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10/1/91

ATTACHMENT G

DESCRIPTION OF OPERATIONS
(ITEM 5. OF SES)

ATTACHMENT G

DESCRIPTION OF OPERATIONS

ARSYNCO, INC.
CARLSTADT, NJ

Arsynco has owned and operated the property known as Block 91, Lot 1 since 1969. As discussed in Attachment B, the property has been owned and operated by a number of chemical companies dating back to approximately the 1920s; these previous chemical companies conducted operations similar in nature to Arsynco. As shown on the facility Site Plan (Attachment F), the eastern portion of the property is known as Block 91, Lot 1, Tract 2. This section consists of approximately 2.8 acres and, due to constant ponding and flooding, this land has never been used by Arsynco and remains vacant. The main portion of the Arsynco property, known as Block 91, Lot 1, Tract 1, consists of approximately 9.5 acres of land. This section of the property contains all production operations and accommodates a total of 17 buildings of various sizes.

The main entrance/exit to the Arsynco facility is located on the south side of the site, at the end of 13th Street. A secondary entrance/exit is located on the northwest corner of the site, along the Berry Street extension. The majority of all deliveries to the facility occur through the 13th Street entrance.

Arsynco, Inc. is involved in the manufacture of specialty organic chemicals and pharmaceutical intermediates such as salts of phenylpropanolamine for inclusion in products such as Contact and Alka Seltzer Plus, propylene imine and derivatives, hair dyes (aromatic amines), silicone intermediates, a quarternary ammonium salt, propiophenone and isobutyrophenone. Operations are batch-type in nature, and batch sizes range from 200 to 3,000 pounds. A majority of the operations are manual. However, the steam and vacuum components of the processes are semi-automatic. Reactor vessels range in size from 200 to 2,000 gallons. Heat is supplied from steam, electricity or oil. After a manufacturing order is initiated, a batch schedule is completed and operating procedures are issued. A log sheet is maintained for every batch operation and must include all relevant process data (quantities, dates, etc.).

Raw materials are delivered to the site in a variety of containers including tank wagon, steel, plastic and fiber drums, bags, gas cylinders, bottles, cans etc. The facility also has numerous aboveground storage tanks for the bulk storage of certain process chemicals. There are two (2) major, diked tank farms at the site and numerous other vessels located inside and outside the site buildings. The exact size, contents and location of all tanks is

described in Attachment H. Raw materials, as well as intermediates and finished products, are stored at both designated indoor and outdoor locations, depending on the use and need for accessibility.

The hazardous waste storage area is located on the north side of Building #20 (Attachment F). This area is covered entirely with macadam, and has been in use since approximately 1991. Hazardous wastes had previously been stored in the former RCRA storage area located on the south side of the site.

All wastewater generated at the site from process operations (i.e., reaction water from process vessels and cleaning of vessels) and stormwater that collects in diked containment areas are routed to the facility wastewater treatment unit located on the south side of Building #5. The waste water is directed to the treatment unit via a series of floor drains and concrete lined troughs. Once wastewater enters the system, it progresses through a series of settling and skimming processes. The wastewater is then neutralized and directed to an air stripper for removal of volatile compounds. The composition of the water from the unit is monitored manually (continuous pH is measured automatically) and is discharged to the POTW operated by the Bergen County Utilities Authority (BCUA).

The following presents a brief description of the specific uses for each of the site buildings.

BUILDING #1

The northeast end of Building #1 is used for the storage of various raw materials used throughout the facility. The main portion of the building is used for the production of the following:

- Propiophenone and Isobutyrophenone - The basic raw materials for the processes which produce these materials are benzoic acid, mineral oil, a proprietary catalyst and propionic acid (for propiophenone) or isobutyric acid (for isobutyrophenone). These materials undergo a chemical reaction to yield the corresponding crude ketone. Crude propiophenone is purified in Building #1 via vacuum distillation and is packaged for shipment or internal use. Crude isobutyrophenone is purified via vacuum distillation in Building #6 and packaged for shipment.

- Methyl Aziridine Phosphine Oxide (MAPO) - Crude MAPO (see Building #6) is "degassed" and purified via high vacuum continuous distillation, then is sent to Building #4 for packaging and shipment.

- Quat D.S. - a-chloromethyl napthalene is reacted with lauryl dimethylamine using water as a solvent to yield Quat D.S. The resulting warm solution is clarified and cooled to room temperature. The crystalline product is isolated from the water liquor via centrifugation. The remaining water is removed from the wet solids in a double cone drier at 45° to 55° C under 40 mm Hg vacuum. The dry powder is then granulated to remove any large lumps and is packaged for shipment.

- Hair Dye - 022B - Intermediate 022A (see Bldg. #8) is reacted with mono ethanol amine in water at reflux (100° C) to yield 022B. The resulting solution is cooled to 20° to 25° C. The crystalline product is isolated from the water liquor via centrifugation. The wet solids are then tray dried at 60-70° C to remove the last trace of water. The dried solids are packaged and sent to Building #3 for milling and packaged for shipment (see Bldg. #3).

- Falba - In this process, white mineral oil, paraffin wax, bees wax, wool wax and lanolin are mixed in a tank at 65 to 80° C. The resulting solution is clarified (hot) and packaged in plastic-lined, 55-gallon steel drums and/or 5-gallon, plastic-lined steel pails, and sent to Building #4 for shipment.

BUILDING #2

Building #2, located on the south side of the site near the 13th Street entrance/exit, is used for the preparation of small size shipments and storage of finished products including SIMA, salicylic acid and salts of phenyl propanolamine. Cylinders containing inert gas (air, nitrogen, etc.) are stored next to the entrance to the building.

BUILDING #3

Building #3 is used for milling, packaging and storage of hair dye - 022B prior to shipment (see Bldg. #1).

BUILDING #4

Building #4 is used for the facility's shipping and receiving departments. Nearly all packaged raw materials are received at Building #4, and all finished product is shipped from this location. This building is also used for the packaging and storage

of small quantities of MAPO (see Bldg. #1), Propylene imine (see Bldg. #19) and other products manufactured throughout the facility.

BUILDING #5

Building #5 is located at the north side of the site and is used for the processing of solids. The processes conducted in Building #5 include drying and milling propanolamine hydrochloride (PPA·HCl) and hair dyes P-132 and P-148 (see Bldg. #8). Development of small size batches of specialty items are also dried, milled or granulated in this building, as the need may arise. PPA·HCl is dried in a rotary drier above 110° C. All other products are tray dried at 60 to 70° C. These products are also packaged for shipment at this location.

BUILDING #6

Building #6 is used for the manufacture of liquid chemicals including isobutyrophenone, MAPO, N-Methyl Acetamide, SIMA, HMS and TMC (pure) and melilotin. The following presents a brief description of the processes:

- Isobutyrophenone - See Building #1.
- MAPO - The basic raw materials used in this process are propylene imine, phosphorous oxychloride, sodium hydroxide, water and methylene chloride. These materials are manipulated and put through various reactions to form MAPO Crude. The MAPO is packaged in 55-gallon drums and sent to Building #1 for purification (see Bldg. #1).
- N-Methyl Acetamide - The basic raw materials used in this process are methyl acetate and 40% aqueous mono methylamine. These compounds are reacted to form N-Methyl Acetamide and methanol dissolved in water. Methanol and water are removed via fractional distillation. N-Methyl Acetamide is then purified via vacuum distillation and packaged in 55-gallon drums for internal use and/or shipment as finished product.
- SIMA - (Methyl-Vinyl bis(N-Methyl-acetamido) Silane). The basic raw materials used in this process are N-Methyl Acetamide, sodium methylate, methyl vinyl dichloro silane and xylol. These compounds are manipulated and put through a series of chemical reactions to form SIMA in xylol. The xylol is distilled off under vacuum, and the residual SIMA is filtered and packaged in 55-gallon drums for shipment.

- Homo Methyl Salicylate (HMS) - The basic raw materials for this process are methyl salicylate trimethyl cyclo hexanol (TMC - see Bldg. #8), a proprietary catalyst, sodium hydroxide, water and phosphoric acid. The raw materials are manipulated and reacted to yield a mixture of HMS and TMC. The TMC is removed via fractional distillation. HMS is then purified via vacuum distillation and packaged in 55-gallon drums for shipment.

- TMC (pure) and Melilotin - See Building #8.

BUILDING #7

Building #7 contains the production offices and the QC lab. No manufacturing is conducted in this building. The QC lab is used for analyzing raw materials, in-process samples and finished goods. The majority of the samples analyzed in this building are returned to the plant operations, and all waste samples are placed into appropriate containers for either disposal (within 90 days) of recycling/recovery. The first aid room and a lunch room are also located in this building. Building #7 also houses the monitoring alarms for the effluent treatment basin.

BUILDING #8

Building #8 is used for the manufacture of both solid and liquid chemicals including intermediate - 022A, hair dyes P-132 and P-148, PPA·HCl, TMC-crude and melilotin crude. The following presents a brief description of the processes used in the manufacture of each material:

- Intermediate - 022A - p-nitro floro aniline and ethylene oxide (E>O) are reacted (using water as a solvent) under approximately 15-20 PSIG to form 022A. Unreacted E>O is removed from the reactions mass via distillation and converted to ethylene glycol by acid hydrolysis. Wet 022A is isolated from the water liquor via centrifugation, packaged and sent to Building #1 to be used to manufacture hair dye 022B.

- Hair dyes P-132 and P-148 - The basic raw materials for these processes are m-ethanolamine, o-chloro nitro benzene (for P-132) and p-nitro floro aniline (for P-148). Water is used as a solvent in both procedures. The amine and halogenated compound undergo a chemical reaction to form the hair dye. The crystalline product is then isolated from the water liquor via centrifugation, packaged and sent to Building #5 for drying, milling and packaging for shipment.

- Phenyl Propanolamine Hydrochloride (PPA·HCl) - The basic raw materials used in this production process are propiophenone, sodium nitrite, methanol, sulfuric acid, hydrogen chloride, water, a proprietary catalyst, isopropyl alcohol, sodium hydroxide, toluene and muriatic acid. The raw materials are manipulated and put through a series of various reactions to form "wet" PPA·HCl which is sent to Building #5 for drying, milling and packaging. The solvents used in this process (IPA and toluene) are recovered and recycled for use in the process. The waste generated form the process is disposed of in accordance with all Federal, State and local regulations.

- TMC-Crude - Raw materials include isophenone, hydrogen and a proprietary catalyst. These materials are reacted under hydrogen pressure to form TMC-Crude. The product is clarified and transferred via pump to a storage tank outside Building #6 for use in HMS manufacture, or the product is purified via vacuum distillation and packaged for shipment.

- Melilotin Crude - The basic raw materials for this process are coumarin, hydrogen and a proprietary catalyst. These materials are reacted under hydrogen pressure to form Melilotin Crude. The product is clarified and sent in 55-gallon drums to Building #6 for purification via vacuum distillation and packaged for shipment.

BUILDING #9

Building #9 is connected to Building #3 (considered the same building) and is also used for storage of phenyl propanolamine, resale items (methyl and propyl paraben) and other products prior to shipment.

BUILDING #10

There is no Building #10.

BUILDING #11

Building #11, located on the north corner of the site, adjacent tot the Berry Street entrance/exit, is used for the storage of safety equipment and various supplies. No hazardous materials are stored in this building.

BUILDING #12

Building #12 is used to store maintenance supplies (glass, steel piping, etc.)

BUILDING #13

There is no Building #13.

BUILDING #14

Building #14 is used as the maintenance shop.

BUILDING #15

Building #15 is used as the guard house and is located adjacent to the 13th Street entrance/exit. This building also houses the facility's gas meter and air sampling pump for the LEL alarm on the effluent pipeline which is connected to the municipal sewer system (POTW-BCUA).

BUILDING #16

Building #16 is an office building and also contains the union employees lunch and locker room.

BUILDING #17 and BUILDING #18

Building #17 and Building #18 were formerly large capacity (150,000 gallon) aboveground storage tanks which were empty and abandoned long before Arsynco purchased the facility (prior to 1969). It is unknown what the tanks had been used for prior to Arsynco. The tanks are presently used as storage buildings. Permanent access doors were cut in each tank at the ground surface.

BUILDING #19

Building #19, located on the northeast portion of the site, is used for the production of Propylene Imine. The basic raw materials used in the production process are isopropanol amine, sulfuric acid, xylene, sodium acetate solution and sodium hydroxide. The raw materials are manipulated and put through various reactions to form Propylene Imine. The xylene is a solvent and is used to keep a solid intermediate (isopropanol amine sulfate)

dispersed during the manufacturing process. The recoveries generated from this process are temporarily staged in steel drums and later recycled for use in the processes.

BUILDING #20

Building #20 is located on the western portion of the site, and houses the offices of the Engineering and Regulatory Affairs (Health, Safety and Environmental) Departments, the Arsynco, Inc. Technical library and the analytical development laboratory. In the analytical development laboratory, R&D materials are analyzed, and procedures for the QC laboratory are developed.

ATTACHMENT L

HISTORICAL DATA ON ENVIRONMENTAL QUALITY
(ITEM 13. A. OF SES)

ENVIRONMENTAL ASSESSMENT REPORT

ARSYNCO, INC.
Carlstadt, NJ

Building 19 Area

Prepared for

ARSYNCO, INC.
Carlstadt, Bergen County,

Prepared by

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JMS Project #91055

October 1991

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ARSYNCO, INC.
Carlstadt, New Jersey

ENVIRONMENTAL ASSESSMENT REPORT

1.0 INTRODUCTION

J M Sorge, Inc. (JMS) was retained by Arsynco, Inc. to conduct a Site Assessment program in the area of Building #19 at their Carlstadt Plant. The Arsynco, Inc. - Carlstadt facility, is located at the Foot of 13th Street, Carlstadt, Bergen County, New Jersey (Figure 1). The Site Assessment program included soil sampling and a preliminary groundwater investigation. The results of the soil sampling program and groundwater investigation are respectively discussed in Sections 3.0 and 4.0 of this report.

1.1 SITE BACKGROUND

The Arsynco, Inc. Carlstadt Plant consists of several manufacturing/storage buildings situated on approximately 12.3 acre parcel (Figure 1.1). The property was acquired by Arsynco sometime in 1969, and has been used for the manufacturing of raw material for the pharmaceutical industries. According to the information obtained from the Plant Consultant, Mr. Wesley Bennett, the plant has been in existence since about 1907. The primary operation at the facility has been the batch production of specialty chemicals.

Building #19, the area of concern, was constructed sometime in the mid-1960s. The building is used for the manufacture of Propylene Imine. The basic raw materials utilized in the manufacturing process are isopropanol amine, sulfuric acid, xylene, sodium acetate solution, and sodium hydroxide. These compounds are reacted in the process to form Propylene Imine. Xylene is non-reactive and is used only to keep the precipitate of isopropanol amine sulfate in solution during the manufacturing process.

An enclosed tank farm is located adjacent to the southeast wall of Building #19. These above ground tanks are used for the storage of sodium hydroxide solution, sulfuric acid, toluene and isopropanol amine. A material staging area is located approximately 40 feet to the south and southeast of the tank farm (Figure 2).

