlined ash impoundment (MW-6, MW-7, MW-7D, MW-8 and MW-9), and are highest in monitoring wells MW-11 and MW-13, in the former ash laydown area (Figure 13). Direct-push groundwater samples correlate with the estimated extent of the Class I groundwater standard for maganese.

Iron is not present in groundwater monitoring wells above the Class I groundwater standard (Figure 14). This observation does not correlate with direct-push samples directly adjacent to the coal storage pile (GP-9, GP-10, and GP-11) where iron concentrations were above the Class I groundwater standard; however, no monitoring wells were finished in the coal storage pile area. Iron is not present in monitoring wells downgradient of the coal storage pile area above the Class I groundwater standard (MW-7, MW-8), indicating no offsite migration.

Nickel concentration exceeds the Class I groundwater standard in MW-11 and MW-13 (Figure 15). Elevated concentrations of nickel in MW-11 and MW-13 coincide with low pH

readings and locations of near-surface coal deposits (Table 7). Nickel exceeds the Class I groundwater standard in direct-push samples, located near the coal storage area and the former ash laydown area (GP-5, GP-10, GP-11, and GP-12), coincident with low pH (Figure 16), and, in the case of the coal storage area, elevated iron concentrations.

Total dissolved solids (TDS) is present in on-site groundwater monitoring wells above the Class I groundwater standard in the same locations as sulfate exceedences (Figure 17). As described previously, elevated sulfate concentrations in coal ash leachate can cause high TDS concentrations. TDS distribution in ash leachate and groundwater direct-push samples shown on Table 6 also reflects this association.

5.3 Surface Water Results

Surface water samples were collected from pooled surface water, or "ponds" at the approximate locations shown in Figure 1, in April 1999. Surface water samples were collected from ponds located in the lined ash impoundment (LAP); unlined ash impoundment (UAP); coal storage area (CYP); and south of the former ash laydown area (P2P). Sample results are summarized in Tables 6 and 7 for comparison with groundwater and leachate samples in the same general locations. Leachate samples in the lined ash impoundment correlate with elevated concentrations of boron in surface water sample LAP. Groundwater and leachate results in the unlined ash impoundment area correlate with elevated concentrations of boron and maganese in surface water sample UAP, although concentrations are much lower in the surface water sample. Elevated maganese, iron, nickel, sulfate and TDS in sample CYP, along with low pH, correlate to direct-push groundwater samples from the coal pile storage area. The P2P sample is dissimilar to any groundwater samples and likely does not represent any source areas.

5.4 Source Area and Receptor Analysis

The direct-push, monitoring well, and surface water sample data suggest two general sources for groundwater impacts at this facility: 1) the unlined ash impoundment and ash laydown areas, and 2) the coal pile and coal spill areas.

Groundwater affected by the ash impoundment and ash laydown areas is characterized by boron concentrations greater than 2 mg/L, sulfate concentrations greater than 200 mg/L, and neutral to alkaline pH. Manganese concentrations tend to be greater than 1 mg/L in these areas; however, the ubiquitous nature of manganese in the environment makes it difficult to determine whether manganese in groundwater is released from the coal ash or whether reducing conditions potentially caused by the coal ash impoundment are causing release of manganese from the soil. Relatively low boron and sulfate concentrations in wells MW-4 and MW-5, immediately downgradient of the lined ash impoundment, suggest that it is not a significant source of groundwater impacts.

Groundwater affected by the coal pile and coal storage areas is characterized by boron concentrations greater than 1 mg/L, sulfate concentrations greater than 500 mg/L, iron concentrations greater than 10 mg/L, nickel concentrations greater than 0.10 mg/L, and acidic pH. Again, manganese concentrations tend to be greater than 1 mg/L in this area. The constituents that differentiate coal impacts from ash leachate impacts are iron, nickel, and pH.

These characteristics suggest that sources affecting groundwater monitoring wells can be identified by groundwater quality and by position relative to the sources (Table 8). The results of this hydrogeologic assessment indicate that coal impacts are restricted to the source areas. Neither direct-push nor monitoring well data outside of the coal pile and coal spill areas showed characteristics of coal impacts. Alternatively, characteristics of ash impacts were observed downgradient of the ash disposal areas, and boron and sulfate are known to be mobile in groundwater; therefore, migration of these constituents toward the Wabash River (the regional groundwater sink) is likely.

There are no groundwater extraction wells, other than the plant wells, between the source areas identified in this hydrogeologic assessment and the Wabash River. The plant wells, as well as two irrigation wells that are southeast of the facility, are completed in deep sand and gravel in the Wabash River valley, which is overlain by less permeable silty sediments. Furthermore, groundwater quality at MW-7D, a relatively deep monitoring well finished in the Wabash River valley, is within standards, with the exception of manganese, which is likely due to anoxic conditions beneath the river sediments. The low boron and sulfate concentrations in MW-7D well suggest little vertical migration of ash constituents; therefore, migration from the ash impoundments is directly to the river, rather than downward toward any extraction wells.

6 CONCLUSIONS

- The hydrostratigraphy of the upland area where the ash impoundments are located consists of a thin layer of unlithified sand-rich material overlying sandstone and siltstone bedrock. The unlithified sands are more permeable than the sandstone and therefore constitute a more-probable pathway for leachate migration from the impoundments.

- There are three areas with coal ash fill: 1) the unlined ash impoundment; 2) the lined ash impoundment; and 3) a former ash laydown area immediately west of the unlined ash impoundment.

- Saturated ash was encountered within the unlined ash impoundment, with saturated thickness up to 16 feet.

- Direct-push water samples indicated high concentrations, relative to Class I standards, of boron, manganese, sulfate, and TDS in ash leachate, although manganese concentrations were only high in samples from the unlined impoundment.

- The direct-push groundwater samples showed no evidence of groundwater impacts south of the impoundments.

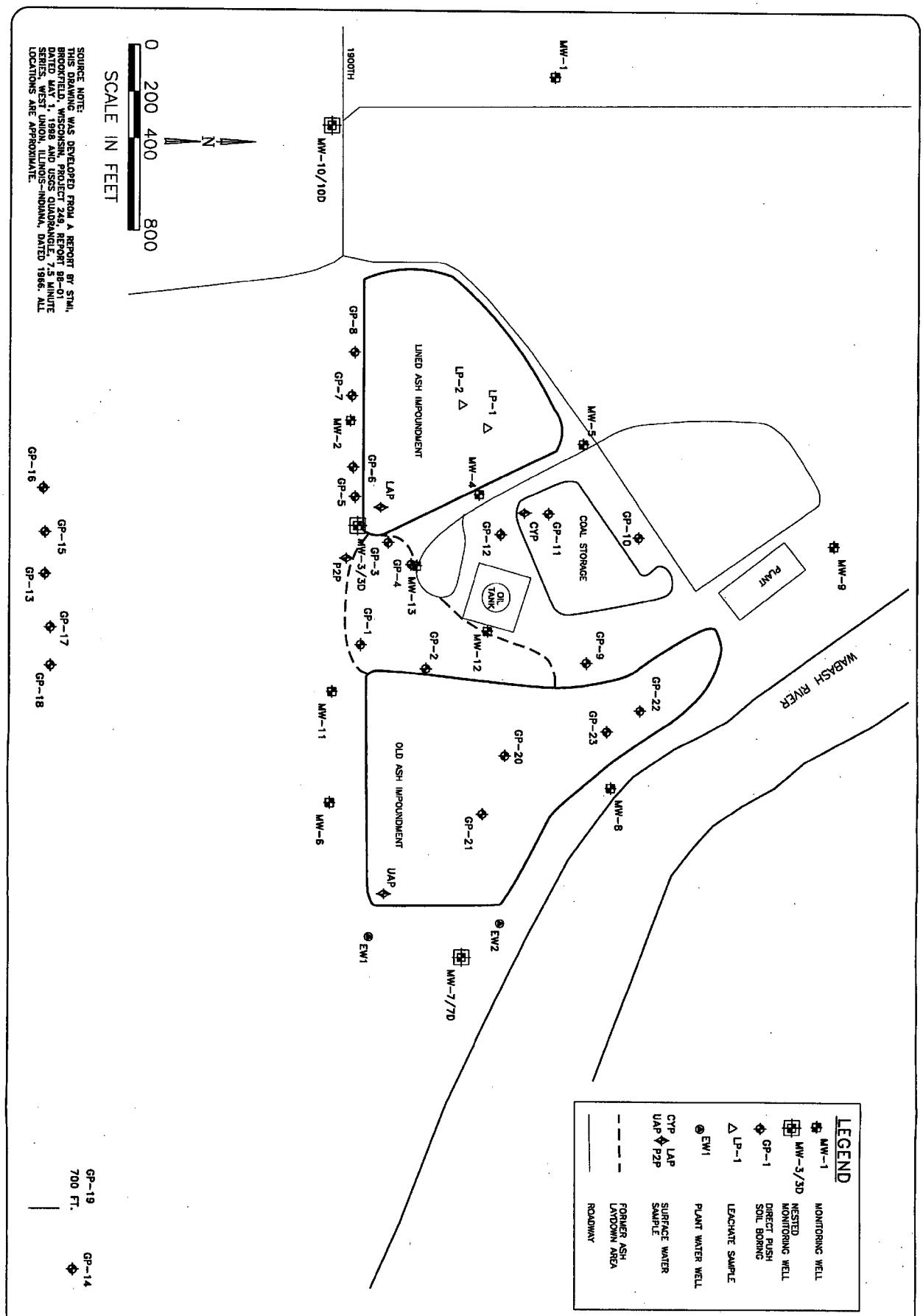
- Groundwater samples from some on-site monitoring wells and probe holes had concentrations of boron, manganese, sulfate, TDS, iron, and nickel higher than Class I standards. High iron and nickel concentrations were found in locations where coal was present near the land surface.

- These observations indicate two sources for groundwater quality impacts: 1) the coal pile and coal spill areas, and 2) the ash laydown area and unlined ash impoundment. There is no evidence that iron and nickel from the coal pile and coal spill areas is migrating

beyond those areas. However, boron and sulfate from all sources are migrating east toward the Wabash River.

- There are no groundwater extraction wells in the shallow sediments between the unlined ash impoundment and the Wabash River. There are four extraction wells within ½ mile of the site, all finished in deep sand and gravel in the Wabash River valley. Two wells are directly east of the unlined impoundment and are used for plant water, and two wells are southeast of the impoundment and used for irrigation water. Groundwater quality data from monitoring well MW-7D, which is directly downgradient of the unlined ash impoundment and is the deepest on-site monitoring well in the Wabash River valley, indicates no evidence of ash impoundment or coal pile impacts at that depth.

FIGURES



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		APPROVED BY:	DATE: 8/18/99
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PROJECT NO. 1375/1	DRAWING NO. 1375-B01	FIGURE NO. 1	

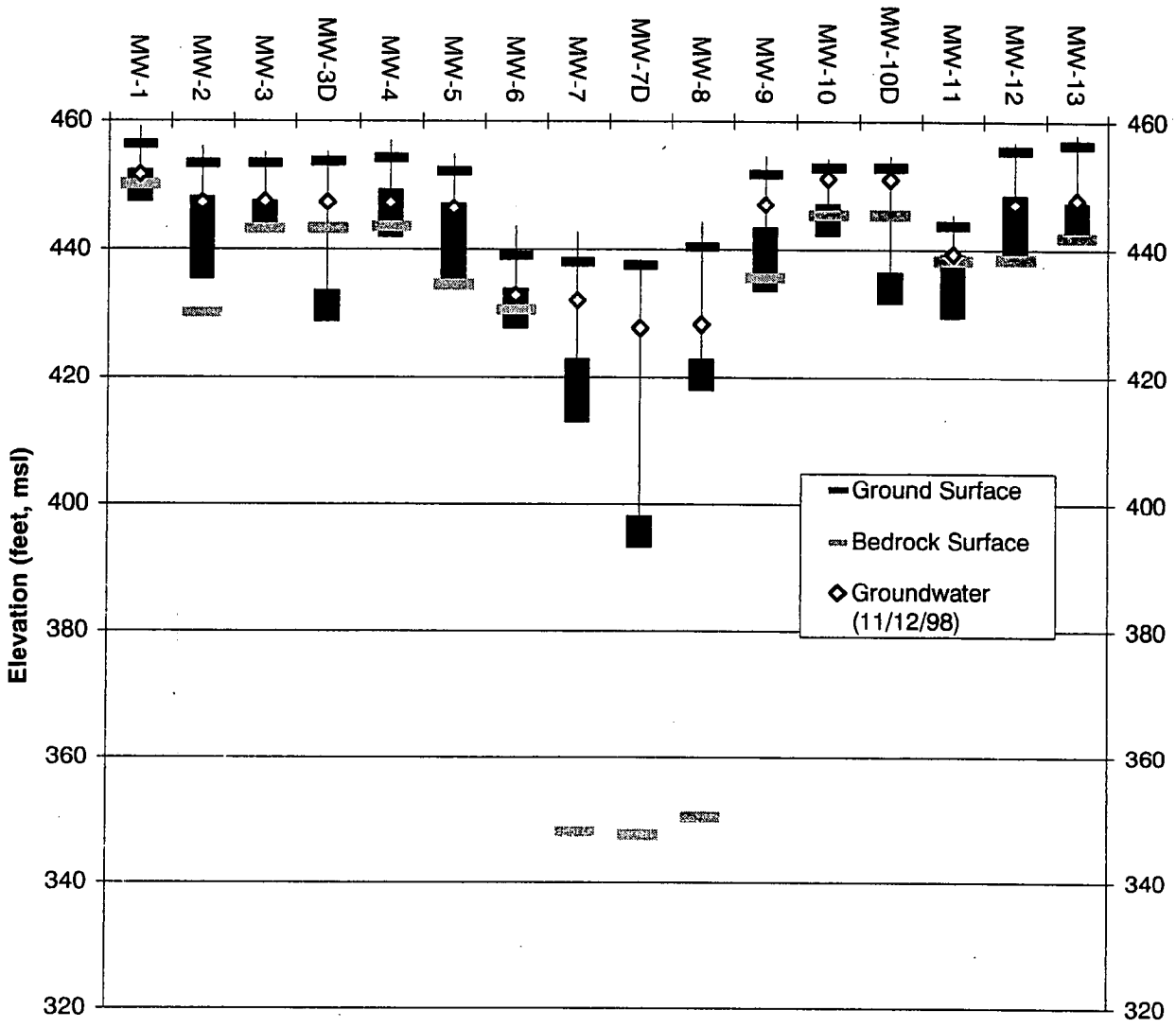
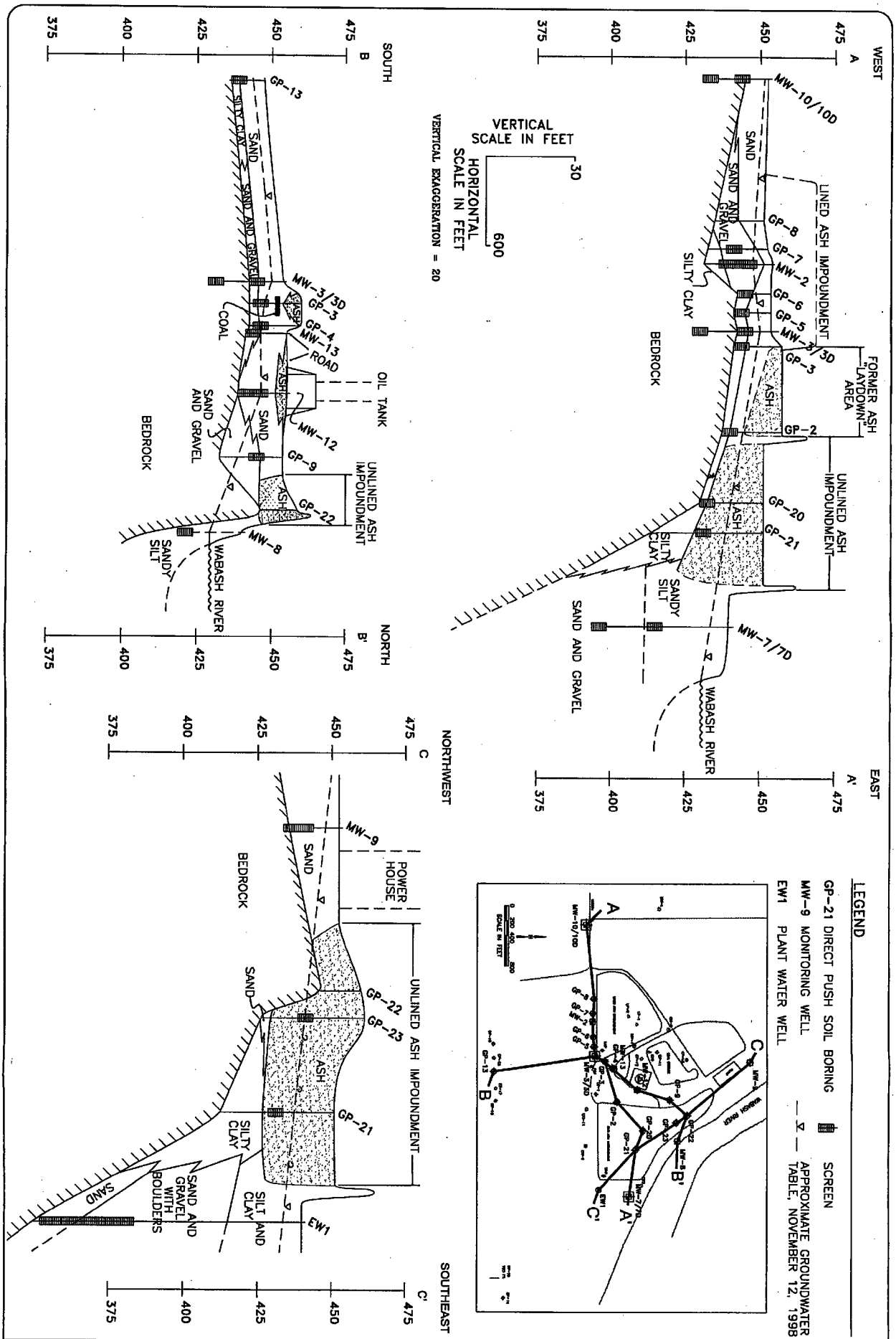


Figure 2. Elevation of well screens, ground surface, bedrock surface, and groundwater. Bedrock surface depths for MW-7, MW-7D, and MW-8 are estimated.

Natural Resource Technology
N R T



Natural Resource Technology	GEOLOGIC CROSS-SECTIONS HYDROGEOLOGIC ASSESSMENT FINAL REPORT HUTSONVILLE POWER STATION HUTSONVILLE, ILLINOIS	DRAWN BY: TAS	DATE: 08/18/99
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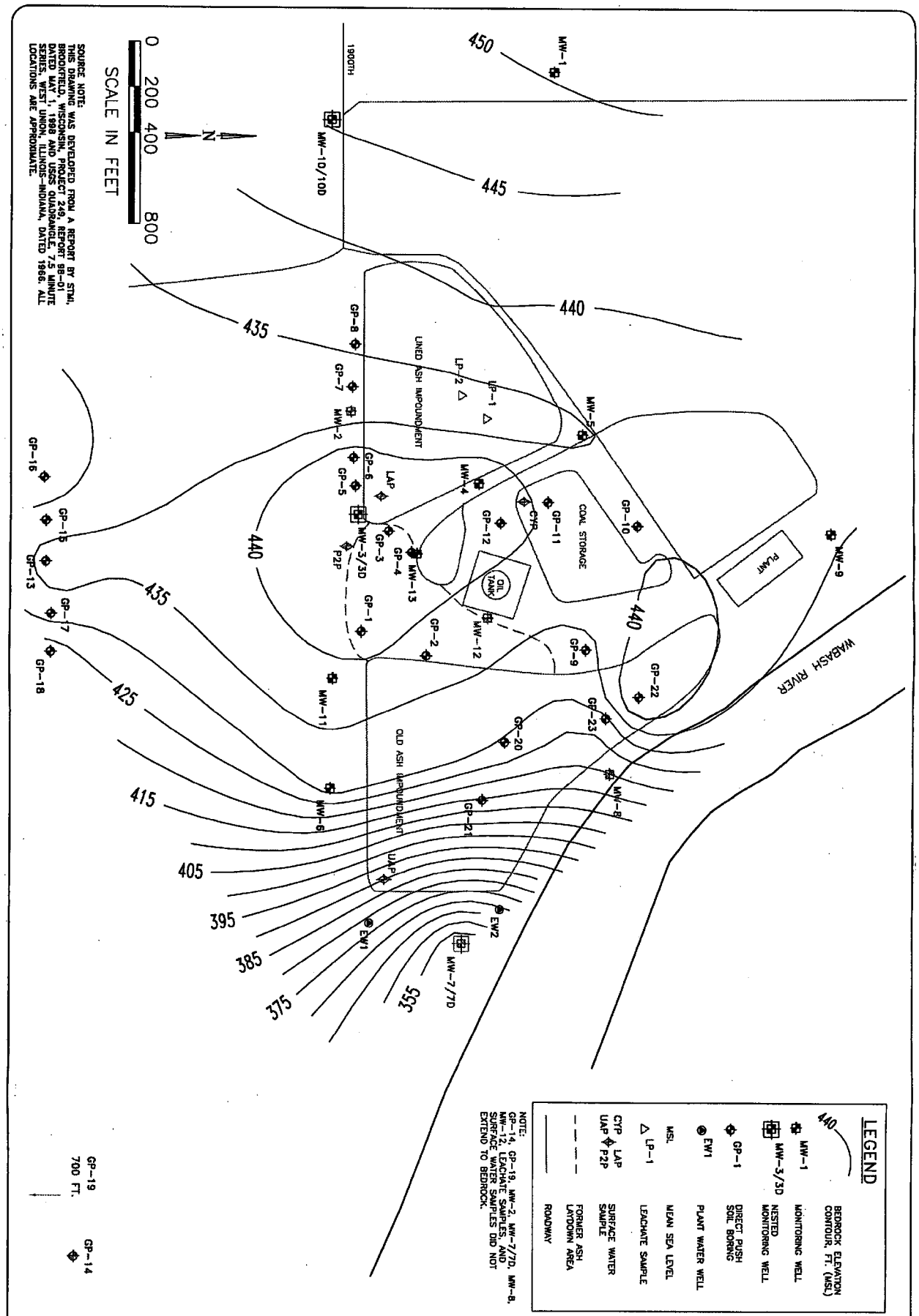
PROJECT NO. 1375/1			
DRAWING NO. 1375-B12			
FIGURE NO. 3			



Natural Resource Technology	BEDROCK ELEVATION CONTOURS HYDROGEOLOGIC ASSESSMENT FINAL REPORT HUTSONVILLE POWER STATION HUTSONVILLE, ILLINOIS	DRAWN BY: TAS	DATE: 08/18/99
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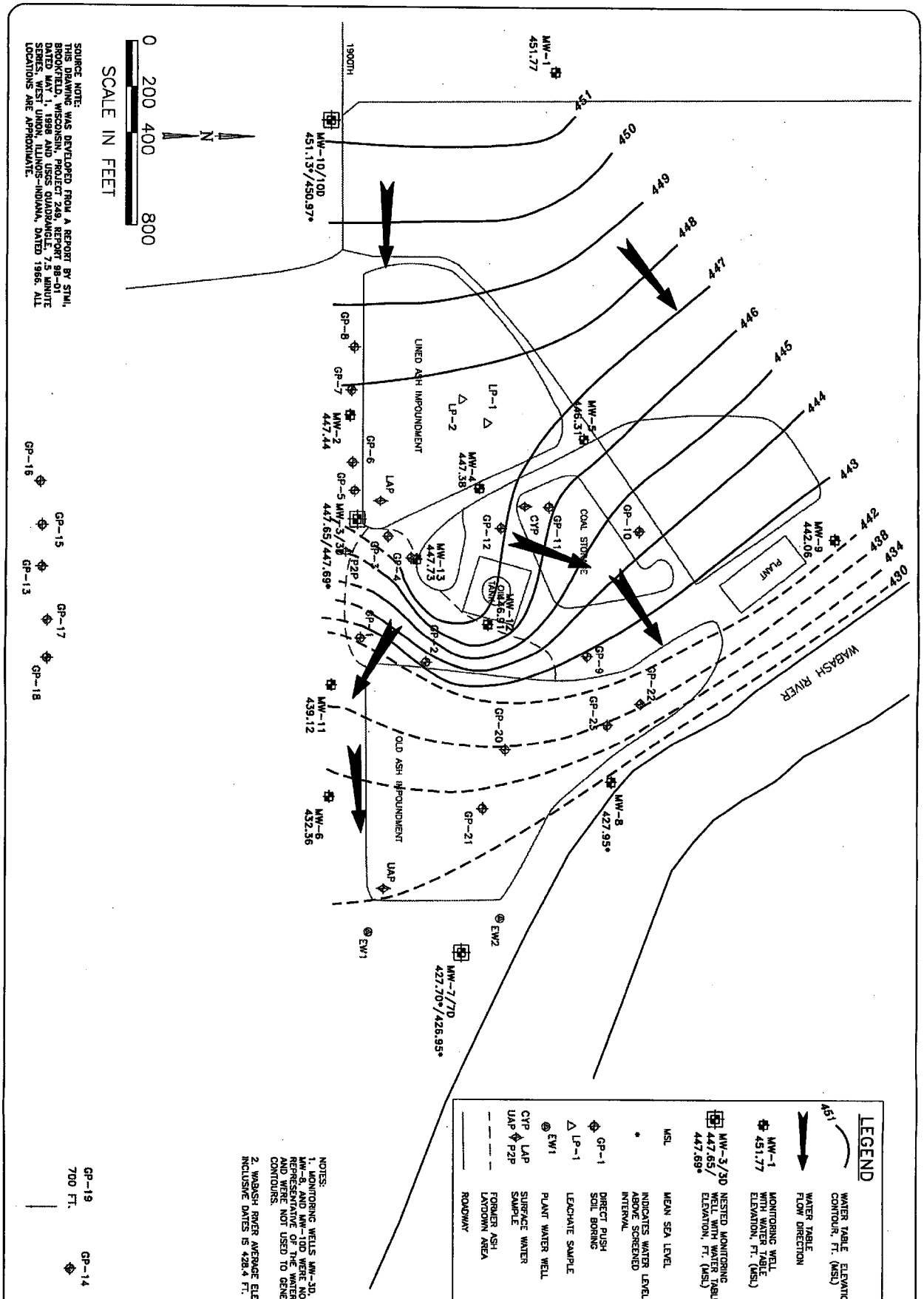
PROJECT NO. 1375/1			
DRAWING NO. 1375-B11			
FIGURE NO. 4			



