01112

FINAL REPORT

DEFENSE ENVIRONMENTAL RESTORATION PROGRAM

CRITERIA DEVELOPMENT REPORT FOR THE CLOSURE OF NINE BURNING PADS

SENECA ARMY DEPOT
ROMULUS, NEW YORK

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VOLUME II

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700 Federal Building
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Metcalf & Eddy

VOLUME TWO

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GEOPHYSICAL SURVEY RESULTS

HAGER-RICHTER
GEOSCIENCE, INC.

SURFACE GEOPHYSICAL SURVEYS
SENECA ARMY DEPOT
ROMULUS, NEW YORK

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File 88J03
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Surface Geophysical Surveys
Seneca Army Depot
August, 1988 File 88J03

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. conducted surface geophysical surveys at the Demolition Grounds of the Seneca Army Depot, Romulus, New York August 23 -24, 1988. The work was conducted under contract to Metcalf & Eddy, Inc. of Wakefield, Massachusetts as part of a larger project undertaken for the U.S. Army Corps of Engineers.

The purpose of the surveys was to detect the presence of large buried metal objects in the vicinity of sites selected and staked by Metcalf & Eddy for the installation of groundwater monitoring wells. An area, 50 feet by 50 feet in size, was surveyed around each of 10 monitoring well locations. Two complementary geophysical methods were used at each location: (1) a magnetic survey, and (2) an electromagnetic (EM) survey.

The combined results of the geophysical surveys indicate that for 8 of the 10 monitoring well locations large metal objects will not disrupt the progress of the drilling. We recommend that the other two of the monitoring well locations be reconsidered:

1. Burning Pad A - MW16 Location. We recommend that the well be relocated approximately 15 north or northeast of the present staked site in order to avoid a large metallic object(s) located in the southeast quadrant of the surveyed area.

2. Burning Pad E - MW12 Location. The magnetic and EM surveys indicate the presence of metallic objects in the subsurface of the entire area surveyed. No area was found within the survey area that can clearly avoid encountering metallic objects during drilling. We recommend that drilling of this well not be done in the surveyed area.

1. INTRODUCTION

Hager-Richter Geoscience, Inc. conducted surface geophysical surveys at the Seneca Army Depot, Romulus, New York on April 22 - 23, 1988. The work was performed under contract to Metcalf & Eddy, Inc. of Wakefield, Massachusetts as part of a larger project for the U. S. Army Corps of Engineers.

Figure 1 is a general location map of the Site. The surveys were conducted at the Demolition Grounds of the Depot property. A number of horseshoe shaped berms at the southern end of the Grounds were used as "burning pads" for the destruction of propellants for weapons. Metcalf & Eddy plans to install 10 groundwater monitoring wells down gradient from each of the burning pads.

The purpose of the geophysical surveys was to detect the presence of large buried metal objects in the vicinity of the locations for the 10 well locations selected and staked at the Site by Metcalf & Eddy. An area 50 feet by 50 feet in size was surveyed around each of 10 monitoring well locations. Plate 1 (in pocket) is a Site map showing the monitoring well locations staked by Metcalf & Eddy and the 50 foot square survey areas centered on each well location. Two complementary geophysical methods were used at each location: (1) magnetics, and (2) electromagnetics (EM).

The overburden, silty clay, and the bedrock, grey shale, are essentially non-magnetic. Therefore, local variations in the magnetic field are dominated by the effects of any ferrous metal present in the subsurface. The overburden and bedrock are also poor electrical conductors and any strong, local variations in electrical conductivity are also due to the presence of buried metal objects.

The Site is generally level and covered by high grassy vegetation. The berms defining the burning pads are 5 - 8 feet high. Surface metal in the form of cartridge casings and other other unidentified debris associated with munitions is broadly scattered over the Site. Weathered and broken shale fill is present throughout the site.

Hager-Richter personnel were on Site August 22 - 24, 1988. Dorothy Richter and Jeffrey Reid conducted the field operations. Ms. Sandra Giesler of Metcalf & Eddy staked the locations of the monitoring wells and was present throughout the geophysical field effort. Mr. Randall Battaglia and Mr. Thomas Enroth of the U.S. Army Corps of Engineers coordinated the Site access and observed parts of the field work. The data were subsequently analyzed at the Hager-Richter offices.

2. EQUIPMENT AND PROCEDURES

2.1 Magnetic Survey

The magnetic survey was conducted using an EG&G Model G856 Proton Precession Portable Magnetometer. The G856 is a microprocessor controlled instrument with a resolution of 0.1 gamma and accuracy of 1 gamma. The G856 has a memory capable of storing the data for approximately 1000 stations. The field data were transferred to floppy disks and the hard disk of a Compaq portable computer at the Site.

We used a 5 foot by 10 foot station spacing for each 50 foot square monitoring well location. Magnetic data were collected at 747 stations at the Site, with 69 - 88 stations per individual monitoring well location. Figures 2 - 11 are magnetic station maps for each monitoring well location.

A base magnetic station was occupied between each monitoring well location survey in order to obtain data necessary for the removal of the temporal variation in the Earth's magnetic field. The magnetic survey data were processed by correcting each reading for the temporal "drift" of the magnetic field based on the base station data. The corrected data were then plotted and contoured by a contouring program developed for use with spatial geophysical data such as those obtained in gravity, magnetic and certain other surveys.

2.2 Electromagnetic Survey

The electromagnetic (EM) survey was conducted using a Geonics EM-31D terrain conductivity meter. The EM-31 is an induction type unit and provides measurement of both the quadrature phase and in-phase components of terrain conductivity without ground electrodes or contact. The instrument is calibrated to read ground conductivity directly in millimhos per meter with a resolution of 2% of full scale and an accuracy of 1 mmho/meter. For this survey, we measured only the relative magnitude of the in-phase component of the magnetic field induced by the instrument because it is particularly sensitive to the presence of metallic objects in the subsurface.

The EM survey was conducted with continuous operation of the meter during traverses across each monitoring well location spaced 10 feet apart. Figures 12 - 21 are maps showing the locations and directions of the EM profiling traverses across each monitoring well survey area. The apparent magnitude of the in-phase component of the induced field was monitored continuously and recorded at 5 foot intervals and contoured with the same computer program used to contour the magnetic data.

3. RESULTS

The results of the geophysical surveys are presented below for each monitoring well location. The magnetic data are presented in contour maps. The contour interval is 100 gammas for most of the well locations. That interval was selected because of the range in magnetic field encountered at the sites. The contoured data are presented as total intensity above 56,000 gammas, an arbitrary value near the "normal" or undisturbed total magnetic field for the area.

In interpreting magnetic data, several factors should be considered. The width, gradient, and amplitude of a magnetic disturbance are useful in estimating the quantity and depth of the metal object(s). In general, the broader the magnetic signature, the deeper the object. Magnetic disturbances with very steep gradients are caused by objects at or near the surface. Note that the magnetic technique is limited to detecting metallic objects. Neither the particular type of metallic object causing a magnetic disturbance nor its contents can be determined from the magnetic data alone.

The EM data are likewise presented in contour form. Note that the values contoured for the EM survey are <u>not</u> direct values of the ground conductivity but are instead relative percent of full scale readings of the inphase component of the induced magnetic field. The response of the EM-31 in that operating mode to buried metallic objects is spikes (both positive and negative) in the apparent readings. The EM response was monitored continuously throughout the survey and no spikes greater than about 2% of full scale occur between adjacent recorded readings. The apparent zero level of the instrument thus was adjusted to 20% of full scale so that negative spikes could be detected. The contour interval of the individual maps is 5 percent of full scale. As in the case of magnetic data, buried metal objects produce steep gradients in the EM values.

3.1 Burning Pad A - MW16 Location

Figures 22 and 23 show respectively the results of the magnetic and EM surveys for Burning Pad A - MW16 Location. The southwestern corner of the the survey area is at the northeastern edge of the burning pad berm. Both the magnetic and EM surveys show large disturbances in the southeastern quadrant of the survey area. We interpret this response to be due to the presence of one or more metallic objects. Although the staked wellsite is in the center of the survey area, we recommend moving MW16 location to the north or northeast approximately 15 feet in order to avoid drilling in the the object(s) accidentally. Small cartridge casings are widely scattered on the surface and might be encountered during drilling at any location within the survey area.

3.2 Burning Pad B - MW15 Location

Figures 24 and 25 show respectively the results of the magnetic and EM surveys for Burning Pad B - MW15 Location. The southern corner of the survey area, where high gradients occur in both the magnetic and EM data, is at the edge of the burning pad berm. The gradients in both magnetic and EM data at the staked location for the well are low. The staked location for MW15 thus appears to be located in an area without large buried metal objects. Small cartridge casings are widely scattered on the surface and might be encountered during drilling at any location within the survey area.

3.3 Burning Pad C - MW17 Location

Figures 26 and 27 show respectively the results of the magnetic and EM surveys for Burning Pad C - MW17 Location. The magnetic data indicate the presence of a metallic object in the northwest quadrant of the survey area. The object is not reflected in the EM data. The gradients in both magnetic and EM data at the staked location for the well are very low. The staked location for MW17 thus appears to be located in an area without large buried metal objects. Small cartridge casings are widely scattered on the surface and might be encountered during drilling at any location within the survey area.

3.4 Burning Pad D - MW14 Location

Figures 28 and 29 show respectively the results of the magnetic and EM surveys for Burning Pad D - MW14 Location. The southern corner of the survey area is at the northeastern edge of the burning pad berm. The surface of the survey area contains widely scattered metallic debris in the form of cartridge casings. The magnetic and EM data are variable across the survey area but the gradients in both magnetic and EM data at the staked location for MW14 and in the upper right quadrant of the survey area are low. The staked location for MW14 thus appears to be located in an area without large buried metal objects, although small cartridge casings might be encountered during drilling. Moving the well slightly to the north within the survey area also appears to be relatively free of subsurface metal.

3.5 Burning Pad E - MW12 Location

Figures 30 and 31 show respectively the results of the magnetic and EM surveys for Burning Pad E - MW12 Location. The southwestern corner of the survey area is at the northeastern edge of the burning pad berm. The surface of the survey area contains abundant metallic debris in the form of large and small cartridge casings and other unidentified munitions debris. The magnetic and EM data are highly variable across the survey area and the gradients in both magnetic and EM data at the staked location for MW12 are very steep. The magnetic data are contoured with a 200 gamma contour interval (rather than 100 gammas or less for the other monitoring well locations.) The EM data were obtained at a higher scale range (100 mmho/m apparent range rather than the 30 mmho/m range used for all of the other locations.) The entire survey area around the staked location for MW12 thus appears to contain abundant buried metal objects. <u>No location within the survey area appears to be sufficiently free of subsurface metal for drilling a monitoring well. We recommend that MW12 not be drilled within the survey area.</u> We have not surveyed the surrounding area and cannot recommend a specific alternate location for MW12.

3.6 Burning Pad F - MW13 Location

Figures 32 and 33 show respectively the results of the magnetic and EM surveys for Burning Pad F - MW13 Location. The gradients in both magnetic and EM data at the staked location for the well are essentially flat. The staked location for MW13 thus appears to be located in an area that does not contain large buried metal objects. Small cartridge casings are scattered on the surface and might be encountered during drilling at any location within the survey area.

3.7 Burning Pad G - MW10 Location

Figures 34 and 35 show respectively the results of the magnetic and EM surveys for Burning Pad G - MW10 Location. The gradients in both magnetic and EM data at the staked location for the well are essentially flat. The staked location for MW13 thus appears to be located in an area that does not contain large buried metal objects. Small cartridge casings were not observed on the surface but might be encountered during drilling at any location within the survey area.

3.8 Burning Pad G - MW11 Location

Figures 36 and 37 show respectively the results of the magnetic and EM surveys for Burning Pad G - MW11 Location. The gradients in both magnetic and EM data at the staked location for the well are essentially flat. The magnetic disturbance in the lower left corner of Figure 36 is due to a metal stake at the edge of the road. The staked location for MW11 thus appears to be located in an area that does not contain large buried metal objects. Small cartridge casings were not observed on the surface but might be encountered during drilling at any location within the survey area.

3.9 Burning Pad H - MW9 Location

Figures 38 and 39 show respectively the results of the magnetic and EM surveys for Burning Pad H - MW9 Location. The gradients in both magnetic and EM data at the staked location for the well are essentially flat. The staked location for MW9 thus appears to be located in an area that does not contain large buried metal objects. Small cartridge casings were observed on the surface and might be encountered during drilling at any location within the survey area.

3.10 Burning Pad J - MW8 Location

Figures 40 and 41 show respectively the results of the magnetic and EM surveys for Burning Pad G - MW11 Location. The gradients in both magnetic and EM data at the staked location for the well are low. The staked location for MW8 thus appears to be located in an area that does not contain large buried metal objects. Small cartridge casings were observed on the surface and might be encountered during drilling at any location within the survey area.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the combined results of the geophysical surveys, we conclude that 8 of the 10 monitoring well locations are located such that large metal objects will not disrupt the progress of the drilling. We recommend that two of the monitoring well locations be reconsidered:

1. At Burning Pad A - MW16 Location, we recommend that the well be relocated at least 15 north of the present staked site in order to avoid a large metallic object(s) located in the southeast quadrant of the surveyed area.

2. At Burning Pad E - MW12 Location, the magnetic and EM surveys indicate the presence of metallic objects in the subsurface of the entire area surveyed. No area was found within the survey area that can clearly avoid encountering metallic objects during drilling operations. We recommend that this well not be be drilled in the survey area. We did not survey any other area in the vicinity and cannot recommend a specific alternate location for MW12.

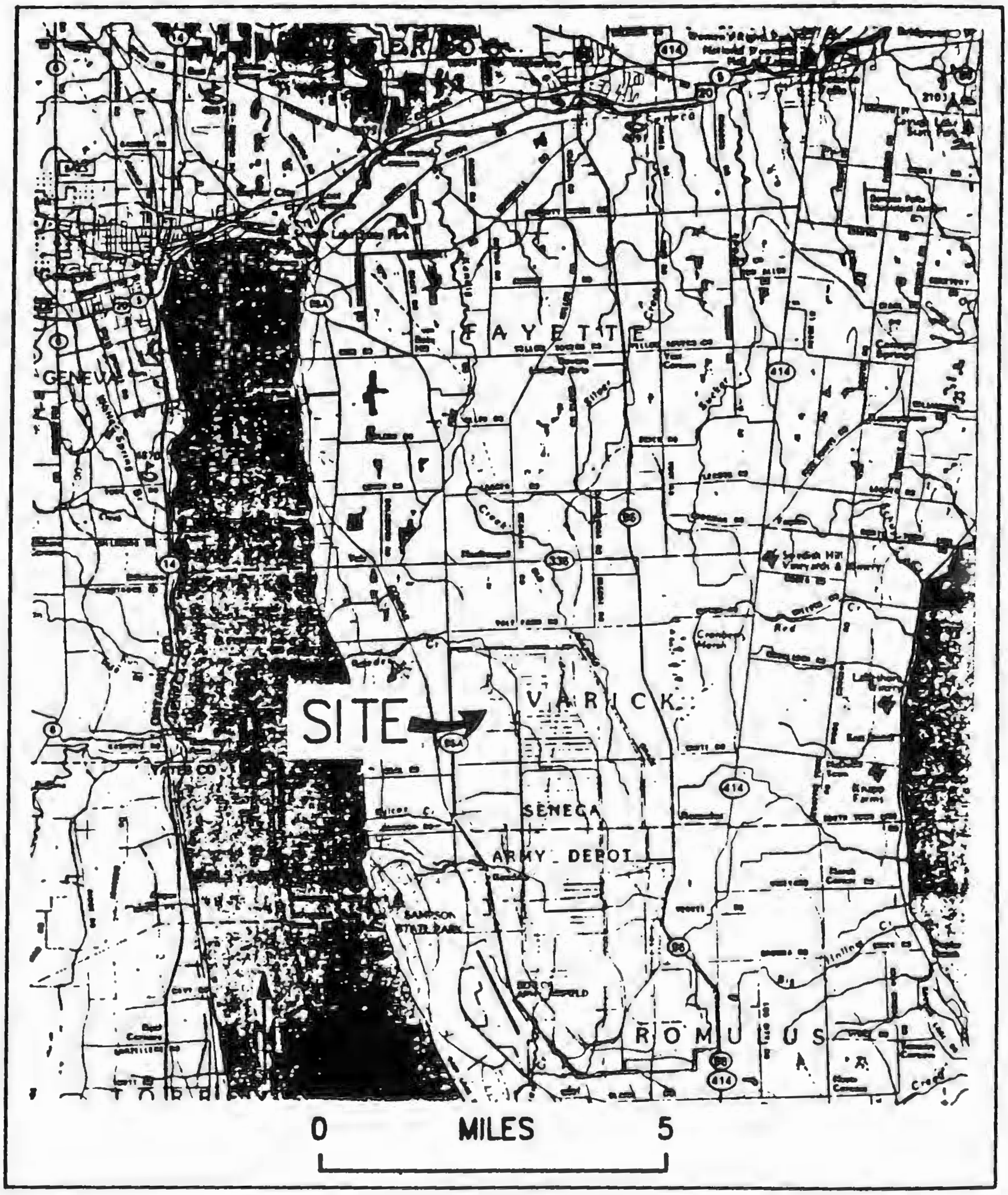

Figure 1. General location of the Demolition Grounds, Seneca Army Depot, Romulus, New York.

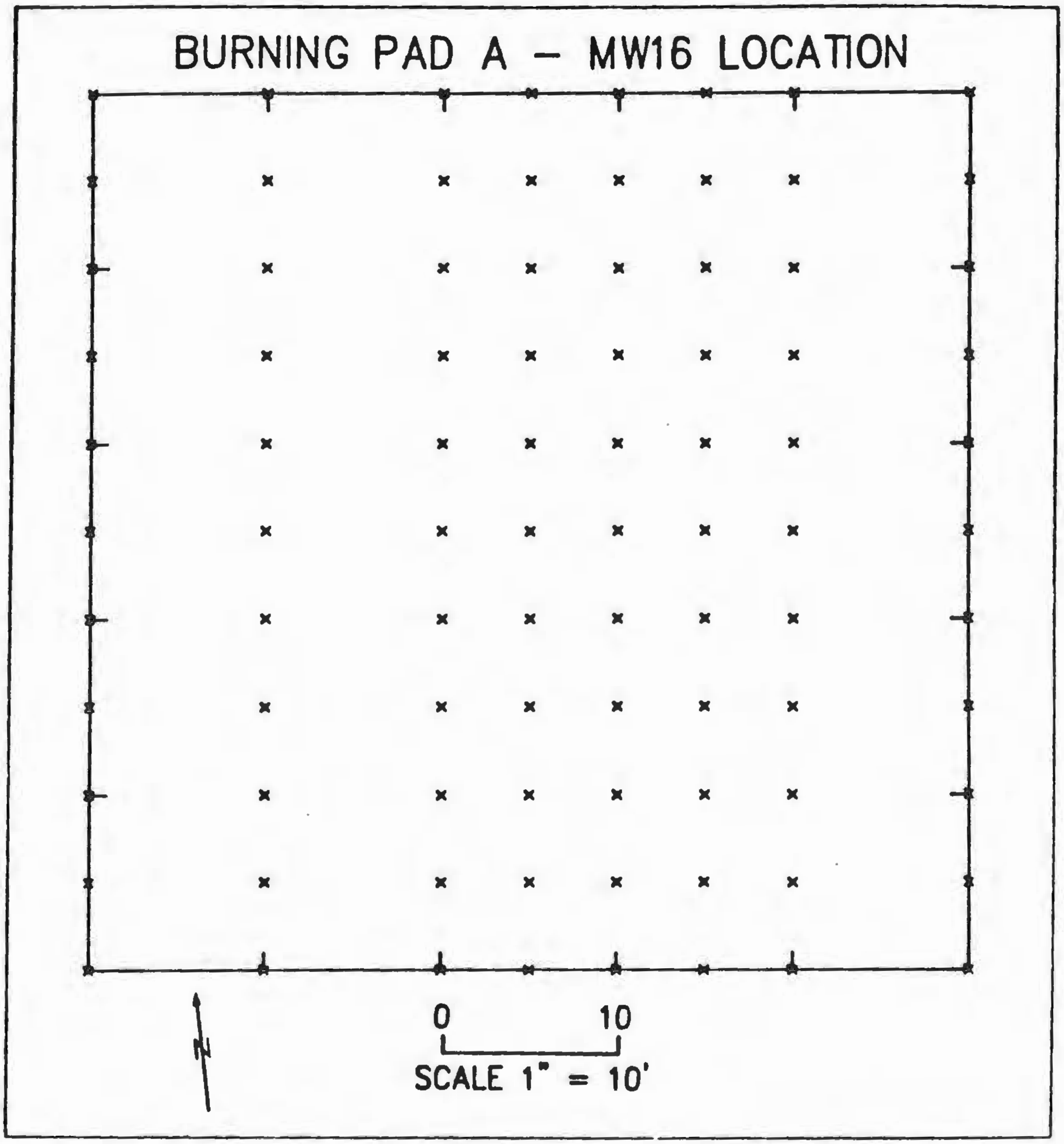

Figure 2. Magnetic station map, Burning Pad A - MW16 Location, Seneca Army Depot.

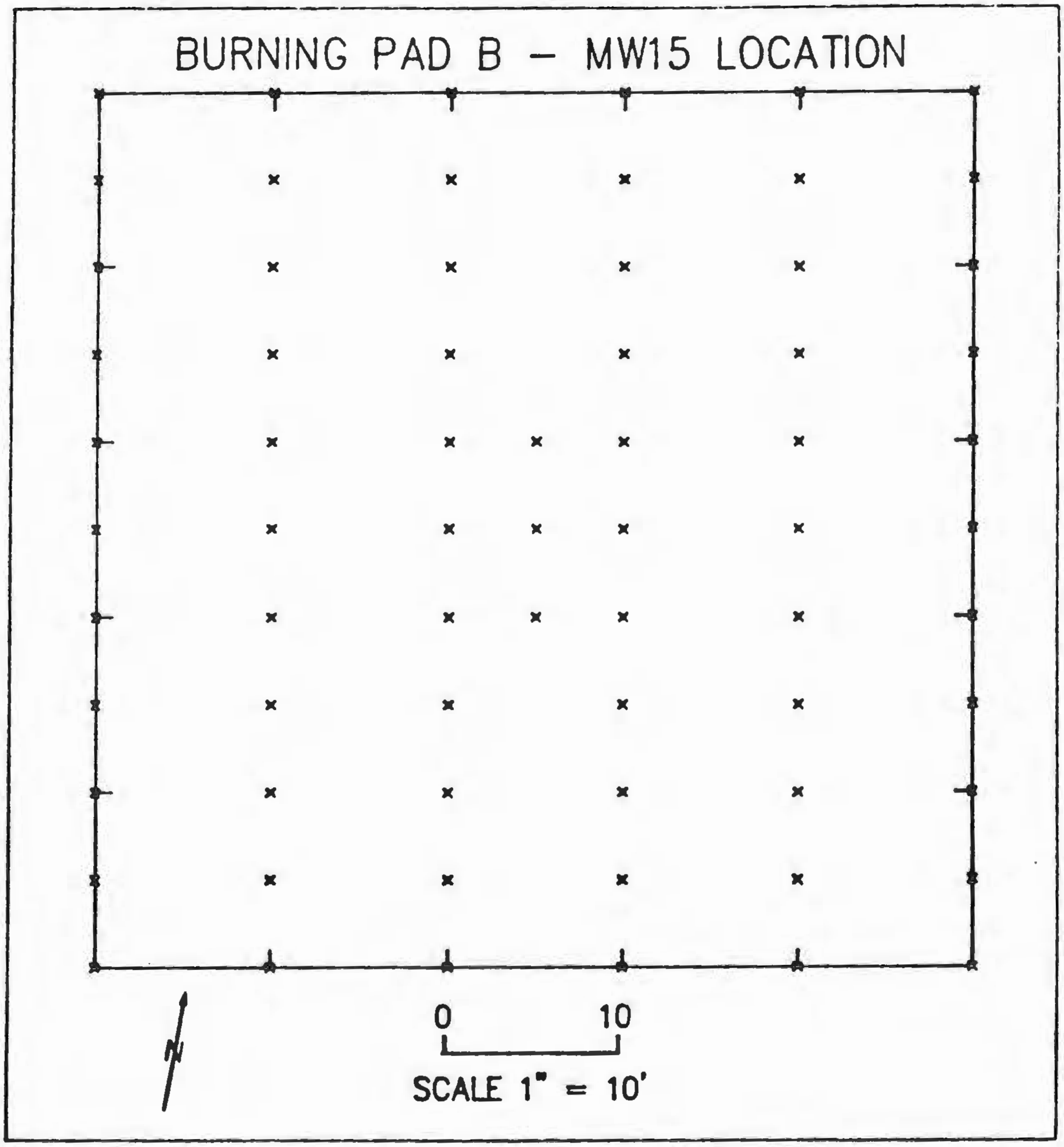

Figure 3. Magnetic station map, Burning Pad B - MW15 Location, Seneca Army Depot.

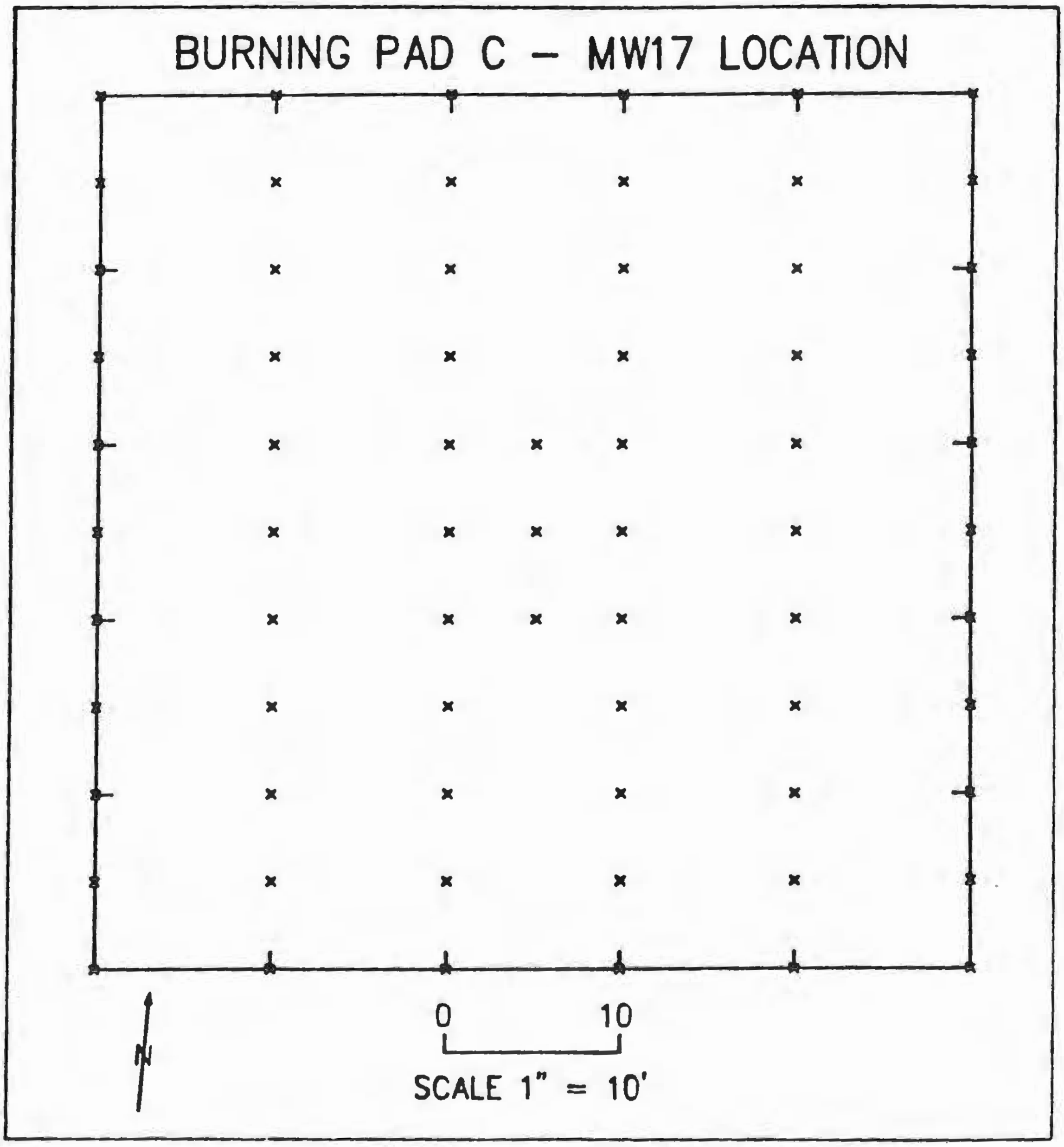

Figure 4. Magnetic station map, Burning Pad C - MW17 Location, Seneca Army Depot.

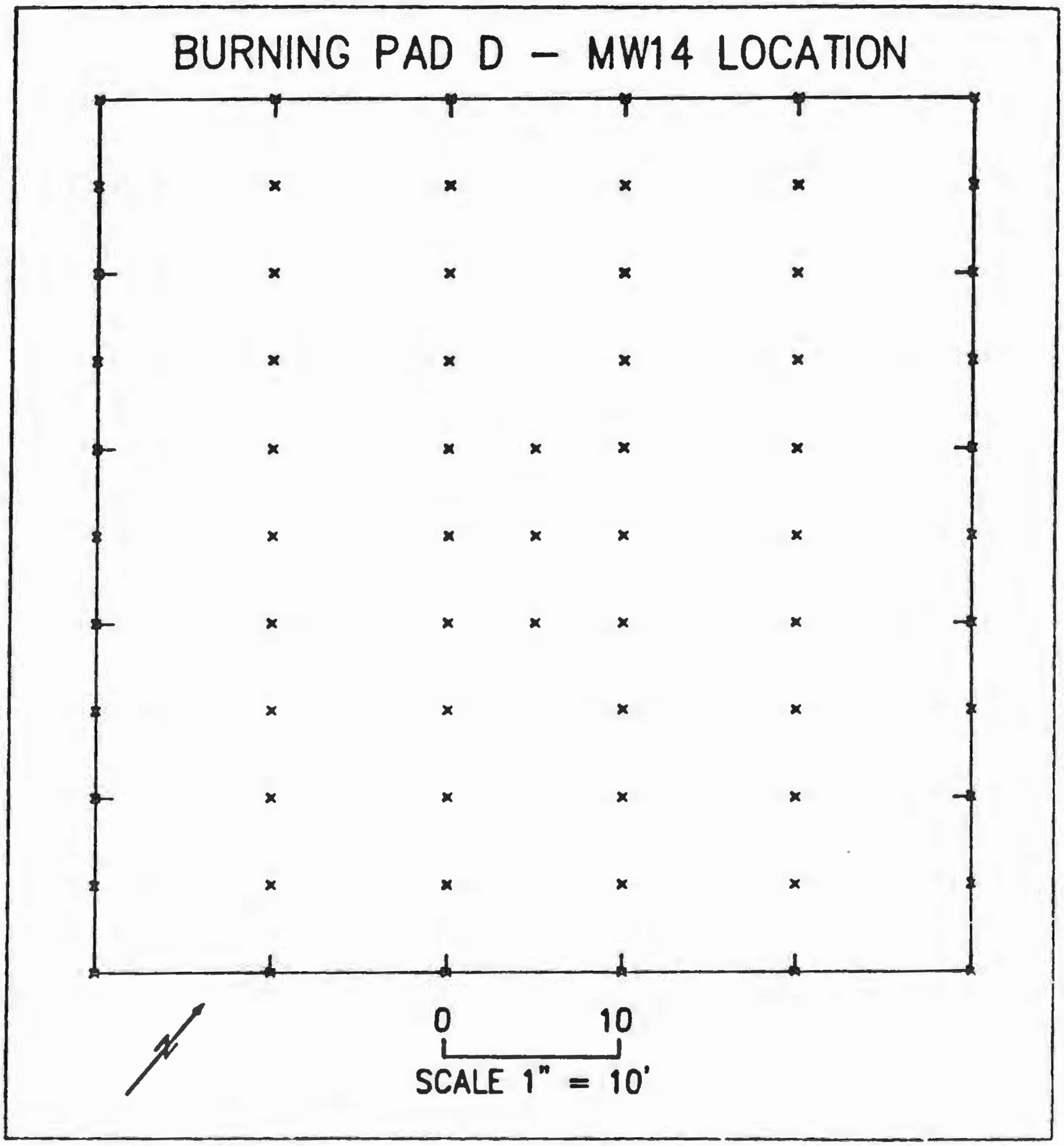

Figure 5. Magnetic station map, Burning Pad D - MW14 Location, Seneca Army Depot.

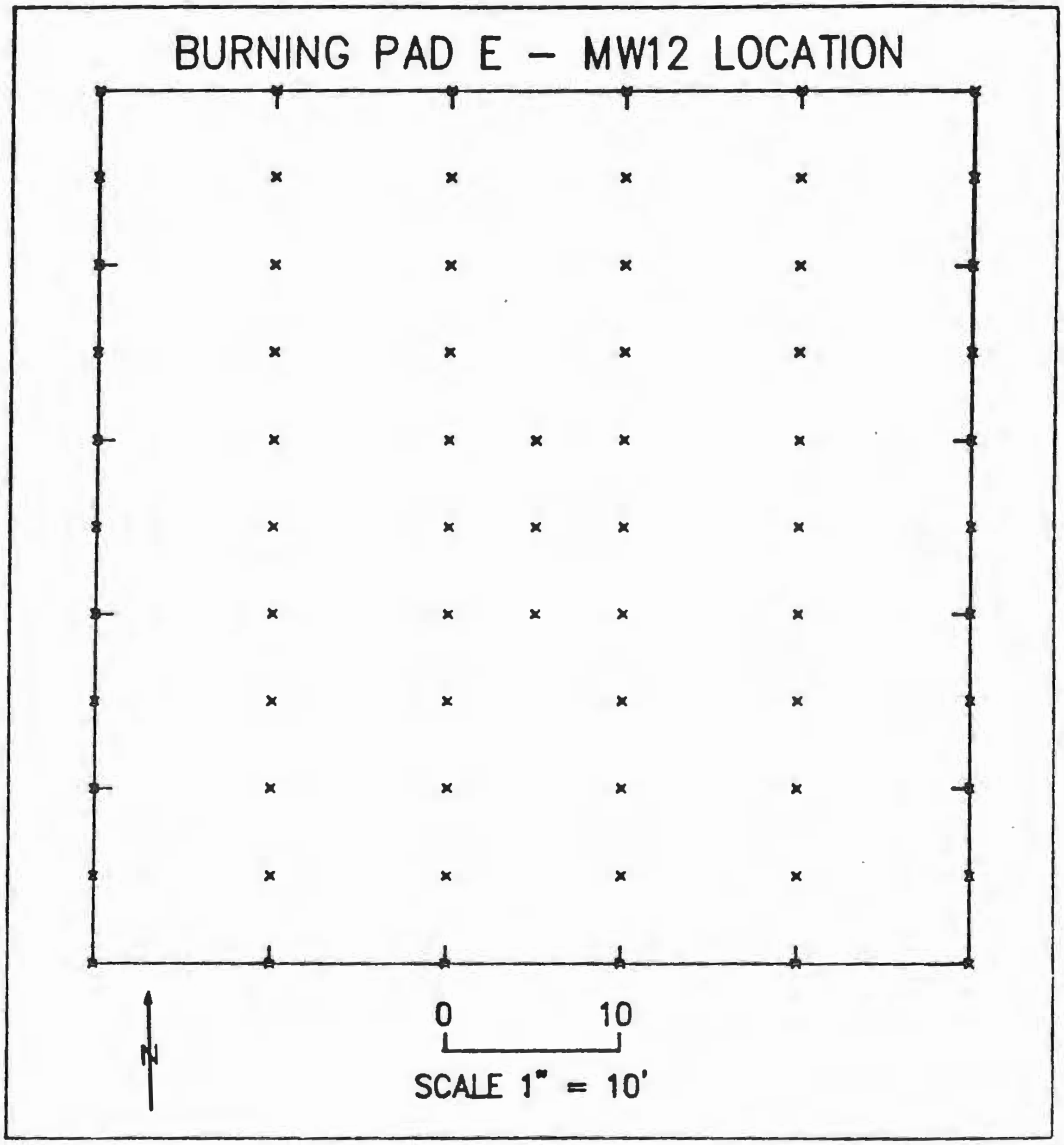

Figure 6. Magnetic station map, Burning Pad E - MW12 Location, Seneca Army Depot.

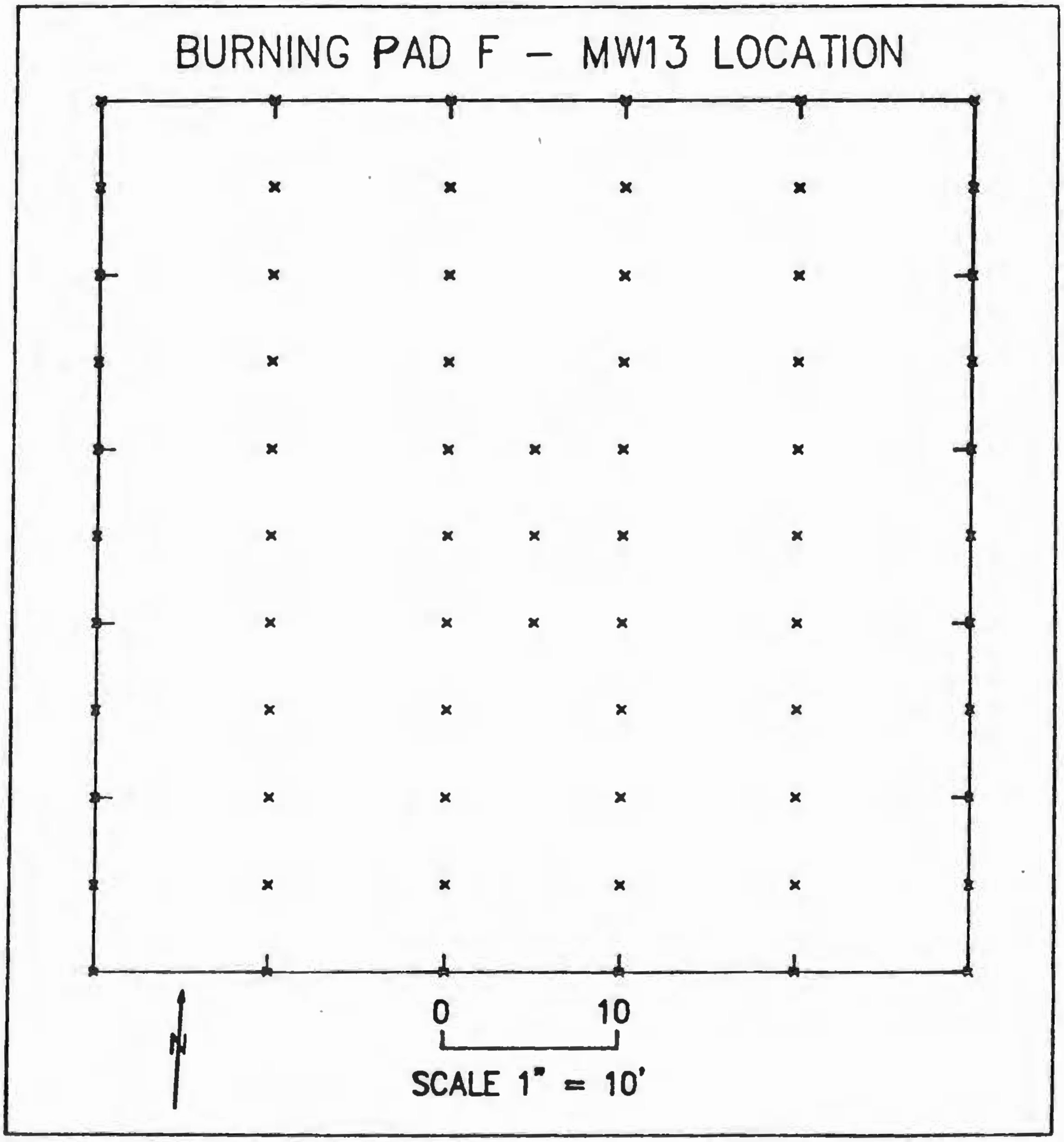

Figure 7. Magnetic station map, Burning Pad F - MW13 Location, Seneca Army Depot.

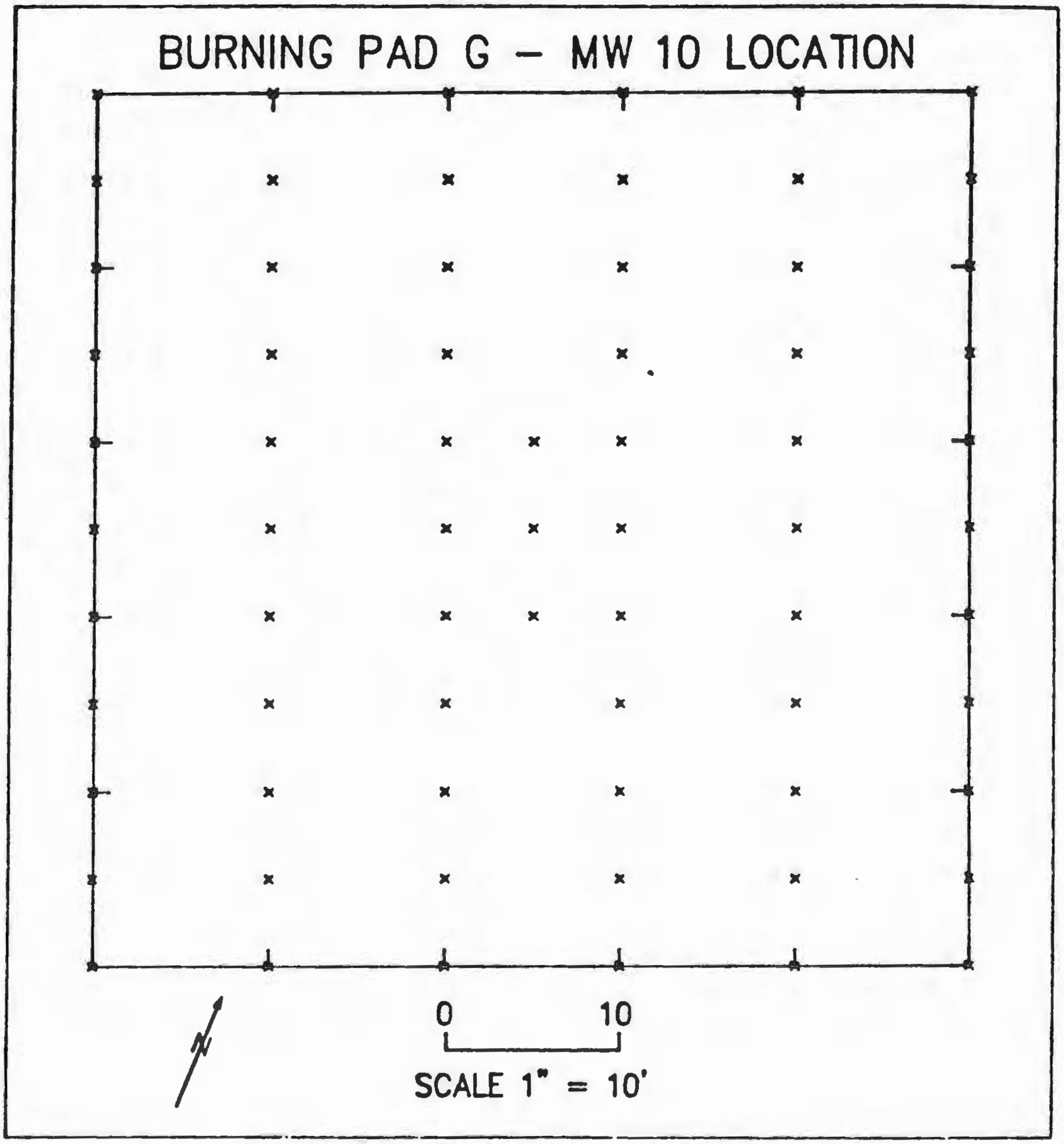

Figure 8. Magnetic station map, Burning Pad G - MW10 Location, Seneca Army Depot.

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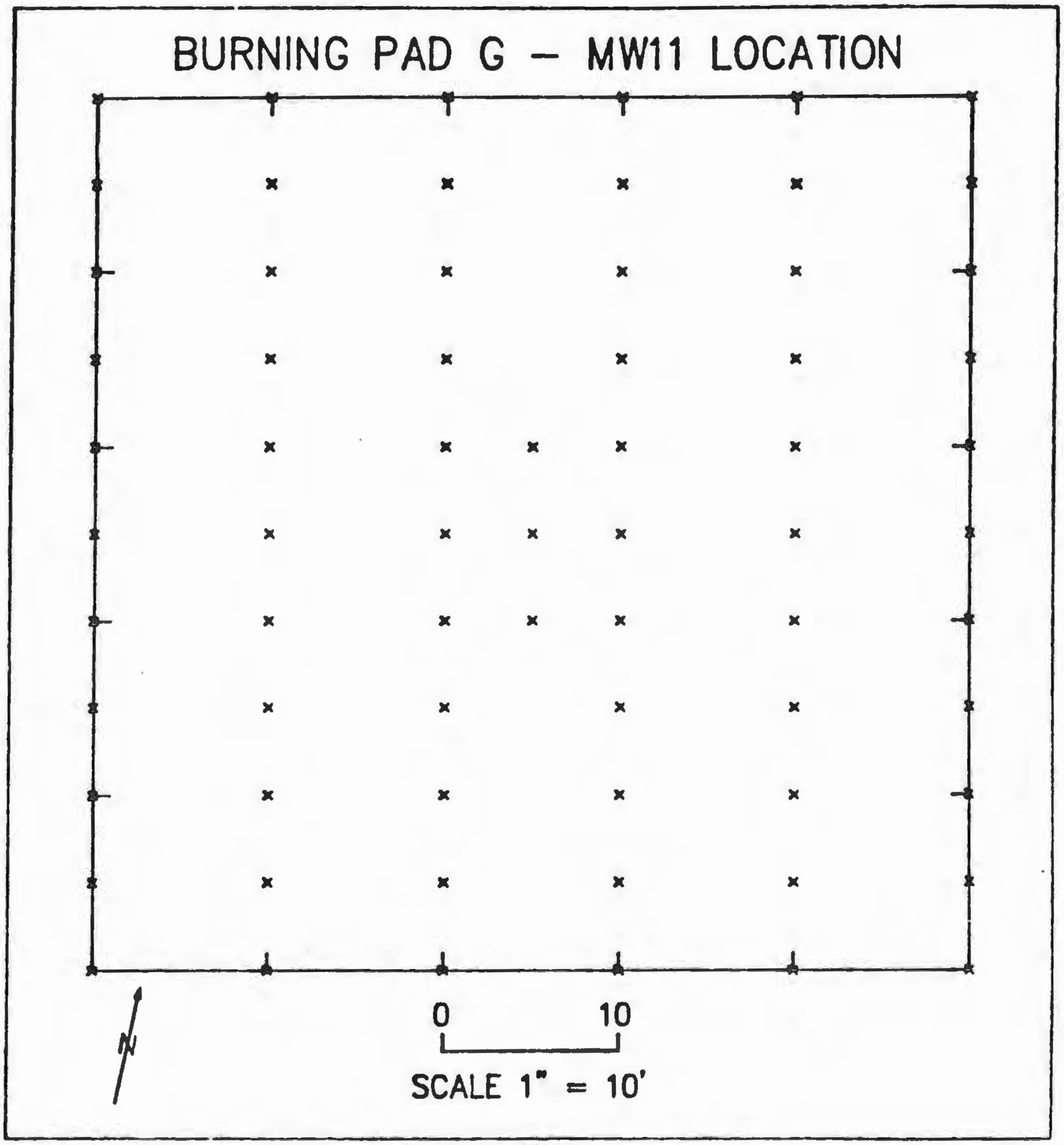

Figure 9. Magnetic station map, Burning Pad G - MW11 Location, Seneca Army Depot.

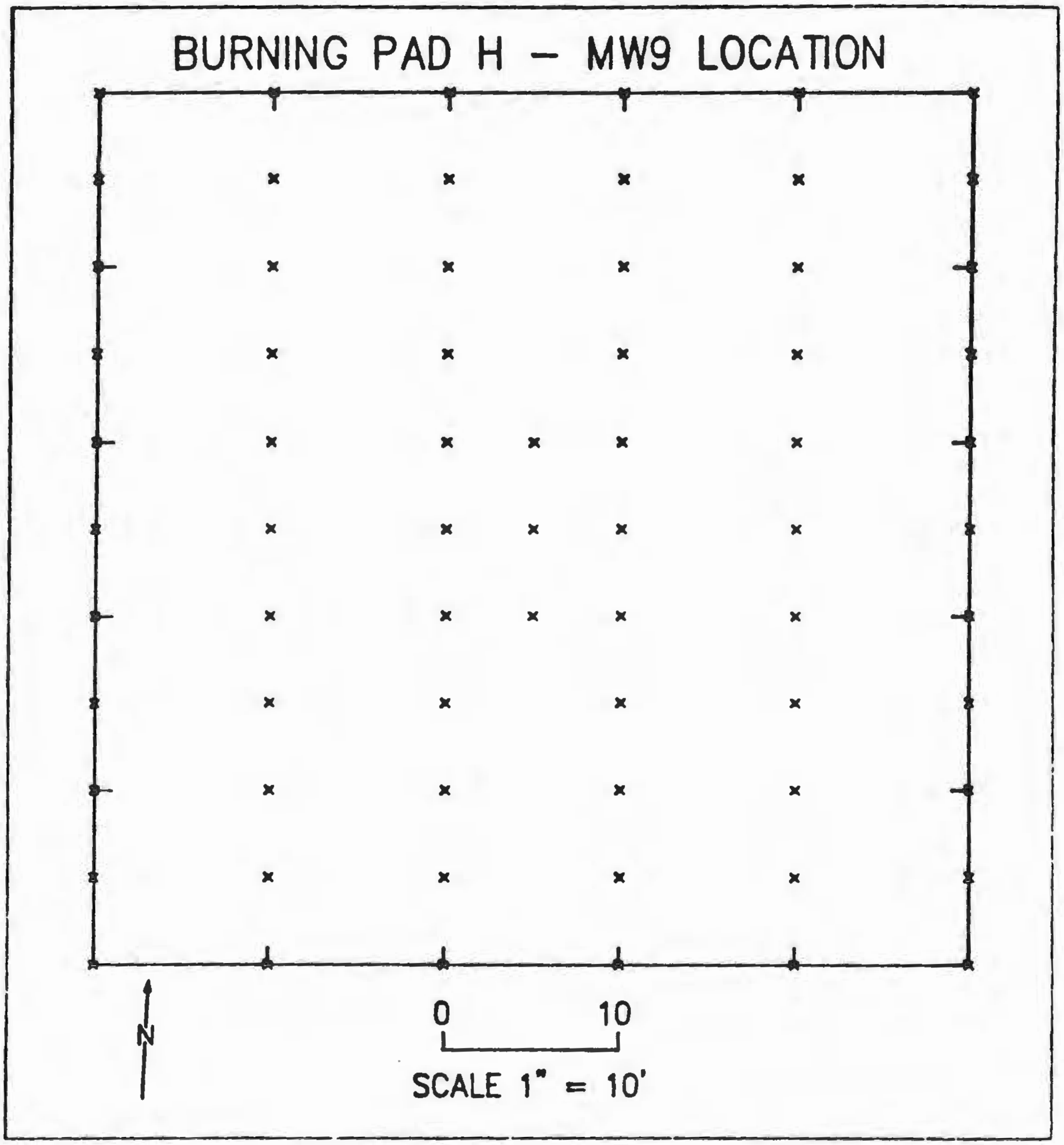

Figure 10. Magnetic station map, Burning Pad H - MW9 Location, Seneca Army Depot.

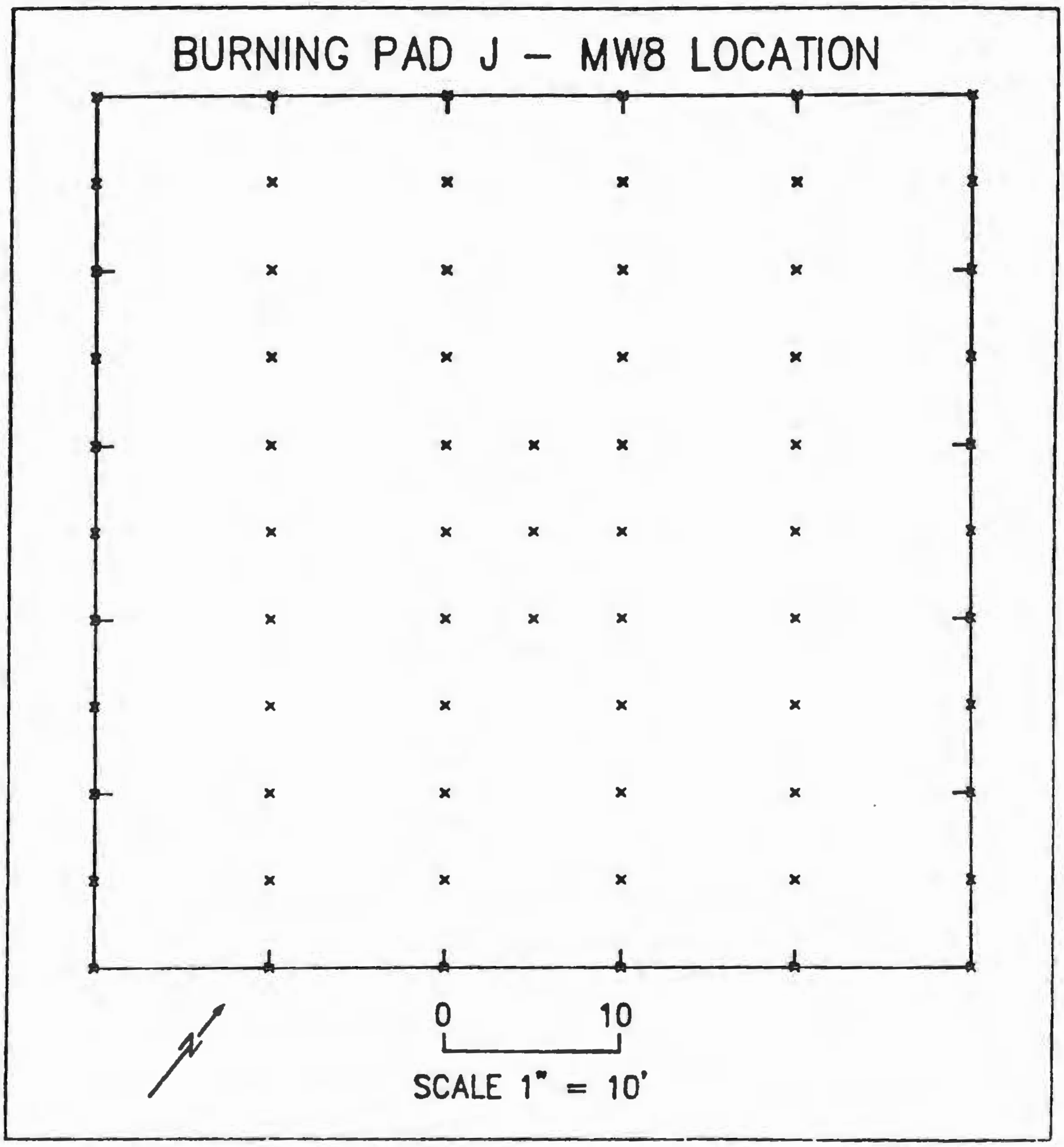

Figure 11. Magnetic station map, Burning Pad J - MW8 Location, Seneca Army Depot.

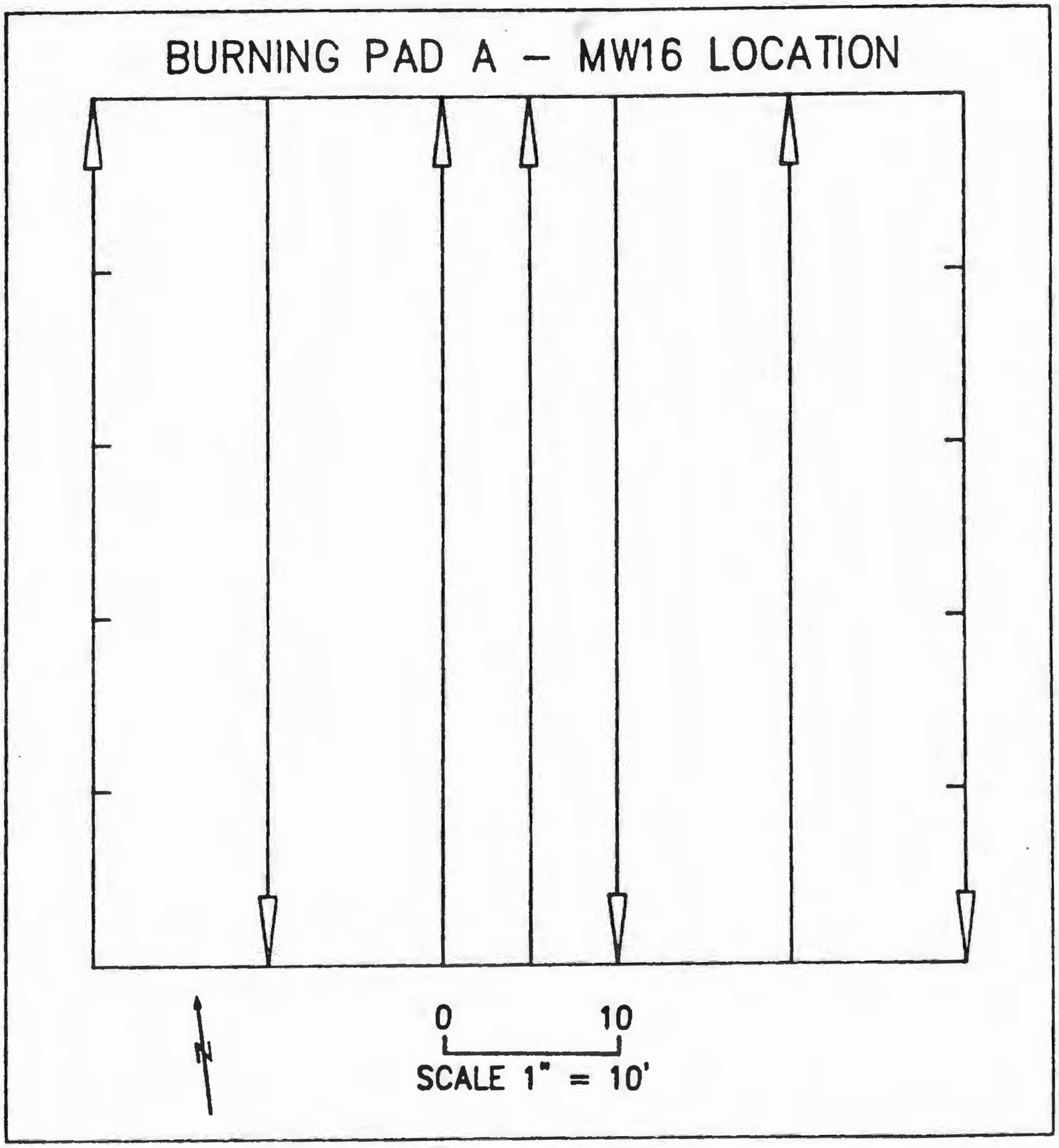

Figure 12. EM survey traverses, Burning Pad A - MW16 Location, Seneca Army Depot.