A swale is located along the northern part of this area; the soil near this swale was sampled by the New Jersey Department Environmental Protection (NJDEP) in April 1991. The sample collected by NJDEP personnel was found to contain elevated levels of xylene and other volatile contaminants. On March 21, 1991, representatives of the Department determined that the pH within a portion

of the swale area ranged between 10 and 12. Subsequent investigations by the facility identified a crack in the containment wall which is believed to have been the source of the problem. The wall was repaired. In addition, Arsynco elected to conduct a more thorough investigation of this area. The results of the delineation borings and groundwater investigation conducted in this area are provided in Sections 3.0 and 4.0, respectively.

A cursory review of the recent issue of the NJDEP Hazardous Waste Program Status Report (1990), the USEPA's CERCLIS list and local regulatory agency's records showed that there are at least four (4) known, or suspected, hazardous waste sites within one-half radius of the Arsynco site. The known or suspected hazardous waste sites identified include Becton of East Rutherford, Scientific Chemical Processing of Carlstadt, Ventron/Velsicol of Carlstadt and Universal Oil Product Corp. of East Rutherford. A summary of the nature of their operations and type of contaminants identified in each site is provided in Appendix A. The hazardous site location map is also included in Appendix A.

2.0 ENVIRONMENTAL SETTING

2.1 GENERAL

The Arsynco Plant is located in Bergen County, New Jersey. The major land uses in the site area are industrial, commercial and residential. The nearest residential area is located approximately within one-half mile to the north (upgradient) of the site.

2.2 SOILS

The soil in the site area, according to the USDA Soil Conservation Service (Soil Survey of Bergen County, New Jersey, 1989) has been mapped as Udorthents wet substratum. Typically, this soil type consists of materials which have been smoothed or extensively disturbed to a depth of 3-feet or more. The fill material generally consists of a mixture of soil material with variable amounts of stones, boulders and rubble, and are somewhat poorly to very poorly drained. This unit is also subject to flooding or prolonged ponding.

Site specific soil information was obtained during installation of delineation soil borings and monitoring wells boreholes. According to the boring log data, the soils beneath the site consist of assorted fill material to the average depth of 5 feet. The fill materials encountered consisted mainly of fine to medium

sand with traces of silt, brick and concrete fragments. The meadowmat layer underlies the fill material and extends to the depth of approximately 9 feet below grade. A layer of grey silty, clayey sand and dense grey clay were encountered at the depth interval of 9 to 21 feet.

2.3 SITE SPECIFIC SURFACE DRAINAGE/TOPOGRAPHY

The site is located in the reclaimed portion of the grassy marsh area of the Hackensack River flood plain. The base topographic elevation of the site is approximately 4.5 feet above mean sea level (msl). Within the confines of the site, runoff from the property is directed toward the municipal storm/sanitary sewer via the effluent treatment basin. All surface drains on site discharge into the effluent treatment basin.

In addition, periodic flood water is drained from the site by a series of interconnecting ditches that run along the southeastern, southern and southwestern boundaries of the site. All ditches discharge into Berry Creek Canal, a tributary of the Hackensack River. The present site topography and drainage pattern have been significantly modified.

2.4 REGIONAL GEOLOGY/HYDROGEOLOGY

The Brunswick and Stockton Formations underlie Bergen County. The Brunswick Formation, the uppermost unit of the Newark Group, consists predominantly of interbedded brown, reddish-brown and gray shale, sandy shales, sandstones and some conglomerates. Overlying the rocks of the Newark Group are unconsolidated clay, sand, and gravel deposits of the Pleistocene and Recent Age. The Pleistocene deposits are the most widespread and are found throughout the County. These glacio-fluvial unconsolidated deposits are as much as 300 feet in thickness. In areas between valleys where bedrock surfaces, it ranges between 0 to 70 feet. Regional studies conducted in the area indicate that unconsolidated deposits range to a depth of up to 50 feet in thickness in this part of the County. The deposits consist of red-brown clay with some silt and sand. Groundwater is expected at a depth of about 5 to 6 feet below grade. Rocks of the Brunswick Formation are the main source of the groundwater in Bergen County. The shales and sandstones are generally capable of sustaining moderate to large yields. Wells in sandstone and shale of the Brunswick Formation yield from 35 to 870 gpm. The most productive wearing-bearing zones occur between depths of 300 to 400 feet.

2.5 SITE SPECIFIC GEOLOGY/HYDROGEOLOGY

Regional information indicates that bedrock will not be encountered at shallow depths due to the thickness of the stratified and unconsolidated glacio-fluvial sandy deposits typical of this area. Groundwater is encountered on-site at an average depth of 12.5 to 13.0 feet in the confined aquifer beneath the fill material and meadowmat overburden. Perched water is encountered within the fill overburden at 1.0 to 6.0 feet below grade.

The site is subject to tidal influences from the Hackensack River and the Newark Bay, which are located less than one-half mile to the east and south of the site, respectively. Groundwater flow beneath the site, although minimal, has a net gradient towards the adjacent Berry Creek.

Figures 5 and 6 are potentiometric maps completed from static water level measurements obtained on August 1, and 20, 1991, respectively. Please note that although groundwater flow is tidal in the site area, the net effect of the tide on actual groundwater flow is minimal. An analysis of the tidal induced component of groundwater flow is provided in Section 4.6.2. The groundwater flow analysis indicates that the net actual groundwater flow direction is toward the east and east/northeast.

3.0 SOIL SAMPLING PROGRAM

JMS conducted a soil sampling program in the area of building #19 during the period of June 21 through 26, 1991. The objective of the program was to delineate the horizontal and vertical extent of any contamination within the fill material overburden in the area. The method used by JMS conforms to current NJDEP guideline for sample quality control and analysis. Soil sampling activities were conducted in accordance with the NJDEP - Division Hazardous Waste Management (DHWM) Remedial Investigation Guide, March 1990 and the NJDEP Field Sampling Procedure Manual, February 1988. A discussion of the soil sampling activity is provided in Section 3.1; the analytical results are discussed in Section 3.2.

3.1 DELINEATION BORING ACTIVITY

A series of soil borings were installed in the areas of Building #19, the Tank Farm and Material Staging Area (Figure 3). The borings were installed in approximately 20-foot grid pattern utilizing either a trailer-mounted drill rig or a stainless steel hand auger. All borings were installed in accordance with JMS standard field procedures (Appendix B). Soil samples were collected from the depths of 1.5 to 2.0 feet and the 6-inch soil increment immediately above the meadowmat surface. Additional soil samples were collected from the 0 to 6-inch soil interval above the perched water zone. Boring logs are included in Appendix D.

A total of 60 borings were installed on the site (Figure 3). Field screening was used to aid in delineation and selection of samples for analysis. An Hnu photoionization detector (PID) was utilized in determining the approximate level of volatile organics within each boring. Samples collected were selectively analyzed for total volatile organics+15 (VO+15), base neutral+15 (BN+15) and total petroleum hydrocarbon (TPHC) based on the area of collection and field screening results. All soil samples collected were analyzed by Accutest Laboratories of Dayton, NJ. Accutest is a NJ-certified laboratory capable of conducting the required analysis. The results of the delineation borings are discussed in Section 3.2, a summary of the analytical results is provided in Table 1.

3.2 SOIL SAMPLING RESULTS

The results of the soil investigation confirm the presence of volatile organic (VO) materials within the industrial fill material at various points across the area investigated. The elevated VO concentrations appear to be concentrated within the immediate vicinity of Building #19, the tank farm and the material staging area. Volatile organics were detected in all samples collected at concentrations varying from .024 to 14,200 parts per million (ppm). The highest levels of VOs detected were obtained from borings ARSD-33, ARSD-36, ARSD-41 and ARSD-53.

These borings, except for ARSD-53, are located along, and within 2-feet of, the northern, eastern and southern walls of Building #19. ARSD-53 is located approximately 40 feet to the southwest of Building #19 (Figure 3).

The major VO parameters identified in all samples analyzed were xylene, ethylbenzene/benzene and toluene. Trace levels of methylene chloride, chloroform and trichlorofluoromethane were also detected. In addition, a slightly elevated PHC level was detected in most of the borings, with the highest concentration (1600 ppm) being detected in ARSD-36 and ARSD-55. Trace levels of base neutrals (BN) were also detected in selected samples ranged from 1.3 ppm to 7.7 ppm. Detailed laboratory results are included in Appendix C. These BN levels are well below current State action levels.

During the soil sampling activity, an Hnu PID was used in determining the approximate level of the aromatic compounds in each boring. The data obtained were used to plot a contaminant isopleth map (Figure 4). As indicated on the map, two (2) separate areas of elevated readings (hotspots) exist. One is located between Building #19 and the tank area, and the other is within the drum storage area. This pattern is relatively consistent with the laboratory analytical data obtained for this area.

4.0 GROUNDWATER INVESTIGATION PROGRAM

A groundwater investigation program was implemented by JMS to characterize the nature and extent of any groundwater contamination in the area of Building #19. The objective of this investigation was to evaluate the environmental quality of the groundwater within the perched zone above the meadowmat, and within the first true groundwater beneath the meadowmat layer. In addition, the groundwater flow direction was also evaluated. Four (4) monitoring wells (MW-1 through MW-4) were installed during this phase of groundwater investigation.

4.1 MONITORING WELL INSTALLATION

A total of four (4) monitoring wells were installed on-site during the period of July 15 through 17, 1991. The wells were installed by Milltown Drilling & Excavation, Inc. (MDE) of Somerville, NJ with the direct supervision of a NJ-licensed well driller and JMS hydrogeologist. A NJDEP well permit was obtained for each well prior to drilling and installation. Copies of well permits are provided in Appendix E.

The locations of the wells are illustrated on Figures 5 and 6. Monitoring wells MW-1 through MW-3 were installed in a triangular pattern around Building #19 and the adjoining tank farm. The wells were installed in the native soils beneath fill material and meadowmat overburden and were designed to assess the impact of the facility operation on groundwater beneath the site. Monitoring well MW-4 was installed in the overburden only to evaluate water quality within this perched zone.

4.2 WELL BORINGS

The borings for the monitoring wells were installed utilizing a truck-mounted, Mobil B-80 air-rotary drill rig. During the drilling, a JMS geologist maintained the soil boring logs and supervised the overall drilling program. Split-spoon soil samples were collected during the advancement of each well boring. All samples collected were logged and screened in the field utilizing an Hnu photoionization organic vapor detector. The drilling equipment was steam cleaned between borings to prevent cross-contamination as per NJDEP guidelines. The depths of the 8-inch diameter boreholes for wells MW-1 through MW-4 were approximately 21, 22.5, 21 and 8 feet, respectively. Boring logs and well construction diagrams are included as Appendix D.

4.3 MONITORING WELL CONSTRUCTION

Monitoring wells MW-1 through MW-4 were constructed of 4-inch OD, Schedule 40 PVC well screen (#20 slot size), and flush-joint threaded casing. All PVC sections were coupled with threaded, flush joints and PVC well caps were placed at the base of the screens. Except for MW-2 and MW-4, all wells on-site were completed with a stick-up steel protective casing. MW-2 and MW-4 were completed as flush-mount installation. Construction details and as-built certifications for each well are included in Appendices D and F, respectively.

The specific well construction details were field determined based on the depth to groundwater. MW-1 through MW-3 were cased off to the depth of the meadowmat and screened within the true groundwater. MW-4 was installed and screened within the fill material above the meadowmat. In each well, the well screen was extended at least 2 feet above the first saturated soil encountered. Once the screen and casing were set in the borehole, a Morie #2 sand filter pack was introduced in the annular space to approximately 1-foot above the top of the screen. A bentonite pellet seal was placed on top of the filter pack. The remainder of the annular space was tremie-grouted with cement/bentonite grout slurry. A steel protective casing or manhole with a locking cap was cemented at the surface to induce runoff away from the well, and to prevent unauthorized entry into the well.

4.4 WELL DEVELOPMENT/SURVEY

Upon completion of the well construction, each well was developed to remove residual sediments. The wells were pumped utilizing the Mobile B-80, truck-mounted pumping unit. Each well was pumped continuously for 1-hour or until clear of all fines.

An elevation/location survey was completed by John Cilo Associates of Somerville, NJ and Chester DiLorenzo of JMS. The top of the protective steel manhole or casing and inner PVC casing (cap-off), as well as the adjacent ground surface, were surveyed to the nearest one-hundredth of a foot with reference to NJGSC datum. The horizontal location of each well was measured with reference to latitude and longitude. Copies of the monitoring well location certification, Form B, are provided in Appendix F.

4.5 GROUNDWATER SAMPLING

Groundwater sampling was conducted on-site on August 1, 1991, approximately 2-weeks after the installation and development of the wells. The laboratory analytical results for the groundwater samples collected are discussed in Section 4.5.1.

Prior to collecting groundwater samples, the depth to the static water was determined in each well. Water level measurements were obtained using an electric water level indicator. Prior to well

sampling, a minimum of three (3) well volumes of water were removed from each well with a stainless steel submersible pump fitted with a new length of inert tubing. No sheen or floating product was observed in any of the wells. A copy of JMS standard groundwater sampling procedures is provided as Appendix B.

Following purging, the wells were allowed to recover with fresh formation water to near static level before sampling. The well purging equipment was decontaminated between wells in order to minimize potential cross-contamination.

4.5.1 Groundwater Sampling Results

The groundwater samples collected from each well were analyzed for PHC, VO+15, BN+15 and pH. Except for MW-2, no PHC contamination was identified in any of the wells on-site at, or above, the laboratory detection limit. Trace levels of BN compounds were detected only in MW-2 and MW-3. Volatile organic compounds were detected in MW-1 through MW-4 at concentrations of 10.3, 75.8, .031 and .082 ppm, respectively. The pH measurement in the wells ranged from 6.3 to 6.75 ppm. A summary of the analytical results is provided in Table 2; detailed results are included in Appendix A.

4.6 PRELIMINARY AQUIFER TESTING PROGRAM

4.6.1 Slug Tests Results

JMS conducted slug tests for the monitoring wells on-site on August 27 through 28, 1991. The tests were conducted in order to assess aquifer conditions. Prior to slug injection, groundwater level measurements were collected from all wells. Pressure transducers were utilized to monitor water level fluctuations in each well. Each transducer was connected to Telog data recorders that were pre-programmed to record every 10-second interval.

Slug test could not be conducted on MW-2 and MW-4 due to their location and/or construction. Both wells are flush-mounted installations. MW-4 is shallow with a total depth of 8 feet, and receives surficial recharge. MW-2 is located in the driveway area that is subject to periodic flooding. These factors were responsible for the elevated groundwater level condition in each of these wells, thereby making it impossible to complete an accurate slug test.

The results obtained for the MW-1 and MW-3 slug tests indicate that the wells installed in the native soils exhibit characteristics typically encountered within confined aquifers. The native soils which consist primarily of fine to medium sand and silty, clayey sand exhibit a characteristically low permeability. The calculated average hydraulic gradient is .0018 ft/ft and the linear velocity for groundwater is estimated at 0.0043 ft/day or 1.58 ft/year. The slug injection/extraction calculation data and

values for hydraulic conductivity (k), transmissivity (t) and the co-efficient of storage (s) for each well are presented in Appendix G. As discussed in the following section, JMS conducted an analysis of tidal influence, which confirmed that tidal changes have no significant impact on the actual groundwater flow gradient beneath the site.