Natural Resource Technology	WATER TABLE ELEVATION CONTOURS NOVEMBER 16-18, 1998 HYDROGEOLOGIC ASSESSMENT FINAL REPORT HUTSONVILLE POWER STATION HUTSONVILLE, ILLINOIS	DRAWN BY: TAS	DATE: 08/18/99
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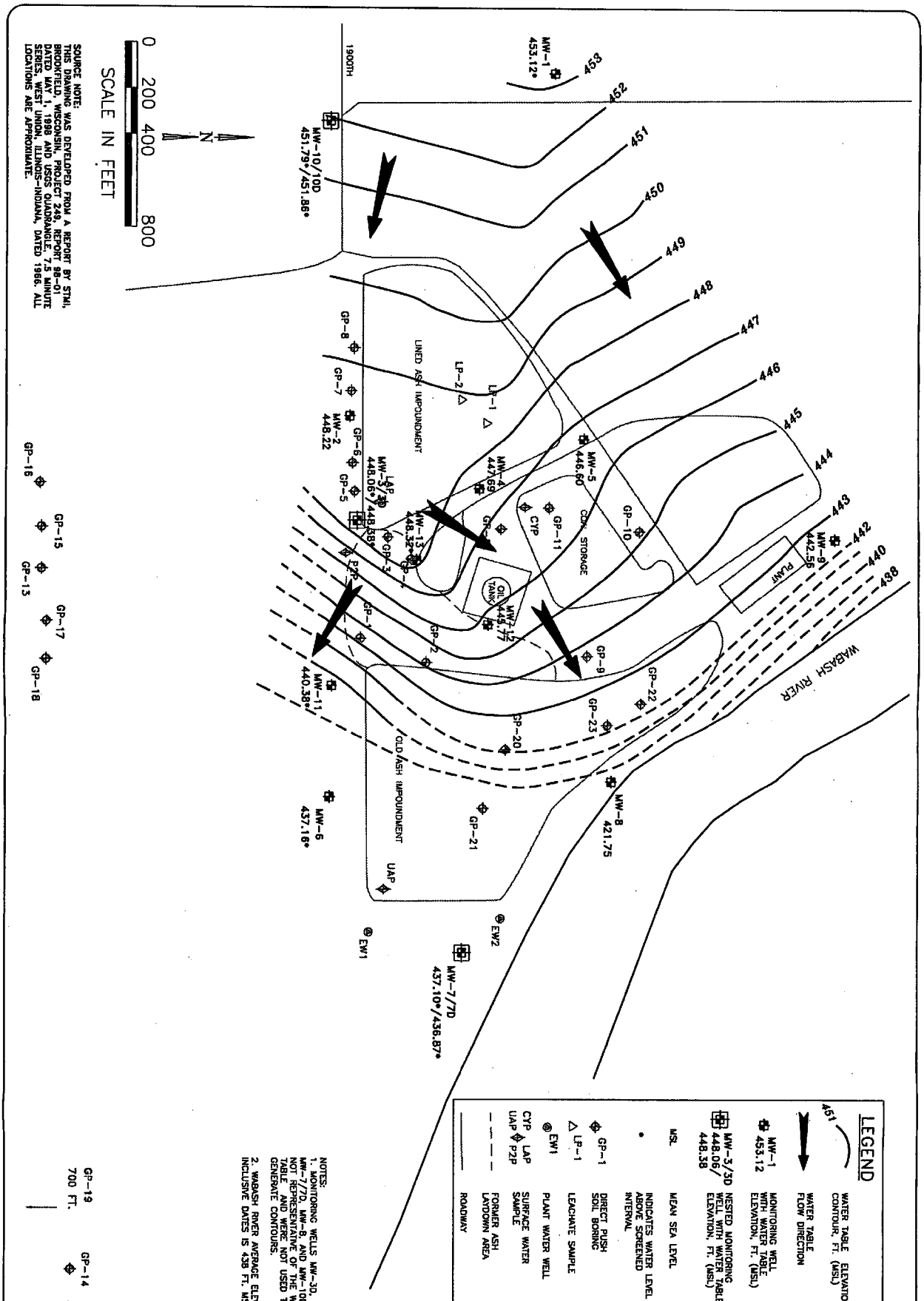
PROJECT NO. 1375/1	DRAWING NO. 1375-B09	FIGURE NO. 5	



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WATER TABLE ELEVATION CONTOURS APRIL 29-30, 1999

HYDROGEOLOGIC ASSESSMENT FINAL REPORT
HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

DRAWN BY:	TAS	DATE:	08/18/99
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PROJECT NO. 1375/1
DRAWING NO. 1375-B10
FIGURE NO. 6

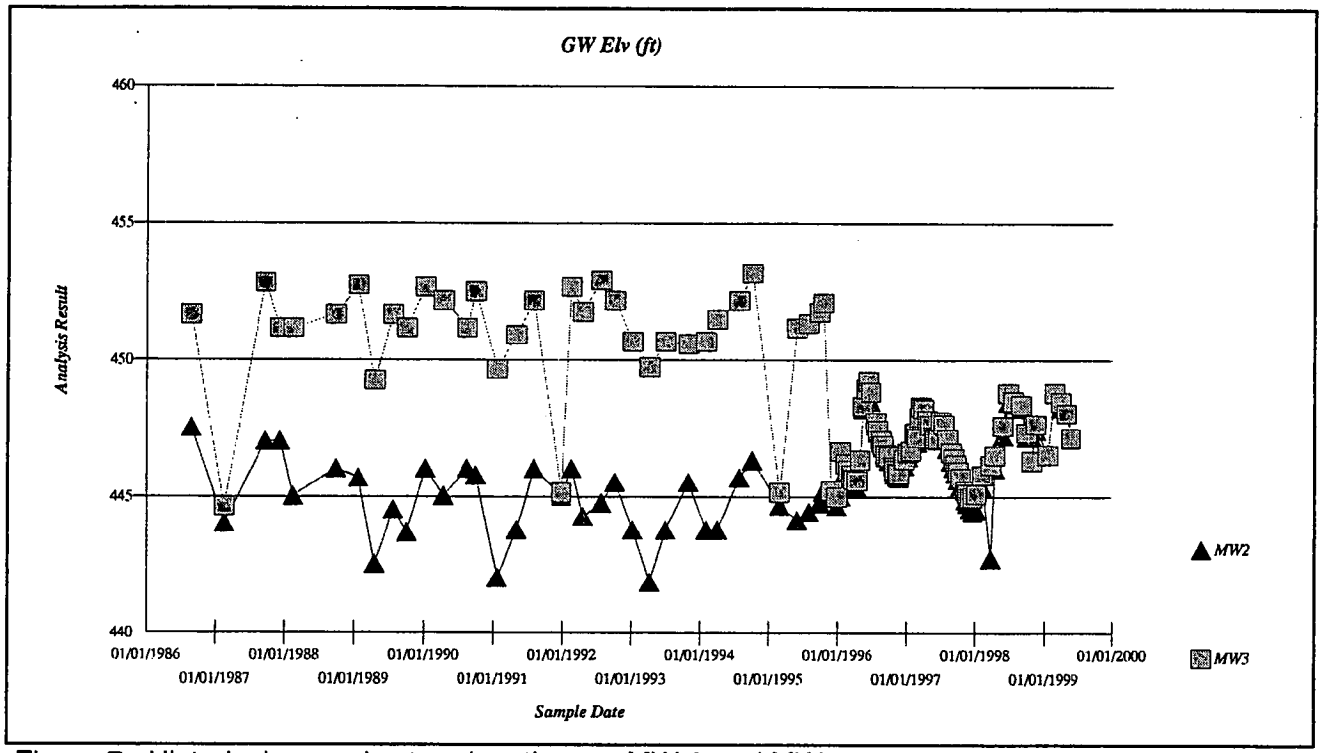
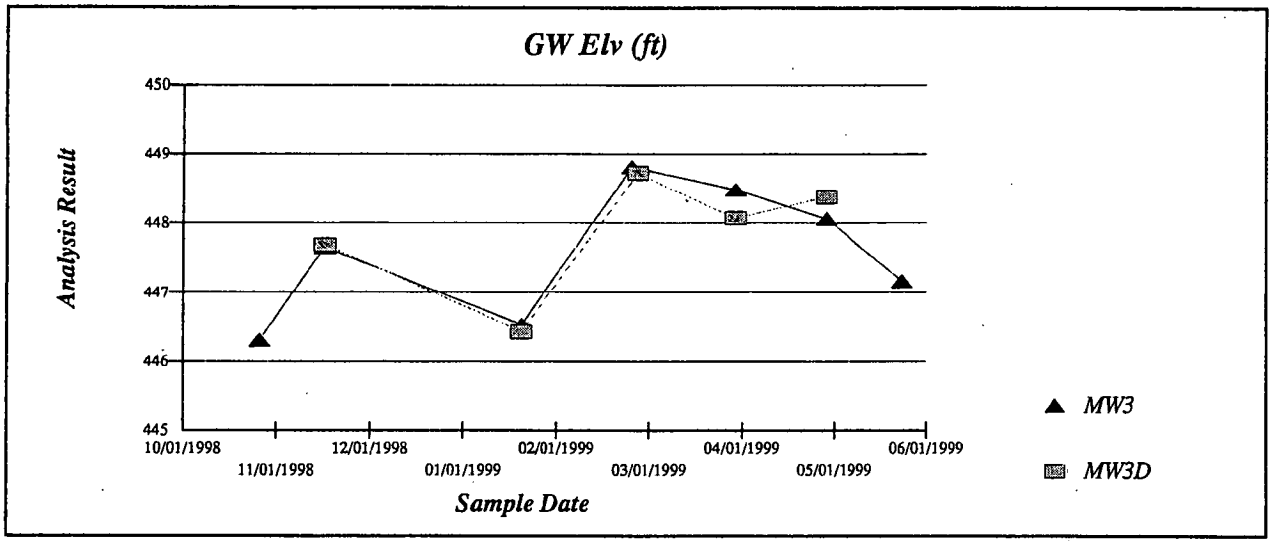
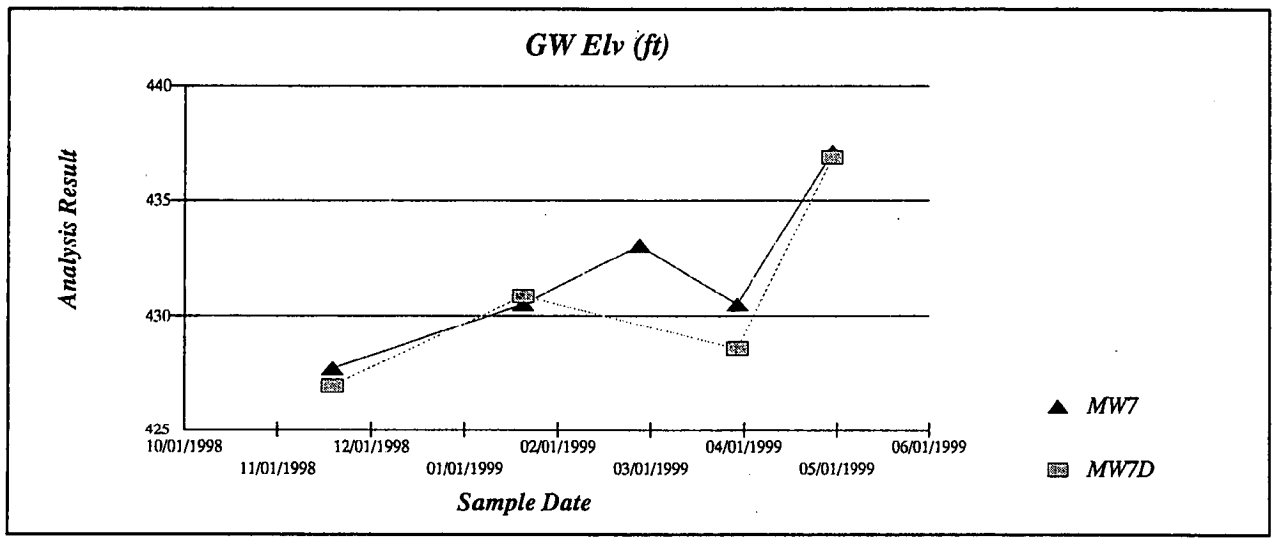


Figure 7. Historical groundwater elevations at MW-2 and MW-3.





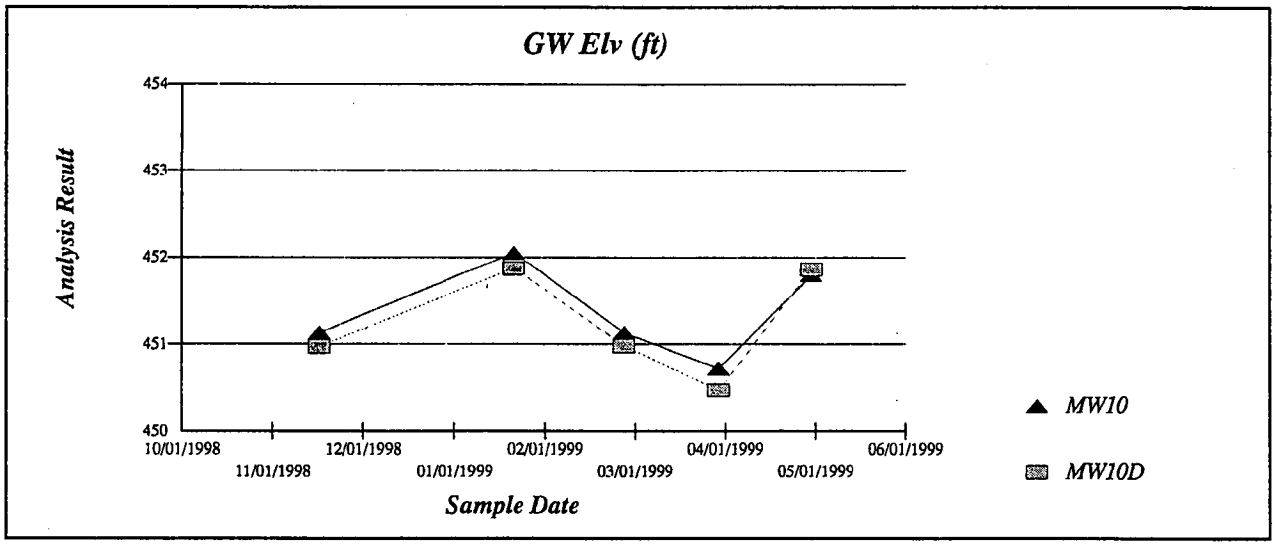


Figure 8. Historical groundwater elevations at nested wells (MW-3/3D, MW-7/7D, MW-10/10D).

Natural Resource Technology

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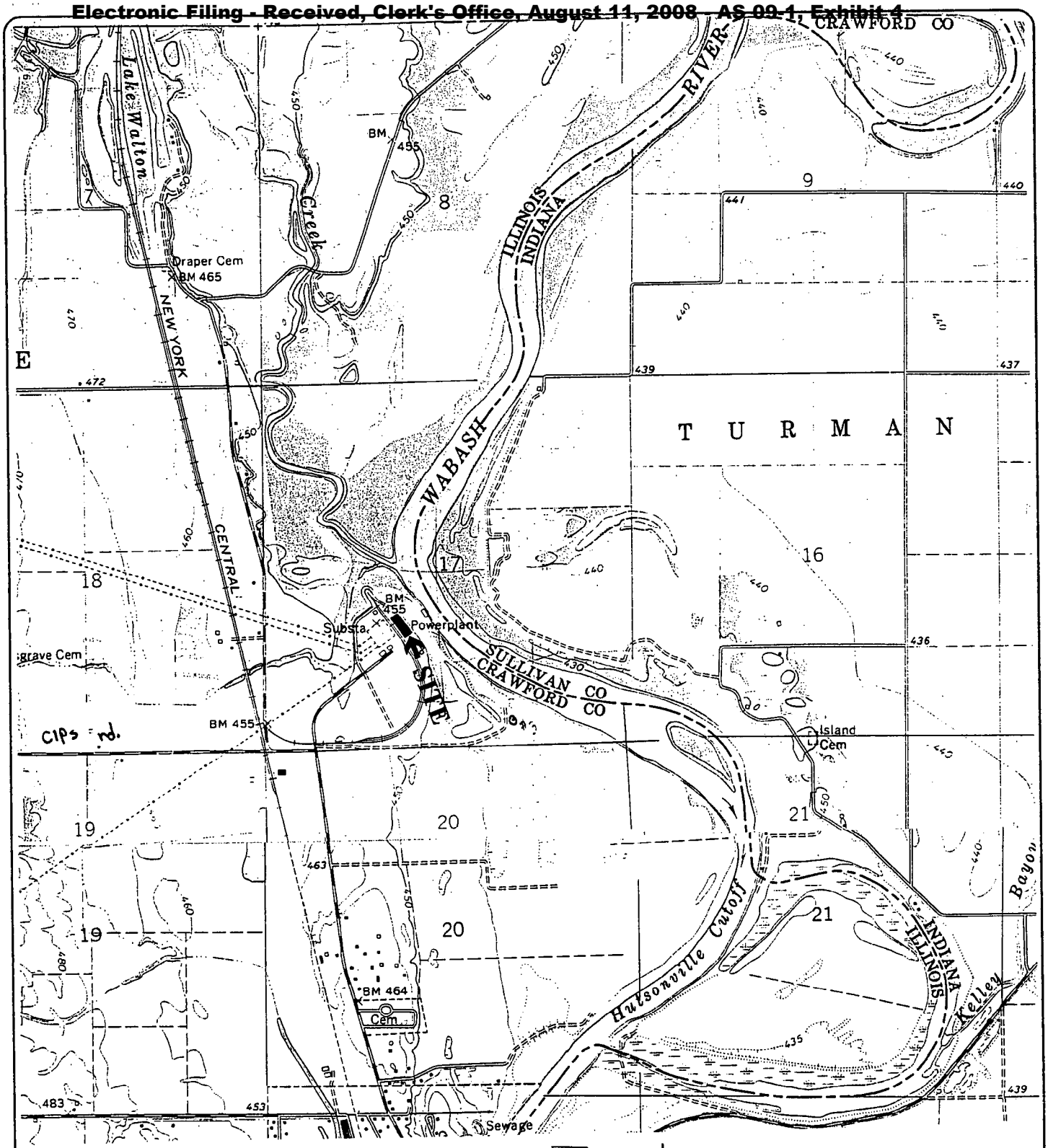

SOURCE: USGS 7.5 MINUTE QUADRANGLE, WEST UNION. DATED 1966.

QUADRANGLE LOCATION

N

0 2000 4000

SCALE IN FEET

CONTOUR INTERVAL 10 FEET

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N R T

SITE LOCATION MAP

HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

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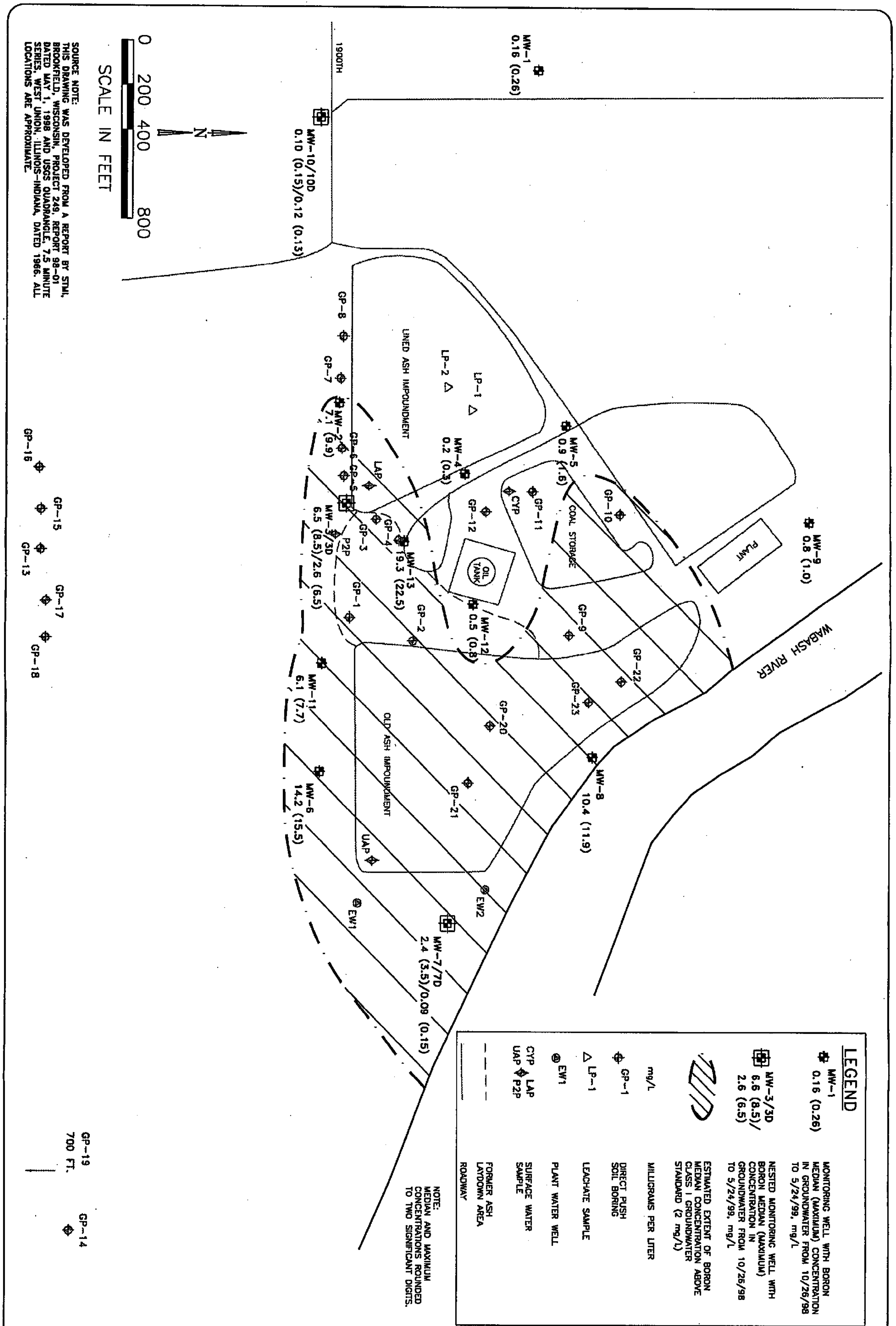
PROJECT NO. 1375

DRAWING NO. 1375-A01

FIGURE NO. 9



Natural Resource Technology	TOTAL BORON IN GROUNDWATER	DRAWN BY: TAS	DATE: 08/18/99
PROJECT NO. 1375/1	HYDROGEOLOGIC ASSESSMENT FINAL REPORT	CHECKED BY: [signature]	DATE: 8/18/99
DRAWING NO. 1375-B02	HUTSONVILLE POWER STATION	APPROVED BY: [signature]	DATE: 8/18/99
FIGURE NO. 10	HUTSONVILLE, ILLINOIS	AUTOCAD FILE: 1375-B02.DWG	

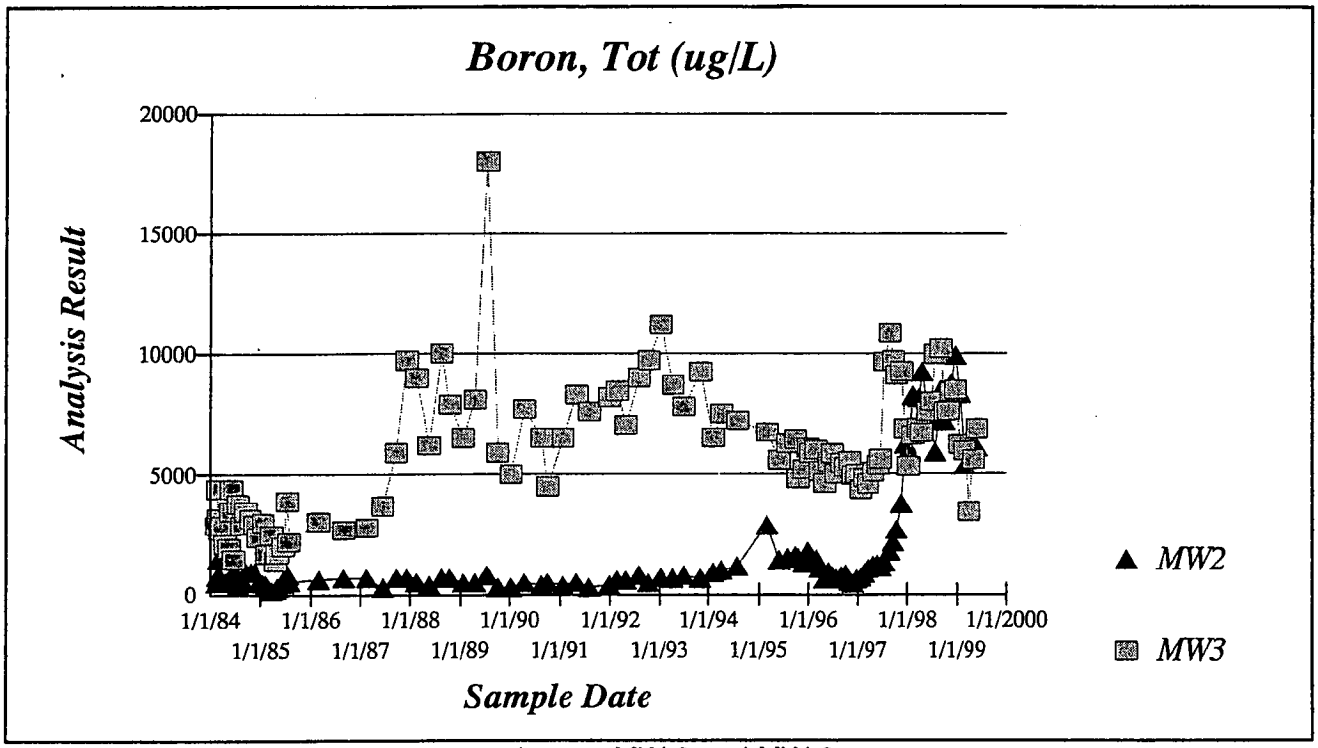
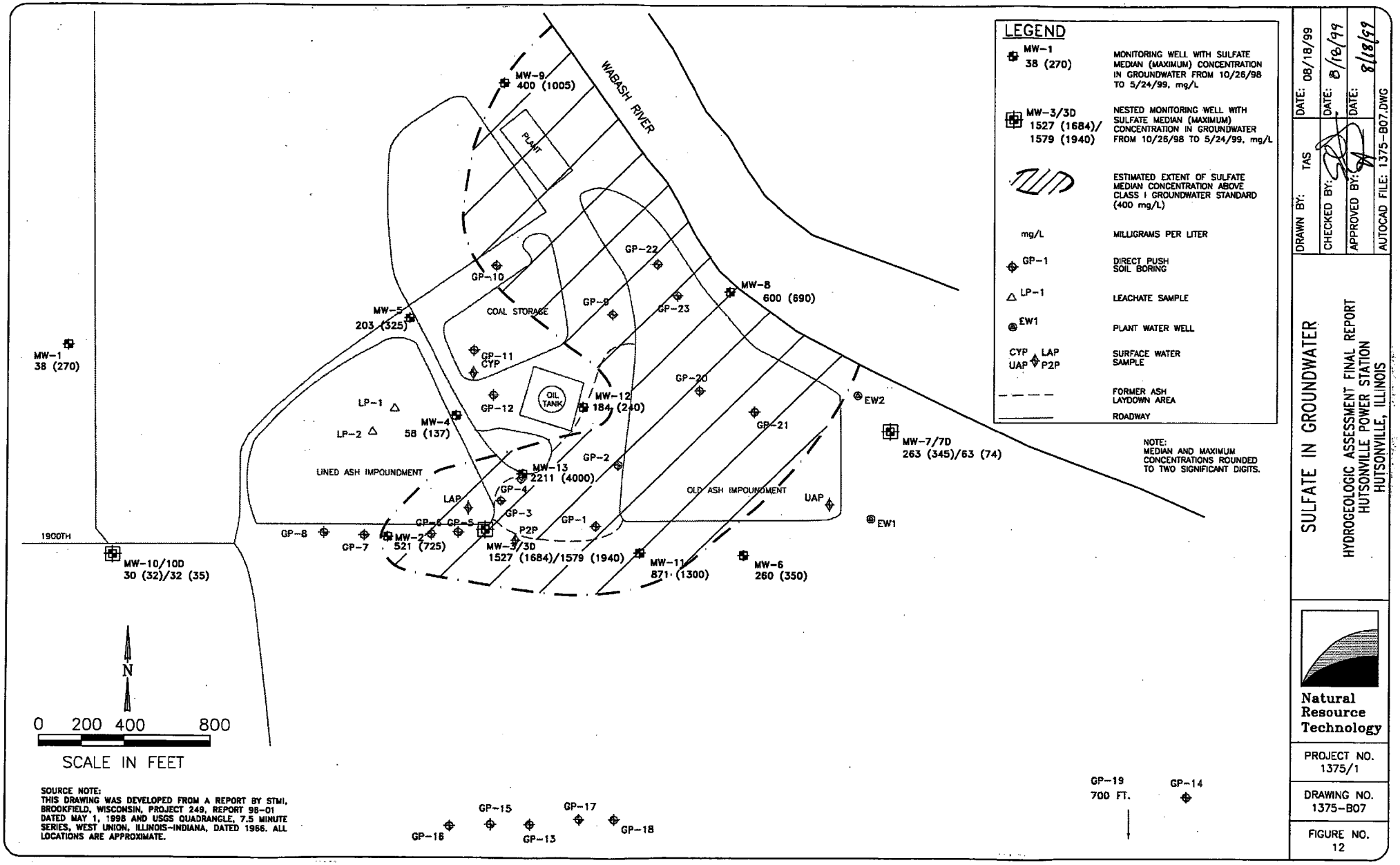


Figure 11. Historical boron concentrations at MW-2 and MW-3.



SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM A REPORT BY STMI, BROOKFIELD, WISCONSIN, PROJECT 249, REPORT 98-01 DATED MAY 1, 1998 AND USGS QUADRANGLE, 7.5 MINUTE SERIES, WEST UNION, ILLINOIS-INDIANA, DATED 1966. ALL LOCATIONS ARE APPROXIMATE.

SULFATE IN GROUNDWATER

HYDROGEOLOGIC ASSESSMENT FINAL REPORT
HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

DRAWN BY: TAS DATE: 08/18/99
CHECKED BY: DATE: 8/18/99
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Natural Resource Technology

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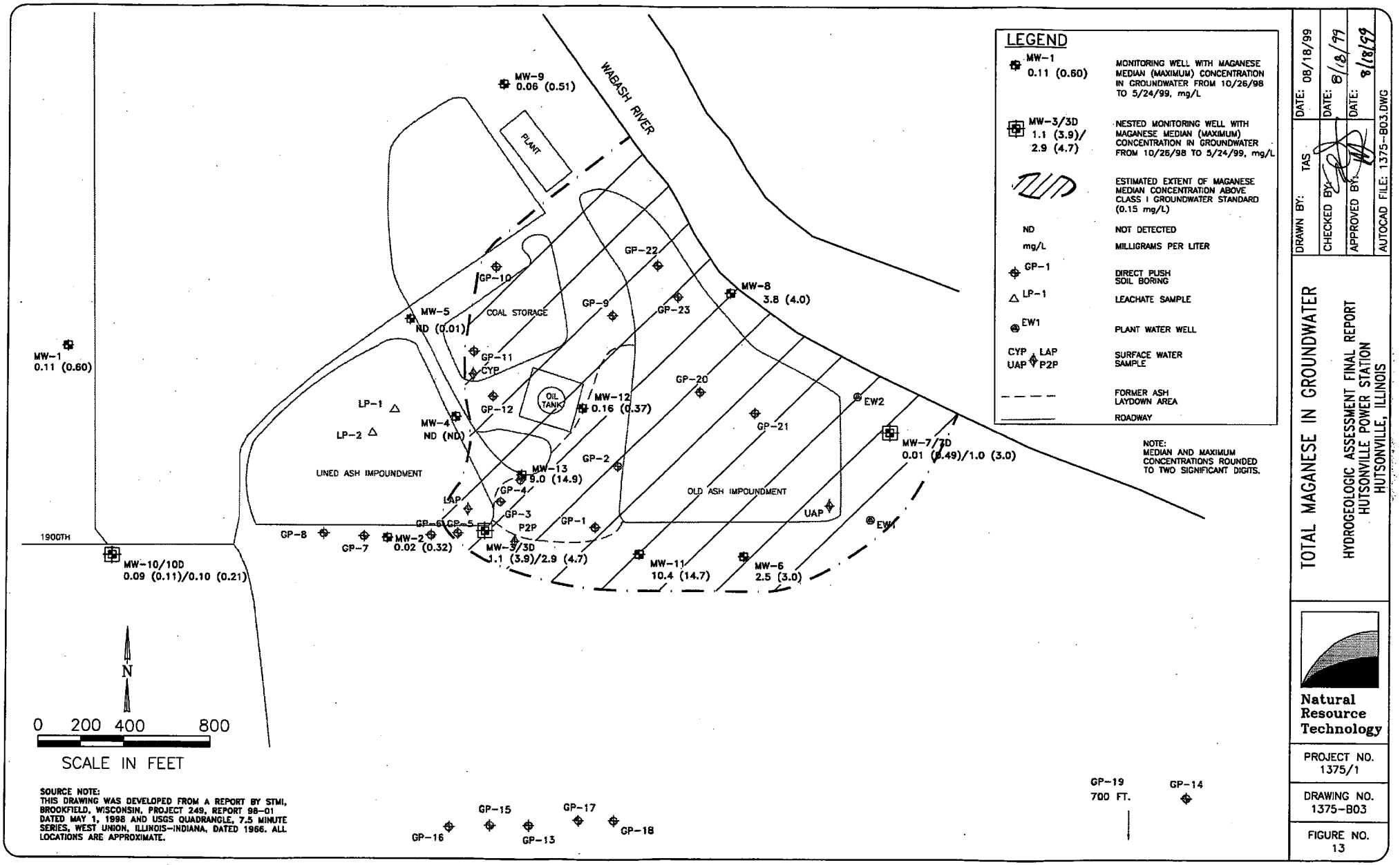
DRAWING NO. 1375-B07

FIGURE NO. 12



SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM A REPORT BY STMI, BROOKFIELD, WISCONSIN, PROJECT 249, REPORT 98-01 DATED MAY 1, 1998 AND USGS QUADRANGLE, 7.5 MINUTE SERIES, WEST UNION, ILLINOIS-INDIANA, DATED 1966. ALL LOCATIONS ARE APPROXIMATE.

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AUTOCAD FILE: 1375-B03.DWG

TOTAL MAGANESE IN GROUNDWATER

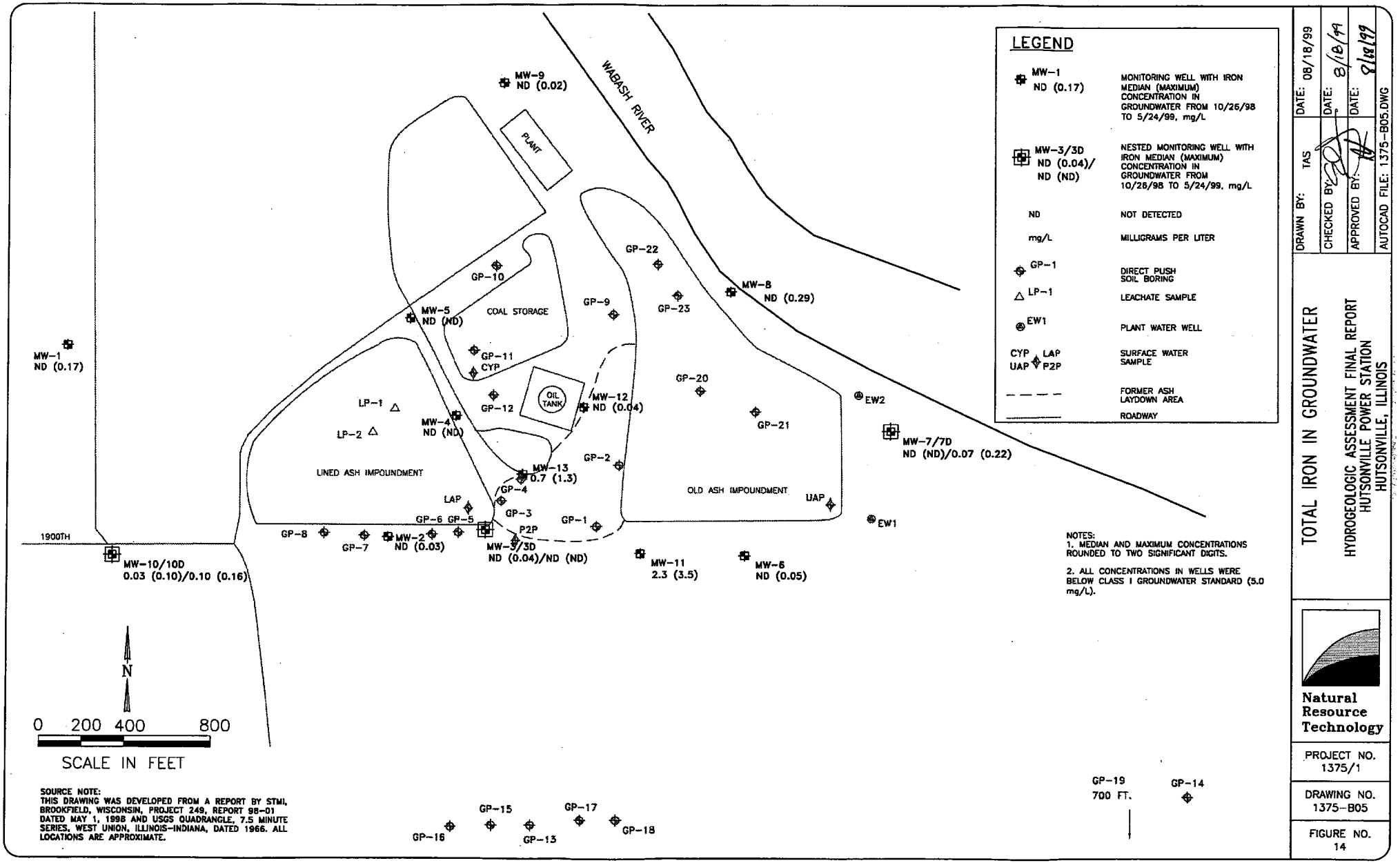
HYDROGEOLOGIC ASSESSMENT FINAL REPORT
HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

Natural Resource Technology

PROJECT NO. 1375/1

DRAWING NO. 1375-B03

FIGURE NO. 13



NOTES:
1. MEDIAN AND MAXIMUM CONCENTRATIONS ROUNDED TO TWO SIGNIFICANT DIGITS.

2. ALL CONCENTRATIONS IN WELLS WERE BELOW CLASS I GROUNDWATER STANDARD (5.0 mg/L).

SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM A REPORT BY STMI, BROOKFIELD, WISCONSIN, PROJECT 249, REPORT 98-01 DATED MAY 1, 1998 AND USGS QUADRANGLE, 7.5 MINUTE SERIES, WEST UNION, ILLINOIS-INDIANA, DATED 1966. ALL LOCATIONS ARE APPROXIMATE.

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AUTOCAD FILE: 1375-B05.DWG

TOTAL IRON IN GROUNDWATER

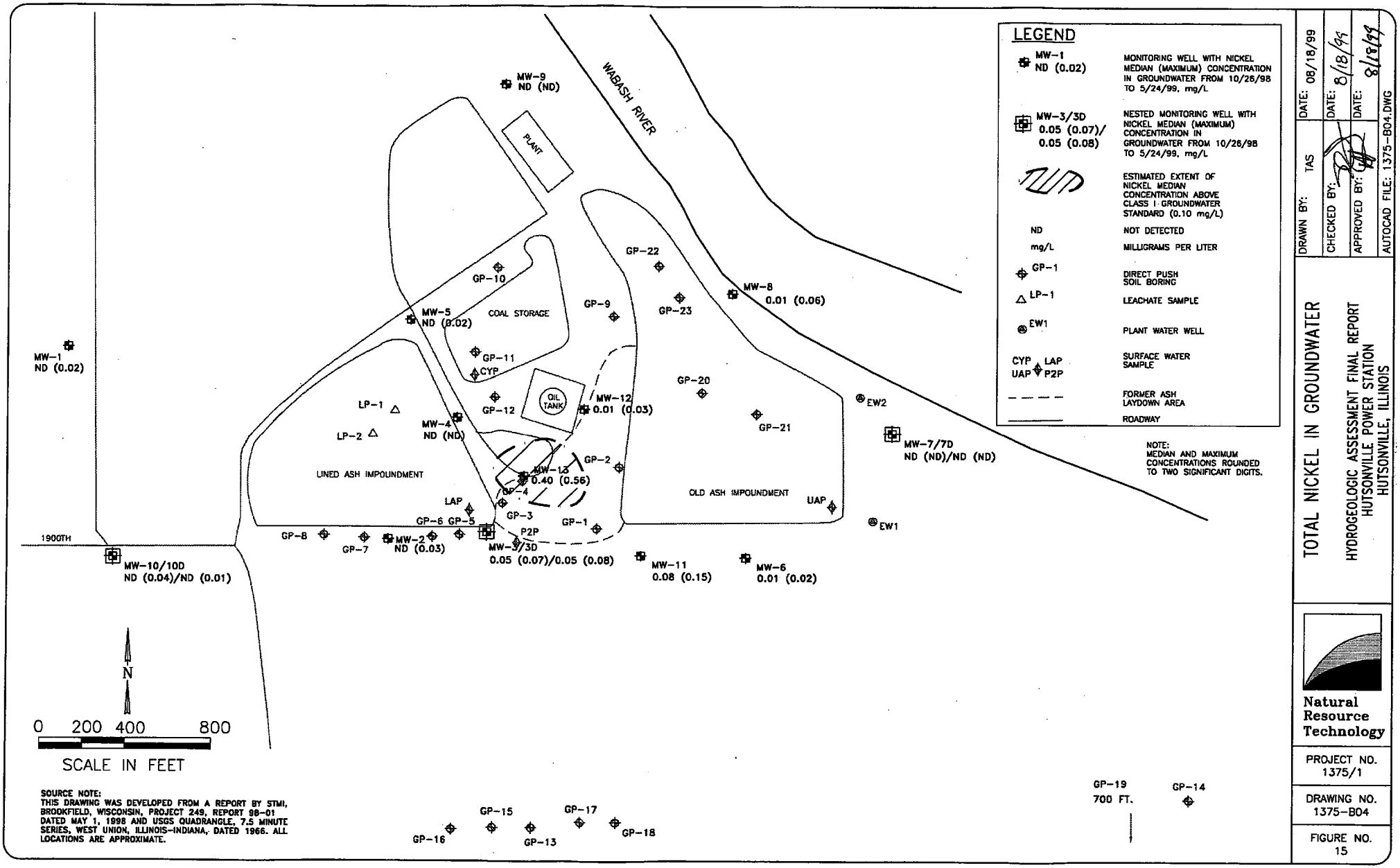
HYDROGEOLOGIC ASSESSMENT FINAL REPORT
HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

Natural Resource Technology

PROJECT NO. 1375/1

DRAWING NO. 1375-B05

FIGURE NO. 14



SOURCE NOTE:
THIS DRAWING WAS DEVELOPED FROM A REPORT BY STMI, BROOKFIELD, WISCONSIN, PROJECT 249, REPORT 98-01 DATED MAY 1, 1998 AND USGS QUADRANGLE, 7.5 MINUTE SERIES, WEST UNION, ILLINOIS-INDIANA, DATED 1966. ALL LOCATIONS ARE APPROXIMATE.

TOTAL NICKEL IN GROUNDWATER

HYDROGEOLOGIC ASSESSMENT FINAL REPORT
HUTSONVILLE POWER STATION
HUTSONVILLE, ILLINOIS

DRAWN BY: TAS DATE: 08/18/99
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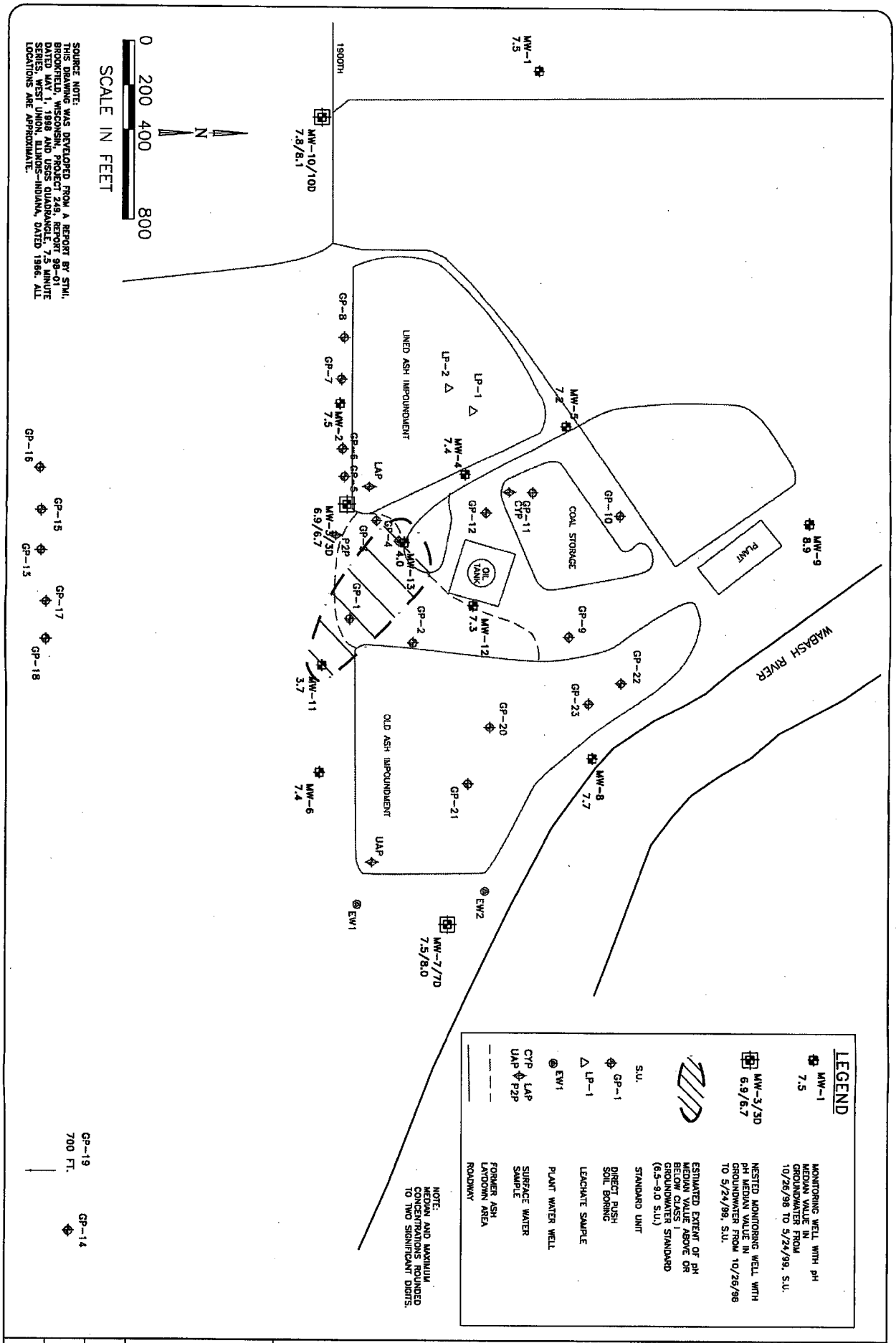
AUTOCAD FILE: 1375-B04.DWG

Natural Resource Technology

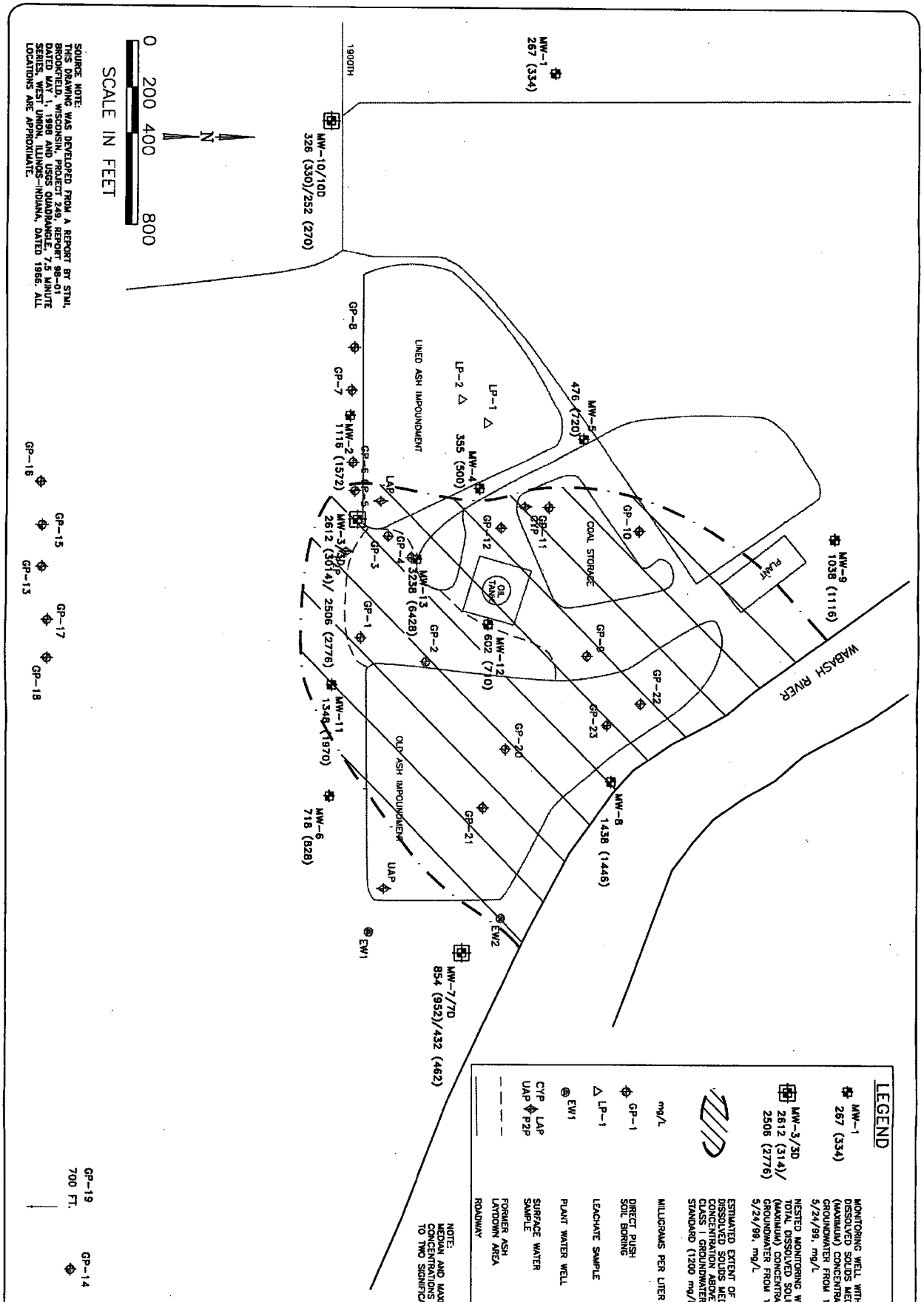
PROJECT NO. 1375/1

DRAWING NO. 1375-B04

FIGURE NO. 15



Natural Resource Technology	FIELD pH IN GROUNDWATER HYDROGEOLOGIC ASSESSMENT FINAL REPORT HUTSONVILLE POWER STATION HUTSONVILLE, ILLINOIS	DRAWN BY: TAS	DATE: 08/18/99
		CHECKED BY:	DATE: 8/18/99
		APPROVED BY:	DATE: 8/18/99
		AUTOCAD FILE: 1375-B06.DWG	
PROJECT NO. 1375/1			
DRAWING NO. 1375-B06			
FIGURE NO. 16			



Natural Resource Technology	TOTAL DISSOLVED SOLIDS IN GROUNDWATER HYDROGEOLOGIC ASSESSMENT FINAL REPORT HUTSONVILLE POWER STATION HUTSONVILLE, ILLINOIS	DRAWN BY: TAS	DATE: 08/18/99
		CHECKED BY:	DATE: 8/18/99
		APPROVED BY:	DATE: 8/18/99
		AUTOCAD FILE: 1375-B08.DWG	
PROJECT NO. 1375/1	DRAWING NO. 1375-B08	FIGURE NO. 17	

TABLES

Table 1
Direct-Push Sampling Data

Location	Northing (ft)	Easting (ft)	Ground Elevation (ft, MSL[2])	Screen[1] Bottom Depth (ft, BGS[2])	Ash Depth (ft, BGS)	Coal Depth (ft, BGS)	Depth to Water (ft, BGS)	Bedrock Surface Depth & Elevation (ft, BGS)	(ft, MSL)
GP-1	3586	4366	460	17 [3]	0 - 2.5	--	14	17.3	442.5
GP-2	3753	4610	457	19	0 - 19	--	9	20.0	437.3
GP-3	3924	4093	459	16	1 - 5.5	7 - 8	11	16.0	443.3
GP-4	3951	4221	459	16	--	--	10	17.0	442.4
GP-5	3918	3859	453	11	--	1.8 - 1.9	6	11.3	441.9
GP-6	3981	3754	453	10	--	2.0 - 2.3	6	10.5	442.5
GP-7	4151	3512	452	10	--	--	4	18.0	434.0
GP-8	4263	3380	451	no water sample	--	trace[5]	4	16.0	435.3
GP-9	4307	4990	453	12	--	trace[5]	7	21.0	432.4
GP-10	4779	4701	454	12	--	0 - 2.5	6	14.3	439.5
GP-11	4534	4399	453	10	--	0 - 1.5	5	13.0	439.5
GP-12	4325	4346	451	9	--	0 - 0.8	4	9.5	441.3
GP-13	2693	3354	447	9	--	--	4	10.0	437.0
GP-14	1105	5752	440	32	--	--	10	>40	<400
GP-15	2790	3213	450	12	--	--	4	18.0	431.8
GP-16	2887	3065	454	12	--	--	4	28.0	425.7
GP-17	2583	3541	446	8	--	--	4	12.0	433.6
GP-18	2488	3677	446	12	--	--	4	23.8	422.2
GP-19	(6)	(6)	~440	no water sample	--	--	10	>32	<410
GP-20	3805	5099	451	21	0 - 19	--	3	21.0	429.7
GP-21	3594	5239	451	22	0 - 23	--	3	36.5	414.2
GP-22	4373	5285	459	11 [3]	0 - 11.5	--	>11.5	11.5	447.2
GP-23	4203	5273	461	22	0 - 31	--	7	34.0	426.7
LP-1 [4]	4405	3961	466	7.3	0 - >7.3	--	1	--	--
LP-2 [4]	4502	3815	466	8	0 - >8	--	1	--	--

1. Four-foot stainless steel screen (for GPs) or polyvinyl chloride (PVC) screen (for LPs).
2. MSL = mean sea level; BGS = below ground surface.
3. Insufficient water sample recovery for laboratory analysis.
4. Temporary 1-inch outside diameter, PVC well point installed in lined ash impoundment.
5. Chips at 3 feet in GP-8 and at 0.5 feet in GP-9.
6. Surveyors could not locate GP-19. It was about 700 feet south of GP-14.