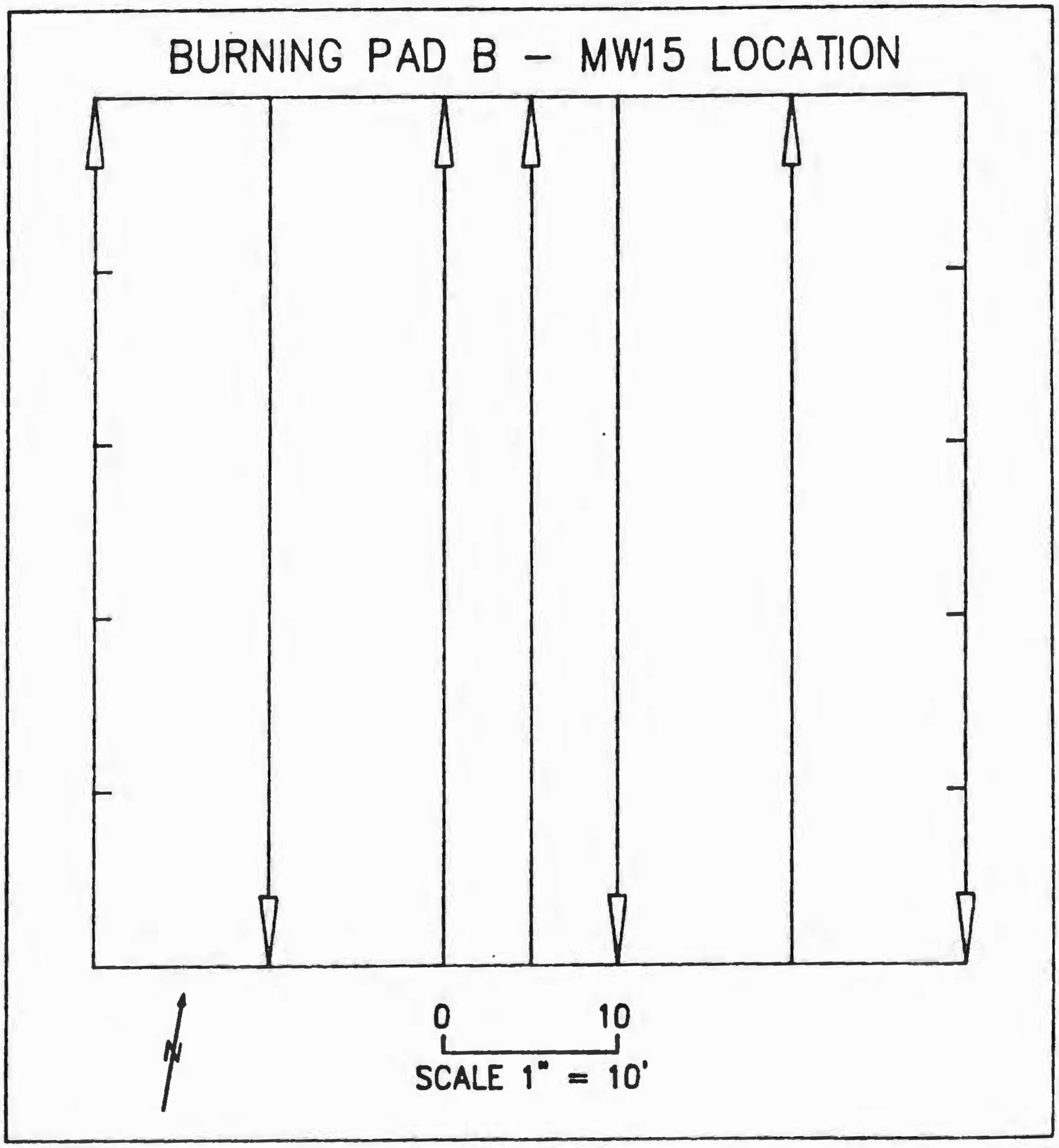

Figure 13. EM survey traverses, Burning Pad B - MW15 Location, Seneca Army Depot.

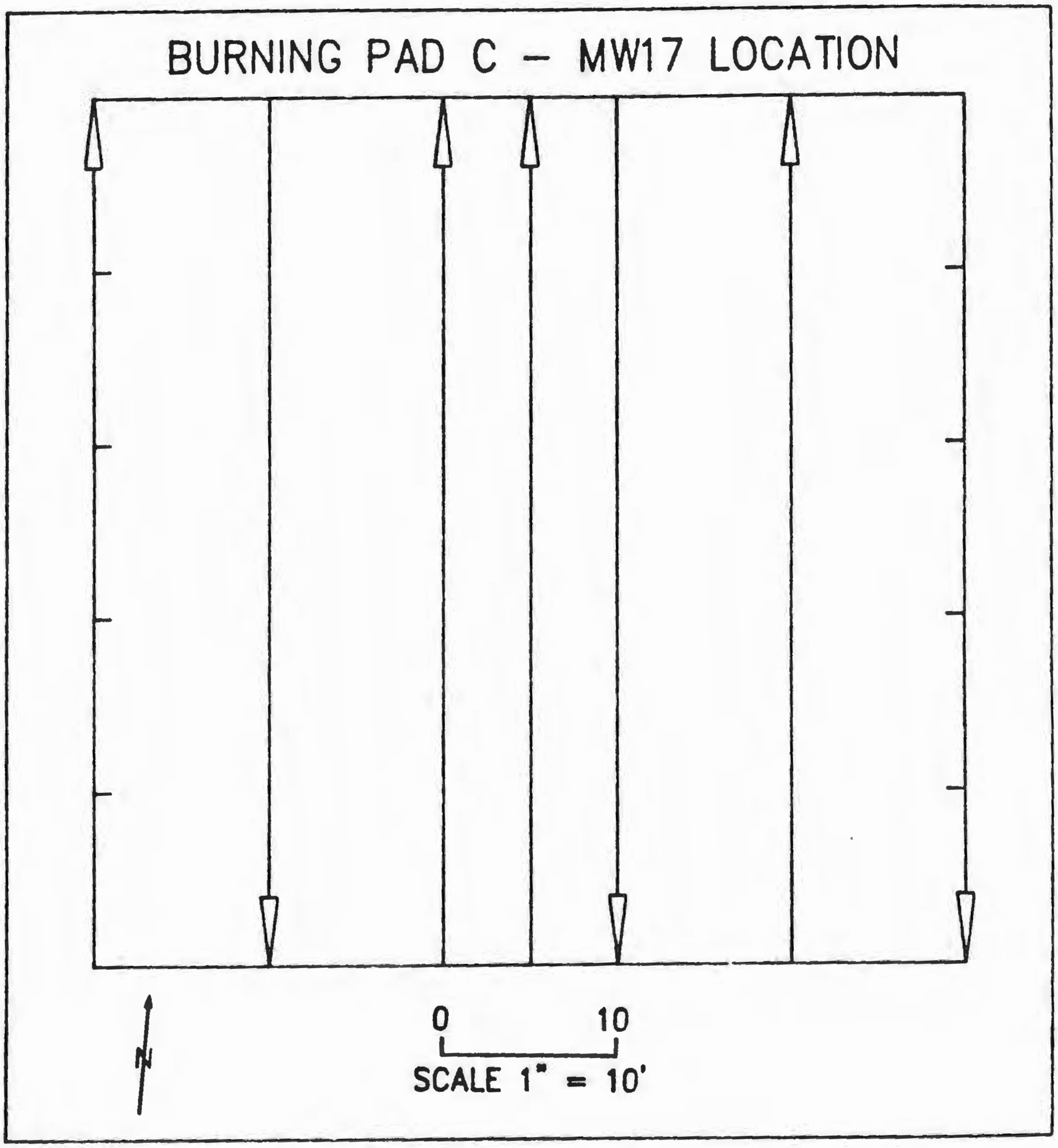

Figure 14. EM survey traverses, Burning Pad C - MW17 Location, Seneca Army Depot.

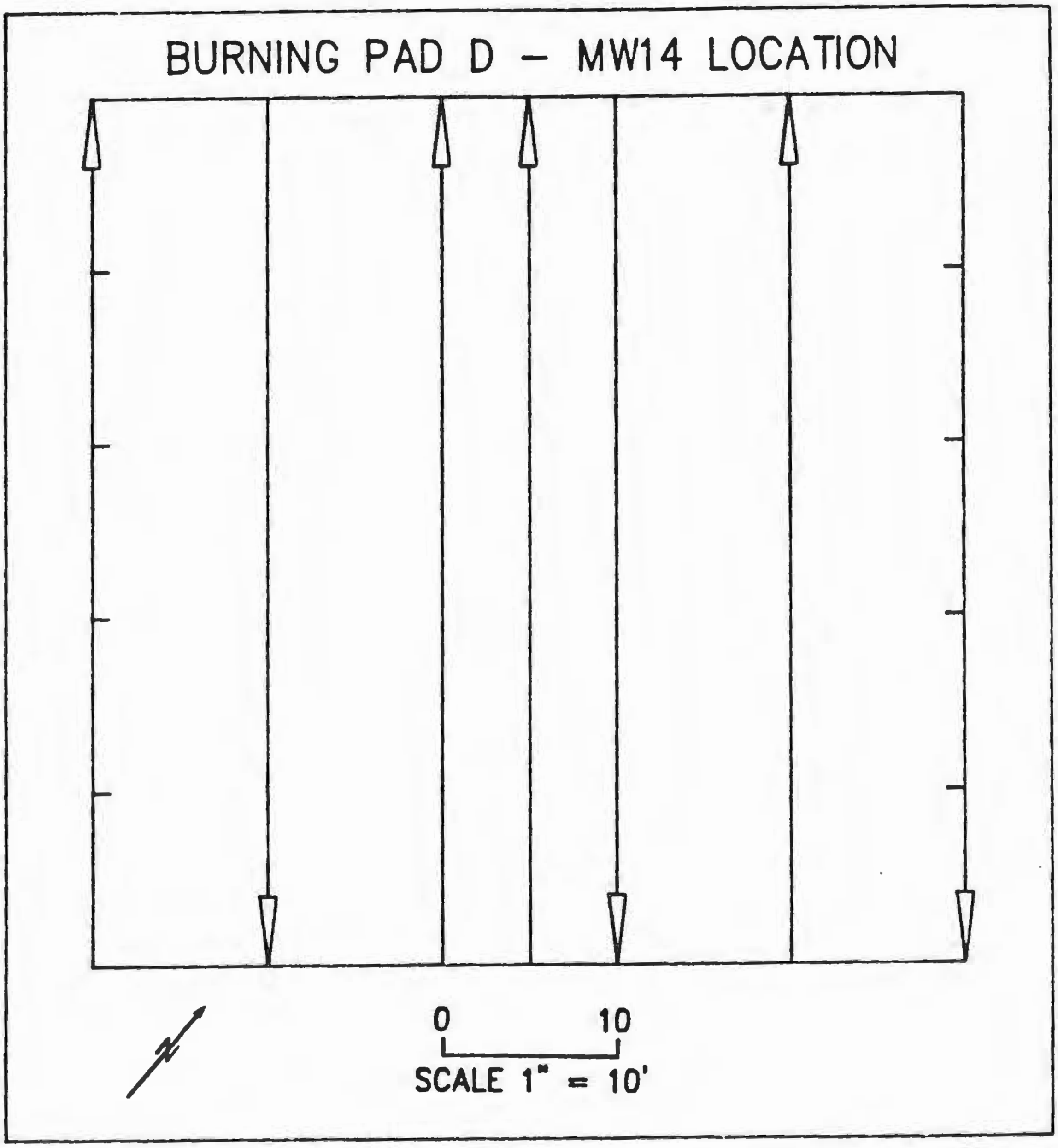

Figure 15. EM survey traverses, Burning Pad D - MW14 Location, Seneca Army Depot.

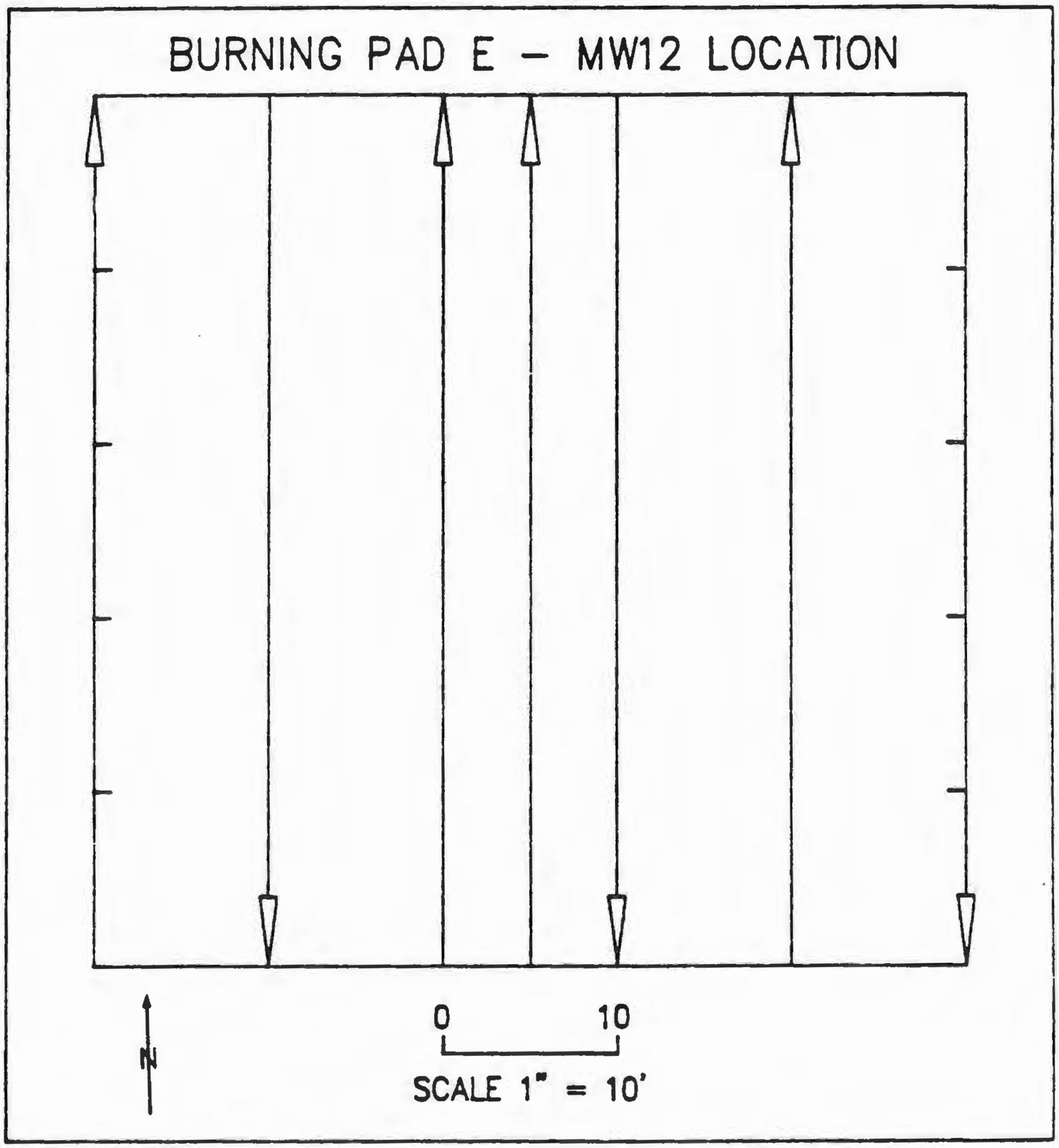

Figure 16. EM survey traverses, Burning Pad E - MW12 Location, Seneca Army Depot.

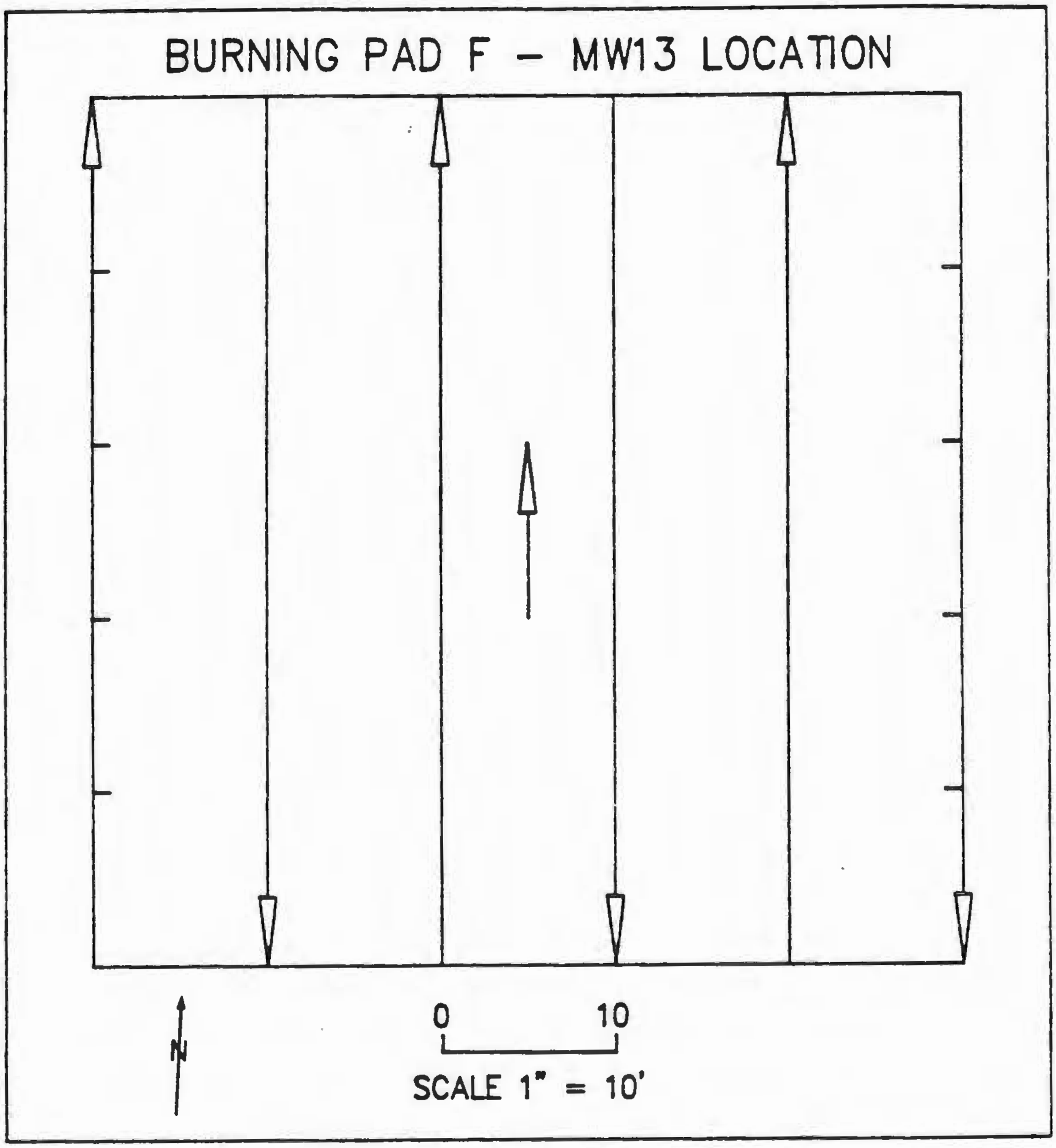

Figure 17. EM survey traverses, Burning Pad F - MW13 Location, Seneca Army Depot.

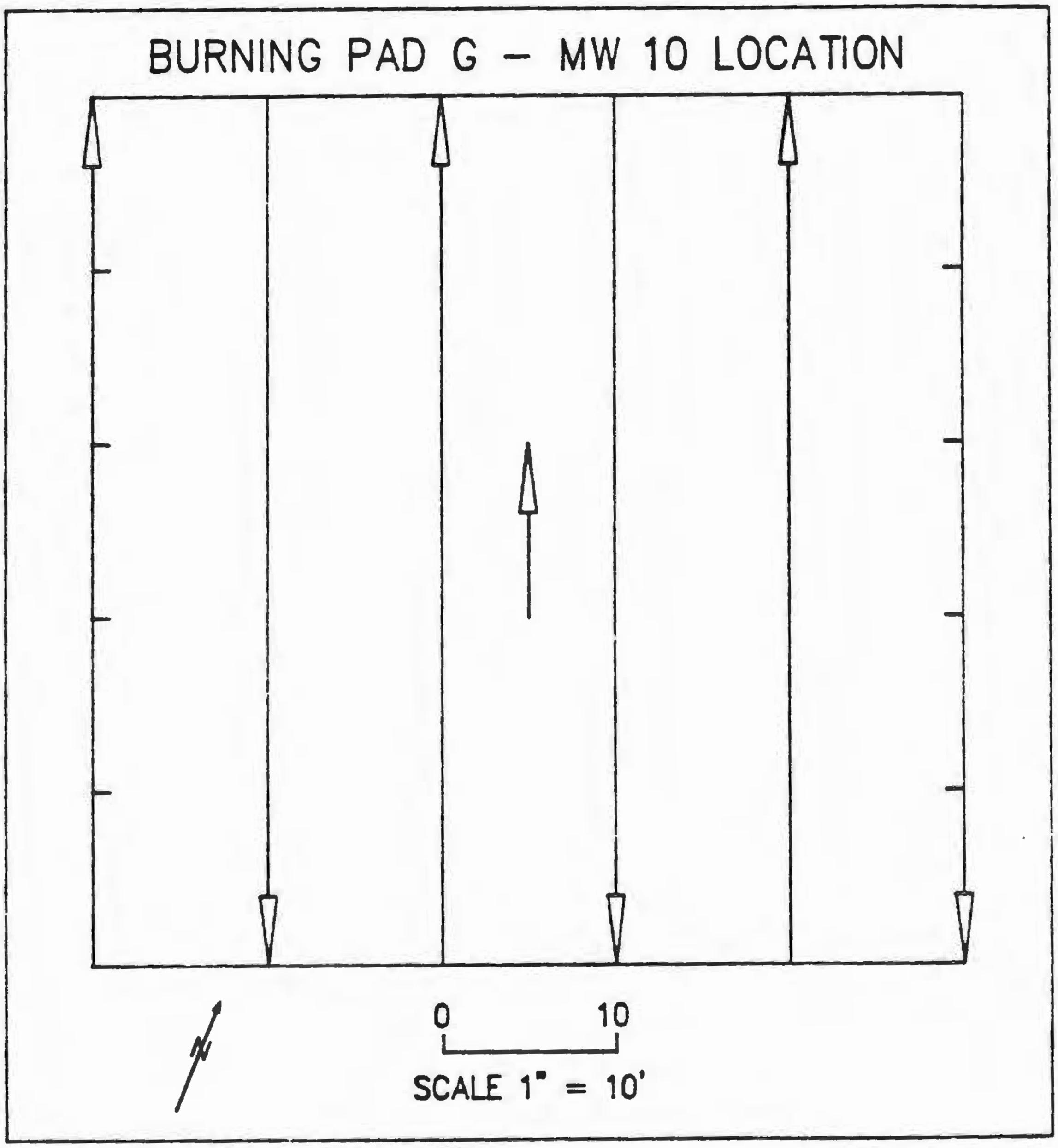

Figure 18. EM survey traverses, Burning Pad G - MW10 Location, Seneca Army Depot.

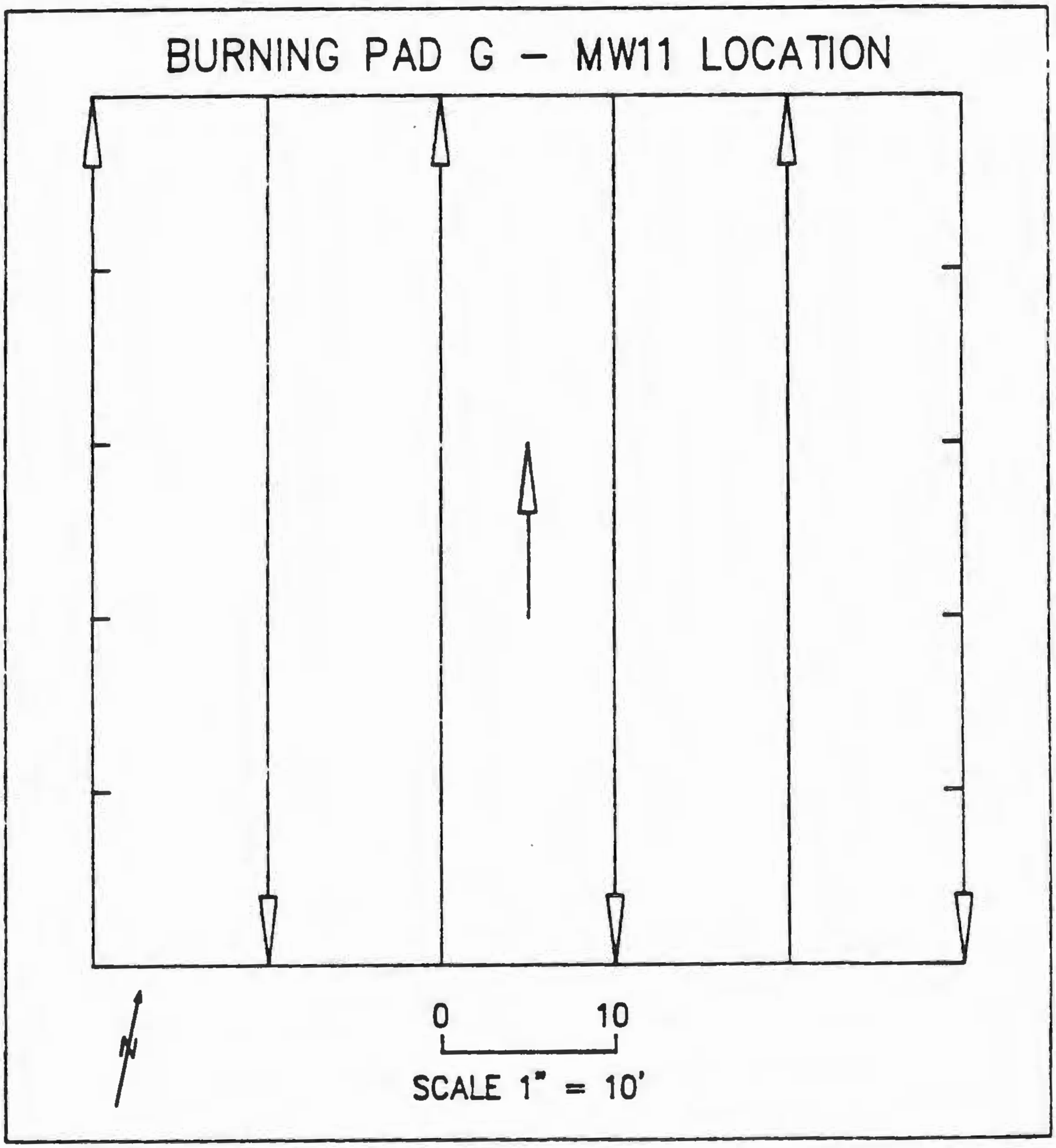

Figure 19. EM survey traverses, Burning Pad G - MW11 Location, Seneca Army Depot.

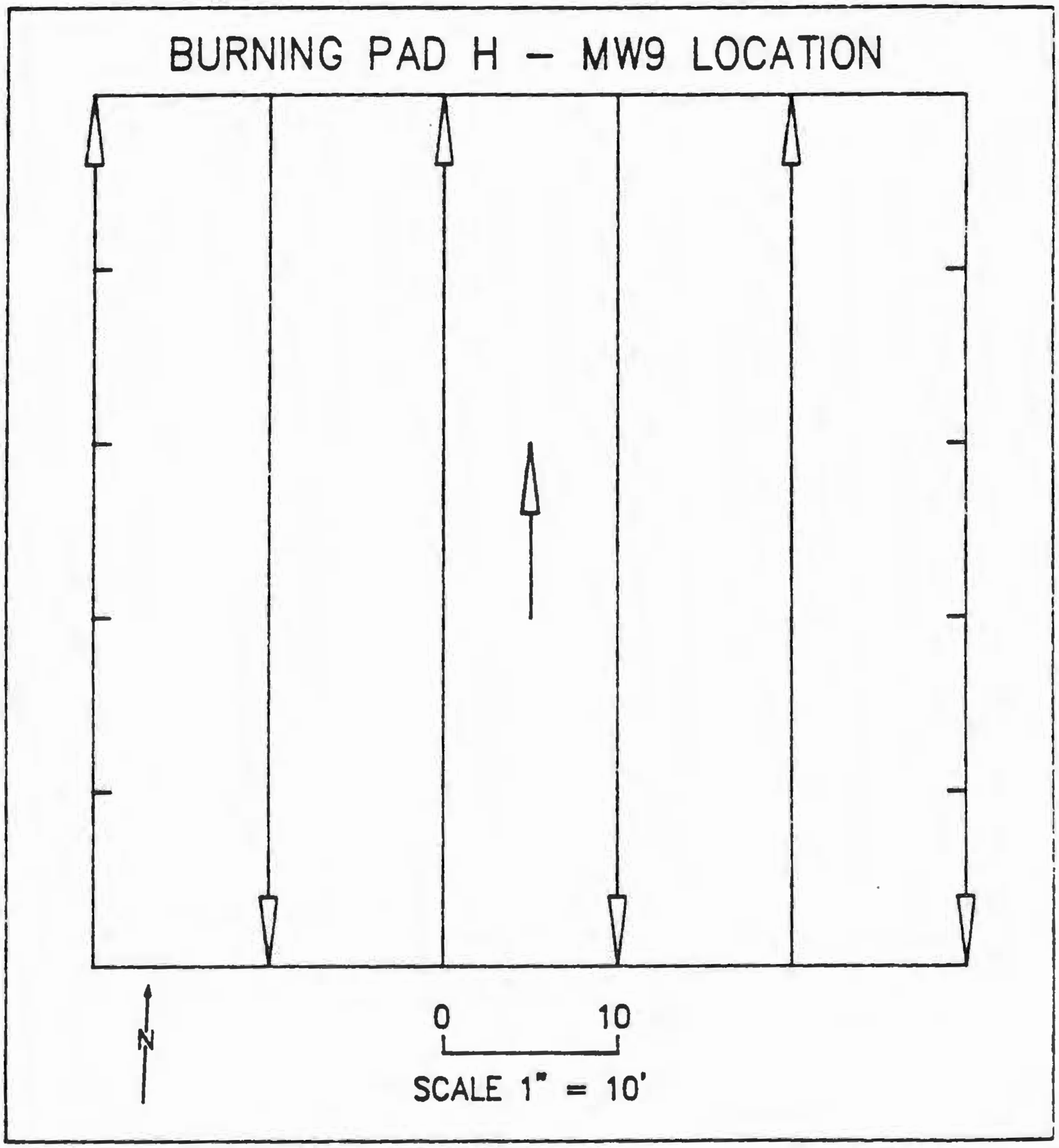

Figure 20. EM survey traverses, Burning Pad H - MW9 Location, Seneca Army Depot.

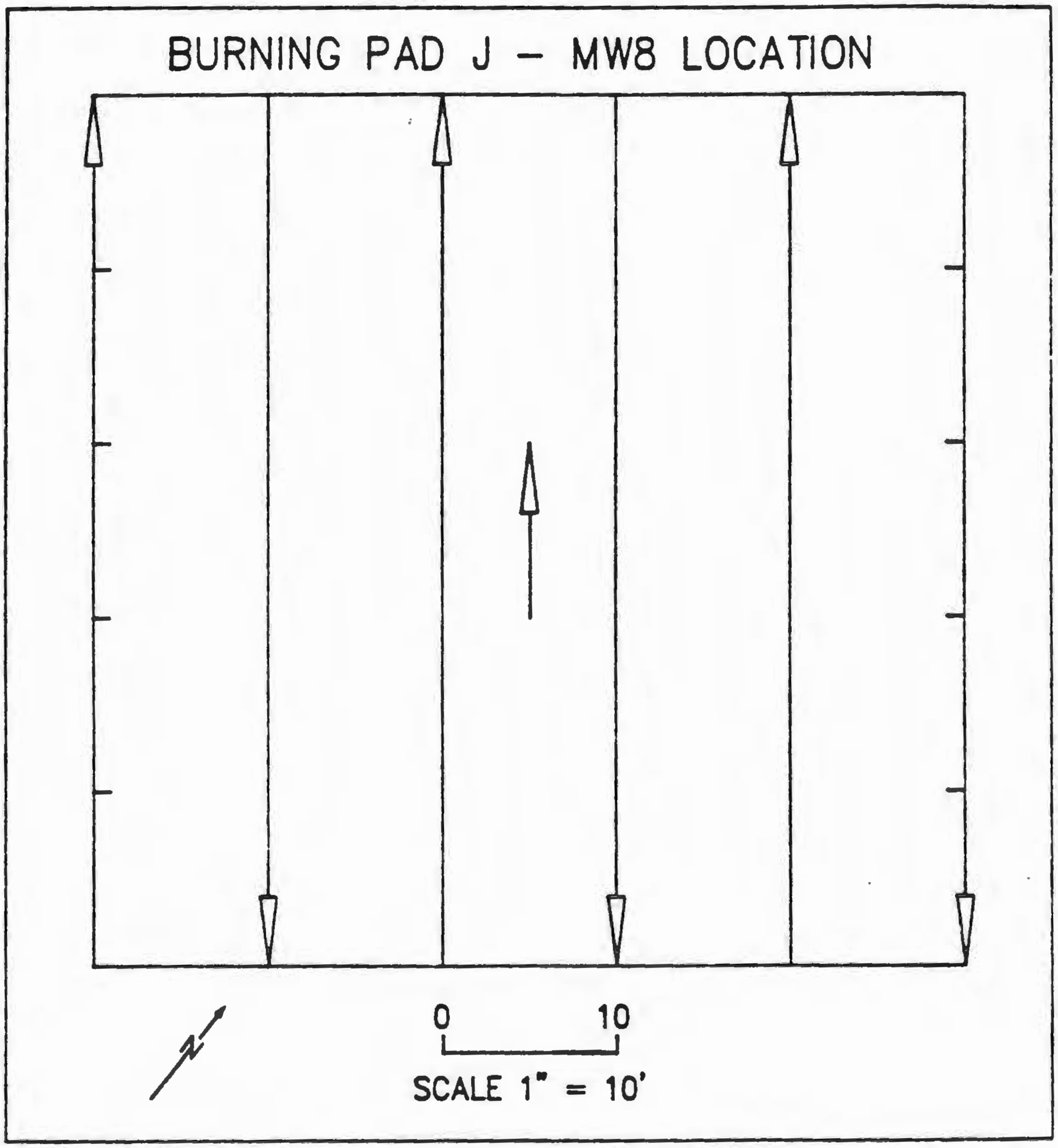

Figure 21. EM survey traverses, Burning Pad J - MW8 Location, Seneca Army Depot.

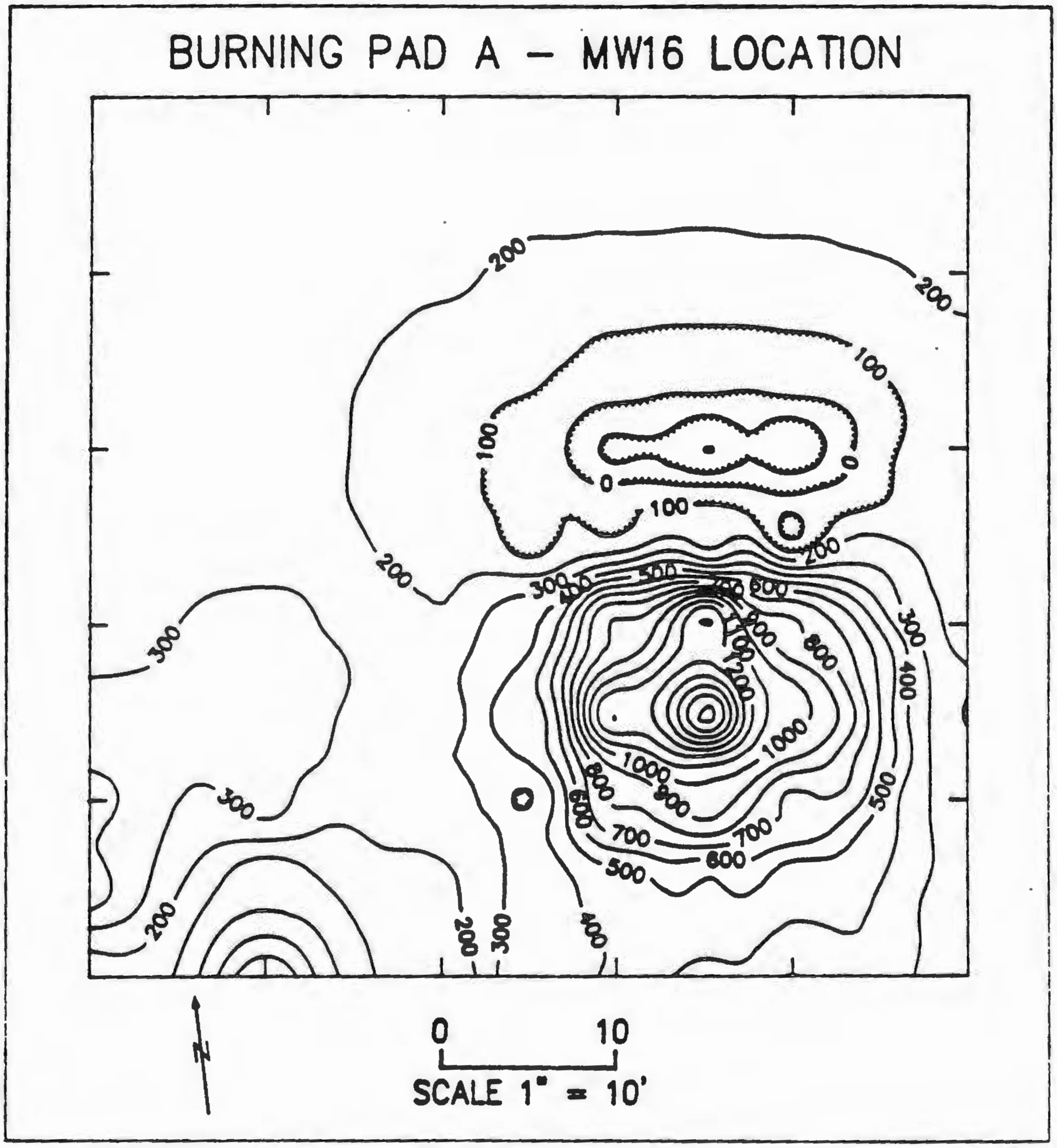

Figure 22. Magnetic field, Burning Pad A - MW16 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

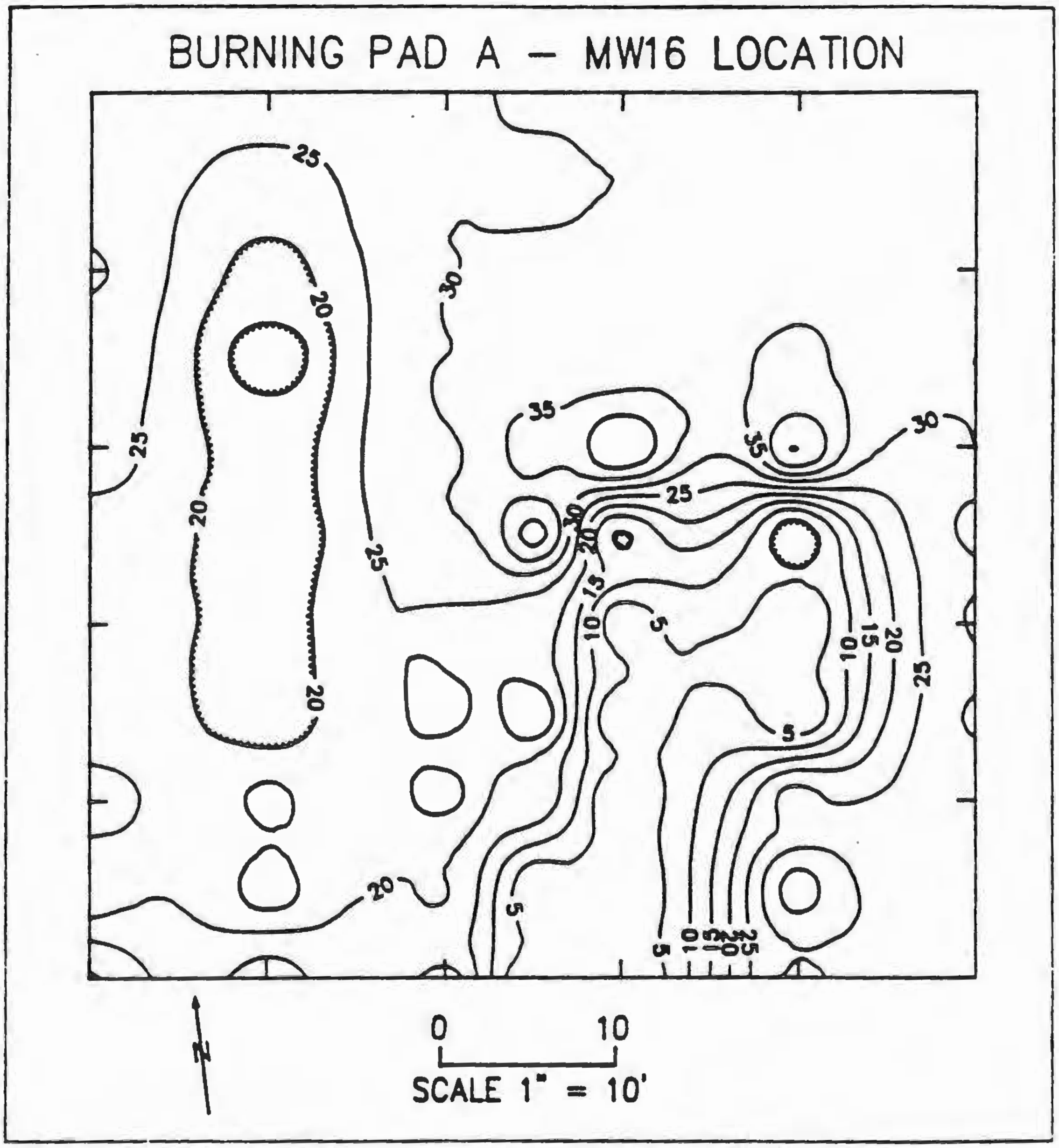

Figure 23. Contours of relative values of inphase component of induced magnetic field, Burning Pad A - MW16 Location, Seneca Army Depot. Contour interval 5% of full scale.

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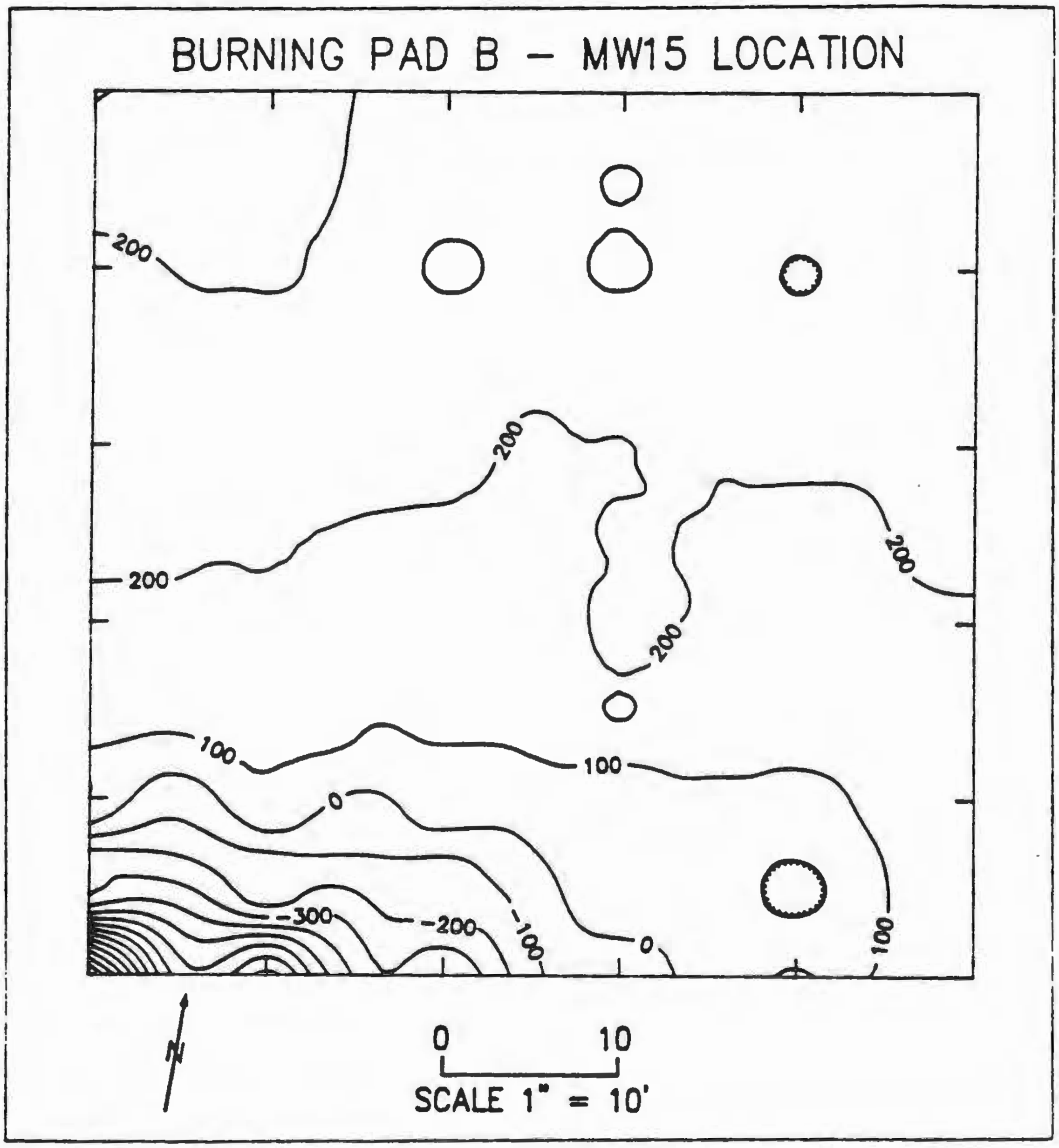

Figure 24. Magnetic field, Burning Pad B - MW15 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

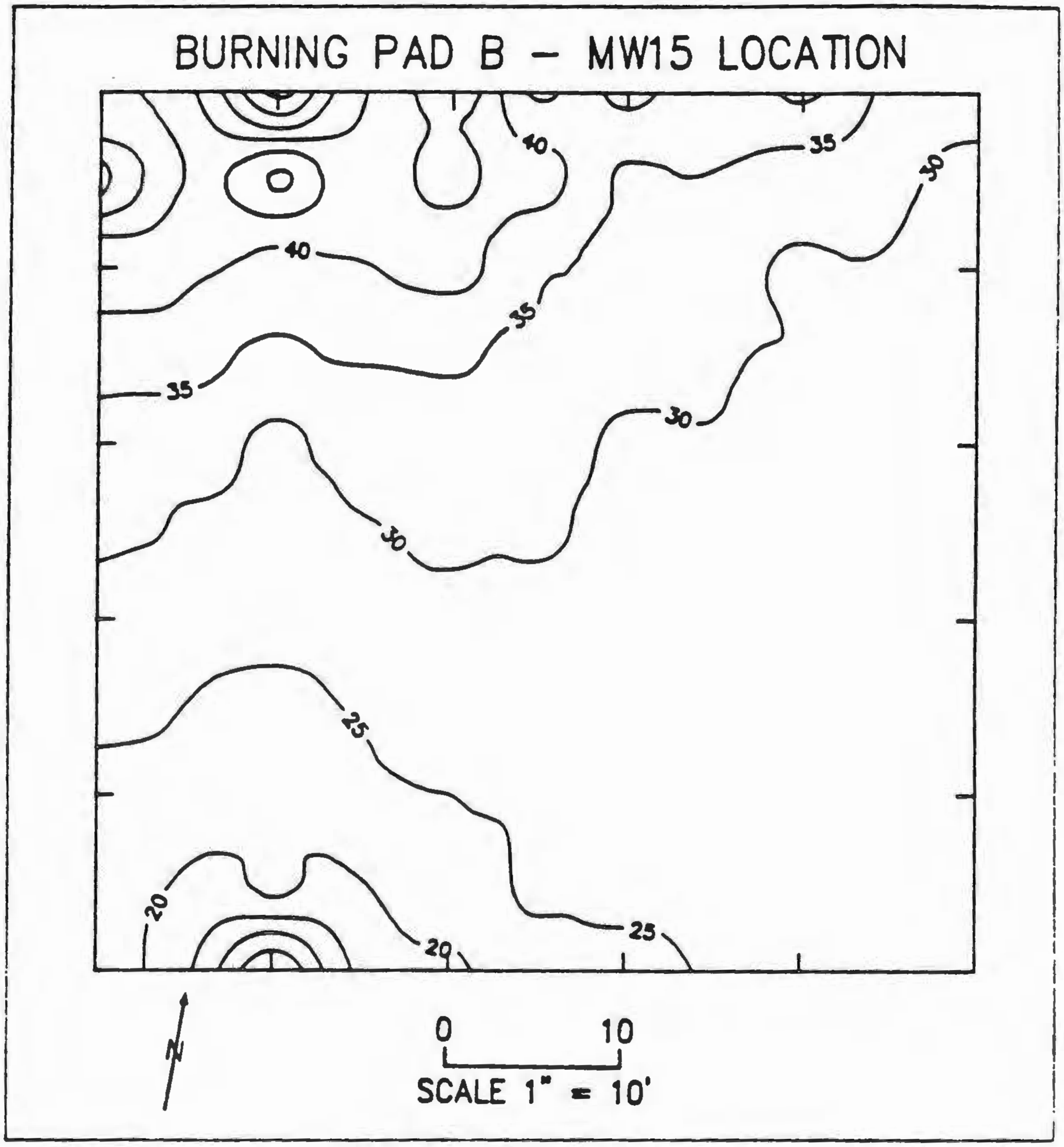

Figure 25. Contours of relative values of inphase component of induced magnetic field, Burning Pad B - MW15 Location, Seneca Army Depot. Contour interval 5% of full scale.

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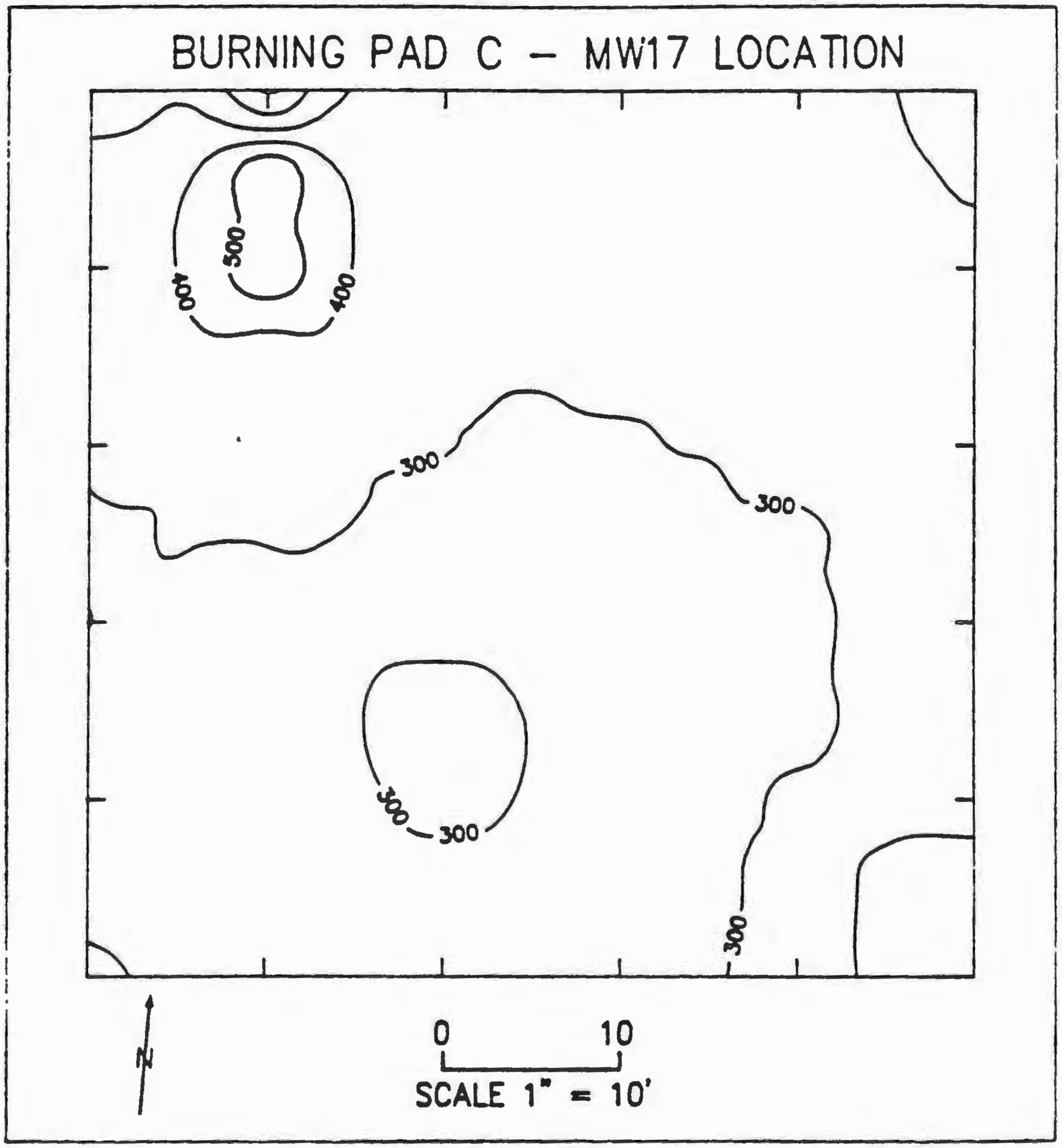


Figure 26. Magnetic field, Burning Pad C - MW17 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

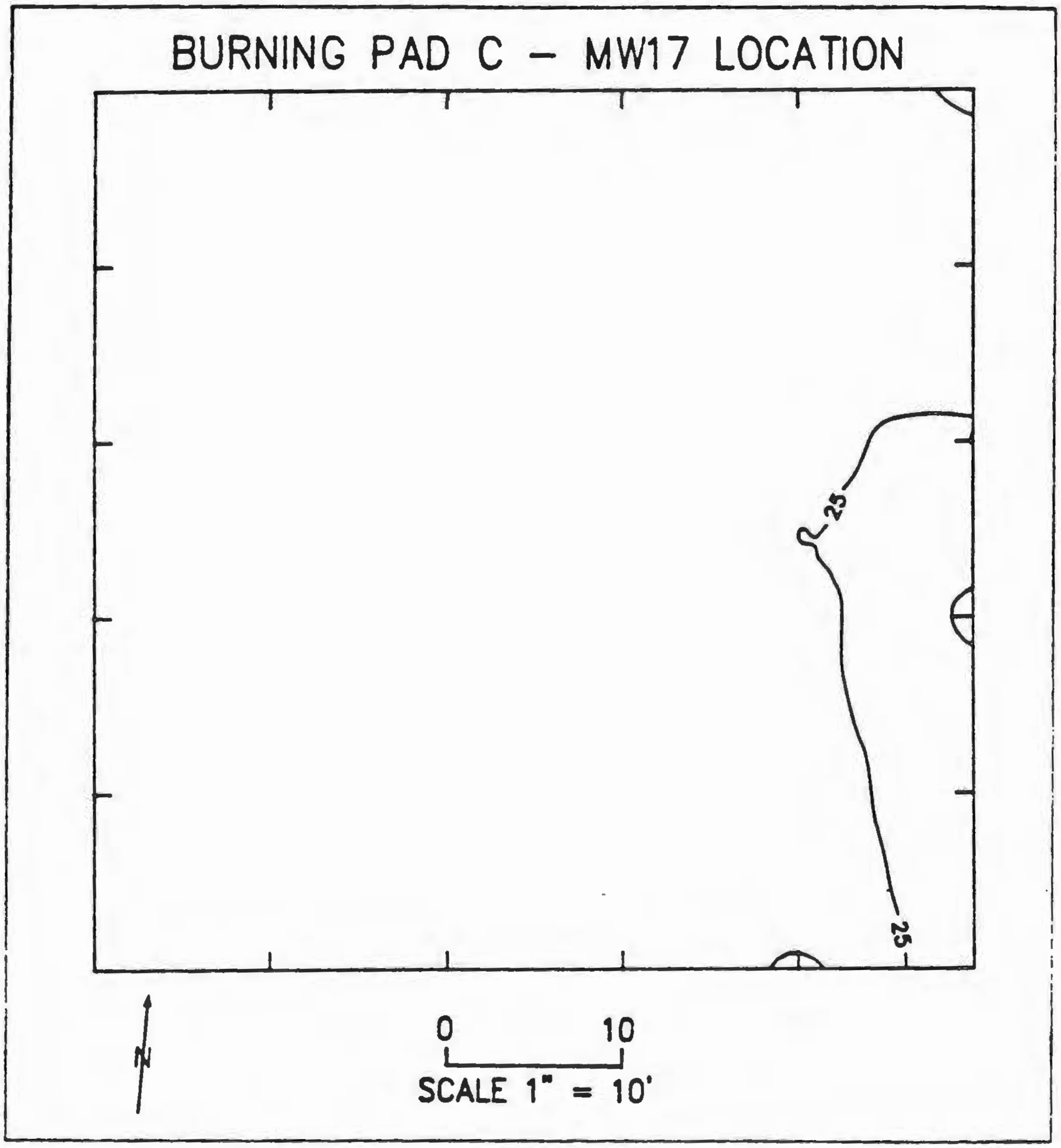


Figure 27. Contours of relative values of inphase component of induced magnetic field, Burning Pad C - MW17 Location, Seneca Army Depot. Contour interval 5% of full scale.