4.6.2 Groundwater Flow Analysis

JMS conducted a tidal influence study at the facility during the period of August 20 through 26, 1991. The study was conducted in order to determine the impact (if any) of tidal influences on the local groundwater elevation. Pressure transducers were installed in all wells on-site and were used to monitor the groundwater fluctuations in the wells. Each transducer was connected to a Telog data recorder that was pre-programmed to record every 1-minute interval.

The data obtained indicates that the site is subject to tidal influences and periodic flooding, especially after heavy rainfall. A plot of the groundwater level changes over the monitoring period is provided in Figure F. The determined average maximum variational changes in water elevation in MW-1 and MW-3 during this monitoring period are 0.21 feet and 0.25 feet, respectively. MW-3 is the closer well to the shoreline. A summary data of the tidal data for each well is provided in Tables 3A through 3D, respectively. As previously noted, the data obtained for MW-2 and MW-4 are somewhat erratic and poorly defined. This was the result of the heavy rainfall and subsequent surface flooding which occurred following a period of heavy thunderstorms which occurred on August 21-22, 1991.

Groundwater elevation data was obtained from each well on August 1st, and August 20th, 1991, respectively. These data were used to plot a potentiometric map for each day. The groundwater level data obtained from well MW-4 was not incorporated in the data plot since this well is screened only in the perched water zone above the meadowmat. The two (2) potentiometric maps generated are provided as Figures 5 and 6.

Groundwater flow direction across the site is affected by tidal variations. Therefore, a continuous water level recording program was conducted to determine the net flow direction in the area. The data obtained was used in calculating the net hydraulic gradient and groundwater net flow distance or velocity within the confined aquifer during each tidal cycle.

The mean groundwater elevation in MW-1 and MW-3 was determined by averaging the groundwater elevation in each well throughout the daily tidal cycle. The average (mean) changes in groundwater elevation in MW-1 and MW-3 were 0.15 and 0.16 feet, respectively. The time fractions for tidal-induced fluctuations to occur at the site are 12.34 hours for the positive subcycle, and 12.12 hours for the negative subcycle. The calculated average net hydraulic gradients associated with the tidal effects in the area, using Serfes' formula (Serfes, 1989), are 0.00126 ft^2 and 0.00129 ft^2, respectively.

Serfes' formula was also used in estimating the net component of flow associated with the tidal effects in the site area. Note that this formula ignores the effect of porosity on groundwater velocity. The estimated tidal induced groundwater flow distance in this area of the site during the positive subcycle is approximately 0.000471 feet, and the conceptual flow is to the west. During the negative subcycle tidal induced groundwater flow is toward the east (approximately .000464 feet). Subtracting one from the other yields a net tidal induced mathematical flow estimate of 0.000007 feet in the direction of MW-3 per tidal cycle. Essentially, this confirms that there is no net tidal induced flow. Due to the extremely low mean hydraulic gradient in this confined aquifer, no reversal in groundwater occurs. Only a negligible change in groundwater flow velocity, due to tidal influences, may exist. The raw data and pertinent calculations are provided in Appendix H. Therefore, the minuscule net tidal effect can be neglected in estimated actual groundwater flow at the site.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

During implementation of the sampling and analytical program, the Quality Assurance/Quality Control (QA/QC) procedures recommended by NJDEP for similar investigations were strictly followed. The detailed sampling procedures and field equipment decontamination procedures are outlined in the following subsections.

5.1 SOIL AND GROUNDWATER SAMPLING PROCEDURES

A stainless steel hand auger was utilized in collecting the soil samples. Water samples were collected with a stainless steel hand bailer. During soil sample collection, a JMS geologist maintained logs of all subsurface materials encountered and was also responsible for sample collection.

Between sample collections, all sampling equipment was thoroughly decontaminated to minimize potential cross-contamination. The detailed sampling and decontamination procedures are included in Appendix B.

5.2 LABORATORY ANALYSES

All soil and water samples collected were analyzed either by Envirotech Research of Edison, NJ or Accutest Laboratories of Dayton, NJ. Both are NJDEP-certified laboratories capable of conducting the required analysis. The soil samples collected were analyzed for PHC, VO+ and BN+15. Groundwater samples were analyzed for VO+15, PHC, BN+ and pH.

The organic analysis was conducted using GC/MS methodologies for the most recent version of Methods 624, and 625 (49 FR, No. 209, October 24, 1984, as revised in 50 FR, No. 32, January 4, 1985) and "Test Methods for Evaluating Solid Waste", USEPA SW 846, 2nd edition, July 1982, with the current revisions. The petroleum hydrocarbons analysis was conducted by Infrared Spectrophotometry (EPA Method 418.1). The priority pollutant metal analyses were conducted using EPA Methods provided in "Methods for Chemical Analysis of Water and Wastewater" (EPA 600/4-79-0200).

In addition, the standard QA/QC samples (such as lab blank, duplicate/spike samples) were analyzed by the laboratories during the soil analysis. A copy of each certified laboratory quality assurance manual has previously been submitted to NJDEP.

6.0 CONCLUSIONS

JMS conducted a soil and groundwater investigation in the area of Building #19 at the Arsynco - Carlstadt Plant. The soil delineation boring/sampling program was conducted in order to determine the horizontal and vertical extent of contamination within the fill overburden. Also, it was to be used in locating "hotspots" or possible source(s) of contamination (if any). The objective of the groundwater investigation was to evaluate the impact of the site operations on groundwater quality, and determine groundwater flow direction.

6.1 SOILS RESULTS

The results of the soil sampling activity confirm the presence of contamination within the fill material. Volatile organic contamination was identified in several borings. The principal contaminants detected consisted of xylene, ethylbenzene and toluene. Of these, xylene constitutes approximately 80% of the total VOC concentration identified in the soils. The highest concentration of VOCs were detected within the immediate vicinity of Building #19 (between Building 19 and the Tank Farm) and within the drum storage area.

There does not appear to be any significant horizontal or vertical migration of contamination (specifically xylene) within the fill material or into the underlying native soil beneath the meadowmat. No xylene was detected in MW-3 which is located downgradient from MW-2. Only a trace level of xylene (.008 ppm) was detected in MW-4. None of the previously listed chlorinated solvents were detected in MW-3 or MW-4.

Conceptual soil remediation could be accomplished using either in-situ methods, on-site treatment or off-site disposal. The volume and nature of the soils involved, as well as the nature of the surrounding area precludes soil removal for on-site treatment or disposal.

In-situ methods of soil treatment include bioremediation, soil venting, and various soil washing alternatives. Soil washing methods are generally not as practical due to the large volume of liquid waste which is generated. Therefore, our initial evaluation of remedial alternatives will concentrate on bioremediation techniques and soil venting methods. The following provides a brief summary of the advantages/disadvantages of these methods.

Bioremediation

Bioremediation utilizes hybrid bacteria to destroy contaminants within the soil. Using a site-specific mix of bacteria types and nutrients, this method can be used effectively to destroy a broad range of organic contaminants. The viability of this method depends on the effectiveness of the installed nutrient distribution system. The nutrient distribution system consists of a combination of injection well points, trenches, or spray irrigation techniques. The objective is to maintain a uniform nutrient level throughout the affected soil zone. Utilization of this technique requires completion of a laboratory treatability study, followed by a permitted pilot scale study at the site.

Vapor Extraction

Vapor extraction techniques have proven to be very effective in remediating volatile organic contamination in soils. The method utilizes a series of vacuum wells and trenches to withdraw saturated air within the void spaces in soils. As the saturated air is withdrawn and replaced by fresh air contaminants desorb off soil particles and the process is repeated. The exhaust air is directed through a permitted treatment system in accordance with a valid air pollution discharge permit. This approach would require that the facility either modify their existing air permit, or obtain a new permit for this approach. Preliminary site investigations would be required to determine the effective radius of induced air flow within the native soils.

On site soil remediation alternatives utilize the same basic treatment methods. However, treatment is conducted within a confined area which affords better nutrient or air flow control. However, since the soil must be excavated and placed within the treatment unit, permitting requirements are far more complex. Therefore, due to current regulatory constraints, on-site treatment methods are not practical.

6.2 GROUNDWATER RESULTS

The sample analysis results indicated minor, to slightly elevated, VOC contamination except in the case of MW-2. MW-2 exhibited the most significant concentrations of VOC and PHC contamination. Total VO and PHC concentrations were 75.8 and 1.4 ppm, respectively. This well also contains several chlorinated solvents such as 1,1-dichloroethane, 1,1-dichloroethene, trans 1,2-dichloroethene, 1,1,1-trichloroethane and vinyl chloride. None of these listed compounds were identified in any of the soil samples. Further, these compounds are reportedly not utilized in the site operation. Therefore, a possible off-site source is suspected.

The boring logs for wells MW-1 through MW-3 clearly show the presence of a continuous layer of meadowmat and dense clay unit beneath the fill material. However, this layer was probably penetrated during construction of the main plant foundation in the area of well MW-2. The fill material is not homogeneous and consists of a variety of soil types. The clay layer has apparently isolated the true groundwater from serious contamination, except in the case of MW-2. This is illustrated by the normal pH range of 6.3 to 6.4 measured in the well water as compared to the 10 to 12 pH range previously obtained in the swale. The results obtained from the aquifer testing activity indicate that groundwater movement beneath the site is extremely slow.

The source of the contamination identified in well MW-2 has not been determined. The nature of the contaminants identified suggest a possible off-site source. As indicated in Appendix A, there are several industrial sources upgradient of the site. Most of the facilities are either currently under investigation or have completed investigations in the past. A thorough review of the information available with the State files regarding these adjacent sites must be conducted.

The groundwater flow analysis results confirmed that groundwater moves very slowly beneath the site. The results obtained for well MW-3 confirm that the contamination detected in well MW-2 does not extend to the Arsynco site boundary. Therefore, there is no immediate concern regarding offsite migration. However, further investigation to identify the source and remedial measures could be appropriate.

6.3 FURTHER INVESTIGATIONS

Following receipt of the Department's comments regarding the results of this investigation, the Phase II Arsynco investigation will commence. The objective of the Phase II program is two-fold. First, JMS proposes additional investigations to identify the source of the groundwater contamination identified in well MW-2. Second, initial treatability studies will be conducted on soils in the Building #19 area to determine an acceptable remediation approach for this area.

JMS will evaluate the data available within State files regarding the principal industrial sites located upgradient of the Arsynco site. Specifically, our review will center on the types of chemicals used on the site,a groundwater sampling results, and groundwater flow data. Based on the results of this data review, we will propose the location(s) for one or two additional site wells. The well locations and our rationale for placement will be discussed with the Department prior to well installation.

JMS proposes to proceed with preliminary investigations to determine the feasibility of utilizing either bioremediation or vapor extraction methods to remediate the Building #19 area. The bioremediation program will consist of completing laboratory scale treatability tests on several fill soil samples. The laboratory results will confirm the effectiveness of treatment and provide some information regarding the anticipated duration of the site remediation program. In addition, JMS will conduct additional hydraulic testing to determine if a practical means of nutrient dispersal can be designed for the site.

A series of air-flow induction tests will be conducted on wells MW-1, 3 and 4. The objective will be to define the radius of induced air flow within the fill soils. Additional vapor extraction test points may also be required to complete our assessment of this method. The objective of this testing is to provide sufficient information to design a collection system capable of remediating the area. In addition to the collection system testing, JMS will conduct laboratory scale vapor extraction tests to determine if vapor extraction is an effective remediation technique for the contamination present in these fill soils. In addition, the laboratory results would provide an indication of the duration of the program required to effectively remediate the Building #19 area.

The results of these investigations will be summarized in a complete Phase II report for evaluation by the Department. The Phase II investigation will provide sufficient information to select a remedial method for the Building #19 area, identify the source of the groundwater contamination present, and allow the facility to proceed with obtaining necessary permits, etc., to implement the soil remediation plan. The Phase II investigation will commence following receipt of comments or recommendations by the Department.

Table 1
Arsynco, Inc. - Carlstadt, NJ
Delineation Boring Sample Result Summary

Sample No.	ARSD-1	ARSD-3B	ARSD-9B	ARSD-12	ARSD-17	ARSD-19	ARSD-21B	ARSD-25
Date Collected	6/21/91	6/21/91	6/24/91	6/24/91	6/24/91	6/24/91	6/24/91	6/24/91
Depth Range (Feet)	1.0-1.5	2.0-2.5	2.25-2.75	1.5-2.0	1.5-2.0	1.5-2.0	2.5-3.0	1.5-2.0
VOLATILE ORGANICS (ppb)								
BENZENE	NA	ND	ND	ND	35000	110	25000	ND
CHLOROFORM	NA	ND	ND	ND	ND	22	ND	ND
ETHYLBENZENE	NA	ND	ND	ND	89000	190	44000	ND
METHYLENE CHLORIDE	NA	ND	ND	ND	1900 B	22 JB	390 JB	ND
TOLUENE	NA	6.0	14	90	5400	4100	17000	ND
TRICHLOROFLUOROMETHANE	NA	ND	ND	ND	ND	220	ND	5 J
m-XYLENE	NA	10	ND	ND	290000	770	240000	ND
p,o-XYLENE	NA	7.2	10	310	130000	720	90000	ND
TOTAL VOLATILES	NA	23.2	24	400	551300	6154	416390	5
FORWARD LIBRARY SEARCH								
IDENTIFIED PEAKS	NA	81 (1)	ND	5514 (5)	39430 (12)	8790 (6)	51540 (14)	ND
UNKNOWN PEAKS	NA	8 (1)	ND	120 (1)	1500 (1)	19 (1)	500 (1)	ND
BASE NEUTRALS (ppb)								
PRIORITY SEARCH								
BIS(2-ETHYLHEXYL)PHTHALATE	NA	NA	NA	NA	2900	NA	NA	NA
DI-N-BUTYL PHTHALATE	NA	NA	NA	NA	440 J	NA	NA	NA
DI-N-OCTYL PHTHALATE	NA	NA	NA	NA	ND	NA	NA	NA
NAPHTHALENE	NA	NA	NA	NA	4400	NA	NA	NA
PHENANTHRENE	NA	NA	NA	NA	ND	NA	NA	NA
TOTAL PRIORITY BNs	NA	NA	NA	NA	7740	NA	NA	NA
FORWARD LIBRARY SEARCH	NA	NA	NA	NA		NA	NA	NA
IDENTIFIED PEAKS					932000 (15)			
UNKNOWN PEAKS					ND			
PETROLEUM HYDROCARBONS (ppm)	47	780	38	170	480	59	780	48

NOTES: ND - not detected above method detection level
NA - not analyzed
ppm - parts per million
ppb - parts per billion
B - found in lab blank
J - below detection limit

Table 1 cont.
Arsynco Inc. - Carlstadt, NJ
Delineation Boring Sample Result Summary