Table 2
Water Sample Parameters and Analytical Methods

Parameter	Method
Alkalinity	EPA 310.1
Boron	ICP – EPA 200.7 Appendix C to Part 136
Calcium	EPA 130.2
Chloride	ICP – EPA 300.0
Iron	ICP – EPA 200.7 Appendix C to Part 136
Magnesium	EPA 130.2
Manganese	ICP – EPA 200.7 Appendix C to Part 136
Nickel	GFAA – EPA 249.2
Potassium	ICP – EPA 200.7 Appendix C to Part 136
Sodium	ICP – EPA 200.7 Appendix C to Part 136
Sulfate	ICP – EPA 300.0 or EPA 375.4
Total Dissolved Solids	EPA 160.1
Field Measurements	
pH	EPA 150.1
Eh	Std. Methods 18th ed.2580
Dissolved Oxygen	Std. Methods 18th ed. 4500-OG
Specific Conductance	EPA 120.1
Temperature	Std. Methods 18th ed. 2550
Groundwater Elevation	Water Level Indicator

Table 3
Monitoring Well Locations, Elevations, Depth to Bedrock, and Screened Formation

Well	Date Drilled	Northing (ft)	Easting (ft)	Surface Elevation (ft, MSL[2])	TOC[1] Elevation (ft, MSL)	Total Well Depth (ft, BGS)	Depth to Bedrock (ft, BGS)	Bedrock Elevation (ft, MSL)	Bedrock Penetration (ft)	Screened Formation[4]
MW-1	2/14/84	5606	2964	456.4	459.12	8.9	6.3	450.1	2.7	sand, ss
MW-2	2/10/84	4087	3594	453.4	456.03	18.1	>21	<431.8	0	s&g
MW-3	2/9/84	3865	3957	453.5	455.16	10.8	10.3	443.2	0.5	s&g
MW-3D	10/6/98	3860	3952	453.7	455.28	25.1	10.5	443.2	15.0	ss
MW-4	2/13/84	4351	4164	454.2	457.07	12.3	10.7	443.5	2.5	s&g, ss
MW-5	2/13/84	4822	4249	452.2	454.89	17.9	17.7	434.5	1.4	s&g, ss
MW-6	2/9/84	3095	4818	439.0	443.66	11.5	8.5	430.5	3.0	s&g, ss
MW-7	2/8/84	3166	5675	438.0	442.70	25.1	>25	<394	0	si s&g
MW-7D	10/5/98	3176	5676	437.5	438.45	44.3	>44	<394	0	si s&g
MW-8	2/7/84	4081	5469	440.4	444.25	22.5	>21.5	<419	0	si sand
MW-9	2/14/84	5408	5205	451.9	454.66	18.4	16.3	435.6	2.4	si s&g, ss
MW-10	10/7/98	4730	2560	452.9	454.23	10.7	7.5	445.4	3.5	si s&g, ss
MW-10D	10/7/98	4729	2565	452.9	454.65	21.3	7.5	445.4	14.0	ss
MW-11	10/6/98	3371	4451	443.8	445.45	14.5	5.5	438.3	9.5	si s&g, ss
MW-12	10/8/98	4054	4638	455.5	456.74	16.9	17.0	438.5	0.0	si s&g
MW-13[4]	10/6/98	3962	4241	456.4	458.03	16.0	14.5	441.9	2.0	si s&g

1. TOC = top of casing
2. BGS = below ground surface; MSL = mean sea level.
3. s&g = sand and gravel, si = silty, ss = sandstone.
4. Total well depth for MW-13 includes a 2-foot sump.

Table 4
Monitoring Well Completion Details

Well	Screen Top Elevation (ft, MSL[1])	Screen Bottom Elevation (ft, MSL)	Screen Length (ft)	Filter Pack Elv.[2] (ft, MSL)	Fine Sand Thickness[3] (ft)	Bentonite Chip Thickness[3] (ft)	Annular Seal Thickness[4] (ft)	Concrete Collar Thickness[5] (ft)	PVC Casing Stickup (ft, AGS[1])	Gallons Water Purged[3,6]	Depth to Water[7] (ft, TOC[1])	Water Level Elevation[7] (ft, MSL)
MW-1	452.5	447.5	5.0	447.4-453.5			1.5	1.5	2.8		7.43	451.69
MW-2	448.3	435.3	13.0	431.8-449.3			2	2	2.6		8.67	447.36
MW-3	447.7	442.7	5.0	442.7-448.1			2	2	1.7		7.64	447.52
MW-3D	433.6	428.6	5.0	428.2-436.7	1	1	14	3	1.6	20	7.91	447.37
MW-4	449.4	441.9	7.5	441.0-450.4			2	2	2.8		9.72	447.35
MW-5	447.3	434.3	13.0	433.1-448.3			2	2	2.7		8.46	446.43
MW-6	433.9	427.5	6.4	427.5-434.9			2	2	4.6		10.83	432.83
MW-7	422.9	412.9	10.0	412.9-423.9			2	2	4.7		10.71	431.99
MW-7D	398.2	393.2	5.0	392.5-402.5	3	0	32	3	0.9	27	10.81	427.64
MW-8	422.9	417.9	5.0	417.9-423.9			2	2	3.8		16.05	428.20
MW-9	443.5	433.5	10.0	433.2-444.0			2	2	2.8		7.59	447.07
MW-10	447.2	442.2	5.0	441.9-448.9	0	1	4	--	1.3	20	3.10	451.13
MW-10D	436.6	431.6	5.0	431.4-438.9	1	1	14	--	1.8	12	3.68	450.97
MW-11	439.3	429.3	10.0	428.8-439.8	0	1	4	--	1.7	22	6.15	439.30
MW-12	448.6	438.6	10.0	438.5-450.5	1	1.5	5	--	1.2	23	9.63	447.11
MW-13	447.4	442.4	5.0	439.9-449.4	1	0.7	7	3	1.7	25	10.23	447.80

1. TOC = top of well casing; MSL = mean sea level; AGS = above ground surface.
2. Filter pack elevation range includes fine sand pack in 1998 wells.
3. Data on fine sand thickness, bentonite chip thickness, and gallons of water purged were only available for wells installed by STMI.
4. Annular seal thickness includes bentonite-cement grout and bentonite pellets/chips.
5. Concrete collar was not installed at shallow 1998 wells in order to maximize annular seal.
6. Volume removed during well development.
7. Depth to groundwater measured on November 12, 1998.

Table 5
Monitoring Well Slug Test Results

Location	Hydraulic Conductivity[1] (ft/min)	Hydraulic Conductivity[1] (cm/s)	Geologic Unit
MW-3	5.2E-02	2.7E-02	Silty Sand & Gravel
MW-3D	1.1E-03	5.4E-04	Sandstone
MW-5	1.6E-02	8.0E-03	Silty Sand & Gravel
MW-6	6.3E-02	3.2E-02	Clayey Gravel, Silty Sand, Sandstone
MW-7	5.1E-04	2.6E-04	Sandy Silt, Sand & Gravel
MW-7D	9.5E-02	4.8E-02	Silty Sand & Gravel
MW-9	1.6E-03	8.3E-04	Silt, Silty Sand, Sandstone
MW-10	1.2E-03	6.2E-04	Silty Sand, Sandstone
MW-10D	7.9E-04	4.0E-04	Sandstone
MW-12	1.2E-01	6.2E-02	Sand
MW-13	3.5E-02	1.8E-02	Clayey Sand & Gravel

1 Bouwer and Rice (1976) analysis method.

Table 6
Leachate and Groundwater Concentration Results from Direct-Push Samples Compared to Ash and Coal Thickness

	Thickness		Concentration						
	ash	coal	Boron	Mn	Iron	Nickel	pH	Sulfate	TDS
Illinois Class I GW Standard	n/a	n/a	2	0.15	5.0	0.10	6.5-9.0	400	1200
Units	ft	ft	mg/L	mg/L	mg/L	mg/L	s.u.	mg/L	mg/L
Ash Leachate									
Lined Ash Impoundment									
LP-1	>7	--	27.9	0.01	<0.02	0.01	10.0	792	1955
LP-2	>8	--	52.9	0.01	<0.02	0.01	9.2	990	2330
LAP	--	--	5.2	0.01	0.80	0.03	8.9	315	594
Former Ash Laydown Area									
GP-2	19	--	15.4	24.5	42.3	0.03	6.8	1326	2220
P2P	--	--	0.3	0.02	0.04	<0.020	6.9	67	148
Unlined Ash Impoundment									
GP-20	19	--	14.9	4.08	<0.02	0.01	7.7	344	1096
GP-21	23	--	13.9	5.40	0.09	0.01	7.3	771	1913
GP-23	31	--	30.2	2.68	0.40	<0.005	7.6	927	2330
UAP	--	--	2.2	0.18	<0.02	0.12	8.0	208	518
Groundwater									
Former Ash Laydown Area									
GP-3	5	1	28.2	2.89	0.34	0.09	5.4	918	1596
GP-4	--	--	21.8	5.80	2.00	0.09	3.7	1531	2190
P2P	--	--	0.3	0.02	0.04	<0.02	6.9	67	148
Lined Ash Impoundment									
GP-5	--	0.1	8.8	11.1	0.05	0.16	6.3	1225	2330
GP-6	--	0.3	4.6	1.02	0.03	0.06	5.5	398	922
GP-7	--	--	0.4	0.17	0.12	0.01	6.4	71	214
Coal Pile Storage Area									
GP-9			0.9	0.24	0.06	0.01	6.8	357	942
GP-10	--	2.5	5.8	26.7	3389	3.24	5.0	7143	8040
GP-11	--	1.5	1.5	3.90	184	0.90	3.5	1276	1707
GP-12	--	0.8	1.2	2.63	11.9	0.78	2.8	867	1667
CYP	--	--	0.9	**0.40**	**139**	**0.36**	**3.2**	**603**	842
Areas South of Plant Site									
GP-13	--	--	0.2	0.01	<0.02	<0.005	7.5	104	716
GP-14	--	--	0.1	0.93	0.13	0.014	8.0	52	900
GP-15	--	--	0.3	0.01	0.03	<0.005	7.6	125	884
GP-16	--	--	0.2	0.01	<0.02	<0.005	7.4	104	957
GP-17	--	--	0.3	0.10	<0.02	<0.005	7.6	83	692
GP-18	--	--	0.3	0.01	<0.02	<0.005	7.4	83	742

Shaded concentrations equal/exceed Class I groundwater standard.

Locations GP-1, GP-8, GP-19, and GP-22 were not sampled.

Pond samples (NAP, P2P, OAP, and CYP), collected 4/29-30/99, are shown for reference.

Pond sample concentrations exceeding Class I groundwater standard are shown in bold.

Mn = manganese

TDS = total dissolved solids

Table 7
Groundwater Concentration Results from Monitoring Wells
Compared to Ash and Coal Thickness

	Thickness		Concentration (Upper 95th Percentile Prediction Limit)						
	ash	coal	Boron	Mn	Iron	Nickel	pH	Sulfate	TDS
IL Class I GW Standard	n/a	n/a	2	0.15	5.0	0.10	6.5-9.0	400	1200
Units	ft	ft	mg/L	mg/L	mg/L	mg/L	s.u.	mg/L	mg/L
Upgradient									
MW-1	--	--	0.2	0.38	0.11	0.02	7.7	124	302
MW-10	--	--	0.1	0.10	0.07	0.03	7.9	32	334
MW-10D	--	--	0.1	0.16	0.15	0.01	8.4	34	262
Former Ash Laydown Area									
MW-3	--	0.4	7.7	2.07	0.03	0.06	7.0	1,628	2,767
MW-3D	--	--	5.0	3.88	<0.02	0.07	6.9	1,801	2,706
MW-11	--	trace	7.2	13.10	3.07	0.13	3.9	1,107	1,706
MW-12	2	--	0.8	0.30	0.03	0.02	7.9	218	673
MW-13	--	--	22.0	14.02	1.01	0.55	4.3	3,457	5,404
P2P	--	--	0.3	0.02	0.04	<0.02	6.9	67	148
Lined Ash Impoundment									
MW-2	--	--	8.4	0.13	0.02	0.02	7.6	639	1,359
MW-4	--	--	0.2	<0.005	<0.02	0.02	7.7	94	426
MW-5	--	0.1	1.2	0.01	<0.02	0.02	7.6	266	622
LAP	--	--	**5.2**	0.01	0.80	0.03	8.9	315	594
Unlined Ash Impoundment									
MW-6	--	--	15.5	2.91	0.04	0.02	7.5	318	781
MW-7	--	--	3.1	0.29	<0.02	0.01	7.9	311	913
MW-7D	--	--	0.1	2.19	0.16	0.01	8.3	72	472
MW-8	--	--	11.9	5.14	0.29	0.06	7.9	691	1,466
MW-9	2.2	0.8	1.0	0.33	0.02	0.01	8.0	756	1,125
UAP	--	--	**2.2**	**0.18**	<0.02	**0.12**	8.0	208	518

Shaded concentrations equal/exceed Class I groundwater standard.
Statistical Interval - 10/26/98 through 5/24/99
Pond samples (P2P, NAP, and OAP), collected 4/29-30/99, are shown for reference.
Pond sample concentrations exceeding Class I groundwater standard are shown in bold.
Mn = manganese
TDS = total dissolved solids

Table 8
Source Area Analysis

Well	Coal Thickness (ft)	Potential Sources: Coal Pile	Coal Spill	Ash Lay-Down Area	Unlined Impoundment	Lined Impoundment	Pipe Leak	Not impacted
Upgradient								
MW-1	--							■
MW-10	--							■
MW-10D	--							■
Former Ash Laydown Area								
MW-3	0.4			■			■	
MW-3D	--			■			■	
MW-11	trace		■	■				
MW-12	--							■
MW-13	--		■	■				
Lined Ash Impoundment								
MW-2	--						■	
MW-4	--							■
MW-5	0.1							■
Unlined Ash Impoundment								
MW-6	--				■			
MW-7	--				■			
MW-7D	--							■
MW-8	--				■			
MW-9	0.8		■					

APPENDIX A

BORING/MONITORING WELL CONSTRUCTION LOGS

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-1	8/25/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/25/98	16.8 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
17.3 Feet	2.2 Inches	459.8 Feet	Geoprobe	3585.650

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	4366.050

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100		Coal Ash	ASH, silty texture, trace coal fragments, dark gray, moist (Fill)		Geoprobe boring, no well installed
	na	5	100		SP	SAND, well sorted/rounded, medium-grained, quartz, trace silt, trace coarse subangular sand of non-quartz lithology, light brown, moist (Fill)		
	na	10	100		CL	SILTY CLAY, roots in top 1 foot, trace to little coarse sand to fine subangular gravel, olive gray to brown, moist		
	na		75		SM	SILTY SAND, fine- to medium-grained, trace fine gravel, dark gray, moist		
		15			SC	CLAYEY SAND, fine- to medium-grained, trace fine gravel, light gray, saturated		
	na		100					insufficient water, no sample collected
						END OF BORING - 17.3 feet (bedrock)		
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-2	8/25/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/25/98	9 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
20.0 Feet	2.2 Inches	457.3 Feet	Geoprobe	3753.193
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	4610.447

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		87.5		Coal Ash	ASH, silty texture, trace cinder gravel, olive to dark gray, moist (Fill)		Geoprobe boring, no well installed
		5			SP	SAND, well sorted/rounded, medium-grained, quartz, light brown, moist, with little gravel, mottled olive gray & light brown below 3.5 ft. (Fill)		
	na		100			ASH, silty texture, trace coal fragments and cinder gravel, coarsens below 12 ft., saturated below 9 ft. (Fill)		
	na	10	100		Coal Ash			
	na		100					
		15			Coal Ash	ASH & SAND, coarse sand-size ash granules, coarse-grained quartz sand, trace cinder pebbles (1/2-1"), black, saturated (Fill)		
	na		100		SW-GW	CLAYEY SAND & GRAVEL, poorly sorted/subrounded, fine- to coarse-grained sand, fine-grained gravel, yellow orange, moist		Groundwater sample collected from 15-19 ft. bgs.
		20				END OF BORING - 20.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-3	8/25/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/25/98	11 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
16.0 Feet	2.2 Inches	459.3 Feet	Geoprobe	3924.268

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	4092.856

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
					SM	SILTY SAND, fine-grained, yellow orange, damp (Fill)		
	na		100		Coal Ash	ASH, silty texture, olive gray, wet below 3 ft. (Fill)		Geoprobe boring, no well installed
	na	5	100		SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, light brown, moist (Fill)		
					Coal	COAL, sand/gravel size, black, damp (Fill)		
	na	10	100		SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, light brown, saturated below 11 ft.		
	na	15	100		SW-GW	SAND & GRAVEL, poorly sorted, fine- to medium-grained, quartz sand, fine-grained subangular gravel, light brown, saturated		Groundwater sample collected from 12-16 ft. bgs.
		20				END OF BORING - 16.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-4	8/25/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/25/98	10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
17.0 Feet	2.2 Inches	459.4 Feet	Geoprobe	3950.707
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	4220.706

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		68.8		SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, little ash cinder gravel 0-1 ft, light brown, moist (Fill)		Geoprobe boring, no well installed
	na	5	81.2			SAND, well sorted/rounded, fine- to medium-grained, quartz, dark brown 5.5-7 ft (old ground surface), light brown below, saturated below 10 ft.		
	na	10	87.5		SP			
	na		56.2					Groundwater sample collected from 12-16 ft. bgs.
	na	15	100		SW-GW	CLAYEY SAND & GRAVEL, poorly sorted, fine- to coarse-grained sand, fine-grained subanguler gravel, light brown, saturated		
		20				END OF BORING - 17.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-5	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	6 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
11.25 Feet	2.2 Inches	453.2 Feet	Geoprobe	3917.782

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3858.831

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100		SM	SILTY SAND, silty topsoil with grass 0-1/2 ft, piece of concrete, 1-in coal-rich layer at 1.75 ft, brown, moist (Fill)		Geoprobe boring, no well installed
	na	5	100		SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, trace to little coarse subangular to subround sand, light brown, saturated below 6 ft.		
	na	10	100		SW-GW	SILTY SAND & GRAVEL, poorly sorted, medium- to coarse-grained subrounded sand, fine-grained subanguler to subround gravel, light gray, saturated		Groundwater sample collected from 7-11 ft. bgs.
		15				END OF BORING - 11.25 feet (Bedrock)		
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-6	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	6 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
10.5 Feet	2.2 Inches	453.0 Feet	Geoprobe	3981.359

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3754.280

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		62.5		SM	SILTY SAND, fine- to medium-grained, silty topsoil with grass 0-1/2 ft, little gravel, little coal fragments 2-2.25 ft, glass fragements, dark brown, moist (Fill)		Geoprobe boring, no well installed
					SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, light brown, moist		
	na	5	100		SW	SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, light brown, saturated below 6 ft.		
	na	10	100			END OF BORING - 10.5 feet (Bedrock)		Groundwater sample collected from 6-10 ft. bgs.
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-7	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
18.0 Feet	2.2 Inches	452.0 Feet	Geoprobe	4151.460

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3511.572

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	0	75		SM	SILTY SAND, fine- to medium-grained, silty topsoil with grass 0-1/2 ft, little gravel, dark brown, moist (Fill)		Geoprobe boring, no well installed
					SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, light brown, moist		
	na	5	50			SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, light brown, saturated below 4 ft.		
	na	10	100		SW			Groundwater sample collected from 6-10 ft. bgs.
	na	15	100					
	na		100		ML	CLAYEY SILT, very stiff to hard, nonplastic, trace angular to subangular coarse sand to fine gravel, olive gray, moist		
		20				SANDSTONE, fine-grained, quartz, friable, light green		
						END OF BORING - 18.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-8	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	Est. 4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
16.0 Feet	2.2 Inches	451.3 Feet	Geoprobe	4262.600
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	2-ft split-spoon	3380.239

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100		SM	SILTY SAND, fine- to medium-grained, silty topsoil with grass 0-3/4 ft, little gravel, dark brown, moist (Fill)		Geoprobe boring, no well installed
					ML	CLAYEY SILT, plant stem fragments and trace coal particles at top, black, moist (topsoil)		
	na	5	100		CL	SILTY CLAY, stiff, medium plasticity, fine vertical roots, little to some medium to coarse sand, trace subangular fine gravel, mottled light brown & gray, moist, estimated water level at 4 ft.		
	na	10	100		SW	SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, light brown, saturated		No groundwater sample collected; geology boring only
	na	15	100		CL	SILTY CLAY, stiff, medium plasticity, sandstone pebble, light to greenish gray, moist		
		20				END OF BORING - 16.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-9	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	7 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
21.0 Feet	2.2 Inches	453.4 Feet	Geoprobe	4306.991
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	4990.027

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
					ML	SILT, vegetated with grass, brown, dry (Topsoil)		
	na		50		SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, trace coal fragments at top, trace coarse sand, light brown, moist		Geoprobe boring, no well installed
	na	5	56.2					
	na	10	100			SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, pale brown, saturated		Groundwater sample collected from 8-12 ft. bgs.
	na	15	100		SW			
	na		100					
	na	20	100					
						END OF BORING - 21.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-10	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	6 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
14.25 Feet	2.2 Inches	453.8 Feet	Geoprobe	4778.861

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	4700.947

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100		Coal	COAL, sand/gravel size, black, damp (Fill)		Geoprobe boring, no well installed
	na	5	75		SP	SAND, well sorted/rounded, fine-grained, quartz, some silt 2.5-3.5 ft, light brown, saturated below 6 ft.		
	na	10	50		SW	SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, grade to well sorted medium to coarse sand below 13 ft, light brown, saturated		Groundwater sample collected from 8-12 ft. bgs.
	na		100			END OF BORING - 14.25 feet (Bedrock)		
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-11	8/26/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/26/98	5 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
13.0 Feet	2.2 Inches	452.5 Feet	Geoprobe	4534.018

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	4398.796

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
					Coal	COAL, sand/gravel size, black, damp (Fill)		
	na		87.5		SM	SILTY SAND, fine- to medium-grained, quartz, trace coarse-grained, light brown, moist (Fill)		Geoprobe boring, no well installed
		5			SP	SAND, well sorted/rounded, fine- to medium-grained, quartz, light brown, saturated below 5 ft.		
	na		68.8		SW	SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, light brown, saturated		
	na	10	100					Groundwater sample collected from 6-10 ft. bgs.
	na		100			END OF BORING - 13.0 feet (Bedrock)		
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-12	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
9.5 Feet	2.2 Inches	450.8 Feet	Geoprobe	4324.544

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	4346.394

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		62.5		Coal	COAL, silty texture, soft, black, wet (coal pile runoff sediment)		
						SAND, well sorted/rounded, quartz, fine- to medium-grained grading to coarse-grained below 8 ft, light brown, saturated and pale brown below 4 ft.		Geoprobe boring, no well installed
		5			SP			
	na		50					Groundwater sample collected from 5-9 ft. bgs.
	na		100					
		10				END OF BORING - 9.5 feet (Bedrock)		
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-13	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
10.0 Feet	2.2 Inches	447.0 Feet	Geoprobe	2693.143
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	3353.985

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		50		ML	SILT, sandy, clayey, trace to little gravel, vegetated with farm crops, brown, moist (Topsoil)		Geoprobe boring, no well installed
	na	5	62.5		SP	SAND, poorly sorted, fine- to coarse-grained, subanguler to subround, trace to little gravel, light brown, saturated		
	na		100		ML	CLAYEY SILT, very stiff to hard, nonplastic, trace root/stem fragments, trace angular to subangular coarse sand to fine gravel, greenish to olive gray, moist		Groundwater sample collected from 5-9 ft. bgs.
		10				END OF BORING - 10.0 feet (Bedrock)		
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-14	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
40.0 Feet	2.2 Inches	439.9 Feet	Geoprobe	1104.830

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	5752.447

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		87.5			CLAYEY SILT, increasing clay content with depth from trace near surface, medium plasticity, stiff above 10 ft to soft below, brown, saturated below ~10 ft		Geoprobe boring, no well installed
	na	5	87.5					
	na	10	100		ML			
	na		100					
	na	15	100					
		20				Drove sampler point to 40 ft. Noted increased resistance to penetration at ~25 ft and ~30 ft, but no soil recovery using 2-ft discrete sampler at 26-28 ft.		
		25						
	na		0					Partial groundwater sample (~50% volume) collected from 28-32 ft. bgs.
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-14	8/27/98	2

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
40.0 Feet	2.2 Inches	439.9 Feet	Geoprobe	1104.830

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	5752.447

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
		40				END OF BORING - 40.0 feet		
		45						
		50						
		55						
		60						
		65						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-15	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
18.0 Feet	2.2 Inches	449.8 Feet	Geoprobe	2790.223

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3212.610

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5, 10, 15, 20, 25, 30	ns		ML/SM	TOPSOIL/SAND/SILT materials similar to GP-13.		Geoprobe boring, no well installed. Groundwater sample collected from 8-12 ft. bgs.
					ML/CL	CLAY/SILT materials similar to GP-13, based on increased resistance to penetration.		
						END OF BORING - 18.0 feet (Bedrock)		

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-16	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
28.0 Feet	2.2 Inches	453.7 Feet	Geoprobe	2886.789

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3064.602

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5, 10, 15, 20, 25, 30	ns		ML/SM	TOPSOIL/SAND/SILT materials similar to GP-13.		Geoprobe boring, no well installed. Groundwater sample collected from 8-12 ft. bgs.
					ML/CL	CLAY/SILT materials similar to GP-13, based on increased resistance to penetration.		
						END OF BORING - 28.0 feet (Bedrock)		

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-17	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
12.0 Feet	2.2 Inches	445.6 Feet	Geoprobe	2582.997

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3541.335

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5	ns		ML/ SM	TOPSOIL/SAND/SILT materials similar to GP-13.		Geoprobe boring, no well installed. Groundwater sample collected from 4-8 ft. bgs.
		10			ML/ CL	CLAY/SILT materials similar to GP-13, based on increased resistance to penetration.		
		15				END OF BORING - 12.0 feet (Bedrock)		
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-18	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 4 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
23.75 Feet	2.2 Inches	446.0 Feet	Geoprobe	2488.262

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	3677.480

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5, 10, 15, 20, 25, 30	ns		ML/SM	TOPSOIL/SAND/SILT materials similar to GP-13.		Geoprobe boring, no well installed. Groundwater sample collected from 8-12 ft. bgs.
					ML/CL	CLAY/SILT material similar to GP-13, based on increased resistance to penetration.		
						END OF BORING - 23.75 feet (Bedrock)		

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-19	8/27/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/27/98	Est. 10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
40.0 Feet	2.2 Inches	Feet	Geoprobe	

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	not sampled	

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5, 10, 15, 20, 25, 30	ns		ML/ CL	CLAY/SILT materials similar to GP-14. Increased resistance to penetration at ~18 ft. Attempted groundwater sample collection at 20-24 ft and 28-32 ft., but no yield. END OF BORING - 32.0 feet		Geoprobe boring, no well installed. No groundwater samples; insuffient yield.