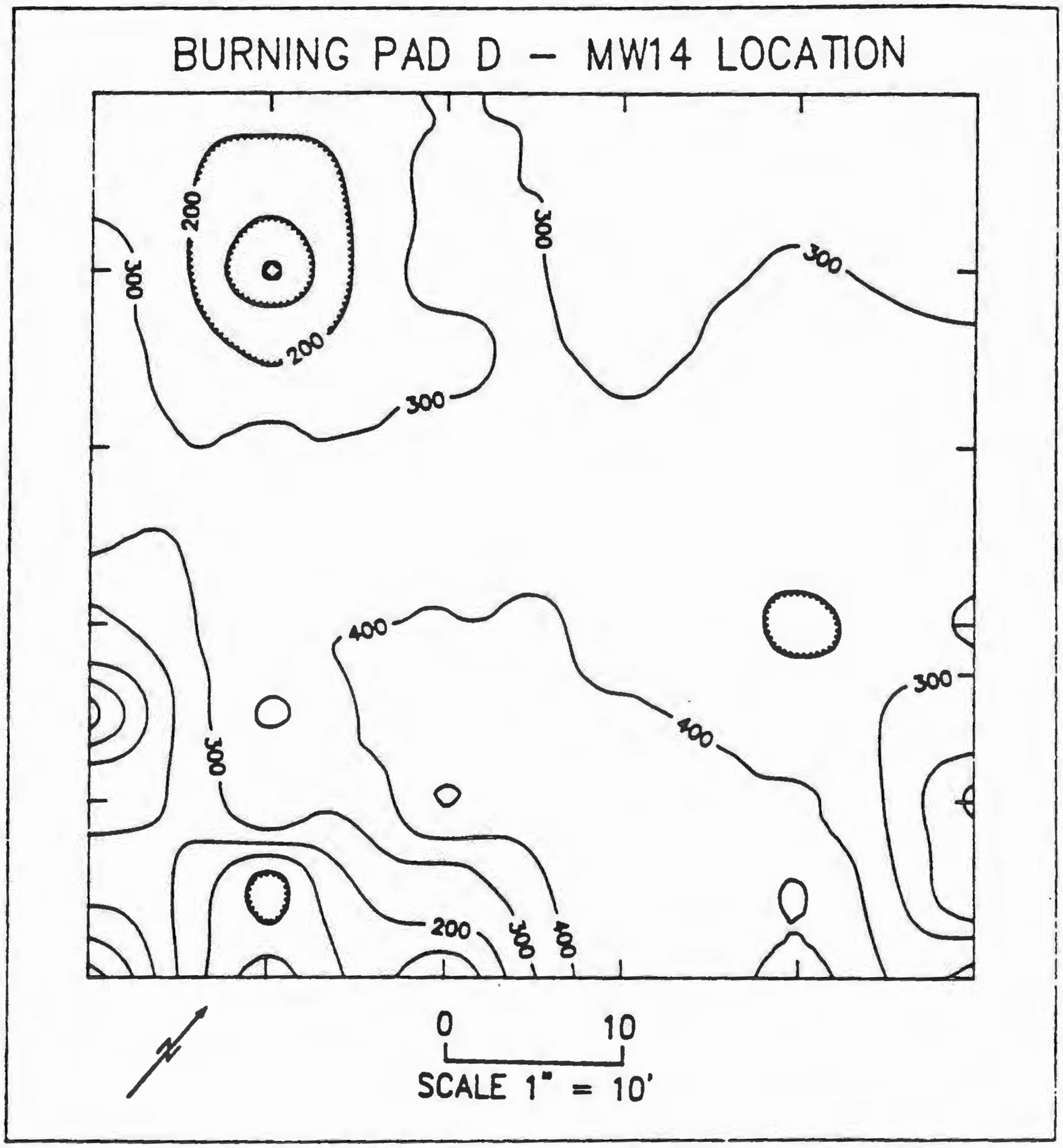


Figure 28. Magnetic field, Burning Pad D - MW14 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

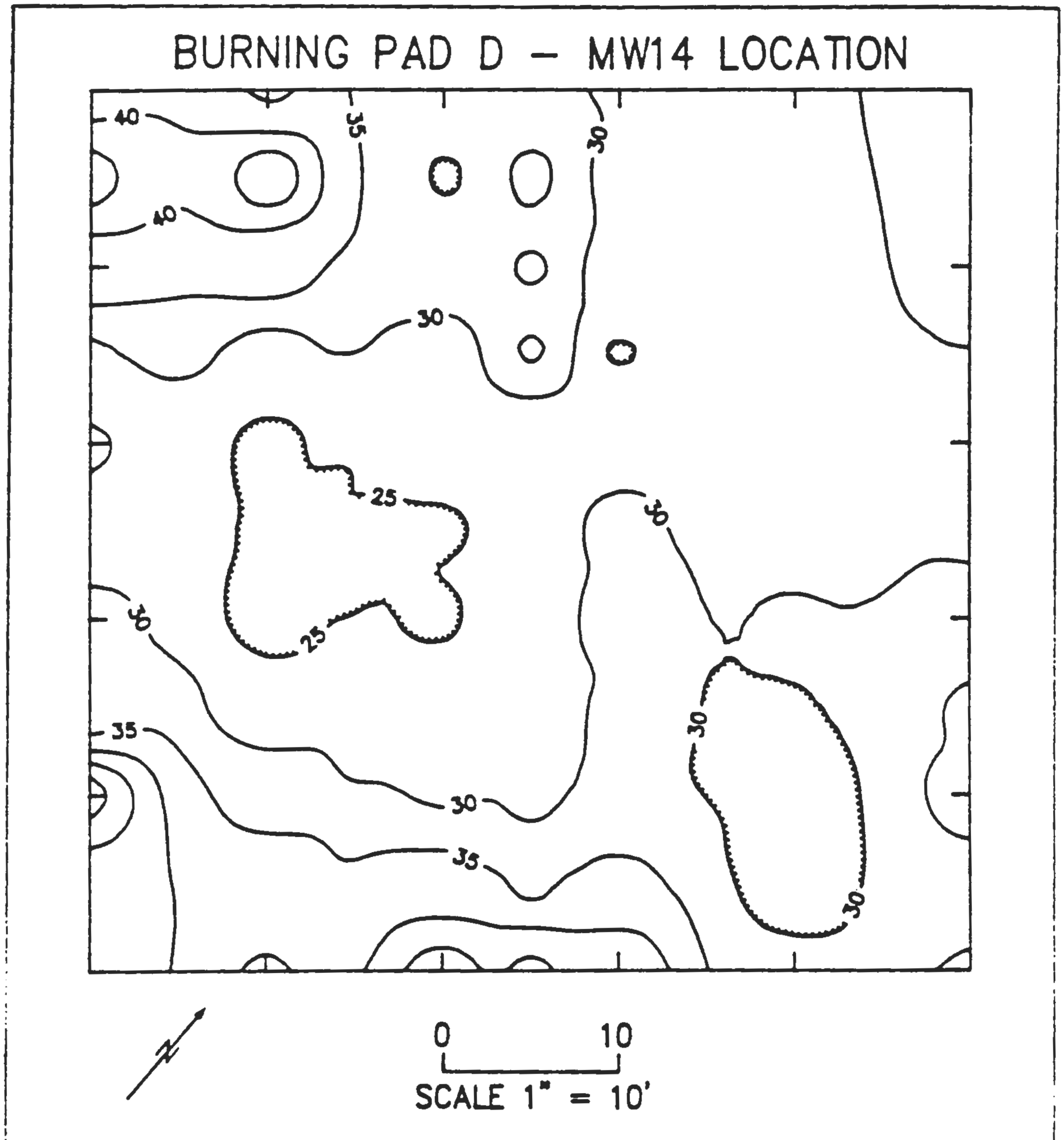


Figure 29. Contours of relative values of inphase component of induced magnetic field, Burning Pad D - MW14 Location, Seneca Army Depot. Contour interval 5% of full scale.

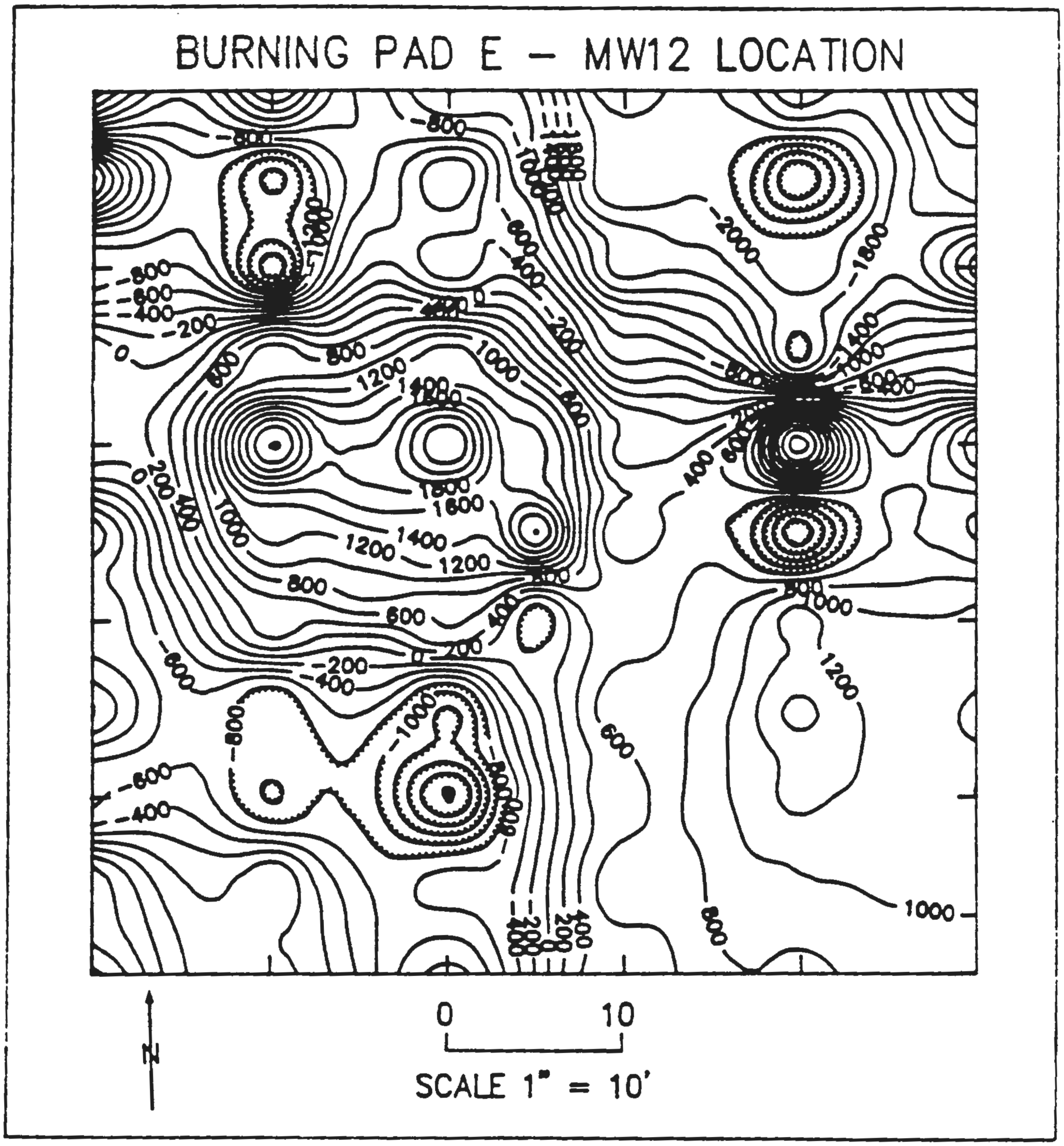


Figure 30. Magnetic field, Burning Pad E - MW12 Location, Seneca Army Depot. Contour interval 200 gammas. Contours = total magnetic field minus 56,000 gammas.

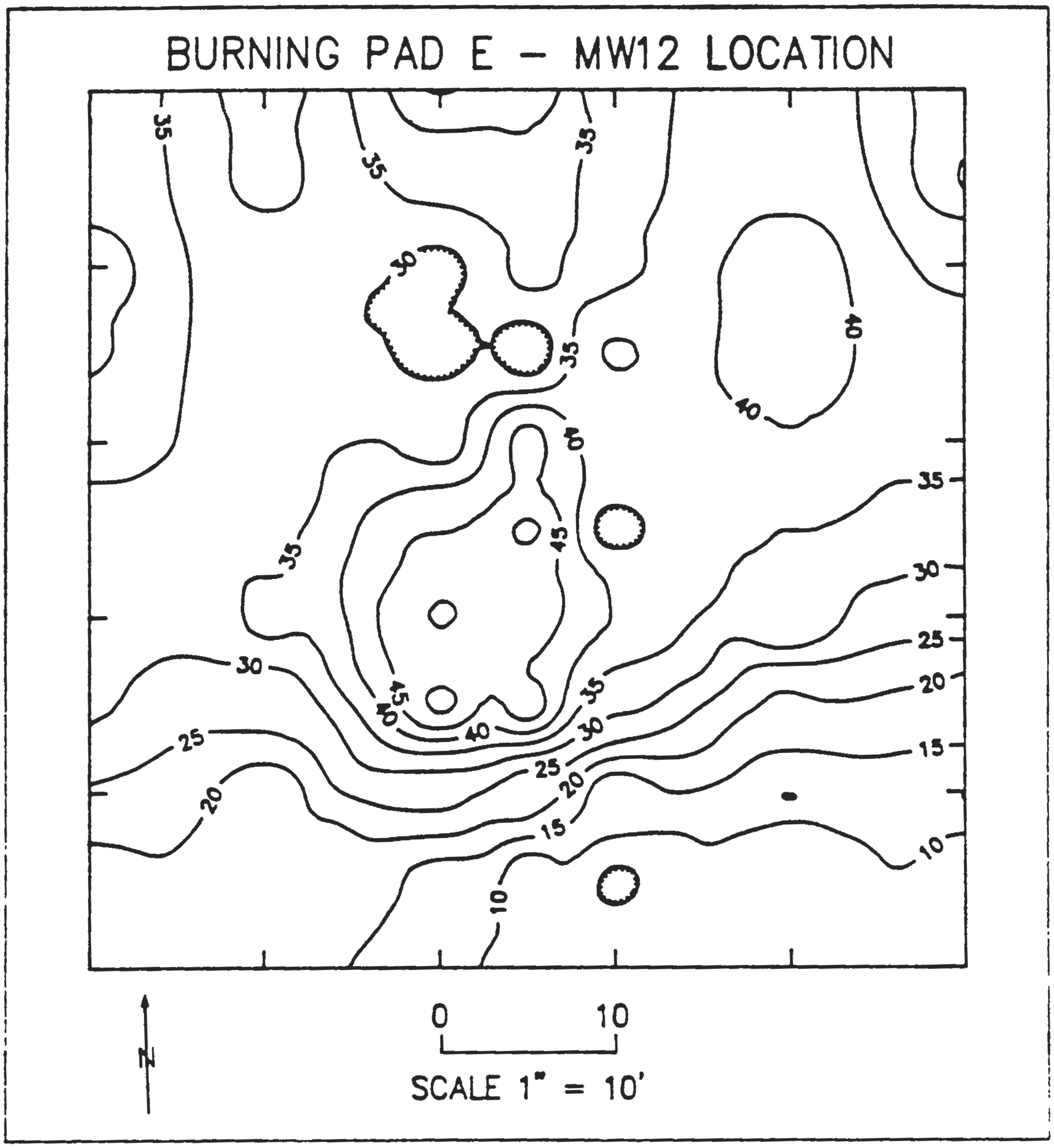


Figure 31. Contours of relative values of inphase component of induced magnetic field, Burning Pad E - MW12 Location, Seneca Army Depot. Contour interval 5% of full scale. Full scale at this location is 3.33 times higher than for all of the other in-phase component contour maps.

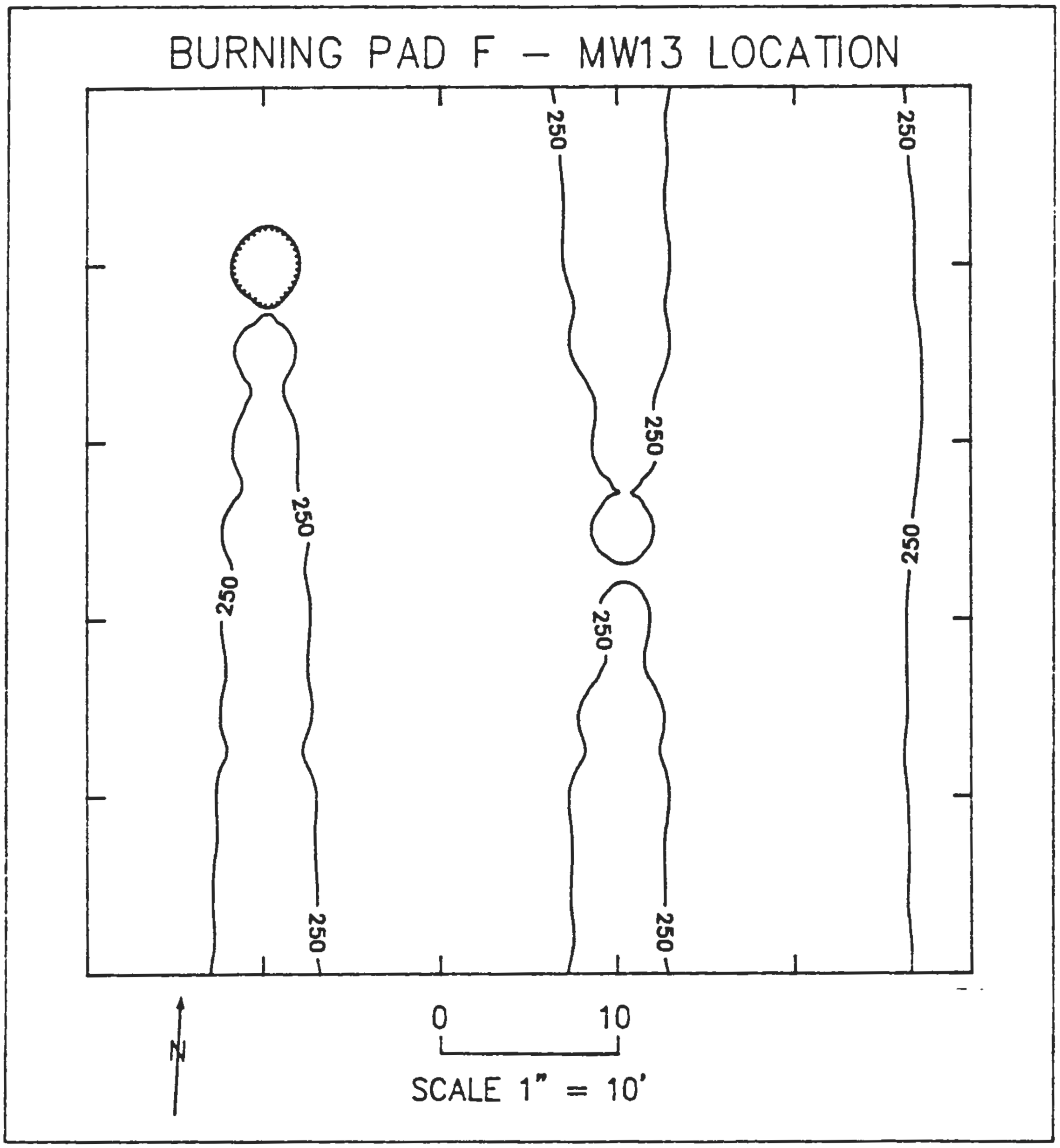


Figure 32. Magnetic field, Burning Pad F - MW13 Location, Seneca Army Depot. Contour interval 50 gammas. Contours = total magnetic field minus 56,000 gammas.

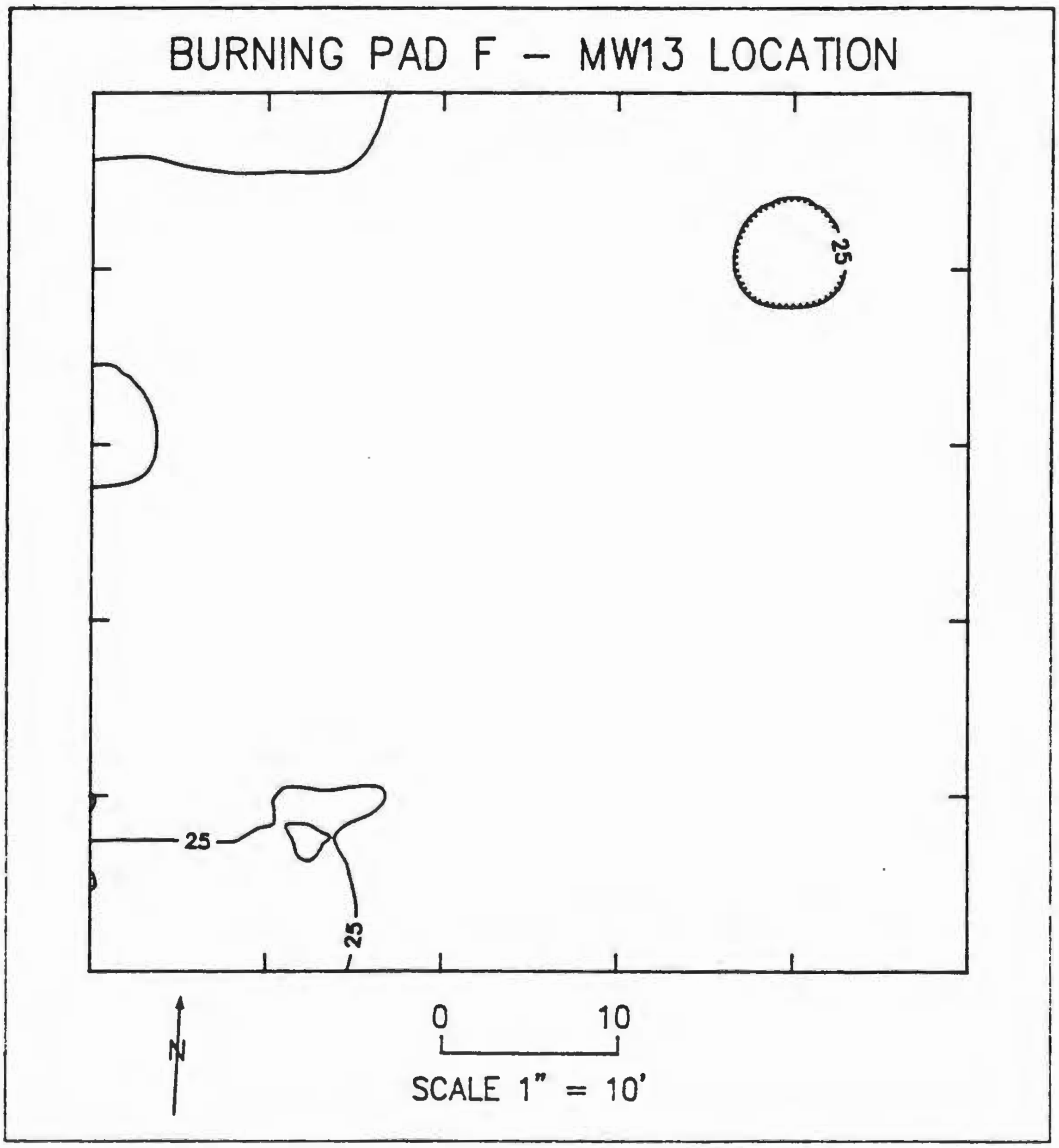


Figure 33. Contours of relative values of inphase component of induced magnetic field, Burning Pad F - MW13 Location, Seneca Army Depot. Contour interval 5% of full scale.

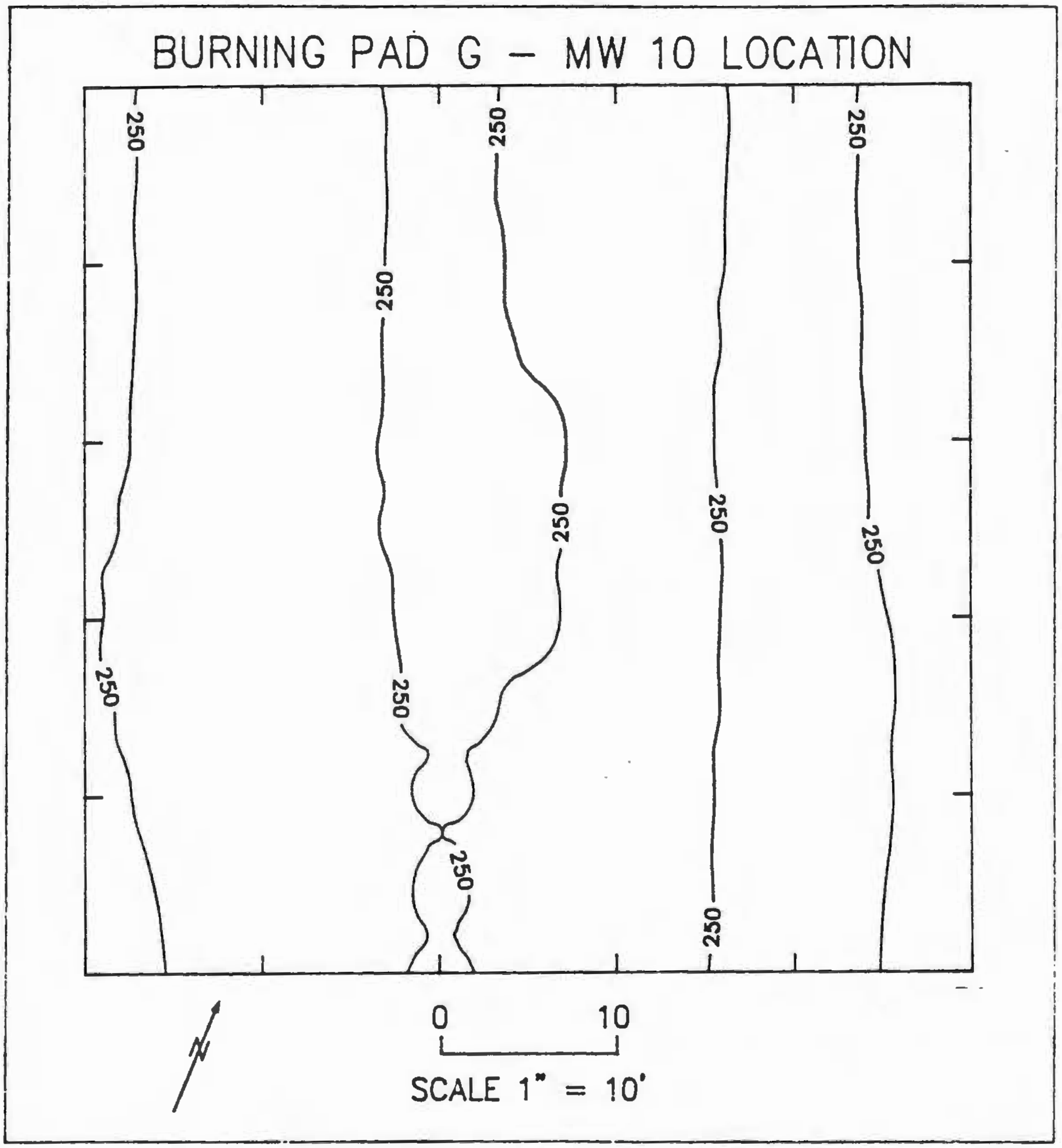


Figure 34. Magnetic field, Burning Pad G - MW10 Location, Seneca Army Depot. Contour interval 50 gammas. Contours = total magnetic field minus 56,000 gammas.

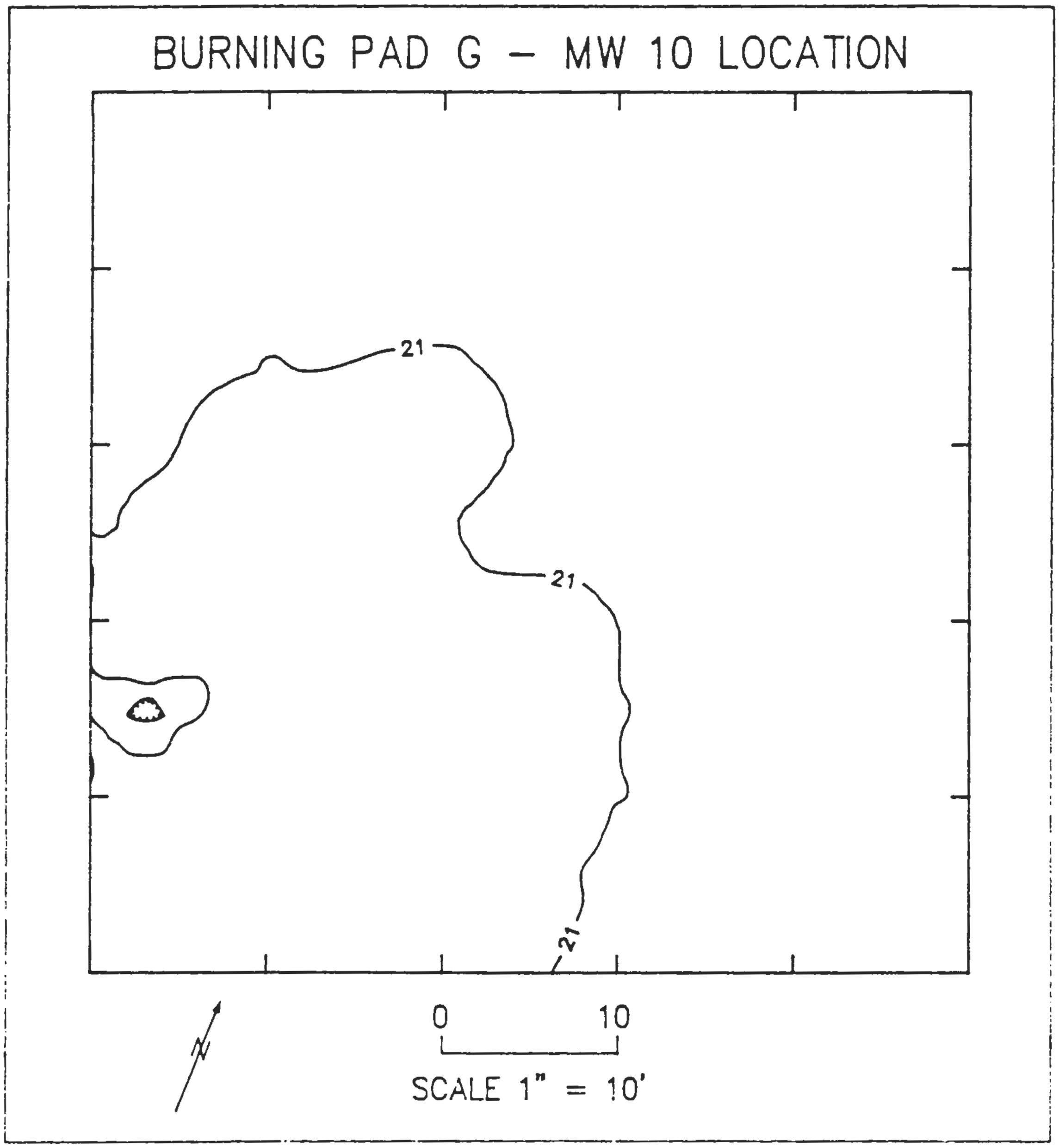


Figure 35. Contours of relative values of inphase component of induced magnetic field, Burning Pad G - MW10 Location, Seneca Army Depot. Contour interval 2% of full scale.

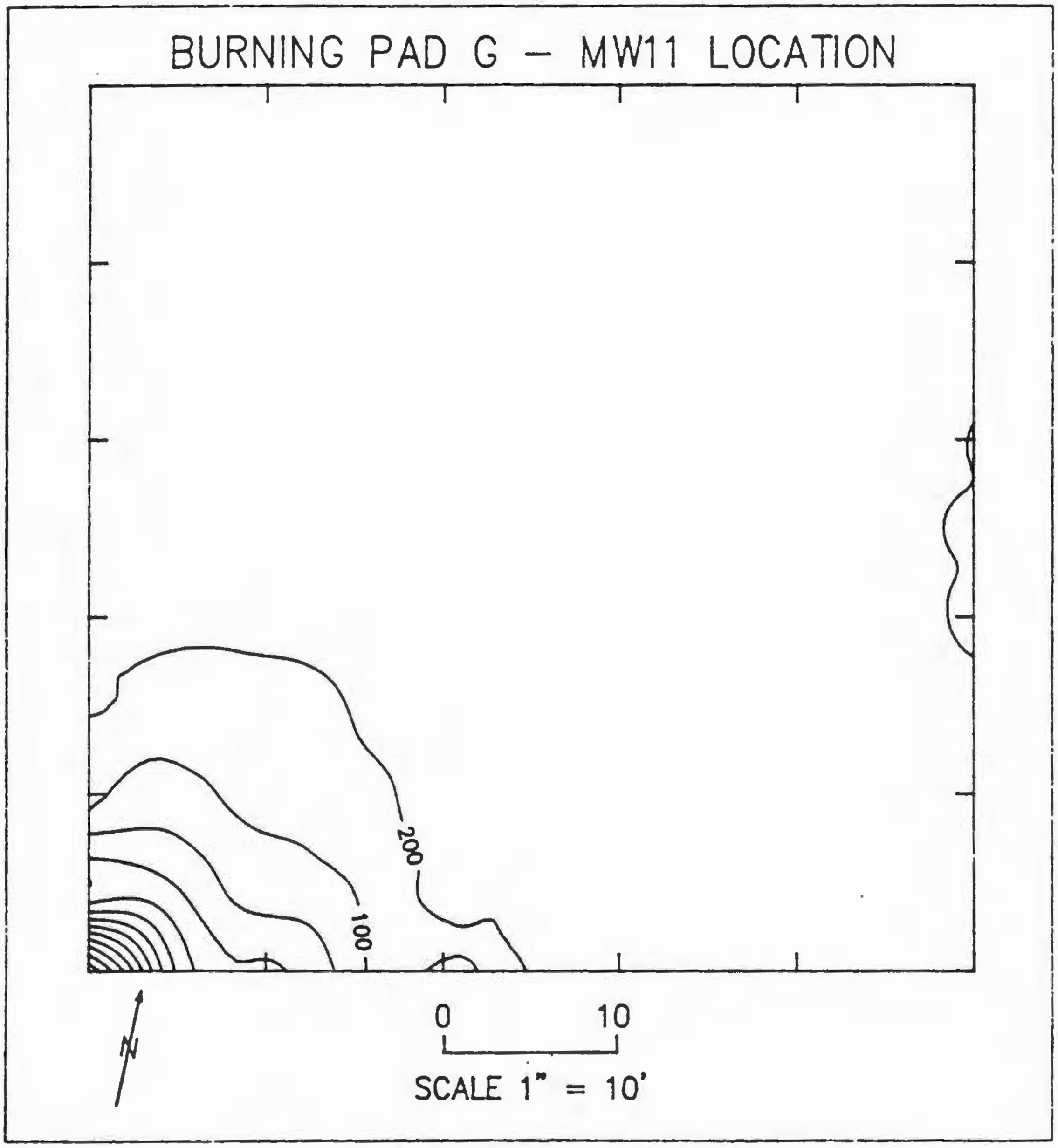


Figure 36. Magnetic field, Burning Pad G - MW11 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

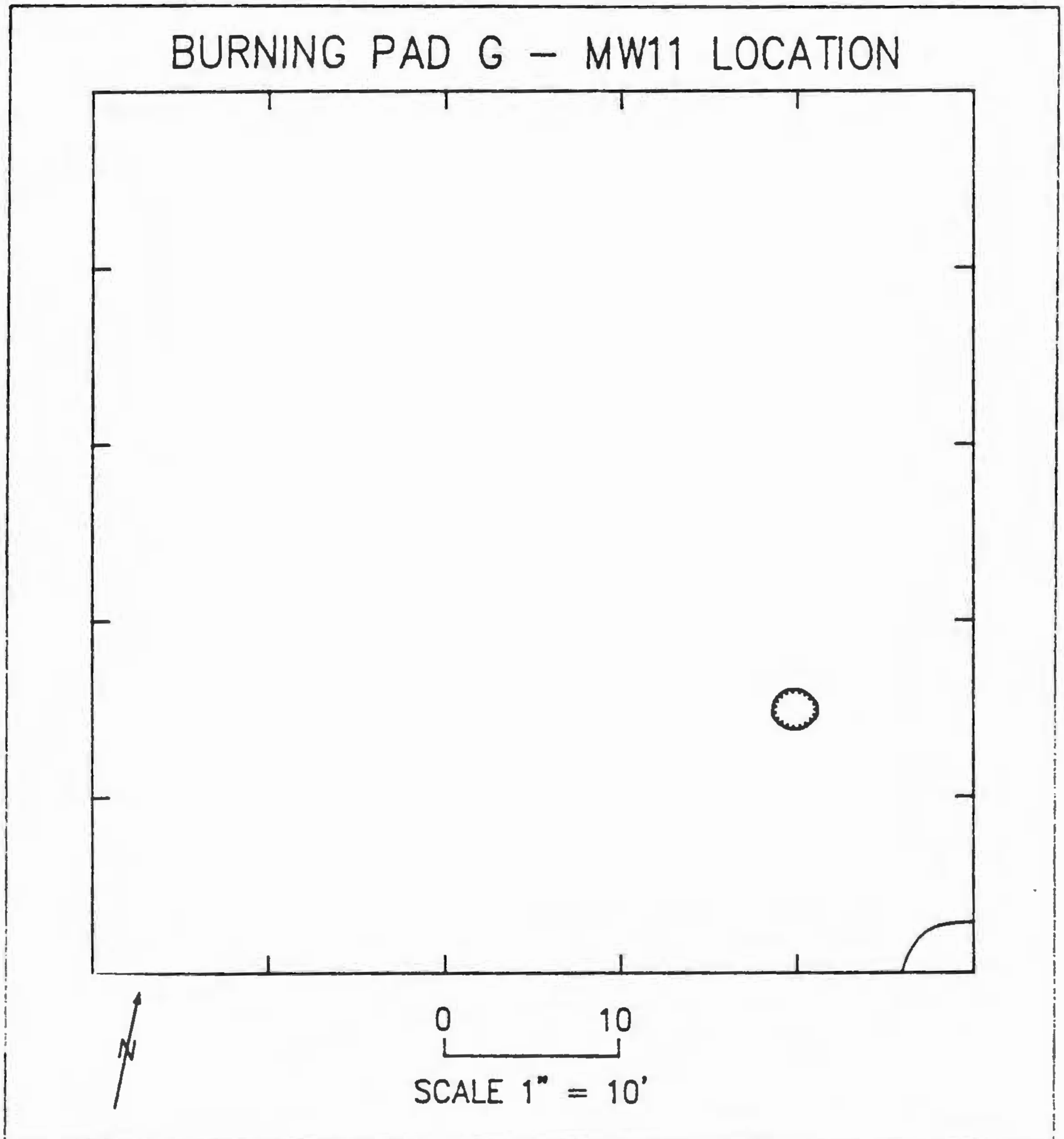


Figure 37. Contours of relative values of inphase component of induced magnetic field, Burning Pad G - MW11 Location, Seneca Army Depot. Contour interval 2% of full scale.

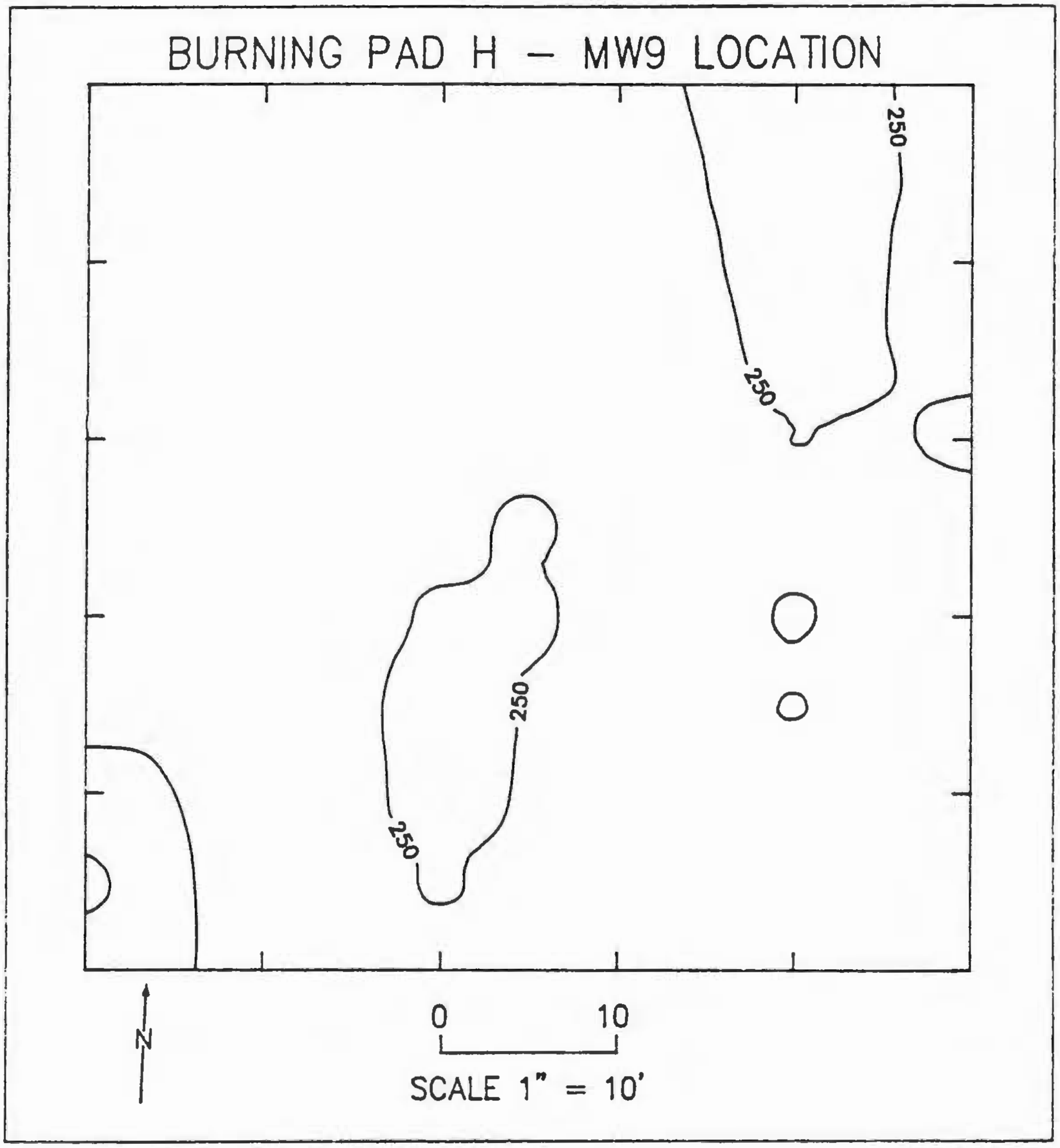


Figure 38. Magnetic field, Burning Pad H - MW9 Location, Seneca Army Depot. Contour interval 50 gammas. Contours = total magnetic field minus 56,000 gammas.

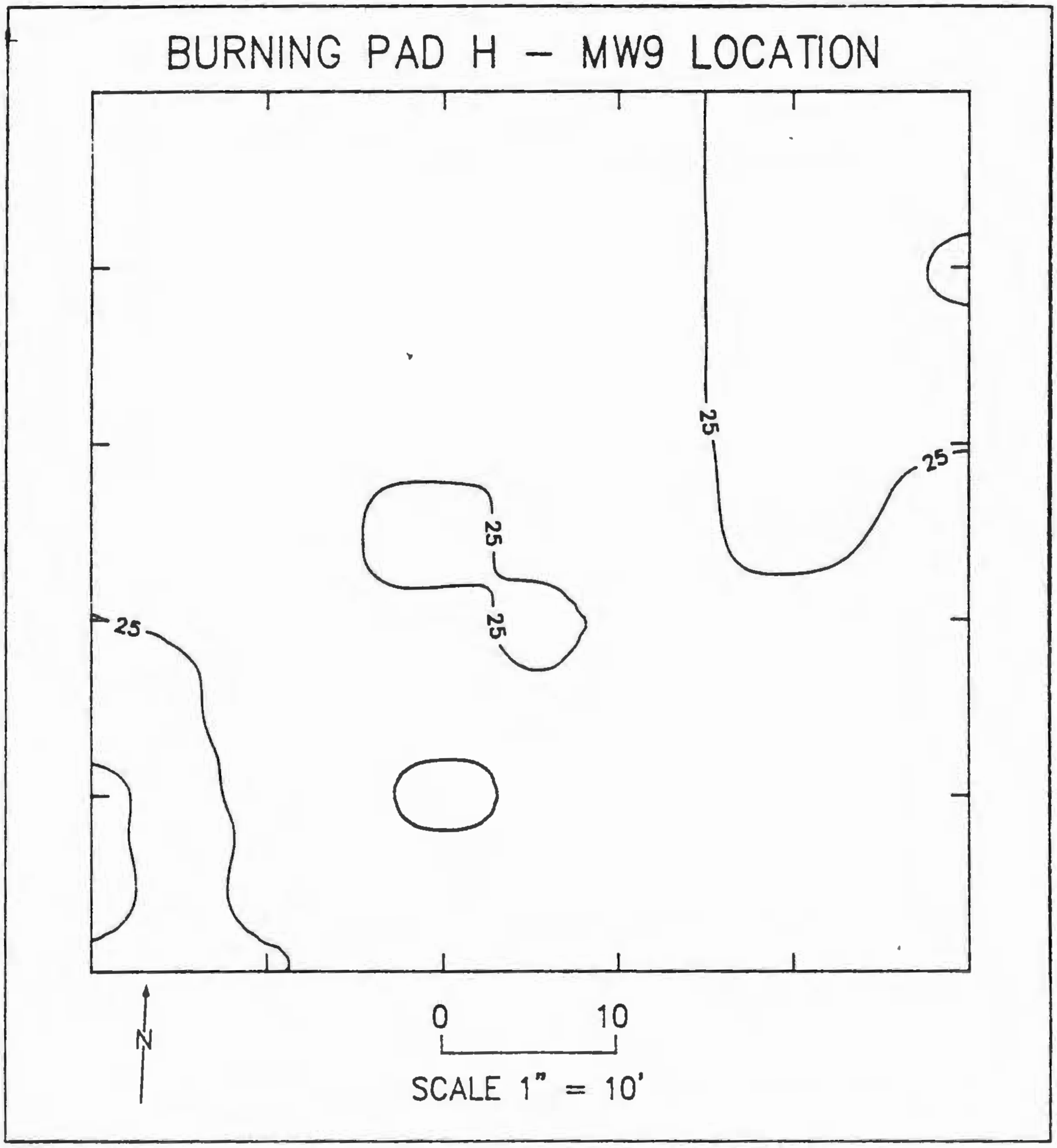


Figure 39. Contours of relative values of inphase component of induced magnetic field, Burning Pad H - MW9 Location, Seneca Army Depot. Contour interval 5% of full scale.

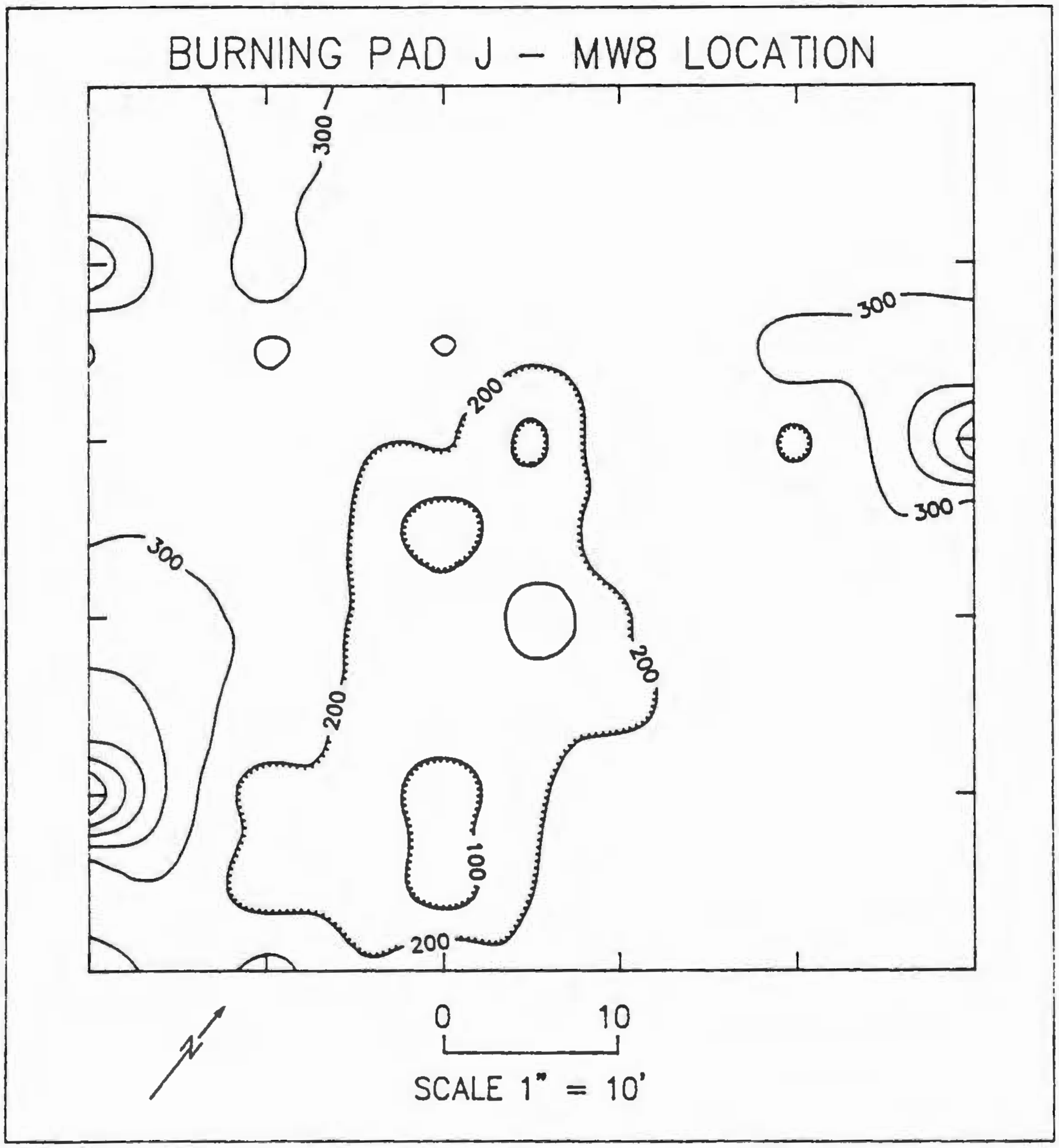


Figure 40. Magnetic field, Burning Pad J - MW8 Location, Seneca Army Depot. Contour interval 100 gammas. Contours = total magnetic field minus 56,000 gammas.

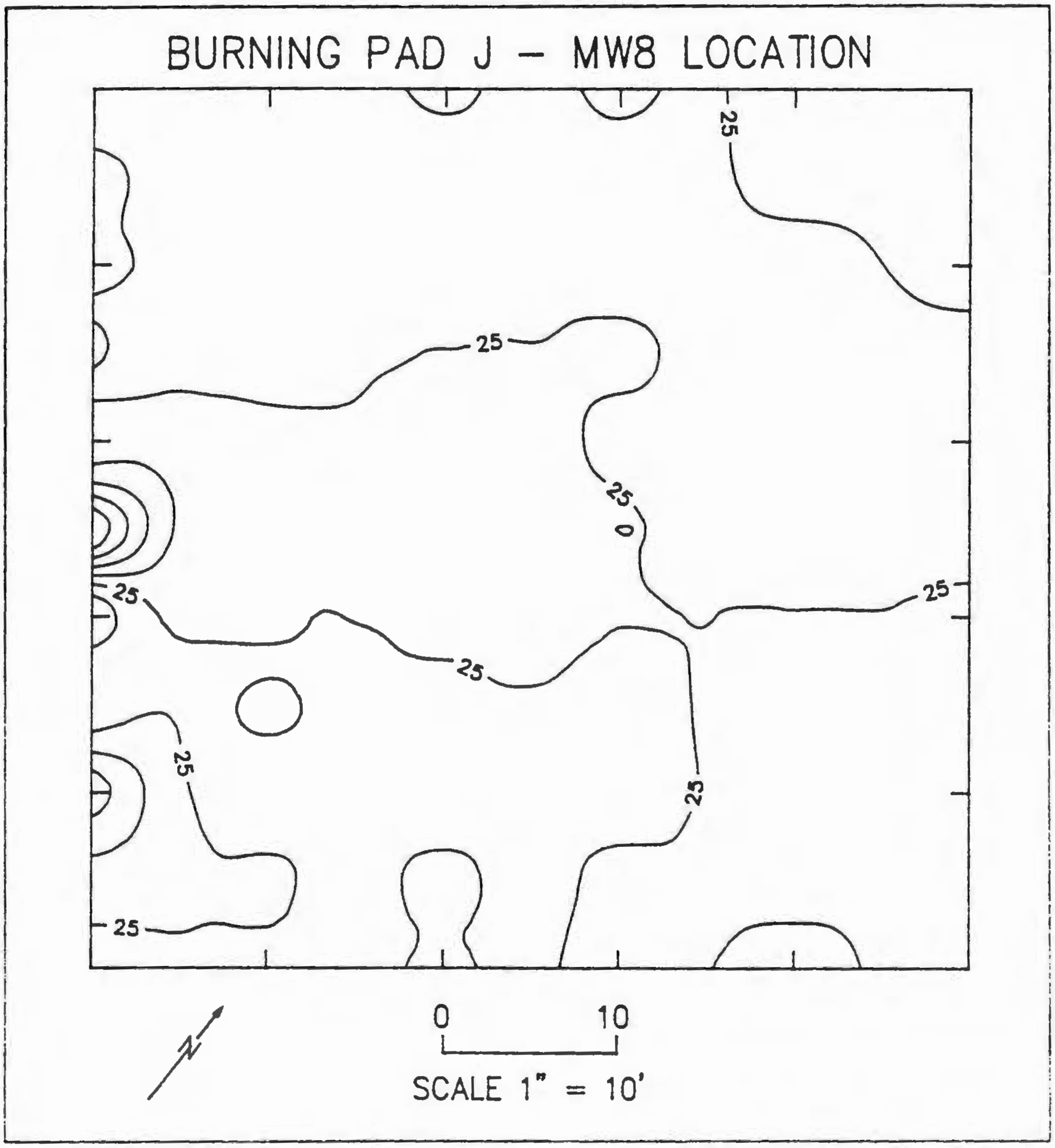


Figure 41. Contours of relative values of inphase component of induced magnetic field, Burning Pad J - MW8 Location, Seneca Army Depot. Contour interval 5% of full scale.

HAGER-RICHTER
GEOSCIENCE, INC.

SUPPLEMENTAL GEOPHYSICAL SURVEYS
BURNING PAD E - MW12 LOCATION
SENECA ARMY DEPOT
ROMULUS, NEW YORK

Prepared for:

Metcalf & Eddy, Inc.
Harvard Mill Square
Wakefield, Massachusetts

Prepared by:

Hager-Richter Geoscience, Inc.
P.O. Box 572
Windham, New Hampshire 03087

File 88J03-A
October, 1988

HAGER-RICHTER
GEOSCIENCE, INC.

Supplemental Geophysical Surveys
Burning Pad E - MW12 Location
Seneca Army Depot
October, 1988 File 88J03-A

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. conducted supplemental surface geophysical surveys in the vicinity of Burning Pad E - MW12 location at the Demolition Grounds of the Seneca Army Depot, Romulus, New York on October 4, 1988. The work was conducted under contract to Metcalf & Eddy, Inc. of Wakefield, Massachusetts as part of a larger project undertaken for the U.S. Army Corps of Engineers.

The purpose of the present surveys was to determine if an area is present down gradient from Burning Pad E that does not contain buried metal objects that would impede the drilling of a groundwater monitoring well. Previous geophysical surveys conducted by Hager-Richter in August, 1988 in a 50′ x 50′ area close to the burning pad indicated the presence of so much subsurface metal that no satisfactory drilling area was found.

The supplemental surveys were conducted in an area measuring 150′ x 180′ (less the original 50′ x 50′ area). The same geophysical survey methods were used as in the original surveys: i.e., magnetics and electromagnetics (EM).

The combined results of the supplemental geophysical surveys indicate that the northeastern part of the survey area (NE of coordinates 100, 100 on Plates 3 and 4, in pocket) is sufficiently free of subsurface metal that a ground water monitoring well can be drilled. The tentative location for MW12 that was staked on October 4, 1988 is in an area of low magnetic and electromagnetic gradients and is a satisfactory location for the drilling of the well.

Supplemental Geophysical Surveys
Burning Pad E - MW12 Location
Seneca Army Depot
October, 1988 File 88J03-A

1. INTRODUCTION

Hager-Richter Geoscience, Inc. conducted surface geophysical surveys at 10 locations in the vicinity of burning pads in the Demolition Grounds of the Seneca Army Depot, Romulus, New York on August 22 - 23, 1988. The work was performed under contract to Metcalf & Eddy, Inc. of Wakefield, Massachusetts as part of a larger project for the U. S. Army Corps of Engineers. The results of the surveys are reported in a document entitled "Surface Geophysical Surveys, Seneca Army Depot, Romulus, New York," dated August, 1988. Figure 1 shows the general location of the Site.

The purpose of the geophysical surveys conducted in August, 1988 was to detect the presence of large buried metal objects in the vicinity of proposed monitoring well locations selected and staked at the Site by Metcalf & Eddy. Two complementary geophysical methods were used at each location: (1) magnetics, and (2) electromagnetics (EM). The results of the surveys indicated that satisfactory drilling locations are present at 9 of the 10 sites. The exception was Burning Pad E - MW12 Location, where the magnetic and EM gradients were variable and steep, indicating the presence of so much subsurface metal that no satisfactory drilling site could be recommended.

The present surveys examined a larger area located down gradient from Burning Pad E for the purpose of determining if an area is present that does not contain large buried metal objects that would impede the drilling of a groundwater monitoring well. The same geophysical methods used in the previous study referred to above were used for the supplementary surveys, i.e., magnetics and EM.

Figure 2 shows the location of the area surveyed. The staked area extends the original 50' x 50' survey area north to the SE edge of Burning Pad D and east to the road separating Burning Pad E and Burning Pad C. The total area measures 150' x 180'. The original 50' x 50' area occupies the SW corner of the total area and was not re-surveyed.

The Site is generally level and covered by grassy vegetation. Surface metal in the form of cartridge casings and other other unidentified debris, probably associated with munitions, is broadly scattered over the Site. Weathered and broken shale fill is present throughout the site.

Hager-Richter personnel were on Site on October 4, 1988. Dorothy Richter and Jeffrey Reid conducted the field operations. Ms. Sandra Giesler and Ms. Heather Vick of Metcalf & Eddy and Mr. Michael Tunnicliff of the U.S. Army Corps of Engineers were at the Site during the geophysical field work. The data were subsequently analyzed at the Hager-Richter offices.

2. EQUIPMENT AND PROCEDURES

2.1 Magnetic Survey

The magnetic survey was conducted using an EG&G Model G856 Proton Precession Portable Magnetometer. The G856 is a microprocessor controlled instrument with a resolution of 0.1 gamma and accuracy of 1 gamma. The G856 has a memory capable of storing the data for approximately 1000 stations. The field data were transferred to floppy disks and the hard disk of a Compaq portable computer at the Site.

We used a 5 foot by 10 foot station spacing the magnetic survey. Data were collected at 529 stations at the Site. Plate 1 (in pocket) is a station map for the Site.

A base magnetic station was occupied approximately every 45 minutes in order to obtain data necessary for the removal of the temporal variation in the Earth's magnetic field. The magnetic survey data were processed by correcting each reading for the temporal "drift" of the magnetic field based on the base station data. The corrected data were then plotted and contoured by a contouring program developed for use with spatial geophysical data such as those obtained in gravity, magnetic and certain other surveys.

2.2 Electromagnetic Survey

The electromagnetic (EM) survey was conducted using a Geonics Model EM-31DL terrain conductivity meter. The instrument is calibrated to read ground conductivity directly in millimhos per meter with a resolution of 2% of full scale and an accuracy of 1 mmho/meter.

The EM-31 is an induction type unit and provides measurement of both the quadrature phase and in-phase components of terrain conductivity without ground electrodes or contact. For this survey, we measured only the relative magnitude of the in-phase component of the magnetic field induced by the instrument because it is particularly sensitive to the presence of metallic objects in the subsurface. The apparent magnitude of the in-phase component of the induced field was monitored continuously, recorded at 5 foot intervals, and contoured with the same computer program used to contour the magnetic data.

During the course of the magnetic survey, we had recognized that the area west of coordinate 60 had extreme magnetic gradients (similar to those observed in the original 50' x 50' survey), and that it was clearly not suitable for unobstructed drilling of a ground water monitoring well. Consequently, we conducted the EM survey with traverses spaced 10 feet apart across the eastern part of the survey, area starting at coordinates 60, 0. Plate 2 (in pocket) shows the locations and directions of the EM profiling traverses.

3. RESULTS

3.1 Magnetic Survey

The magnetic data are presented in Plate 3 (in pocket) in contour form. The contour interval of 100 gammas was selected because of the range in magnetic field encountered. The contoured data are presented as total intensity above 56,000 gammas, an arbitrary value near the "normal" or undisturbed total magnetic field for the area.

In interpreting magnetic data, several factors should be considered. The width, gradient, and amplitude of a magnetic disturbance are useful in estimating the quantity and depth of the metal object(s). In general, the broader the magnetic signature, the deeper the object. Magnetic disturbances with very steep gradients are caused by objects at or near the surface. Note that the magnetic technique is limited to detecting ferrous metal objects. Neither the particular type of metallic object causing a magnetic disturbance nor its contents can be determined from the magnetic data alone.

The magnetic gradients in the western half of Plate 3 are extremely steep and the general disturbance to the normal magnetic field is large. We interpret the magnetic contour pattern of that area to indicate the widespread presence of metal in the subsurface. The magnetic gradients in the eastern half of Plate 3 are much lower, in general. The area northeast of coordinates (100, 100) on Plate 3 appears to be suitable for drilling a monitoring well.