Sample No.	ARSD-33	ARSD-36	ARSD-41B	ARSD-42	ARSD-44B	ARSD-47	ARSD-53	ARSD-55	ARSD-58
Date Collected	6/25/91	6/25/91	6/25/91	6/25/91	6/25/91	6/25/91	6/26/91	6/26/91	6/26/91
Depth Range (Feet)	1.0-1.5	.75-1.25	2.5-3.0	1.5-2.0	2.75-3.25	1.5-2.0	1.0-1.5	.75-1.25	.75-1.25
VOLATILE ORGANICS (ppb)									
BENZENE	ND	ND	ND	ND	NA	NA	110000	ND	NA
CHLOROFORM	ND	ND	ND	ND	NA	NA	ND	ND	NA
ETHYLBENZENE	2000000	1500000	130000	220000	NA	NA	1300000	ND	NA
METHYLENE CHLORIDE	ND	ND	15000 B	3100	NA	NA	37000	970 B	NA
TOLUENE	81000	2700000	ND	4300	NA	NA	49000	ND	NA
TRICHLOROFLUOROMETHANE	ND	ND	ND	ND	NA	NA	ND	ND	NA
m-XYLENE	5200000	5900000	410000	930000	NA	NA	3300000	7400	NA
p,o-XYLENE	4100000	4100000	310000	520000	NA	NA	2500000	3400	NA
TOTAL VOLATILES	11381000	14200000	865000	1677400	NA	NA	7296000	11770	NA
FORWARD LIBRARY SEARCH									
IDENTIFIED PEAKS	198000 (5)	ND	ND	ND	NA	NA	ND	1900 (1)	NA
UNKNOWN PEAKS	ND	ND	ND	ND	NA	NA	ND	ND	NA
BASE NEUTRALS (ppb)									
PRIORITY SEARCH									
BIS(2-ETHYLHEXYL)PHTHALATE	4300	840	NA	NA	NA	NA	5000	NA	NA
DI-N-BUTYL PHTHALATE	ND	ND	NA	NA	NA	NA	ND	NA	NA
DI-N-OCTYL PHTHALATE	ND	ND	NA	NA	NA	NA	180 J	NA	NA
NAPHTHALENE	ND	240 J	NA	NA	NA	NA	ND	NA	NA
PHENANTHRENE	ND	200 J	NA	NA	NA	NA	ND	NA	NA
TOTAL PRIORITY BNs	4300	1280	NA	NA	NA	NA	5180	NA	NA
FORWARD LIBRARY SEARCH			NA	NA	NA	NA		NA	NA
IDENTIFIED PEAKS	471400 (14)	656100 (15)					285000 (14)		
UNKNOWN PEAKS	1200 (1)	ND					640 (1)		
PETROLEUM HYDROCARBONS (ppm)	580	1600	380	640	610	280	650	1600	100

NOTES: ND - not detected above method detection level
NA - not analyzed
ppm - parts per million
ppb - parts per billion
B - found in lab blank
J - below detection limit

Table 2

Arsynco, Inc. - Carlstadt, NJ

Groundwater Sample Results Summary

Sample No.	MW-1	MW-2	MW-3	MW-4	FB-8/1	TB-8/1
Date Sampled	8/1/91	8/1/91	8/1/91	8/1/91	8/1/91	8/1/91
VOLATILE ORGANICS (ppb)						
BENZENE	ND	ND	5.4	40	ND	ND
CHLOROBENZENE	ND	ND	13	18	ND	ND
1,1-DICHLOROETHANE	170	3000	ND	ND	ND	ND
1,1-DICHLOROETHENE	ND	230 J	ND	ND	ND	ND
TRANS-1,2-DICHLOROETHENE	8200	13000	ND	ND	ND	ND
ETHYLBENZENE	ND	690	2.5 J	11	ND	ND
METHYLENE CHLORIDE	ND	7600	ND	ND	ND	ND
TOLUENE	ND	7000	10	5 J	ND	ND
1,1,1-TRICHLOROETHANE	ND	14000	ND	ND	ND	ND
TRICHLOROFLUOROMETHANE	ND	2000	ND	ND	ND	ND
VINYLE CHLORIDE	1900	25000	ND	ND	ND	ND
XYLENES (TOTAL)	ND	3300	ND	7.8	ND	ND
TOTAL VOLATILES (ppb)	10270	75820	30.9	81.8	ND	ND
IDENTIFIED PEAKS	ND	ND	48 (4)	162 (6)	ND	ND
UNKNOWN PEAKS	ND	ND	7 (1)	16 (1)	ND	ND
BASE NEUTRALS (ppb)						
1,4-DICHLOROBENZENE	ND	ND	1.1 J	ND	ND	NA
1,2-DICHLOROBENZENE	ND	ND	8.6 J	ND	ND	NA
ISOPHORONE	ND	3 J	ND	ND	ND	NA
DIETHYLPHTHALATE	ND	26	ND	ND	ND	NA
TOTAL BASE NEUTRALS (ppb)	ND	29	9.7	ND	ND	NA
IDENTIFIED PEAKS	305 (4)	6310 (9)	1784 (7)	5195 (7)	ND	NA
UNKNOWN PEAKS	42 (5)	1489 (6)	144 (8)	670 (8)	ND	NA
PETROLEUM HYDROCARBONS (ppm)	ND	1.4	ND	ND	ND	NA
pH (STANDARD UNITS)	6.7	6.3	6.4	6.75	NA	NA

NOTES: ND - not detected
NA - not analyzed
J - below detection
( ) - # of peaks
ppm - parts per million
ppb - parts per billion

TABLE 3A

ARSYNCO INCORPORATED - CARLSTADT, NJ

TIDAL INDUCED GROUNDWATER FLUCTUATION DATA SUMMARY

MW-1

DATE	TIME	CHANGE IN WATER LEVEL (feet) (+ up, - down)	TIDAL
8/20/91	18:43:53	+0.26	
8/20/91	23:28:53	-0.15	-
8/21/91	16:58:53	-0.07	-
8/21/91	20:34:53	+0.17	+
8/22/91	17:04:53	-0.22	-
8/22/91	21:12:53	+0.16	+
8/23/91	06:33:53	-0.11	-
8/23/91	08:54:53	+0.04	+
8/23/91	16:14:53	-0.13	-
8/23/91	21:12:53	+0.16	+
8/24/91	06:53:53	-0.12	-
8/24/91	09:00:53	+0.06	+
8/24/91	15:41:53	-0.09	-
8/24/91	22:31:53	+0.24	+
8/25/91	08:27:53	-0.18	-
8/25/91	10:25:53	+0.09	+
8/25/91	17:38:53	-0.14	-
8/25/91	23:09:53	+0.26	+
8/26/91	08:51:53	-0.20	-

NOTE:

+ = HIGHEST LEVEL IN FEET

- = LOWEST LEVEL IN FEET

TABLE 3B

ARSYNCO INCORPORATED - CARLSTADT, NJ

TIDAL INDUCED GROUNDWATER FLUCTUATION DATA SUMMARY

MW-2

DATE	TIME	CHANGE IN WATER LEVEL (feet) (+ up, - down)	TIDAL
8/21/91	20:43:48	+0.23	+
8/22/91	05:45:48	-0.17	-
8/22/91	06:37:48	+0.18	|
8/22/91	06:53:48	-0.18	Thunderstorm (?)
8/22/91	11:39:48	+0.98	+ tidal
8/22/91	13:07:48	-2.98	(anomalous
8/22/91	14:28:48	+7.79	undefined)
8/23/91	00:54:48	-8.93	|
8/23/91	01:35:48	+0.69	|
8/23/91	02:31:48	-1.07	|
8/23/91	11:31:48	+3.58	+
8/23/91	15:43:48	-1.82	-
8/23/91	17:55:49	+0.65	+
8/24/91	00:20:49	-1.81	?
8/24/91	05:21:49	+3.21	?
8/24/91	17:28:49	-0.85	-
8/25/91	14:29:48	+0.82	?
8/25/91	15:20:49	-2.31	?
8/25/91	16:22:49	+2.52	?
8/26/91	01:31:49	-3.02	?
8/26/91	10:56:49	+3.66	?

NOTE:

+ = HIGHEST LEVEL IN FEET

- = LOWEST LEVEL IN FEET

TABLE 3C

ARSYNCO INCORPORATED - CARLSTADT, NJ

TIDAL INDUCED GROUNDWATER FLUCTUATION DATA SUMMARY

MW-3

DATE	TIME	CHANGE IN WATER LEVEL (feet) (+ up, - down)	TIDAL
8/20/91	19:05:32	+0.28	
8/21/91	05:42:32	-0.15	-
8/21/91	09:28:32	+0.07	+
8/21/91	15:11:32	-0.11	-
8/21/91	20:14:32	+0.20	+
8/22/91	16:47:32	-0.29	-
8/22/91	20:52:32	+0.20	+
8/23/91	06:38:32	-0.15	-
8/23/91	09:23:32	+0.05	+
8/23/91	10:52:32	-0.06	?
8/23/91	11:38:32	+0.05	+
8/23/91	17:46:32	-0.12	-
8/23/91	21:53:32	+0.21	+
8/24/91	06:53:53	-0.18	-
8/24/91	09:00:53	+0.12	+
8/24/91	09:51:32	-0.09	-
8/24/91	16:38:32	+0.28	+
8/25/91	22:43:32	-0.22	-
8/25/91	10:33:32	+0.15	+
8/25/91	17:36:32	-0.17	-
8/25/91	23:14:32	+0.32	+
8/26/91	08:42:32	-0.26	-

NOTE:

+ = HIGHEST LEVEL IN FEET

- = LOWEST LEVEL IN FEET

TABLE 3D

ARSYNCO INCORPORATED - CARLSTADT, NJ

TIDAL INDUCED GROUNDWATER FLUCTUATION DATA SUMMARY

MW-4

DATE	TIME	CHANGE IN WATER LEVEL (feet) (+ up, - down)	TIDAL
8/21/91	05:38:23	-	
8/21/91	17:26:23	-0.11	
8/21/91	23:18:23	+0.12	+
8/22/91	08:33:23	-0.15	-
8/22/91	09:57:23	+4.41	?
8/23/91	04:16:23	-3.60	?
8/23/91	11:51:23	+3.21	?
8/24/91	07:19:23	-4.29	?
8/24/91	22:05:23	+0.38	+
8/25/91	06:22:23	-0.38	-
8/25/91	15:23:23	+0.07	?
8/25/91	20:33:23	-0.05	?
8/26/91	00:17:23	+0.09	+
8/26/91	06:30:23	-0.02	-
8/26/91	07:06:23	+0.03	+
8/26/91	09:21:23	-0.03	-

NOTE:

+ = HIGHEST LEVEL IN FEET

- = LOWEST LEVEL IN FEET

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET

SOURCE:

U.S.G.S. 7.5
MINUTE SERIES
WEEHAWKEN
QUADRANGLE – NJ

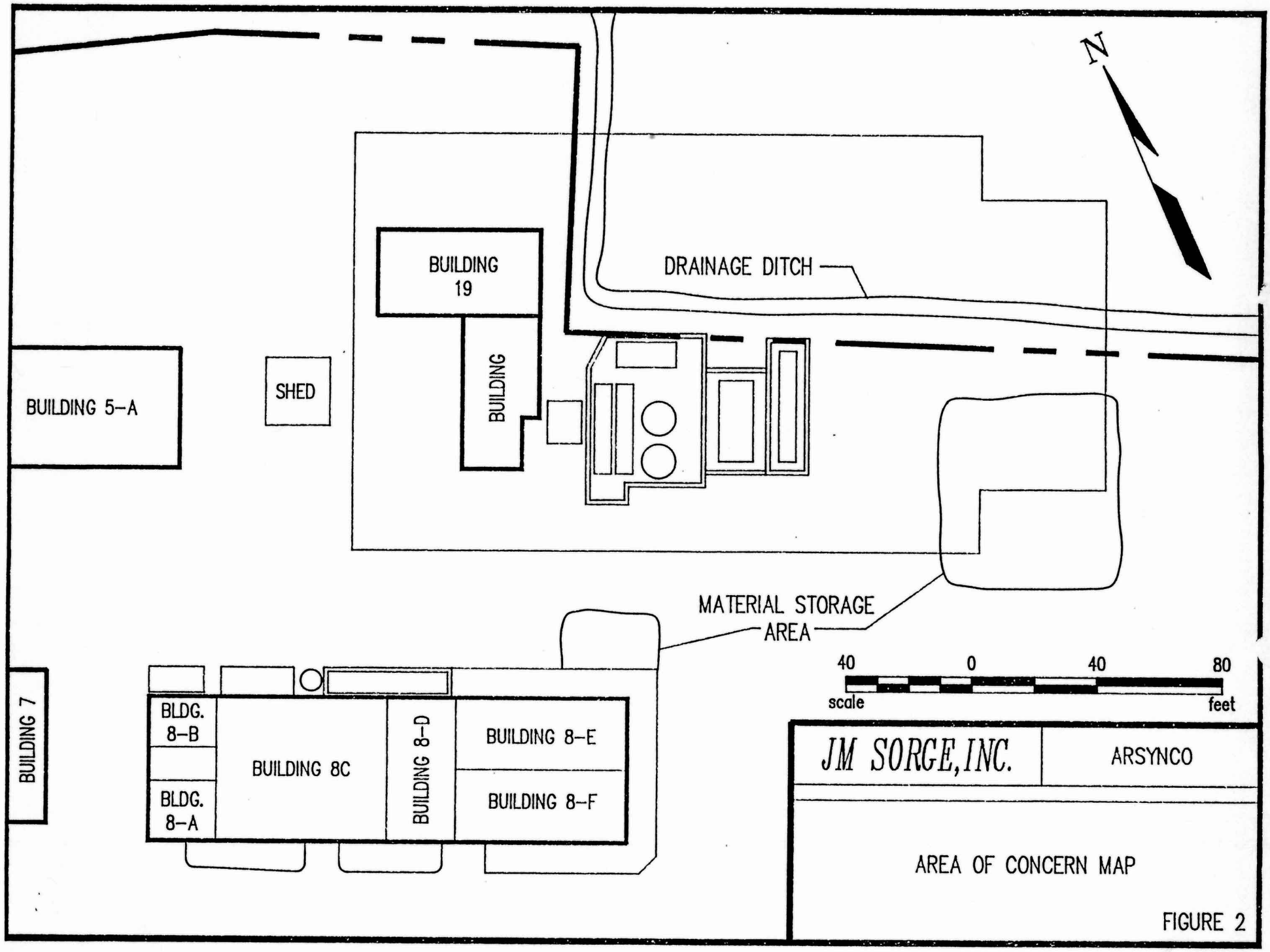
MN GN
12°
213 MILS
0°37'
11 MILS

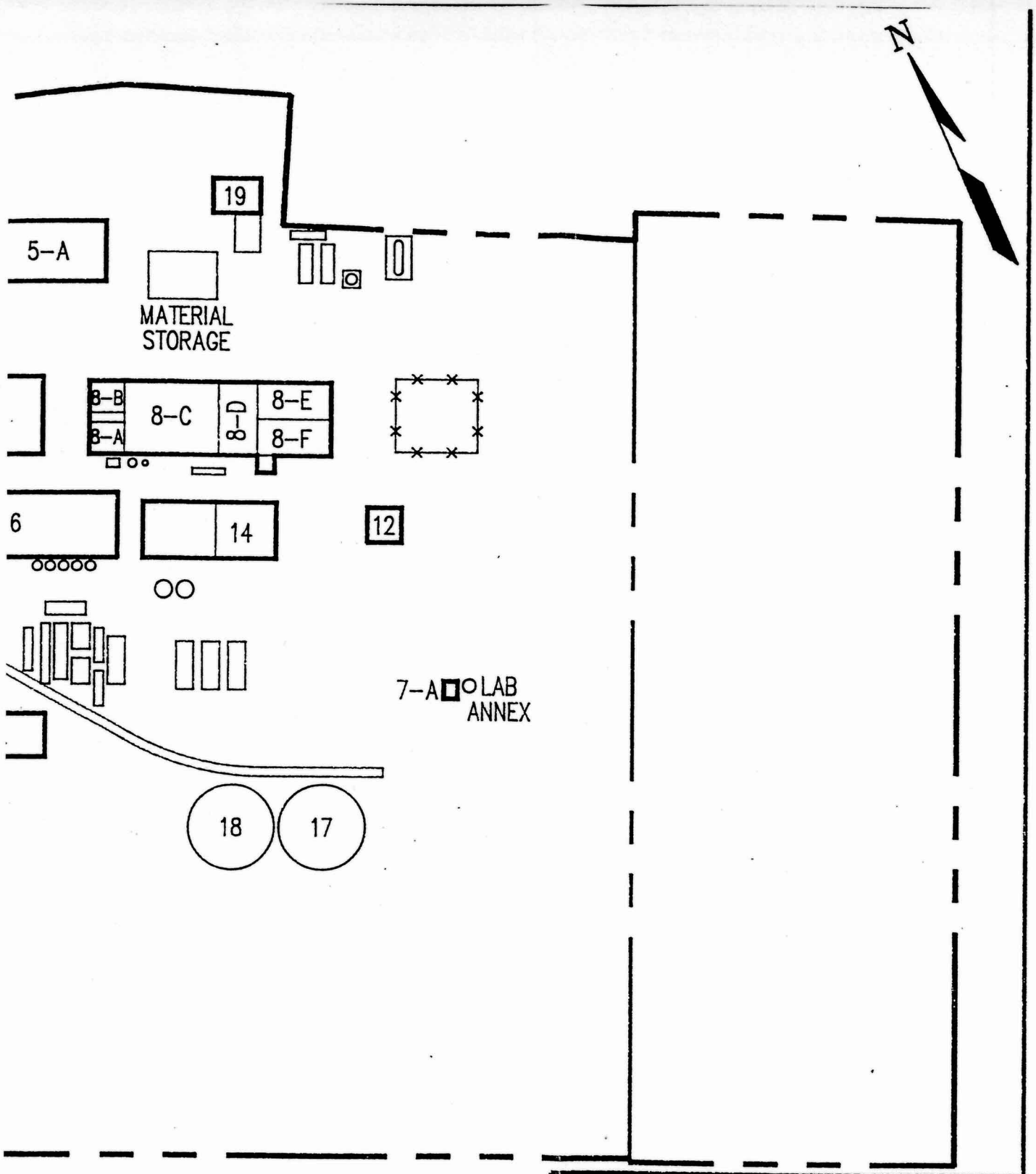
UTM GRID AND 1981 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

JM SORGE, INC.	ARSYNCO

SITE LOCATION MAP

FIGURE 1


N
DRAINAGE DITCH
BUILDING 19
BUILDING
SHED
BUILDING 5-A
MATERIAL STORAGE AREA
40 0 40 80
scale
feet
BUILDING 7
BLDG. 8-B
BLDG. 8-A
BUILDING 8C
BUILDING 8-D
BUILDING 8-E
BUILDING 8-F
JM SORGE, INC.
ARSYNCO
AREA OF CONCERN MAP
FIGURE 2



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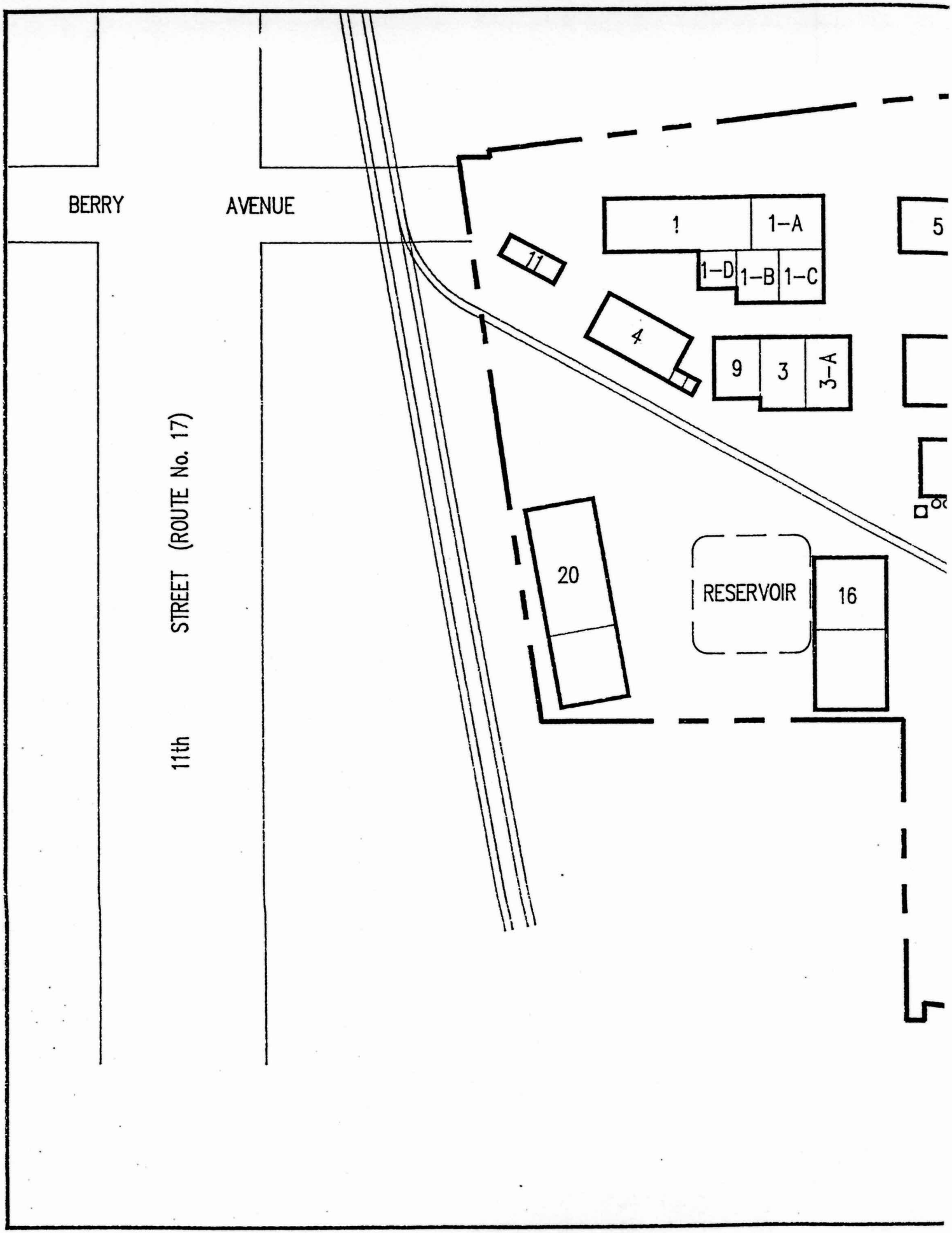
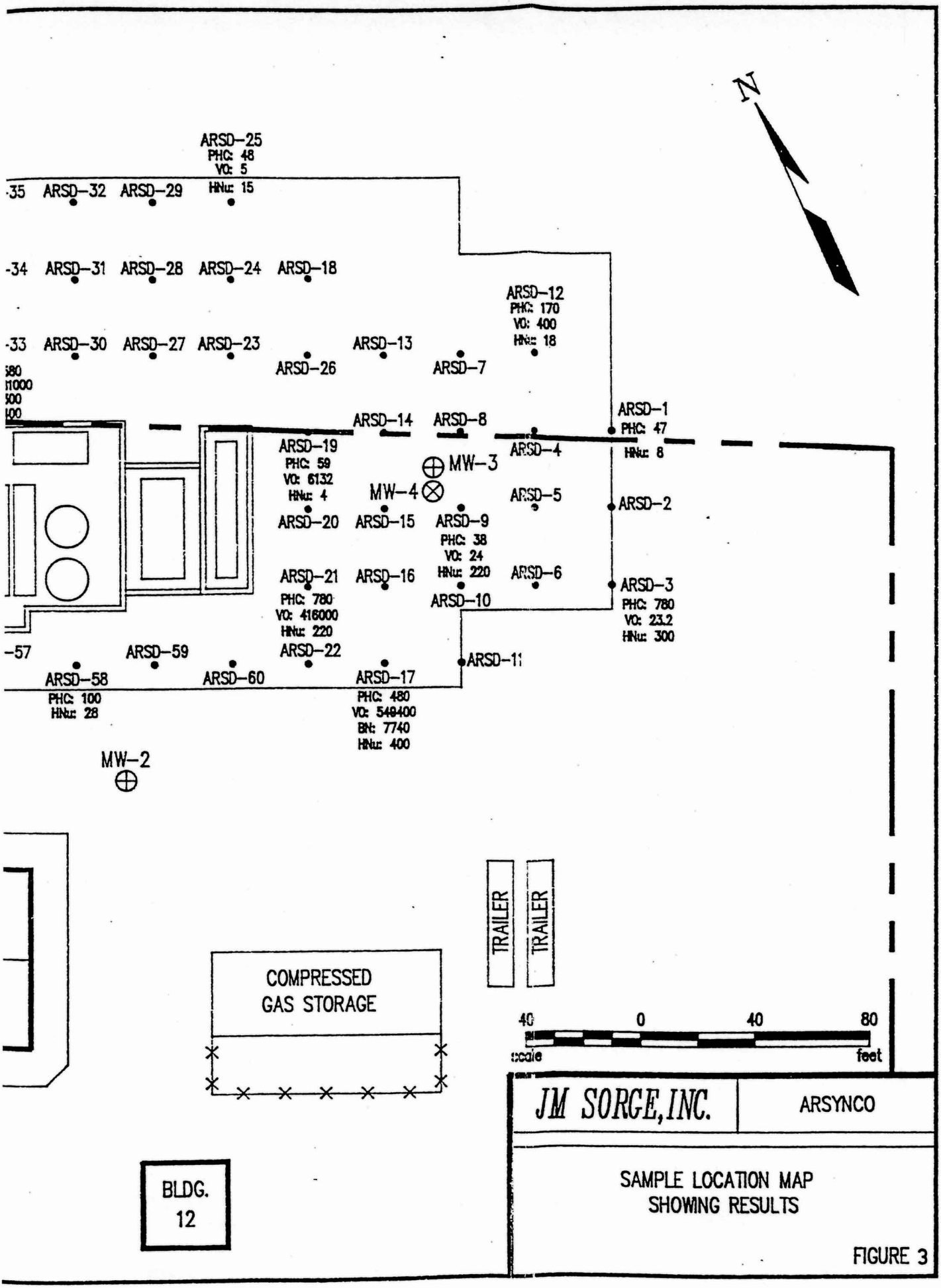
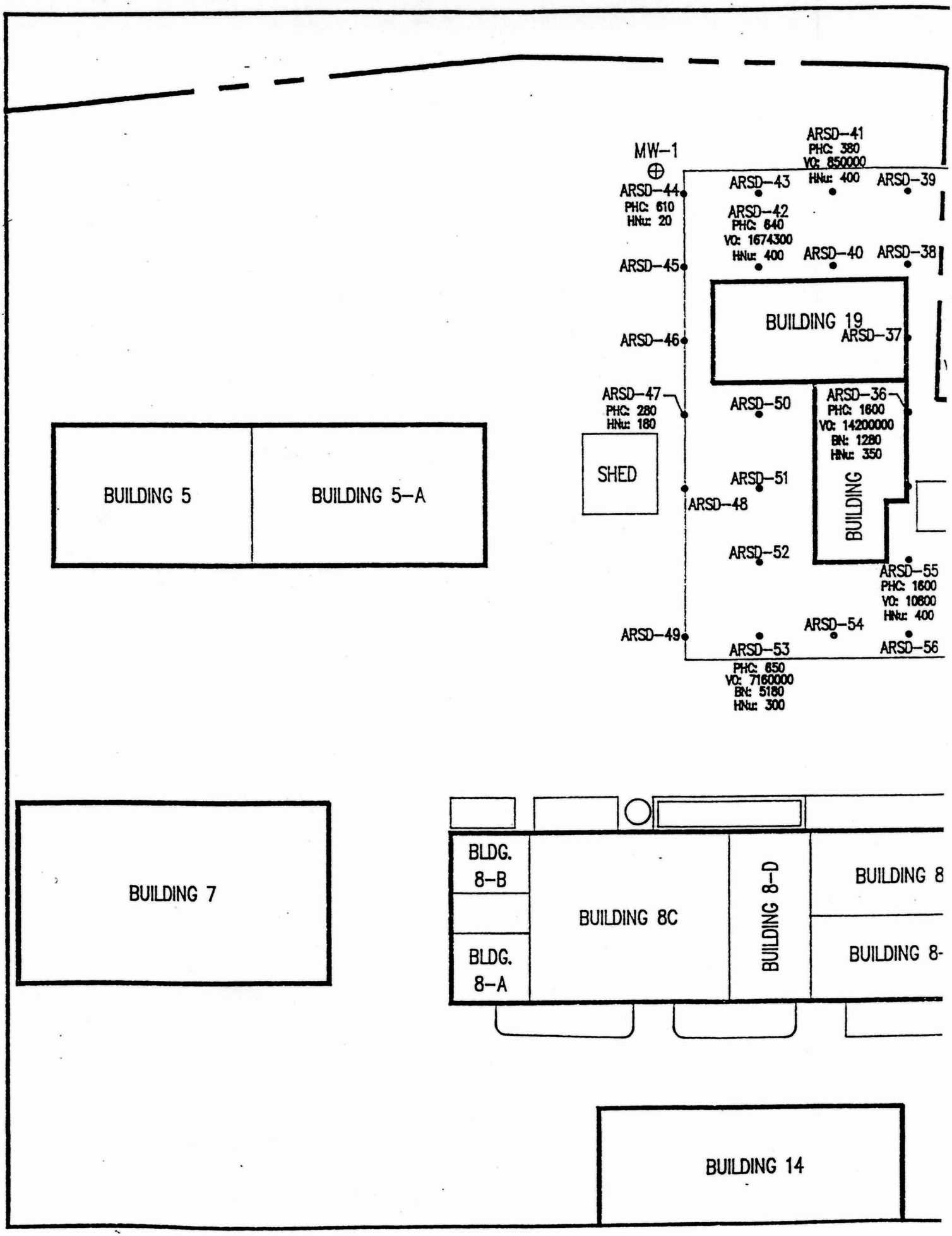
SITE PLAN