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-20	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/28/98	3 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
21.0 Feet	2.2 Inches	450.7 Feet	Geoprobe	3805.064
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	5099.419

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100			ASH, silty texture, soft, dark gray, ~3/4-ft layer of cinder gravel at 9 ft, saturated below 3 ft (Fill)		Geoprobe boring, no well installed
	na	5	100					
	na	10	100		Coal Ash			
	na		50					
	na	15	100					Groundwater sample collected from 17-21 ft. bgs.
	na	20	100		CL	SILTY CLAY, trace coarse sand, trace fine subanular to subround gravel, stiff, medium plasticity, mottled yellow orange & light gray, moist END OF BORING - 21.0 feet (Bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-21	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/28/98	3 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
36.5 Feet	2.2 Inches	450.7 Feet	Geoprobe	3593.599
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	5239.017

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		100			ASH, silty texture, soft, dark gray,saturated below 3 ft (Fill)		Geoprobe boring, no well installed
	na	5	50					
	na	10	0		Coal Ash			
	na		0					
	na	15	0					Groundwater sample collected from 18-22 ft. bgs.
	na	20	50					
	na	25	50		CL	SILTY CLAY, stiff, medium plasticity, brown, moist		
		30			CL	SILTY CLAY (estimated based on resistance to penetration) END OF BORING - 36.5 feet (Bedrock)		

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-22	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/28/98	>11.5 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
11.5 Feet	2.2 Inches	458.7 Feet	Geoprobe	4373.353

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	4-ft Macro-Core	5285.420

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na		81.2		ML	SANDY SILT, fine sand, vegetated with grass, brown, moist (Topsoil)		Geoprobe boring, no well installed
	na	5	100		Coal Ash	ASH, silty to very fine-grained texture, trace fine cinder gravel, coarsens below 8 ft, dark gray, moist with wet interval 6-7 ft (Fill)		
	na	10	100		Coal Ash	ASH, coarse sand to fine gravel size, some silt, several 1/4-5/8" pyrite pebbles		No groundwater sample collected; no water in sampler.
		15				END OF BORING - 11.5 feet (Bedrock)		
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	GP-23	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	8/28/98	7 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
34.0 Feet	2.2 Inches	460.7 Feet	Geoprobe	4203.035
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	4-ft Macro-Core	5272.661

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
					SM	SILTY SAND, fine-grained, quartz, trace to little clay, fine sand, vegetated with grass, yellow orange, moist (Fill)		
	na		93.8			ASH, silty to very fine-grained texture, trace cinder gravel up to 1/2", coarsens below 13.5 ft, dark gray, wet below 7 ft (Fill)		Geoprobe boring, no well installed
		5						
	na		100		Coal Ash			
	na	10	100					
	na		100			ASH, coarse sand to fine gravel size, some silt		
		15			Coal Ash			
	na		100					Groundwater sample collected from 18-22 ft. bgs.
		20			CL	SILTY CLAY, stiff, medium plasticity, dark olive green, moist		
	na		100			ASH (same as 13.5-19.8 ft). Increased resistance to penetration at 31 ft.		
		25			Coal Ash			Jammed liner in Macro-Core sampler; used 1-in I.D. by 2-ft, piston-tip discrete sampler to collect soil sample near bedrock surface.
		30						
	na		100		SP	SILTY SAND, well sorted/rounded, fine-grained, quartz, yellow orange to light brown, saturated. Top 2-3" were light olive green, indicating proximity of ash bottom.		
						END OF BORING - 34.0 feet (Bedrock)		

Project Name/No.	Boring No:	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	LP-1	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
STMI	Steve Mueller/STMI	8/28/98	0.25 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
7.3 Feet	2.37 Inches	465.9 Feet	Hand-driven	4405.098

Well Depth	Well Diameter	TOC Elev.	Sample Method	Easting
na	na	na	not sampled	3961.179

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5	na		Coal Ash	ASH, silty to very fine-grained texture, wet below 0.25 ft (Fill)		Temporary well-point with filter sock installed, leachate sample collected from 3.3-7.3 ft.
		10				END OF BORING - 7.3 feet		
		15						
		20						Removed well point 8/28/98
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville Plant 249.03	LP-2	8/28/98	1

Driller	Logged by:	End Date	Depth to Water
STMI	Steve Mueller/STMI	8/28/98	0.25 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
8.0 Feet	2.37 Inches	466.24 Feet	Hand-driven	4502.022
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
na	na	na	not sampled	3815.305

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	na	5	na		Coal Ash	ASH, silty to very fine-grained texture, wet below 0.25 ft (Fill)		Temporary well-point with filter sock installed, leachate sample collected from 4.0-8.0 ft.
		10				END OF BORING - 8.0 feet		
		15						
		20						Removed well point 8/28/98.
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-3D	10/6/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/6/98	~6 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
25.5 Feet	8* Inches	453.7 Feet	HSA/air-rotary	3860.230
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
25.1 Feet	2-in I.D.	455.28 Feet	2-ft. split-spoon	3952.034

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	1, 2, 3, 6		75		ML	SANDY SILT, little fine-grained gravel, trace coal fragments, medium stiff, dark brown, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~1.8 ft; concrete seal 0-3 ft.
	4, 4, 6, 4		88		SP	SAND, well sorted/rounded, fine-grained, quartz, loose, light brown, to medium brown, saturated below 6 ft		
	1, 2, 3, 5	5	75					
	2, 2, 2, 10		63		SW-GW	SILTY SAND & GRAVEL, poorly sorted, medium-grained sand, fine-grained subangular to subround gravel, loose, light gray, saturated		Bentonite/cement grout 3-16 ft; 1/4-in bentonite chips 16-17 ft.
	2, 2, 3, 5		50					
		10			Ss	SANDSTONE, fine-grained, quartz		Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 20.1-25.1 ft; #7 fine silica sand 17-18 ft; #5 silica sand pack 18-25.5 ft.
		15						
		20						
		25				END OF BORING - 25.5 feet		* 4-in diam. borehole drilled 16-25.5 ft using air-hammer.
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-7D	10/5/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/5/98	~10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
45.0 Feet	8 Inches	437.5 Feet	HSA	3175.915
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
44.3 Feet	2-in I.D.	438.45 Feet	2-ft. split-spoon	5676.110

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
						CLAYEY SILT, medium plasticity, trace roots fibers, soft, medium brown, moist, saturated below 10 ft.		
	1, 1, 2, 3	5	75					5-ft by 4-in square steel stick-up casing to ~1.3 ft; concrete seal 0-3 ft.
	1, 1, 1, 2	10	100		ML			
	1, 1, 2, 3	15	100					
	0, 0, 1, 2	20	100					
					SP	SILTY SAND, well sorted/rounded, fine-grained, quartz, grades from clayey silt above, loose, medium brown, saturated		
	3, 3, 4, 9	25	75					Bentonite/cement grout 3-35 ft.
						SILTY SAND & GRAVEL, well sorted medium-grained quartz sand, trace coarse sand, fine-grained angular to subangular gravel, medium dense, pale brown, saturated		
	5, 8, 6, 8	30	75					
					SP-GP			

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-7D	10/5/98	2

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/5/98	~10 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
45.0 Feet	8 Inches	437.5 Feet	HSA	3175.915
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
44.3 Feet	2-in I.D.	438.45 Feet	2-ft. split-spoon	5676.110

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	sand heave		0					Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 39.3-44.3 ft; #7 fine silica sand 35-38 ft; #5 silica sand pack 38-45 ft.
	sand heave	40	0					
	16, 25, 7, 11	45	75		ML	CLAYEY SILT, medium plasticity, trace sand, stiff, brown, moist END OF BORING - 45 feet		
		50						
		55						
		60						
		65						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-10	10/7/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/7/98	~2.5 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
11 Feet	8 Inches	452.9 Feet	HSA	4730.478
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
10.7 Feet	2-in I.D.	454.23 Feet	2-ft. split-spoon	2559.807

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	1, 2, 2, 2		50		ML	CLAYEY SILT, vegetated with grass, soft, dark brown to black, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~1.5 ft.
	1, 2, 2, 6		50		SP	SILTY SAND, well sorted/rounded, fine-grained, quartz, loose, yellowish orange with dark orange lamina (2-3 mm), saturated below ~2.5 ft		
	1, 2, 6, 25	5	100					Bentonite/cement grout 0-3 ft; 1/4-in bentonite chips 3-4 ft.
	5, 20, 25, 50		63		SP	SILTY SAND, well sorted/rounded, fine-grained, quartz, laminated, dense, light gray to rust colored, predominantly light gray below 7.5 ft, saturated (weathered bedrock)		
		10			Ss	SANDSTONE, fine-grained, quartz		Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 5.7-10.7 ft; #5 silica sand pack 4-11 ft.
						END OF BORING - 11 feet		
		15						
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-10D	10/7/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/7/98	~2.5 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
21.5 Feet	8 Inches	452.9 Feet	HSA	4729.427
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
21.3 Feet	2-in I.D.	454.65 Feet	see MW-10 log	2564.715

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
					ML	CLAYEY SILT*, vegetated with grass, soft, dark brown to black, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~2.0 ft.
			see MW-10		SP	SILTY SAND*, well sorted/rounded, fine-grained, quartz, loose, yellowish orange with dark orange lamina (2-3 mm), saturated below ~2.5 ft		Bentonite/cement grout 0-13 ft; 1/4-in bentonite chips 13-14 ft.
		5			SP	SILTY SAND*, well sorted/rounded, fine-grained, quartz, laminated, dense, light gray to rust colored, predominantly light gray below 7.5 ft, saturated (weathered bedrock)		
		10				SANDSTONE, fine-grained, quartz, becomes medium-grained, trace gravel clasts, increasingly well cemented/hard (very difficult to auger) below 20 ft.		Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 16.3-21.3 ft; #7 silica sand 14-15 ft; #5 silica sand pack 15-21.5 ft.
		15	drill cuts		Ss			
	50 (1")	20	1"			END OF BORING - 21.5 feet		* based on MW-10 boring log
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-11	10/6/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/7/98	~6 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
15.0 Feet	8 Inches	443.8 Feet	HSA	3371.329
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
14.5 Feet	2-in I.D.	445.45 Feet	2-ft. split-spoon	4451.486

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	1, 2, 3, 4		63		ML	SANDY SILT, little fine-grained gravel, trace coal fragments, medium stiff, medium brown, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~2.0 ft.
	1, 2, 6, 8		63		SM	SILTY SAND, medium- to coarse-grained, quartz, loose, light brown, moist		
	3, 5, 25, 50	5	75		SW-GW	SILTY SAND & GRAVEL, poorly sorted, dense, light brown, saturated		Bentonite/cement grout 0-3 ft; 1/4-in bentonite chips 3-4 ft.
						SANDSTONE		
		10			Ss			Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 4.5-14.5 ft; #5 silica sand pack 4-15 ft.
		15				END OF BORING - 15 feet		
		20						
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-12	10/8/98	1

Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/8/98	~12 Feet

Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
17 Feet	8 Inches	455.5 Feet	HSA	4053.583
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
16.9 Feet	2-in I.D.	456.74 Feet	2-ft. split-spoon	4637.976

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	1, 1, 1, 1		63		ML	SANDY SILT, little clay, soft, dark brown, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~1.5 ft.
					Coal Ash	ASH, silty texture, soft, olive gray, moist		
	2, 3, 10, 8		100		GM	SILTY SAND & GRAVEL, poorly sorted, medium dense, light brown, moist (fill)		
	1, 1, 2, 3	5	63		SP	SAND, well sorted/rounded, fine-grained, quartz, loose, light brown, moist		
	2, 2, 4, 3		75					
	1, 2, 3, 2		50			SAND, poorly sorted, fine- to coarse-grained, subangular to subround, quartz, trace fine gravel, loose, light brown, saturated below ~12 ft		Bentonite/cement grout 0-3.5 ft; 1/4-in bentonite chips 3.5-5 ft.
	1, 1, 1, 2	10	75		SW			
	1, 2, 2, 3		75					Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 6.9-16.9 ft; #7 fine silica sand 5-6 ft; #5 silica sand pack 6-17 ft.
	2, 3, 3, 4	15	100					
	10, 10, 35, 50		50		ML	SILT, stiff, light brown, moist		
		20				END OF BORING - 17 feet (bedrock)		
		25						
		30						

Project Name/No.	Boring No.	Start Date	Page
AmerenCIPS - Hutsonville 249-3	MW-13	10/6/98	1

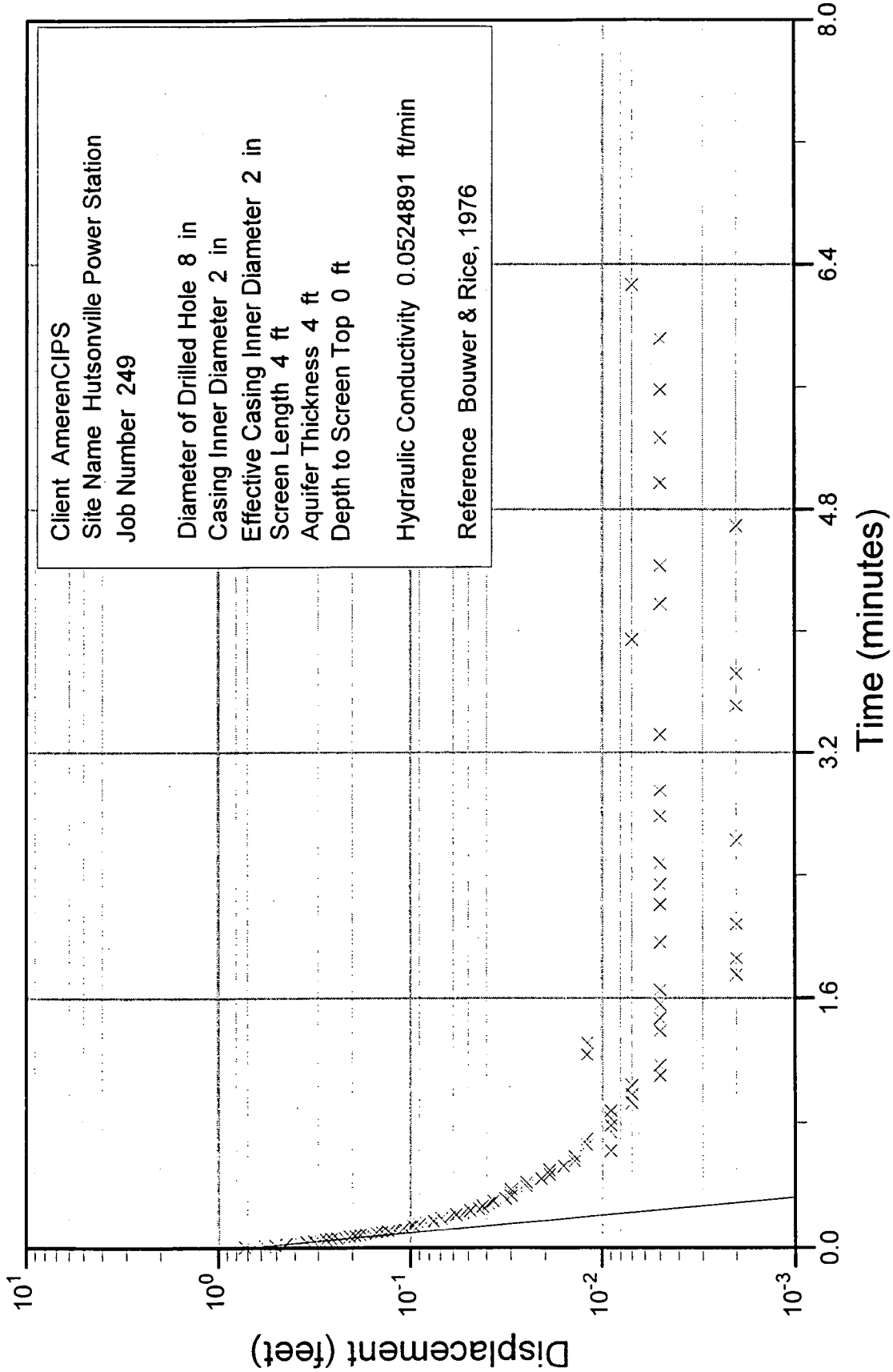
Driller	Logged by:	End Date	Depth to Water
AEC, Indianapolis, IN	Steve Mueller/STMI	10/6/98	~7 Feet

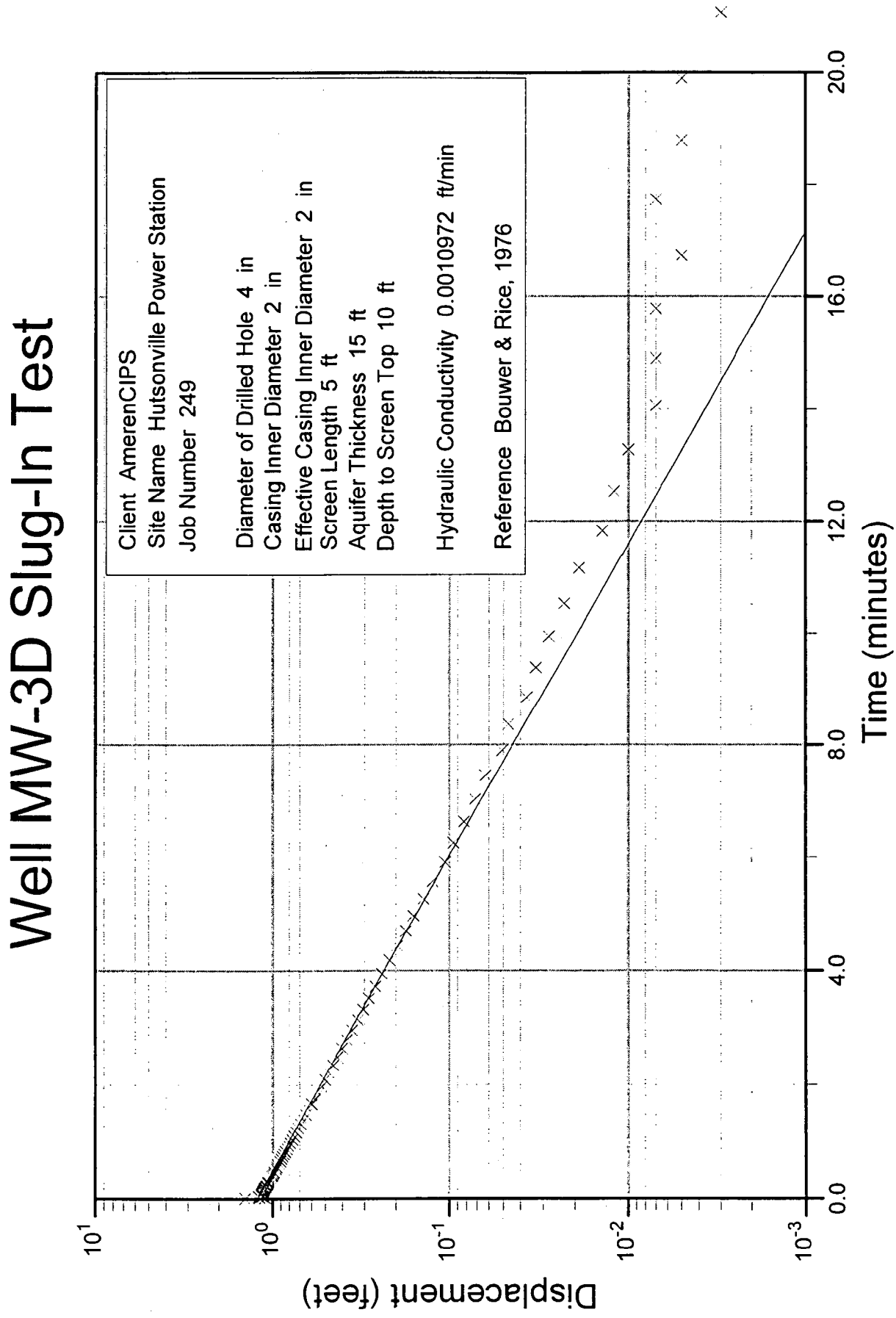
Boring Depth	Boring Diameter	Surface Elevation	Drill Method	Northing
16.5 Feet	8 Inches	456.4 Feet	HSA	3961.759
Well Depth	**Well Diameter**	**TOC Elev.**	**Sample Method**	**Easting**
16.0 Feet	2-in I.D.	458.03 Feet	2-ft. split-spoon	4241.200

Sample	Blows/6 inches	Sample Depth (ft)	Recovery (%)	Graphic Log	Classification	Description	Well Completion	Comments
	1, 2, 3, 5		25		SM	SILTY SAND, with gravel, loose, dark brown, moist (topsoil)		5-ft by 4-in square steel stick-up casing to ~2.0 ft; concrete 0-3 ft.
		5			SP	SAND*, well sorted/rounded, fine- to medium-grained, quartz, light brown, saturated below ~9 ft. * based on drill cuttings and geologic log for geoprobe GP-4		Bentonite/cement grout 3-6.3 ft; 1/4-in bentonite chips 6.3-7 ft.
	1, 2, 2, 2	10	50		SW-GW	CLAYEY SAND & GRAVEL, poorly sorted, fine- to coarse-grained sand, fine-grained subangular gravel, loose, light brown, saturated		Sch. 40 PVC casing flush-threaded to 0.01-in factory-slotted PVC screen 9-14 ft; #7 fine silica sand 7-8 ft; #5 silica sand pack 8-16.5 ft.
		15			Ss	SANDSTONE		
						END OF BORING - 16.5 feet		
		20						
		25						Unslotted casing/sediment sump 14-16 ft.
		30						

APPENDIX B

SLUG-TEST DATA


Well MW-3 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 4 ft
Aquifer Thickness 4 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0524891 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)