3.2 Electromagnetic Survey

The in-phase EM data are presented in contour form in Plate 4 (in pocket). As stated in section 2.2, the EM survey was conducted in the area east of the original survey area only. The contour interval in Plate 4 is 2 percent of full-scale of the EM-31.

Note that the values contoured for the EM survey are not direct values of the ground conductivity but are instead relative to the full scale readings of the in-phase component of the induced magnetic field. The response of the EM-31 in that operating mode to buried metallic objects is spikes (both positive and negative) in the apparent readings. The EM response was monitored continuously throughout the survey and no spikes greater than about 2% of full scale occur between adjacent recorded readings. The apparent zero level of the instrument was adjusted to 20% of full scale at the start of the survey so that negative spikes could be detected. As in the case of magnetic data, buried metal objects produce steep gradients in the EM values.

The in-phase EM gradients in the eastern part of the survey area, as shown in Plate 4, are much less steep than in the western part. As in the magnetic contour map, the area of lowest EM gradient is in the area northeast of coordinates (100, 100). It is this area that we interpret to be least likely to contain large buried metallic objects that can impede the progress of the drilling program.

4. DISCUSSION AND CONCLUSIONS

The magnetic and EM methods are complementary. The magnetic method detects those metallic objects that are magnetic, but not all metallic objects are magnetic. For instance, brass objects are not magnetic. The EM method detects those objects that are electrical conductors, but not all metallic objects are good conductors. However, most, if not all (from a practical viewpoint), metallic objects are magnetic and/or good electrical conductors.

Comparison of Plates 3 and 4 shows that the results of the magnetic and EM surveys conducted near Burning Pad E correlate very well. We interpret the western part of the survey area to contain much metallic fill material. The eastern part of the survey area is very slightly lower in elevation and displays low magnetic and EM gradients. We interpret this area to be "original ground" and relatively free of buried metallic objects.

An east-west oriented anomaly occurs in the eastern part of the survey area in both the magnetic and EM maps, between about 70 to 90 feet north of the baseline. This anomaly extends to the SW edge of a marshy areas marked by cattails and may be due to an old drainage culvert.

Based on our preliminary field evaluation of the combined surveys, Ms. Sandra Giesler of Metcalf & Eddy staked a tentative preferred new location for MW12 at approximately coordinates (125, 120) on October 4, 1988. This location is shown on Plates 2 - 4. We conclude that the tentative location for MW12 staked by Ms. Giesler is in an area that does not contain large buried metal objects that will disrupt the progress of the drilling. Small cartridge casings are widely scattered on the surface in the area and might be encountered during drilling at any location within the survey area. If MW12 is relocated for any reason, we recommend that it be relocated towards the north, not south, in order to avoid possible buried metal objects in the region of the east-west anomaly described above.

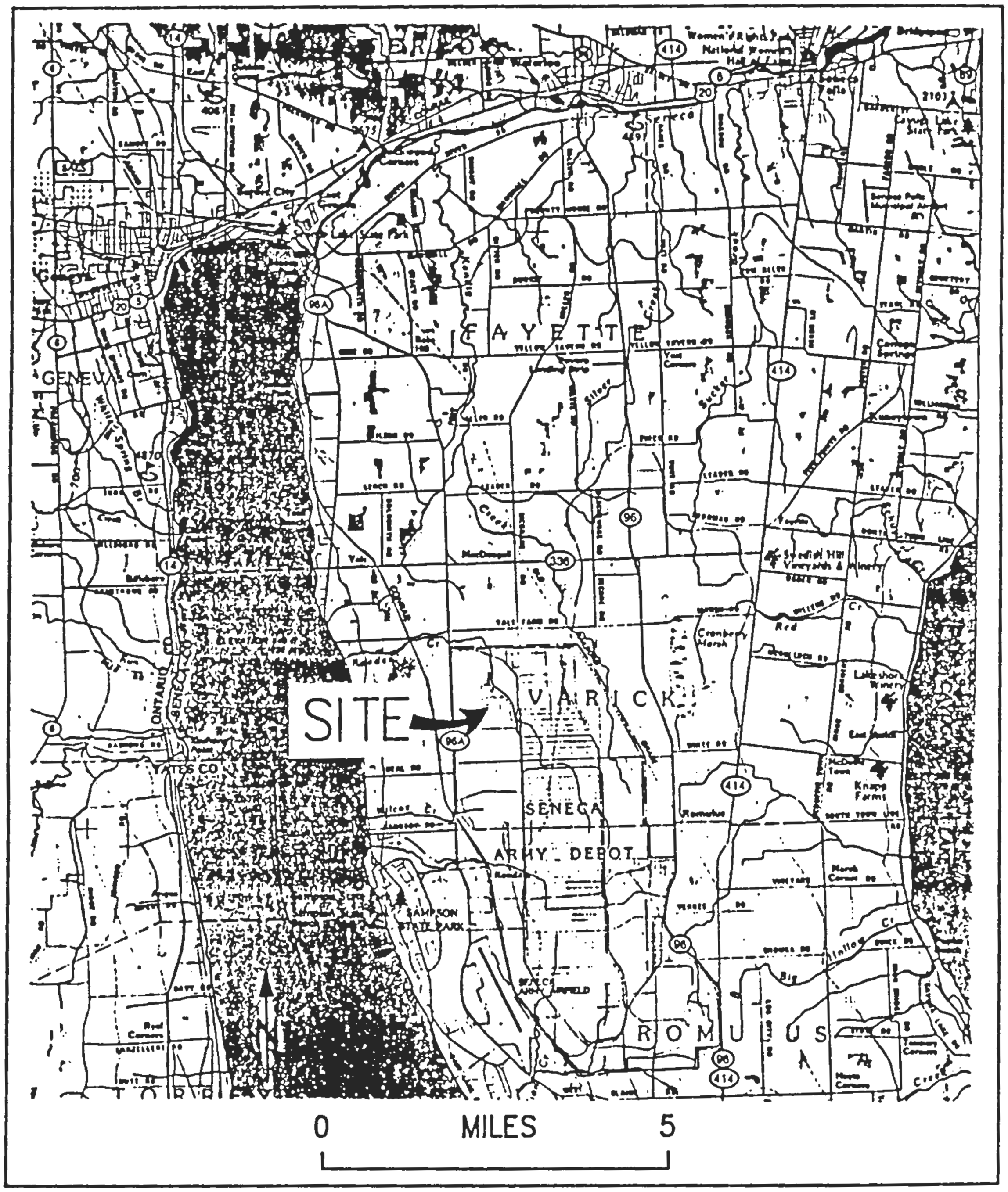


Figure 1. General location of the Demolition Grounds, Seneca Army Depot, Romulus, New York.

APPENDIX B

WELL LOGS AND FIELD DATA

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

M&E

PROJECT : Seneca Army Depot COE
SITE LOCATION: Romulus NY Burning Pads
JOB NO. 3161
LOCATION: 003266
SHEET 1 OF 1
BORING NO. MW8
GROUND ELEV. 119.74
TOTAL DEPTH 18.5'

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
0		0'				f. SAND and SHALE			
2'		2'				dk. brown vf SAND some silt trace clay few ~~gravel~~ 1/4"-1/2" shale gravels			
4'		4'				dk brown vf SAND some silt little clay few gravel			
		~~5'~~							
		6'				vf. gray brown dry SAND and SILT trace gravel < 1"			Till
		8'				vf. gray dry SAND and SILT some gravel (weathered shale) angular flat pieces < 1"			
		10-12	4"	50/4"		spoon - gray black fine material surrounding flat thin layers of shale			Weathered Bedrock
		12'	5"	55/3"		1st 3" cave in wet clay last 3" dry weathered bedrock - very fractured flat pieces 1/4 - 1/2" diam			Competent Bedrock
		13.5'	5'	7 min		gray black shale few fractures competent - not weathered			
				6 min					
				6 min					
				6 min					
				5 min					
		18.5'							

HNU=0
HNU=0
HNU=0
HNU 20
HNU=0

SAMPLE TYPES
SS=SPLIT SPOON, ST=SHELBY TUBE
R=ROCK CORE, O=OTHER

NOTES:

BORING NO.: MW8

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

M&E

PROJECT: Seneca Army Depot COE		SHEET 1 OF	BORING NO. MW9
SITE LOCATION: Romulus NY Demo Grounds	JOB NO.		
	LOCATION: E. of Pad H	GROUND ELEV. 115.48	TOTAL DEPTH 15'
DRILL CONTRACTOR: Parrott-Wolfe	ENG/GEO: S. Giesler	BEGUN: 10-6-88	
DRILL RIG: 850 CME	DRILLER: G. Lansing	FINISHED: 10-7-88	
HOLE SIZE: 6"	WEATHER:	GROUND WATER (DEPTH/ELEV.): 113.59 14.3'	
DRILLING METHOD: HSA - CORE	DRILLING FLUID/SOURCE: Water	TOP OF ROCK (DEPTH/ELEV.): 7.5	

	DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
HNU=6	0		0		grab		brown vf SAND and SILT trace clay			till
HNU=0			2'		grab		brown vf. SAND and SILT some clay 5% ½" gravel			
	5		4'		grab		brown vf. SAND and SILT some clay 10% gravel ½-¾" d.			
HNU=0			6'		grab		90% gravel angular to subangular ½"-1½" some sand silt+clay			
HNU=0	10		8'				½-1½" subangular gravel and fine material			Weathered bedrock
HNU=0		SS	10'		50/.05"		fractured bedrock			
	15		10' ↓ 15'		8-8-8-10-8	minutes	thinly bedded sandy shale-cleaved along bedding planes 2"-4" beds			bedrock
	20									
	25									

SAMPLE TYPES
SS=SPLIT SPOON, ST=SHELBY TUBE
R=ROCK CORE, O=OTHER

NOTES:

BORING NO.:

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

PROJECT : Seneca Army Depot		SHEET 1 OF 1	BORING NO. MW10
SITE LOCATION: Demo grounds Romulus NY	JOB NO. 003288-3101		
	LOCATION: SW of Pad G	GROUND ELEV. 119.1	TOTAL DEPTH 18.5
DRILL CONTRACTOR: Parratt-Wolff	ENG/GEO: S. Giesler/H. Vick	BEGUN: 10-4-88	
DRILL RIG: CME 850	DRILLER: G. Lansing	FINISHED: 10-4-88	
HOLE SIZE: 7"	WEATHER: Rainy	GROUND WATER (DEPTH/ELEV.): 5.7 ft. / 116.54	
DRILLING METHOD: 6 1/4" HSA level C	DRILLING FLUID/SOURCE: DRY	TOP OF ROCK (DEPTH/ELEV.): 13.5 ft	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'		grab		brown/gray vf SAND little SILT, trace clay			
		2'		grab		brown f. SAND and Clay little silt 5% gravel 1/4-3/4"d. dry loose			
5		4'		grab		brown f. SAND and Clay little Silt 10% 1/8-1"d. gravel			TILL
10		6'				brown f. SAND and CLAY some silt 10% 1/8"-1"d. gravel			
		8'				brown Silty SAND and clay 80% gravel			
15								9.0	Weathered
	SS	10'-12		50/4"		fresh shale gray weathered			
20	SS	12-14		50/1"		SHALE			
							13.5		
	R	13.5			100%	Sandy Shale			SHALE
25		16.5							

Hnu = 0

Hnu = 0

Hnu = 0

SAMPLE TYPES
SS=SPLIT SPOON, ST=SHELBY TUBE
R=ROCK CORE, O=OTHER

NOTES:

BORING NO.: MW10

Metcalf & Eddy, Inc. ENGINEERS

GEOLOGIC LOG

PROJECT: Seneca Army Depot COE		SHEET 1 OF 1	BORING NO. MW11
SITE LOCATION: Demo Grounds Romulus NY	JOB NO. 003288 3161		
	LOCATION: N. of burning pad G	GROUND ELEV. 111.46	TOTAL DEPTH 17.5'
DRILL CONTRACTOR: Parratt-Wolff	ENG/GEO: Sandra Giesler	BEGUN: 10-11-88	
DRILL RIG: 8500 mc track	DRILLER: Glen Lansing	FINISHED: 10-11-88	
HOLE SIZE: 10"	WEATHER: Cold 40° Windy Rainy Dark	GROUND WATER (DEPTH/ELEV.): approx 6-6.5' / 107.85	
DRILLING METHOD: 6" HSA level C	DRILLING FLUID/SOURCE: DRY	TOP OF ROCK (DEPTH/ELEV.): weathered - 9' competent - 10'	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'				brown v.f. SAND and SILT little clay - wet			
		2'				brown v.f. SAND and SILT little clay 5% 1/2"d. gravel.			Till
		4				br. v.f. SAND and SILT some clay 2% 1/4"-1/2"d. gravel			
		6'				br. v.f. SAND, SILT and CLAY 5% 1/2"d. rounded gravel	6 1/2'		▽
		8'				brown-gray v.f. SAND SILT and CLAY 15% angular gravel 1/2-1"d.		9	weathered bedrock (SHALE)
		10'	4"	50/4"		gray black fractured SHALE and CLAY rock thin laminar weathered pieces 1/10" thick			
		12.5		5 min 4 min 4 min 5 min 6 min		2"-4" beds cleaving along bedding planes 5-10% off horizontal @ 3' some cleavage oriented 10°-20° off vertical after 3' beds 6" thick			~~Shale~~ SHALE
		17.5				17.5' EOB			

Hnu=0

Hnu=0

Core Hnu=0

SAMPLE TYPES
SS=SPLIT SPOON, ST=SHELBY TUBE
R=ROCK CORE, O=OTHER

NOTES:

BORING NO.: MW11

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

PROJECT: Seneca Army Depot COG		SHEET 1 OF 1	BORING NO. MW12
SITE LOCATION: Demo Grounds Romulus NY	JOB NO. 003288		
	LOCATION: NE of Burning pad E	GROUND ELEV. 105.46	TOTAL DEPTH 15'
DRILL CONTRACTOR: Parrott Wolff	ENG/GEO: Sandra Giesler	BEGUN: 10-11-88	
DRILL RIG: 850 cme Track	DRILLER: Glen Lansing	FINISHED: 10-12-88	
HOLE SIZE: 6"	WEATHER: cold 35-40° Rainy - Windy	GROUND WATER (DEPTH/ELEV.): 4.5 ft / 103.24	
DRILLING METHOD: 4" HSA & core	DRILLING FLUID/SOURCE: DRY	TOP OF ROCK (DEPTH/ELEV.): weathered 7' competent 9'	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'				Brn v.f SAND and SILT trace Clay			
		2'				Brn v.f SAND and SILT Some Clay 5% ¼"-½" gravel rounded			TILL
5		4'				brn v.f SAND and SILT Some Clay 10% angular gravel ½"-1"			
10		6'				90% gravel ½"-1½" d. Little-trace clay+silt		7.5'	weathered SHALE
						7.5' drilling gets harder		9'	SHALE
15		9'				weathered bedrock drilling slow			
		10	CORE	5 min		cleaved along bedding planes beds 1"-2"			
				4 min					
				5 min		@11' very fractured			
20				4 min		12' fractures @ 45°			
		15'		4 min		12.5' vertical fractures			
						13' beds thick ~4"			
						15' weathered silty ground up lens where water has run through. silt + clay			
25									

Hnu=0
1
HNU=0
HNU=0
HNU=0

SAMPLE TYPES SS=SPLIT SPOON, ST=SHELBY TUBE R=ROCK CORE, O=OTHER	NOTES:	BORING NO.: MW12

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

M&E

PROJECT: Seneca Army Depot COE		SHEET 1 OF	BORING NO. MW-13
SITE LOCATION: Demo Grounds	JOB NO.		
	LOCATION: W. of Burning Pad F	GROUND ELEV. 111.57	TOTAL DEPTH 17'
DRILL CONTRACTOR: Parratt-Wolff	ENG/GEO: Sandra Giesler	BEGUN: 10-7-88	
DRILL RIG: 850 CME track	DRILLER:	FINISHED: 10-8-88	
HOLE SIZE: ~~8~~ 6"	WEATHER:	GROUND WATER (DEPTH/ELEV.): 5.1ft / 108.9	
DRILLING METHOD: ~~HS 6¼" HSA~~ 4" HSA + Corebarrel	DRILLING FLUID/SOURCE: water	TOP OF ROCK (DEPTH/ELEV.): 8'	

	DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
Hnu=0			0'				m. brown SAND and SILT trace clay 5% rounded ¼-½" d gravel			
			2'				brown v.f. SAND and SILT some clay 5% rounded gravel ¼-½" d.			Till
	~~5~~									
Hnu=0			4'				brown v.f. SAND and SILT some clay 10% subangular ½"-1" d. gravel			
Hnu=0	~~10~~		6'				GRAVEL ¼"-2" d. subangular 10% silt sand and clay	6.5'	▽	Till
			8'				wet brown v.f. SAND silt and clay 40-50% gravel			Weathered Bedrock
	~~15~~									
HNU=0		SS	10'	1"	50/1"		fractured shale			SHALE
	20		12'		6-6-5-5-6	minutes	Competent gray-black shale			
			17'							
	25									

SAMPLE TYPES SS=SPLIT SPOON, ST=SHELBY TUBE R=ROCK CORE, O=OTHER	NOTES:	BORING NO.: MW 13

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

PROJECT: Seneca Army Depot OE		SHEET 1 OF	BORING NO. MW14	
SITE LOCATION: Demolition Grounds Romulus NY	JOB NO. 003288			
	LOCATION: NE. of Burning pad #14	GROUND ELEV. 105.25	TOTAL DEPTH 16.5'	
DRILL CONTRACTOR: Parrott-wolff	ENG/GEO: S. Gresler	BEGUN: 10-13-88		
DRILL RIG: 850cme	DRILLER: G. Lansing	FINISHED: 10-13-88		
HOLE SIZE: 7"	WEATHER: Cold - snowing 35°	GROUND WATER (DEPTH/ELEV.): 5.5ft / 101.93		
DRILLING METHOD: HSA Level C . Rock-CORE	DRILLING FLUID/SOURCE: Dry - Core water	TOP OF ROCK (DEPTH/ELEV.): 9' weathered 11' competent		

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0		grab		brown v.f SAND and SILT trace clay 2% 1" gravel			
		2'		"		brn. v.f SAND and SILT little clay 5-7% gravel ½"-1"d.			
		4'		"		brn. v.f SANDY SILT some clay 7% gravel ¼-½"d.			TILL
		6'				75% gravel ¼-1"d. angular to subang. Some Silty Clay			
		8'				80% gravel ¼"-1"d angular some black silty clay			
						9' drilling harder weathered rock		9'	weathered SHALE
	SS	10'		50 blows / 2"		flat 1/8" thin ~~[illegible]~~ fractured SHALE some clay dust		11'	SHALE
	R	11.5'	5' 100%	4 min		gray-black SHALE first few inches fractured cleaved along bedding about 1-2" thick			
				5 min					
				4 min					
				4 min		2½' vertical fracture filled with silt layer 1mm. thick			
		16.5		4 mm					

HNU=0
HNU=0
HNU=0
HNU=0
HNU=0
HNU=0

SAMPLE TYPES SS=SPLIT SPOON, ST=SHELBY TUBE R=ROCK CORE, O=OTHER	NOTES:	BORING NO.: MW14

Metcalf & Eddy, Inc. ENGINEERS

GEOLOGIC LOG

M&E

PROJECT: Seneca Army Depot COE		SHEET 1 OF 1	BORING NO. MW15
SITE LOCATION: Demolition Grounds Romulus, NY	JOB NO. 003288 3161 / LOCATION: NE of Burning Pad B	GROUND ELEV. 99.67	TOTAL DEPTH 13.5'
DRILL CONTRACTOR: Parrott-wolff	ENG/GEO: S. Giesler	BEGUN: 10-14-88	
DRILL RIG: 850CME	DRILLER: G. Lansing	FINISHED: 10-14-88	
HOLE SIZE: 7"	WEATHER: Sunny 55° windy	GROUND WATER (DEPTH/ELEV.): 4 ft 1101.01	
DRILLING METHOD: HSA - core (water)	DRILLING FLUID/SOURCE: Dry	TOP OF ROCK (DEPTH/ELEV.): 6.5' weathered	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'		grab		brown v/ SAND and SILT ~~few~~ trace "gravel"			
		2'		grab		brown v/ SAND and silty CLAY trace 2% 1/4"-1/2" gravel			
5		4'				90% 1/2-1 3/4" gravel 10% brown silty clay			TILL
		6'				98% 1/2"-3" gravel angular 2% SILTY CLAY			
10						6 1/2' drilling harder weathered bedrock	6.5		WEATHERED SHALE
	R	8.5				broken up gray-black SHALE - no orientation of fractures in first			
		9.5		5 min			8.5		SHALE
		10.5		4 min		horizontal fractures begins @ 11.5' filled with silt layer			
15		11.5		4 min					
		12.5		5 min					
		13.5		5 min					
20									
25									

HNU=0 HNU=0 HNU=0 HNU=0 HNU=6

SAMPLE TYPES
SS=SPLIT SPOON, ST=SHELBY TUBE
R=ROCK CORE, O=OTHER

NOTES:

BORING NO.: MW15

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

M&E

PROJECT : Seneca Army Depot COE		SHEET	BORING NO.
SITE LOCATION: Demo grounds Romulus NY	JOB NO. 00328831601	1 OF	MW16
	LOCATION: NE of burning pad A	GROUND ELEV. 103.5	TOTAL DEPTH 13.5'
DRILL CONTRACTOR: Parrott-wolff	ENG/GEO: S. Giesler	BEGUN : 10-14-88	
DRILL RIG: 850 CME	DRILLER: G. Lansing	FINISHED: 10-15-88	
HOLE SIZE: 11"	WEATHER: Sunny 65-70°	GROUND WATER (DEPTH/ELEV.): 6.4 ft TOI 99.3 ft TO	
DRILLING METHOD: Level C HSA - core w/Water	DRILLING FLUID/SOURCE: Water	TOP OF ROCK (DEPTH/ELEV.): 6.5'	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'		grab		brown v.f. SAND and Silty CLAY			
		2'		"		brown v.f. SAND and Silty CLAY			
5		4'		"		brown/gray v.f. SAND and SILTY CLAY 5% 1/4"-2" angular gravel			TILL
		6'		"					
10						gray brown - v.f. SAND and SILTY CLAY 10% angular gravel <1" d.			
						6.5 drilling slows weathered bedrock	6.5		WEATHERED SHALE
15		8.5		4 min		SHALE-SANDY	8.5		
		↓		5 min					SHALE
				5 min					
20		13.5		7 min					
				6 min					
25									

HNU=0
HNU=0
HNU=0
HNU=0

SAMPLE TYPES SS=SPLIT SPOON, ST=SHELBY TUBE R=ROCK CORE, O=OTHER	NOTES:	BORING NO.:

Metcalf & Eddy, Inc.
ENGINEERS

GEOLOGIC LOG

PROJECT : Seneca Army Depot COE		SHEET 1 OF 1	BORING NO. MW-17
SITE LOCATION: Demo Grounds Romulus, NY	JOB NO. 003288		
	LOCATION: SE of PAD C	GROUND ELEV. 105.52	TOTAL DEPTH 19'
DRILL CONTRACTOR: Parrott-Wolff	ENG/GEO: S. Giesler	BEGUN : 10-12-88	
DRILL RIG: 850CME TRACK	DRILLER: G. Lansing	FINISHED: 10-12-88	
HOLE SIZE: 7"	WEATHER: COLD - SNOW - WINDY 35°	GROUND WATER (DEPTH/ELEV.): 4.55ft / 103.34	
DRILLING METHOD: HSA - NX CORE - LEVELC	DRILLING FLUID/SOURCE: DRY-WATER	TOP OF ROCK (DEPTH/ELEV.): 8'	

DEPTH	SAMPLE TYPE/NO.	SAMPLE DEPTH	SAMPLE RECOVERY	BLOW COUNT (per 6 inches) OR DRILLING TIME (min/ft)	% RECOVERY OR RQD	SAMPLE DESCRIPTION	ELEVATION	GRAPHIC LOG	STRATIGRAPHIC DESCRIPTION
		0'				SAND and SILT little clay, 5% ½" angular gravel			
		2'				SAND and SILT little clay 2% ½" angular gravel			
5		4'				SAND and SILT some clay 5% ½-1" angular gravel			
		6'				SAND and SILT and CLAY 20% gravel ½"-¼" 40% gravel ½"-1½"			
10									TILL
		8'				70% gravel ¼"-2"		8'	
	SS	10		39-40-50/4"		weathered SHALE flat pieces -⅛-¼" thick with silt and clay			weathered shale
15								10	SHALE
	R	14'		5min		Gray-black SHALE cleaved along bedding planes also cleaved after 2' along one line perpendicular to bedding - silty deposit inside held together along some sections to the end of core			
				6min					
20				5min					
				5min					
		19		6min					
25									

HNU=0

HNU=0

HNU=0

HNU=0

SAMPLE TYPES	NOTES:	BORING NO.:
SS=SPLIT SPOON, ST=SHELBY TUBE R=ROCK CORE, O=OTHER		MW17

METCALF & EDDY, INC.

Project Abbrev. Seneca COE
Project No. 0032883161

Date 10-6-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW8
Depth of Boring 18.5 ft.
Size of Core 2"
Type of Core Barrel NX

Location ~~West of~~ NE of road T
Boring Elev. 120.06
Elev. Top of Bedrock 106.56
Elev. Groundwater 115.12

Depth	Run No.	Recovery % 100%	RQD % 0%	Graphic Log	Fractures	Lithology
13.5	R-1	100%	6%		cleavage 30°	gray-black Sandy SHALE parting along bedding approx. 5° from horizontal Consistent and competent with cleavage ≥ 30°. Partings producing beds 1-6" thick.
18.5					cleavage 30°	

Form No. 350

Project Abbrev. Seneca Cov
Project No. 0032883161

Date 10-6-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW9
Depth of Boring 15 ft.
Size of Core 2"
Type of Core Barrel NX

Location NE of pad H
Boring Elev. 115.74
Elev. Top of Bedrock 105.74
Elev. Groundwater 113.59

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
		100%	0%			gray black sandy SHALE fissile, parting along bedding 0-5° from horizontal. beds 1"-3" thick fractured area @ 6" no stain or silt within
10 ft – 15 ft	R-1	100%	0%		fractured area; cleavage 30°; cleavage 30	

Form No. 350

METCALF & EDDY, INC.

Project Abbrev. Seneca COE
Project No. 0032883161

Date 10-4-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW10
Depth of Boring 18.5 ft
Size of Core 2"
Type of Core Barrel NX

Location SW of pad G
Boring Elev. 120.09
Elev. Top of Bedrock 106.59
Elev. Groundwater 115.84

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
13.5'		100%	0%			
	R-1	100%	0%		30° fracture	gray-black sandy shale fissile, parting along bedding - few fractures
18.5'						

METCALF & EDDY, INC.

Form No. 350

Project Abbrev. Seneca COE
Project No. 003288 31601

Date 10-11-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW11
Depth of Boring 17.5 ft
Size of Core 2"
Type of Core Barrel NX

Location NE of pad G
Boring Elev. 111.4
Elev. Top of Bedrock 98.9
Elev. Groundwater 107.65

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
12.5'		100%	37%			gray black sandy SHALE fissile, parting along bedding 0°-5° beds 1"-6"
	R-1	100%	37%		vertical 25°	
17.5'						

METCALF & EDDY, INC.

Form No. 350

METCALF & EDDY, INC.

Project Abbrev. Seneca
Project No. 0032883161

Date 10-12-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW12
Depth of Boring 15 ft
Size of Core 2"
Type of Core Barrel NX

Location NE of Pad E
Boring Elev. 105.57
Elev. Top of Bedrock 95.57
Elev. Groundwater 103.76

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
10' – 15'	R-1	100%	0%		uneven fractures; 70'; 70'; vertical fracture contains no deposits	gray black sandy SHALE fissile, parting along bedding 0-5° beds 2"-6" - first foot broken up 70° fractures around 2' vertical fracture through bedding 2 ft long contains no deposits

Form No. 350

Project Abbrev. Seneca Cot

Project No. 003288 3161

Date 10-8-88

Logged by S Giesler

LOG OF ROCK CORE

Boring No. MW13

Depth of Boring 17 ft

Size of Core 2"

Type of Core Barrel NX

Location NE of road F

Boring Elev. 111.83

Elev. Top of Bedrock 99.73

Elev. Groundwater 109.1

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
12'		100%	17%			gray black sandy SHALE fissile, parting along bedding 1"-8" thick cleavage + fractures 30° + 70° at 4' broken up layer 2" thick contains silt
17'	R1	100%	17%		70° 30° SILTY BROKEN UP	

Form No. 350

METCALF & EDDY, INC.

Project Abbrev. Seneca
Project No. 00328831(01

Date 10-13-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW14
Depth of Boring 16.5 ft.
Size of Core 2"
Type of Core Barrel NX

Location NE. of road D
Boring Elev. 105.47
Elev. Top of Bedrock 93.97
Elev. Groundwater 101.96

METCALF & EDDY, INC.

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
		100%	0%			gray black sandy SHALE fissile parting along bedding planes 0-5° beds 1-4" thick - Vertical fracture containing 1/4" silt layer 12.5'-14.5'
11.5' – 16.5'	R-1	100%	0%		uneven fractures; Vertical fracture containing 1/4" silt layer; 30°	

Form No. 350

Project Abbrev. Seneca
Project No. 0033883161

Date 10-14-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW15
Depth of Boring 13.5 ft.
Size of Core 2"
Type of Core Barrel NX

Location NE of pad B
Boring Elev. 102.95
Elev. Top of Bedrock 94.45
Elev. Groundwater 101.83

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
8.5' – 13.5	R-1	100%	0%		unevenly fractured 0-5°	gray-black sandy SHALE fissile, parting along bedding 0°-5° beds 1-4" thick 1st foot very fractured 3/4" sandy layer @ 9.5 ft. long vertical fracture 2½-3' long exists through beds and contains a 1/4" silt layer along fracture

METCALF & EDDY, INC.

Form No. 350

Project Abbrev. Seneca
Project No. 0032883161

Date 10-14-88
Logged by S. Giesler

LOG OF ROCK CORE

Boring No. MW16
Depth of Boring 13.5 ft.
Size of Core 2"
Type of Core Barrel NX

Location NE of pad A
Boring Elev. 103.7
Elev. Top of Bedrock 95.2
Elev. Groundwater 100.41

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
8.5' – 13.5'	R-1	100%	0%		vertical fracture; 30°; 30°	gray black sandy SHALE fissile, parting along bedding planes 0-5° beds 1"-4" thick competent

METCALF & EDDY, INC.

Form No. 350

Project Abbrev. Seneca
Project No. 0032883161

Date 10-12-88
Logged by S Giesler

LOG OF ROCK CORE

Boring No. MW17
Depth of Boring 19 ft.
Size of Core 2"
Type of Core Barrel NX

Location SE of pad C
Boring Elev. 105.81
Elev. Top of Bedrock 91.81
Elev. Groundwater 103.77

Depth	Run No.	Recovery %	RQD %	Graphic Log	Fractures	Lithology
14' – 19'	R1	100%	0%		30° Vertical fracture cemented by silt 2° 30°	gray black sandy SHALE fissile, parting along bedding 0-5° beds 2-4" thick. Vertical fracture 16.5'–19' thin silty deposit inside

METCALF & EDDY, INC.

Form No. 350

WATER CONTENT

LABORATORY NO. 018 - GEOTECH ACCT. ABBR. COE - E. SENECA, NY

SAMPLE NO. VARIOUS ACCT. NO. 003288 - 3161

DATE TESTED 10/22/88 TESTED BY W. CHECCHI

TEST NUMBER	MW8 8'	MW8 10'	MW9 4'	MW9 6'	MW10 4'
TARE NUMBER	3K	3P	2X	3G	2S
A. WEIGHT OF WET SOIL + TARE	219.15	200.49	159.15	213.00	194.38
B. WEIGHT OF DRY SOIL + TARE	212.35	195.79	148.14	198.29	179.18
C. WEIGHT OF WATER, W_w=(A-B)	6.80	4.70	11.01	14.71	15.20
D. WEIGHT OF TARE	31.77	31.57	31.80	31.83	32.38
E. WEIGHT OF DRY SOIL, W_s=(B-D)	180.58	164.22	116.34	166.46	146.80
F. WATER CONTENT, W= (C/E x 100)	3.8	2.9	9.5	8.8	10.4

TEST NUMBER	MW10 8'	MW11 4'	MW11 8'	MW12 2'	MW12 6'
TARE NUMBER	3W	2I	2M	6	2E
A. WEIGHT OF WET SOIL + TARE	219.47	177.37	224.74	166.93	212.73
B. WEIGHT OF DRY SOIL + TARE	208.10	158.13	207.16	149.35	197.57
C. WEIGHT OF WATER, W_w=(A-B)	11.37	19.24	17.58	17.58	15.16
D. WEIGHT OF TARE	32.00	31.84	31.74	20.80	31.64
E. WEIGHT OF DRY SOIL, W_s=(B-D)	176.10	126.29	175.42	128.55	165.93
F. WATER CONTENT, W= (C/E x 100)	6.4	15.2	10.0	13.7	9.1

TEST NUMBER	MW13 6'	MW13 8'	MW14 4'	MW14 8'	MW15 2'
TARE NUMBER	3A	2W	3B	2G	2D
A. WEIGHT OF WET SOIL + TARE	210.38	187.44	164.04	240.89	144.65
B. WEIGHT OF DRY SOIL + TARE	193.43	161.71	148.28	229.13	129.12
C. WEIGHT OF WATER, W_w= (A-B)	16.95	25.73	15.76	11.76	15.53
D. WEIGHT OF TARE	32.07	31.75	31.88	32.03	31.89
E. WEIGHT OF DRY SOIL, W_s = (B-D)	161.36	129.96	116.40	197.10	97.23
F. WATER CONTENT, W= (C/E x 100)	10.5	19.8	13.5	6.0	16.0

TEST NUMBER	MW15 6'	MW16 4'	MW16 6'	MW17 6'	MW17 8'
TARE NUMBER	3I	3X	3M	2H	2R
A. WEIGHT OF WET SOIL + TARE	210.71	201.88	211.90	198.79	230.73
B. WEIGHT OF DRY SOIL + TARE	200.97	189.75	202.40	186.27	222.17
C. WEIGHT OF WATER, W_w=(A-B)	9.74	12.13	9.50	12.52	8.56
D. WEIGHT OF TARE	31.79	31.90	31.70	31.91	31.54
E. WEIGHT OF DRY SOIL, W_s=(B-D)	169.18	157.85	170.70	154.36	190.63
F. WATER CONTENT, W=(C/E x 100)	5.8	7.7	5.6	8.1	4.5

METCALF & EDDY, ENGINEERS. BOSTON • NEW YORK • PALO ALTO

ORM NO. 305

FORM 291

GRADATION CURVES

LABORATORY NO. 018-GEOTECH

FIELD SAMPLE NOS. MW-8; 8', 10'

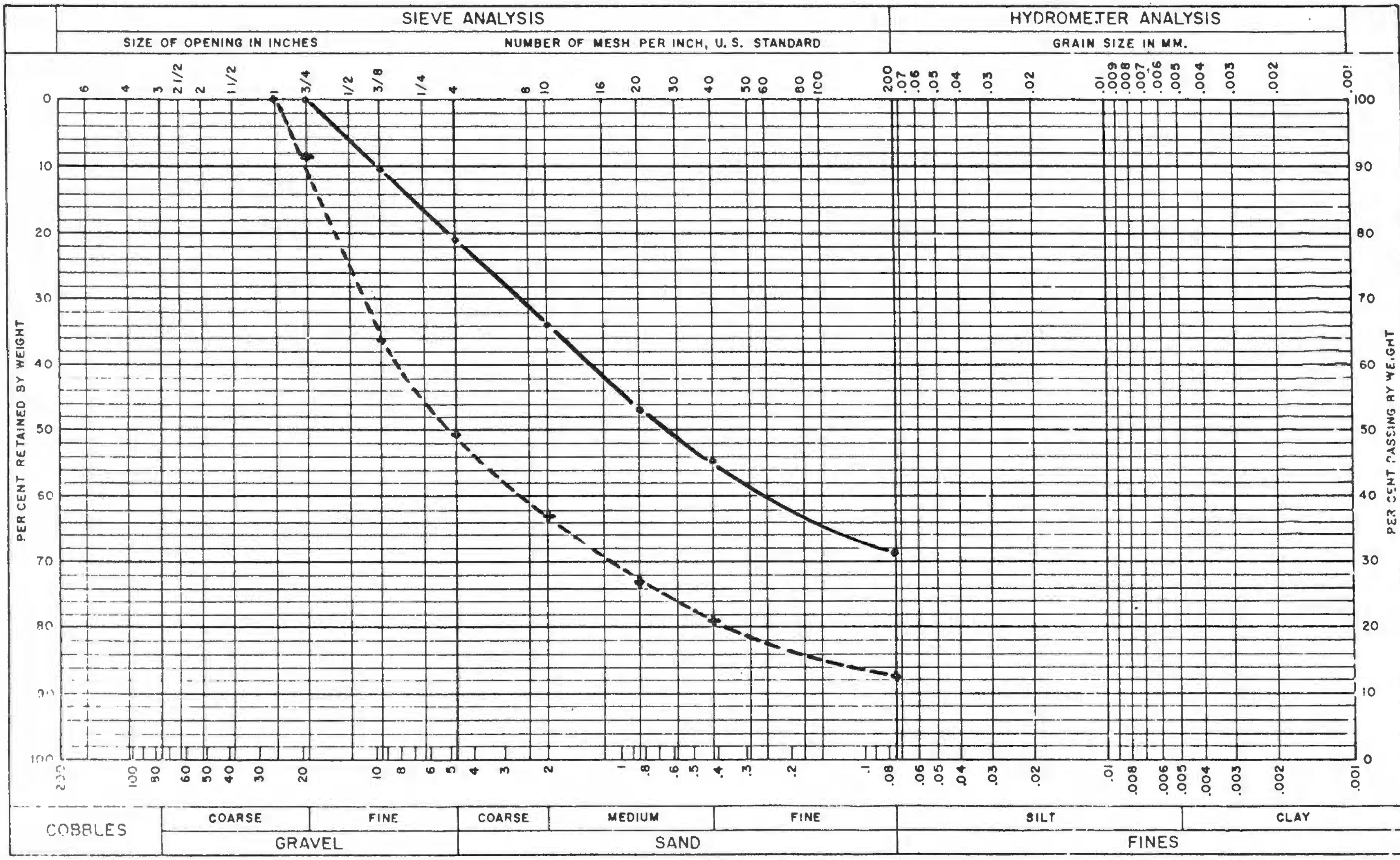
DATE TESTED 10/23/88 10/31/88

ACCT. ABBR. COE - SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW8 - 8'		8'-10'	(SM)
MW8 - 10'		10'-12'	(GM)

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH　　ACCT. ABBR. COE - E. SENECA, NY

FIELD SAMPLE NO. MW 8　8'　　ACCT. NO. 003288 - 3161

DATE TESTED 10/23/88　　TESTED BY W. CHECCHi

WT. TOTAL DRY SAMPLE + TARE 212.35

WT. TARE # 3K　31.77

WT. TOTAL DRY SAMPLE 180.58

WT. RETAINED #10 SIEVE 61.20　　% PLUS #10 33.9

WT. PASSING #10 SIEVE 119.38　　% MINUS #10 66.1

NONPLASTIC FINES
DILATANCY
NO DRY STRENGTH
(SM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______

WT. TARE # ______

WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______

WT. TARE # ______

WT. RETAINED #200 SIEVE ______

WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	19.26	10.7
NO. 4 3K	38.26	21.2
NO. 10	61.20	33.9
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	84.55		46.8
#40 2L	98.35		54.5
#60			
#140			
#200 20	123.87		68.6
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV 6/82

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH　　ACCT. ABBR. COE - E. SENECA, NY

FIELD SAMPLE NO. MW 8　10'　　ACCT. NO. 003288 - 3161

DATE TESTED 10/23/88　　TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 195.79

WT. TARE # 3P 31.57

WT. TOTAL DRY SAMPLE 164.22

WT. RETAINED #10 SIEVE 103.53　　% PLUS #10 63.0

WT. PASSING #10 SIEVE 60.69　　% MINUS #10 37.0

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

NONPLASTIC FINES
DILATANCY
NO DRY STRENGTH
(GM)

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"	0	0
3/4"	14.19	8.6
3/8"	59.49	36.2
NO. 4 3P	82.92	50.5
NO. 10	103.53	63.0
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	119.89		73.0
#40 21	129.70		79.0
#60			
#140			
#200 3E	143.50		87.4
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

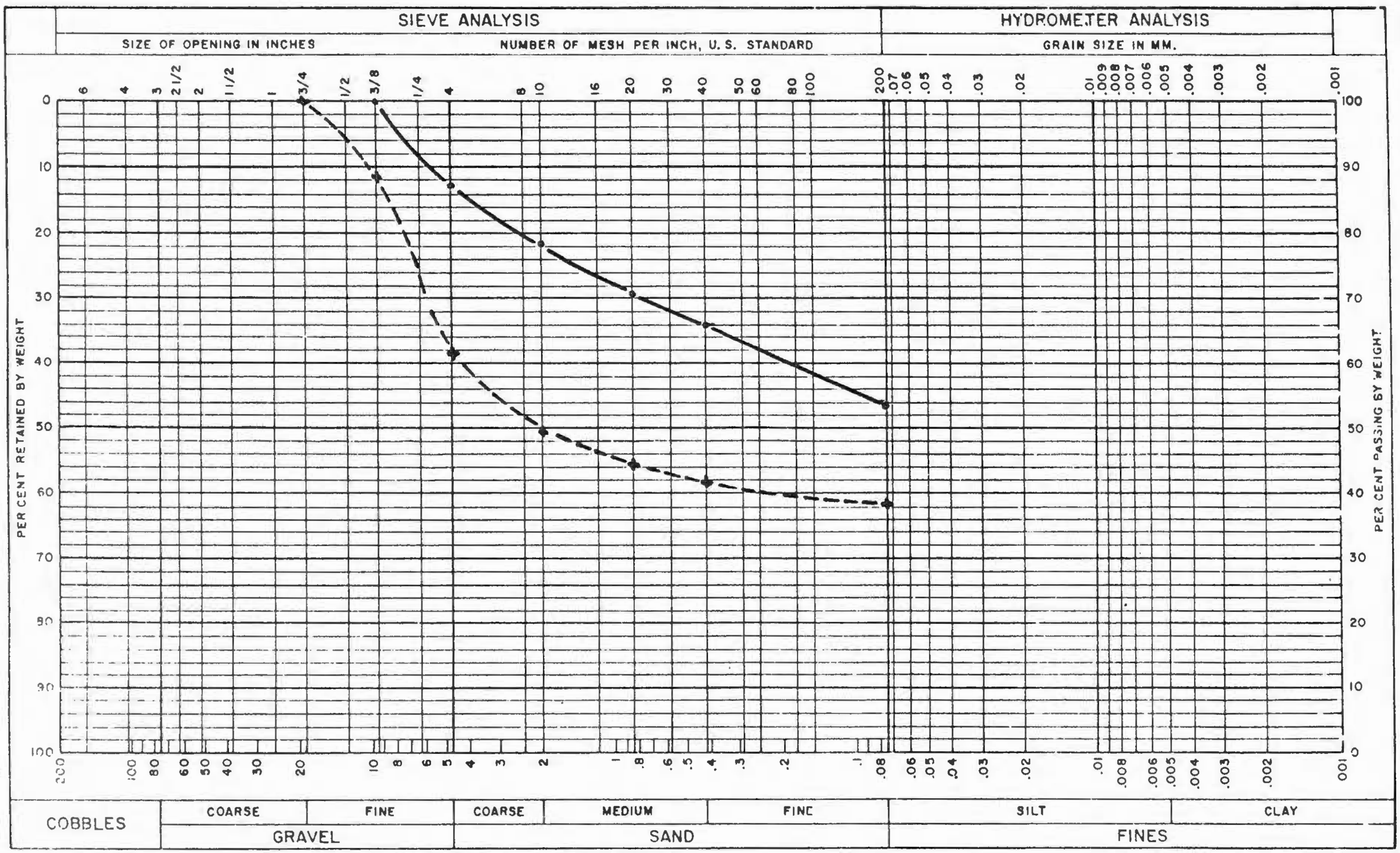
B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

FORM 291

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW9 - 4'		4'-6'	(CL)
MW9 - 6'		6'-8'	(GC)

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH

FIELD SAMPLE NOS. MW-9 ; 4', 6'

DATE TESTED 10/23/88 - 10/31/88

ACCT. ABBR. COE - E. SENECA NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH ACCT. ABBR. COE- E. SENECA, NY

FIELD SAMPLE NO. MW 9 4' ACCT. NO. 003288-3161

DATE TESTED 10/23/88 TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 148.14

WT. TARE # 2X 31.80

WT. TOTAL DRY SAMPLE 116.34

WT. RETAINED #10 SIEVE 25.24 % PLUS #10 21.7

WT. PASSING #10 SIEVE 91.10 % MINUS #10 78.3

PLASTICITY
NO DILATANCY
SOME DRY STRENGTH

SANDY, SILTY, CLAY
(CL)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"		
3/8"	0	0
NO. 4 2X	14.87	12.8
NO. 10	25.24	21.7
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	34.24		29.4
#40 3	39.60		34.0
#60			
#140			
#200 24	53.75		46.2
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH ACCT. ABBR. COE -E.SENECA, NY

FIELD SAMPLE NO. MW 9 6' ACCT. NO. 003288-3161

DATE TESTED 10/23/88 TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 198.29

WT. TARE # 3G 31.83

WT. TOTAL DRY SAMPLE 166.46

WT. RETAINED #10 SIEVE 84.00 % PLUS #10 50.5

WT. PASSING #10 SIEVE 82.46 % MINUS #10 49.5

PLASTICITY
NO DILATANCY
SOME DRY STRENGTH

CLAYGY, SILTY, GRAVEL
(GC)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______

WT. TARE # ______

WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______

WT. TARE # ______

WT. RETAINED #200 SIEVE ______

WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	19.26	11.6
NO. 4 3G	64.48	38.7
NO. 10	84.00	50.5
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	92.60		55.6
#40 11	96.84		58.2
#60			
#140			
#200 71	102.50		61.6
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

FORM 291

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH

FIELD SAMPLE NOS. MW-10; 4', 8'

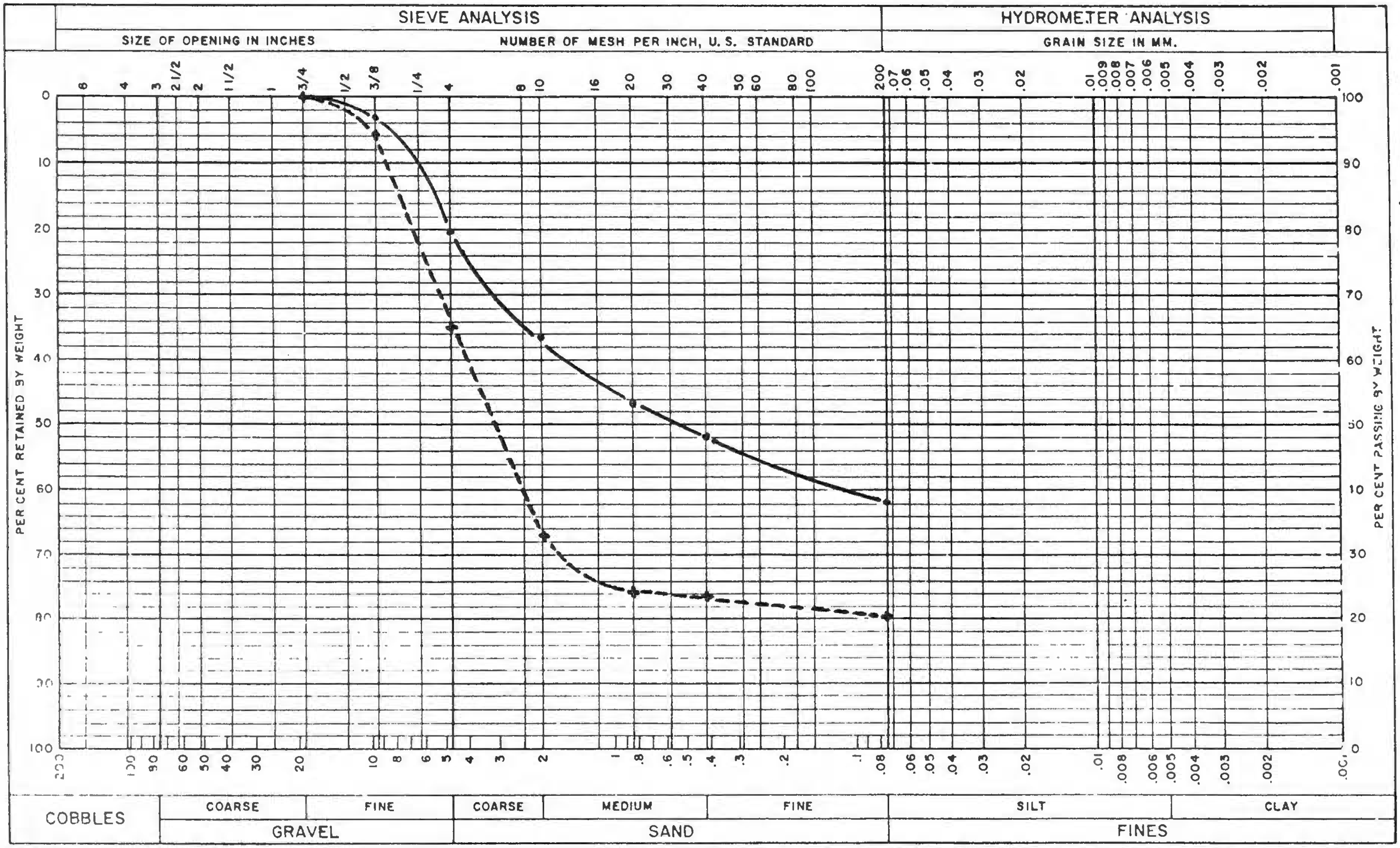
DATE TESTED 10/23/88 - 10/31/88

ACCT. ABBR. COE - SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW 10 - 4'		4'-6'	(SC)
MW 10 - 8'		8'-10'	(SC)

SIEVE ANALYSIS

Gt

LABORATORY NO. 018- GEOTECH ACCT. ABBR. COE - E.SENECA, NY

FIELD SAMPLE NO. MW 10 4' ACCT. NO. 003288-3161

DATE TESTED 10/28/88 TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 179.18

WT. TARE # 25 32.38

WT. TOTAL DRY SAMPLE 146.80

WT. RETAINED #10 SIEVE 53.41 % PLUS #10 36.4

WT. PASSING #10 SIEVE 93.39 % MINUS #10 63.6

PLASTICITY
NO DILATANCY
SLIGHT DRY STRENGTH
CLAYEY, SILTY SANDS
(SC)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	4.37	3.0
NO. 4 25	29.53	20.1
NO. 10	53.41	36.4
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	68.64		46.8
#40 20	76.32		52.0
#60			
#140			
#200 14	90.90		61.9
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ________ + ________ × A

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH

ACCT. ABBR. COE - E. SENECA, NY

FIELD SAMPLE NO. MW 10 8'

ACCT. NO. 003293-3161

DATE TESTED 10/23/88

TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 208.10

WT. TARE # 3W 32.00

WT. TOTAL DRY SAMPLE 176.10

WT. RETAINED #10 SIEVE 118.84

% PLUS #10 67.5

WT. PASSING #10 SIEVE 57.26

% MINUS #10 32.5

SLIGHT/LOW PLASTICITY
SLOW DILATANCY
SLIGHT DRY STRENGTH
(SC)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	10.15	5.8
NO. 4 3W	61.50	34.9
NO. 10	118.84	67.5
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	132.80	–	75.4
#40 8	134.12	–	76.2
#60		–	
#140		–	
#200 31	140.49	–	79.8
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV. 6/83

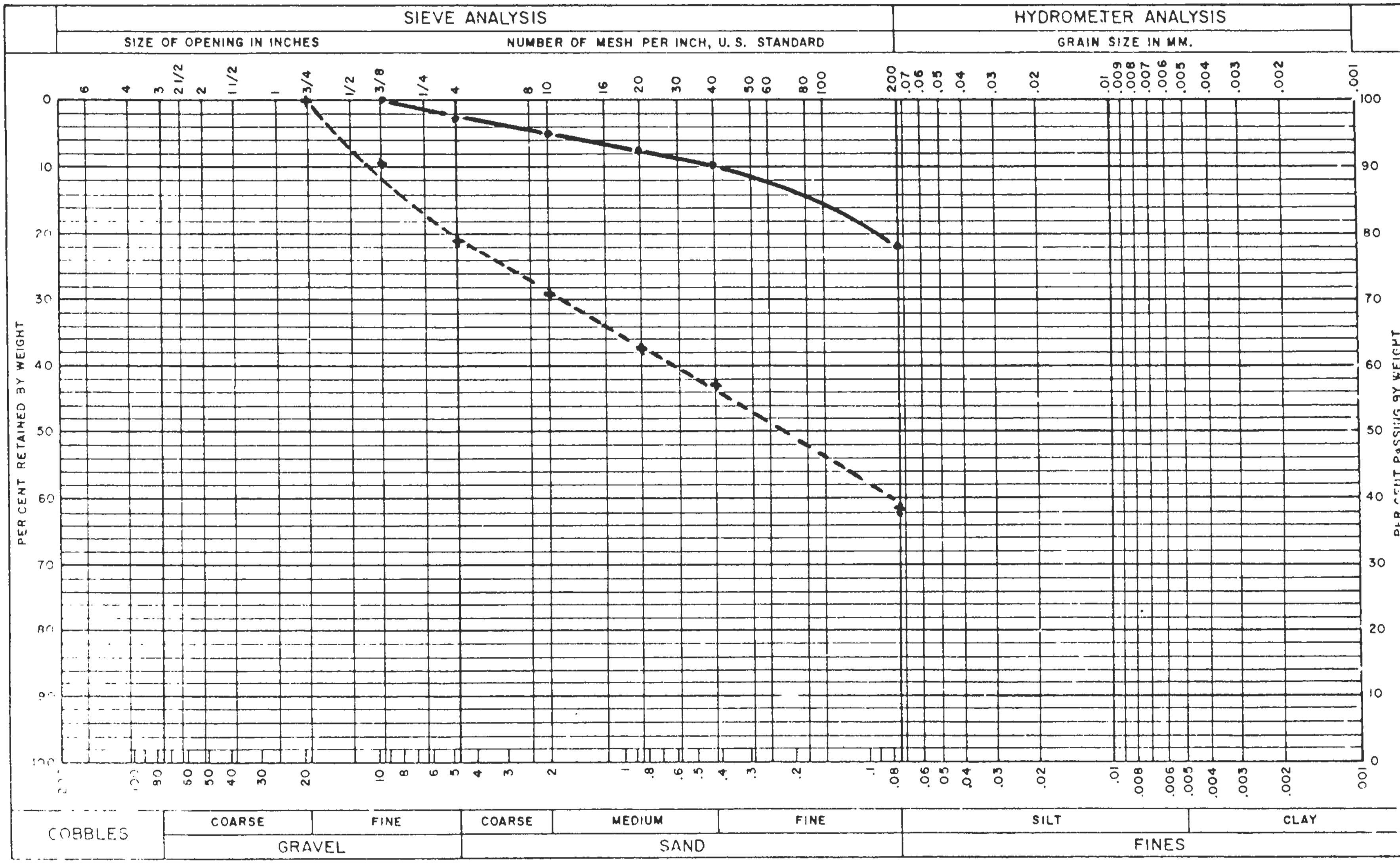
FORM 291

METCALF & EDDY, ENGINEERS

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH
FIELD SAMPLE NOS. MW-11; 4', 8'
DATE TESTED 10/23/88 - 10/31/88

ACCT. ABBR. COE - SENECA, NY
ACCT. NO. 003288 - 3161
TESTED BY W. CHECCHI



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW 11 - 4'	•——•——•	4'-6'	(ML)
MW 11 - 8'	+- - - -+- - - -+	8'-10'	(SM-ML)

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH — ACCT. ABBR. COE - E. SENECA, NY

FIELD SAMPLE NO. MW 11 4' — ACCT. NO. 003288-3161

DATE TESTED 10/23/88 — TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 158.13

WT. TARE # 2I 31.84

WT. TOTAL DRY SAMPLE 126.29

WT. RETAINED #10 SIEVE 6.20 — % PLUS #10 4.9

WT. PASSING #10 SIEVE 120.09 — % MINUS #10 95.1

NONPLASTIC FINES
DILATANCY
NO DRY STRENGTH
(ML)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______

WT. TARE # ______

WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______

WT. TARE # ______

WT. RETAINED #200 SIEVE ______

WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"		
3/8"	0	0
NO. 4 2I	3.35	2.6
NO. 10	6.20	4.9
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	9.69		7.7
#40 2C	12.42		9.8
#60			
#140			
#200 2Q	27.76		22.0
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH   ACCT. ABBR. COE - E. SENECA, NY

FIELD SAMPLE NO. MW 11 8'   ACCT. NO. 003288 - 3161

DATE TESTED 10/23/88   TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 207.16

WT. TARE # 2M 31.74

WT. TOTAL DRY SAMPLE 175.42

WT. RETAINED #10 SIEVE 51.30   % PLUS #10 29.2

WT. PASSING #10 SIEVE 124.12   % MINUS #10 70.8

NON PLASTIC

DILATANCY

NO DRY STRENGTH

SAND + SILT

(SM-ML)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______

WT. TARE # ______

WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______

WT. TARE # ______

WT. RETAINED #200 SIEVE ______

WT. PASSING #200 SIEVE ______

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	16.75	9.5
NO. 4 2N	36.75	20.9
NO. 10	51.30	29.2
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	66.14		37.7
#40 2M	74.87		42.7
#60			
#140			
#200 3C	107.69		61.4
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