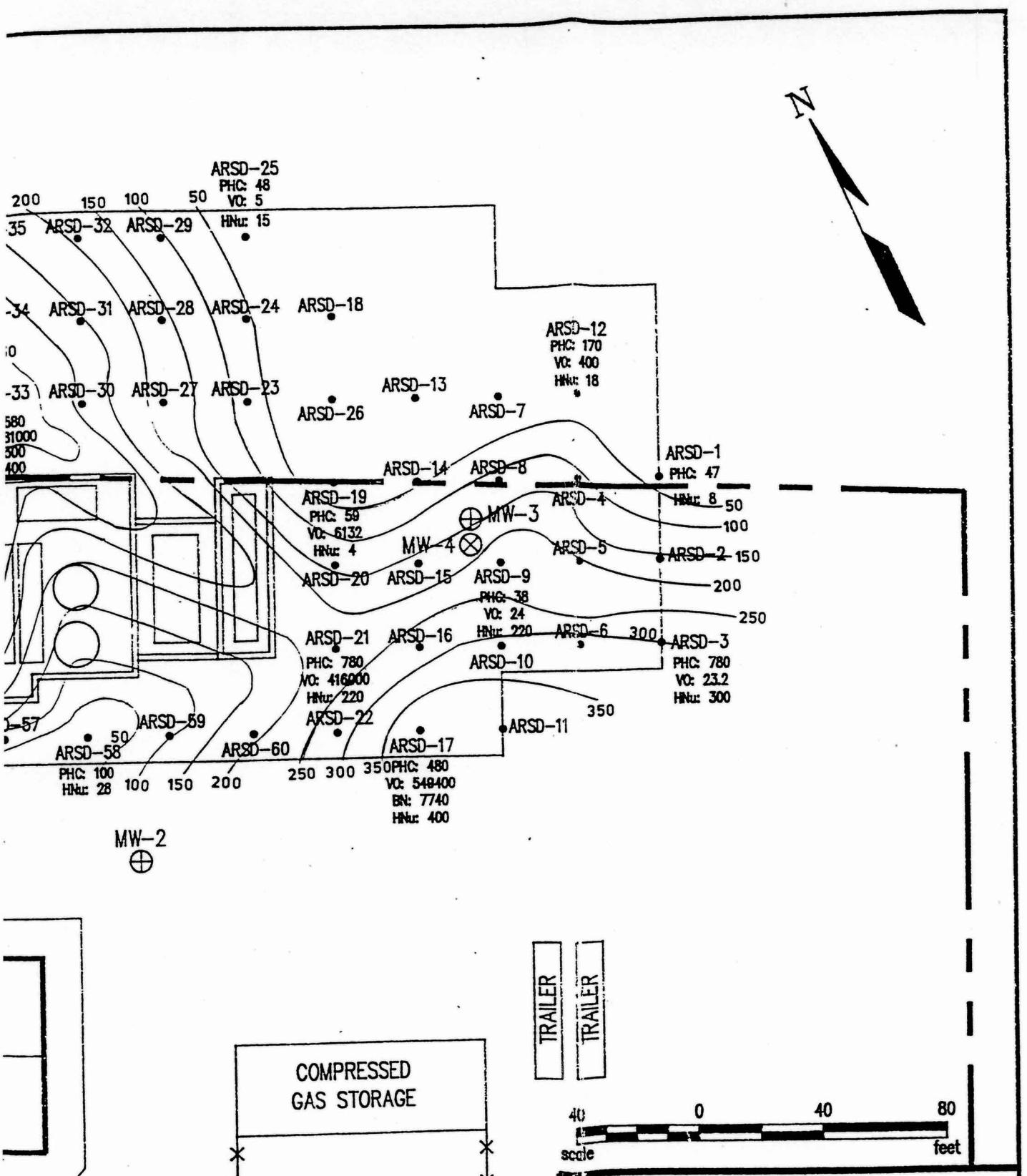
FIGURE 1.1

80 0 80 160
scale feet


BERRY
AVENUE
11th
STREET (ROUTE No. 17)
1
1-A
1-D
1-B
1-C
5
11
4
9
3
3-A
20
RESERVOIR
16


N
ARSD-25
PHC: 48
VO: 5
HNu: 15
ARSD-32
ARSD-29
ARSD-31
ARSD-28
ARSD-24
ARSD-18
ARSD-12
PHC: 170
VO: 400
HNu: 18
ARSD-30
ARSD-27
ARSD-23
ARSD-13
ARSD-26
ARSD-7
ARSD-1
PHC: 47
HNu: 8
ARSD-14
ARSD-8
ARSD-19
PHC: 59
VO: 6132
HNu: 4
ARSD-4
MW-3
MW-4
ARSD-5
ARSD-2
ARSD-20
ARSD-15
ARSD-9
PHC: 38
VO: 24
HNu: 220
ARSD-21
ARSD-16
ARSD-6
ARSD-3
PHC: 780
VO: 23.2
HNu: 300
ARSD-10
PHC: 780
VO: 416000
HNu: 220
ARSD-59
ARSD-22
ARSD-11
ARSD-58
PHC: 100
HNu: 28
ARSD-60
ARSD-17
PHC: 480
VO: 549400
BN: 7740
HNu: 400
MW-2
TRAILER
TRAILER
COMPRESSED
GAS STORAGE
40
0
40
80
scale
feet
BLDG.
12
JM SORGE, INC.
ARSYNCO
SAMPLE LOCATION MAP
SHOWING RESULTS
FIGURE 3


MW-1
ARSD-41
PHC: 380
VO: 850000
HNu: 400
ARSD-43
ARSD-39
ARSD-44
PHC: 610
HNu: 20
ARSD-42
PHC: 640
VO: 1674300
HNu: 400
ARSD-40
ARSD-38
ARSD-45
BUILDING 19
ARSD-37
ARSD-46
ARSD-47
PHC: 280
HNu: 180
ARSD-50
ARSD-36
PHC: 1600
VO: 14200000
BN: 1280
HNu: 350
SHED
ARSD-51
ARSD-48
BUILDING
ARSD-52
ARSD-55
PHC: 1600
VO: 10800
HNu: 400
ARSD-54
ARSD-49
ARSD-53
ARSD-56
PHC: 850
VO: 7160000
BN: 5180
HNu: 300
BUILDING 5
BUILDING 5-A
BUILDING 7
BLDG. 8-B
BLDG. 8-A
BUILDING 8C
BUILDING 8-D
BUILDING 8
BUILDING 8-
BUILDING 14



JM SORGE, INC.

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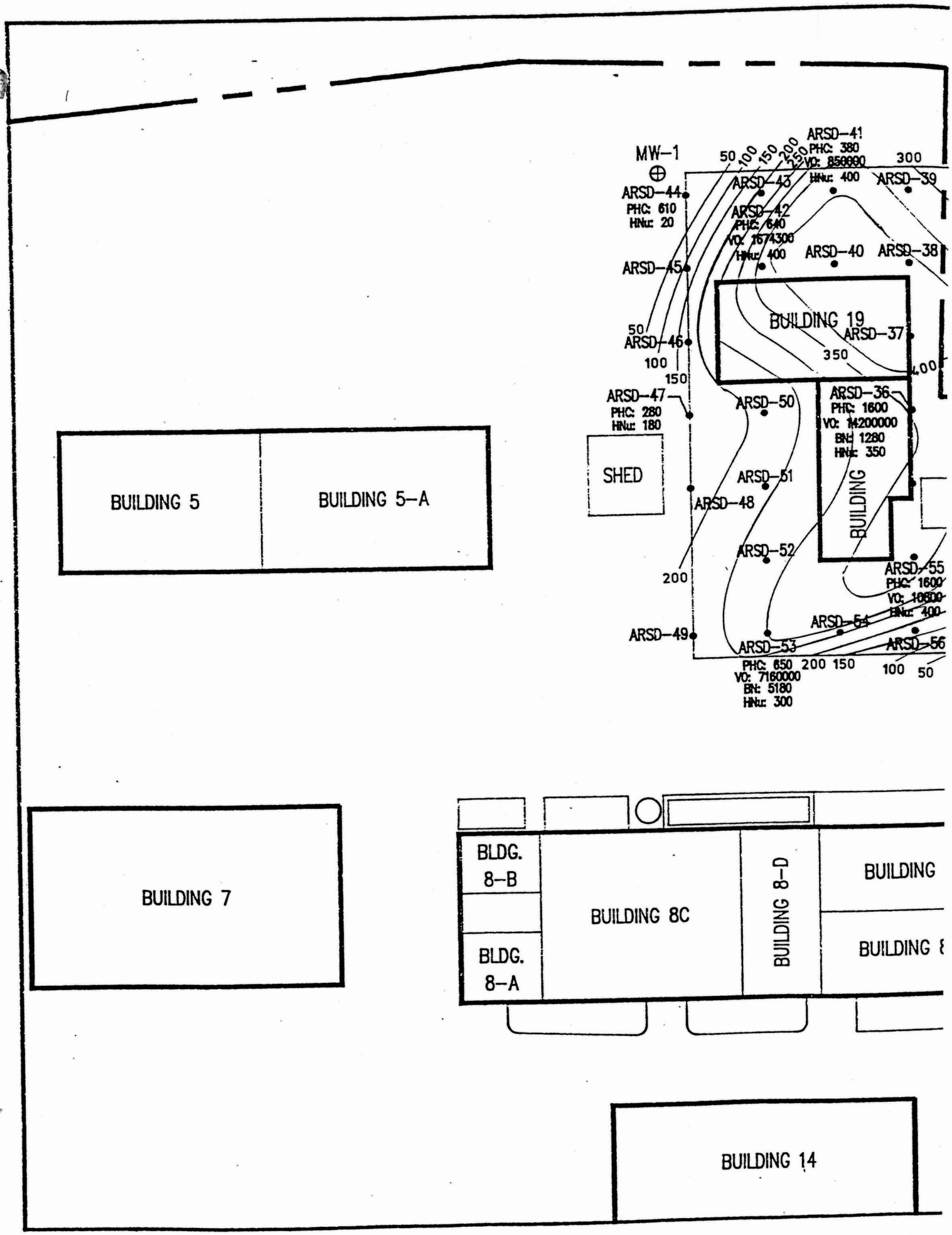
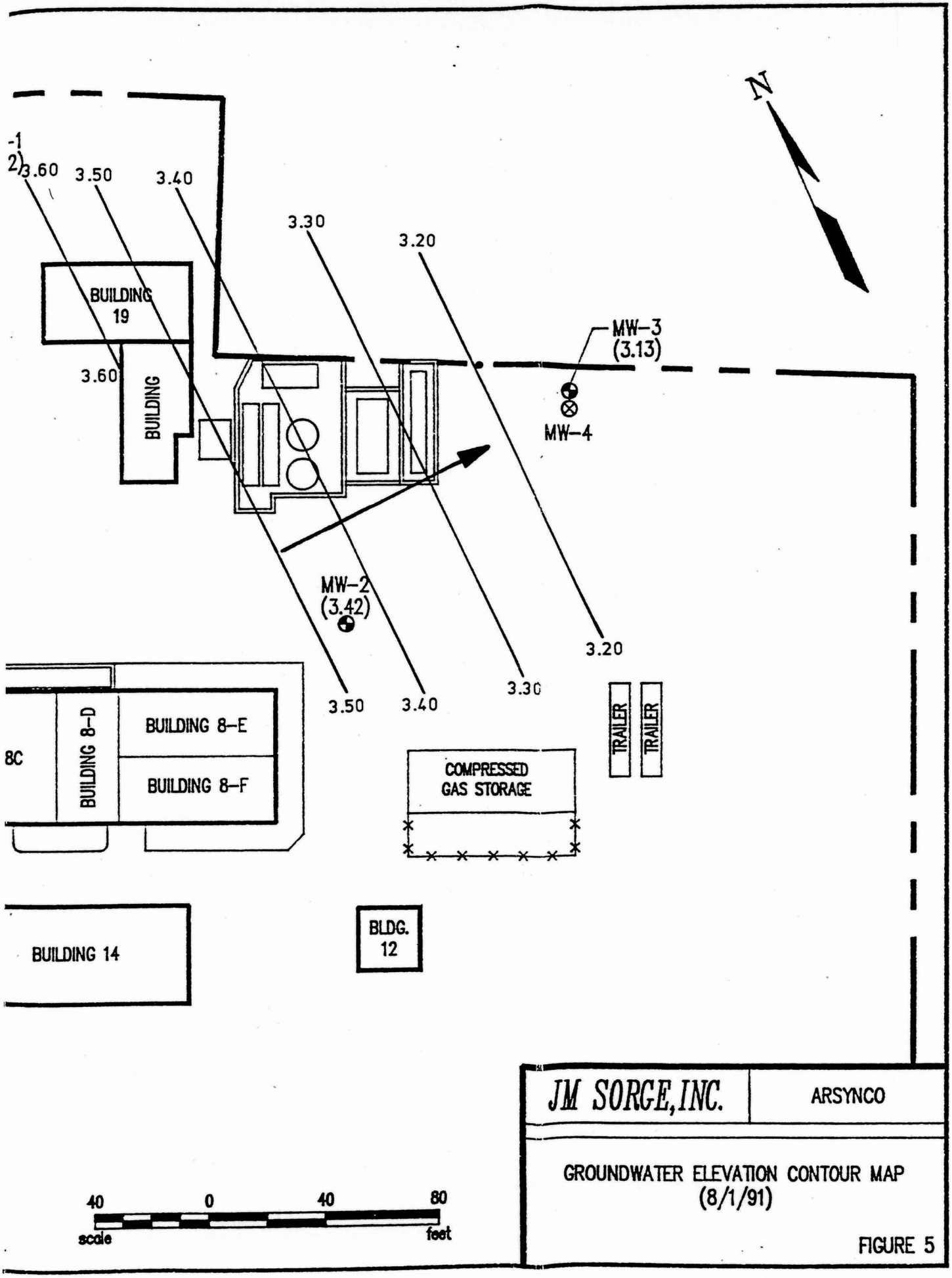
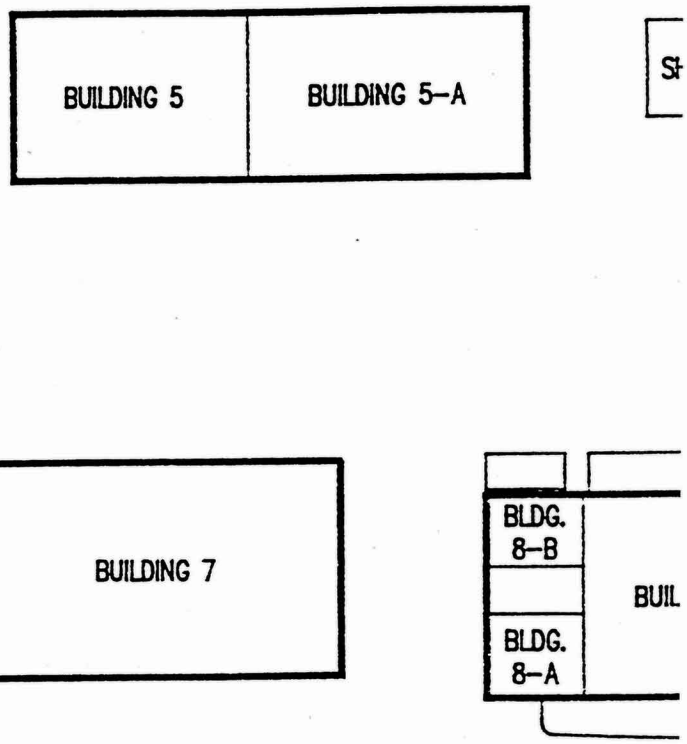
VOLATILE ORGANICS CONTAMINANTS
ISOPLETH BASED ON HNu DATA