Well MW-3D Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 4 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 15 ft
Depth to Screen Top 10 ft
Hydraulic Conductivity 0.0010972 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
Time (minutes)
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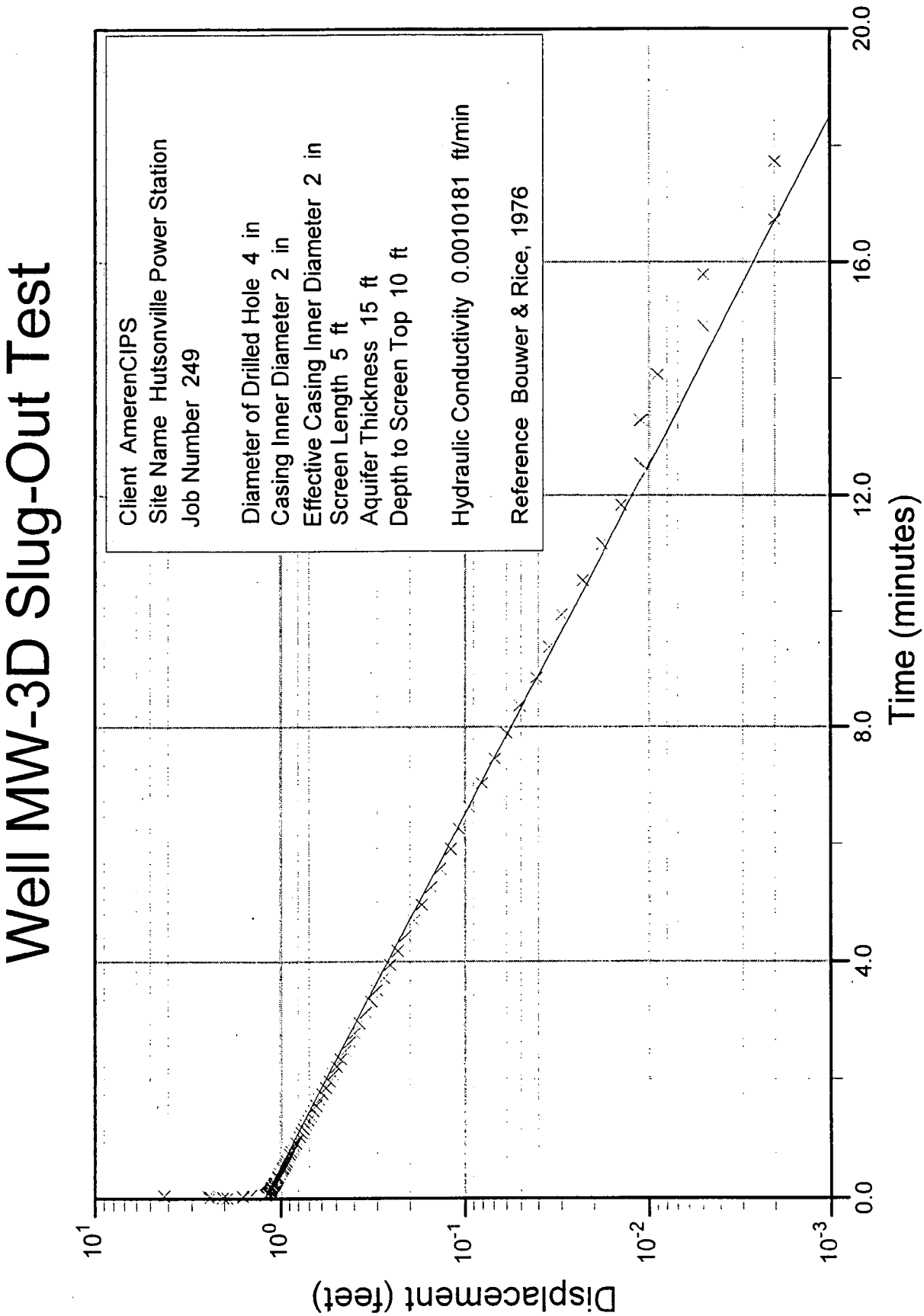
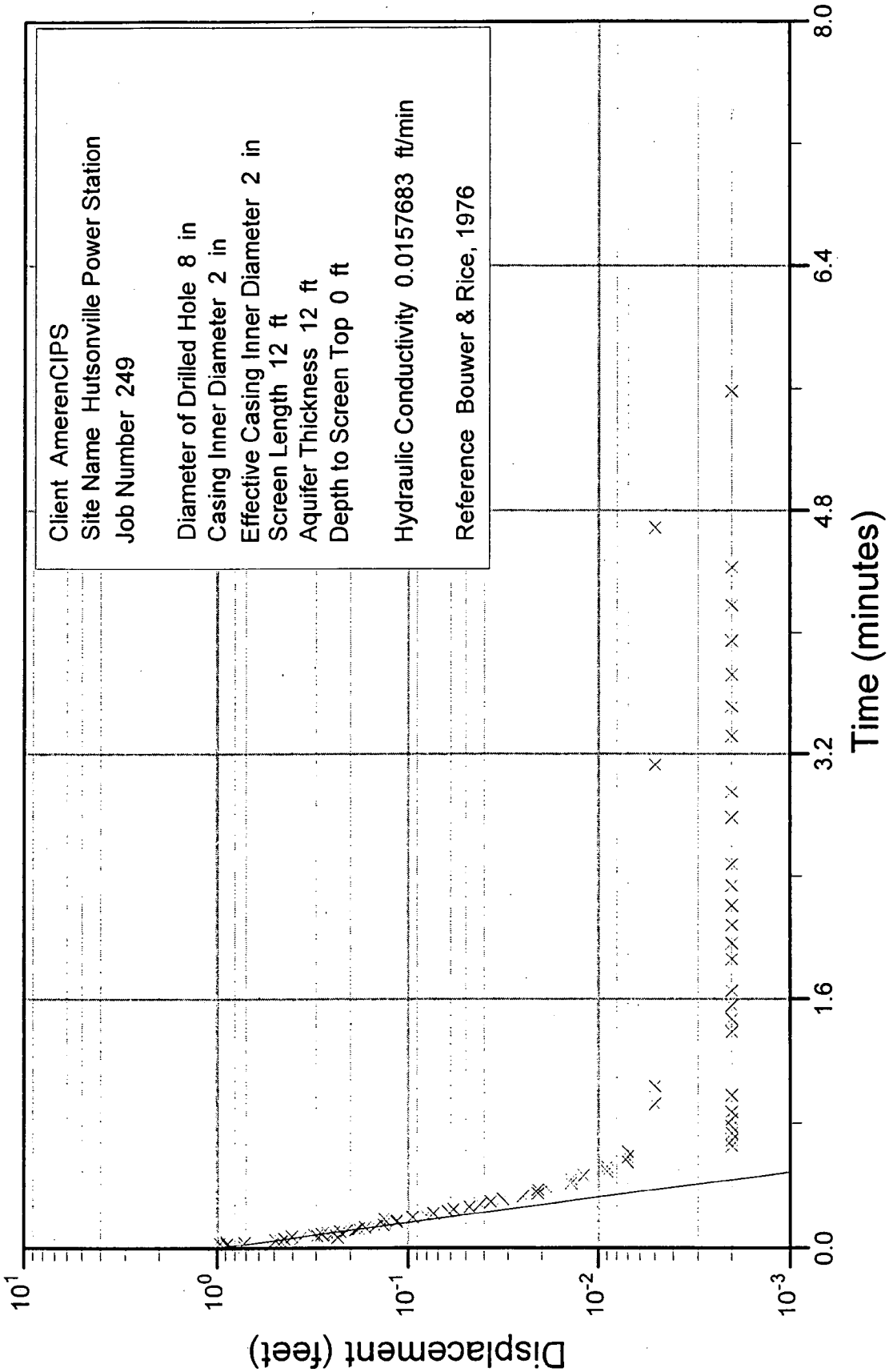
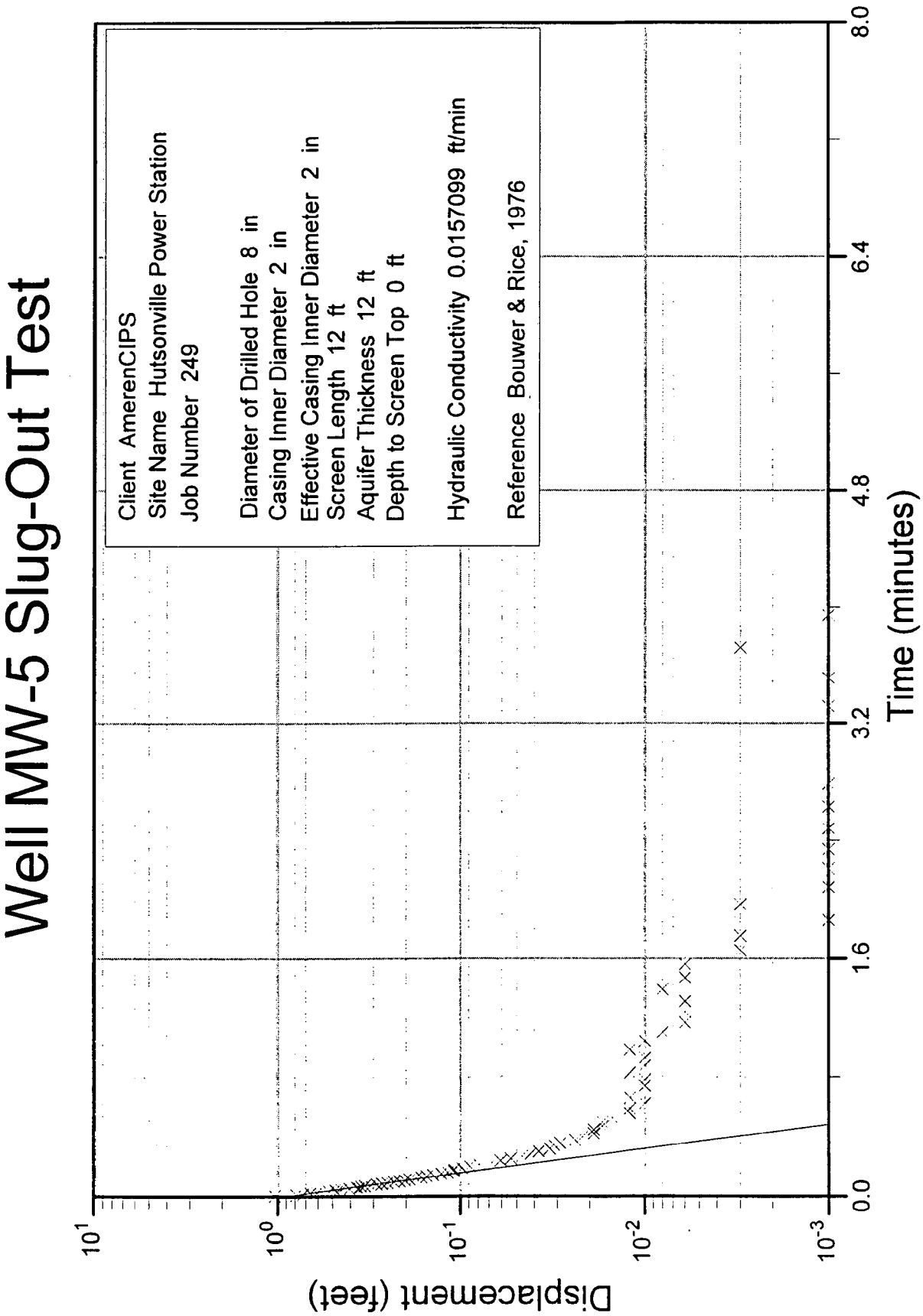
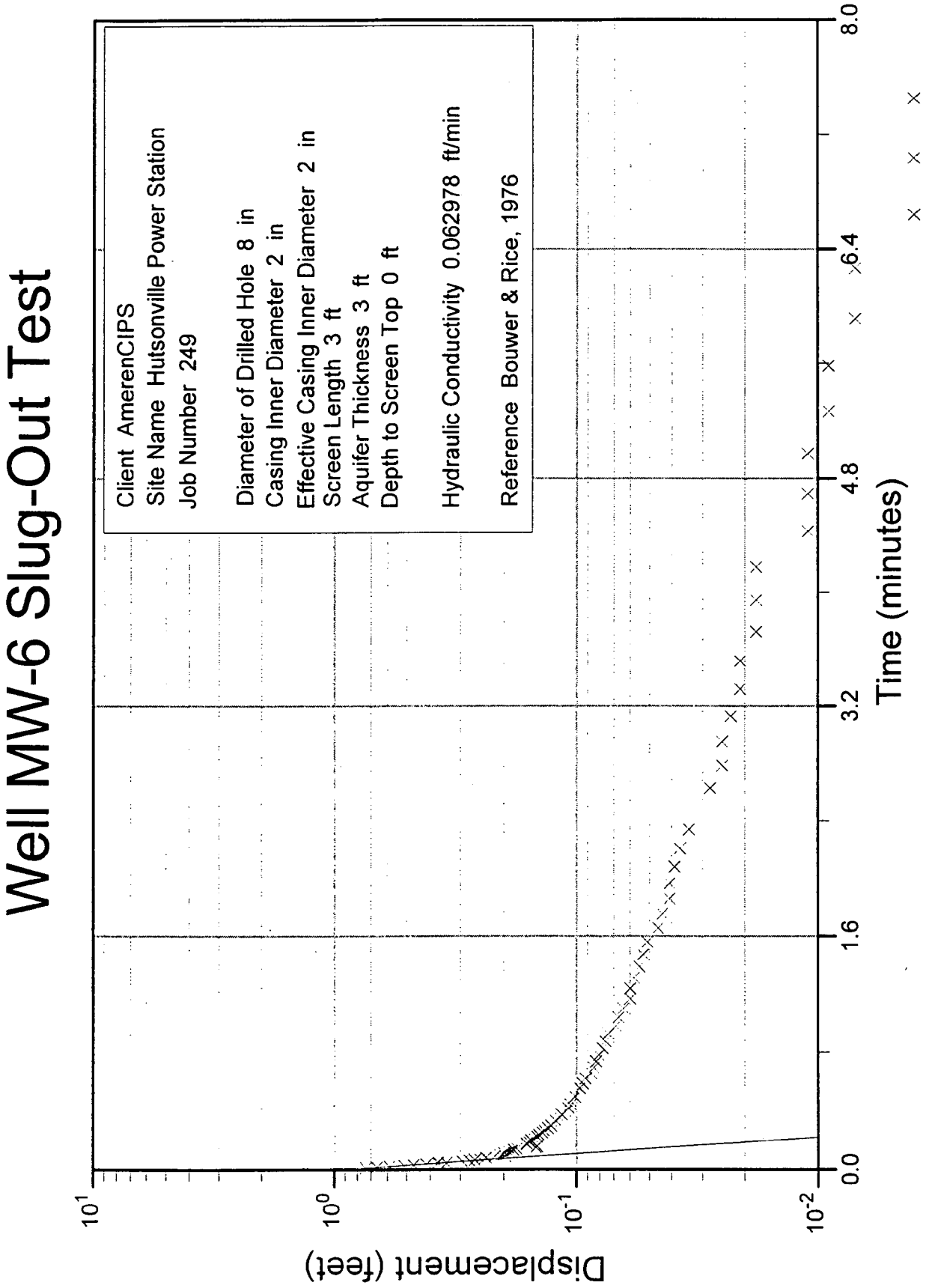
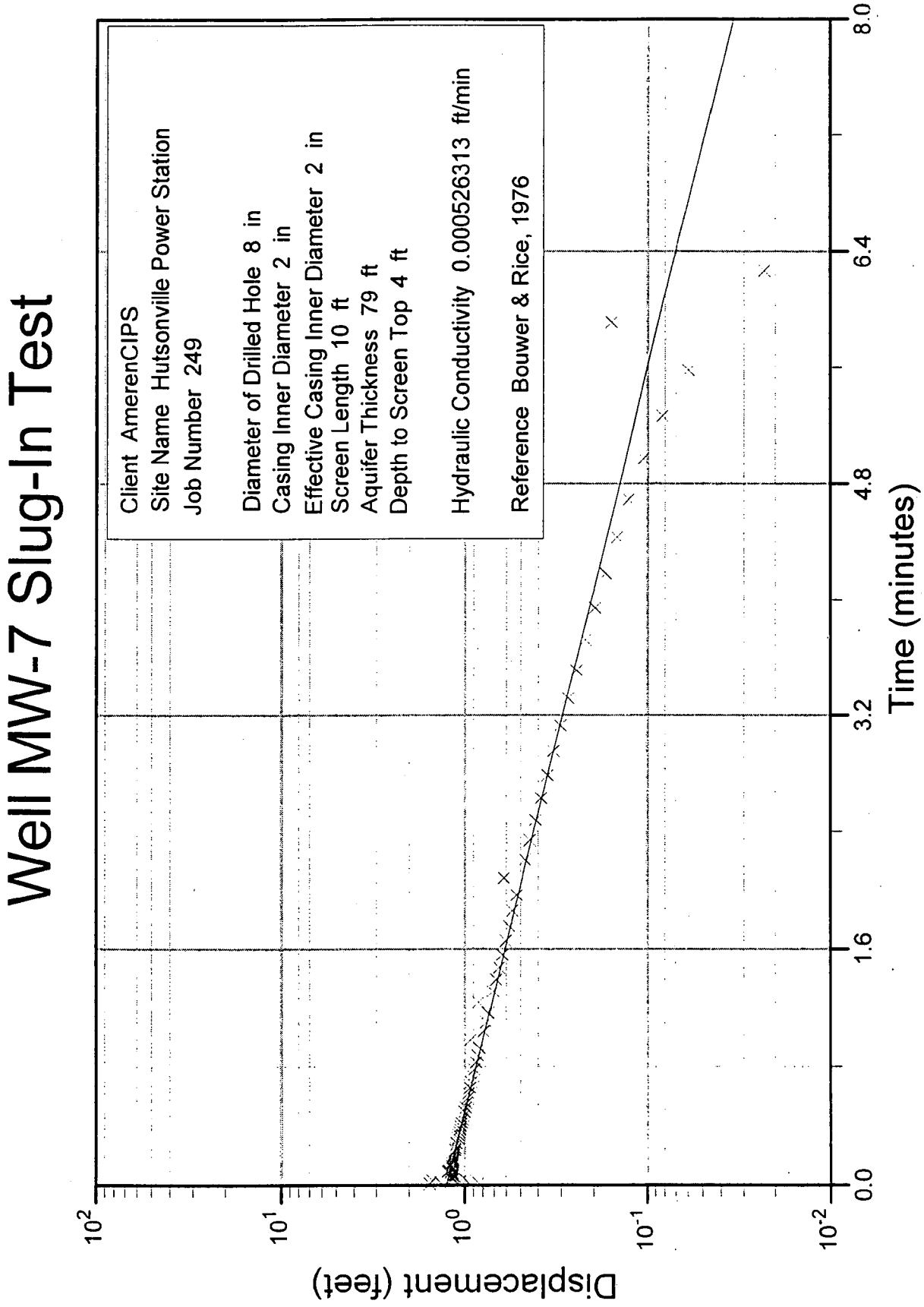
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
4.0
8.0
12.0
16.0
20.0

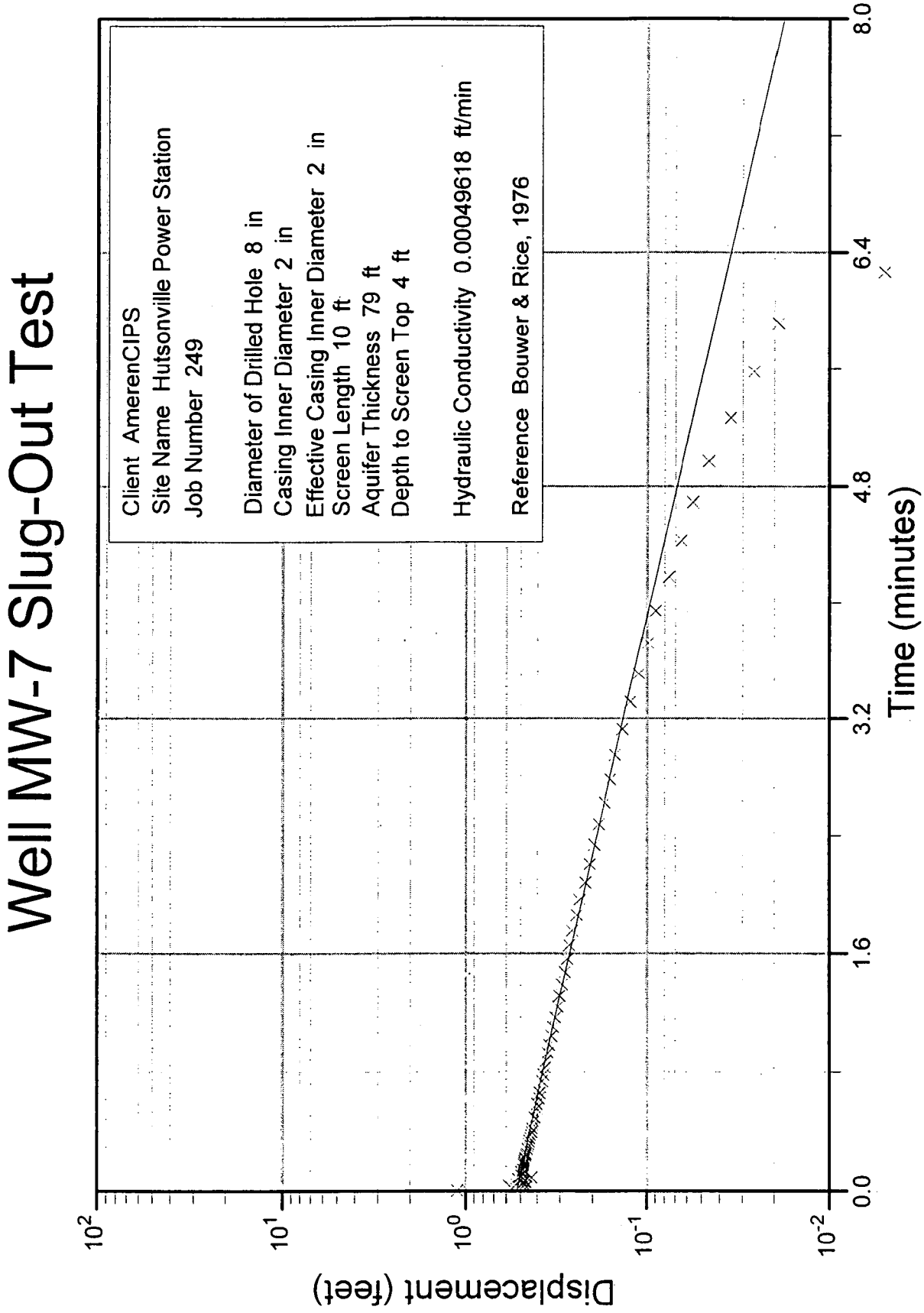

Well MW-3D Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 4 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 15 ft
Depth to Screen Top 10 ft
Hydraulic Conductivity 0.0010181 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
4.0
8.0
12.0
16.0
20.0
Time (minutes)

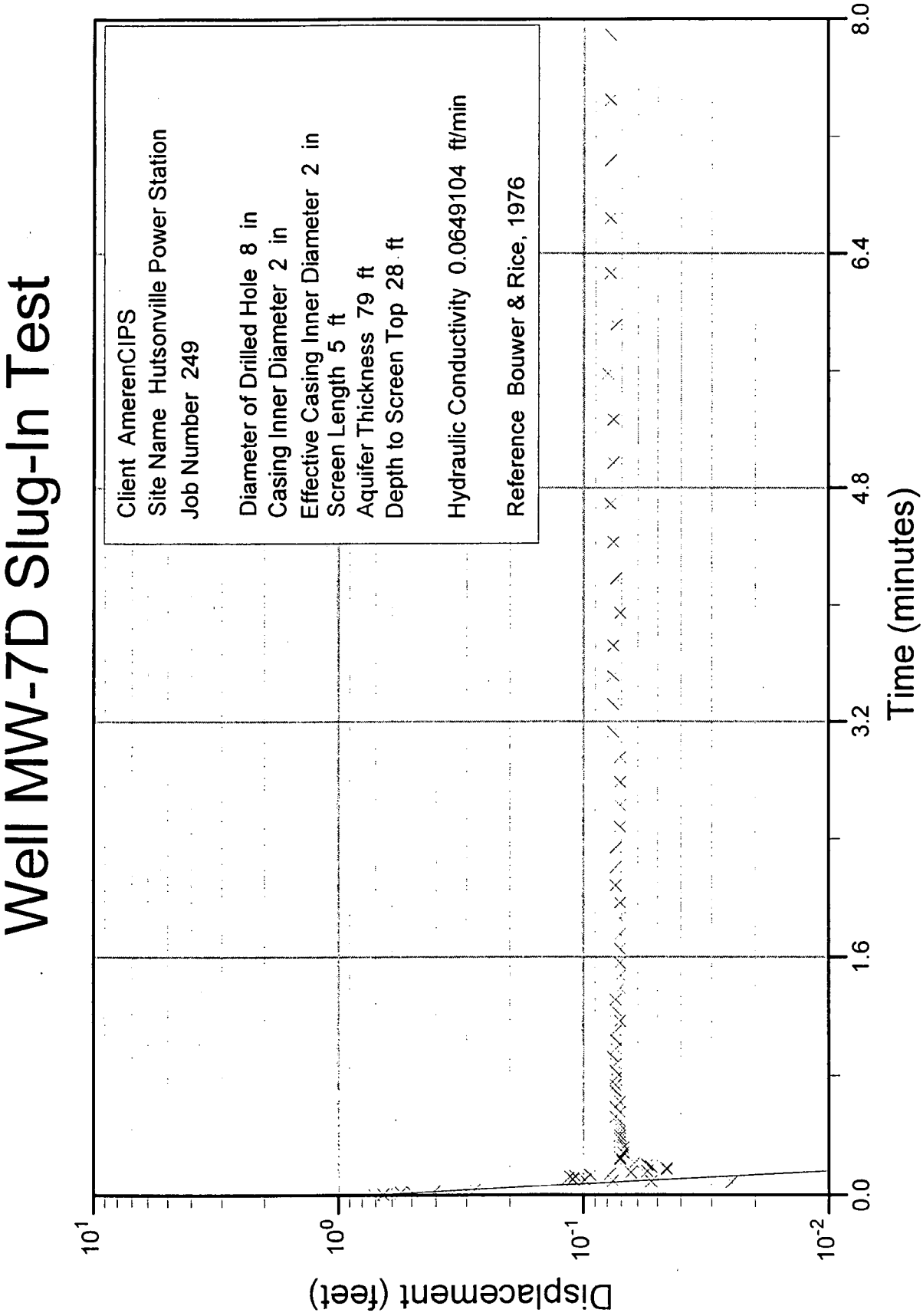

Well MW-5 Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 12 ft
Aquifer Thickness 12 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0157683 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

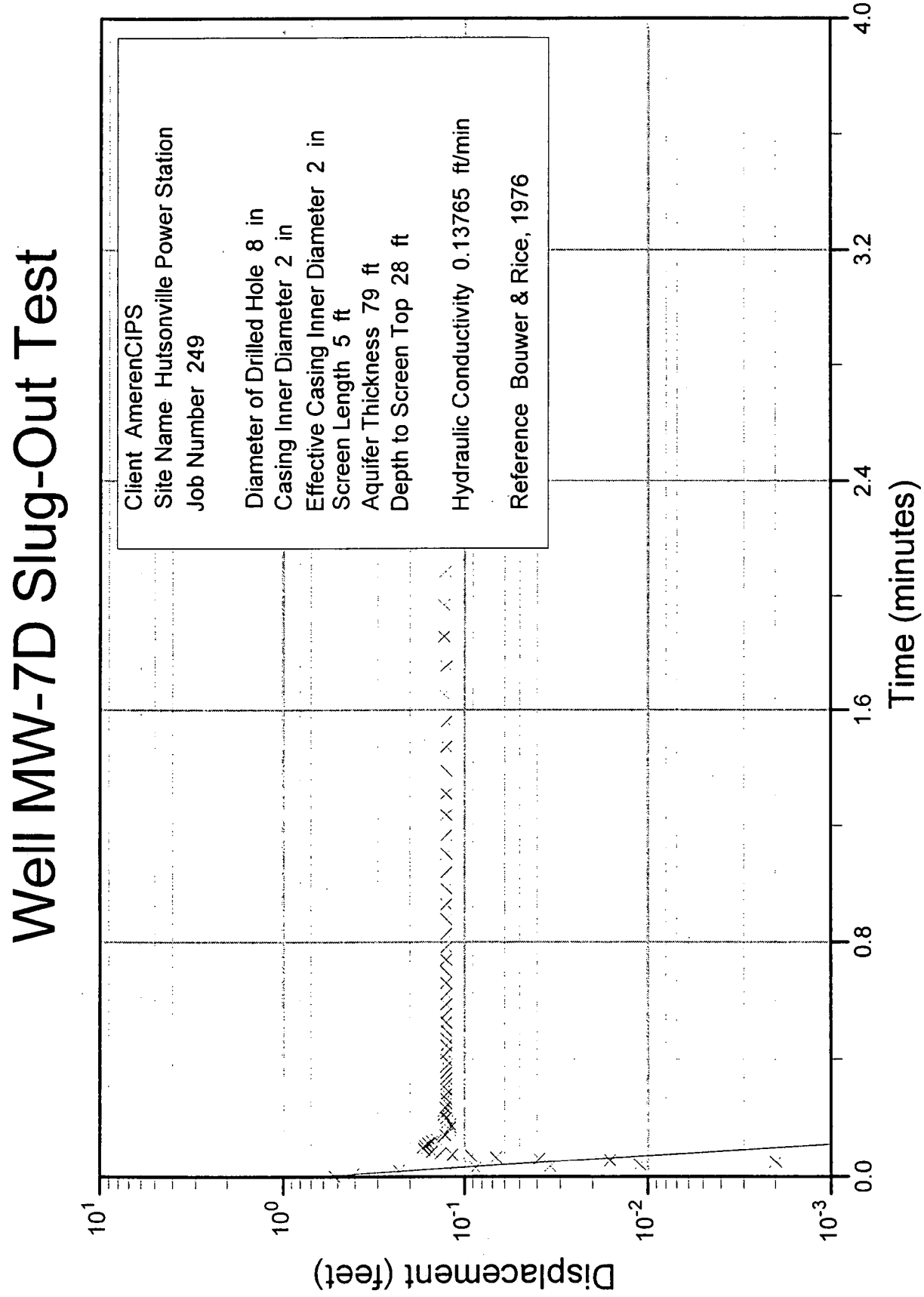

Well MW-5 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 12 ft
Aquifer Thickness 12 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0157099 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

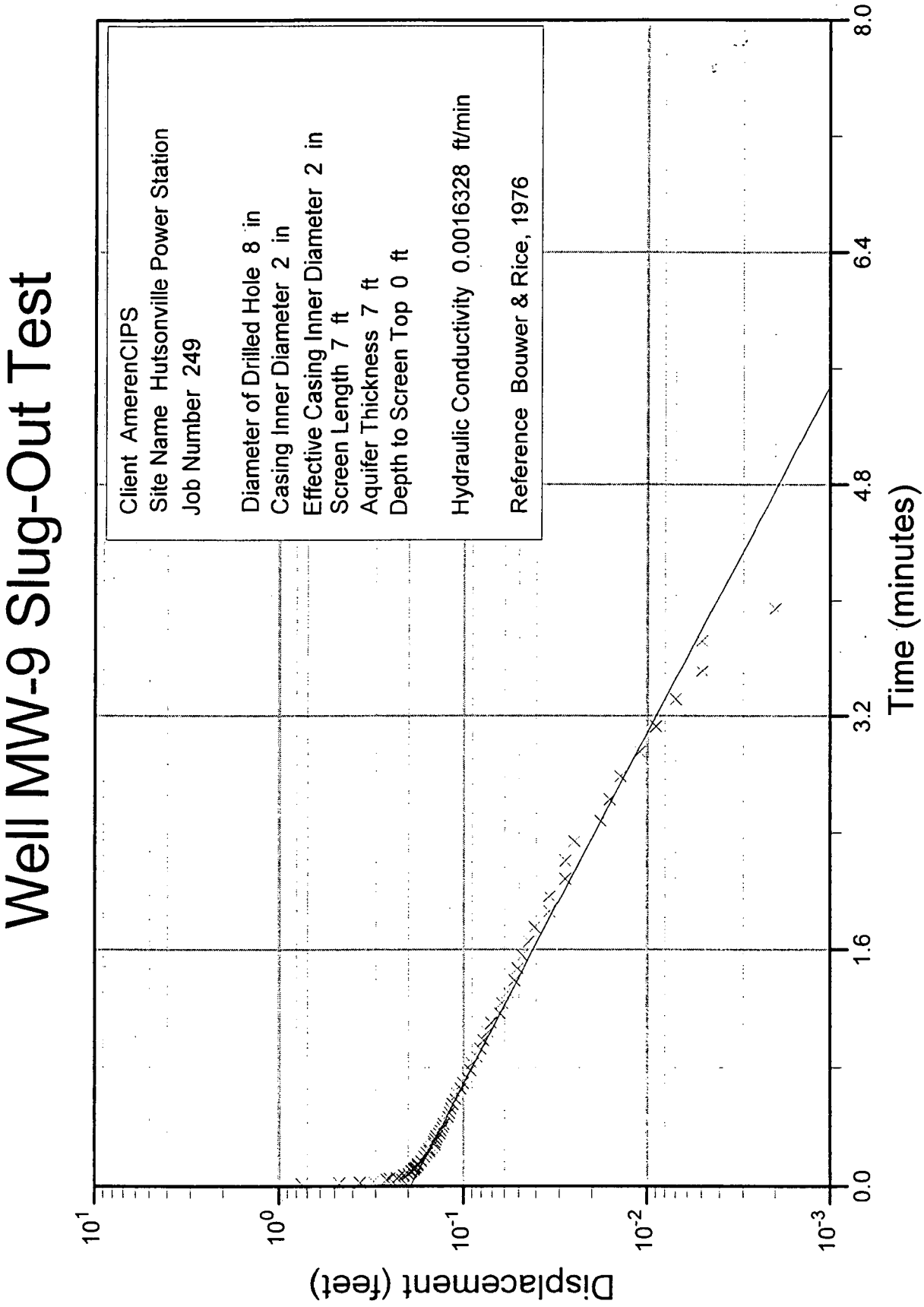

Well MW-6 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 3 ft
Aquifer Thickness 3 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.062978 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