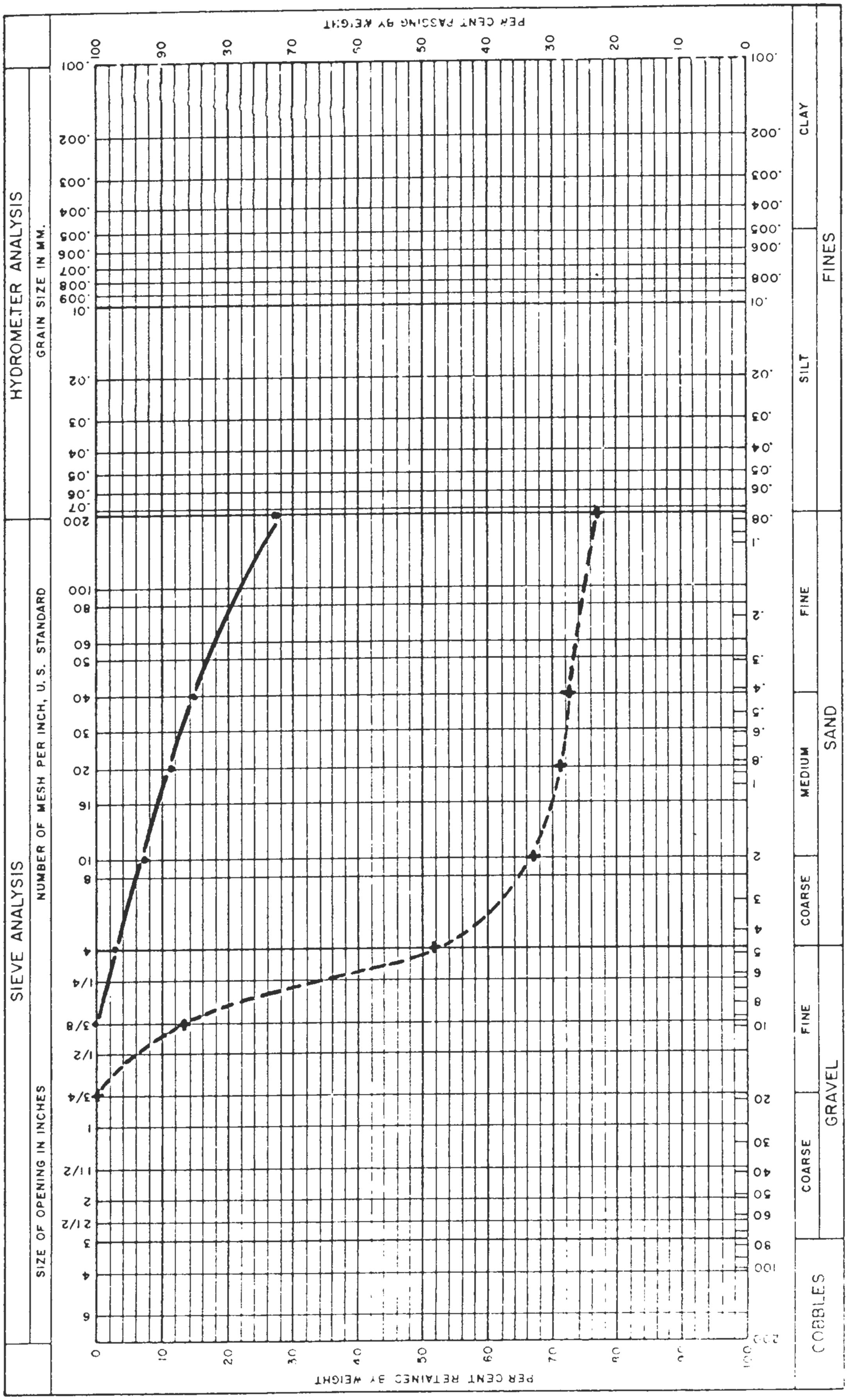
B = ______ + ______ × A

FORM 309
REV 6/83

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH
FIELD SAMPLE NOS. MW-12 ; 2', 6'
DATE TESTED 10/23/88 - 10/31/88

ACCT. ABBR. COE - SENECA, NY
ACCT. NO. 003288-3161
TESTED BY W. CHECCHI



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW 12- 2'	——•——	2'-4'	(ML)
MW 12-6'	--+--	6'-8'	(GM)

FORM 291

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH
ACCT. ABBR. COE - E. SENECA, NY
FIELD SAMPLE NO. MW 12 2'
ACCT. NO. 003288-3161
DATE TESTED 10/23/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 149.35
WT. TARE # 6 20.80
WT. TOTAL DRY SAMPLE 128.55

WT. RETAINED #10 SIEVE 9.74
% PLUS #10 7.6
WT. PASSING #10 SIEVE 118.81
% MINUS #10 92.4

NON PLASTIC FINES
DILATANCY
NO DRY STRENGTH
TRACE CLAY
(ML)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ____

WT. TARE # ____

WT. PASSING #10 SIEVE ____

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ____

WT. TARE # ____

WT. RETAINED #200 SIEVE ____

WT. PASSING #200 SIEVE ____

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"		
3/8"	0	•
NO. 4 6	4.00	3.1
NO. 10	9.74	7.6
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	14.63		11.4
#40 70	18.25		14.2
#60			
#140			
#200 2F	35.48		27.6
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ____ + ____ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018-GEOTECH
FIELD SAMPLE NO. MW 12 6'
DATE TESTED 10/28/88

ACCT. ABBR. COE-E. SENECA, NY
ACCT. NO. 003288-3161
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 197.57
WT. TARE # 2E 31.64
WT. TOTAL DRY SAMPLE 165.93

WT. RETAINED #10 SIEVE 111.67 % PLUS #10 67.3
WT. PASSING #10 SIEVE 54.26 % MINUS #10 32.7

NON PLASTIC FINES
SLIGHT DILATANCY
NO DRY STRENGTH
TRACE CLAY
(GM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE
WT. TARE #
WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE
WT. TARE #
WT. RETAINED #200 SIEVE
WT. PASSING #200 SIEVE

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	21.78	13.1
NO. 4 2E	86.00	51.8
NO. 10	111.67	67.3
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	118.23		71.2
#40 1	120.23		72.4
#60			
#140			
#200 121	128.00		77.1
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV. 6/83

FORM 291

METCALF & EDDY, ENGINEERS

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH

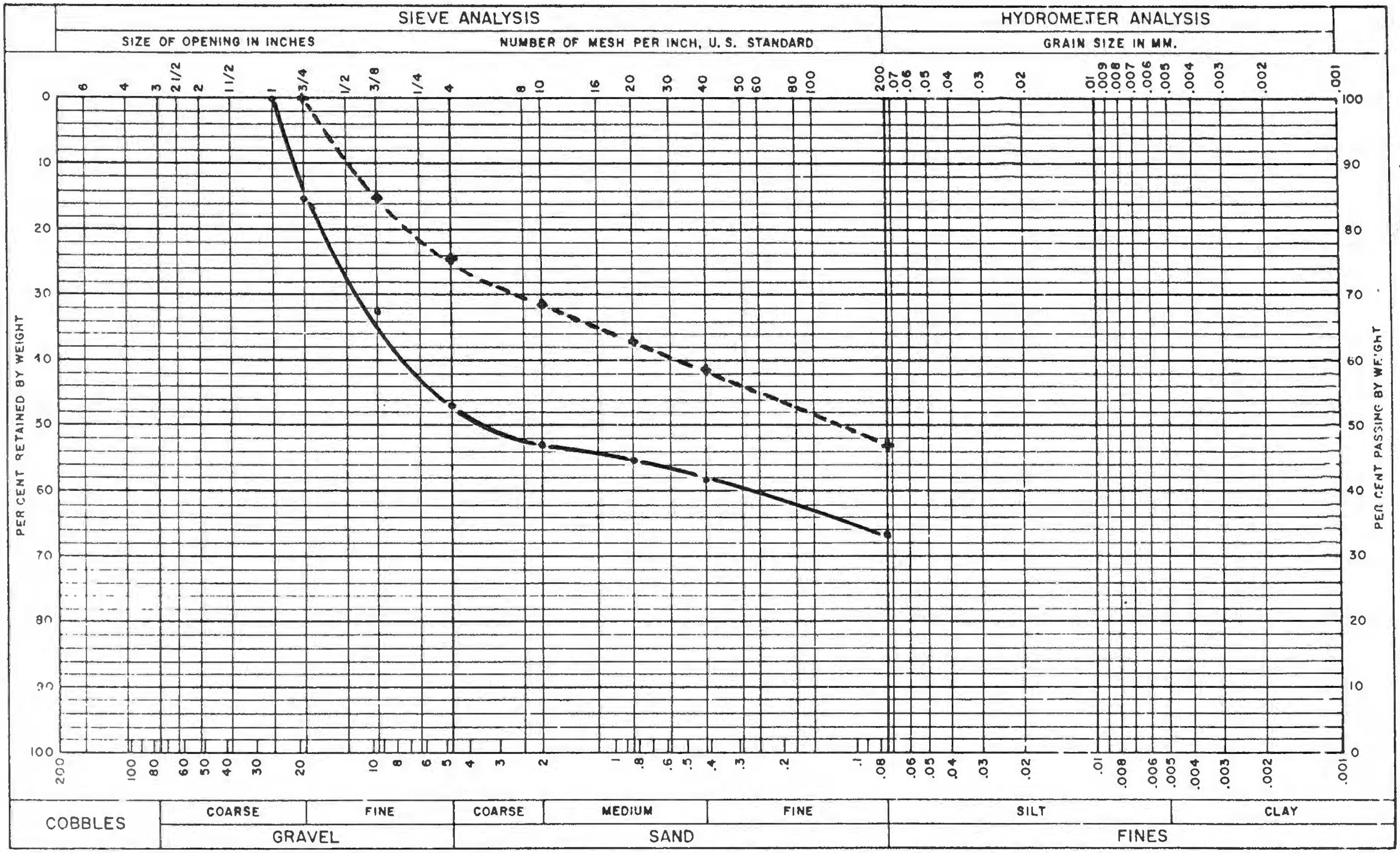
FIELD SAMPLE NOS. MW-13 ; 6', 8'

DATE TESTED 10/23/88 – 10/31/88

ACCT. ABBR. COE - SENECA, NY

ACCT. NO. 003288 - 3161

TESTED BY W. CHECCHI



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW13 - 6'	——•——	6'- 8'	(GM)
MW13 - 8'	+- - - -+- - - -+	8'- 10'	(ML)

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH

ACCT. ABBR. COE- E. SENECA, NY

FIELD SAMPLE NO. MW 13 6'

ACCT. NO. 003288-3161

DATE TESTED 10/28/88

TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 193.43

WT. TARE # 3A 32.07

WT. TOTAL DRY SAMPLE 161.36

WT. RETAINED #10 SIEVE 85.46

% PLUS #10 53.0

WT. PASSING #10 SIEVE 75.90

% MINUS #10 47.0

NON PLASTIC
SLOW DILATANCY
NO DRY STRENGTH
TRACE CLAY
(GM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"	0	0
3/4"	25.37	15.7
3/8"	52.09	32.3
NO. 4 3A	75.76	47.0
NO. 10	85.46	53.0
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	89.89		55.7
#40 2J	93.87		58.2
#60			
#140			
#200 3	107.85		66.8
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ________ + ________ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 – GEOTECH
ACCT. ABBR. COE – E. SENECA, NY

FIELD SAMPLE NO. MW 13 8'
ACCT. NO. 003288-3161

DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 161.71

WT. TARE # 2W 31.75

WT. TOTAL DRY SAMPLE 129.96

WT. RETAINED #10 SIEVE 40.88
% PLUS #10 31.4

WT. PASSING #10 SIEVE 89.08
% MINUS #10 68.6

NON-PLASTIC TO SLIGHT PLAST
SLOW DILATANCY
NO DRY STRENGTH
TRACE CLAY
(ML)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	19.13	14.7
NO. 4 2W	32.00	24.6
NO. 10	40.88	31.4
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	48.34	—	37.2
#40 3J	53.83		41.4
#60			
#140			
#200 2S	68.91		53.0
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

FORM 291

GRADATION CURVES

LABORATORY NO. 018 - GEOTECH

FIELD SAMPLE NOS. MW-14 ; 4', 8'

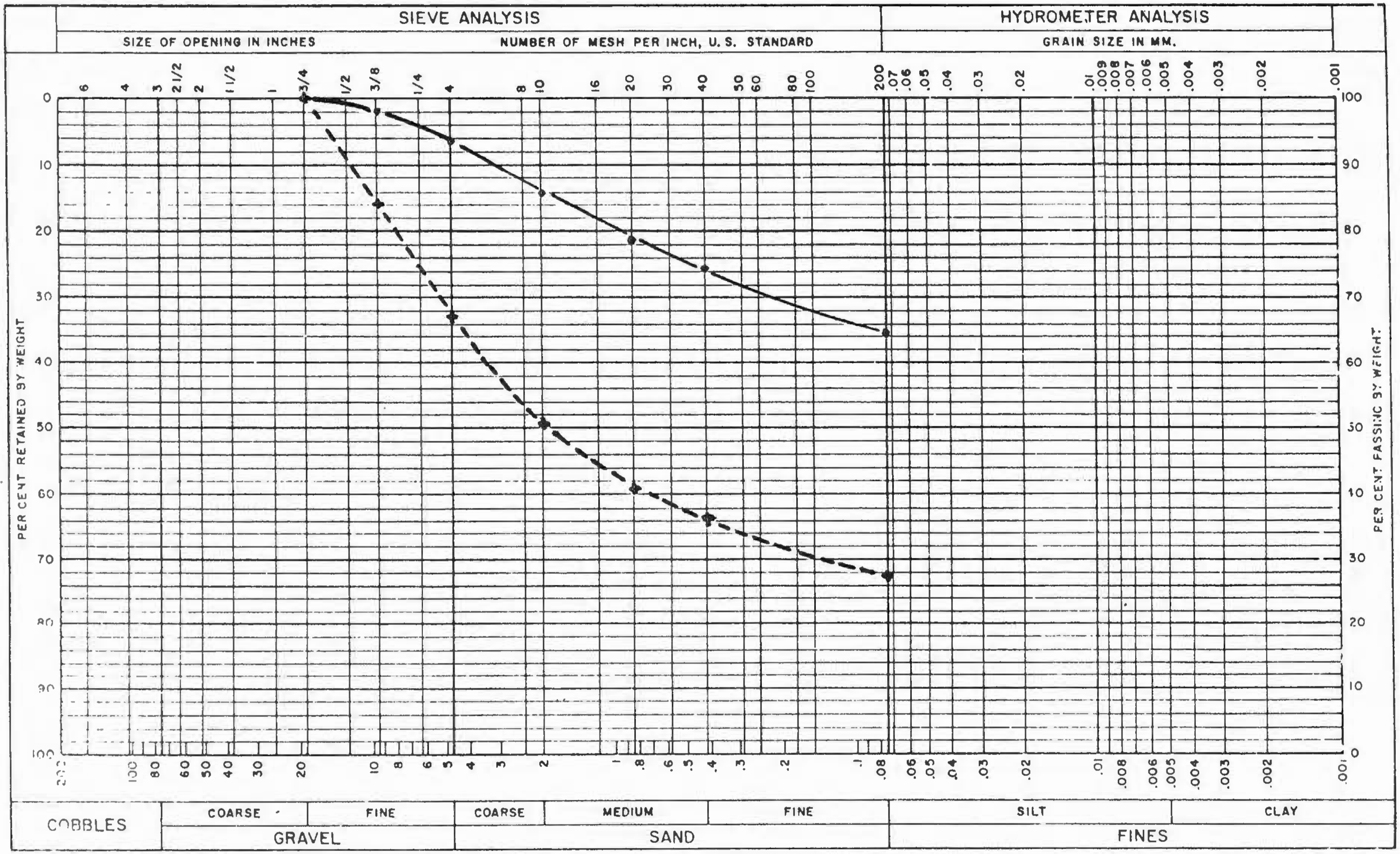
DATE TESTED 10/22/88 - 10/31/88

ACCT. ABBR. COE - SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW 14 - 4'	•———•———•	4'-6'	(CL)
MW14 - 8'	+- - - - +- - - - +	8'-10'	(SC)

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH
ACCT. ABBR. COE - E.SENECA, NY
FIELD SAMPLE NO. MW 14 4'
ACCT. NO. 003288 - 3161
DATE TESTED 10/28/88
TESTED BY W. CHECCHi

WT. TOTAL DRY SAMPLE + TARE 148.28
WT. TARE # 3B 31.88
WT. TOTAL DRY SAMPLE 116.40

WT. RETAINED #10 SIEVE 16.51
% PLUS #10 14.2
WT. PASSING #10 SIEVE 99.89
% MINUS #10 85.8

PLASTICITY
SLOW DILATANCY
SOME DRY STRENGTH
SILT and CLAY
(CL)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ____
WT. TARE # ____
WT. PASSING #10 SIEVE ____

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ____
WT. TARE # ____
WT. RETAINED #200 SIEVE ____
WT. PASSING #200 SIEVE ____

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	2.36	2.0
NO. 4 3B	7.74	6.6
NO. 10	16.51	14.2
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	25.09		21.6
#40 3D	29.81		25.6
#60			
#140			
#200 3T	41.60		35.7
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ____ + ____ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH
ACCT. ABBR. COE-E.SENECA, NY

FIELD SAMPLE NO. MW 14 8'
ACCT. NO. 003288 - 3161

DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 229.13

WT. TARE # 2G 32.03

WT. TOTAL DRY SAMPLE 197.10

WT. RETAINED #10 SIEVE 97.34 % PLUS #10 49.4

WT. PASSING #10 SIEVE 99.76 % MINUS #10 50.6

PLASTICITY
NO DILATANCY
SOME DRY STRENGTH
(SC)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE

WT. TARE #

WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE

WT. TARE #

WT. RETAINED #200 SIEVE

WT. PASSING #200 SIEVE

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	31.64	16.0
NO. 4 2G	64.75	32.8
NO. 10	97.34	49.4
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	116.52		59.1
#40 3F	125.49		63.7
#60			
#140			
#200 34	142.91		72.5
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV. 6/83

FORM 291

GRADATION CURVES

LABORATORY NO. 018-GEOTECH

FIELD SAMPLE NOS. MW-15; 2', 6'

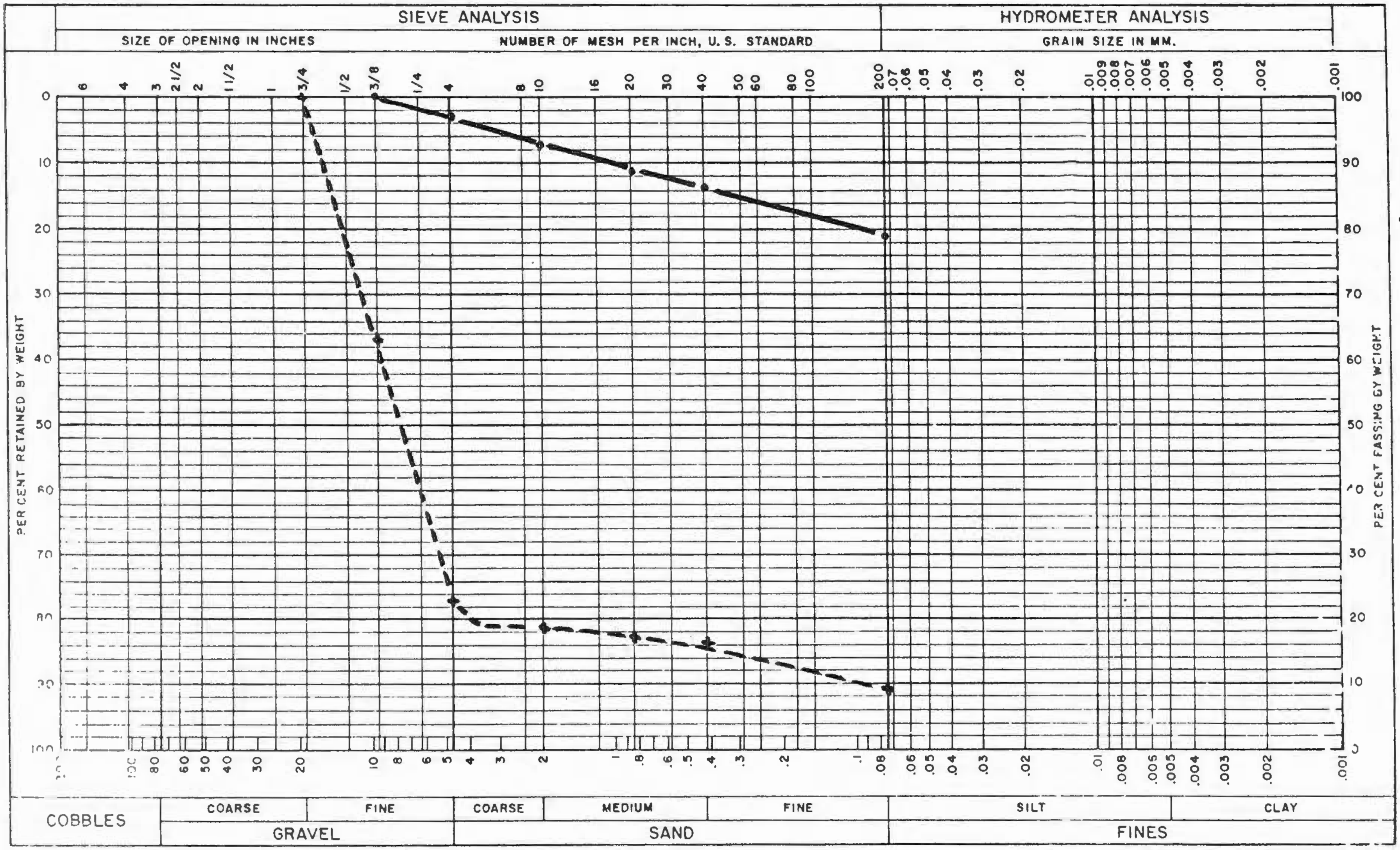
DATE TESTED 10/22/88 - 10/31/88

ACCT. ABBR. COE - E. SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW15-2'	•———•——•	2'-4'	(CL)
MW15-6'	+– – –+– – –+	6'-8'	(GP)

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH
ACCT. ABBR. COE - E.SENECA, NY
FIELD SAMPLE NO. MW 15 2'
ACCT. NO. 003288 - 3161
DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 129.12
WT. TARE # 2D 31.89
WT. TOTAL DRY SAMPLE 97.23

WT. RETAINED #10 SIEVE 7.30 % PLUS #10 7.5
WT. PASSING #10 SIEVE 89.93 % MINUS #10 92.5

PLASTICITY
NO DILATANCY
DRY STRENGTH
SOME SILT
(CL)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE
WT. TARE #
WT. PASSING #10 SIEVE

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE
WT. TARE #
WT. RETAINED #200 SIEVE
WT. PASSING #200 SIEVE

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"		
3/8"	0	0
NO. 4 2D	2.87	3.0
NO. 10	7.30	7.5
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	11.10		11.4
#40 35	13.20		13.6
#60			
#140			
#200 12	20.55		21.1
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH
ACCT. ABBR. COE - E. SENECA, NY
FIELD SAMPLE NO. MW 15 6'
ACCT. NO. 008288-3161
DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 200.97
WT. TARE # 3I 31.79
WT. TOTAL DRY SAMPLE 169.18

WT. RETAINED #10 SIEVE 137.56 % PLUS #10 81.3
WT. PASSING #10 SIEVE 31.62 % MINUS #10 18.7

NON PLASTIC
RAPID DILATANCY
NO DRY STRENTH
Rock Fragments
(GP)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______
WT. TARE # ______
WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______
WT. TARE # ______
WT. RETAINED #200 SIEVE ______
WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	63.00	37.2
NO. 4 3I	131.13	77.5
NO. 10	137.56	81.3
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	139.89		82.7
#40 2Z	141.46		83.6
#60			
#140			
#200 7	153.65		90.8
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

ORM 291

METCALF & EDDY, ENGINEERS.

GRADATION CURVES

LABORATORY NO. 018-GEOTECH

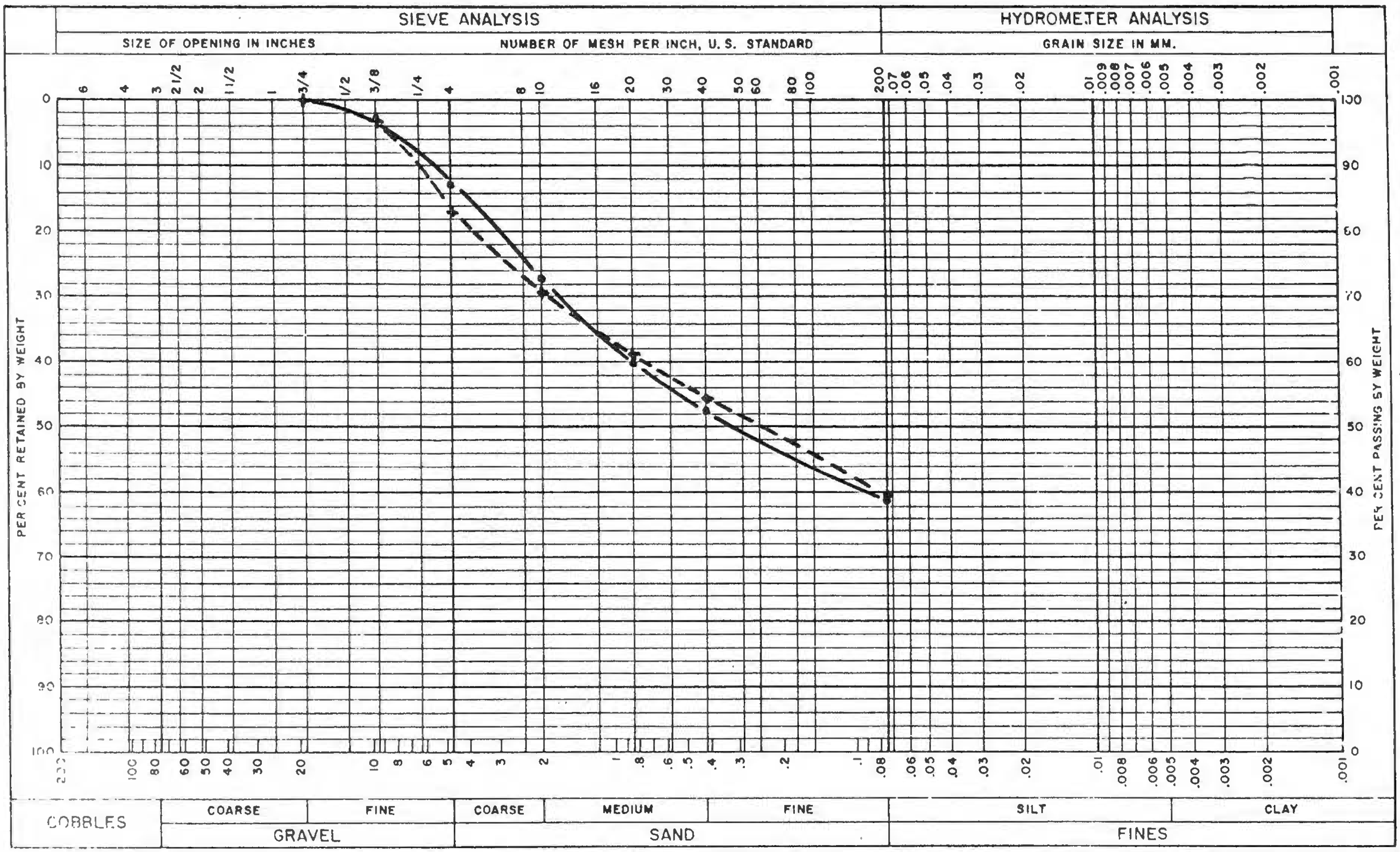
FIELD SAMPLE NOS. MW-16 ; 4', 6'

DATE TESTED 10/24/88 - 10/31/88

ACCT. ABBR. COE - E. SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW 16-4'	•——•——•	4'-6'	(SM)
MW 16-6'	+- - -+- - -+	6'-8'	(SM)

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH
ACCT. ABBR. COE - C. SENECA, NY
FIELD SAMPLE NO. MW 16 4'
ACCT. NO. 003288 - 8161
DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 189.75
WT. TARE # 3X 31.90
WT. TOTAL DRY SAMPLE 157.85

WT. RETAINED #10 SIEVE 43.27
% PLUS #10 27.4
WT. PASSING #10 SIEVE 114.58
% MINUS #10 72.6

SLIGHT PLASTICITY
DILATANCY
NO DRY STRENGTH
TRACE CLAY
(SM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______
WT. TARE # ______
WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______
WT. TARE # ______
WT. RETAINED #200 SIEVE ______
WT. PASSING #200 SIEVE ______

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	3.97	2.5
NO. 4 3X	20.26	12.8
NO. 10	43.27	27.4
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	63.40		40.2
#40 2A	75.39		47.8
#60			
#140			
#200 50	95.85		60.7
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 - GEOTECH | ACCT. ABBR. COE - E. SENECA, NY
FIELD SAMPLE NO. MW 16 6' | ACCT. NO. 008288-3161
DATE TESTED 10/28/88 | TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 202.40
WT. TARE # 3M 31.70
WT. TOTAL DRY SAMPLE 170.70

WT. RETAINED #10 SIEVE 50.43 | % PLUS #10 29.5
WT. PASSING #10 SIEVE 120.27 | % MINUS #10 70.5

SLIGHT PLASTICITY
DILATANCY
NO DRY STRENGTH
TRACE CLAY
(SM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______
WT. TARE # ______
WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______
WT. TARE # ______
WT. RETAINED #200 SIEVE ______
WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	5.46	3.2
NO. 4 3M	29.53	17.3
NO. 10	50.43	29.5
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	67.00		39.2
#40 2P	78.07		45.7
#60			
#140			
#200 3R	102.68		60.2
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

ORM 291

GRADATION CURVES

LABORATORY NO. 018-GEOTECH

FIELD SAMPLE NOS. MW 17 ; 6'-8'

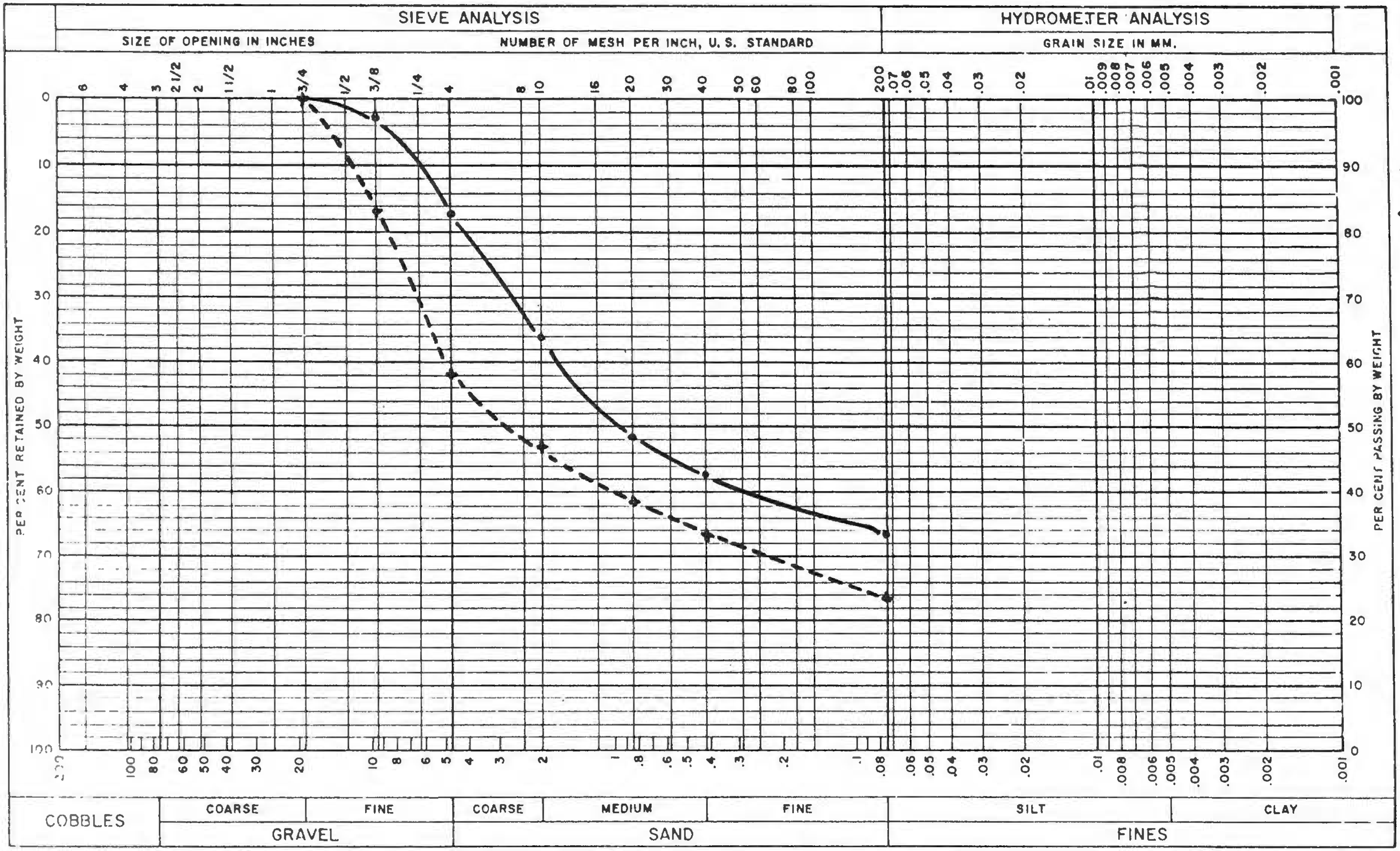
DATE TESTED 10/23/88 -10/31/88

ACCT. ABBR. COE-E. SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

METCALF & EDDY, ENGINEERS.



FIELD SAMPLE NO.	KEY	SAMPLE DEPTH	SAMPLE DESCRIPTION
MW17-6'		6'-8'	(SM)
MW17-8'		8'-10'	(GM)

SIEVE ANALYSIS

LABORATORY NO. 018- GEOTECH
ACCT. ABBR. COE-E.SENECA, NY
FIELD SAMPLE NO. MW 17 6'
ACCT. NO. 003288-3161
DATE TESTED 10/28/88
TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 186.27
WT. TARE # 2H 31.91
WT. TOTAL DRY SAMPLE 154.36

WT. RETAINED #10 SIEVE 55.61 — % PLUS #10 36.0
WT. PASSING #10 SIEVE 98.75 — % MINUS #10 64.0

NON PLASTIC
SLOW DILATANCY
NO DRY STRENGTH
TRACE CLAY
(SM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______
WT. TARE # ______
WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______
WT. TARE # ______
WT. RETAINED #200 SIEVE ______
WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	3.50	2.3
NO. 4 2H	26.75	17.3
NO. 10	55.61	36.0
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	79.20		51.3
#40 3N	88.14		57.1
#60			
#140			
#200 2H	102.63		66.5
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SIEVE ANALYSIS

LABORATORY NO. 018 – GEOTECH

FIELD SAMPLE NO. MW 17 8'

DATE TESTED 10/28/88

ACCT. ABBR. COE- E.SENECA, NY

ACCT. NO. 003288-3161

TESTED BY W. CHECCHI

WT. TOTAL DRY SAMPLE + TARE 222.17

WT. TARE # 2R 31.54

WT. TOTAL DRY SAMPLE 190.63

WT. RETAINED #10 SIEVE 100.85 — % PLUS #10 52.9

WT. PASSING #10 SIEVE 89.78 — % MINUS #10 47.1

NON PLASTIC
SLOW DILATANCY
NO DRY STRENGTH

GRAVEL AND SAND
TRACE CLAY
(GM)

SPLIT PORTION PASSING #10 SIEVE (approx. 115 gm max.)

WT. PASSING #10 SIEVE + TARE ______

WT. TARE # ______

WT. PASSING #10 SIEVE ______

WASH PORTION PASSING #10 SIEVE

WT. RETAINED #200 SIEVE + TARE ______

WT. TARE # ______

WT. RETAINED #200 SIEVE ______

WT. PASSING #200 SIEVE ______

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% RETAINED
3"		
2"		
1 1/2"		
1"		
3/4"	0	0
3/8"	32.19	16.9
NO. 4 2R	79.88	41.9
NO. 10	100.85	52.9
PAN		

U.S. SIEVE NO.	CUMULATIVE WEIGHT RETAINED	% PASSING 10% RETAINED A	% TOTAL SAMPLE RETAINED B
#20	116.76		61.2
#40 2B	126.66		66.4
#60			
#140			
#200 2V	145.91		76.5
PAN -200			
WASHED -200			
TOTAL -200			

B = % PLUS #10 + % MINUS #10 × A

B = ______ + ______ × A

METCALF & EDDY, INC., Engineers, BOSTON . NEW YORK . PALO ALTO

FORM 309
REV. 6/83

SENECA MONITORING

WELL DEVELOPMENT

MW-8

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial depth to water 6.3'	10-16	8:20	cloudy	13	7.10	1000	4.5
surged-bailed dry		9:30					2
bailed dry		11:00	dirty	20	7.22		2
photo		1:30	cloudy	24	7.26	950	1
bailed total		5 hrs.					9.5 total

SENECA MONITORING

WELL DEVELOPMENT

MW-9

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 4.3'	10/16	12:00	cloudy	22	7.13	950	5
surge & bail		1:30	cloudy				5
surge & bail		2:20		23	7.12	950	3
photo		3:50	cloudy	21	7.11	970	3
bailed total		4 hrs.					16 total

SENECA MONITORING

WELL DEVELOPMENT

MW-10

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial depth to water 5.7'	10-7	10:10	brown-cloudy	11	6.91	500	2.5
bailed dry		11:45	cloudy	11	7.14	600	2.5
initial depth to water 5.4'	10-7	9:30		13	7.17	750	3.5
surge & bail dry		10:50	very silty	20	7.28	800	2.5
bailed dry		1:18	silty	24	7.42	875	2
photo		3:06	cloudy	22	7:20	940	2
bailed total		7.5 hrs.					14.5 total

SENECA MONITORING

WELL DEVELOPMENT

MW-11

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 6.1'	10/16	12:00	very silty				19
surged & bailed		1:00	black/brown				5
pumped	10/18	8:00	black/brown	17	7.55	1300	13
		10:40	brown		7.47	1250	15
pumped & bailed		4 hrs.					52 total

SENECA MONITORING

WELL DEVELOPMENT

MW-12

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 4.5'	10/17	12:10	lt. brown/cloudy	24	7.33	1050	4.5
surged & bailed		1:30	getting cleaner				3.5
bailed dry		2:10		24	7.46	1075	3
surged & bailed dry		4:00		22	7.41	1300	4.5
bailed dry photo		7:00	cloudy black	17	7.37	1100	2.5
total hrs.		4.5					18.0 total

SENECA MONITORING

WELL DEVELOPMENT

MW-13

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 5.1'	10/16	3:30	black	23	7.11	875	5
surge & bail dry	10/17	8:00	black	15	7.17	850	5
bailed dry		9:45	black				5
surged & bailed dry		11:00	clearing up some	20	7.20	900	5
photo		11:30	black-brown				
bailed total		4 hrs.					20 total

SENECA MONITORING

WELL DEVELOPMENT

MW-14

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 5.5'	10/17	7:30	cloudy	14	7.04	1000	4
surge & bailed dry		9:00					3
surged & bailed dry		11:00					2
photo		11:45	cloudy	21	7.25	1100	5
total		4 hrs.					14 total

SENECA MONITORING

WELL DEVELOPMENT

MW-15

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 4.0'	10/17	12:30	cloudy	25	7.21	1040	3
surged & bailed		1:30	silty				2.5
slow recharge		4:00	very silty	22	7.44	1050	0.1
bailed dry	10/18	8:00	very silty	17	7.42	1300	2
photo		11:00	cloudy-silty				2
total		6.5 hrs.					9.6 total

SENECA MONITORING

WELL DEVELOPMENT

MW-16

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 6.4'	10/18	8:00	photo cloudy	17	7.73	850	0.1
well almost dry							
well amost dry		12:30					dry
total		4.5 hrs.					0.1 total

MW-17

Comments	Date	Time	Appearance	Temp (C)	pH	SP COND mmhos/cm2	# gals.
initial water table 4.55'	10/17	12:15	brown/black	24	7.30	1040	10
surged-well regenerating							
quickly, plan to pump							
surged throughout pumping	10/18	10:40					
photo		12:00	clear	16	7.95	700	25
total		2 hours					35 total

Seneca Army Depot- Recovery Test Data

MW-8
Static W.L.= 6.90 ft (TOC)

Time (sec)	Water Level (ft) TOC	
0	8.05	
6	8.03	
9	8.02	
13	8.01	
19	7.98	
35	7.97	
41	7.95	
50	7.94	
62	7.92	
86	7.91	
100	7.90	
131	7.88	
142	7.87	
152	7.87	
165	7.86	
200	7.85	
235	7.83	
266	7.82	
297	7.81	
373	7.80	
411	7.79	
582	7.76	
916	7.70	
1220	7.66	
1610	7.62	
2231	7.56	
2771	7.52	
3352	7.47	EOT

MW-9
Static W.L.= 4.30 ft (TOC)

Time (sec)	Water Level (ft) TOC	Time (sec)	Water Level (ft) TOC	
0	5.96	256	4.74	
4	5.94	258	4.73	
7	5.91	275	4.68	
11	5.87	288	4.66	
16	5.85	293	4.64	
24	5.81	301	4.62	
28	5.79	310	4.60	
33	5.77	330	4.57	
36	5.75	342	4.55	
45	5.73	350	4.54	
49	5.72	373	4.50	
53	5.70	397	4.48	
58	5.68	423	4.45	
63	5.66	454	4.43	
66	5.65	490	4.42	
77	5.64	543	4.39	
80	5.61	591	4.38	
86	5.59	650	4.37	
97	5.57	711	4.35	EOT
101	5.55			
109	5.53			
115	5.52			
122	5.50			
127	5.48			
133	5.42			
140	5.35			
145	5.32			
152	5.25			
158	5.20			
165	5.15			
172	5.11			
179	5.07			
184	5.04			
187	5.02			
191	5.00			
196	4.97			
200	4.95			
213	4.90			
218	4.87			
227	4.85			
230	4.82			
236	4.79			
246	4.77			

MW-10
Static W.L.= 6.40 ft (TOC)

Time (sec)	Water Level (ft) TOC	
0	7.68	
10	7.65	
20	7.63	
25	7.62	
33	7.60	
44	7.59	
51	7.58	
63	7.57	
76	7.56	
101	7.55	
126	7.52	
138	7.50	
174	7.49	
208	7.47	
266	7.45	
320	7.43	
468	7.40	
676	7.33	
875	7.30	
1294	7.25	
1548	7.20	
2296	7.15	
6671	6.87	
10250	6.73	
12600	6.68	
15414	6.63	EOT

Seneca Army Depot- Recovery Test Data

MW-11
Static W.L.= 6.30 ft (TOC)

Time (sec)	Water Level (ft) TOC
0	7.30
6	7.27
10	7.23
16	7.18
23	7.15
29	7.12
35	7.08
42	7.05
47	7.03
53	7.00
58	6.98
65	6.97
70	6.94
76	6.93
80	6.92
88	6.88
98	6.87
102	6.85
108	6.89
113	6.83
140	6.77
146	6.76
150	6.74
162	6.73
171	6.72
177	6.70
183	6.69
195	6.68
206	6.66
211	6.65
230	5.63
262	6.60
278	6.58
288	6.57
312	6.55
338	6.53
388	6.47
428	6.42
455	6.41
492	6.39
534	6.38
609	6.38 EOT

MW-12
Static W.L.= 3.98 ft (TOC)

Time (sec)	Water Level (ft) TOC
0	5.85
5	5.82
9	5.79
12	5.76
18	5.73
23	5.71
28	5.68
34	5.66
41	5.63
49	5.58
54	5.56
59	5.54
69	5.40
74	5.30
78	5.25
82	5.18
85	5.15
89	5.10
94	5.03
98	5.00
101	4.95
106	4.90
112	4.85
119	4.80
124	4.75
130	4.70
136	4.65
145	4.60
152	4.55
163	4.50
174	4.45
187	4.40
204	4.35
221	4.30
251	4.25
287	4.20
341	4.15
434	4.10
735	4.05 EOT

MW-13
Static W.L.= 4.90 ft (TOC)

Time (sec)	Water Level (ft) TOC
0	6.23
7	6.20
11	6.18
15	6.17
20	6.15
26	6.13
34	6.10
39	6.08
46	6.07
50	6.05
57	6.03
65	6.00
76	5.98
86	5.96
92	5.95
102	5.92
114	5.90
123	5.88
131	5.86
143	5.84
152	5.82
159	5.80
178	5.78
196	5.75
213	5.73
231	5.70
260	5.65
301	5.60
347	5.55
386	5.50
401	5.45
420	5.40
424	5.35
439	5.30
456	5.25
475	5.20
497	5.15
529	5.10
585	5.05
676	5.00
833	4.96 EOT

MW-14
Static W.L.= 5.47 ft (TOC)

Time (sec)	Water Level (ft) TOC
0	6.93
7	6.92
19	6.90
21	6.89
29	6.86
34	6.85
40	6.83
48	6.81
54	6.80
65	6.78
80	6.76
85	6.75
89	6.74
100	6.72
110	6.71
122	6.68
138	6.66
164	6.64
171	6.61
213	6.58
240	6.55
304	6.50
384	6.45
469	6.40
554	6.35
649	6.30
769	6.25
889	6.20
994	6.15
1136	6.10
1319	6.05
1724	5.95
1924	5.90
1975	5.85
2040	5.80
2121	5.75
2241	5.70
2391	5.65
2631	5.60
3016	5.55
EOT	

Seneca Army Depot- Recovery Test Data

MW-15
Static W.L.= 3.18 ft (TOC)

Time (sec)	Water Level (ft) TOC	Time (sec)	Water Level (ft) TOC	
0	6.35	459	5.17	
4	6.34	469	5.14	
8	6.32	472	5.10	
11	6.29	485	5.05	
16	6.28	494	5.00	
23	6.26	506	4.97	
27	6.25	523	4.90	
31	6.23	537	4.85	
36	6.21	549	4.80	
42	6.20	561	4.75	
47	6.18	572	4.70	
53	6.17	586	4.65	
61	6.15	603	4.60	
67	6.13	618	4.55	
73	6.12	638	4.47	
79	6.10	645	4.45	
85	6.09	664	4.40	
94	6.07	685	4.35	
105	6.05	707	4.30	
114	6.03	730	4.25	
128	6.00	752	4.20	
136	5.98	774	4.15	
151	5.97	796	4.10	
160	5.95	821	4.05	
168	5.93	850	4.00	
177	5.91	877	3.95	
200	5.87	909	3.90	
214	5.85	956	3.85	
234	5.82	977	3.80	
243	5.81	1042	3.75	
262	5.78	1034	3.70	
274	5.76	1122	3.65	
290	5.74	1188	3.60	
302	5.72	1272	3.55	
319	5.70	1376	3.50	
364	5.65	1492	3.45	
390	5.60	1668	3.40	EOT
399	5.50			
411	5.40			
421	5.38			
433	5.34			
442	5.27			
452	5.22			

MW-16
Static W.L.= 5.32 ft (TOC)

Time (sec)	Water Level (ft) TOC	
0	6.62	
5	6.58	
7	6.52	
9	6.48	
14	6.44	
21	6.41	
26	6.37	
31	6.35	
37	6.33	
44	6.30	
54	6.27	
64	6.25	
72	6.23	
82	6.20	
89	6.17	
104	6.15	
137	6.10	
164	6.05	
212	6.00	
266	5.95	
322	5.90	
406	5.85	
516	5.80	
626	5.75	
747	5.70	
896	5.65	
1093	5.60	
1324	5.55	
1645	5.50	
2184	5.45	EOT

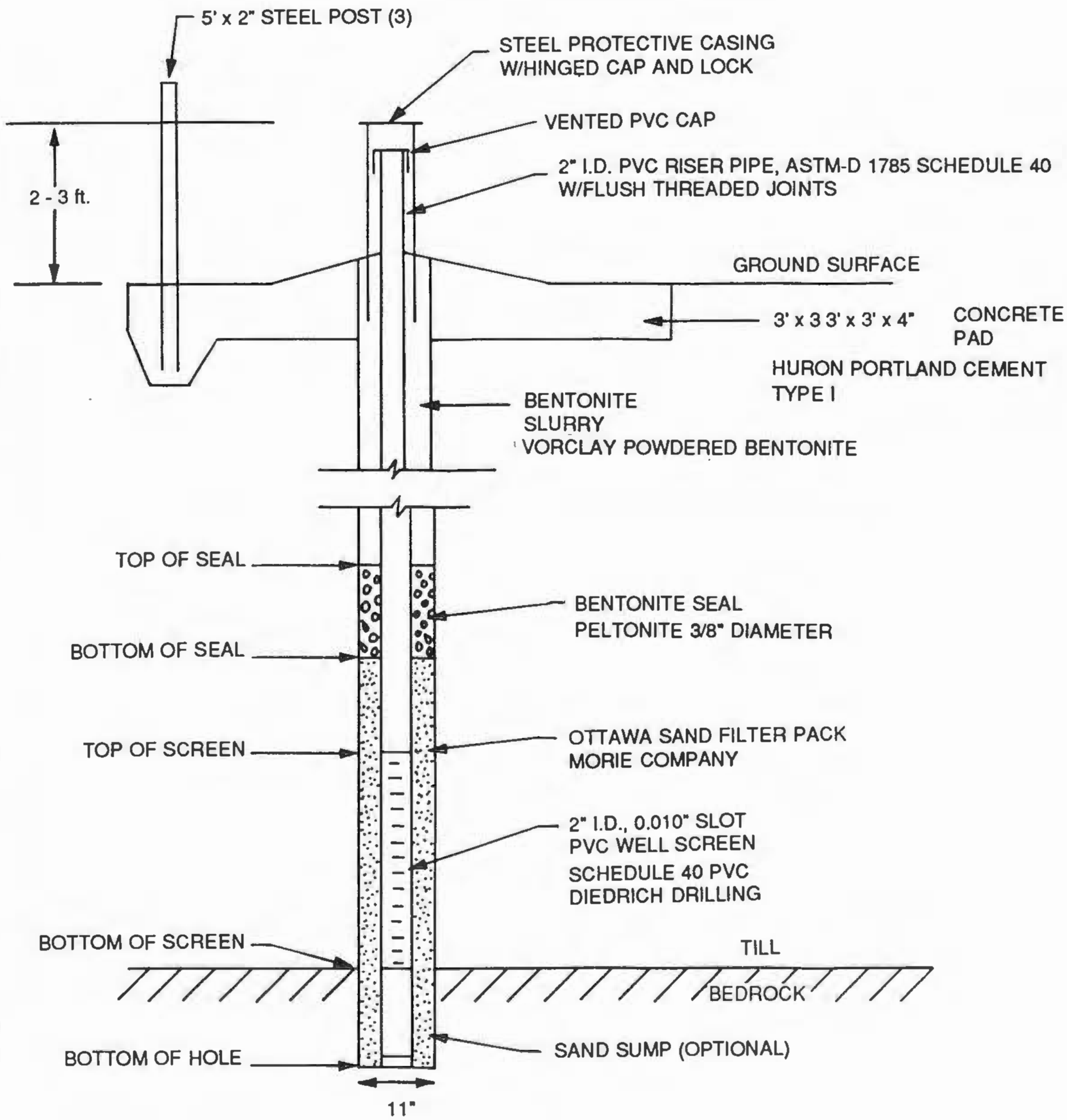
MW-17
Static W.L.= 4.12 ft (TOC)

Time (sec)	Water Level (ft) TOC	
0	6.63	
3	6.52	
7	6.42	
10	6.34	
14	6.22	
17	6.10	
22	5.98	
25	5.88	
30	5.82	
33	5.73	
39	5.66	
44	5.58	
47	5.51	
50	5.45	
54	5.37	
59	5.34	
66	5.28	
70	5.22	
77	5.15	
88	5.04	
96	4.98	
105	4.93	
113	4.87	
123	4.83	
139	4.75	
153	4.72	
163	4.69	
173	4.67	
188	4.63	
201	4.62	
220	4.58	
248	4.54	
281	4.51	
296	4.49	
327	4.46	
346	4.44	
362	4.42	
403	4.41	
420	4.40	
472	4.38	
503	4.36	
553	4.32	
595	4.30	
745	4.27	
865	4.25	EOT

APPENDIX C
MONITORING WELL COMPLETION DIAGRAMS

GROUNDWATER INSTALLATION		PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW8
DRILLING CONTRACTOR: Parratt-Wolff		COORDINATES: N 4864 E 8323		
BEGUN: 10-5-88 FINISHED: 10-6-88	SUPERVISOR: S. Giesler DRILLER: G. Lansing	WELL SITE: NW of pad H	WATER LEVEL 6.3'	DEPTH ELEV. 115.78

DEPTH IN.	ELEV. IN.
	122.08
0 ft	120.06
1.5 ft	118.56
3 ft	117.06
4.5 ft	115.56
9.5 ft	110.56
10 ft	110.06

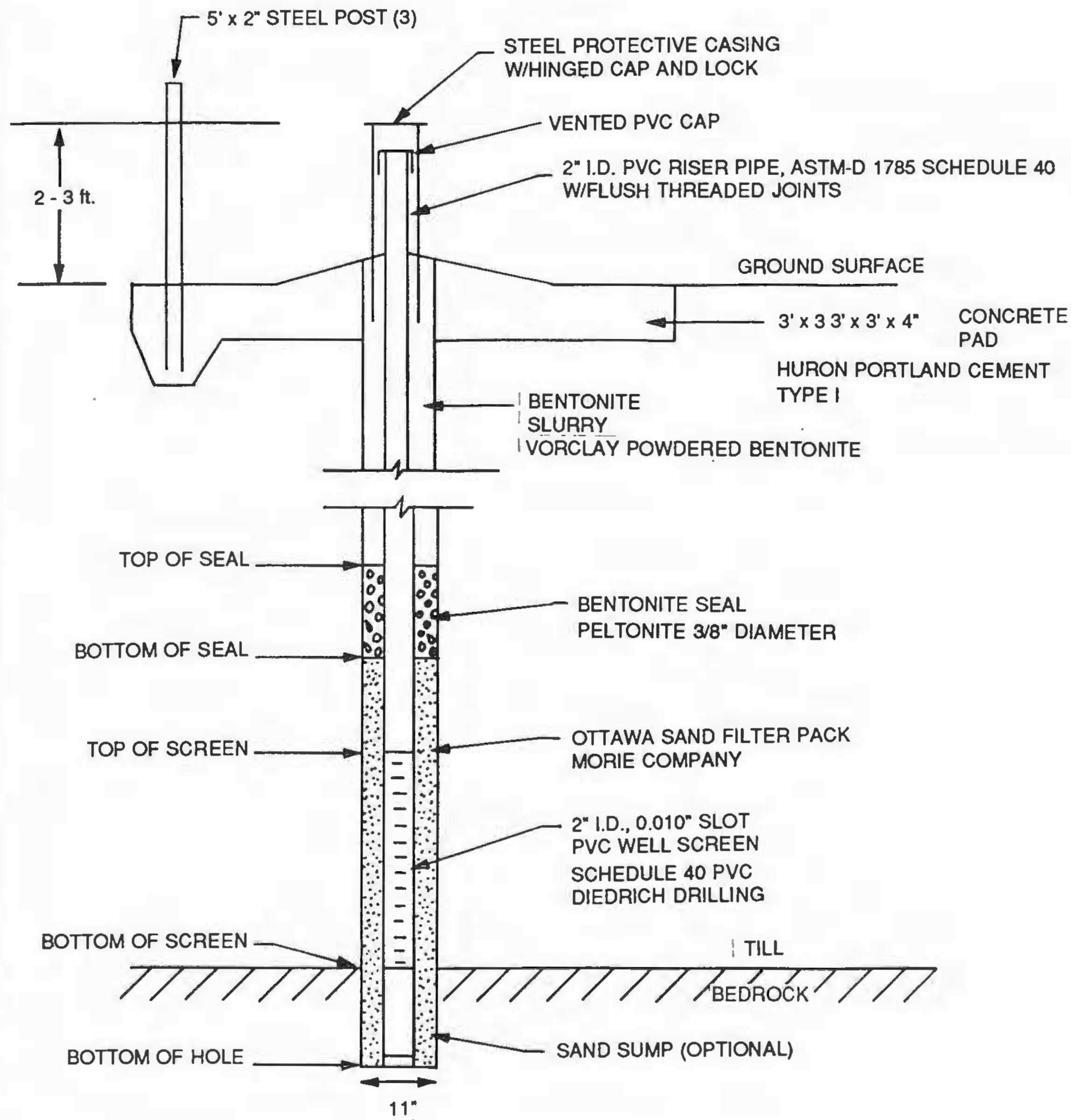


TIME DEVELOPED: 5 hrs

GALLONS EXTRACTED: 9.5 gals

GROUNDWATER INSTALLATION	PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW9	
DRILLING CONTRACTOR: Parratt-Wolff	COORDINATES: N 4990 E 8547			
BEGUN: 10-6-88 / FINISHED: 10-7-88	SUPERVISOR: S. Giesler / DRILLER: G. Lansing	WELL SITE: E. of pad H	WATER LEVEL 4.3'	DEPTH ELEV. 113.59

DEPTH IN.	ELEV. IN.
	117.89
0	115.74
1.0 ft	114.74
2.0 ft	113.74
3.0 ft	112.74
7.0 ft	108.74
7.5 ft	108.24

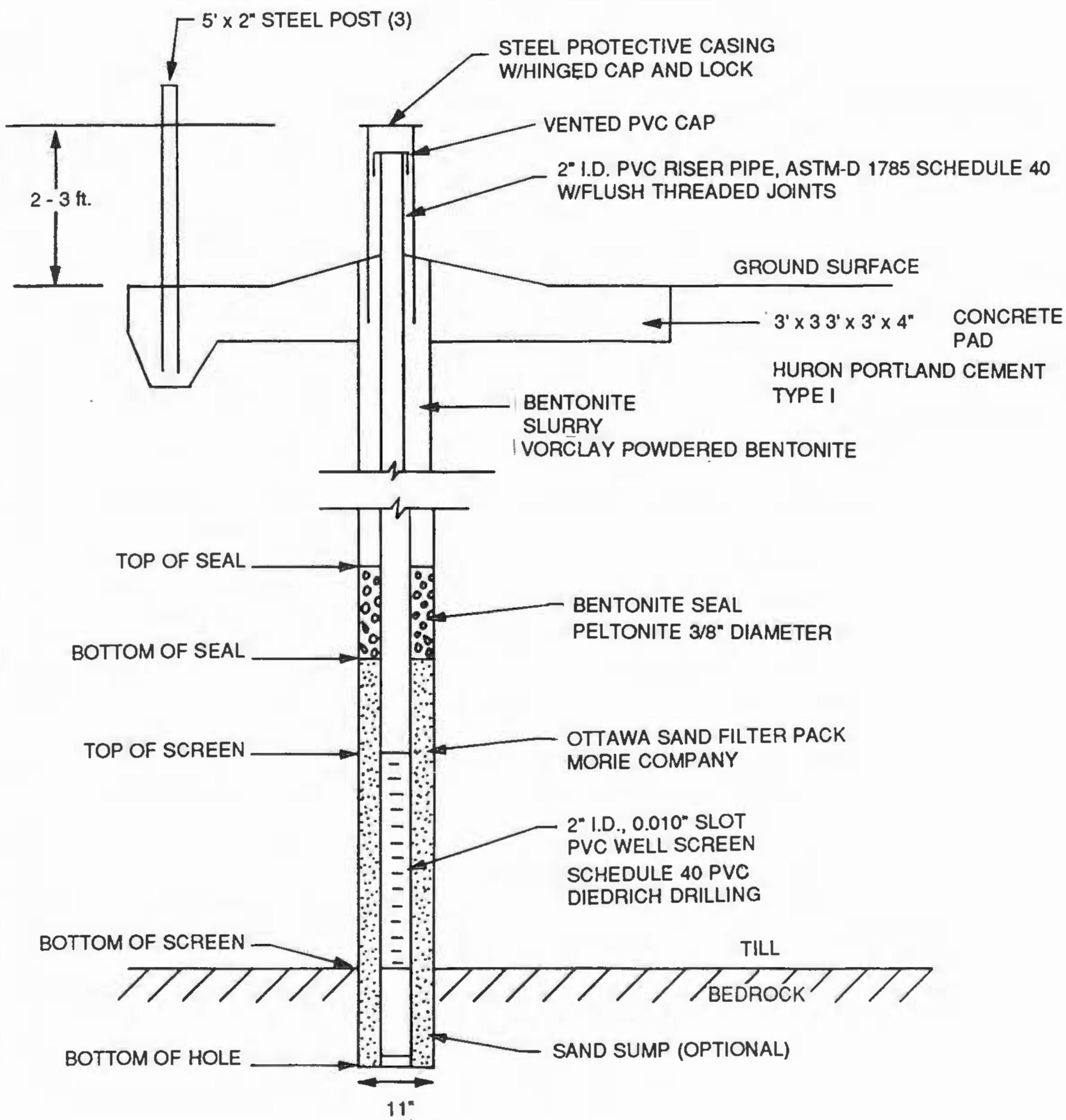


TIME DEVELOPED: 4 hours

GALLONS EXTRACTED: 16 gals

GROUNDWATER INSTALLATION	PROJECT: Seneca Army Depot JOB NO. 0032883161			WELL NO. MW10
DRILLING CONTRACTOR: Parratt-Wolff	COORDINATES: N 4347 E 8397			
BEGUN: 10-4-88 FINISHED: 10-4-88	SUPERVISOR: S. Giesler DRILLER: G. Lansing	WELL SITE: SW of pad G	WATER LEVEL 5.7'	DEPTH ELEV. 116.54