FIGURE 4


MW-1
ARSD-41
PHC: 380
VO: 850000
HNu: 400
ARSD-39
ARSD-44
PHC: 610
HNu: 20
ARSD-43
ARSD-42
PHC: 640
VO: 1674300
HNu: 400
ARSD-40
ARSD-38
ARSD-45
BUILDING 19
ARSD-37
ARSD-46
ARSD-47
PHC: 280
HNu: 180
ARSD-50
ARSD-36
PHC: 1600
VO: 14200000
BN: 1280
HNu: 350
SHED
ARSD-51
ARSD-48
BUILDING
ARSD-52
ARSD-55
PHC: 1600
VO: 10800
HNu: 400
ARSD-54
ARSD-49
ARSD-53
ARSD-56
PHC: 850
VO: 7160000
BN: 5180
HNu: 300
BUILDING 5
BUILDING 5-A
BUILDING 7
BLDG. 8-B
BLDG. 8-A
BUILDING 8C
BUILDING 8-D
BUILDING
BUILDING 8
BUILDING 14


N
-1
2)
3.60
3.50
3.40
3.30
3.20
BUILDING 19
3.60
BUILDING
MW-3
(3.13)
MW-4
MW-2
(3.42)
3.20
3.50
3.40
3.30
TRAILER
TRAILER
8C
BUILDING 8-D
BUILDING 8-E
BUILDING 8-F
COMPRESSED GAS STORAGE
BUILDING 14
BLDG. 12
40
0
40
80
scale
feet
JM SORGE, INC.
ARSYNCO
GROUNDWATER ELEVATION CONTOUR MAP
(8/1/91)
FIGURE 5

WELL NUMBER	MW-1	MW-2	MW-3	MW-4*
ELEVATION OF TOP OF PVC	7.53	4.67	6.88	4.79
DEPTH TO WATER	3.91	1.25	3.75	1.52
GROUNDWATER ELEVATION	3.62	3.42	3.13	3.27



LEGEND:

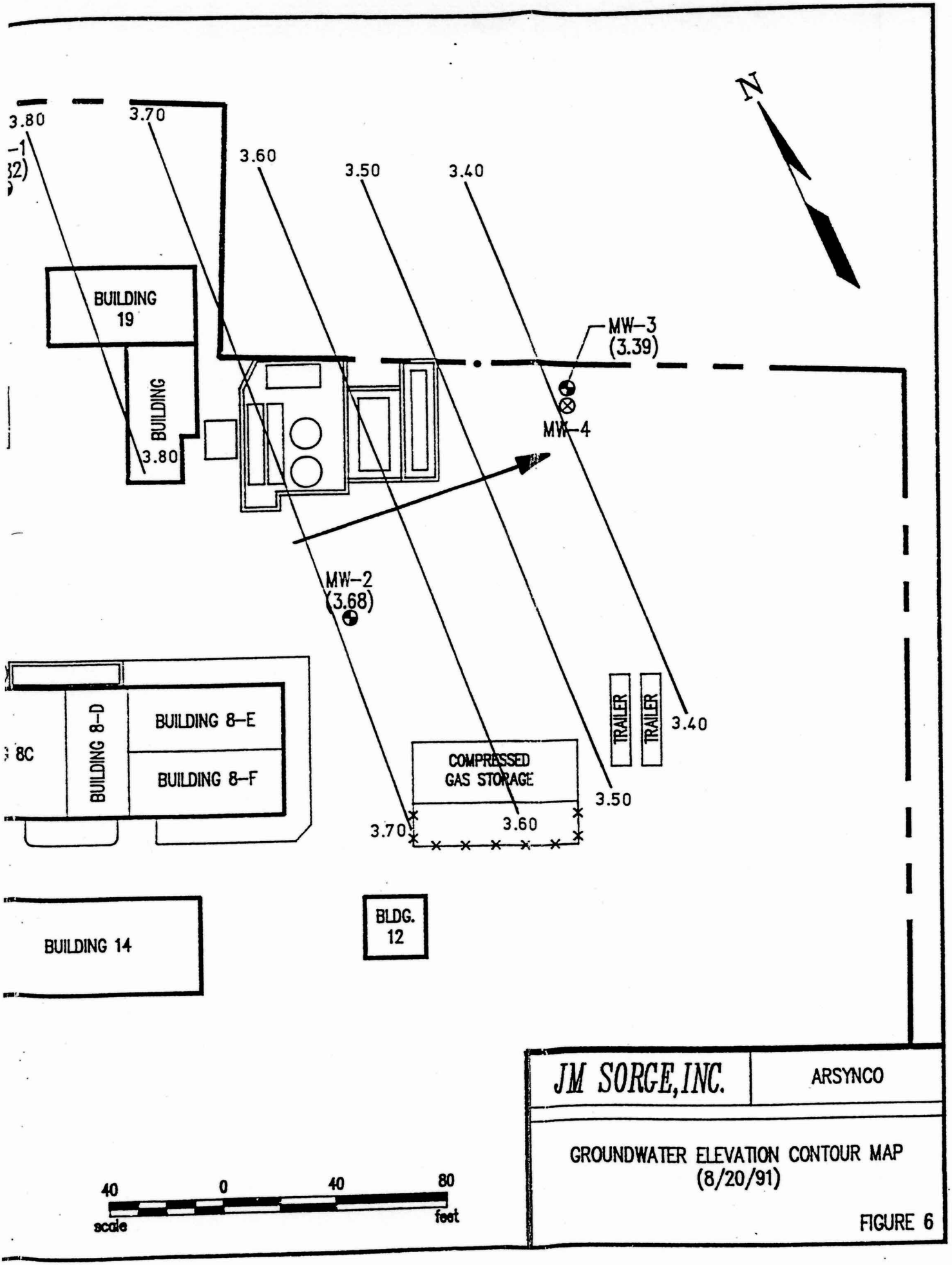
⊕ GROUNDWATER MONITORING WELLS (BELOW MEADOW MAT)

⊗ SHALLOW WELLS (ABOVE MEADOW MAT)

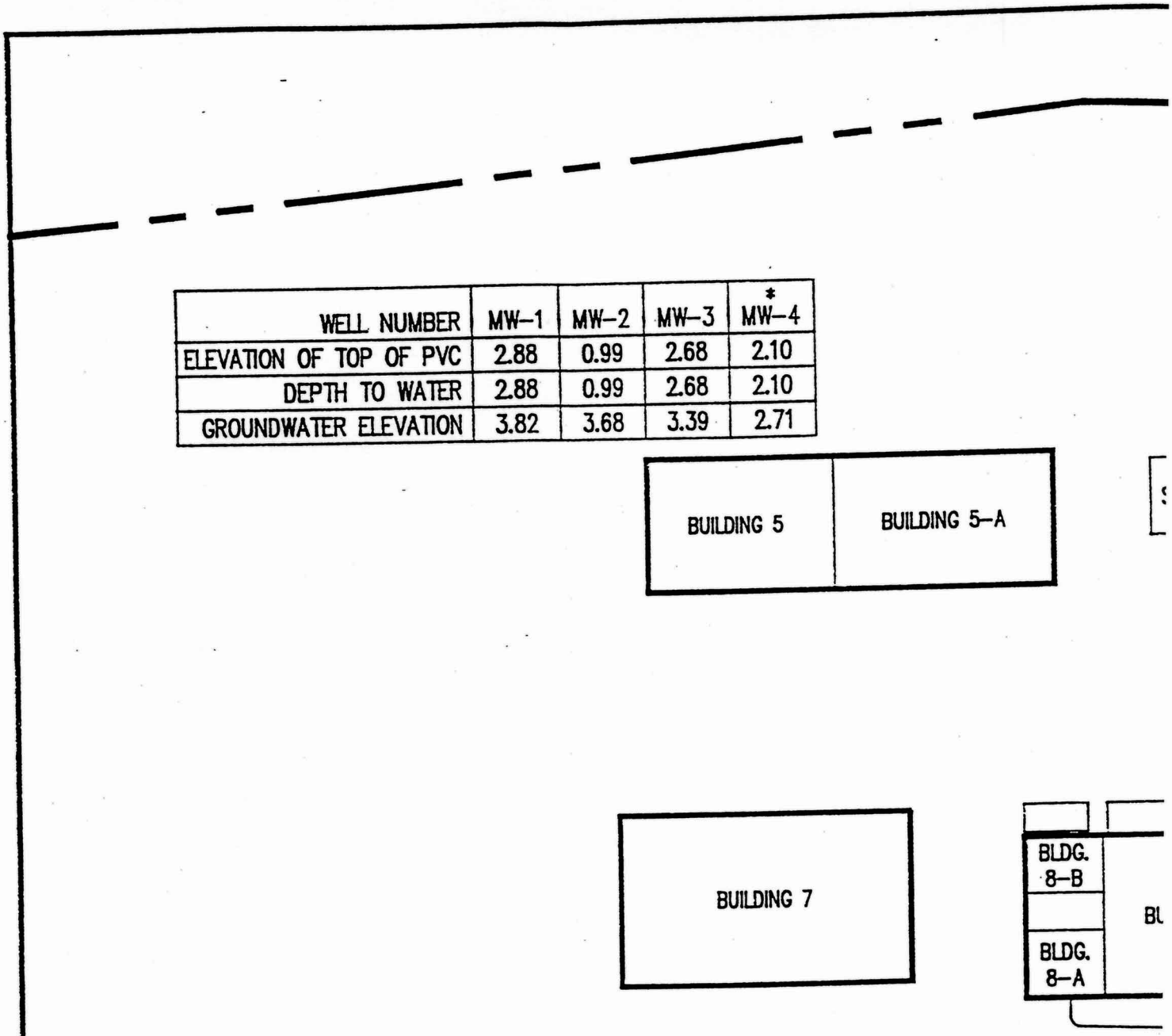
← GROUNDWATER FLOW DIRECTION

0.10 FOOT CONTOUR INTERVALS

* DATA NOT INCLUDED IN THE PLOT. SURVEY
DATA PROVIDED BY JOHN CILCO JR. ASSOCIATES, INC.


N
3.80
3.70
3.60
3.50
3.40
BUILDING 19
BUILDING
3.80
MW-3 (3.39)
MW-4
MW-2 (3.68)
BUILDING 8-D
BUILDING 8-E
BUILDING 8-F
8C
COMPRESSED GAS STORAGE
TRAILER
TRAILER
3.40
3.50
3.60
3.70
BUILDING 14
BLDG. 12
40 0 40 80
scale
feet
JM SORGE, INC.
ARSYNCO
GROUNDWATER ELEVATION CONTOUR MAP
(8/20/91)
FIGURE 6

WELL NUMBER	MW-1	MW-2	MW-3	* MW-4
ELEVATION OF TOP OF PVC	2.88	0.99	2.68	2.10
DEPTH TO WATER	2.88	0.99	2.68	2.10
GROUNDWATER ELEVATION	3.82	3.68	3.39	2.71



LEGEND:

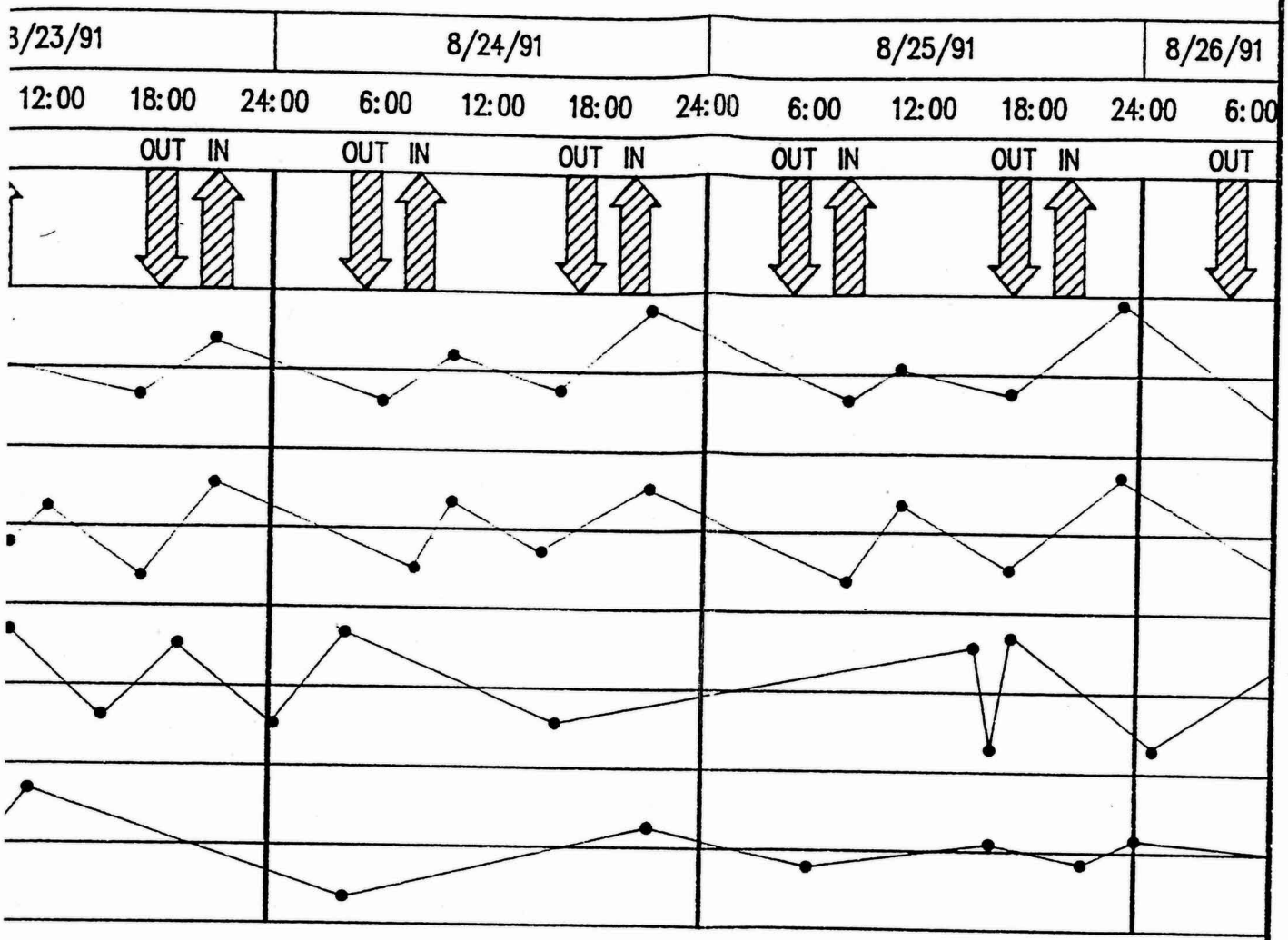
⊕ GROUNDWATER MONITORING WELLS (BELOW MEADOW MAT)