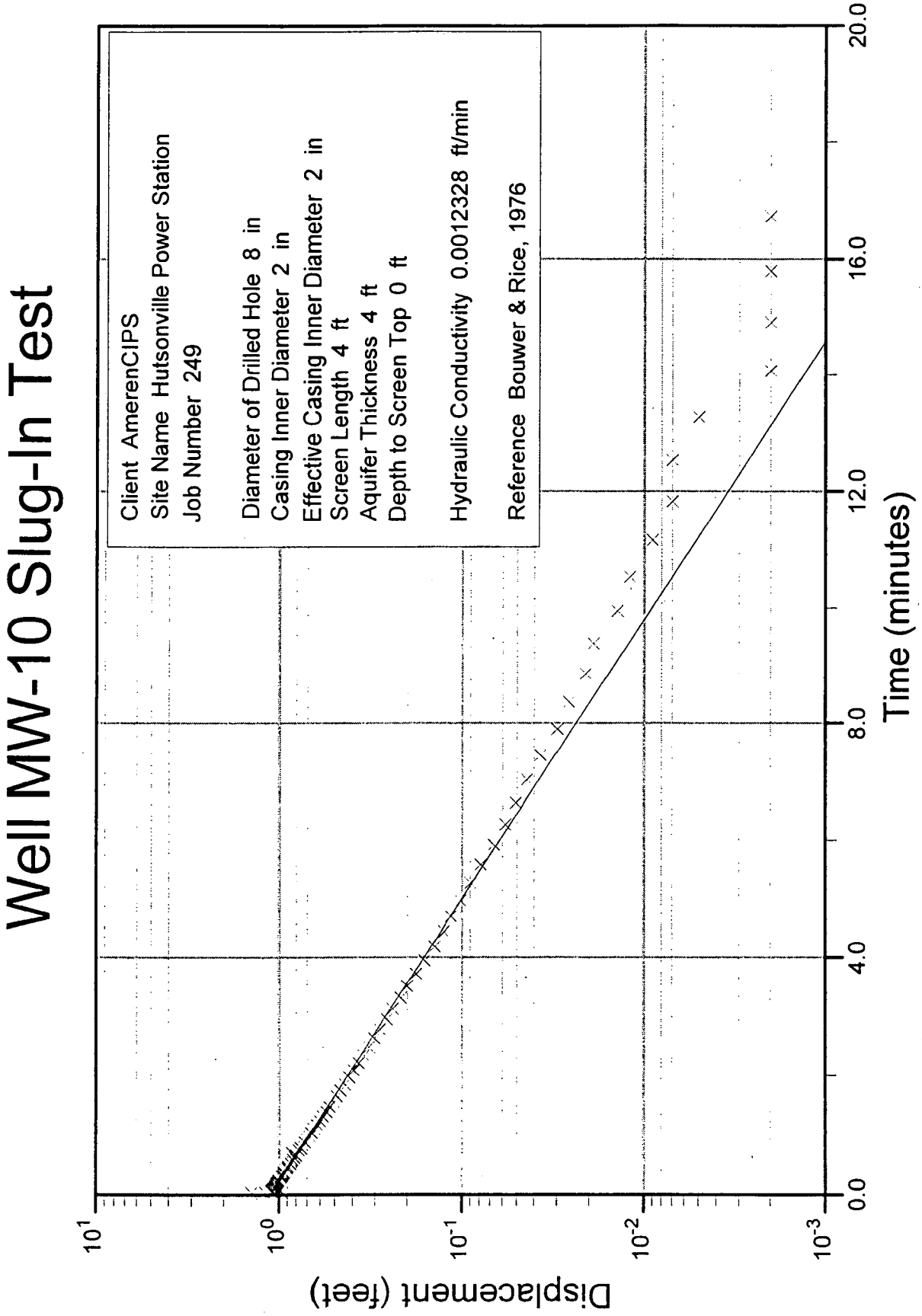

Well MW-7 Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 10 ft
Aquifer Thickness 79 ft
Depth to Screen Top 4 ft
Hydraulic Conductivity 0.000526313 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
Time (minutes)
10^2
10^1
10^0
10^-1
10^-2
0.0
1.6
3.2
4.8
6.4
8.0

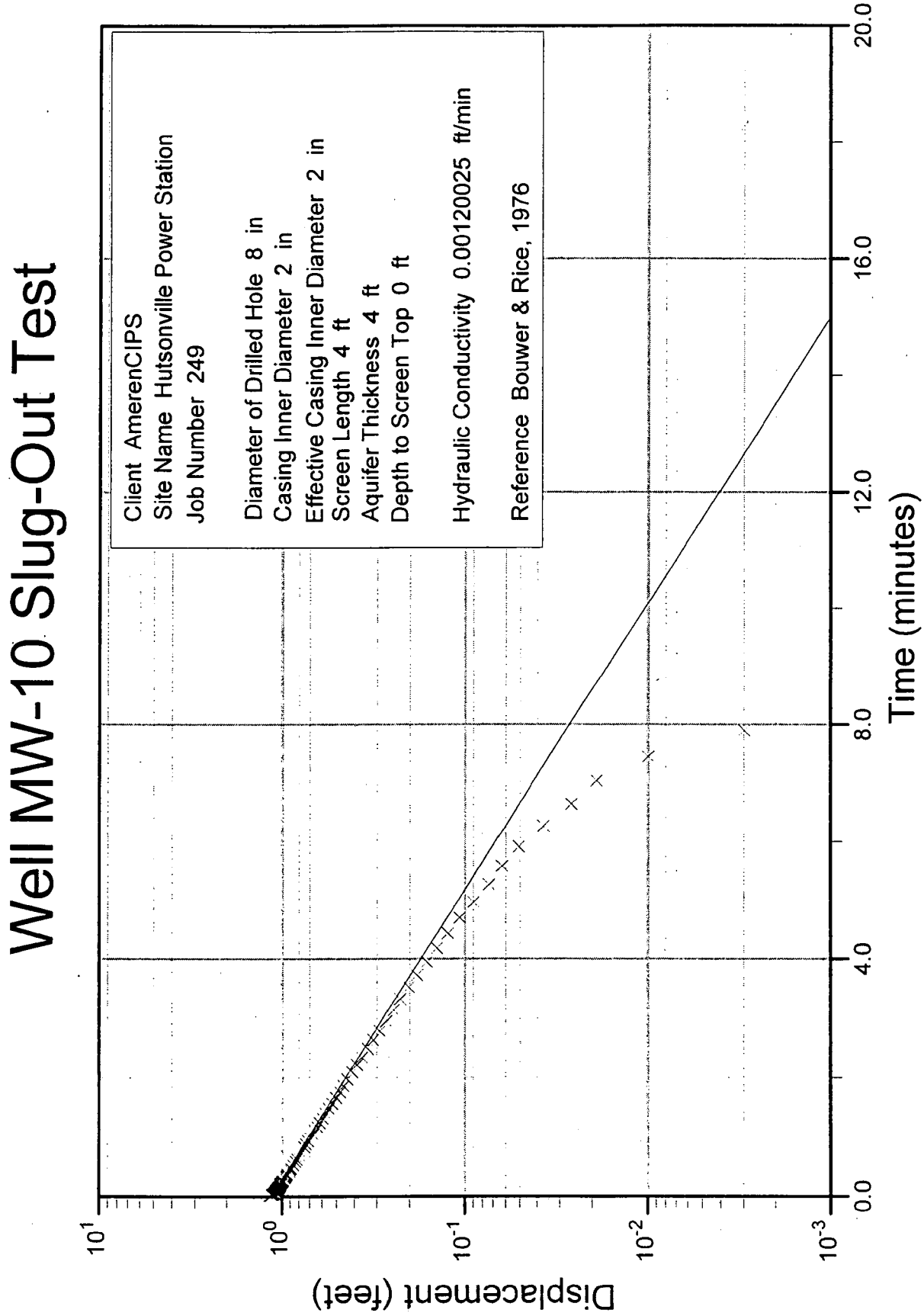

Well MW-7 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 10 ft
Aquifer Thickness 79 ft
Depth to Screen Top 4 ft
Hydraulic Conductivity 0.00049618 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

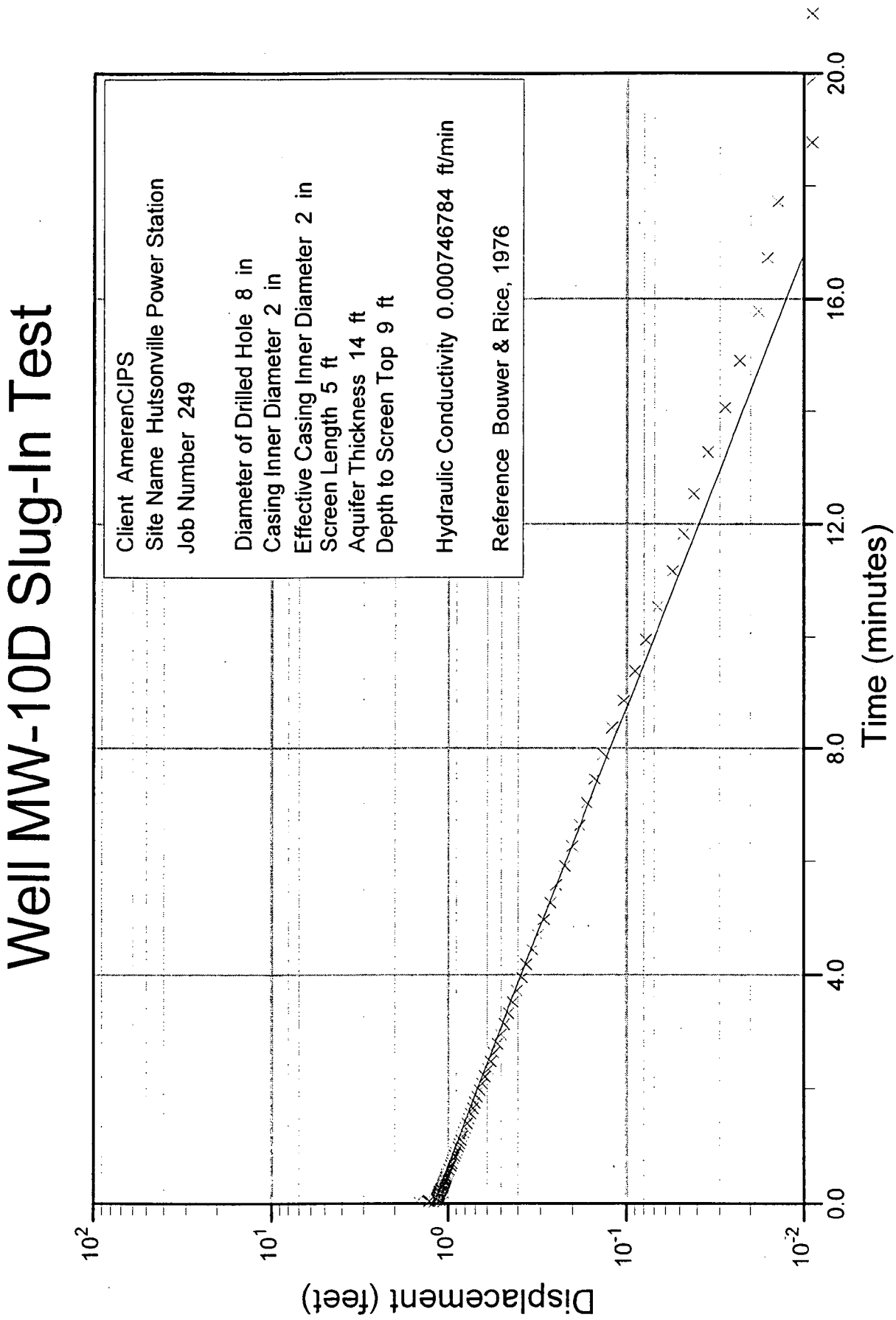

Well MW-7D Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 79 ft
Depth to Screen Top 28 ft
Hydraulic Conductivity 0.0649104 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

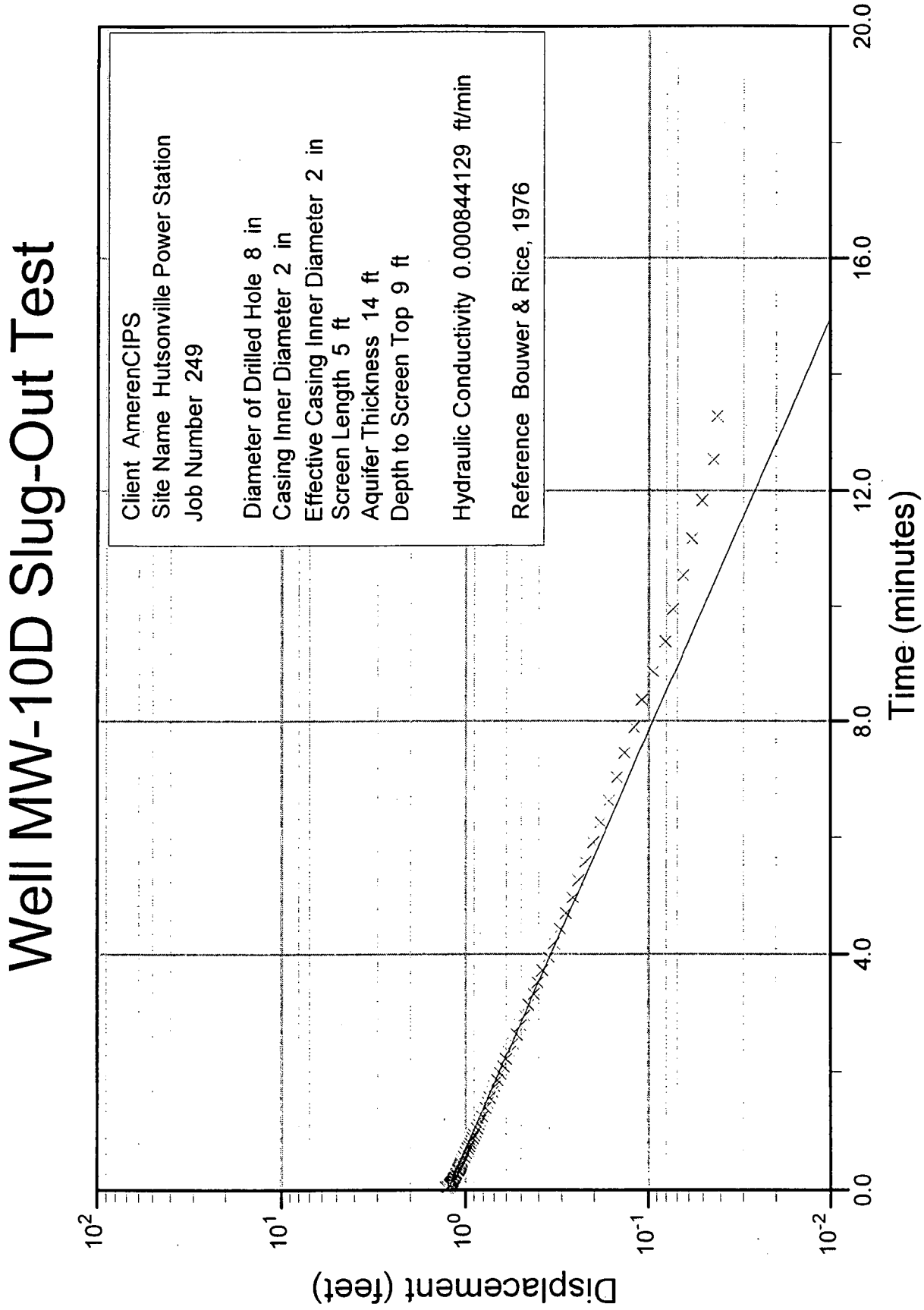

Well MW-7D Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 79 ft
Depth to Screen Top 28 ft
Hydraulic Conductivity 0.13765 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
0.8
1.6
2.4
3.2
4.0
Time (minutes)

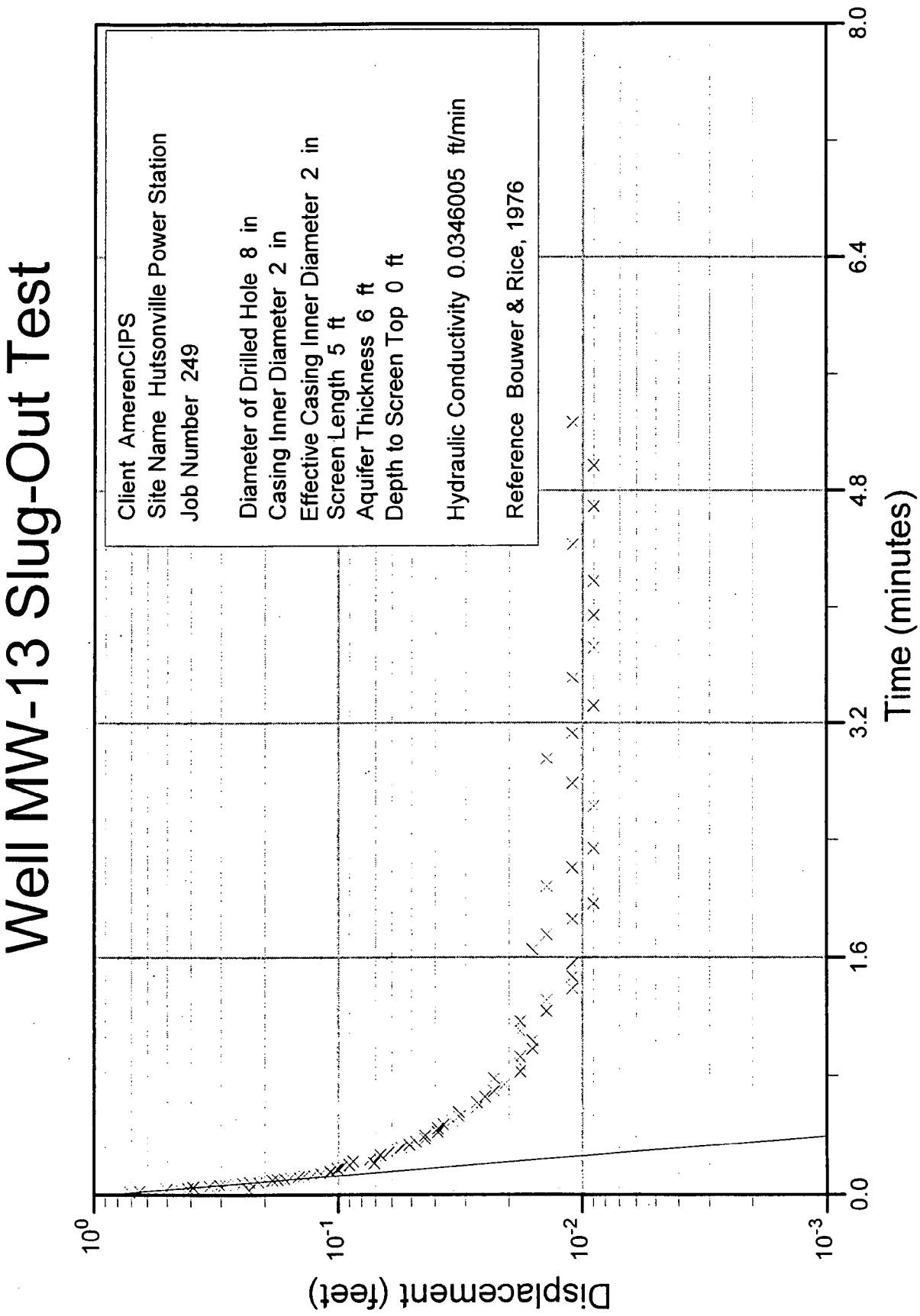

Well MW-9 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 7 ft
Aquifer Thickness 7 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0016328 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)

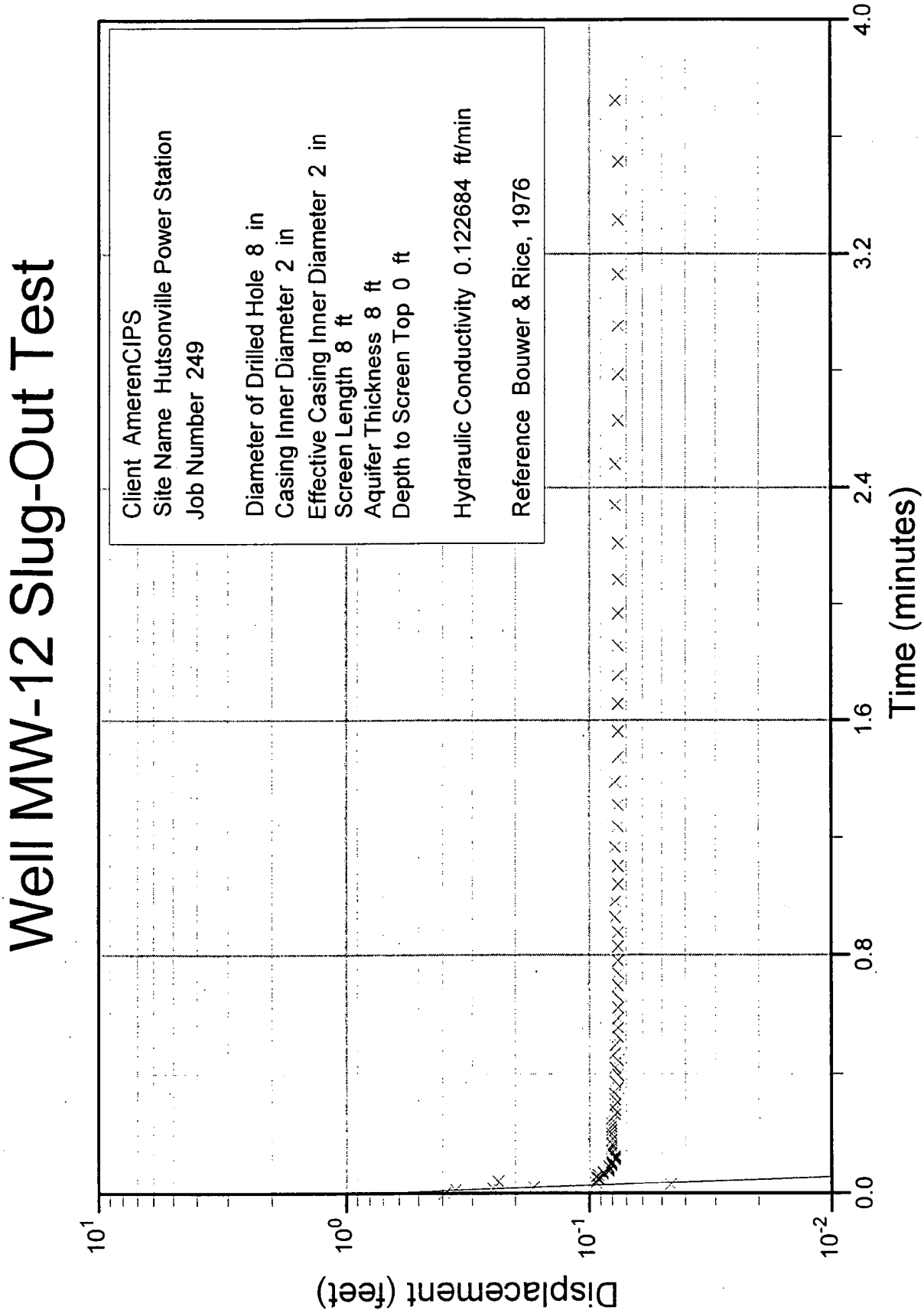

Well MW-10 Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 4 ft
Aquifer Thickness 4 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0012328 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
4.0
8.0
12.0
16.0
20.0
Time (minutes)


Well MW-10 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 4 ft
Aquifer Thickness 4 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.00120025 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
Time (minutes)
10^1
10^0
10^-1
10^-2
10^-3
0.0
4.0
8.0
12.0
16.0
20.0


Well MW-10D Slug-In Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 14 ft
Depth to Screen Top 9 ft
Hydraulic Conductivity 0.000746784 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
4.0
8.0
12.0
16.0
20.0
Time (minutes)


Well MW-10D Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 14 ft
Depth to Screen Top 9 ft
Hydraulic Conductivity 0.000844129 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
4.0
8.0
12.0
16.0
20.0
Time (minutes)


Well MW-13 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 5 ft
Aquifer Thickness 6 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.0346005 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{0}
10^{-1}
10^{-2}
10^{-3}
0.0
1.6
3.2
4.8
6.4
8.0
Time (minutes)


Well MW-12 Slug-Out Test
Client AmerenCIPS
Site Name Hutsonville Power Station
Job Number 249
Diameter of Drilled Hole 8 in
Casing Inner Diameter 2 in
Effective Casing Inner Diameter 2 in
Screen Length 8 ft
Aquifer Thickness 8 ft
Depth to Screen Top 0 ft
Hydraulic Conductivity 0.122684 ft/min
Reference Bouwer & Rice, 1976
Displacement (feet)
10^{1}
10^{0}
10^{-1}
10^{-2}
0.0
0.8
1.6
2.4
3.2
4.0
Time (minutes)

APPENDIX C

DIRECT-PUSH WATER QUALITY RESULTS

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
EB - 0 — grab ☐

Lab ID# W98-550
Sample Date 08/25/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	261	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	12	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	ND	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	110	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	30	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	80	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	19	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	112	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	4	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	ND	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	9.053	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.434	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	0.164	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Potassium	diss.	ND	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	0.624	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 2 — composite ☐ grab ☐

Lab ID# W98-551
Sample Date 08/25/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	2220	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	60	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	440	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	10	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1310	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	1100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	210	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	50	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	2118	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	1326	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	15.405	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	42.275	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	24.540	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.030	total		mg/L	0.005	GFAA EPA 243.2	09/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	43.219	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	31.103	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 3 — composite ☐ grab ☐

Lab ID# W98-552
Sample Date 08/25/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1569	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	4	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	320	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	6	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	930	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	800	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	130	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	31	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1470	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	918	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	28.235	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.344	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	2.892	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.087	total		mg/L	0.005	GFAA EPA 243.2	09/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	26.889	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	15.319	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 4 — composite ☐ grab ☐

Lab ID# W98-553
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	2190	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	384	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	3	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1340	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	960	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	380	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	91	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1688	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	1531	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	21.823	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	2.002	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	5.799	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	0.093	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Potassium	diss.	10.140	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	17.586	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 5 — composite ☐ grab ☐

Lab ID# W98-554
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	2330	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	216	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	556	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	11	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1650	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	1390	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	260	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	62	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1109	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	1225	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	8.821	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.049	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	11.078	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	0.160	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Potassium	diss.	5.782	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	13.190	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
GP - 6 — grab ☐

Lab ID# W98-555
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	922	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	40	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	164	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	16	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	540	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	410	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	130	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	31	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	724	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	398	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	4.592	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.030	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	1.022	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.063	total		mg/L	0.005	GFAA EPA 243.2	09/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.938	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	13.465	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 7 — composite ☐ grab ☐

Lab ID# W98-556
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	278	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	40	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	40	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	5	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	160	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	60	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	14	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	214	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	71	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.388	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.118	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.165	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.006	total		mg/L	0.005	GFAA EPA 243.2	09/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	1.808	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	4.876	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description	Hutsonville Power Station	composite	
	GP - 9	grab	

Lab ID#	W98-557				
Sample Date	08/26/98	Time Sampled		Sampler ID	
Report Date	09/16/98				
Approved by	SD			☐ Check if Entered	
Results to:	John Romang	Jacque Bush			

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1226	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	280	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	224	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	6	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	710	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	560	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	150	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	36	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	942	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	357	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.882	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.056	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.241	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.009	total		mg/L	0.005	GFAA EPA 243.2	09/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	5.480	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	6.981	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 10 — composite ☐ grab ☐

Lab ID# W98-558
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	8040	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	440	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	5	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	3200	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	1100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	2100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	504	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	12058	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	7143	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	5.821	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	3388.660	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	26.656	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	3.241	total		mg/L	0.020	ICP EPA 200.7	9/16/98	sd
Potassium	diss.	10.972	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	187.503	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 10D — composite ☐ grab ☐

Lab ID#: W98-559
Sample Date: 08/26/98 Time Sampled: _____ Sampler ID: _____
Report Date: 09/16/98
Approved by: SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	8030	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	200	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	5	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	2100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	500	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	1600	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	384	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	12110	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	7143	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	5.553	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	3350.980	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	25.603	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	3.146	total		mg/L	0.020	ICP EPA 200.7	9/16/98	sd
Potassium	diss.	13.135	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	195.791	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 10F — composite ☐ grab ☐

Lab ID# W98-560
Sample Date 08/26/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	8060	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	240	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	5	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	2000	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	600	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	1400	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	336	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	12236	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	7143	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	5.639	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	3391.560	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	26.135	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	2.710	total		mg/L	0.020	ICP EPA 200.7	9/16/98	sd
Potassium	diss.	13.276	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	196.860	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
GP - 11 — grab ☐

Lab ID# W98-561
Sample Date 08/27/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1707	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	72	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	3	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	410	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	180	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	230	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	55	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1918	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	1276	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	1.460	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	184.150	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	3.904	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	0.900	total		mg/L	0.020	ICP EPA 200.7	9/16/98	sd
Potassium	diss.	1.334	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	19.638	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 12 — composite ☐ grab ☐

Lab ID#: W98-562
Sample Date: 08/27/98 — Time Sampled: _____ — Sampler ID: _____
Report Date: 09/16/98
Approved by: SD — ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1667	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	72	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	2	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	340	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	180	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	160	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	38	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1194	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	867	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	1.234	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	11.931	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	2.626	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.		total		mg/L	0.005	GFAA EPA 243.2		
Nickel	diss.	0.781	total		mg/L	0.020	ICP EPA 200.7	9/16/98	sd
Potassium	diss.	1.490	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	21.400	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
EB - 2 — grab ☐