DEPTH IN.	ELEV. IN.
	122.24
0 ft	120.09
1.0 ft	119.09
2.5 ft	117.59
4.0 ft	116.09
9.0 ft	111.09
9.5 ft	110.59

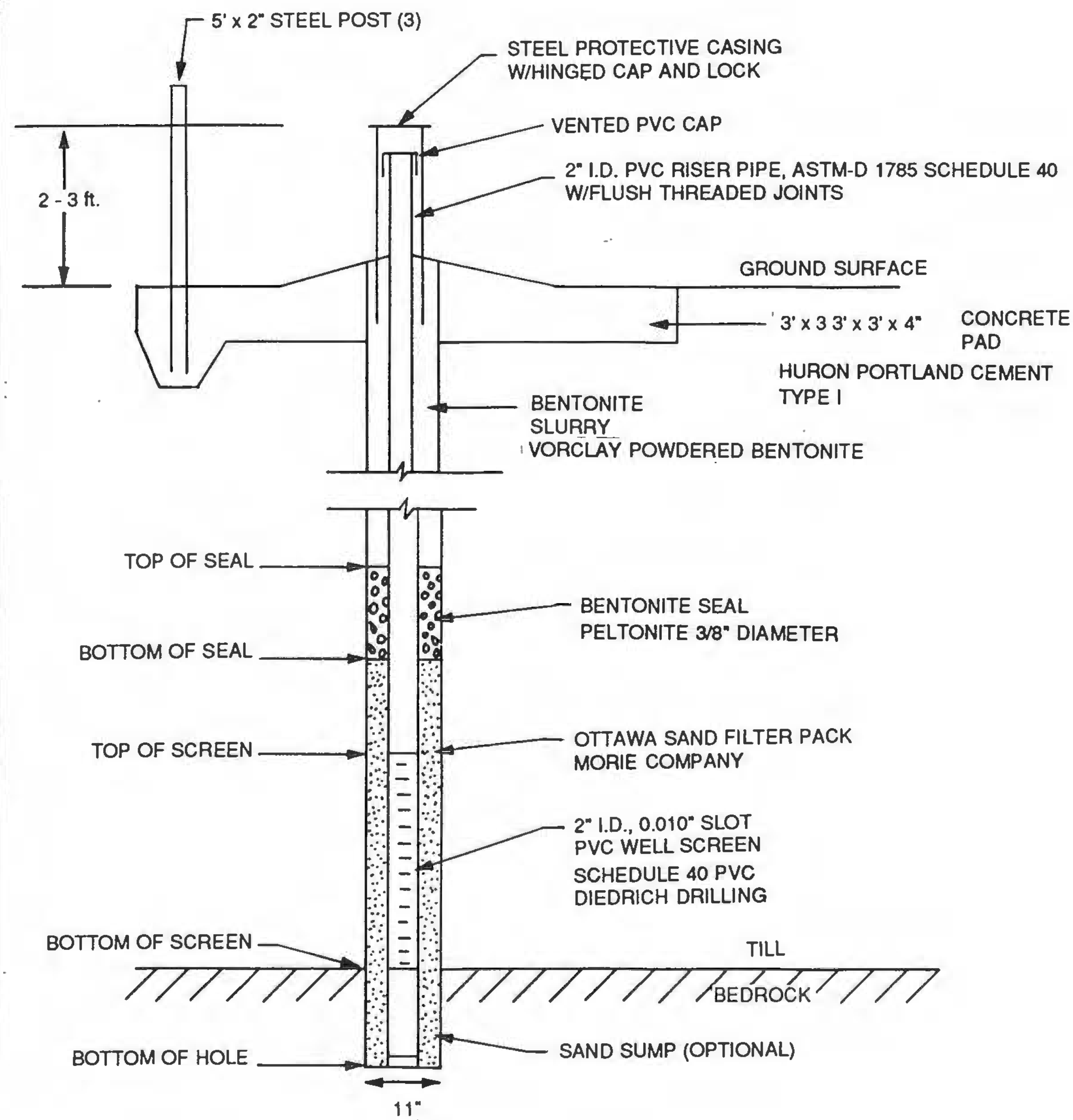


TIME DEVELOPED: 7.5 hours

GALLONS EXTRACTED: 14.5 gals

GROUNDWATER INSTALLATION	PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW11
DRILLING CONTRACTOR: Parratt-Wolff	COORDINATES: N 4728 E 8864		
BEGUN: 10-11-88 / FINISHED: 10-11-88	SUPERVISOR: S. Giesler / DRILLER: G. Lansing	WELL SITE: NE of pad G	WATER LEVEL 6.1 ft / DEPTH ELEV. 107.85

DEPTH IN.	ELEV. IN.
	113.95
0 ft	111.40
1.0 ft	110.40
2.5 ft	108.90
4 ft	107.40
9.0 ft	102.40
9.5 ft	101.90



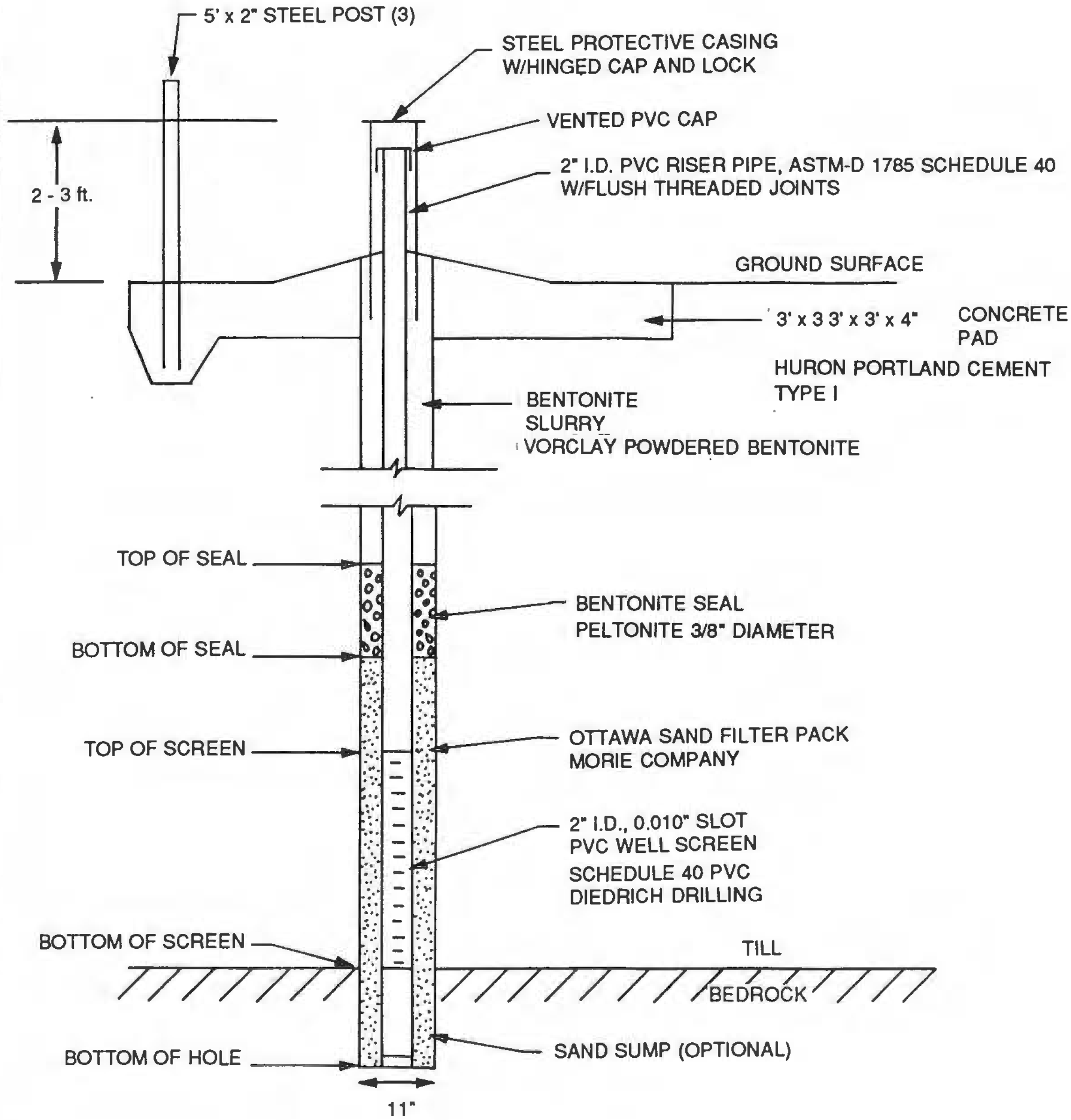
TIME DEVELOPED: 4 hours

GALLONS EXTRACTED: 52 gals

GROUNDWATER INSTALLATION	PROJECT: Seneca Army Depot JOB NO. 0032883161	WELL NO. MW12
DRILLING CONTRACTOR: Parratt-Wolff	COORDINATES: N 4910 E 9322	

BEGUN: 10-11-88	SUPERVISOR: S. Giesler	WELL SITE: NE of pad E	WATER LEVEL 4.5 ft	DEPTH ELEV. 103.24
FINISHED: 10-12-88	DRILLER: G. Lansing			

DEPTH IN.	ELEV. IN.
	107.74
0 ft	105.57
1.0 ft	104.57
2.0 ft	103.57
3.0 ft	102.57
7.0 ft	98.57
7.5 ft	98.07

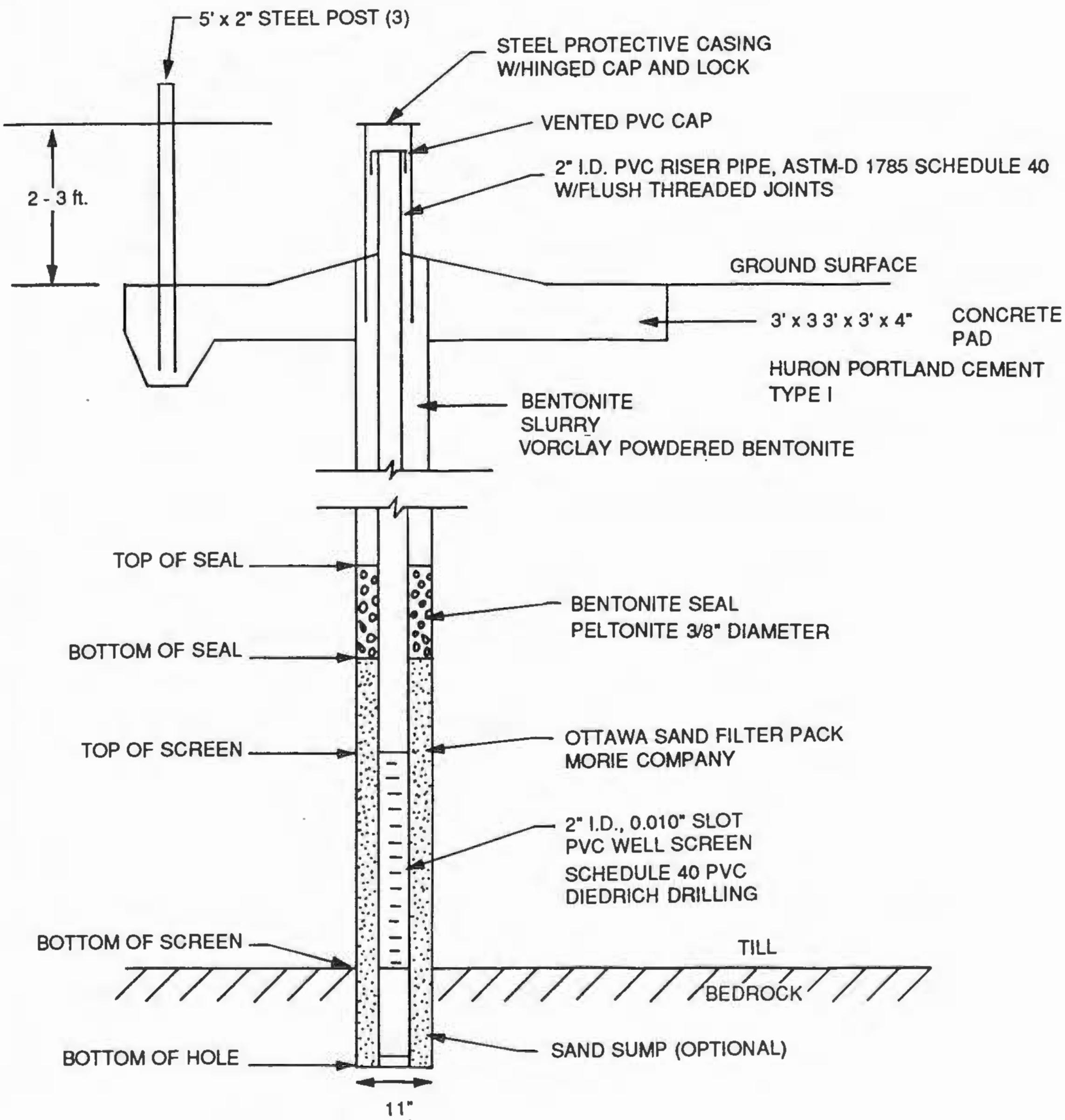


TIME DEVELOPED: 4.5 hrs

GALLONS EXTRACTED: 18 gals

GROUNDWATER INSTALLATION		PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW13
DRILLING CONTRACTOR: Parratt-Wolff		COORDINATES: N 5018 E 8913		
BEGUN: 10-7-88	SUPERVISOR: S. Giesler	WELL SITE:	WATER LEVEL	DEPTH ELEV.
FINISHED: 10-7-88	DRILLER: G. Lansing	E. of pad F	5.1'	108.9

DEPTH IN.	ELEV. IN.
	114.0
0 ft	111.83
1 ft	110.83
2 ft	109.83
3 ft	108.83
8.0 ft	103.83
8.5 ft	103.33

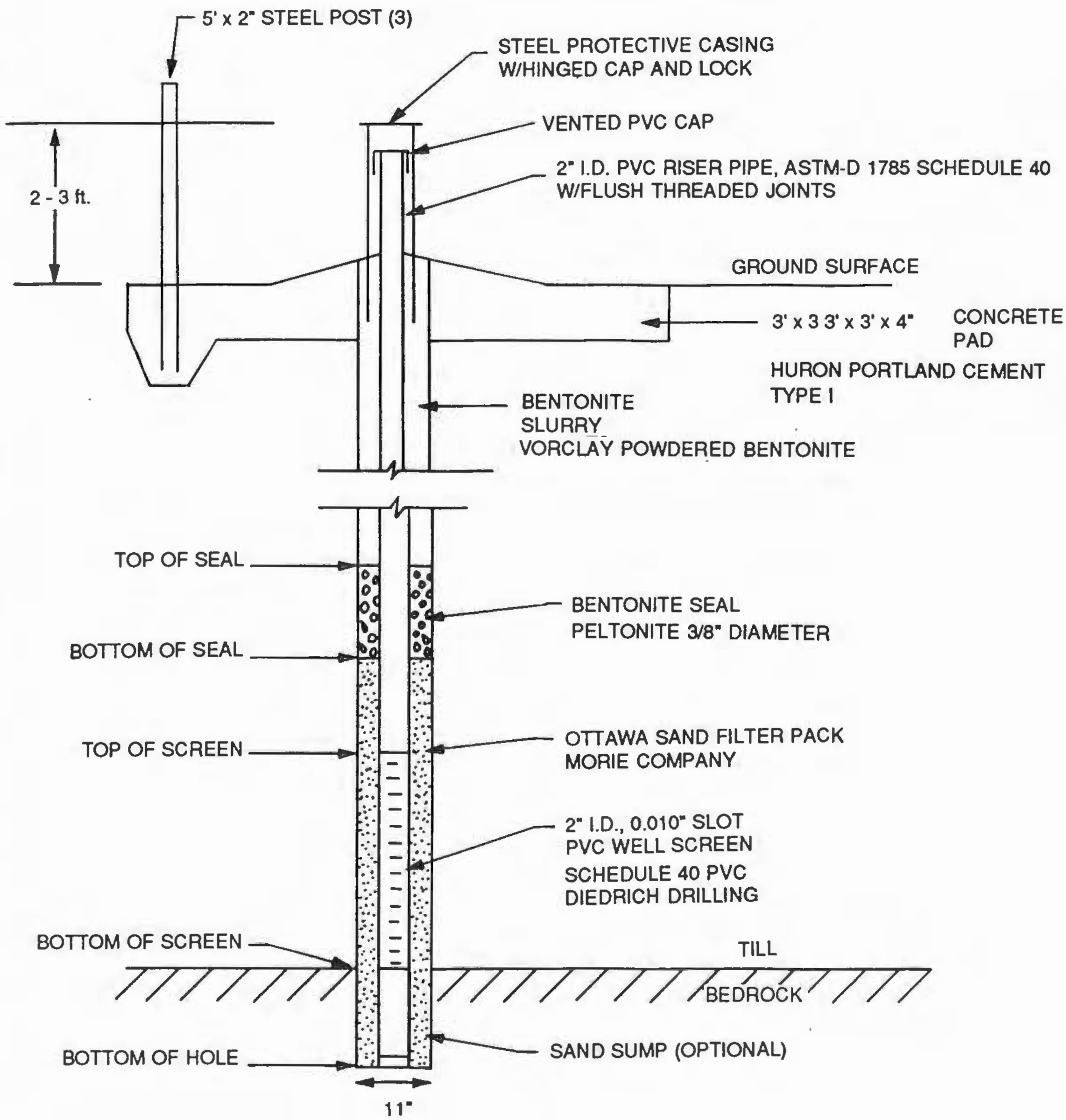


TIME DEVELOPED: 4 hours

GALLONS EXTRACTED: 20 gals

GROUNDWATER INSTALLATION		PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW14
DRILLING CONTRACTOR: Parratt-Wolff		COORDINATES: N 5076 E 9212		
BEGUN: 10-13-88 FINISHED: 10-13-88	SUPERVISOR: S. Giesler DRILLER: G. Lansing	WELL SITE: NE of pad D		WATER LEVEL 5.5 ft DEPTH ELEV. 101.93

DEPTH IN.	ELEV. IN.
	107.43
0 ft	105. 47
	105.47 104.47
1 ft	104. 47
2.5 ft	102.97 102. 97
3.5 ft	101.97 101. 97
8.5 ft	96.97 96. 97
9.0 ft	96.47 96. 47



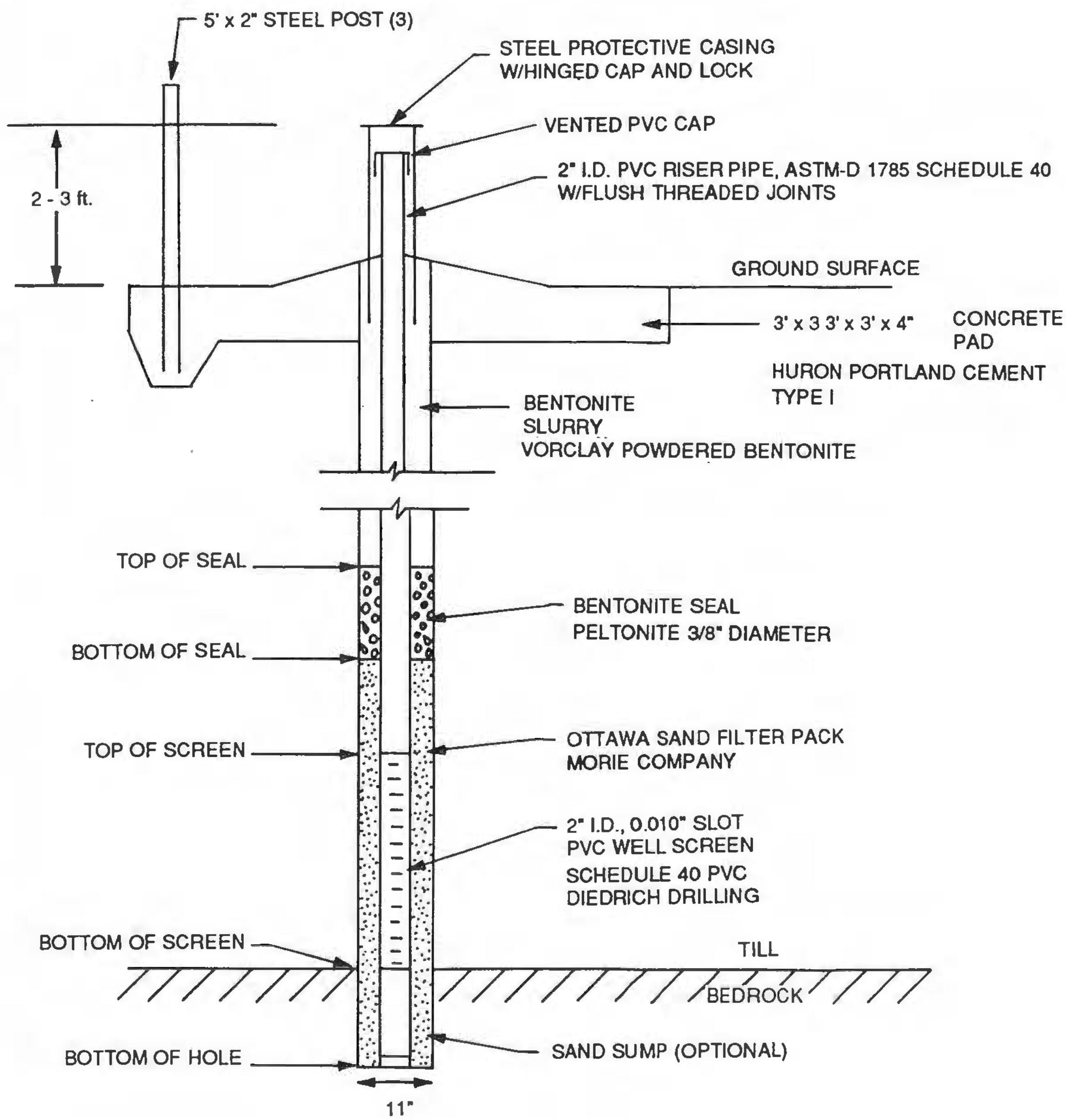
TIME DEVELOPED: 4 hrs

GALLONS EXTRACTED: 14 gals

GROUNDWATER INSTALLATION	PROJECT: Seneca Army Depot JOB NO. 0032883161	WELL NO. MW15
DRILLING CONTRACTOR: Parratt-Wolff	COORDINATES: N 5073 E 9548	

BEGUN: 10-14-88	SUPERVISOR: S. Giesler	WELL SITE:	WATER LEVEL	DEPTH ELEV.
FINISHED: 10-14-88	DRILLER: G. Lansing	NE of pad B	4 ft	101.01

DEPTH IN.	ELEV. IN.
	105.01
0 ft	102.95
1.0 ft	101.95
2.0 ft	100.95
3.0 ft	99.95
6.5 ft	96.45
7.0 ft	95.95

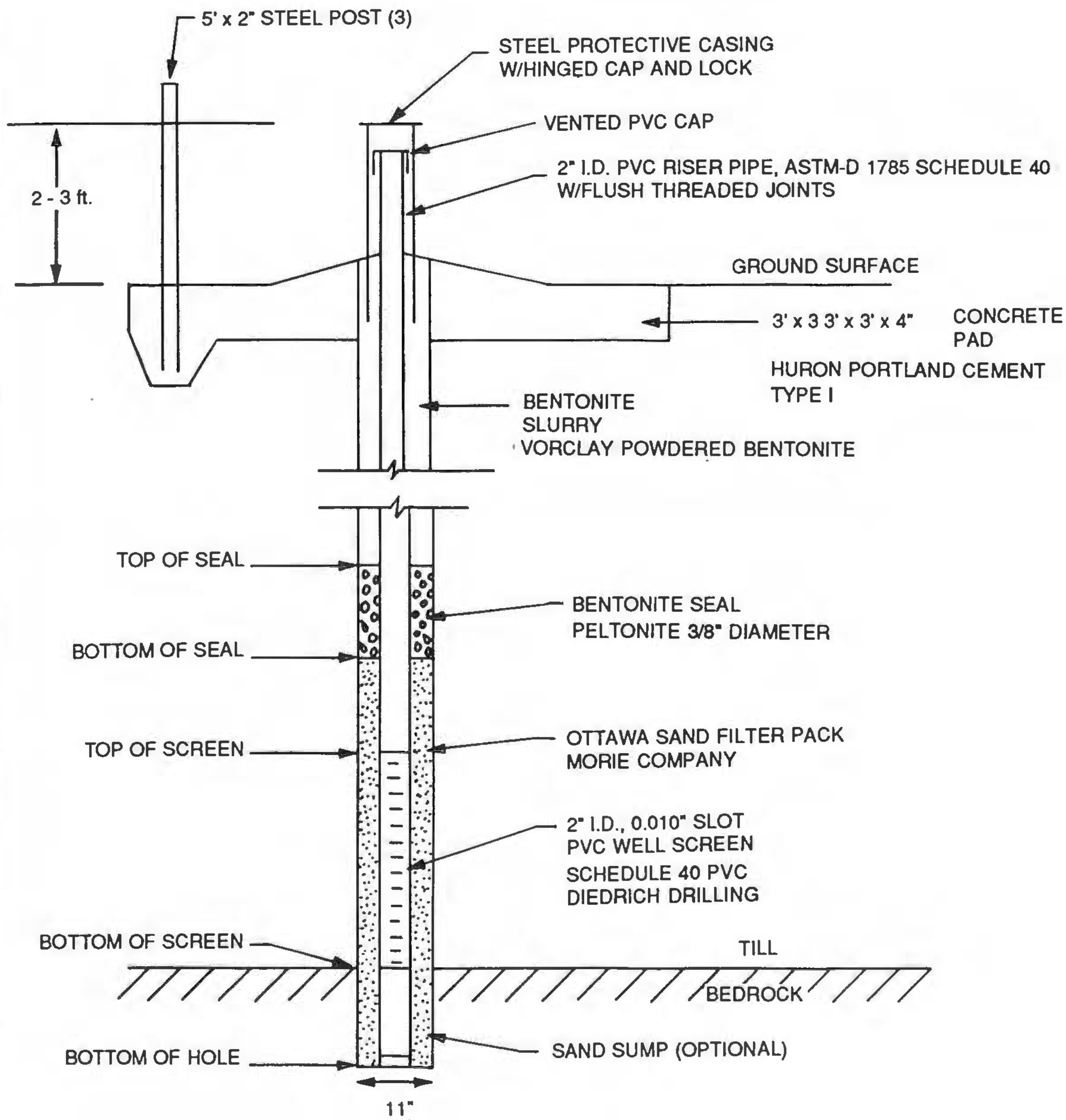


TIME DEVELOPED: 6.5 hrs

GALLONS EXTRACTED: 9.6 gals

GROUNDWATER INSTALLATION		PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW16
DRILLING CONTRACTOR: Parratt-Wolff		COORDINATES: N 5036 E 9847		
BEGUN: 10-15-88 FINISHED: 10-15-88	SUPERVISOR: S. Giesler DRILLER: G. Lansing	WELL SITE: NE. of pad A	WATER LEVEL 6.4 ft	DEPTH ELEV. 99.33

DEPTH IN.	ELEV. IN.
	105.73
0 ft	103.7
1.0 ft	102.7
2.0 ft	101.7
3.0 ft	100.7
6.5 ft	97.3
7.0 ft	96.8

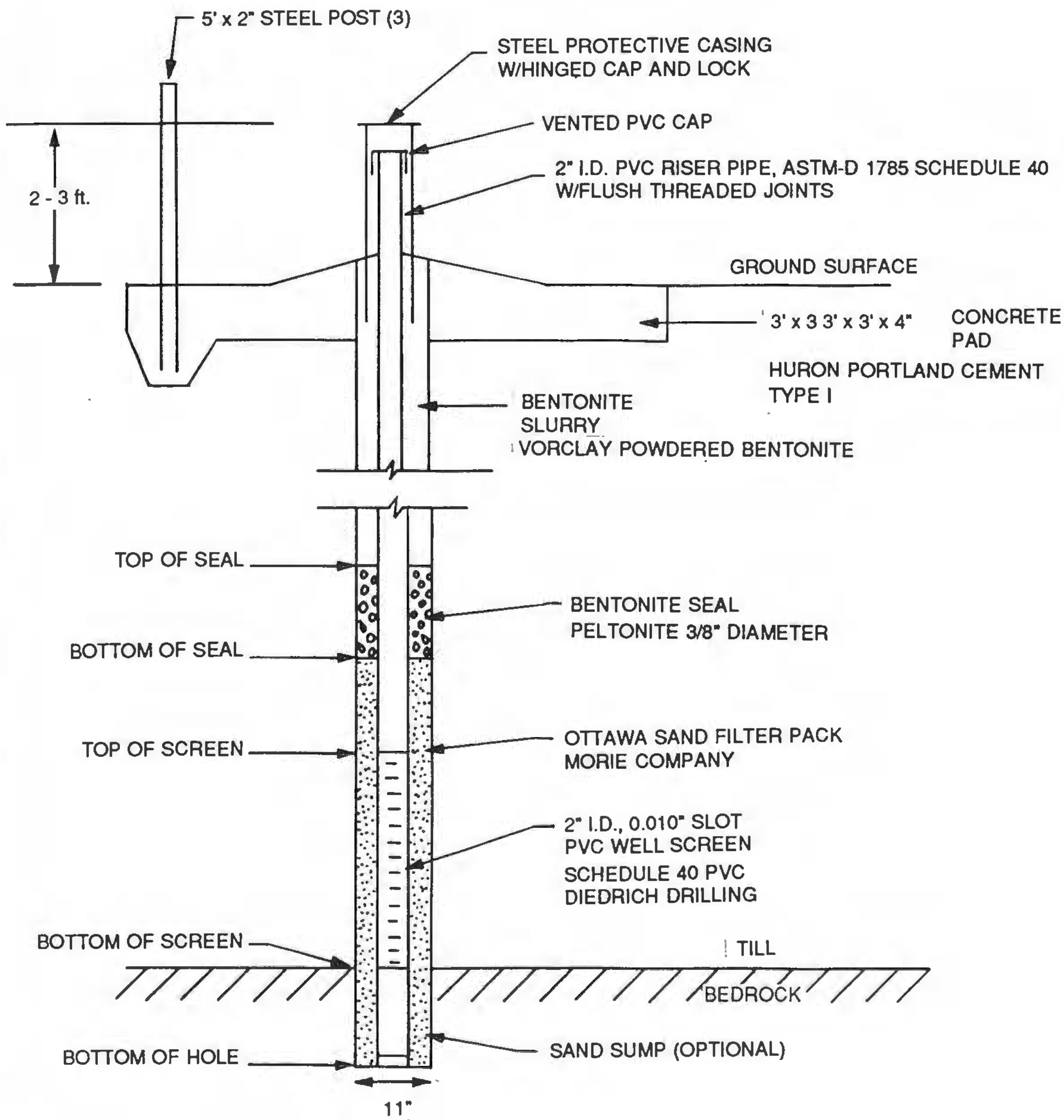


TIME DEVELOPED: 4.5 hrs

GALLONS EXTRACTED: 0.1 gal

GROUNDWATER INSTALLATION		PROJECT: Seneca Army Depot JOB NO. 0032883161		WELL NO. MW17
DRILLING CONTRACTOR: Parratt-Wolff		COORDINATES: N 4707 E 9472		
BEGUN: 10-12-88	SUPERVISOR: S. Giesler	WELL SITE:	WATER LEVEL	DEPTH ELEV.
FINISHED: 10-12-88	DRILLER: G. Lansing	SE of pad C	4.55 ft	103.34

DEPTH IN.	ELEV. IN.
	107.89
0 ft	105.81
1.5 ft	104.31
3.0 ft	102.81
4.5 ft	101.31
9.5 ft	96.31
10.0 ft	95.81



TIME DEVELOPED: 2 hrs

GALLONS EXTRACTED: 35 gals

APPENDIX D
WELL SURVEY DATA

COORDINATES * 003288-3161

	N	E	
MW-8	4864	8323	✓
MW-9	4990	8547	✓
MW-10	4347	8397	✓
MW-11	4728	8864	✓
MW-12	4910	9322	✓
MW-13	5018	8913	✓
MW-14	5076	9212	✓
MW-15	5073	9548	✓
MW-16	5036	9847	✓
MW-17	4707	9472	

* COORDINATES ARE SITE-SPECIFIC BASED ON OLD WELL LOCATIONS AND 100-SCALE TOPO BY HIBBARD ENGINEERS

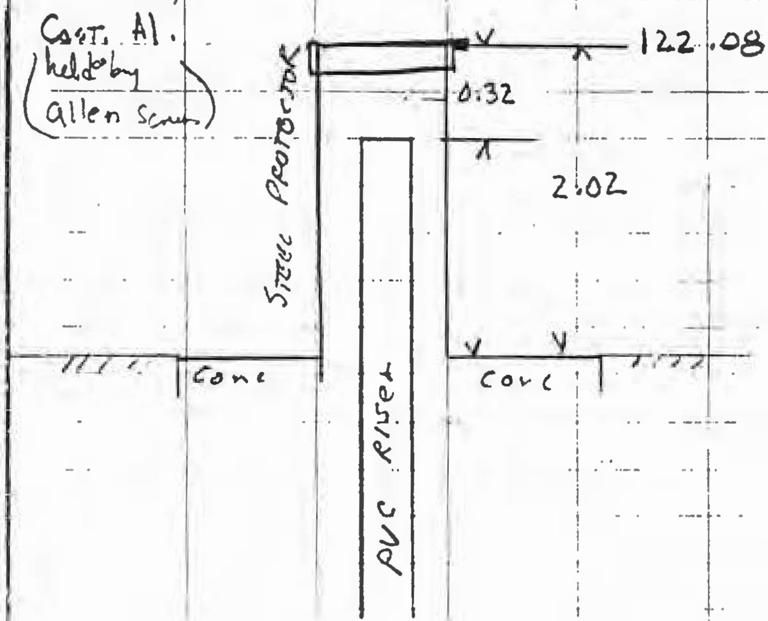
J 003289 - 3161

MW-8

[Burning Pad 'J']

Y'ards 4' 4'

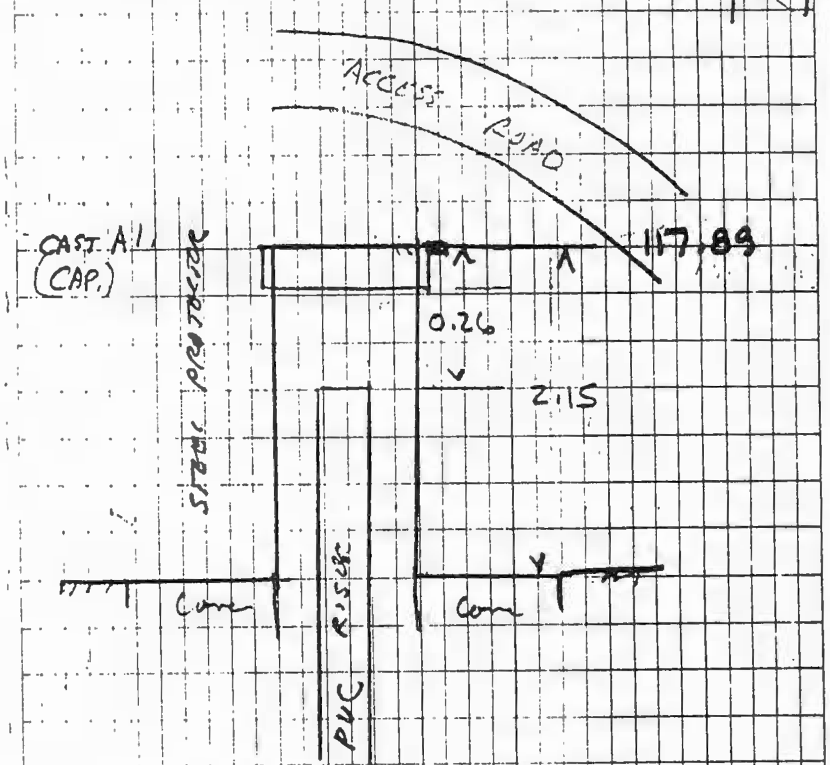
Roadway



MW-9

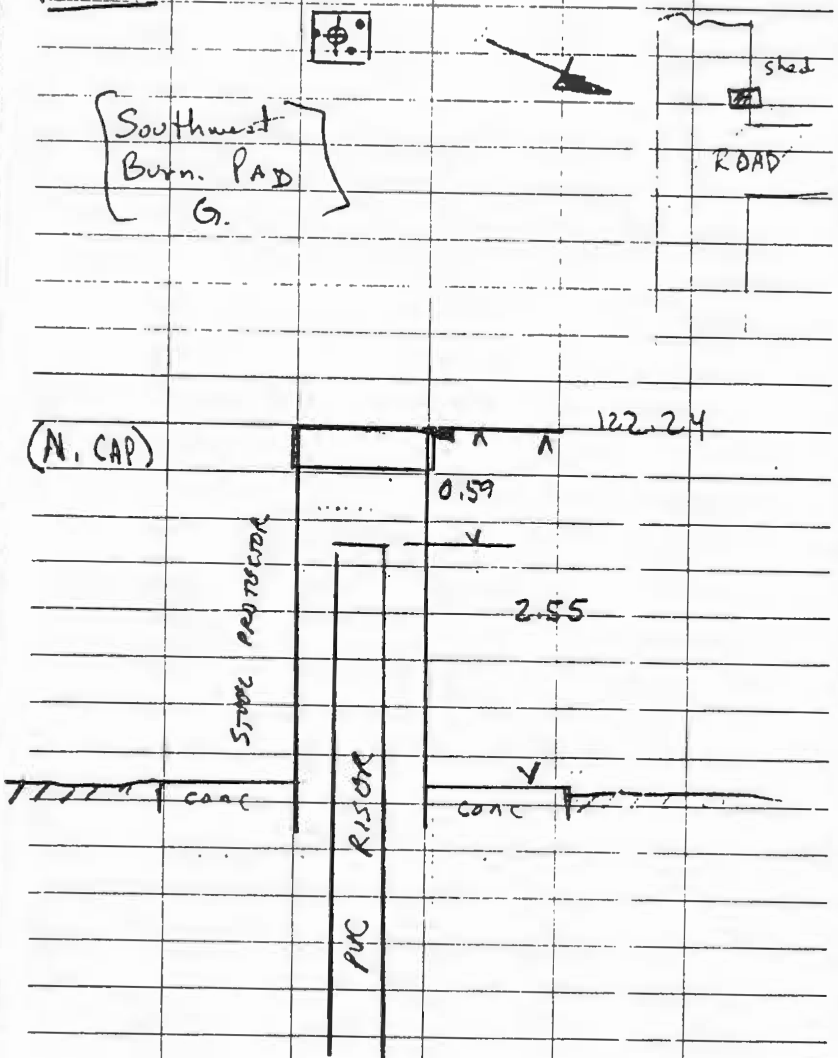
[Burning Pad Southeast 'H']

Roadway

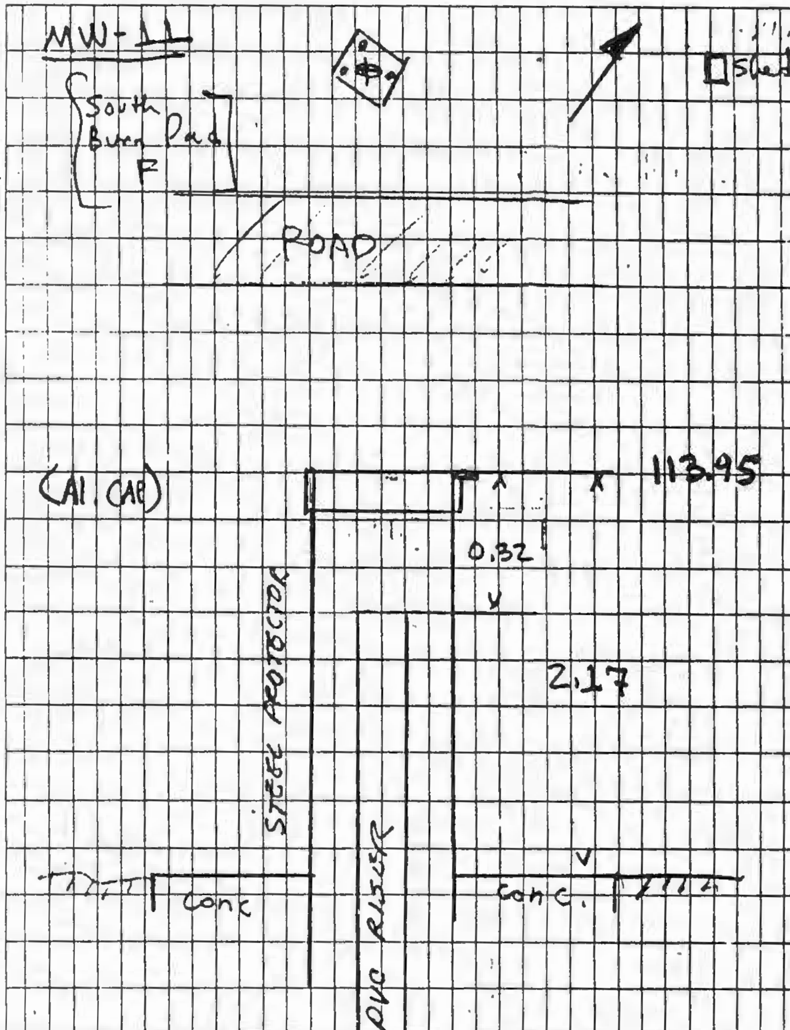


0032888-2161

MW-10



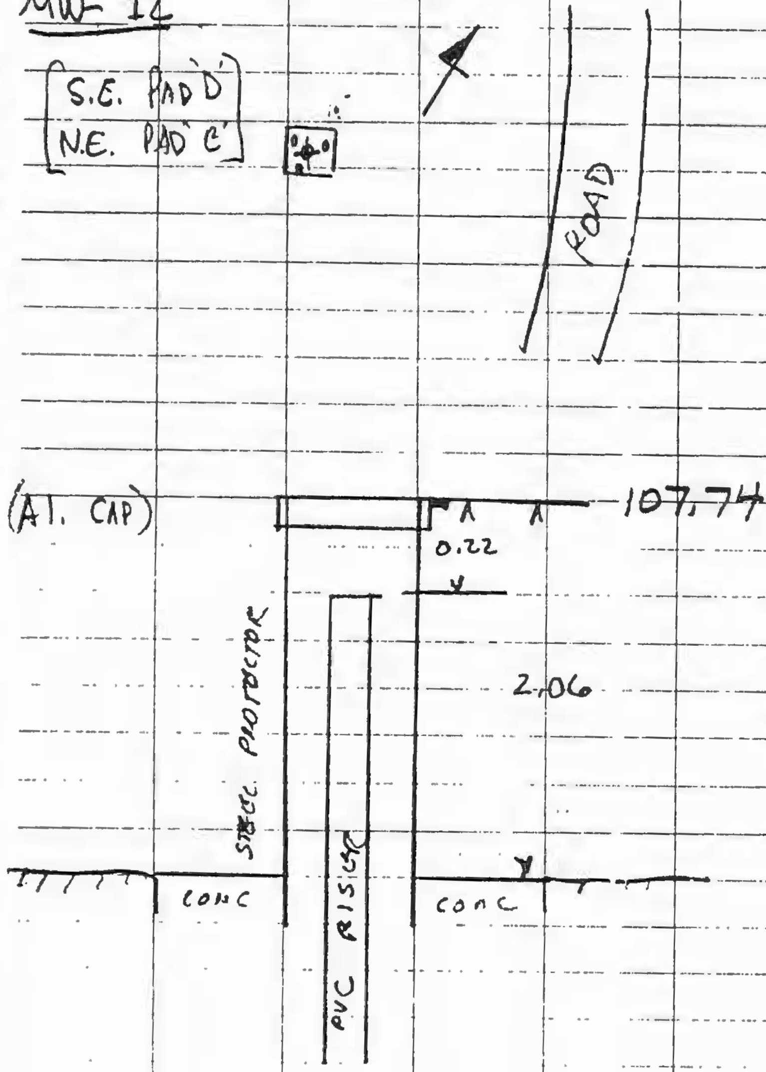
MW-11



003288-3161

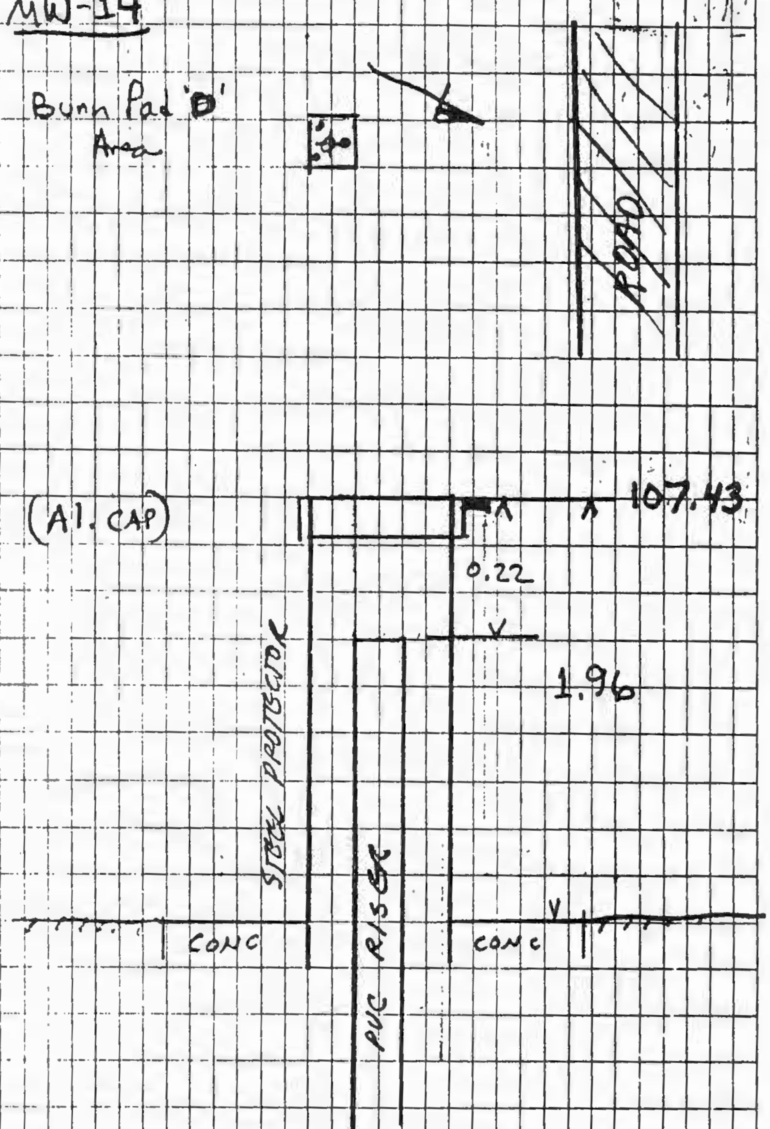
MW-12

S.E. PAD 'D'
N.E. PAD 'C'

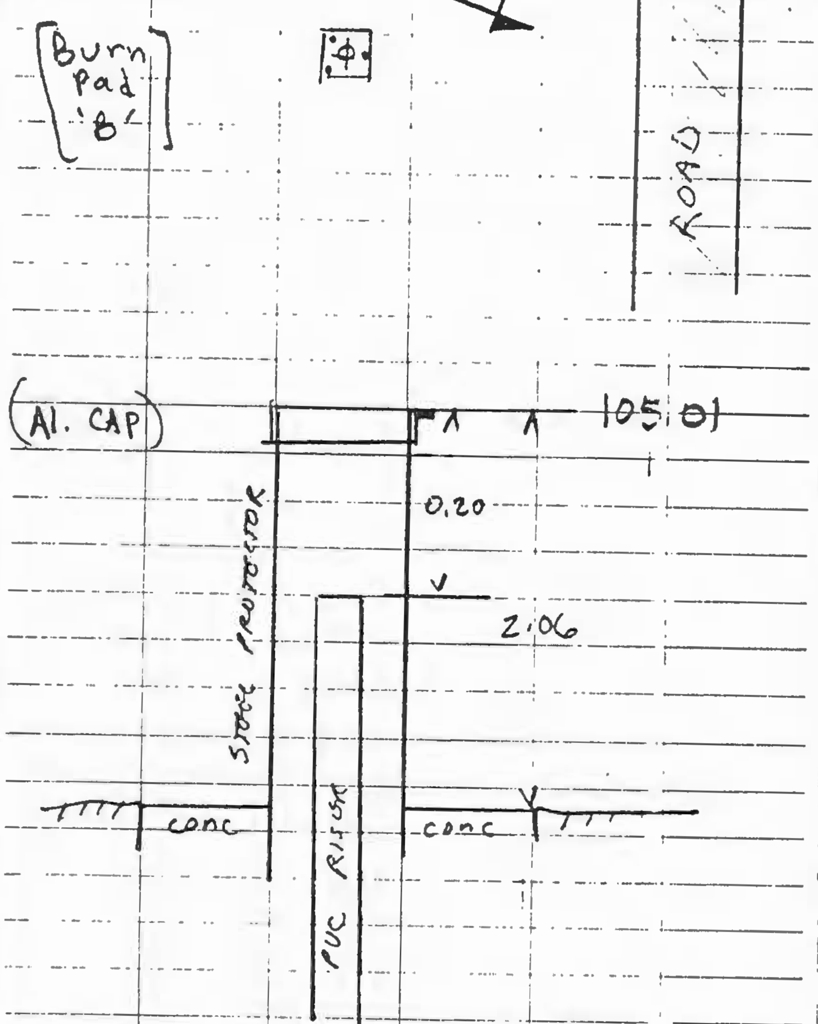


MW-14

Bunn Pad 'B'
Area

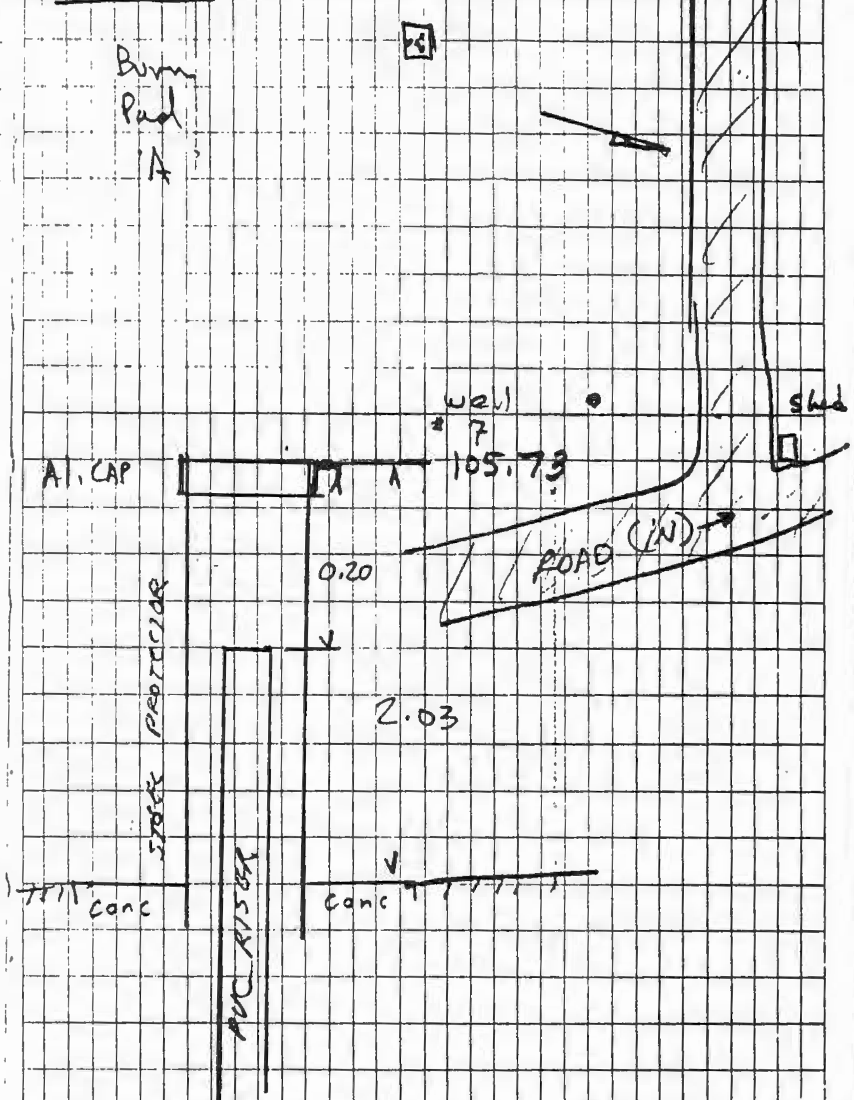


MW- 15



Burn Pad '8'
ROAD
(Al. CAP)
105.01
0.20
2.06
STEEL PROTECTOR
PVC RISER
conc
conc

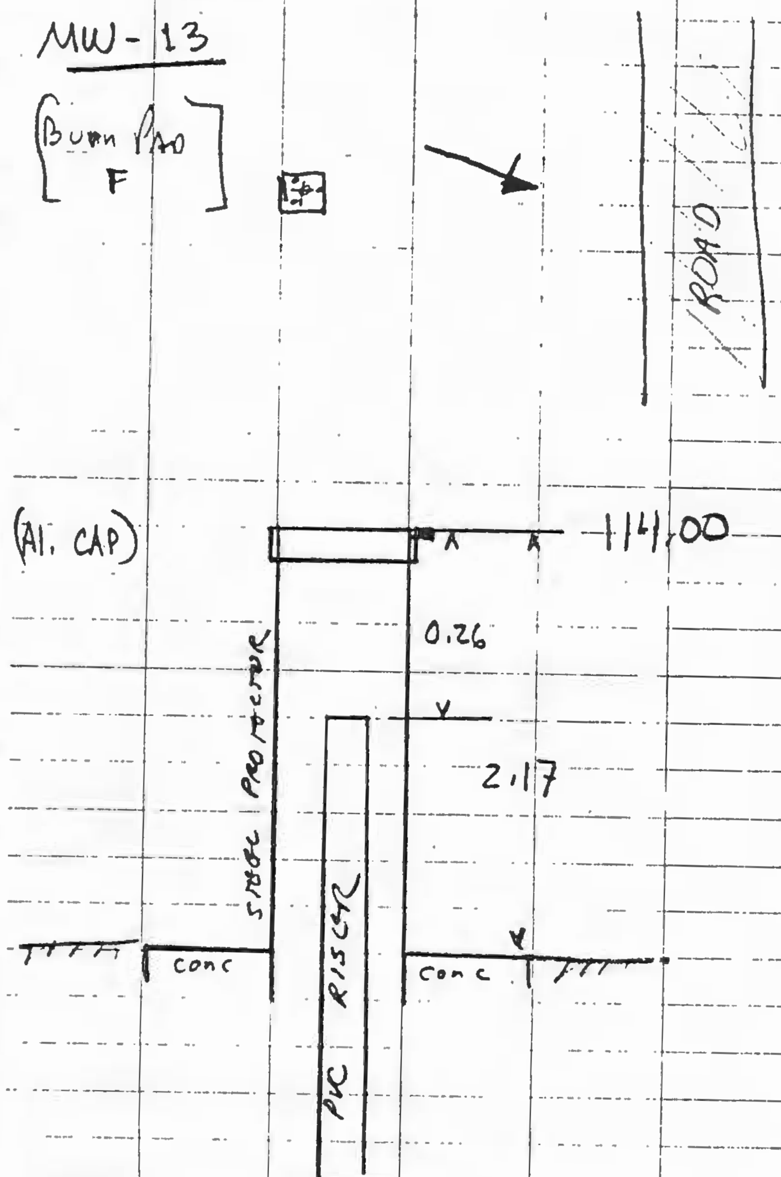
MW-16



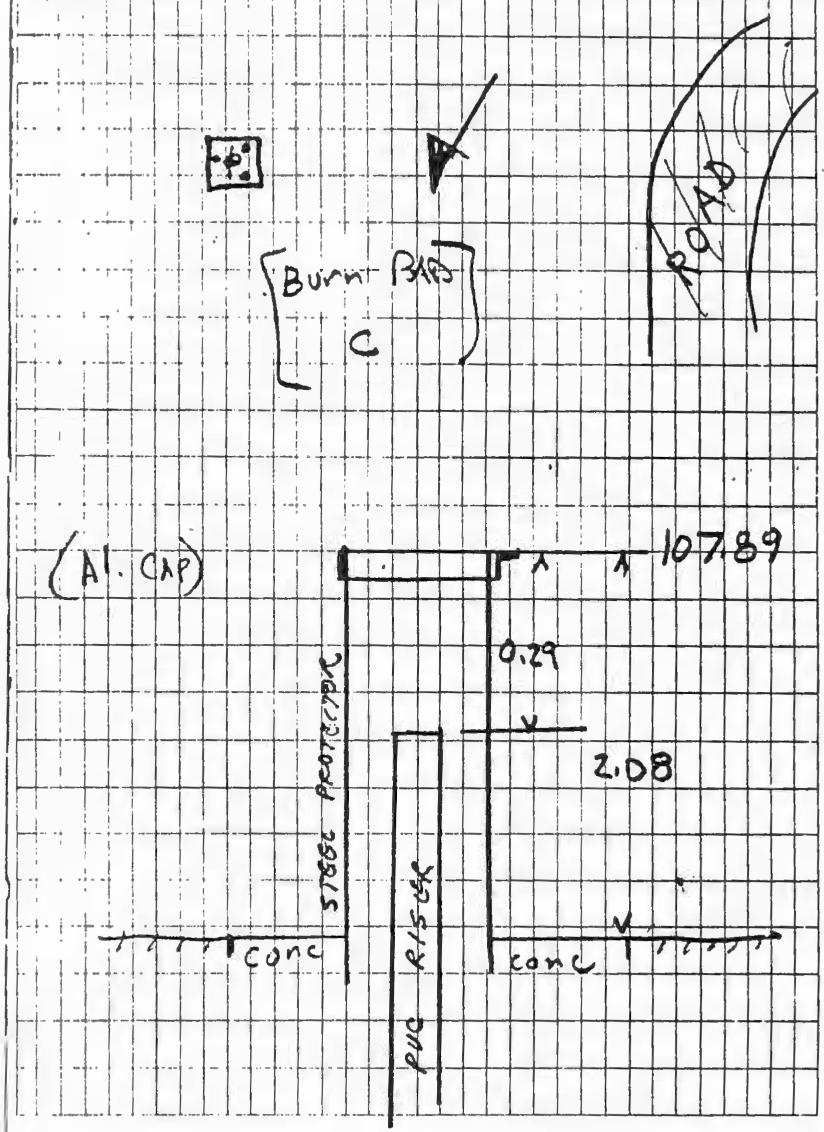
Burn Pad A
well # 7
105.73
shed
ROAD (N)
Al. CAP
0.20
2.03
STEEL PROTECTOR
PVC RISER
conc
conc

003288-3161

MW-13



MW-17



APPENDIX E

ANALYTICAL DATA

SENECA ARMY DEPOT

LOCATION	SAMPLE NO.	EQUIPMENT BLANKS	SAMPLE NO.
MW-1	3161-101		
MW-2	3161-102	EB-1	3161-126
MW-3	3161-103	EB-2 (EB-1 duplicate)	3161-127*
MW-4	3161-104	EB-3	3161-128
MW-5	3161-105	EB-4 (EB-3 duplicate)	3161-129*
MW-6	3161-106	EB-5	3161-130
MW-7	3161-107	EB-6 (EB-5 duplicate)	3161-131*
MW-8	3161-108	EB-7	3161-132
MW-9	3161-109	EB-8 (EB-7 duplicate)	3161-133*
MW-10	3161-110		
MW-10 (duplicate)	3161-118	TRAVEL BLANKS	SAMPLE NO.
MW-10 (triplicate)	3161-119*		
MW-11	3161-111	TB-1	3161-134
MW-11 (duplicate)	3161-120	TB-2 (TB-1 duplicate)	3161-135*
MW-11 (triplicate)	3161-121*	TB-3	3161-136
		TB-4 (TB-3 duplicate)	3161-137*
MW-12	3161-112		
MW-13	3161-113	TB-5	3161-138
		TB-6 (TB-5 (duplicate)	3161-139*
MW-14	3161-114		
MW-15	3161-115		
MW-16	3161-116		
MW-17	3161-117		
MW-17 (duplicate)	3161-122		
MW-17 (triplicate)	3161-123*		

*Sample analyzed by MRDED-L. Data is presented in this appendix following analytical data from Weston.