⊗ SHALLOW WELLS (ABOVE MEADOW MAT)

← GROUNDWATER FLOW DIRECTION

0.10 FOOT CONTOUR INTERVALS

* DATA NOT INCLUDED IN THE PLOT. SURVEY
DATA PROVIDED BY CHESTER DiLORENZO, LS, PE



MEAN CHANGES IN: MW-1 ± 0.15'

MW-3 ± 0.16'

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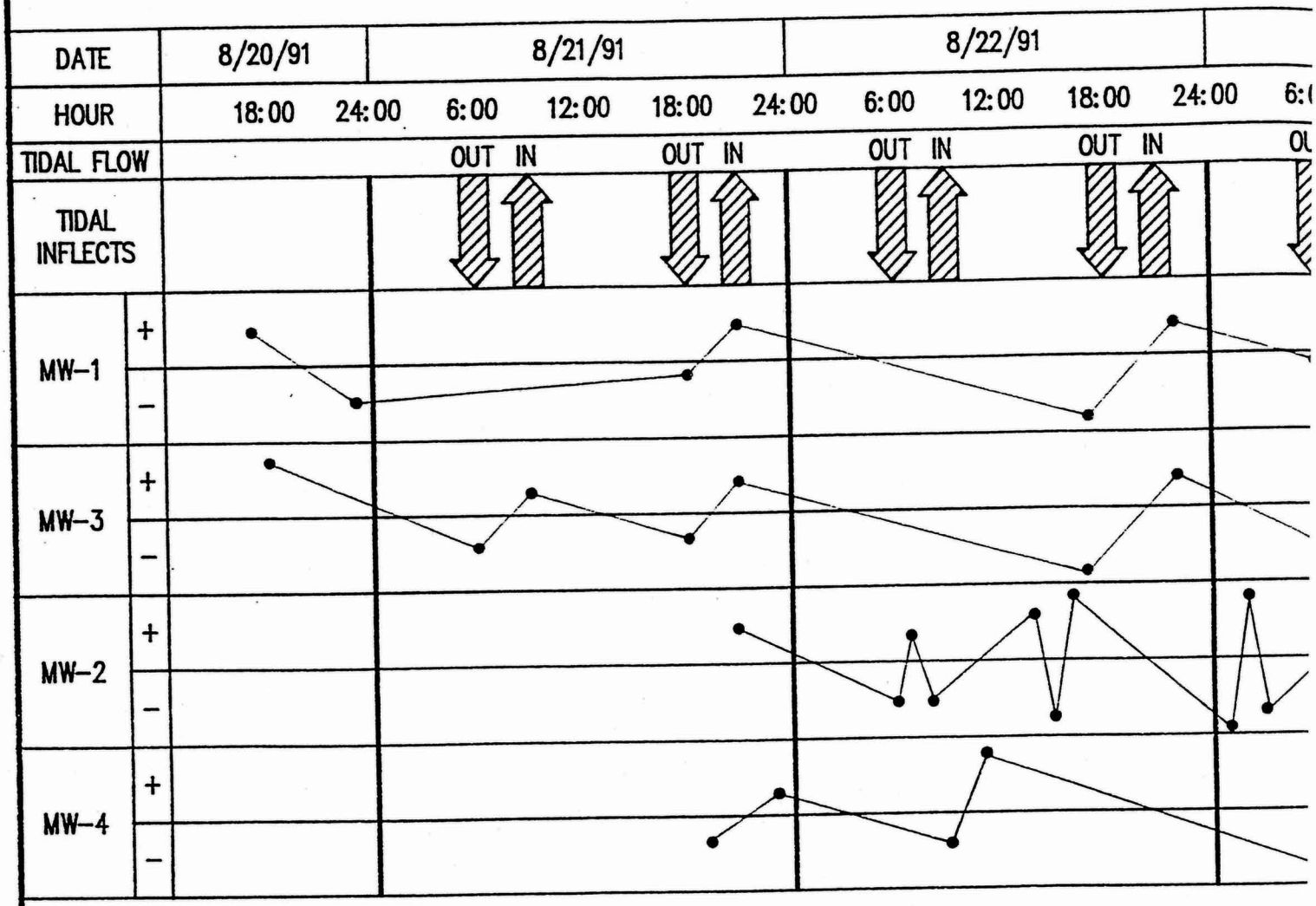
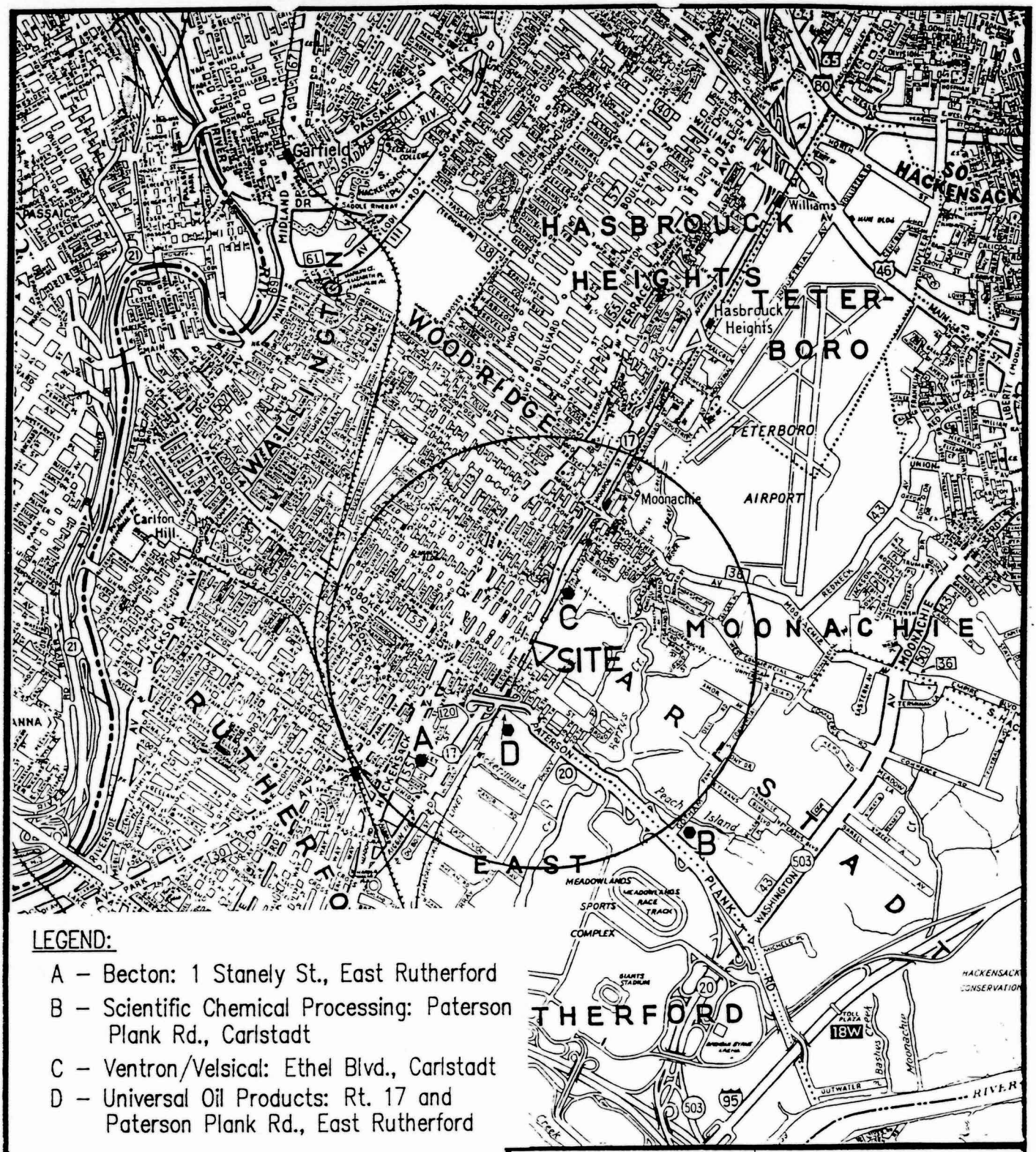
DIAGRAMATIC ILLUSTRATION OF TIDAL INFLUENCES ON GROUNDWATER ELEVATIONS IN MONITORING WELLS ON SITE

FIGURE 7



AVERAGE MAXIMUM CHANGES IN WATER LEVELS: MW-1 + 0.21 FEET
− 0.20 FEET

MW-3 + 0.24 FEET
− 0.23 FEET



JM SORGE, INC.

ARSYNCO

LOCATION OF SUSPECTED SURROUNDING HAZARDOUS SITES WITHIN A 1-MILE RADIUS

APPENDIX B-1

APPENDIX G

SLUG TEST RAW DATA/CALCULATION

TABLE 1
COEFFICIENT OF PERMEABILITY VALUES (k)
in cm/sec. and feet per day

COOPER et al	MW-1	MW-3
Slug injection	1.7×10^{-4} 0.50	2.8×10^{-4} 0.80
Slug extraction	1.8×10^{-4} 0.51	3.8×10^{-4} 1.08
Average	0.50	0.94

Note: The coefficient of permeability (k) counted the Cooper et al method ranges from 0.5 ft/day (MW-1) to 0.94 ft/day (MW-3).

TABLE 2
COEFFICIENT OF TRANSMISSIVITY VALUES (T)
in feet per day

COOPER et al	MW-1	MW-3
Slug injection	7.54	12.03
Slug extraction	6.15	16.30
Average	6.84	14.1

Note: The coefficient of transmissivity (T) ranges from 6.84 ft/day (MW-1) to 14.1 ft/day (MW-3).

TABLE 3
STORATIVITY (S)

COOPER et al	MW-1	MW-2
Slug injection	2.9×10^{-2}	1.3×10^{-3}
Slug extraction	2.2×10^{-2}	3.2×10^{-5}
Average	2.5×10^{-2}	6.6×10^{-4}

Note: The coefficient of storage (S) ranges from 6.6×10^{-4} (MW-3) to 2.5×10^{-2} (MW-1).

APPENDIX H

GROUNDWATER FLOW ANALYSIS DATA

HYDRAULIC GRADIENT

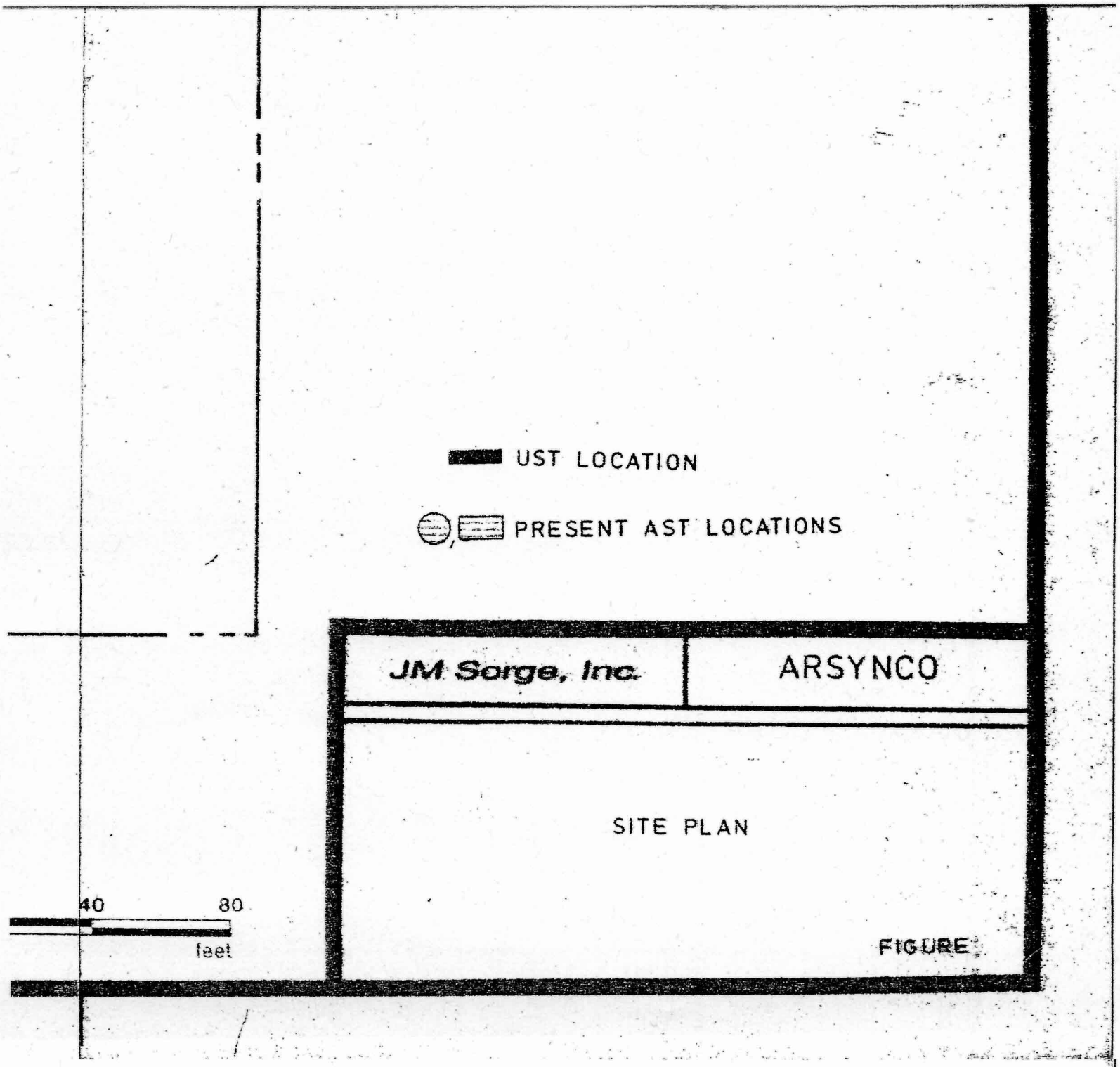
$$\left.\begin{array}{l} \text{MW-1 TO MW-3} = 0.14'/211' = .0007\ ft^2 \\ \text{MW-1 TO MW-2} = 0.43'/198' = .0022\ ft^2 \\ \text{MW-2 TO MW-3} = 0.29'/115' = .0025\ ft^2 \end{array}\right\} \text{AVERAGE} = 0.0018\ ft/ft$$

AVERAGE LINEAR VELOCITY

$$Vav = \frac{k(dh/dl)}{ne} = \frac{0.72 \times 0.0018}{30\%}$$

$$= 0.0043\ ft/day$$

$$= 1.58\ ft/year$$


UST LOCATION
PRESENT AST LOCATIONS
JM Sorge, Inc.
ARSYNCO
SITE PLAN
40
80
feet
FIGURE