Lab ID# W98-563
Sample Date 08/27/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	39	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	ND	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	ND	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	ND	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	ND	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	ND	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	ND	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	30	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	2	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	ND	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	1.398	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.039	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.012	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	ND	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	0.211	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 13 — composite ☐ grab ☐

Lab ID# W98-573
Sample Date 08/27/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	716	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	136	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	108	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	29	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	390	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	270	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	120	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	29	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	554	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	104	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.226	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.005	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.530	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	3.994	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 14 — composite ☐ grab ☐

Lab ID# W98-574
Sample Date 08/27/98 Time Sampled ____ Sampler ID ____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	900	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	32	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	336	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	128	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	26	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	560	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	320	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	240	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	58	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	620	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	52	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.066	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.126	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.925	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.014	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	3.499	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	5.281	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 15 — composite ☐ grab ☐

Lab ID#: W98-575
Sample Date: 08/27/98 — Time Sampled: _____ — Sampler ID: _____
Report Date: 09/16/98
Approved by: SD — ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	884	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	232	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	140	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	34	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	500	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	350	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	150	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	36	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	646	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	125	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.292	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.028	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.013	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.795	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	4.048	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 16 — composite ☐ grab ☐

Lab ID#	W98-576			
Sample Date	08/27/98	Time Sampled		Sampler ID
Report Date	09/16/98			
Approved by	SD			☐ Check if Entered
Results to:	John Romang	Jacque Bush		

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	957	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	244	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	168	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	52	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	530	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	420	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	110	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	26	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	674	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	104	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.213	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.012	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.441	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	4.182	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description	Hutsonville Power Station	composite	
	GP - 17	grab	

Lab ID#	W98-577				
Sample Date	08/27/98	Time Sampled		Sampler ID	
Report Date	09/16/98				
Approved by	SD			☐ Check if Entered	
Results to:	John Romang	Jacque Bush			

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	692	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	104	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	100	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	36	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	320	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	250	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	70	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	17	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	596	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	83	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.291	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.099	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.942	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	3.444	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 18 — composite ☐ grab ☐

Lab ID# W98-578
Sample Date 08/27/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	742	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	160	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	120	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	32	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	400	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	300	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	100	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	24	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	558	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	83	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.280	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.010	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.547	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	3.471	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
EB - 1 — grab ☐

Lab ID# W98-579
Sample Date 08/28/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	25	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	4	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	ND	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	40	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	10	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	30	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	7	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	ND	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	1	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	0.053	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.039	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.005	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	ND	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	ND	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
GP - 20 — grab ☐

Lab ID# W98-580
Sample Date 08/28/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1096	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	16	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	192	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	164	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	29	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	560	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	410	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	150	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	36	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	810	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	344	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	14.878	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	4.079	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.009	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	4.825	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	28.469	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — composite ☐
GP - 20D — grab ☐

Lab ID#: W98-581
Sample Date: 08/28/98 — Time Sampled: _____ — Sampler ID: _____
Report Date: 09/16/98
Approved by: SD — ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1066	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	8	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	220	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	168	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	31	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	550	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	420	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	130	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	31	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	700	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	313	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	12.868	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.029	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	2.020	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.007	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	3.810	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	21.397	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 20F

composite ☐ grab ☐

Lab ID# W98-582
Sample Date 08/28/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1066	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	8	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	224	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	180	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	29	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	560	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	420	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	140	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	34	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	848	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	302	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	13.248	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.031	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	2.006	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.007	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	4.609	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	25.810	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description	Hutsonville Power Station	composite	
	GP - 21	grab	

Lab ID#	W98-583				
Sample Date	08/28/98	Time Sampled		Sampler ID	
Report Date	09/16/98				
Approved by	SD			☐ Check if Entered	
Results to:	John Romang	Jacque Bush			

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1913	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	12	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	228	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	356	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	27	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1190	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	890	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	300	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	72	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1754	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	771	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	13.910	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.085	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	5.397	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.007	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	0.836	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	31.620	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — GP - 23 — composite ☐ grab ☐

Lab ID#: W98-584
Sample Date: 08/28/98 — Time Sampled: ____ — Sampler ID: ____
Report Date: 09/16/98
Approved by: SD — ☐ Check if Entered
Results to: John Romang — Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	2330	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	ND	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	292	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	440	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	23	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1440	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	1110	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	330	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	79	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	2210	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	927	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	30.207	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	0.402	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	2.680	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	ND	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	19.898	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	58.502	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station / LP - 1 — composite ☐ grab ☐

Lab ID# W98-585
Sample Date 08/28/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD
Results to: John Romang Jacque Bush ☐ Check if Entered

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	1955	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	116	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	136	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	384	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	42	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	990	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	960	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	30	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	7	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	1832	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	792	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	27.876	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.006	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.005	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	85.718	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	31.442	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

WATER ANALYSIS REPORT CIPS Central Laboratory

ROUTINE

Sample Description: Hutsonville Power Station — LP - 2 — composite ☐ grab ☐

Lab ID# W98-586
Sample Date 08/28/98 Time Sampled _____ Sampler ID _____
Report Date 09/16/98
Approved by SD ☐ Check if Entered
Results to: John Romang Jacque Bush

Inorganic Analysis

	Results	Units	Report Limit	Method	Test Date/	Analyst
pH lab		units	0.1	EPA 150.1		
Sp Conductivity lab	2330	umho	1	EPA 120.1	08/31/98	lj
Alkalinity, P	120	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Alkalinity,M	164	mg/L as CaCO3	1	EPA 310.1	08/31/98	lj
Bicarbonate HCO3		mg/L	1	EPA 310.1		
Carbonate		mg/L	1	EPA 310.1		
Hydroxide		mg/L	1	EPA 310.1		
Calcium	552	mg/L	1	EPA 130.2	08/31/98	lj
Chloride	32	mg/L	1	EPA 300.0 (IC)	09/04/98	rm
Hardness, total	1450	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, ca	1380	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Hardness, mg	70	mg/L as CaCO3	1	EPA 130.2	08/31/98	lj
Magnesium	17	mg/L	1	EPA 130.2	08/31/98	lj
Residue, TSS		mg/L	5	EPA 160.2		
Residue, TDS	2378	mg/L	10	EPA 160.1	08/31/98	lj
Silica		mg/L	0.001	EPA 370.2		
Sulfate	990	mg/L	5	EPA 300.0 (IC)	09/04/98	rm
Sulfate		mg/L	5	EPA 375.4		
TOC		mg/L	0.5	EPA 415.2		
Oil & Grease		mg/L	2	EPA 1664		

Metals Analysis

		Results			Units	Report Limit	Method	Test Date	Analyst
Aluminum	diss.		total		mg/L	0.075	ICP EPA 200.7		
Aluminum	diss.		total		mg/L	0.005	GFAA EPA 202.2		
Boron	diss.	52.896	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Copper	diss.		total		mg/L	0.005	ICP EPA 200.7		
Copper	diss.		total		mg/L	0.002	GFAA EPA 220.2		
Iron	diss.	ND	total		mg/L	0.020	ICP EPA 200.7	09/16/98	sd
Iron	diss.		total		mg/L	0.010	GFAA EPA 236.2		
Manganese	diss.	0.014	total		mg/L	0.005	ICP EPA 200.7	09/16/98	sd
Nickel	diss.	0.007	total		mg/L	0.005	GFAA EPA 243.2	9/16/98	sd
Nickel	diss.		total		mg/L	0.020	ICP EPA 200.7		
Potassium	diss.	45.640	total		mg/L	0.050	ICP EPA 200.7	09/16/98	sd
Silica	diss.		total		mg/L	0.050	ICP EPA 200.7		
Sodium	diss.	16.078	total		mg/L	0.070	ICP EPA 200.7	09/16/98	sd
Sodium	diss.		total		mg/L	0.0005	GFAA EPA 273.2		

Note: ND denotes result below detection limit

APPENDIX D

WATER WELL LOGS

LOG OF WATER WELL

Property owner Russ Correll Well No. 1

Drilled by Claude Miller Year 1962

Formations passed through	Thickness	Depth of Bottom
top soil	2	2
yellow clay	20	22
yellow sand	21	43
Gray H.P.	18	61
lime	3	64
shale	7	71
sand shale	19	90
shale	10	100
drip.		

COUNTY No. 9188

[Continue on back if necessary]

Finished in ______ at ______ to ______ ft.

Cased with ______ inch ______ from 0 to ______ ft.

and ______ inch ______ from ______ to ______ ft.

Size hole below casing ______ inch. Static level from surf. ______ ft.

Tested capacity ______ gal. per min. Temperature ______ °F.

Water lowered to ______ ft. ______ in. in ______ hrs. ______ min.

Length of test ______ hrs. ______ min. Screen ______

Slot ______ Diam. ______ Length ______ Bottom set at ______ ft.

[Show location in Section Plat]

Township name Crawford Elev. ______ Sec. 7

Description of location ______ Twp. 8N

Rge. 11W

Signed Claude Miller County Crawford

CRAWFORD

Copy for Illinois State Geological Survey

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LOG OF WATER WELL

Property owner Russ Correll Well No. 2

Drilled by Claude Miller Year 1962

Formations passed through	Thickness	Depth of Bottom
top soil	2	2
yellow H.P.	10	12
Gray H.P.	13	35
Brown lime	2	37
Gray shale	10	47
lime	4	51
Shale	6	57
gravel packed		

COUNTY No. 9189

[Continue on back if necessary]

Finished in shale at 51 to 57 ft.

Cased with 6 1/4 inch used pipe from 0 to 51 ft.

and ______ inch ______ from ______ to ______ ft.

Size hole below casing 6 1/4 inch. Static level from surf. 33 ft.

Tested capacity 3 3/4 gal. per min. Temperature ______ °F.

Water lowered to ______ ft. ______ in. in ______ hrs. ______ min.

Length of test ______ hrs. ______ min. Screen ______

Slot ______ Diam. ______ Length ______ Bottom set at ______ ft.

[Show location in Section Plat]

Township name Crawford Elev. ______ Sec. 7

Description of location ______ Twp. 8N

Rge. 11W

Signed Claude Miller County Crawford

CRAWFORD

Copy for Illinois State Geological Survey

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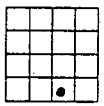
GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Central Il Public Serv.Co. Well No. #4
Address Hutsonville Power Generator St Hutsonville IL
Driller Ruester, John T. License No. 102-2045
11. Permit No. 109053 Date 08/26/83
12. Water from alluvial 13. County Crawford
at depth 25 to 97 ft. Sec. 17
14. Screen: Diam. 26 in. Twp. 8 N
Length: 30 ft. Slot .5 Rge. 11 W
Elev. 440



15. Casing and Liner Pipe 350' N 150' E SWc SE SW SE

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
26	.375 WALL	0	57
42	.375 WALL	-22	30

16. Size hole below casing: 42 in.
17. Static level 15 ft. below casing top which is 0 ft. above ground level. Pumping level 22 ft. when pumping at 826 gpm for 5 hours.

18. Formations passed through	Thickness	Bottom
cinders, sand & clay	5	5
med to soft clay	17	22
soft gray clay	4	26
f-med s, gvl & bld	62	88

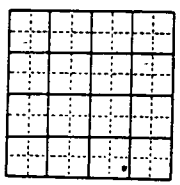
Crawford 12-033-33867-00 17-08N-11W

ILLINOIS GEOLOGICAL SURVEY, URBANA

Permit # 47367	Thickness	Top	Bottom
Brown clay, very soft		0	20
Gray clay very soft		20	25
Coarse sand and gravel with boulders at 40'(water bearing)		25	54
Gravel with boulders very loose(water bearing)		54	75
Medium to fine sand very loose (water bearing)		75	90
Bedrock at		90	
Total Depth			90
Plugged back			87.5

Hole record: 52" 0 - 30'
42" 30 - 87.5'
Casing record: 42" +1 to 30';
26" +1 to 57.5'
Screen record: 30' of 26" Layne Stainless Steel Shutter type slot # 6 set 57.5 to 87.5'
Gravel pack between 26" and 42" pipe from 6 - 87.5' 42" casing cemented from 5 - 30'
Chief aquifer: sand and gravel from 25 - 87.5'
Nonpumping level 18.02' below measuring point
Pumping level: 24.29' below measuring point after pumping at approximately 825 gpm for 3 hours
Measuring point for above measurements: Hole in well housing, 2' above ground level
S.S. # 60350
*App. 1 mile north of Village of Hutsonville near Wabash River
NO ENVELOPE

COMPANY	Layne-Western Company
FARM	C.I.P.S.-Hutsonville Unit NO. 3
DATE DRILLED	May 25, 1976 COUNTY NO. 29913
AUTHORITY	State Water Survey
ELEVATION	440' T.M.
LOCATION	350' S line,1630' E line, SE
COUNTY	CRAWFORD



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age 1

ILLINOIS GEOLOGICAL SURVEY, URBANA

	Thickness	Top	Bottom
Clay	10	0	10
Gummy clay andsand	8	10	18
Gray hardpan	9	18	37
Yellow hardpan	4	37	41
Gray shale	16	41	57
Lime	2	57	59
Dark shale	3	59	62
			TD

Static level from surface 10'

Tested capacity 2 gallons per minute

Shot torch diameter 6" length 3' Bottom set at 37'

OMPANY V. Eaton
ARM Johnson, Rollie NO.
ATE DRILLED 1951 COUNTY NO. 6493
UTHORITY
EVATION
OCATION NE SW NW
UNTY CRAWFORD

18-8N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Lingafelter, Brad Well No. #1
Address 19961 North 1500th Hutsonville IL
Driller Hacker, Tim License No. 092-6477
11. Permit No. 033-24-96 Date 11/08/96
12. Water from sand 13. County Crawford
at depth 25 to 30 ft.
14. Screen: Diam. 6 in.
Length: 5 ft. Slot .02
Sec. 18
Twp. 8 N
Rge. 11 W
Elev.

NW NE NE

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PVC SDR 21	0	27

16. Size hole below casing: _____ in.
17. Static level 16 ft. below casing top which is 2 ft. above ground level. Pumping level _____ ft. when pumping at 30 gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
topsoil	2	2
gravelly stabilizer	11	13
large gravel	3	16
coarse brown sand with small gravel	14	30
hard brown clay	1	31

Household - Private

Crawford 12-033-36385-00 18-08N-11W

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Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

Strata	Thickness	Top	Bottom
Soil & gravel		0	10
Sand & gravel with clay		10	20
Sand & gravel with water		20	25
Sand with little gravel (water)		25	32
Coarse gravel and some sand (water)		32	37
			TD

Static level from surface: 23'.
Tested capacity: 45 gallons per minute, no drawdown.

NO ENVELOPE

COMPANY Virgil Eaton & Son
FARM Musgrave, William L. NO.
DATE DRILLED Dec. 1954 COUNTY NO. 1838
AUTHORITY Virgil Eaton & Son
ELEVATION
LOCATION Approx. NE NE NE
COUNTY CRAWFORD

18-8N-11W

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Page 1 **ILLINOIS GEOLOGICAL SURVEY, URBANA**

Strata	Thickness	Top	Bottom
Soil and clay		0	6
Yellow clay and sand		6	20
Yellow sand and water		20	21
Gray sand hardpan solid		21	49
Boulders		49	51
Gray hardpan soft		51	62
Glacial mud (dark green yellow)	(soft)	62	75
Dark shale and slate solid		75	84
Coal and water		84	86
Fire clay		86	90
Sandy shale		90	94
Sandy lime		94	96
Brown shale		96	105
			TD

Cased with 7" used iron pipe from 0 to 78'.

Static level from surface: 11'.
Tested capacity: 90 gallons per hour.
Storage of water in well: 250 gallons.

NO ENVELOPE

COMPANY Virgil Eaton and Son
FARM Newlin, Morgan NO.
DATE DRILLED March 1957 COUNTY NO. 1424
AUTHORITY Virgil Eaton and Son
ELEVATION
LOCATION N 1/2 of NW SW
COUNTY CRAWFORD

18-8N-11W

LOG OF WATER WELL

Property owner Russell Rains Well No.

Drilled by Claude Miller Year 1962

Formations passed through	Thick-ness	Depth of Bottom
top soil	2	2
yellow H P	12	14
yellow sand	3	17
Gray H. P.	11	28
Green shale	2	30
gravel & sand	8	38

COUNTY No. 9190

[Continue on back if necessary]

Finished in Gravel & Sand at 30 to 38 ft.

Cased with 4 inch used pipe from 0 to 39 ft.

and ____ inch ____ from ____ to ____ ft.

Size hole below casing ____ inch. Static level from surf. 12 ft.

Tested capacity 9 gal. per min. Temperature ____ °F.

Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.

Length of test ____ hrs. ____ min. Screen ____

Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name Crawford Elev. ____ Sec. 18

Description of location ____ Twp. 8N

Rge. 11W

Signed Claude Miller County Crawford

CRAWFORD

Copy for Illinois State Geological Survey Index: 18-8N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Stephens, Gilbert Well No. ____
Address R.R. #1 Hutsonville IL
Driller Hacker, Delbert License No. 102-2003
11. Permit No. 127747 Date 10/27/86
12. Water from sand & gravel 13. County Crawford
at depth 10 to 14 ft. Sec. 18
14. Screen: Diam. 6 in. Twp. 8 N
Length: 4 ft. Slot .03 Rge. 11 W
Elev. ____

SE SE SW

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	0	10
6	SLOT PIPE	10	14

16. Size hole below casing: ____ in.
17. Static level ____ ft. below casing top which is ____ ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
surface	9	9
sand & gravel	5	14

Crawford 12-033-34185-00 18-08N-11W

)UESTED AND MAIL ORIGINAL TO STATE
)MER HEALTH PROTECTION, 535 WEST
. DO NOT DETACH GEOLOGICAL/WATER
PROPER V LOCATIC

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner CARL TINGLEY Well No. _____
Address RR#1 HUTSONVILLE
Driller JOSEPH REYNOLD License No. 92-601
11. Permit No. 54476 Date 11-76
12. Water from SAND & GRAVEL 13. County Crawford
Formation
at depth 27 to _____ ft.
14. Screen: Diam. _____ in.
Length: _____ ft. Slot _____

Sec. 18
Twp. 8N
Rge. 11W
Elev. _____

15. Casing and Liner Pipe

Diam. (in.)	Kind and Weight	From (Ft.)	To (Ft.)
36	CONCRETE	+3	-36

SHOW LOCATION IN SECTION PLAT
500' S line,
1500' W line,
NW (permit)

16. Size Hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. FORMATIONS PASSED THROUGH	THICKNESS	DEPTH OF BOTTOM
TOP SOIL		2
YELLOW CLAY		12
SANDY CLAY		19
HARD PAN		23
BLUE CLAY		27
SAND + GRAVEL		27'6"
BLUE CLAY		36

(CONTINUE ON SEPARATE SHEET IF NECESSARY)

SIGNED Joseph Reynolds DATE _____

COUNTY No. 30159

CRAWFORD 18-8N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Earleywine, Mike Well No. _____
Address R.R. #1 Hutsonville IL
Driller Hacker, Delbert License No. 102-2003
11. Permit No. 127748 Date 10/27/86
12. Water from sand 13. County Crawford
at depth 18 to 20 ft.
14. Screen: Diam. 6 in.
Length: 25 ft. Slot .03

Sec. 19
Twp. 8 N
Rge. 11 W
Elev. _____

15. Casing and Liner Pipe NW NE NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
6	PLASTIC	0	15
6	SLOT PIPE	15	40

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

18. Formations passed through	Thickness	Bottom
surface	7	7
clay	11	18
sand	2	20
gray dirt	20	40

Crawford 12-033-34186-00 19-08N-11W

(L)OG OF WATER WELL

(P)roperty owner Walter Griffith Well No. ____

(D)rilled by V. Eaton, West Union, Ill. Year ____

Formations passed through	Thick-ness	Depth of Bottom
clay	5	5
hardpan	6	11
sand (little water)	1	12
hardpan (solid)	2	14
gravel (little water)	2	16
gray hardpan	27	43
sand (lots of water)	2	45
yellow hardpan	5	50

COUNTY NO. 6497

S.S. # 19287

[Continue on back if necessary]

Finished in sand at 43 to 45 ft.

Cased with 6 inch iron from 0 to 50 ft.

and ____ inch ____ from ____ to ____ ft.

Size hole below casing ____ inch. Static level from surf. 12 ft.

Tested capacity 8 gal. per min. Temperature ____ °F.

Water lowered to ____ ft. ____ in. in ____ hrs. ____ min.

Length of test ____ hrs. ____ min. Screen ____

Slot ____ Diam. ____ Length ____ Bottom set at ____ ft.

[Show location in Section Plat]

Township name Hutsonville Elev. ____ Sec. 19

Description of location ____ Twp. 8N

Rge. 11W

Signed Virgil Eaton County Crawford

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ILLINOIS GEOLOGICAL SURVEY, URBANA

	Thickness	Top	Bottom
Soil and yellow clay	8		8
Soft silty mud	13		21
Solid hardpan	29		50
Dark gummy hardpan	16		66
Sand and gas	2		68
Dark gum hardpan	26		94
Sand and water	1		95
Limestone		95	
Total Depth			95

Finished in sand at 94 - 95'
Casing: 6" iron pipe from 0 - 95', slotted from 94 - 95'
Static level: 11' from surface
Tested capacity: 5 g.p.m.

REPORT OF GAS FLOW MEASUREMENT by W.F. Meents
April 27, 1971
Water temperature: 56°F, through 30 gallon tank in basement and 100' of buried line
Barometer reading: 29.34"
Gas Volume: In 2 minutes= 2 1/8" of gas in mason jar under water with 3 gallons of water per minute passing through
NOTE: Gas will burn

S.S. # 21760

*200' east of road

See map of area on back of log
NO ENVELOPE

(C)OMPANY Virgil Eaton
(F)ARM Griffith, Walter
(D)ATE DRILLED 1950
(A)UTHORITY Company
(EL)EVATION 492' T.M.
(LO)CATION 1800' S line, 800' W line of SW
(CO)UNTY CRAWFORD

NO.
COUNTY NO. 6496

19-8N-11W

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Page 1

ILLINOIS GEOLOGICAL SURVEY, URBANA

Strata	Thickness	Top	Bottom
Soil and clay		0	10
Yellow hardpan, solid		10	25
Gray hardpan, solid		25	37
Gray glacial mud, soft		37	48
Green and gray mud, soft		48	56
Gray hardpan, solid		56	64
Green and gray sand, good supply of water		64	65
Gray hardpan, solid		65	69
Gray sand, soft fine, more water		69	70
Gray mud and gravel soft		70	74
			TD

Casing: 6" from 0 to 74'.- 17# used iron pipe
Gravel pack method used.

Static level from surface 14'.
Tested capacity 270 gallons per hour
Storage of water in well 200 gallons.

NO ENVELOPE

COMPANY Virgil Eaton & Son
FARM Musgrave, Hershel NO.
DATE DRILLED February 1954 COUNTY NO. 1472
AUTHORITY Virgil Eaton & Son
ELEVATION
LOCATION NE NE NW
COUNTY CRAWFORD

19-8N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Storkman, Laddie Well No. #1
Address Hutchsonville IL
Driller Bartmess, John B License No. 102-1229
11. Permit No. 82788 Date 12/08/78
12. Water from sand 13. County Crawford
at depth 66 to 78 ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 19
Twp. 8 N
Rge. 11 W
Elev. ____

15. Casing and Liner Pipe 400' S 200'-W NEc NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
7	BLACK 20#	-1	78

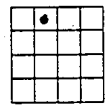
16. Size hole below casing: 6.25 in.
17. Static level 20 ft. below casing top which is 1 ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
clay	4	4
sand rock	36	40
softer sand	10	50
sand rock	16	66
water bearing sand	12	78
hard sand	8	86

Crawford 12-033-33868-00 19-08N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Vandevender, Leroy Well No. #1
Address Hutsonville IL
Driller Bartmess, John B License No. 102-1229
11. Permit No. 87751 Date 07/16/79
12. Water from gravel 13. County Crawford
at depth 76 to 81 ft.
14. Screen: Diam. ____ in.
Length: ____ ft. Slot ____
Sec. 19
Twp. 8 N
Rge. 11 W
Elev. ____



15. Casing and Liner Pipe 200' N 300' E SWc NE NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
7	BLACK 20#	-1	81

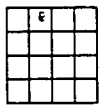
16. Size hole below casing: ____ in.
17. Static level 15 ft. below casing top which is 1 ft. above ground level. Pumping level ____ ft. when pumping at ____ gpm for ____ hours.

18. Formations passed through	Thickness	Bottom
clay	18	18
sand & gravel	7	25
mud & sand	20	45
mud	31	76
gravel	5	81

Crawford 12-033-33869-00 19-08N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

Property owner Wampler, Duane Well No. #1
Address R.R. #1 Sullivan IN
Well address Hutsonville, IL
Lot ____ Subd ____ ISWS P# 301186
Driller Hacker, Tim License No. 092-6477
Permit No. 033-1-97 Date 01/15/1997
Water from sand & gravel County Crawford
at depth 25 to 66 ft.
Screen: Diam. 12 in.
Length: 3 ft. Slot .06
Sec. 20
Twp. 8 N
Rge. 11 W
Elev. ____



Casing and Liner Pipe NE NE NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
12	SCH 40 PVC	0	32

Size hole below casing: ____ in.
Static level 11 ft. below casing top which is 1 ft. above ground level. Pumping level 0 ft. when pumping at 1000 gpm for ____ hours.

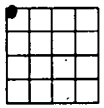
Formations passed through	Thickness	Bottom
topsoil	3	3
silty dark clay	17	20
gray clay	5	25
coarse gray sand with fine-med gravel	41	66
gray clay at	0	66

Irrigation

Crawford 12-033-36667-00 20-8N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Dement, Margaret R. Well No. _____
Address R.R. #1 Box #3 Hudsonville IL
Driller Erwin, Harold E. License No. 092-6402
11. Permit No. 139628 Date 02/10/89
12. Water from sand & gravel 13. County Crawford
at depth _____ to _____ ft.
14. Screen: Diam. 16 in.
Length: 30 ft. Slot .12
Sec. 20
Twp. 8 N
Rge. 11 W
Elev. _____



15. Casing and Liner Pipe NW NW NW

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
16	PVC WC SCH 80	2	64

16. Size hole below casing: _____ in.
17. Static level _____ ft. below casing top which is _____ ft. above ground level. Pumping level _____ ft. when pumping at _____ gpm for _____ hours.

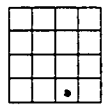
18. Formations passed through	Thickness	Bottom
SS #66941 (0'-65')	0	0
top soil	1	1
fine brown sand	12	13
coarse brown sand	32	45
gravel & sand	19	64

Irrigation

Crawford 12-033-35196-00 20-08N-11W

GEOLOGICAL AND WATER SURVEYS WELL RECORD

10. Property owner Hutsonville, City of Well No. #4
Address City Hall Hutsonville IL
Driller Petersen, Steven R. License No. 102-3092
11. Permit No. 132217 Date 06/01/87
12. Water from Alluvial 13. County Crawford
at depth 77 to 61 ft.
14. Screen: Diam. 10 in.
Length: 15 ft. Slot .08
Sec. 20
Twp. 8 N
Rge. 11 W
Elev. _____



15. Casing and Liner Pipe 557' N 1855' W SEc

Diam. (in.)	Kind and Weight	From (ft)	To (ft)
10	STEEL 40.48#/FT	-5	61

16. Size hole below casing: 24 in.
17. Static level 245 ft. below casing top which is 5 ft. above ground level. Pumping level 35 ft. when pumping at 400 gpm for 5 hours.

18. Formations passed through	Thickness	Bottom
fine dark brown sand	5	5
fine to medium sand	25	30
fine/med sand & gvl	43	73

Crawford 12-033-34405-00 20-08N-11W