WESTON
MANAGERS DESIGNERS/CONSULTANTS
208 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19353
PHONE: (215) 524-7360
TELEX: 83-5348

METCALF & EDDY
JAN 13 1989
RECEIVED

12 January 1989

Ms. Deborah Simone
Metcalf & Eddy
P.O. Box 4043
Woburn,MA 01888-4043

Subject: **Data Reports for Seneca Project**

Dear Deborah:

Attached are the analytical data reports for the petroleum hydrocarbon, PETN, and Explosives analyses performed on Seneca water samples received November 18, 19, 21, 1988.

I will forward the metals reports as soon as they are complete. I have spoken with Carter Nulton, (our Lab Manager) and Deb White (Inorganics Section Manager) regarding our conversation today, and they have assured me that they will do everything they can to speed the completion of the metals analyses.

Please give me a call if you should have any questions regarding the enclosed information.

Very truly yours,

ROY F. WESTON, INC.

Sharon Nordstrom

Sharon A. Nordstrom
Project Manager
Analytics Division

SAN/gjk

Enclosure:

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: METCALF & EDDY   SAMPLES RECEIVED: 11-18-88
RFW #: 8811L522
W.O.#: 0010-10-11-0000

The following qualifiers/codes are used on the data summary:

U = Indicates that the compound was analyzed for but not detected. The detection limit for the sample (not the method detection limit) is reported with the U (e.g., 10u).

MB = Method Blank consists of deionized, distilled water processed through each sample preparation procedure performed. The analysis of method blanks provides a means of assessing the existence and magnitude of contamination introduced via the analytical scheme. The reported sample results are not corrected for the blank results.

NA = Not applicable.

NR = Not required.

NC = Not calculable, result below detection limit.

The method used for the analysis of petroleum hydrocarbons is EPA Method 418.1 (USEPA 600/4-79-020). Solid samples are extracted using Method 9071 (USEPA SW846) then analyzed by EPA Method 418.1.

Date of Extraction: 12-13-88
Date of Analysis: 12-14-88

for [signature]   12-30-88
J. Michael Taylor   DATE
Project Director
Lionville Analytical Laboratory

WESTON ANALYTICS

ORGANICS DATA SUMMARY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	WE 3161 109	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-002	WE 3161 110	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-003	WE 3161 113	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-004	WE 3161 115	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-005	WE 3161 116	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-006	WE 3161 118	PETROLEUM HYDROCARBONS	1.2		MG/L	1.0
-007	WE 3161 134	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-008	WE 3161 111	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-009	WE 3161 117	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-010	WE 3161 120	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-011	WE 1316 122	PETROLEUM HYDROCARBONS	6.8		MG/L	1.0
-012	WE 3161 126	PETROLEUM HYDROCARBONS	1.7		MG/L	1.0
-013	WE 3161 136	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0

WESTON ANALYTICS

ORGANICS METHOD BLANK DATA SUMMARY PAGE 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK10	88DH1551-MB1	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0

WESTON ANALYTICS

ORGANICS ACCURACY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	88DH1551-MB1	PETROLEUM HYDROCARBONS	37	1.0 u	40	92.1
		PETROLEUM HYDROCARBONS	36	1.0 u	40	90.1

WESTON ANALYTICS

ORGANICS DUPLICATE SPIKE REPORT 12/19/88

CLIENT: METCALF & EDDY

WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK10	88DH1551-MB1	PETROLEUM HYDROCARBONS	92.1	90.1	2.2

CASE NARRATIVE

Samples have been prepared and analyzed according to U.S. Army COE Methodology.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than   > - Greater than

Analysis Summary:

Weston Analytical Batch: 8811L522
Samples Collected: 11-16-88 - 11-17-88
Samples Prepared: 11-22-88
Samples Analyzed: 12-21-88

APPROVED BY George Perry

George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L522 CLIENT: METCALF & EDDY

Sample Information							
	Client	3161	3161	3161	3161	3161	3161
	ID :	109	110	113	115	116	118
	RFW#:	001	002	003	004	005	006
	D.F.:	1	1	1	1	1	1
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PETN...........................		< 4.5	< 4.5	< 4.5	< 4.5	< 4.5	< 4.5

Sample Information							
	Client	3161	3161	3161	3161	3161	----
	ID :	111	117	120	122	126	
	RFW#:	008	009	010	011	012	BLANK
	D.F.:	1	1	1	1	1	1
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PETN...........................		< 4.5	< 4.5	< 4.5	< 4.5	< 4.5	< 4.5

Sample Information			
	Client	3161	3161
	ID :	126	126
	RFW#:	012 MS	012 MSD
	D.F.:	1	1
	Units:	ug/L	ug/L
PETN...........................		94.7(71.0%)	109(81.5%)

CASE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method UW01.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
G -	Indicates elevated detection limit due to interference.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than   > - Greater than

Analysis Summary:

Weston Analytical Batch:	8811L522
Samples Collected:	11-16-88 - 11-17-88
Samples Prepared:	11-22-88
Samples Analyzed:	11-22-88

APPROVED BY George Perry

George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L522 CLIENT: METCALF & EDDY

Sample Information							
	Client ID :	3161 109	3161 110	3161 113	3161 115	3161 116	3161 118
	RFW#:	001	002	003	004	005	006
	D.F.:	1	1	1	1	1	1
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
HMX		< 1.30	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30
RDX		< 0.63	< 0.63	0.71	< 0.63	< 0.63	< 0.63
Tetryl		< 0.66	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66
2,4,6-TNT		5.61	1.80	< 0.78	< 0.78	< 0.78	< 0.78
2,6-DNT		< 0.55	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55
2,4-DNT		< 0.60	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60

Sample Information							
	Client ID :	3161 111	3161 117	3161 120	3161 122	3161 126	----
	RFW#:	008	009	010	011	012	BLANK
	D.F.:	1	1	1	1	1	1
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
HMX		< 1.30	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30
RDX		< 0.63	< 0.63	< 0.63	< 0.63	< 0.63	< 0.63
Tetryl		< 0.66	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66
2,4,6-TNT		< 0.78	< 0.78	< 0.78	< 0.78	< 0.78	< 0.78
2,6-DNT		< 0.55	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55
2,4-DNT		< 0.60	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L522   CLIENT: METCALF & EDDY

Sample Information			
	Client ID :	3161 122	3161 122
	RFW#:	011 MS	011 MSD
	D.F.:	1	1
	Units:	ug/L	ug/L
HMX		11.0(84.9%)	11.9(91.5%)
RDX		5.79(91.9%)	5.89(93.5%)
Tetryl		5.40(81.8%)	6.20(93.9%)
2,4,6-TNT		6.52(83.7%)	6.65(85.3%)
2,6-DNT		4.70(85.4%)	4.77(86.8%)
2,4-DNT		5.05(84.1%)	5.20(86.7%)

Deo P, Linda, Carter, gtt, Tracy, Kerri, Bob, Tammy, Steph, Mike, (PM) Gloria, Chang

Custody Transfer Record/Lab Work Request

WESTON

WESTON Analytics Use Only
8811L522.

Client: Art Colt + Eddy
Work Order: 0910-10-11
Date Rec'd.: 11/18/88 Date Due: 12/16/88
RFW Contact:
Client Contact/Phone:

Refrigerator#						
#/Type Container			1 G	1 G	1 P	
Volume			950ml	950ml	1 lr	
Preservative			Cool	HCL	HNO3	
ANALYSES REQUESTED			Explos	PHC	metals	
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**	See below	418.1	See below	
001	WF 3161 109	W	11/16/88	✓	✓	✓	
2	3161 110						
3	3161 113						
4	3161 115						
5	3161 116						
6	3161 118						
~~—~~	~~3161 120~~		~~11/16/88~~				Bottles NOT SENT pg
7	3161 134		11/17/88		✓		
8	3161 111			✓		✓	
9	3161 117						Metals = AS, BA, CD,
10	3161 120		11/17/88				CR, PB, HG, SE,
11	3161 122						AG
12	3161 126						
13	3161 136				✓		EXPLOSIVES =
							HMX, RDX, 2,4,6 TNT

Matrix: S - Soil, SE - Sediment, SO - Solid, W - Water, O - Oil, A - Air, WI - Wipe, DS - Drum Solids, DL - Drum Liquids, F - Fish, X - Other

Special Instructions: QC Lev II
Del = Std

26DNT, 24DNT
PETN (see COE Procedure)

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	A Ely	P. [illegible]	11/18/88	9:30 AM					

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:
Well #20 Not rec'd for 11/16/88 as indicated on COC.

RFW 21-21-001/A-7/88

7-115

WESTON

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: METCALF & EDDY
RFW #: 8811L547
W.O.#: 0010-10-11-0000

SAMPLES RECEIVED: 11-19-88

The following qualifiers/codes are used on the data summary:

U = Indicates that the compound was analyzed for but not detected. The detection limit for the sample (not the method detection limit) is reported with the U (e.g., 10u).

MB = Method Blank consists of deionized, distilled water processed through each sample preparation procedure performed. The analysis of method blanks provides a means of assessing the existence and magnitude of contamination introduced via the analytical scheme. The reported sample results are not corrected for the blank results.

NA = Not applicable.

NR = Not required.

NC = Not calculable, result below detection limit.

The method used for the analysis of petroleum hydrocarbons is EPA Method 418.1 (USEPA 600/4-79-020). Solid samples are extracted using Method 9071 (USEPA SW846) then analyzed by EPA Method 418.1.

Date of Extraction: 12-13-88
Date of Analysis: 12-14-88

for [signature] 12-30-88

J. Michael Taylor
Project Director
Lionville Analytical Laboratory

DATE

WESTON ANALYTICS

ORGANICS DATA SUMMARY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	3161-101	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-002	3161-102	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-003	3161-103	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-004	3161-105	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-005	3161-106	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-006	3161-108.	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-007	3161-112	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-008	3161-114	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-009	3161-124	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-010	3161-125	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-011	3161-128	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-012	3161-130	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-013	3161-132	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-014	3161-138	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0

WESTON ANALYTICS

ORGANICS   METHOD BLANK DATA SUMMARY PAGE   12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	1.0 u	MG/L	1.0

WESTON ANALYTICS

ORGANICS ACCURACY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	36	1.0 u	40	90.7
		PETROLEUM HYDROCARBONS	36	1.0 u	40	90.4

WESTON ANALYTICS

ORGANICS DUPLICATE SPIKE REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	90.7	90.4	0.30

CASE NARRATIVE

Samples have been prepared and analyzed according to U.S. Army COE Methodology.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than > - Greater than

Analysis Summary:

Weston Analytical Batch:	8811L547
Samples Collected:	11-18-88
Samples Prepared:	11-23-88
Samples Analyzed:	12-21-88

APPROVED BY George Perry

George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L547 CLIENT: METCALF & EDDY

Sample Information						
Client ID :	3161 101	3161 102	3161 103	3161 105	3161 106	3161 108
RFW#:	001	002	003	004	005	006
D.F.:	1	1	1	1	1	1
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PETN............................	< 4.5	< 4.5	< 4.5	8.5	< 4.5	< 4.5

Sample Information						
Client ID :	3161 112	3161 114	3161 124	3161 125	3161 128	3161 130
RFW#:	007	008	009	010	011	012
D.F.:	1	1	1	1	1	1
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PETN............................	< 4.5	< 4.5	< 4.5	< 4.5	< 4.5	< 4.5

Sample Information				
Client ID :	3161 132	----	3161 128	3161 128
RFW#:	013	BLANK	011 MS	011 MSD
D.F.:	1	1	1	1
Units:	ug/L	ug/L	ug/L	ug/L
PETN............................	< 4.5	< 4.5	116(87.1%)	93.7(70.3%)

CASE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method UW01.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
G -	Indicates elevated detection limit due to interference.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than　　　　> - Greater than

Analysis Summary:

Weston Analytical Batch:	8811L547
Samples Collected:	11-18-88
Samples Prepared:	11-22-88
Samples Analyzed:	11-22-88

APPROVED BY George Perry

George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L547 CLIENT: METCALF & EDDY

Sample Information						
Client ID :	3161 101	3161 102	3161 103	3161 105	3161 106	3161 108
RFW#:	001	002	003	004	005	006
D.F.:	1	1	1	1	1	1
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
HMX	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30
RDX	0.86	< 0.63	< 0.63	< 0.63	< 0.63	< 0.63
Tetryl	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66
2,4,6-TNT	< 0.78	< 0.78	< 0.78	< 0.78	< 0.78	< 0.78
2,6-DNT	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55
2,4-DNT	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60

Sample Information						
Client ID :	3161 112	3161 114	3161 124	3161 125	3161 128	3161 130
RFW#:	007	008	009	010	011	012
D.F.:	1	1	1	1	1	1
Units:	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
HMX	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30	< 1.30
RDX	< 0.63	< 0.63	< 0.63	< 0.63	< 0.63	< 0.63
Tetryl	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66	< 0.66
2,4,6-TNT	< 0.78	< 0.78	< 0.78	< 0.78	< 0.78	< 0.78
2,6-DNT	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55	< 0.55
2,4-DNT	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60	< 0.60

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L547 CLIENT: METCALF & EDDY

Sample Information					
	Client ID :	3161 132	----	3161 114	3161 114
	RFW#:	013	BLANK	008 MS	008 MSD
	D.F.:	1	1	1	1
	Units:	ug/L	ug/L	ug/L	ug/L
HMX		< 1.30	< 1.30	11.3(87.2%)	12.1(93.4%)
RDX		< 0.63	< 0.63	5.69(90.4%)	6.02(95.5%)
Tetryl		< 0.66	< 0.66	5.51(83.5%)	5.56(84.2%)
2,4,6-TNT		< 0.78	< 0.78	6.39(81.9%)	6.43(82.4%)
2,6-DNT		< 0.55	< 0.55	4.50(81.8%)	4.54(82.6%)
2,4-DNT		< 0.60	< 0.60	5.04(83.9%)	5.04(83.9%)

Geo P, Linda, Carter, Terry, Ken, Bob, Tammy, Steph, Mike, Phil, Gloria, - 7ch. 19

WESTON Analytics Use Only
8811L547

Custody Transfer Record/Lab Work Request

WESTON

Client Metcalf + Eddy
Work Order 0010-10-11
Date Rec'd. 11/19/88 Date Due 12/17/88
RFW Contact
Client Contact/Phone

		Refrigerator#												
		#/Type Container		1/G	1/G	1/P								
		Volume		250ml	92ml	Hr								
		Preservative		Cool	HCL	HNO3								
		ANALYSES REQUESTED		Expl	PHC	Metals								
WA Use Only Lab ID	Client ID/Description	Matrix	Date Collected	ExPW	PHC	See Below								
001	3161-101	W	11/18/88											
2	102													
3	103													
4	105													
5	106													
6	108													
7	112													
8	114													
9	124													
10	125													
11	128													
12	130													
13	132													
14	138													

Metals = AS, BA, CD, CR, PB, HG, SE, AG

Explosives: HMX, RDX, 2,4,6TNT, 26DNT, 24DNT, PETN (See COE procedures)

Matrix:
S - Soil W - Water DS - Drum Solids
SE - Sediment O - Oil DL - Drum Liquids
SO - Solid A - Air F - Fish
WI - Wipe X - Other

Special Instructions: QC = Tier II
DL = Std.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	[illegible]	P. Geiger	11/19/88	9:30					

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:
2 Ambient or Chilled
NOTES:
3 Received Broken/Leaking (Improperly Sealed) Y N
NOTES:
4 Properly Preserved Y N
NOTES:
5 Received Within Holding Times Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-7/88

7-115

WESTON

ROY F. WESTON INC.
LIONVILLE LABORATORY

CLIENT: METCALF & EDDY
RFW #: 8811L522
W.O. #: 0010-10-11-0000

SAMPLES RECEIVED: 11-18-88

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All calibration verification checks were within the required control limits of 90-110% (85-115% for Hg). Calibration verification is performed using an independent standard purchased from Inorganic Ventures, Inc.

3. All preparation blanks were analyzed below the required detection limit.

4. All laboratory control standards were within the control limits of 80-120%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. Matrix spike recoveries for selenium were outside of the 75-125% guidance limits. This may be due to an interference present in the sample matrix and/or sample inhomogeneity.

6. Replicate results were within the 20% guidance limit.

7. The analytical methods applied by the laboratory for the determination of metals, are:

As :	EPA 206.2	Hg	: EPA 245.1
Se :	EPA 270.2	ICP Scan	: EPA 200.7
Pb :	EPA 239.2	All others	: EPA 200.7
Tl :	EPA 279.2	EP Leachates (except Hg):	200.7

8. USEPA-CLP SOW 787 was followed for the analysis of these samples.

NOTE: For solid samples, all results are reported on a dry weight basis.

1/16/89

Debra K. White Date

Inorganic Section Manager

Lionville Analytical Laboratory

ROY F. WESTON, INC.
Lionville Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples were this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO - This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO - This type of code indicates a soluble metal analysis (eg. MAGSO indicates an analysis for soluble silver).

M**EP - This type of code indicates an EP-Toxicity metals analysis (eg. MAGEP indicates an analysis for soluble silver).

I**TO - This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicate a replicate or spike analysis, respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	WE 3161 109	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.6		UG/L	5.0
-002	WE 3161 110	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-003	WE 3161 113	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-004	WE 3161 115	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	6.0		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-005	WE 3161 116	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-006	WE 3161 118	SILVER, TOTAL	70.4		UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-008	WE 3161 111	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	9.0		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-009	WE 3161 117	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	9.9		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-010	WE 3161 120	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	10.6		UG/L	5.0
		SELENIUM, TOTAL	27.5		UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-011	WE 1316 122	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	11.6		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-012	WE 3161 126	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	89I975-MB1	SILVER, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
BLANK1	89A974-MB1	ARSENIC, TOTAL	10.0	u	UG/L	10.0
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
BLANK1	88C171A-MB1	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK2	88C171A-MB2	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK3	88C171A-MB3	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK4	88C171A-MB4	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK5	88C171A-MB5	MERCURY, TOTAL	0.20	u	UG/L	0.20

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
-001	WE 3161 109	SILVER, TOTAL	51.2	10.0 u	50.0	102
		ARSENIC, TOTAL	30.6	10.0 u	40.0	76.5
		BARIUM, TOTAL	2030	200 u	2000	101
		CADMIUM, TOTAL	39.9	5.0 u	50.0	79.8
		CHROMIUM, TOTAL	186	10.0 u	200	92.8
		MERCURY, TOTAL	1.0	0.20u	1.0	102
		LEAD, TOTAL	17.3	5.0 u	20.0	86.5
		SELENIUM, TOTAL	8.3	5.6	10.0	27.0

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	89I975-LC2	SILVER, LCS	114	114	0.39
		BARIUM, LCS	96.5	96.5	0.010
		CADMIUM, LCS	90.7	92.0	1.4
		CHROMIUM, LCS	91.3	91.0	0.33
LCS2	89A974-LC2	ARSENIC, LCS	110	110	0.60
		LEAD, LCS	91.0	87.0	4.5
		SELENIUM, LCS	100	102	1.3
LCS2	88C171A-LC2	MERCURY, LCS	89.8	86.6	3.6

ROY F. WESTON INC.

INORGANICS PRECISION REPORT 01/16/89

CLIENT: METCALF & EDDY

WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L522

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	% DIFF
-001REP	WE 3161 109	SILVER, TOTAL	10.0 u	10.0 u	NC
		ARSENIC, TOTAL	10.0 u	10.0 u	NC
		BARIUM, TOTAL	200 u	200 u	NC
		CADMIUM, TOTAL	5.0 u	5.0 u	NC
		CHROMIUM, TOTAL	10.0 u	10.0 u	NC
		MERCURY, TOT	0.20u	0.20u	NC
		LEAD, TOTAL	5.0 u	5.0 u	NC
		SELENIUM, TOTAL	5.6	5.0 u	NC

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 01/16/89

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	89I975-LC1	SILVER, LCS	572	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	227	250	UG/L	90.7
		CHROMIUM, LCS	456	500	UG/L	91.3
LCS2	89I975-LC2	SILVER, LCS	570	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	230	250	UG/L	92.0
		CHROMIUM, LCS	455	500	UG/L	91.0
LCS1	89A974-LC1	ARSENIC, LCS	32.9	30.0	UG/L	110
		LEAD, LCS	27.3	30.0	UG/L	91.0
		SELENIUM, LCS	30.1	30.0	UG/L	100
LCS2	89A974-LC2	ARSENIC, LCS	33.1	30.0	UG/L	110
		LEAD, LCS	26.1	30.0	UG/L	87.0
		SELENIUM, LCS	30.5	30.0	UG/L	102
LCS1	88C171A-LC1	MERCURY, LCS	0.36	0.4	UG/L	89.8
LCS2	88C171A-LC2	MERCURY, LCS	1.7	2.0	UG/L	86.6
LCS3	88C171A-LC3	MERCURY, LCS	3.4	4.0	UG/L	84.5
LCS4	88C171A-LC4	MERCURY, LCS	6.9	8.0	UG/L	86.2
LCS5	88C171A-LC5	MERCURY, LCS	2.0	2.0	UG/L	100

ROY F. WESTON INC.
LIONVILLE LABORATORY

CLIENT: METCALF & EDDY
RFW #: 8811L552
W.O. #: 0010-10-11-0000

SAMPLES RECEIVED: 11-21-88

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All calibration verification checks were within the required control limits of 90-110% (85-115% for Hg). Calibration verification is performed using an independent standard purchased from Inorganic Ventures, Inc.

3. All preparation blanks were analyzed below the required detection limit.

4. All laboratory control standards were within the control limits of 80-120%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. Matrix spike recoveries for mercury were outside of the 75-125% guidance limits. This may be due to an interference present in the sample matrix and/or sample inhomogeneity.

6. Replicate results for mercury were within the 20% guidance limit.

7. The analytical methods applied by the laboratory for the determination of metals, are:

As :	EPA 206.2	Hg	: EPA 245.1
Se :	EPA 270.2	ICP Scan	: EPA 200.7
Pb :	EPA 239.2	All others	: EPA 200.7
Tl :	EPA 279.2	EP Leachates (except Hg):	200.7

8. USEPA-CLP SOW 787 was followed for the analysis of these samples.

NOTE: For solid samples, all results are reported on a dry weight basis.

1/16/89

Debra K. White Date
Inorganic Section Manager
Lionville Analytical Laboratory

ROY F. WESTON, INC.
Lionville Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples were this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO - This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO - This type of code indicates a soluble metal analysis (eg. MAGSO indicates an analysis for soluble silver).

M**EP - This type of code indicates an EP-Toxicity metals analysis (eg. MAGEP indicates an analysis for soluble silver).

I**TO - This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicate a replicate or spike analysis, respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-002	3161-104	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	835		UG/L	200
		CADMIUM, TOTAL	18.8		UG/L	5.0
		CHROMIUM, TOTAL	152		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	206		UG/L	25.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	89I975-MB1	SILVER, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
BLANK1	89A974-MB1	ARSENIC, TOTAL	10.0	u	UG/L	10.0
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
BLANK2	88C172A-MB2	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK3	88C172A-MB3	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK4	88C172A-MB4	MERCURY, TOTAL	0.20	u	UG/L	0.20

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
-002	3161-104	MERCURY, TOTAL	1.3	0.20u	1.0	132

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	89I975-LC2	SILVER, LCS	114	114	0.39
		BARIUM, LCS	96.5	96.5	0.010
		CADMIUM, LCS	90.7	92.0	1.4
		CHROMIUM, LCS	91.3	91.0	0.33
LCS2	89A974-LC2	ARSENIC, LCS	110	110	0.60
		LEAD, LCS	91.0	87.0	4.5
		SELENIUM, LCS	100	102	1.3
LCS2	88C172A-LC2	MERCURY, LCS	103	99.2	3.8

ROY F. WESTON INC.

INORGANICS PRECISION REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	% DIFF
-002REP	3161-104	MERCURY, TOT	0.20u	0.20u	NC

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 01/16/89

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	89I975-LC1	SILVER, LCS	572	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	227	250	UG/L	90.7
		CHROMIUM, LCS	456	500	UG/L	91.3
LCS2	89I975-LC2	SILVER, LCS	570	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	230	250	UG/L	92.0
		CHROMIUM, LCS	455	500	UG/L	91.0
LCS1	89A974-LC1	ARSENIC, LCS	32.9	30.0	UG/L	110
		LEAD, LCS	27.3	30.0	UG/L	91.0
		SELENIUM, LCS	30.1	30.0	UG/L	100
LCS2	89A974-LC2	ARSENIC, LCS	33.1	30.0	UG/L	110
		LEAD, LCS	26.1	30.0	UG/L	87.0
		SELENIUM, LCS	30.5	30.0	UG/L	102
LCS2	88C172A-LC2	MERCURY, LCS	2.0	2.0	UG/L	99.2
LCS3	88C172A-LC3	MERCURY, LCS	4.1	4.0	UG/L	103
LCS4	88C172A-LC4	MERCURY, LCS	8.2	8.0	UG/L	103

WESTON
MANAGERS DESIGNERS/CONSULTANTS

208 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19353
PHONE: (215) 524-7360
TELEX: 83-5348

2 February 1989

Ms. Deborah Simone
Project Manager
10 Harvard Mill Square
Wakefield, Massachusetts 01880

Dear Ms. Simone:

Enclosed is the "hardcopy" metals report for batch 8811L547 that I telecopied to you this afternoon.

As we discussed earlier this week, we have reviewed the raw data, analyst notes, and calculations associated with the petroleum hydrocarbon analyses performed on RFW Batch 8811L522. There did not appear to be any analytical abnormalities or calculation errors made during the analysis and reporting.

As indicated in the report, our method blank sample had no detectable hydrocarbons, the spike recoveries were good, and there does not appear to have been an "across the-board" laboratory contamination problem. The possibility of contamination of isolated samples either in the field or during lab analysis must be considered, however during the petroleum hydrocarbon procedure the entire 1 liter sample was consumed so we are not able to repeat the analyses using the same samples.

Please feel free to contact me if you have further questions regarding the petroleum hydrocarbon analysis, or any of the other analyses for the Seneca program.

Very truly yours,

ROY F. WESTON, INC.

Sharon Nordstrom

Sharon A. Nordstrom
Project Manager
Analytics Division

SAN/gjk

Enclosure:

ROY F. WESTON INC.
LIONVILLE LABORATORY

WESTON

CLIENT: METCALF & EDDY
RFW #: 8811L547
W.O. #: 0010-10-11-0000

SAMPLES RECEIVED: 11-19-88

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All calibration verification checks were within the required control limits of 90-110% (85-115% for Hg). Calibration verification is performed using an independent standard purchased from Inorganic Ventures, Inc.

3. All preparation blanks were analyzed below the required detection limit.

4. All laboratory control standards were within the control limits of 80-120%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. Matrix spike recoveries for silver, arsenic, cadmium, lead and selenium were outside of the 75-125% guidance limits. This may be due to an interference present in the sample matrix and/or sample inhomogeneity.

6. Replicate results were within the 20% guidance limit.

7. The analytical methods applied by the laboratory for the determination of metals, are:

As :	EPA 206.2	Hg	: EPA 245.1
Se :	EPA 270.2	ICP Scan	: EPA 200.7
Pb :	EPA 239.2	All others	: EPA 200.7
Tl :	EPA 279.2	EP Leachates (except Hg):	200.7

8. USEPA-CLP SOW 787 was followed for the analysis of these samples.

NOTE: For solid samples, all results are reported on a dry weight basis.

Debra K. White 2/2/89
Debra K. White / Date
Inorganic Section Manager
Lionville Analytical Laboratory

ROY F. WESTON, INC.
Lionville Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples were this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO - This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO - This type of code indicates a soluble metal analysis (eg. MAGSO indicates an analysis for soluble silver).

M**EP - This type of code indicates an EP-Toxicity metals analysis (eg. MAGEP indicates an analysis for soluble silver).

I**TO - This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicate a replicate or spike analysis, respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	3161-101	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	511		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	52.3		UG/L	10.0
		MERCURY, TOTAL	0.58		UG/L	0.20
		LEAD, TOTAL	104		UG/L	50.0
		SELENIUM, TOTAL	7.5		UG/L	5.0
-002	3161-102	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	21.5		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	38.9		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-003	3161-103	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	294		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	31.2		UG/L	10.0
		MERCURY, TOTAL	0.47		UG/L	0.20
		LEAD, TOTAL	100		UG/L	10.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-004	3161-105	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	19.3		UG/L	10.0
		BARIUM, TOTAL	440		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	55.8		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	83.2		UG/L	20.0
		SELENIUM, TOTAL	14.3		UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-005	3161-106	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	859		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	143		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	106		UG/L	25.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-006	3161-108.	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-007	3161-112	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-008	3161-114	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-009	3161-124	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	13.3		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-010	3161-125	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.9		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-011	3161-128	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-012	3161-130	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-013	3161-132	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	89I975-MB1	SILVER, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
BLANK1	89A974-MB1	ARSENIC, TOTAL	10.0	u	UG/L	10.0
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
BLANK1	88C171A-MB1	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK2	88C171A-MB2	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK3	88C171A-MB3	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK4	88C171A-MB4	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK5	88C171A-MB5	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK1	89L0035-MB1	SILVER, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
BLANK1	89L0034-MB1	ARSENIC, TOTAL	10.0	u	UG/L	10.0
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	
-001	3161-101	SILVER, TOTAL	33.0	10.0 u	50.0	66.0	
		ARSENIC, TOTAL	28.6	10.0 u	40.0	71.5	
		BARIUM, TOTAL	2380	511	2000	93.3	
		CADMIUM, TOTAL	32.2	5.0 u	50.0	64.4	
		CHROMIUM, TOTAL	237	52.3	200	92.4	
		MERCURY, TOTAL	1.4	0.58	1.0	82.4	
		LEAD, TOTAL	137	104	20.0	165	*
		SELENIUM, TOTAL	3.8	7.5	10.0	-37.	
-009	3161-124	SILVER, TOTAL	36.8	10.0 u	50.0	73.6	
		ARSENIC, TOTAL	31.4	10.0 u	40.0	78.5	
		BARIUM, TOTAL	2030	200 u	2000	101	
		CADMIUM, TOTAL	30.7	5.0 u	50.0	61.4	
		CHROMIUM, TOTAL	198	10.0 u	200	98.8	
		LEAD, TOTAL	20.1	13.3	20.0	34.0	
		SELENIUM, TOTAL	9.2	5.0 u	10.0	92.0	

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	89I975-LC2	SILVER, LCS	114	114	0.39
		BARIUM, LCS	96.5	96.5	0.010
		CADMIUM, LCS	90.7	92.0	1.4
		CHROMIUM, LCS	91.3	91.0	0.33
LCS2	89A974-LC2	ARSENIC, LCS	110	110	0.60
		LEAD, LCS	91.0	87.0	4.5
		SELENIUM, LCS	100	102	1.3
LCS2	88C171A-LC2	MERCURY, LCS	89.8	86.6	3.6
LCS2	89L0035-LC2	SILVER, LCS	82.2	78.3	4.8
		BARIUM, LCS	104	96.3	7.2
		CADMIUM, LCS	85.8	80.4	6.5
		CHROMIUM, LCS	103	97.7	5.3
LCS2	89L0034-LC2	ARSENIC, LCS	88.0	89.3	1.5
		LEAD, LCS	95.7	98.7	3.1
		SELENIUM, LCS	100	105	4.6

ROY F. WESTON INC.

INORGANICS PRECISION REPORT 02/02/89

CLIENT: METCALF & EDDY
WORK ORDER: 3272-03-01-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	% DIFF
-001REP	3161-101	SILVER, TOTAL	10.0 u	10.0 u	NC
		ARSENIC, TOTAL	10.0 u	10.0 u	NC
		BARIUM, TOTAL	511	549	7.2
		CADMIUM, TOTAL	5.0 u	5.0 u	NC
		CHROMIUM, TOTAL	52.3	56.6	7.9
		MERCURY, TOT	0.58	0.58	0.00
		LEAD, TOTAL	104	109	4.7
		SELENIUM, TOTAL	7.5	5.0 u	NC
-010REP	3161-125	SILVER, TOTAL	10.0 u	10.0 u	NC
		ARSENIC, TOTAL	10.0 u	10.0 u	NC
		BARIUM, TOTAL	200 u	200 u	NC
		CADMIUM, TOTAL	5.0 u	5.0 u	NC
		CHROMIUM, TOTAL	10.0 u	10.0 u	NC
		LEAD, TOTAL	5.9	5.1	14.5
		SELENIUM, TOTAL	5.0 u	5.0 u	NC

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 02/02/89

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	89I975-LC1	SILVER, LCS	572	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	227	250	UG/L	90.7
		CHROMIUM, LCS	456	500	UG/L	91.3
LCS2	89I975-LC2	SILVER, LCS	570	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	230	250	UG/L	92.0
		CHROMIUM, LCS	455	500	UG/L	91.0
LCS1	89A974-LC1	ARSENIC, LCS	32.9	30.0	UG/L	110
		LEAD, LCS	27.3	30.0	UG/L	91.0
		SELENIUM, LCS	30.1	30.0	UG/L	100
LCS2	89A974-LC2	ARSENIC, LCS	33.1	30.0	UG/L	110
		LEAD, LCS	26.1	30.0	UG/L	87.0
		SELENIUM, LCS	30.5	30.0	UG/L	102
LCS1	88C171A-LC1	MERCURY, LCS	0.36	0.4	UG/L	89.8
LCS2	88C171A-LC2	MERCURY, LCS	1.7	2.0	UG/L	86.6
LCS3	88C171A-LC3	MERCURY, LCS	3.4	4.0	UG/L	84.5
LCS4	88C171A-LC4	MERCURY, LCS	6.9	8.0	UG/L	86.2
LCS5	88C171A-LC5	MERCURY, LCS	2.0	2.0	UG/L	100
LCS1	89L0035-LC1	SILVER, LCS	411	500	UG/L	82.2
		BARIUM, LCS	5180	5000	UG/L	104
		CADMIUM, LCS	214	250	UG/L	85.8
		CHROMIUM, LCS	515	500	UG/L	103

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 02/02/89

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS2	89L0035-LC2	SILVER, LCS	392	500	UG/L	78.3
		BARIUM, LCS	4810	5000	UG/L	96.3
		CADMIUM, LCS	201	250	UG/L	80.4
		CHROMIUM, LCS	488	500	UG/L	97.7
LCS1	89L0034-LC1	ARSENIC, LCS	26.4	30.0	UG/L	88.0
		LEAD, LCS	28.7	30.0	UG/L	95.7
		SELENIUM, LCS	30.0	30.0	UG/L	100
LCS2	89L0034-LC2	ARSENIC, LCS	26.8	30.0	UG/L	89.3
		LEAD, LCS	29.6	30.0	UG/L	98.7
		SELENIUM, LCS	31.4	30.0	UG/L	105

ROY F. WESTON, INC.
Lionville Laboratory

CLIENT: METCALF & EDDY SAMPLES RECEIVED: 11-21-88
RFW #: 8811L552
W.O.#: 0010-10-11-0000

The following qualifiers/codes are used on the data summary:

U = Indicates that the compound was analyzed for but not detected. The detection limit for the sample (not the method detection limit) is reported with the U (e.g., 10u).

MB = Method Blank consists of deionized, distilled water processed through each sample preparation procedure performed. The analysis of method blanks provides a means of assessing the existence and magnitude of contamination introduced via the analytical scheme. The reported sample results are not corrected for the blank results.

NA = Not applicable.

NR = Not required.

NC = Not calculable, result below detection limit.

The method used for the analysis of petroleum hydrocarbons is EPA Method 418.1 (USEPA 600/4-79-020). Solid samples are extracted using Method 9071 (USEPA SW846) then analyzed by EPA Method 418.1.

Date of Extraction: 12-13-88
Date of Analysis: 12-14-88

for Zahraf [illegible] 12-30-88

J. Michael Taylor DATE
Project Director
Lionville Analytical Laboratory

WESTON ANALYTICS

ORGANICS DATA SUMMARY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	3161-140	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0
-002	3161-104	PETROLEUM HYDROCARBONS	1.0	u	MG/L	1.0

WESTON ANALYTICS

ORGANICS METHOD BLANK DATA SUMMARY PAGE 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	RESULT	UNITS	REPORTING LIMIT
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	1.0 u	MG/L	1.0

WESTON ANALYTICS

ORGANICS ACCURACY REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	36	1.0 u	40	90.7
		PETROLEUM HYDROCARBONS	36	1.0 u	40	90.4

WESTON ANALYTICS

ORGANICS DUPLICATE SPIKE REPORT 12/19/88

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L552

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
BLANK10	88DH1552-MB1	PETROLEUM HYDROCARBONS	90.7	90.4	0.30

CASE NARRATIVE

Samples have been prepared and analyzed according to U.S. Army COE Methodology.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than   > - Greater than

Analysis Summary:

Weston Analytical Batch:	8811L552
Samples Collected:	11-19-88
Samples Prepared:	11-22-88
Samples Analyzed:	12-21-88

APPROVED BY George Perry

George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L552	CLIENT: METCALF & EDDY	Page: 1

Sample Information	Client ID :	3161 104
	RFW#:	002
	D.F.:	10
	Units:	ug/L
PETN	<	45.0

CASE NARRATIVE

Samples have been prepared and analyzed according to USATHAMA Method UW01.

The following QA/QC control samples have been analyzed concurrently with each extraction batch. Abbreviations noted below have been used in the data summary.

Abbreviation	Description
Blank -	USATHAMA standard matrix (soil or water) analyzed to provide an indication of lab contamination and it's effect on reported analytical data.

Samples (soil or water) are spiked with target compounds to provide precision and accuracy data.

MS -	designates sample spiked with target compound.
MSD -	designates sample spiked with target compound in duplicate.
NS -	Not spiked.
D -	Indicates duplicate analysis of a sample.
DL -	Diluted below calibration range.
G -	Indicates elevated detection limit due to interference.
NOTE:	Spikes have been reported as result (% recovery).

Data Qualifiers:

< - Less than   > - Greater than

Analysis Summary:

Weston Analytical Batch:	8811L552
Samples Collected:	11-19-88
Samples Prepared:	11-22-88
Samples Analyzed:	11-22-88

APPROVED BY George Perry
George Perry
HPLC Unit Leader
Lionville Analytical Laboratories

WESTON ANALYTICS
WATER EXPLOSIVES DATA

RFW Batch Number: 8811L552	CLIENT:	METCALF & EDDY	Page: 1

Sample Information	Client ID :	3161 104
	RFW#:	002
	D.F.:	1
	Units:	ug/L

HMX	<	1.30
RDX		1.84
Tetryl	<	0.96 G
2,4,6-TNT	<	0.78
2,6-DNT	<	0.55
2,4-DNT	<	0.60

Geof, Linda, ???, Terry, Ken, Bob, Tammy, Sergio, Mike, PM, Gloria, Xhang

WESTON Analytics Use Only

88116552

Custody Transfer Record/Lab Work Request

WESTON

Client: Metcalf + Eddy
Work Order: 0010-10-11
Date Rec'd.: 11/21/88 Date Due: 12/19/88
RFW Contact:
Client Contact/Phone:

Refrigerator#					
#/Type Container		1/G	1/G	1/P	
Volume		950ml	950ml	1lr	
Preservative		Cool	HCL	HNO3	
ANALYSES REQUESTED		Expl	PHC	metal	
WA Use Only Lab ID	**Client ID/Description**	**Matrix**	**Date Collected**			
001	3161-140	W	11/19/88		✓	
002	3161-104	W	11/19/88	✓	✓	✓

Metals = AS, BA, CD, CR, PB, HG, SE, AG

Explosives = HMX, RDX, 2,4,6 TNT, 2,6 DNT, 2,4 DNT, PETN (see COE procedures)

Matrix:
S - Soil
SE - Sediment
SO - Solid
W - Water
O - Oil
A - Air
WI - Wipe
DS - Drum Solids
DL - Drum Liquids
F - Fish
X - Other

Special Instructions: QC = Tier II
Del = Std.

Item/Reason	Relinquished by	Received by	Date	Time	Item/Reason	Relinquished by	Received by	Date	Time
	[illegible]	[illegible]	11/21/88	9:30 am					

WESTON Analytics Use Only

Samples Were:
1 Shipped or Hand-Delivered
NOTES:

2 Ambient or Chilled
NOTES:

3 Received Broken/Leaking (Improperly Sealed)
Y N
NOTES:

4 Properly Preserved
Y N
NOTES:

5 Received Within Holding Times
Y N
NOTES:

COC Tape Was:
1 Present on Outer Package Y N
2 Unbroken on Outer Package Y N
3 Present on Sample Y N
4 Unbroken on Sample Y N
NOTES:

COC Record Was:
1 Present Upon Receipt of Samples Y N

Discrepancies Between Sample Labels and COC Record? Y N
NOTES:

RFW 21-21-001/A-7/88

7-115

WESTON
MANAGERS DESIGNERS/CONSULTANTS
208 WELSH POOL ROAD
PICKERING CREEK INDUSTRIAL PARK
LIONVILLE, PA 19353
PHONE: (215) 524-7360
TELEX: 83-5348

17 January 1989

Ms. Deborah Simone
Metcalf & Eddy
P.O. Box 4043
Woburn,MA 01888-4043

Subject: **Data Reports for Seneca Project**

Dear Deborah:

Attached are the analytical data reports for the metals analyses performed on Seneca water samples received November 18, 19, 21, 1988.

This should complete the analytical requirements for these samples. I have spoken to our Unit Leader for petroleum hydrocarbons regarding the data reported for 8811L522, and he is now in the process of reviewing the raw data and calculations.

Please give me a call if you should have any questions regarding the enclosed information.

Very truly yours,

ROY F. WESTON, INC.

Sharon Nordstrom

Sharon A. Nordstrom
Project Manager
Analytics Division

SAN/gjk

Enclosure:

ROY F. WESTON INC.
LIONVILLE LABORATORY

CLIENT: METCALF & EDDY
RFW #: 8811L547
W.O. #: 0010-10-11-0000

SAMPLES RECEIVED: 11-19-88

METALS NARRATIVE

The following is a summary of the quality control results and a description of any problems encountered during the analysis of this batch of samples:

1. All sample holding times as required by 40CFR136 were met for water samples. Note: Holding times for soil samples have not been promulgated by the USEPA.

2. All calibration verification checks were within the required control limits of 90-110% (85-115% for Hg). Calibration verification is performed using an independent standard purchased from Inorganic Ventures, Inc.

3. All preparation blanks were analyzed below the required detection limit.

4. All laboratory control standards were within the control limits of 80-120%.

   Note: The USEPA-CLP has dropped control limits for silver and antimony due to documented difficulties in obtaining reliable results. WESTON Analytics has adopted the same policy.

5. Matrix spike recoveries for silver, arsenic, cadmium and selenium were outside of the 75-125% guidance limits. This may be due to an interference present in the sample matrix and/or sample inhomogeneity.

6. Replicate results were within the 20% guidance limit.

7. The analytical methods applied by the laboratory for the determination of metals, are:

As	EPA 206.2	Hg	EPA 245.1
Se	EPA 270.2	ICP Scan	EPA 200.7
Pb	EPA 239.2	All others	EPA 200.7
Tl	EPA 279.2	EP Leachates (except Hg)	200.7

ROY F. WESTON, INC.
Lionville Laboratory

GLOSSARY OF TERMS - INORGANIC REPORTS

DATA QUALIFIERS

U - Indicates that the parameter was not detected at or above the reported limit. The associated numerical value is the sample detection limit.

* - Indicates that the original sample result is greater than 4x the spike amount added. The USEPA-CLP has determined that spike results on samples were this occurs may be unreliable and, therefore, the control limits are not applicable.

ABBREVIATIONS

MB - Method or preparation blank.
MS - Matrix Spike.
MSD - Matrix Spike Duplicate.
REP - Sample Replicate.
LC - Indicates a method LCS or Blank Spike.
NC - Not calculable, result below the detection limit.

LABORATORY CHRONOLOGY AND HOLDTIME REPORT

The test code listed indicates the specific analysis or preparation procedure employed. The codes may be interpreted as follows:

MAAW - Metals prep test for AA digestion, water matrix.
MAAS - Metals prep test for AA digestion, soil matrix.
MICW - Metals prep test for ICP digestion, water matrix.
MICS - Metals prep test for ICP digestion, soil matrix.

M**TO - This type of code indicates a total metal analysis (eg. MAGTO indicates an analysis for total silver).

M**SO - This type of code indicates a soluble metal analysis (eg. MAGSO indicates an analysis for soluble silver).

M**EP - This type of code indicates an EP-Toxicity metals analysis (eg. MAGEP indicates an analysis for soluble silver).

I**TO - This type of code indicates a non-metallic total analysis. There is also a complimentary soluble analysis for each of these codes (eg. ICNTO indicates an analysis for total cyanide).

A suffix of -R or -S following these codes indicate a replicate or spike analysis, respectively.

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-001	3161-101	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	511		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	52.3		UG/L	10.0
		MERCURY, TOTAL	0.58		UG/L	0.20
		LEAD, TOTAL	104		UG/L	50.0
		SELENIUM, TOTAL	7.5		UG/L	5.0
-002	3161-102	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	21.5		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	38.9		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-003	3161-103	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	294		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	31.2		UG/L	10.0
		MERCURY, TOTAL	0.47		UG/L	0.20
		LEAD, TOTAL	100		UG/L	10.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-004	3161-105	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	19.3		UG/L	10.0
		BARIUM, TOTAL	440		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	55.8		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	83.2		UG/L	20.0
		SELENIUM, TOTAL	14.3		UG/L	5.0
-005	3161-106	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	859		UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	143		UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	106		UG/L	25.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-006	3161-108.	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-007	3161-112	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-008	3161-114	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-009	3161-124	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	13.3		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-010	3161-125	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.9		UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-011	3161-128	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
-012	3161-130	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS DATA SUMMARY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
-013	3161-132	SILVER, TOTAL	10.0	u	UG/L	10.0
		ARSENIC, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
		MERCURY, TOTAL	0.20	u	UG/L	0.20
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0

ROY F. WESTON INC.

INORGANICS METHOD BLANK DATA SUMMARY PAGE 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	RESULT		UNITS	REPORTING LIMIT
BLANK1	89I975-MB1	SILVER, TOTAL	10.0	u	UG/L	10.0
		BARIUM, TOTAL	200	u	UG/L	200
		CADMIUM, TOTAL	5.0	u	UG/L	5.0
		CHROMIUM, TOTAL	10.0	u	UG/L	10.0
BLANK1	89A974-MB1	ARSENIC, TOTAL	10.0	u	UG/L	10.0
		LEAD, TOTAL	5.0	u	UG/L	5.0
		SELENIUM, TOTAL	5.0	u	UG/L	5.0
BLANK1	88C171A-MB1	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK2	88C171A-MB2	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK3	88C171A-MB3	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK4	88C171A-MB4	MERCURY, TOTAL	0.20	u	UG/L	0.20
BLANK5	88C171A-MB5	MERCURY, TOTAL	0.20	u	UG/L	0.20

ROY F. WESTON INC.

INORGANICS ACCURACY REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	INITIAL RESULT	SPIKED AMOUNT	%RECOV	
-001	3161-101	SILVER, TOTAL	33.0	10.0 u	50.0	66.0	
		ARSENIC, TOTAL	28.6	10.0 u	40.0	71.5	
		BARIUM, TOTAL	2380	511	2000	93.3	
		CADMIUM, TOTAL	32.2	5.0 u	50.0	64.4	
		CHROMIUM, TOTAL	237	52.3	200	92.4	
		MERCURY, TOTAL	1.4	0.58	1.0	82.4	
		LEAD, TOTAL	137	104	20.0	165	*
		SELENIUM, TOTAL	3.8	7.5	10.0	-37.	

ROY F. WESTON INC.

INORGANICS DUPLICATE SPIKE REPORT 01/16/89

CLIENT: METCALF & EDDY
WORK ORDER: 0010-10-11-0000

WESTON BATCH #: 8811L547

SAMPLE	SITE ID	ANALYTE	SPIKE#1 %RECOV	SPIKE#2 %RECOV	%DIFF
LCS2	89I975-LC2	SILVER, LCS	114	114	0.39
		BARIUM, LCS	96.5	96.5	0.010
		CADMIUM, LCS	90.7	92.0	1.4
		CHROMIUM, LCS	91.3	91.0	0.33
LCS2	89A974-LC2	ARSENIC, LCS	110	110	0.60
		LEAD, LCS	91.0	87.0	4.5
		SELENIUM, LCS	100	102	1.3
LCS2	88C171A-LC2	MERCURY, LCS	89.8	86.6	3.6

ROY F. WESTON INC.

INORGANICS PRECISION REPORT 01/16/89

CLIENT: METCALF & EDDY WESTON BATCH #: 8811L547

WORK ORDER: 0010-10-11-0000

SAMPLE	SITE ID	ANALYTE	INITIAL RESULT	REPLICATE	% DIFF
-001REP	3161-101	SILVER, TOTAL	10.0 u	10.0 u	NC
		ARSENIC, TOTAL	10.0 u	10.0 u	NC
		BARIUM, TOTAL	511	549	7.2
		CADMIUM, TOTAL	5.0 u	5.0 u	NC
		CHROMIUM, TOTAL	52.3	56.6	7.9
		MERCURY, TOT	0.58	0.58	0.00
		LEAD, TOTAL	104	109	4.7
		SELENIUM, TOTAL	7.5	5.0 u	NC

ROY F. WESTON INC.

INORGANICS LABORATORY CONTROL STANDARDS REPORT 01/16/89

SAMPLE	SITE ID	ANALYTE	SPIKED SAMPLE	SPIKED AMOUNT	UNITS	%RECOV
LCS1	89I975-LC1	SILVER, LCS	572	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	227	250	UG/L	90.7
		CHROMIUM, LCS	456	500	UG/L	91.3
LCS2	89I975-LC2	SILVER, LCS	570	500	UG/L	114
		BARIUM, LCS	4820	5000	UG/L	96.5
		CADMIUM, LCS	230	250	UG/L	92.0
		CHROMIUM, LCS	455	500	UG/L	91.0
LCS1	89A974-LC1	ARSENIC, LCS	32.9	30.0	UG/L	110
		LEAD, LCS	27.3	30.0	UG/L	91.0
		SELENIUM, LCS	30.1	30.0	UG/L	100
LCS2	89A974-LC2	ARSENIC, LCS	33.1	30.0	UG/L	110
		LEAD, LCS	26.1	30.0	UG/L	87.0
		SELENIUM, LCS	30.5	30.0	UG/L	102
LCS1	88C171A-LC1	MERCURY, LCS	0.36	0.4	UG/L	89.8
LCS2	88C171A-LC2	MERCURY, LCS	1.7	2.0	UG/L	86.6
LCS3	88C171A-LC3	MERCURY, LCS	3.4	4.0	UG/L	84.5
LCS4	88C171A-LC4	MERCURY, LCS	6.9	8.0	UG/L	86.2
LCS5	88C171A-LC5	MERCURY, LCS	2.0	2.0	UG/L	100

MRD LAB NO. 89/431

DEPARTMENT OF THE ARMY
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS
DIVISION LABORATORY
OMAHA, NEBRASKA 68102

03 MAY 1989

Subject: QA/QC Final Report

Project: Seneca Army Depot, Romulus, New York
Intended Use: Army IRP Site-Closure of 9 burning pads
Source of Material:

Submitted by: Pradip Dalal, CEMRK-ED-TD
Date Sampled: , Date Received: 18 Nov thru 21 Nov 88
Method of Test or Specification: See attached Tables 1-10

References: Kansas City District Request No MIL 89-17 dated 28 Nov 88

-- REMARKS --

1. Overall Evaluation: The Quality Assurance data agrees with the Contractor's data. Additional samples were received that were not specified in the revised Scope of Work dated 12 Sept 88. The Contractor's quality control data were acceptable.

2. Contractor Data Evaluation: Proper Quality Control procedures were followed and documented in most cases. The Contractor performed analyses using the EPA methods called for in the contract document. Most of the QC data on matrix spike recoveries for metals, explosives and total recoverable petroleum hydrocarbons (TRPH) indicated recoveries that were within specified limits. There were two extremes where the recoveries of lead and selenium were 165% and -37% respectively, well outside the specified limits. Most of the QC data for matrix spike duplicate recoveries for metals, explosives and TRPH indicated acceptable recoveries and acceptable relative percent differences (RPDs). Most of the QC data for field duplicates on metals, explosives and TRPH indicated acceptable RPDs with exceptions such as a RPD of 150% for silver and a RPD of 79% for 2,4,6 TNT. The data reported for lab duplicates (replicates) were for metals only and most of the RPDs were below the Contractor's objective, a maximum of 20%. Selenium in one case had a RPD of 40% which is outside the Contractor's objective. The QC data for Laboratory (Method) blanks for metals, explosives and TRPH indicated contaminations below the instrument detection limits. The QC data for trip and field blanks indicated analytes below instrument detection limits with the exception of sample EB#2;3161-126 where the contractor reported TRPH of 1.7 mg/L.

Solsky/lav/444-4304

3. QA/QC Data Comparison: All of the data on metals, explosives and total recoverable petroleum hydrocarbons (TRPH) agreed.

4. Other Problems: Scopes of Work should be written such that the contents of the Final Data Report are very carefully defined. Several laboratory QC criteria items were not included in the Final Data Package. One additional well sample, three additional equipment blank samples and four travel blank samples were received by the QA Lab than originally specified in the Scope of Work dated 12 Sept 88.

5. Corrective Action: Telephone calls were made to Kansas City District chemists (CEMEK-ED-TD) to alert them to the additional samples being received.

Submitted by

R. K. SCHLENKER, P.E.
Director, MRD Laboratory

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: Well #19; 3161-119
Material Description: Water
Contractor's Sample ID.: MW-10; 3161-110
Date Sampled: 16 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	<1	<1.0	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	<5	<5.0	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	1.80	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

Table 2

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: TB #2; 3161-135
Material Description: Water

Contractor's Sample ID.: 3161-134
Date Sampled: 16 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	-	<1.0	mg/L

COMMENTS:
-: Not analyzed or not reported.

Table 3 .

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: Well #23; 3161-123
Material Description: Water

Contractor's Sample ID.: MW-17; 3161-117
Date Sampled: 17 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	4	<1.0	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	10	9.9	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	<0.78	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: Well #21; 3161-121
Material Description: Water
Contractor's Sample ID.: MW-11; 3161-111
Date Sampled: 17 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	-	<1.0	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	17	9.0	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	<0.78	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

Table 5

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: EB #2; 3161-127
Contractor's Sample ID.: 3161-126
Material Description: Water
Date Sampled: 17 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	1	1.7	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	<5	<5.0	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	<0.78	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: TB #4; 3161-137
Material Description: Water

Contractor's Sample ID.: 3161-136
Date Sampled: 17 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	-	<1.0	mg/L

COMMENTS:
-: Not analyzed or not reported.

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: EB #6; 3161-131
Material Description: Water
Contractor's Sample ID.: 3161-130
Date Sampled: 18 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	2	<1.0	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	<5	<5.0	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	<0.78	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: EB #8; 3161-133
Material Description: Water

Contractor's Sample ID.: 3161-132
Date Sampled: 18 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	<1	<1.0	mg/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
METALS							
Arsenic	<10	<10.0	ug/L	Lead	<5	<5.0	ug/L
Barium	<200	<200	ug/L	Mercury	<0.2	<0.20	ug/L
Cadmium	<5	<5.0	ug/L	Selenium	<5	<5.0	ug/L
Chromium	<10	<10.0	ug/L	Silver	<10	<10.0	ug/L

Analysis	QA Lab Result	Contractor Result	Units	Analysis	QA Lab Result	Contractor Result	Units
EXPLOSIVES							
HMX	<15.3	<1.30	ug/L	2Am-DNT	<7	-	ug/L
RDX	<13.9	<0.63	ug/L	2,6-DNT	<9.4	<0.55	ug/L
TNB	<7.3	-	ug/L	2,4-DNT	<5.7	<0.60	ug/L
DNB	<4.0	-	ug/L	o-NT	<11.7	-	ug/L
Tetryl	<43.6	<0.66	ug/L	m-NT	<7.9	-	ug/L
NB	<6.4	-	ug/L	p-NT	<8.5	-	ug/L
TNT	<6.9	<0.78	ug/L	PETN	-	<4.5	ug/L

COMMENTS: Data agreed.
-: Not analyzed or not reported.

Table 10 .

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
Division Laboratory
Omaha, Nebraska

COMPARISON OF QA & CONTRACTOR RESULTS

Project: Seneca Army Depot, Romulus, New York
QA Sample ID.: TB #6; 3161-139
Material Description: Water

Contractor's Sample ID.: 3161-138
Date Sampled: 18 Nov 88

Analysis	QA Lab Result	Contractor Result	Units
MISCELLANEOUS			
TRPH	-	<1.0	mg/L

COMMENTS: -: Not analyzed or not reported.

Y 1

PETN, HMX, AND RDX IN WATER SAMPLES

1. APPLICATION

This method is applicable to the quantitative analysis of environmental water samples for PETN, HMX, and RDX.

A. TESTED CONCENTRATION RANGE

The tested concentration ranges in natural and standard water are listed below:

Analyte	Range (ug/L)
PETN	1.58 to 31.6
HMX	0.43 to 8.5
RDX	1.26 to 25.2

B. SENSITIVITY

The normalized responses (integrator counts) at the natural water detection limits designated in Section 1(C) are listed below:

Analyte	Integrator Counts	Nanograms
PETN	37700	281.1
HMX	121000	143.7
RDX	173000	256.2

The normalized responses (integrator counts) at the standard water detection limits designated in Section 1(C) are listed below:

Analyte	Integrator Counts	Nanograms
PETN	27179	213.1
HMX	96096	110.4
RDX	68495	91.1

C. DETECTION LIMIT

The detection limits in natural water, calculated according to Hubaux and Vos (1970), are listed below:

Analyte	Detection Limit (ug/L)
PETN	4.5
HMX	2.3
RDX	4.1

The detection limits in standard water, calculated according to Hubaux and Vos (1970), are listed below:

Analyte	Detection Limit (ug/L)
PETN	3.4
HMX	1.8
RDX	1.5

D. INTERFERENCES

This method may be subject to interferences from nonvolatile organic compounds which absorb light at 215 nm and are extractable from water with methylene chloride.

E. ANALYSIS RATE

After instrument calibration, one analyst can analyze 10 extracts in an 8-hour day. One analyst can perform approximately eight extractions in an 8-hour day.

2. CHEMISTRY

A. ALTERNATE NOMENCLATURE AND CHEMICAL ABSTRACT SERVICE (CAS) REGISTRY NUMBER

Analyte	Alternate Nomenclature	CAS Registry Number
PETN	Pentaerythrite tetranitrate	78-11-5
	Pentaerythritol tetranitrate	
	2,2-Bis[(nitrooxy)-methyl]-1,3-Propanediol dinitrate (ester)	
	Nitropentaerythritol	
	Pentrit	
HMX	Cyclotetramethylenetetranitramine	2691-41-0
	Octahydro-1,3,5,7-tetrazocine	
	1,3,5,7-Tetranitro-1,3,5,7-tetrazacyclooctane	
	Octogen	
RDX	Cyclotrimethylenetrinitramine	121-84-4
	Hexogen, T-4, Cyclonite, Hexahydro-1,3,4-trinitro-s-triazine	

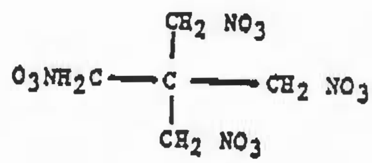
B. PHYSICAL AND CHEMICAL PROPERTIES OF ANALYTE

Analyte	Formula	Melting Point (°C)	Boiling Point	Density (g/ml)
PETN	$C_5H_8N_4O_{12}$	141	180 at 50 torr	1.77
HMX	$C_4H_8N_8O_8$	276	—	1.77-1.96*
RDX	$C_3H_6N_6O_6$	204.1	—	1.816

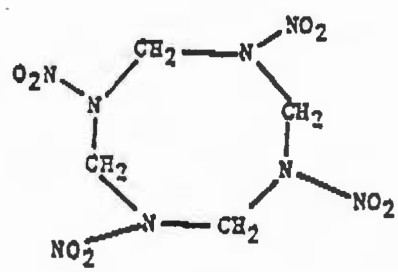
* There are four polymorphic forms of HMX with this range of densities.

Chemical Structures

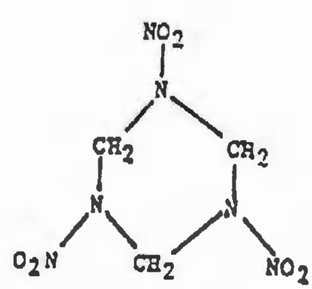
PETN



HMX



RDX



C. CHEMICAL REACTIONS

All of these compounds are highly explosive, and caution should be used in handling. Each compound is subject to alkaline hydrolysis in aqueous solution.

3. APPARATUS

A. INSTRUMENTATION

Altex Model 322 dual-pump liquid chromatograph equipped with a Perkin-Elmer LC-75 variable-wavelength detector interfaced to a Spectra Physics Model 4100 computing integrator.

B. HPLC INSTRUMENTAL PARAMETERS

1. Detector: Perkin-Elmer LC-75 variable-wavelength detector (λ = 215 nm)
2. Column: Zorbax-CN (4.6-mm ID x 25 cm)
   Particle size: 7-8 um
3. Flow Rate/Mobile Phase: 1 ml/min/35% H_2O/65% methanol
4. Temperature: 22°C
5. Injection Volume: 250 ul, fixed loop
6. Retention Times:

Analyte	Retention Time (Minutes)
RDX	7.8
HMX	11.8
PETN	13.9

C. HARDWARE/GLASSWARE

1. 1-liter separatory funnel (Teflon® or glass) (8).
2. 500-ml K-D flask (8).
3. 15-ml K-D receiver (8).
4. 3-ball Snyder column (8).
5. 2-ball micro-Snyder column (8).
6. 10-ml graduated centrifuge tubes (8).
7. Disposable glass pipettes.

D. CHEMICALS

1. Nanograde methylene chloride--J.T. Baker Company.
2. HPLC-grade acetonitrile--J.T. Baker Company.
3. HPLC-grade water--J.T. Baker Company.
4. Anhydrous sodium sulfate--reagent grade.
5. HPLC-grade methanol.

4. STANDARDS

A. CALIBRATION STANDARDS

Separate calibration stock solutions are prepared for each analyte. A composite working calibration standard is prepared from these solutions.

1. The RDX stock calibration standard (6,310 ug/ml) is prepared by weighing 63.1 mg of RDX in a 10-ml volumetric flask, dissolving the RDX in a few ml of acetonitrile, and diluting to the mark with acetonitrile. An intermediate RDX stock calibration standard is prepared by pipetting 1 ml of the RDX stock calibration standard into a 100-ml volumetric flask and diluting to the mark with methanol to give a solution containing 63.1 ug/ml of RDX.
2. The HMX stock calibration standard (5,320 ug/ml) is prepared by weighing 53.2 mg of HMX in a 10-ml volumetric flask, dissolving the HMX in a few ml of acetonitrile (a drop of acetone is added to aid in solubilization), and diluting to the mark with acetonitrile. An intermediate HMX stock calibration standard is prepared by pipetting 1 ml of the HMX stock calibration standard into a 50-ml volumetric flask and diluting to the mark with methanol to give a solution containing 106.4 ug/ml of HMX.
3. The PETN stock calibration standard (3,950 ug/ml) is prepared by weighing 39.5 mg of PETN in a 10-ml volumetric flask, dissolving the PETN in a few ml of acetonitrile (a drop of acetone is added to aid in solubilization), and

diluting to the mark with acetonitrile. An intermediate PETN stock calibration standard is prepared by pipetting 1 ml of the PETN stock calibration standard into a 50-ml volumetric flask and diluting to the mark with methanol to give a solution containing 79.0 ug/ml of PETN.

4. Prepare a series of composite working calibration standards by making dilutions of the intermediate calibration standards with 50% methanol/50% water as follows:

Working Calibration Standard	Intermediate Standard Diluted	Volume of Standard Used (ml)	Final Volume (ml)
B	RDX	5	50
	HMX	1	
	PETN	5	
C	RDX	5	100
	HMX	1	
	PETN	5	
D	Standard B	5	25
E	Standard B	5	50
F	Standard B	5	100

Working Calibration Standard	Concentration (ug/ml)		
	RDX	HMX	PETN
B	6.31	2.13	7.90
C	3.15	1.06	3.95
D	1.26	0.426	1.58
E	0.631	0.213	0.790
F	0.315	0.106	0.395

B. CONTROL SPIKES

1. The working control spike solutions are prepared in the same manner as the working calibration standards using the same letter designations for the different solutions; therefore,

the Working Control Spike Solution B has the same concentration as the Working Calibration Standard B.

2. Pipette 2 ml of the corresponding working control spike solutions into 500 ml of standard or natural water. The solutions used are selected to provide a concentration range of 0.5 to 10 times the desired detection limit.
3. Determine the precision, accuracy, and detection limits for each analyte.

Working Control Spike Used	Analyte Concentration in the Working Control Spike Solution (ug/ml)		Spiked Analyte Concentration in Water (ug/L)
--		--	0.0
B	RDX	6.31	25.2
	HMX	2.13	8.5
	PETN	7.90	31.6
C	RDX	3.15	12.6
	HMX	1.06	4.26
	PETN	3.95	15.8
D	RDX	1.26	5.04
	HMX	0.426	1.70
	PETN	1.58	6.32
E	RDX	0.631	2.52
	HMX	0.213	0.851
	PETN	0.790	3.16
F	RDX	0.315	1.26
	HMX	0.106	0.426
	PETN	0.395	1.58

5. PROCEDURE

A. EXTRACTION

1. Measure 500 ml of the water sample into a 1-L separatory funnel.
2. Check the pH of the sample with pH paper, and adjust the pH to neutral, if necessary.

3. Extract the sample sequentially with three 100-ml portions of methylene chloride. After each portion has been added, shake the funnel vigorously for at least 5 minutes.
4. Let the layers separate for about 2 minutes after each extraction.
5. Draw off the methylene chloride and pass through a glass funnel filled with a small plug of glass wool and about 1 inch of anhydrous sodium sulfate into a 500-ml K-D flask fitted with a 10-ml K-D receiver.
6. After the third extract has been transferred to the K-D flask, rinse the sodium sulfate in the funnel with approximately 20 ml of methylene chloride.
7. Add a boiling chip (Hengar) to the methylene chloride extract in the flask and attach a 3-ball Snyder column to the apparatus.
8. Concentrate the methylene chloride extract by placing the K-D apparatus in an 80°C water bath. Immerse the receiver of the K-D nearly up to the joint.
9. The balls of the Snyder column should actively chatter when the solvent is evaporating.
10. When the apparent volume of the solution remaining in the receiver is about 1 ml, remove the apparatus from the water bath and allow to cool. After about 1 ml of methylene chloride has drained into the receiver, remove the receiver from the K-D flask.
11. Add approximately 2 ml of HPLC methanol to the receiver. Attach a 2-ball micro-Snyder column and reconcentrate. When the apparent volume in the receiver reaches 0.5 ml, remove the receiver from the water bath.
12. Repeat Step 11 two times.
13. Detach the micro-Snyder column from the receiver. Transfer the extract into a 10-ml graduated centrifuge tube rinsing quantitatively with HPLC acetonitrile. Raise the extract

volume to 1.0 ml in the centrifuge tube with HPLC methanol. Dilute to 2 ml with HPLC water.

14. Transfer to a 5-ml amber, septum-sealed vial for storage at 4°C.
15. The extract is now ready for chromatography by HPLC.

B. CALIBRATION

1. Inject Working Calibration Standards G, F, E, D, C, and B and a blank singly at the beginning of the analytical run. Inject Working Calibration Standard D at the conclusion of the analytical run to verify constant instrument response.
2. Plot the normalized integrator areas versus nanograms/microliter of each standard to obtain a working curve.

C. ANALYSIS

1. Inject 250 ul of the extract onto the HPLC column.
2. Perform the analysis of the sample according to the conditions given in Section 3(B).
3. Measure the response of the sample for the components of interest.

6. CALCULATIONS

Determine the concentration of RDX according to the following formula:

$$\text{Concentration (ug/L)} = \frac{(A)(V_t)}{V_s}$$

where: A = Concentration (ug/ml) of analyte found in the sample by comparison with the appropriate standard curve (ug/ml),

V_t = Volume of total extract (ml), and

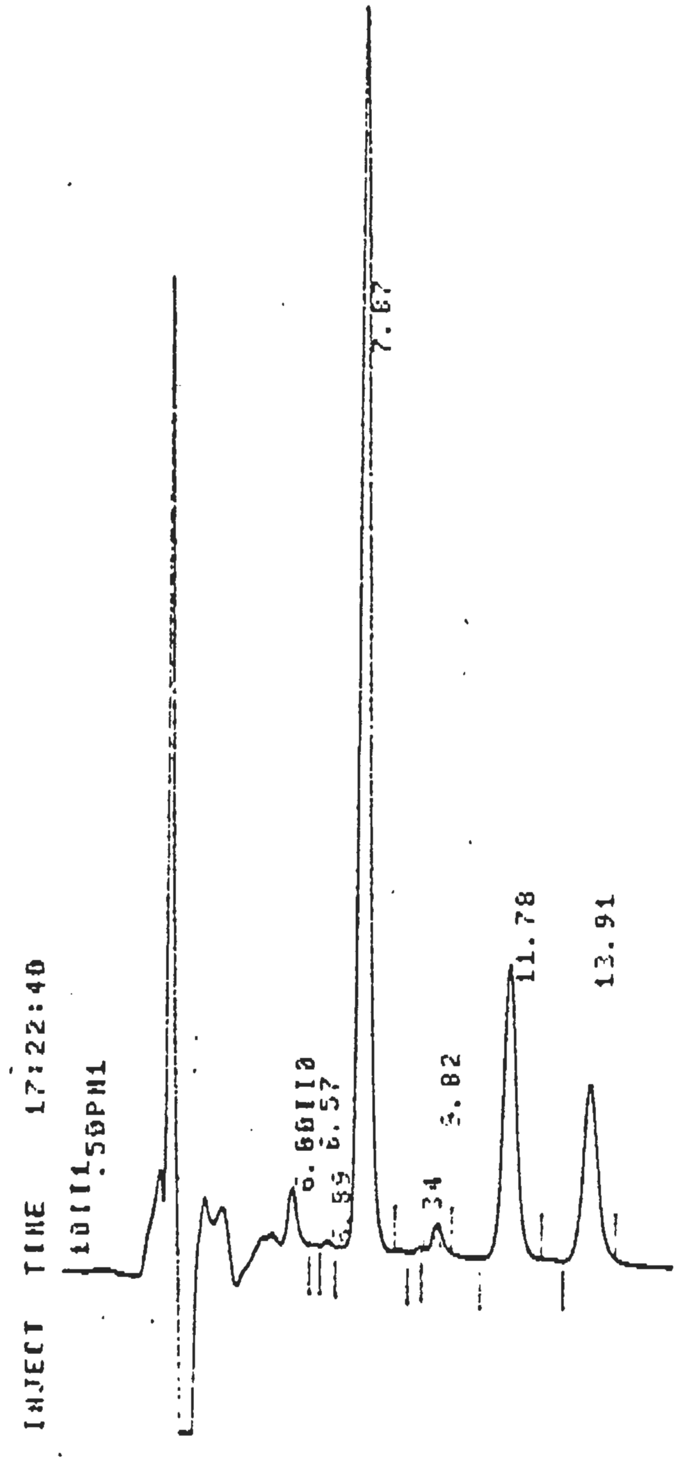
V_s = Volume of initial sample extracted (L).

7. REFERENCES

None found.

8. DATA

See attached data sheets.



Chromatogram of Standard Water Spiking Experiment

Analyte	Amount Spiked	Retention Time
RDX	12.6 ug/L	7.87 min
HMX	4.3 ug/L	11.78 min
PETN	15.8 ug/L	13.91 min

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
				SAMPLING SITES RESULTS						
ARSENIC	05 JAN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
ARSENIC	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
ARSENIC	29 JUN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
ARSENIC	28 SEP 82	.010	MGL	ND		ND	ND	ND	ND	
BARIUM	05 JAN 82	.10	MGL	ND	ND	ND	ND	ND	ND	ND
BARIUM	13 APR 82	.10	MGL	ND	ND	ND	ND	ND	ND	ND
BARIUM	29 JUN 82	.10	MGL	ND	ND	ND	ND	ND	ND	ND
BARIUM	28 SEP 82	.10	MGL	ND		ND	ND	ND	ND	
CADMIUM	05 JAN 82	5.000	UGL	ND	ND	ND	ND	ND	ND	ND
CADMIUM	13 APR 82	5.000	UGL	ND	ND	ND	ND	ND	ND	ND
CADMIUM	29 JUN 82	5.000	UGL	ND	ND	ND	ND	ND	ND	ND
CADMIUM	28 SEP 82	5.000	UGL	ND		ND	ND	ND	ND	
CHROMIUM	05 JAN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	29 JUN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
CHROMIUM	28 SEP 82	.010	MGL	ND		ND	ND	ND	ND	
FLUORIDE	05 JAN 82	.1	MGL	.3	2	.3	.1	.2	.1	.3
FLUORIDE	13 APR 82	.1	MGL	.3	.2	.2	.2	.2	.1	.2
FLUORIDE	29 JUN 82	.1	MGL	.4	.2	.2	.2	.2	.2	.3
FLUORIDE	28 SEP 82	.1	MGL	.3	.2	.2	.2	.2	.2	
LEAD	05 JAN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
LEAD	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
LEAD	29 JUN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
LEAD	28 SEP 82	.010	MGL	ND		ND	ND	ND	ND	
MERCURY	05 JAN 82	.2	UGL	ND	ND	ND	ND	ND	ND	ND
MERCURY	13 APR 82	.2	UGL	ND	ND	ND	ND	ND	ND	ND
MERCURY	29 JUN 82	.2	UGL	ND	ND	ND	ND	ND	ND	ND
MERCURY	28 SEP 82	.2	UGL	ND	ND	ND	ND	ND	ND	
NO2+NO3 AS N	05 JAN 82	.05	MGL	6.70	.71	1.20	1.60	.08	ND	.22
NO2+NO3 AS N	13 APR 82	.05	MGL	5.00	.49	1.00	1.00	.13	ND	.38
NO2+NO3 AS N	29 JUN 82	.05	MGL	6.00	.52	2.00	2.00	.06	ND	.30
NO2+NO3 AS N	28 SEP 82	.05	MGL	10.00	.12	3.00	2.00	.08	ND	
SELENIUM	05 JAN 82	.005	MGL	ND	ND	ND	ND	ND	ND	ND
SELENIUM	13 APR 82	.005	MGL	ND	ND	ND	ND	ND	ND	ND
SELENIUM	29 JUN 82	.005	MGL	ND	ND	ND	ND	ND	ND	ND
SELENIUM	28 SEP 82	.005	MGL	ND		ND	ND	ND	ND	
SILVER	05 JAN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
SILVER	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
SILVER	29 JUN 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
SILVER	28 SEP 82	.010	MGL	ND		ND	ND	ND	ND	
ENDRIN	05 JAN 82	.04	UGL	ND	ND	ND	ND	ND	ND	ND

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	SAMPLING SITES RESULTS B W5	W4	W6	W1	W3	W2	W7
ENDRIN	13 APR 82	40.00	UGL	ND	ND	ND	ND	ND	ND	ND
ENDRIN	29 JUN 82	.04	UGL	ND	ND	ND	ND	ND	ND	ND
ENDRIN	28 SEP 82	.04	UGL	ND		ND	ND	ND	ND	
LINDANE	05 JAN 82	.08	UGL	ND	ND	ND	ND	ND	ND	ND
LINDANE	13 APR 82	.08	UGL	ND	ND	ND	ND	ND	ND	ND
LINDANE	29 JUN 82	.08	UGL	ND	ND	ND	ND	ND	ND	ND
LINDANE	28 SEP 82	.08	UGL	ND		ND	ND	ND	ND	
TOXAPHENE	05 JAN 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	13 APR 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	29 JUN 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
TOXAPHENE	28 SEP 82	1.6	UGL	ND		ND	ND	ND	ND	
METHOXYCHLOR	05 JAN 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
METHOXYCHLOR	13 APR 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
METHOXYCHLOR	29 JUN 82	1.6	UGL	ND	ND	ND	ND	ND	ND	ND
METHOXYCHLOR	28 SEP 82	1.6	UGL	ND		ND	ND	ND	ND	
2,4-D	05 JAN 82	3.8	UGL	ND	ND	ND	ND	ND	ND	ND
2,4-D	13 APR 82	3.8	UGL	ND	ND	ND	ND	ND	ND	ND
2,4-D	29 JUN 82	3.8	UGL	ND	ND	ND	ND	ND	ND	ND
2,4-D	28 SEP 82	3.8	UGL	ND		ND	ND	ND	ND	
SILVEX	05 JAN 82	.5	UGL	ND	ND	ND	ND	ND	ND	ND
SILVEX	13 APR 82	.5	UGL	ND	ND	ND	ND	ND	ND	ND
SILVEX	29 JUN 82	.5	UGL	ND	ND	ND	ND	ND	ND	ND
SILVEX	28 SEP 82	.5	UGL	ND		ND	ND	ND	ND	
GROSS ALPHA	05 JAN 82	4.61	PCL	ND	ND	ND	ND	ND	4.14	ND
GROSS ALPHA	13 APR 82	3.37	PCL	3.33	ND	2.63	2.30	3.64	3.39	ND
GROSS ALPHA	29 JUN 82	6.49	PCL	4.81	4.26	5.99	ND	12.60	9.04	3.87
GROSS ALPHA	28 SEP 82	5.20	PCL	ND		ND	ND	ND		
RADIUM-226	28 JUN 82	.24	PCL			ND	.27	ND	ND	
RADIUM-226	28 SEP 82	.18	PCL	ND						
GROSS BETA	05 JAN 82	1.52	PCL	2.02	3.01	2.06	2.31	2.91	2.12	ND
GROSS BETA	13 APR 82	1.64	PCL	ND	1.60	ND	2.05	2.08	ND	ND
GROSS BETA	29 JUN 82	1.86	PCL	1.59	3.34	ND	1.62	1.96	1.99	ND
GROSS BETA	28 SEP 82	1.76	PCL	ND		1.22	1.85	3.14		
CHLORIDE	05 JAN 82	1.0	MGL	4.6	10.0	17.6	7.9	28.5	5.8	3.5
CHLORIDE	13 APR 82	1.0	MGL	4.0	9.0	3.0	7.0	46.0	4.9	2.0
CHLORIDE	29 JUN 82	1.0	MGL	9.0	9.0	11.0	12.0	51.0	10.0	7.0
CHLORIDE	28 SEP 82	1.0	MGL	1.0	ND	ND	3.0	11.2	6.0	
CHLORIDE	08 FEB 83	1.0	MGL	2.0	6.0	7.0	6.0	9.0	3.0	2.0
CHLORIDE	09 AUG 83	1.0	MGL	3.0	5.0	3.0		15.0	4.0	
CHLORIDE	14 FEB 84	2.0	MGL	ND	8.7	20.0	2.3	4.0	ND	ND
CHLORIDE	20 MAR 85	1.0	MGL		6.0	12.0	7.0	15.0	4.0	3.0

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD. NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES
RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
CHLORIDE	18 MAR 86	1.0	MGL	3.0	5.0	4.0	5.0	6.0	3.0	2.0
CHLORIDE	17 MAR 87	1.0	MGL	2.0	4.0	4.0	6.0	5.0	3.0	1.0
IRON	05 JAN 82	.02	MGL	.13	.15	.27	.15	.19	.10	.14
IRON	13 APR 82	.03	MGL	ND	.08	.09	.10	.10	.02	.10
IRON	29 JUN 82	.03	MGL	ND	.24	.26	.44#	.06	.09	.70#
IRON	28 SEP 82	.02	MGL	.12		.24	.19	.23	.09	
IRON	08 FEB 83	.02	MGL	.13	.10	.15	.09	.07	.06	.08
IRON	09 AUG 83	.02	MGL	.09	.16	.25		.07	.12	
IRON	14 FEB 84	.10	MGL	.15	.11	ND	ND	ND	ND	1.02#
IRON	20 MAR 85	.10	MGL		ND	ND	ND	ND	ND	ND
IRON	18 MAR 86	.03	MGL	ND	ND	.03	ND	ND	ND	ND
IRON	17 MAR 87	.10	MGL	ND	ND	ND	ND	ND	ND	ND
MANGANESE	05 JAN 82	.010	MGL	.270#	.040	.300#	ND	ND	.070#	.090#
MANGANESE	13 APR 82	.010	MGL	.100#	.060#	.040	.020	ND	.050	.030
MANGANESE	29 JUN 82	.001	MGL	.210#	.050	.020	.020	.030	.130#	.010
MANGANESE	28 SEP 82	.010	MGL	ND		ND	ND	.040	.160#	
MANGANESE	08 FEB 83	.010	MGL	.020	.120#	.020	ND	ND	.010	.010
MANGANESE	09 AUG 83	.001	MGL	.120#	.320#	.010		.020	.210#	
MANGANESE	14 FEB 84	.030	MGL	ND	ND	.035	ND	ND	ND	ND
MANGANESE	20 MAR 85	.030	MGL		.085#	.045	ND	ND	.038	ND
MANGANESE	18 MAR 86	.010	MGL	ND	.120#	ND	ND	ND	ND	ND
MANGANESE	17 MAR 87	.030	MGL	.078#	.275#	ND	ND	ND	ND	ND
PHENOL	05 JAN 82	.01	MGL	ND	ND	ND	ND	ND	ND	ND
PHENOL	13 APR 82	.01	MGL	ND	ND	ND	ND	ND	ND	ND
PHENOL	29 JUN 82	.01	MGL	ND	ND	ND	.01&	ND	ND	ND
PHENOL	28 SEP 82	.01	MGL	.01&	.01&	ND	.02&	ND	.01&	
PHENOL	08 FEB 83	.01	MGL	ND	ND	ND	ND	ND	ND	ND
PHENOL	09 AUG 83	.01	MGL	ND	ND	ND		ND	ND	
PHENOL	14 FEB 84	.01	MGL	ND	ND	ND	ND	ND	ND	ND
PHENOL	20 MAR 85	.01	MGL		ND	ND	ND	ND	ND	ND
PHENOL	18 MAR 86	.01	MGL	ND	ND	ND	ND	ND	ND	ND
PHENOL	17 MAR 87	.01	MGL	ND	ND	ND	ND	ND	ND	ND
SODIUM	05 JAN 82	1.	MGL	15.	28.	20.	15.	14.	22.	12.
SODIUM	13 APR 82	1.	MGL	10.	37.	8.	11.	15.	21.	10.
SODIUM	29 JUN 82	1.	MGL	12.	11.	9.	15.	20.	24.	8.
SODIUM	28 SEP 82	1.	MGL	12.		9.	8.	10.	16.	
SODIUM	08 FEB 83	1.	MGL	21.	37.	11.	12.	8.	15.	7.
SODIUM	09 AUG 83	1.	MGL	16.	36.	11.		9.	15.	
SODIUM	14 FEB 84	1.	MGL	7.	7.	16.	5.	4.	14.	3.
SODIUM	20 MAR 85	1.	MGL		23.	24.	9.	7.	9.	2.
SODIUM	18 MAR 86	1.	MGL	8	20.	30.	7.	5.	6.	4.

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
SODIUM	17 MAR 87	1.	MGL	8.	30.	14.	11.	6.	9.	4.
SULFATE	05 JAN 82	2.0	MGL	57.5	327.0&	38.8	233.0	147.0	225.0	77.0
SULFATE	13 APR 82	2.0	MGL	110.0	330.0&	100.0	220.0	210.0	263.0&	84.0
SULFATE	29 JUN 82	2.0	MGL	110.0	150.0	100.0	260.0&	220.0	293.0&	70.0
SULFATE	28 SEP 82	2.0	MGL	130.0	81.0	88.0	180.0	194.0	280.0&	
SULFATE	08 FEB 83	2.0	MGL	93.0	600.0&	110.0	210.0	180.0	200.0	74.0
SULFATE	09 AUG 83	2.0	MGL	129.0	333.0&	106.0		215.0	203.0	
SULFATE	14 FEB 84	2.0	MGL	51.0	117.0	130.0	119.0	148.0	108.0	7.3
SULFATE	20 MAR 85	2.0	MGL		306.0&	231.0	231.0	194.0	180.0	47.0
SULFATE	18 MAR 86	2.0	MGL	77.0	283.0&	63.0	248.0	148.0	117.0	57.0
SULFATE	17 MAR 87	2.0	MGL	24.0	255.0&	67.0	160.0	56.0	6.0	27.0
COND(FIELD)	20 MAR 85	1.	UMC		680.	440.	540.	550.	490.	270.
COND(FIELD)	18 MAR 86	1.	UMC	415.	650.	315.	460.	440.	340.	240.
COND(FIELD)	18 MAR 86	1.	UMC	415.	645.	320.	460.	440.	335.	240.
COND(FIELD)	18 MAR 86	1.	UMC	415.	650.	315.	460.	450.	335.	240.
COND(FIELD)	18 MAR 86	1.	UMC	415.	645.	310.	460.	445.	335.	235.
COND(FIELD)	17 MAR 87	1.	UMC	380.	700.	400.	500.	445.	450.	310.
COND(FIELD)	17 MAR 87	1.	UMC	375.	705.	400.	495.	440.	445.	315.
COND(FIELD)	17 MAR 87	1.	UMC	370.	700.	405.	500.	445.	450.	315.
COND(FIELD)	17 MAR 87	1.	UMC	375.	695.	405.	500.	440.	440.	315.
PH(FIELD)	05 JAN 82		PH	7.3	7.2	7.5	7.2	7.4	7.3	7.1
PH(FIELD)	05 JAN 82		PH	7.3	7.2	7.5	7.2	7.4	7.3	7.1
PH(FIELD)	05 JAN 82		PH	7.3	7.2	7.5	7.2	7.4	7.3	7.1
PH(FIELD)	05 JAN 82		PH	7.3	7.2	7.5	7.2	7.4	7.3	7.1
PH(FIELD)	13 APR 82		PH	7.6	7.2	7.6	7.6	7.4	7.4	7.4
PH(FIELD)	13 APR 82		PH	7.6	7.2	7.6	7.6	7.4	7.4	7.4
PH(FIELD)	13 APR 82		PH	7.6	7.2	7.6	7.6	7.4	7.4	7.4
PH(FIELD)	13 APR 82		PH	7.6	7.2	7.6	7.6	7.4	7.4	7.4
PH(FIELD)	29 JUN 82		PH	7.8	7.8	7.8	8.1	7.7	7.8	7.8
PH(FIELD)	29 JUN 82		PH	7.8	7.8	7.8	8.1	7.7	7.8	7.8
PH(FIELD)	29 JUN 82		PH	7.8	7.8	7.8	8.1	7.7	7.8	7.8
PH(FIELD)	29 JUN 82		PH	7.8	7.8	7.8	8.1	7.7	7.8	7.8
PH(FIELD)	27 SEP 82		PH	7.6	7.9	7.7	7.5	7.5	7.6	
PH(FIELD)	27 SEP 82		PH	7.6	7.9	7.7	7.5	7.5	7.6	
PH(FIELD)	27 SEP 82		PH	7.6	7.9	7.7	7.5	7.5	7.6	
PH(FIELD)	27 SEP 82		PH	7.6	7.9	7.7	7.5	7.5	7.6	
PH(FIELD)	08 FEB 83		PH	7.8	7.3	7.8	7.5	7.5	7.7	7.6
PH(FIELD)	08 FEB 83		PH	7.8	7.3	7.8	7.5	7.5	7.7	7.6
PH(FIELD)	08 FEB 83		PH	7.8	7.3	7.8	7.5	7.5	7.7	7.6
PH(FIELD)	08 FEB 83		PH	7.8	7.3	7.8	7.5	7.5	7.7	7.6
PH(FIELD)	09 AUG 83		PH	7.1	6.9	6.9		7.0	7.1	

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES
RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
PH(FIELD)	09 AUG 83		PH	7.1	6.9	6.9		7.0	7.1	
PH(FIELD)	09 AUG 83		PH	7.1	6.9	6.9		7.0	7.1	
PH(FIELD)	09 AUG 83		PH	7.1	6.9	6.9		7.0	7.1	
PH(FIELD)	14 FEB 84		PH	7.3	6.8	7.2	7.3	7.4	7.4	7.5
PH(FIELD)	14 FEB 84		PH	7.3	6.9	7.2	7.3	7.4	7.5	7.5
PH(FIELD)	14 FEB 84		PH	7.4	6.8	7.3	7.3	7.4	7.4	7.6
PH(FIELD)	14 FEB 84		PH	7.3	6.9	7.3	7.3	7.5	7.4	7.6
PH(FIELD)	27 JUN 84		PH	7.0	6.8	7.1	7.1	7.0	7.1	7.1
PH(FIELD)	18 SEP 84		PH	8.4	7.5	7.6	7.6	7.5	7.1	7.6
PH(FIELD)	18 SEP 84		PH	8.3	7.6	7.5	7.7	7.4	7.1	7.5
PH(FIELD)	18 SEP 84		PH	8.4	7.6	7.5	7.7	7.4	7.1	7.5
PH(FIELD)	18 SEP 84		PH	8.3	7.5	7.6	7.6	7.4	7.2	7.5
PH(FIELD)	20 MAR 85		PH		6.8	6.9	6.7	6.8	7.0	7.0
PH(FIELD)	13 SEP 85		PH	7.1		7.1	7.1	7.1	7.0	
PH(FIELD)	18 MAR 86		PH	7.1	6.8	7.4	7.2	7.0	7.2	7.3
PH(FIELD)	18 MAR 86		PH	7.1	6.9	7.4	7.3	7.1	7.3	7.3
PH(FIELD)	18 MAR 86		PH	7.1	6.8	7.4	7.2	7.0	7.3	7.3
PH(FIELD)	18 MAR 86		PH	7.1	6.8	7.4	7.1	7.0	7.2	7.3
PH(FIELD)	16 SEP 86		PH	7.1	7.0	7.4	6.9	7.0	7.0	7.2
PH(FIELD)	17 MAR 87		PH	6.9	7.3	7.4	6.9	7.2	7.1	6.9
PH(FIELD)	17 MAR 87		PH	7.0	7.2	7.4	6.8	7.1	7.0	7.0
PH(FIELD)	17 MAR 87		PH	6.8	7.1	7.5	6.9	7.1	6.9	6.8
PH(FIELD)	17 MAR 87		PH	6.9	7.2	7.4	6.9	7.1	6.9	6.9
PH(LAB)	14 FEB 84		PH	7.9	7.7	7.8	7.7	7.8	7.9	7.5
SPEC COND	05 JAN 82	1.	UMC	730.	1130.	720.	850.	860.	930.	640.
SPEC COND	05 JAN 82	1.	UMC	730.	1120.	722.	850.	860.	930.	640.
SPEC COND	05 JAN 82	1.	UMC	730.	1130.	720.	850.	850.	930.	640.
SPEC COND	05 JAN 82	1.	UMC	730.	1130.	720.	850.	850.	920.	640.
SPEC COND	13 APR 82	1.	UMC	719.	1300.	699.	810.	1000.	975.	639.
SPEC COND	13 APR 82	1.	UMC	718.	1302.	699.	810.	1000.	972.	639.
SPEC COND	13 APR 82	1.	UMC	719.	1301.	699.	810.	1000.	974.	640.
SPEC COND	13 APR 82	1.	UMC	720.	1300.	699.	810.	1000.	973.	638.
SPEC COND	29 JUN 82	1.	UMC	620.	590.	580.	750.	1040.	890.	490.
SPEC COND	29 JUN 82	1.	UMC	620.	590.	580.	760.	1030.	890.	490.
SPEC COND	29 JUN 82	1.	UMC	620.	600.	585.	760.	1030.	890.	490.
SPEC COND	29 JUN 82	1.	UMC	620.	600.	580.	750.	1030.	890.	490.
SPEC COND	28 SEP 82	1.	UMC	795.		665.	700.	925.	980.	
SPEC COND	28 SEP 82	1.	UMC	790.		665.	700.	920.	980.	
SPEC COND	28 SEP 82	1.	UMC	795.		665.	700.	920.	980.	
SPEC COND	28 SEP 82	1.	UMC	795.		665.	700.	920.	980.	
SPEC COND	08 FEB 83	1.	UMC	580.	1160.	685.	760.	680.	755.	605.

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
SPEC COND	08 FEB 83	1.	UMC	580.	1160.	690.	755.	680.	755.	605.
SPEC COND	08 FEB 83	1.	UMC	585.	1160.	680.	755.	680.	760.	600.
SPEC COND	08 FEB 83	1.	UMC	580.	1160.	685.	760.	685.	760.	600.
SPEC COND	09 AUG 83	1.	UMC	900.	1190.	1020.		1050.	930.	
SPEC COND	09 AUG 83	1.	UMC	890.	1200.	1020.		1050.	940.	
SPEC COND	09 AUG 83	1.	UMC	890.	1190.	1020.		1040.	940.	
SPEC COND	09 AUG 83	1.	UMC	900.	1200.	1020.		1040.	940.	
SPEC COND	14 FEB 84	1.	UMC	360.	430.	620.	400.	500.	570.	88.
SPEC COND	14 FEB 84	1.	UMC	360.	420.	620.	410.	510.	580.	87.
SPEC COND	14 FEB 84	1.	UMC	360.	430.	620.	400.	510.	580.	88.
SPEC COND	14 FEB 84	1.	UMC	360.	430.	630.	400.	510.	570.	88.
SPEC COND	18 SEP 84	1.	UMC	710.	1000.	620.	670.	760.	860.	500.
SPEC COND	18 SEP 84	1.	UMC	720.	990.	620.	680.	760.	860.	500.
SPEC COND	18 SEP 84	1.	UMC	720.	1000.	620.	680.	760.	860.	490.
SPEC COND	18 SEP 84	1.	UMC	720.	1000.	620.	680.	760.	860.	510.
SPEC COND	20 MAR 85	1.	UMC		990.	700.	750.	760.	750.	390.
SPEC COND	20 MAR 85	1.	UMC		1000.	700.	750.	760.	740.	400.
SPEC COND	20 MAR 85	1.	UMC		1000.	700.	750.	760.	740.	390.
SPEC COND	20 MAR 85	1.	UMC		990.	700.	760.	760.	740.	390.
SPEC COND	13 SEP 85	1.	UMC	720.		610.	880.	830.	840.	
SPEC COND	13 SEP 85	1.	UMC	720.		600.	880.	840.	840.	
SPEC COND	13 SEP 85	1.	UMC	730.		600.	870.	840.	840.	
SPEC COND	13 SEP 85	1.	UMC	730.		600.	880.	830.	830.	
SPEC COND	18 MAR 86	1.	UMC	590.	960.	490.	670.	620.	520.	3600.
SPEC COND	18 MAR 86	1.	UMC	590.	960.	500.	660.	620.	520.	3600.
SPEC COND	18 MAR 86	1.	UMC	590.	950.	500.	670.	620.	520.	3600.
SPEC COND	18 MAR 86	1.	UMC	590.	950.	490.	660.	610.	520.	3600.
SPEC COND	16 SEP 86	1.	UMC	710.	1160.	690.	870.	950.	820.	600.
SPEC COND	16 SEP 86	1.	UMC	720.	1150.	690.	880.	950.	810.	600.
SPEC COND	16 SEP 86	1.	UMC	710.	1150.	690.	880.	950.	820.	600.
SPEC COND	16 SEP 86	1.	UMC	720.	1160.	690.	880.	960.	820.	610.
SPEC COND	17 MAR 87	1.	UMC	640.	990.	670.	820.	710.	730.	530.
SPEC COND	17 MAR 87	1.	UMC	630.	1000.	680.	810.	710.	730.	530.
SPEC COND	17 MAR 87	1.	UMC	630.	1000.	680.	820.	720.	730.	530.
SPEC COND	17 MAR 87	1.	UMC	640.	1000.	690.	820.	710.	740.	530.
TOC	05 JAN 82	.1	MGL	1.0	1.0	1.0	1.0	4.0	1.0	1.0
TOC	05 JAN 82	.1	MGL	1.0	1.0	1.0	1.0	4.0	1.0	1.0
TOC	05 JAN 82	.1	MGL	1.0	1.0	1.0	1.0	4.0	1.0	1.0
TOC	05 JAN 82	.1	MGL	1.0	1.0	1.0	1.0	4.0	1.0	1.0
TOC	13 APR 82	.1	MGL	39.0	54.0	40.0	37.0	48.0	44.0	40.0
TOC	13 APR 82	.1	MGL	39.0	54.0	40.0	37.0	47.0	44.0	40.0

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES
RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
TOC	13 APR 82	.1	MGL	40.0	54.0	42.0	37.0	47.0	44.0	40.0
TOC	13 APR 82	.1	MGL	39.0	55.0	43.0	37.0	48.0	44.0	40.0
TOC	29 JUN 82	.1	MGL	43.0	30.0	43.0	42.0	53.0	42.0	38.0
TOC	29 JUN 82	.1	MGL	42.0	30.0	41.0	40.0	53.0	42.0	39.0
TOC	29 JUN 82	.1	MGL	42.0	30.0	43.0	40.0	54.0	41.0	40.0
TOC	29 JUN 82	.1	MGL	42.0	30.0	43.0	42.0	54.0	43.0	38.0
TOC	28 SEP 82	.1	MGL	37.0	28.0	39.0	21.0	44.0	4.0	
TOC	28 SEP 82	.1	MGL	38.0	29.0	39.0	23.0	43.0	4.0	
TOC	28 SEP 82	.1	MGL	37.0	27.0	39.0	22.0	43.0	4.0	
TOC	28 SEP 82	.1	MGL	38.0	28.0	39.0	22.0	43.0	4.0	
TOC	08 FEB 83	.1	MGL	23.0	32.0	26.0	22.0	27.0	25.0	26.0
TOC	08 FEB 83	.1	MGL	23.0	33.0	27.0	22.0	26.0	25.0	26.0
TOC	08 FEB 83	.1	MGL	24.0	32.0	27.0	22.0	27.0	25.0	26.0
TOC	08 FEB 83	.1	MGL	23.0	33.0	27.0	22.0	27.0	25.0	26.0
TOC	09 AUG 83	.1	MGL	53.0	47.0	46.0		74.0	23.0	
TOC	09 AUG 83	.1	MGL	53.0	47.0	47.0		74.0	22.0	
TOC	09 AUG 83	.1	MGL	54.0	46.0	45.0		74.0	21.0	
TOC	09 AUG 83	.1	MGL	53.0	46.0	46.0		74.0	22.0	
TOC	14 FEB 84	.1	MGL	24.0	35.0	32.0	24.0	29.0	29.0	12.0
TOC	14 FEB 84	.1	MGL	23.0	36.0	33.0	24.0	29.0	29.0	11.0
TOC	14 FEB 84	.1	MGL	23.0	36.0	33.0	24.0	29.0	30.0	11.0
TOC	14 FEB 84	.1	MGL	24.0	35.0	32.0	24.0	29.0	29.0	11.0
TOC	18 SEP 84	.1	MGL	3.0	3.0	3.0	3.0	4.0	3.0	3.0
TOC	18 SEP 84	.1	MGL	3.0	4.0	3.0	3.0	4.0	3.0	4.0
TOC	18 SEP 84	.1	MGL	3.0	4.0	3.0	3.0	4.0	3.0	2.0
TOC	18 SEP 84	.1	MGL	3.0	4.0	3.0	3.0	5.0	4.0	3.0
TOC	20 MAR 85	.1	MGL		5.9	8.8	5.9	6.0	4.1	9.5
TOC	20 MAR 85	.1	MGL		5.7	8.8	6.1	6.0	4.0	9.6
TOC	20 MAR 85	.1	MGL		5.8	8.7	5.8	6.0	4.1	9.4
TOC	20 MAR 85	.1	MGL		5.7	8.8	5.9	6.0	4.1	9.5
TOC	13 SEP 85	.1	MGL	3.4		3.0	2.7	3.3	3.1	
TOC	13 SEP 85	.1	MGL	3.4		2.7	2.5	3.2	3.3	
TOC	13 SEP 85	.1	MGL	3.4		2.8	2.6	3.3	3.1	
TOC	13 SEP 85	.1	MGL	3.4		2.9	2.5	3.3	3.5	
TOC	18 MAR 86	.1	MGL	3.4	3.6	6.3	5.0	5.4	3.5	4.2
TOC	18 MAR 86	.1	MGL	3.4	3.5	6.3	5.0	5.1	3.5	4.2
TOC	18 MAR 86	.1	MGL	3.4	3.5	6.4	5.0	5.1	3.4	4.2
TOC	18 MAR 86	.1	MGL	3.4	3.5	6.2	5.2	5.2	3.6	4.2
TOC	16 SEP 86	.1	MGL	5.1	4.7	5.3	5.2	6.2	4.7	5.2
TOC	16 SEP 86	.1	MGL	5.0	4.7	5.4	5.4	6.2	4.9	5.1
TOC	16 SEP 86	.1	MGL	5.0	4.8	5.4	5.4	6.3	4.7	5.1

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
TOC	16 SEP 86	.1	MGL	4.9	4.8	5.5	5.4	6.2	4.8	5.2
TOC	17 MAR 87	.1	MGL	5.0	3.8	3.7	2.3	5.6	4.0	3.6
TOC	17 MAR 87	.1	MGL	5.0	3.7	3.8	2.2	5.5	4.0	3.6
TOC	17 MAR 87	.1	MGL	4.9	3.6	3.7	2.2	5.5	3.9	3.5
TOC	17 MAR 87	.1	MGL	5.0	3.7	3.8	2.1	5.6	4.0	3.5
TOX	05 JAN 82	.010	MGL	ND	.060	.033	.016	.063	.048	.021
TOX	05 JAN 82	.010	MGL	ND	.050	.025	ND	.038	.059	.039
TOX	05 JAN 82	.010	MGL	ND	.050	.014	.019	.048	.016	.034
TOX	05 JAN 82	.010	MGL	.016	.052	.013	.016	.046	.056	.020
TOX	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	.014
TOX	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	13 APR 82	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	13 APR 82	.010	MGL	ND	ND	.012	ND	.011	ND	.010
TOX	29 JUN 82	.010	MGL	ND	ND	ND	.017	.063	.068	.026
TOX	29 JUN 82	.010	MGL	.064	ND	ND	.076	ND	.039	.028
TOX	29 JUN 82	.010	MGL	.098	ND	.015	.070	.051	.026	.031
TOX	29 JUN 82	.010	MGL	.045	ND	ND	.066	ND	.082	.020
TOX	28 SEP 82	.010	MGL	.041		.130	.067	.096		
TOX	28 SEP 82	.010	MGL	ND		.080	ND	.069		
TOX	28 SEP 82	.010	MGL	ND		.095	.077	ND		
TOX	28 SEP 82	.010	MGL	ND		.095	.040	.062		
TOX	08 FEB 83	.010	MGL	.043	.030	.040	.039	.046	.017	.030
TOX	08 FEB 83	.010	MGL	.042	.047	.047	.028	.046	.033	.038
TOX	08 FEB 83	.010	MGL	.042	.041	.040	.044	.031	.039	.047
TOX	08 FEB 83	.010	MGL	.036	.041	.043	.041	.056	.038	.036
TOX	09 AUG 83	.010	MGL	.041	.040	.041		ND	ND	
TOX	09 AUG 83	.010	MGL	.036	.041	.036		ND	ND	
TOX	09 AUG 83	.010	MGL	.042	.038	.039		ND	ND	
TOX	09 AUG 83	.010	MGL	.040	.040	.036		ND	ND	
TOX	14 FEB 84	.010	MGL	.070	.064	ND	.037	.055	.064	ND
TOX	14 FEB 84	.010	MGL	.060	.074	ND	.035	.055	.030	.014
TOX	14 FEB 84	.010	MGL	.077	.041	ND	.036	.049	.044	.014
TOX	14 FEB 84	.010	MGL	.032	.062	ND	.039	.064	.041	.012
TOX	18 SEP 84	.010	MGL	.022	.016	ND	.015	.013	ND	.027
TOX	18 SEP 84	.010	MGL	.022	.018	.011	.025	.012	ND	.034
TOX	18 SEP 84	.010	MGL	.020	.016	ND	.013	ND	ND	.045
TOX	18 SEP 84	.010	MGL	.021	.026	.012	.013		ND	.045
TOX	20 MAR 85	.010	MGL		ND	ND	ND	ND	ND	.012
TOX	20 MAR 85	.010	MGL		ND	ND	ND	ND	ND	.013
TOX	20 MAR 85	.010	MGL		ND	ND	ND	ND	ND	.014
TOX	20 MAR 85	.010	MGL		ND	ND	ND	ND	ND	.014

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES
RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
TOX	13 SEP 85	.010	MGL	ND		ND	ND	ND	ND	
TOX	13 SEP 85	.010	MGL	ND		ND	ND	ND	ND	
TOX	13 SEP 85	.010	MGL	ND		ND	ND	ND	ND	
TOX	13 SEP 85	.010	MGL	ND		ND	ND	ND	ND	
TOX	18 MAR 86	.010	MGL	ND	ND	.010	ND	ND	ND	ND
TOX	18 MAR 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	18 MAR 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	18 MAR 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	16 SEP 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	16 SEP 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	16 SEP 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	16 SEP 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	17 MAR 87	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	17 MAR 67	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	17 MAR 87	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TOX	17 MAR 87	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TDS	29 JUN 82	1.	MGL	465.	431.	406.	672.#	704.#	698.#	382.
2,4,6-TNT	27 JUN 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	18 SEP 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	20 MAR 85	.001	MGL		ND	ND	ND	ND	ND	ND
2,4,6-TNT	13 SEP 85	.001	MGL	ND		ND	ND	ND	ND	
2,4,6-TNT	18 MAR 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	16 SEP 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	17 MAR 87	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	27 JUN 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	18 SEP 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	20 MAR 85	.001	MGL		ND	ND	ND	ND	ND	ND
2,4-DNT	13 SEP 85	.001	MGL	ND		ND	ND	ND	ND	
2,4-DNT	18 MAR 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	16 SEP 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	17 MAR 87	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	27 JUN 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	18 SEP 84	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	20 MAR 85	.001	MGL		ND	ND	ND	ND	ND	ND
2,6-DNT	13 SEP 85	.001	MGL	ND		ND	ND	ND	ND	
2,6-DNT	18 MAR 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	16 SEP 86	.001	MGL	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	17 MAR 87	.001	MGL	ND	ND	ND	ND	ND	ND	ND
RDX	27 JUN 84	.030	MGL	ND	ND	ND	ND	ND	ND	ND
RDX	18 SEP 84	.030	MGL	ND	ND	ND	ND	ND	ND	ND
RDX	20 MAR 85	.030	MGL		ND	ND	ND	ND	ND	ND

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

SAMPLING SITES
RESULTS

PARAMETER	SAMPLING DATE	DETECTION LIMIT	UNITS	B W5	W4	W6	W1	W3	W2	W7
RDX	13 SEP 85	.030	MGL	ND		ND	ND	ND	ND	
RDX	18 MAR 86	.030	MGL	ND	ND	ND	ND	ND	ND	ND
RDX	16 SEP 86	.030	MGL	ND	ND	ND	ND	ND	ND	ND
RDX	17 MAR 87	.030	MGL	ND	ND	ND	ND	ND	ND	ND
HMX	27 JUN 84	.100	MGL	ND	ND	ND	ND	ND	ND	ND
HMX	18 SEP 84	.100	MGL	ND	ND	ND	ND	ND	ND	ND
HMX	20 MAR 85	.100	MGL		ND	ND	ND	ND	ND	ND
HMX	13 SEP 85	.100	MGL	ND		ND	ND	ND	ND	
HMX	18 MAR 86	.100	MGL	ND	ND	ND	ND	ND	ND	ND
HMX	16 SEP 86	.100	MGL	ND	ND	ND	ND	ND	ND	ND
HMX	17 MAR 87	.100	MGL	ND	ND	ND	ND	ND	ND	ND
TETRYL	27 JUN 84	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TETRYL	18 SEP 84	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TETRYL	20 MAR 85	.010	MGL		ND	ND	ND	ND	ND	ND
TETRYL	13 SEP 85	.010	MGL	ND		ND	ND	ND	ND	
TETRYL	18 MAR 86	.005	MGL	ND	ND	ND	ND	ND	ND	ND
TETRYL	16 SEP 86	.010	MGL	ND	ND	ND	ND	ND	ND	ND
TETRYL	17 MAR 87	.010	MGL	ND	ND	ND	ND	ND	ND	ND

RUN DATE: 19 AUG 87

INSTALLATION: SENECA AD, NY

SITE: DEMOLITION GROUNDS

LEGEND

NOTES: ALL METALS AND OTHER PARAMETERS WHERE APPROPRIATE ARE ON A DISSOLVED (FILTERED) BASIS UNLESS OTHERWISE NOTED. DETECTION LIMITS SHOWN ARE NORMAL LEVELS; ACTUAL LIMITS MAY VARY IN ENVIRONMENTAL SAMPLES. ANALYTICAL RESULTS ARE ACCURATE TO EITHER 2 OR 3 SIGNIFICANT FIGURES.

B UPGRADIENT SITE
VALUE EXCEEDS A NATIONAL SECONDARY DRINKING WATER REGULATION CRITERIA
& VALUE EXCEEDS A STATE WATER QUALITY STANDARD OR CRITERIA

MGL - MILLIGRAMS/LITER
UGL - MICROGRAMS/LITER
PCL - PICOCURIES/LITER
UMC - MICROMHOS/CENTIMETER
NTU - NEPHELOMETRIC TURBIDITY UNITS
TON - THRESHOLD ODOR NUMBER
TDN - TASTE DILUTION INDEX NUMBER
CU - COLOR UNITS
PHM - PER 100 MILLILITERS

APPENDIX E

ANALYTICAL RESULTS - SEAD

TABLE E-1. DEMOLITION AREA

Sample No. and Description	EP Toxicity*								Explosives†‡					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
4727-001 Demolition Crater No. 2	ND	ND	0.19	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	1.6
-002 Demolition Crater No. 2	ND	ND	0.20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9
-003 Demolition Crater No. 4	ND	ND	0.16	ND	ND	ND	ND	ND	ND	1.4	1.6	ND	ND	1.9
-004 Demolition Crater No. 4	ND	ND	0.16	ND	ND	ND	ND	ND	ND	ND	32.0	ND	ND	ND
-005 Demolition Crater No. 6	ND	ND	0.17	ND	ND	ND	ND	ND	ND	1.3	16.3	2.2	ND	ND
-006 Demolition Crater No. 6	ND	ND	0.18	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	1.7
-007 Demolition Crater No. 8	ND	ND	0.17	ND	ND	ND	ND	ND	ND	1.7	ND	1.4	ND	1.1
-008 Demolition Crater No. 8	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	ND	61	ND	ND

TABLE E-2. BURNING GROUND AREA

	Sample No. and Description	EP Toxicity*								Explosives†‡					
		As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
	4727-009 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	24.6	ND	ND	ND	1.1	ND	ND	1.6	21.0
H	-010 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	1.5	6.0
	-011 Burn Area H, 0-6 inches	ND	ND	ND	ND	ND	6.3	ND	ND	ND	4.7	ND	ND	1.6	6.6
	-012 Burn Area F, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2	ND	24.0	ND	1.8
F	-013 Burn Area F, 0-6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	2.7	ND	46.0	ND	ND
	-014 Burn Area F, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.0	ND	9270	23.0	45.0
	-015 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	7.4	ND	ND
D	-016 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
	-017 Burn Area D, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND
	-018 Burn Area E, 0-6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
E	-019 Burn Area E, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
	-020 Burn Area E, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
	-021 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND
	-022 Burn Area G, 0-6 inches	ND	ND	0.14	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND
G	-023 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
	-024 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND
	-025 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
	-026 Burn Area G, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	ND	6.7	ND	ND
	-027 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C	-028 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
	-029 Burn Area C, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	-030 Burn Area B, 0-6 inches	ND	508	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
B	-031 Burn Area B, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND	ND
	-032 Burn Area B, 0-6 inches	ND	246	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE E-3. ANALYTICAL LIMITS*

	As	Ba	Cd	Cr	Hg	Pb	Se	Ag
Detection Limit	0.5	10	0.1	0.5	0.02	0.5	0.1	0.5
RCRA Criteria Limit	5.0	100	1.0	5.0	0.02	5.0	1.0	5.0

* All units in mg/L
† All units in ug/g
‡ Detection limit for all explosives was 1.0 ug/g.
ND - not detected

RODOLFO BONGIOVANNI
CPT, MSC
Chief, Chromatographic Analysis Branch
Organic Environmental Chemistry Division

PETER FIANU
Chief, Metals Analysis Branch
Radiological and Inorganic Chemistry Division

TABLE C-1. PAD F SOIL SAMPLES

Sample No. and Description	EP Toxicity*								Explosives†					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
0479-001 Bore hole 1, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	1.3	ND	ND
0479-002 Bore hole 1, 6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND
0479-003 Bore hole 1, 4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-004 Bore hole 2, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3	ND	ND
0479-005 Bore hole 2, 6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18.7	ND	ND
0479-006 Bore hole 2, 4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-007 Bore hole 2, 5-6 feet	ND	ND	ND	ND	ND	1.430	ND	ND	ND	ND	ND	ND	ND	ND
0479-008 Bore hole 2, 7-8 feet	ND	ND	ND	ND	ND	0.79	ND	ND	ND	ND	ND	ND	ND	ND
0479-009 Bore hole 3, 0-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.7	ND	ND
0479-010 Bore hole 3, 1-2 feet	ND	ND	ND	ND	ND	10.7	ND	ND	ND	ND	ND	ND	ND	ND
0479-011 Bore hole 3, 4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-042 East Berm, composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-043 South Berm, composite	ND	ND	ND	ND	ND	2.516	ND	ND	ND	1.6	ND	124.5	ND	1.1
0479-044 West Berm, composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.2	ND	1.2	ND	ND
Detection Limit	0.500	10.000	0.100	0.500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
RCRA Criteria Limit	5.000	100.000	1.000	5.000	0.020	5.000	1.000	5.000	NA	NA	NA	NA	NA	NA

* All units in mg/L
† All units in μg/g
ND - not detected
NA - not applicable

Table C-2. PAD B SOIL SAMPLES

Sample No. and Description	EP Toxicity*								Explosives†					
	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
0479-012 Bore hole 4, 0-12 inches	ND	ND	ND	ND	ND	1.43	ND	ND	4.0	ND	ND	ND	ND	ND
0479-013 Bore hole 4, 1-2 feet	ND	ND	ND	ND	ND	3.81	ND	ND	ND	ND	ND	11.6	ND	ND
0479-014 Bore hole 4, 4 feet	ND	42.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-015 Bore hole 4, 4 1/2-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-016 Bore hole 5, 0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-017 Bore hole 5, 6-12 inches	ND	ND	ND	ND	ND	0.830	ND	ND	3.6	ND	ND	ND	ND	ND
0479-018 Bore hole 5, 3 1/2 to 4 1/2 feet	ND	187.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-019 Bore hole 5, 5-6 feet	ND	ND	ND	ND	ND	101.5	ND	ND	ND	ND	ND	ND	ND	ND
0479-045 North Berm, composite	ND	ND	ND	ND	ND	0.81	ND	ND	ND	ND	ND	ND	ND	ND
0479-046 East Berm, composite	ND	424.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-047 South Berm, composite	ND	ND	ND	ND	ND	ND	ND	ND	NR	NR	NR	NR	NR	NR
Detection Limit	0.500	10.000	0.100	500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
RCRA Criteria Limit	5.000	100.000	1.000	5000	0.020	5.000	1.000	5.000	NA	NA	NA	NA	NA	NA

* All units in mg/L
† All units in μg/g
ND - not detected
NR - not reported by laboratory
NA - not applicable

APPENDIX F

QUALITY CONTROL SAMPLE RESULTS

Table F.1 FIELD DUPLICATE ANALYSIS

MONITORING WELL SAMPLES:	MW-10 3161-110 ug/L	MW-10 Field Duplicate 3161-118 ug/L	Relative Percent Difference (%)	QAPP Precision Objective
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	< 200	< 200	0	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	< 10.0	< 10.0	0	< 20
Mercury	< 0.20	< 0.20	0	< 20
Lead	< 5.0	< 5.0	0	< 20
Selenium	< 5.0	5.0	0	< 20
Silver	< 10.0	70.4	150 *	< 20
EXPLOSIVES:				
PETN	< 4.5	< 4.5	0	< 20
HMX	< 1.30	< 1.30	0	< 20
RDX	< 0.63	< 0.63	0	< 20
Tetryl	< 0.66	< 0.66	0	< 20
2,4,6 TNT	1.80	0.78	79 *	< 20
2,6 DNT	< 0.55	< 0.55	0	< 20
2,4 DNT	< 0.60	< 0.60	0	< 20
PETROLEUM HYDROCARBONS:	< 1000	1200	18	< 30

NOTES:

< - indicates that the following value is an instrument detection limit.

$$\text{Relative Percent Difference} = \frac{\text{Range}}{\text{Mean}} \times 100$$

* = Outside QAPP precision objective.

Table F.1 FIELD DUPLICATE ANALYSIS *continued*

MONITORING WELL SAMPLES:	MW-11 3161-111 ug/L	MW-11 Field Duplicate 3161-120 ug/L	Relative Percent Difference (%)	QAPP Precision Objective
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	< 200	< 200	0	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	< 10.0	< 10.0	0	< 20
Lead	9.0	10.6	16	< 20
Mercury	< 0.20	< 0.20	0	< 20
Selenium	< 5.0	27.5	138 *	< 20
Silver	< 10.0	< 10.0	0	< 20
EXPLOSIVES:				
PETN	< 4.5	< 4.5	0	< 20
HMX	< 1.30	< 1.30	0	< 20
RDX	< 0.63	< 0.63	0	< 20
Tetryl	< 0.66	< 0.66	0	< 20
2,4,6 TNT	< 0.78	< 0.78	0	< 20
2,6 DNT	< 0.55	< 0.55	0	< 20
2,4 DNT	< 0.60	< 0.60	0	< 20
PETROLEUM HYDROCARBONS:	< 1000	< 1000	0	< 30

NOTES:

< - indicates that the following value is an instrument detection limit.

$$\text{Relative Percent Difference} = \frac{\text{Range}}{\text{Mean}} \times 100$$

Table F.2 LABORATORY MATRIX SPIKES

MW-9
3161-109

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
TOTAL METALS:					
Arsenic	< 10.0	40.0	30.6	76.5	75-125
Barium	< 200	2,000	2,030	101	75-125
Cadmium	< 5.0	50.0	39.9	79.8	75-125
Chromium	< 10.0	200	186	92.8	75-125
Lead	< 5.0	20.0	17.3	86.5	75-125
Mercury	< 0.20	1.0	1.0	102	75-125
Selenium	5.6	10.0	8.3	53.2 *	75-125
Silver	< 10.0	50.0	51.2	102	75-125

MW-1
3161-101

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
TOTAL METALS:					
Arsenic	< 10.0	40.0	28.6	71.5 *	75-125
Barium	511	2,000	2,380	94.8	75-125
Cadmium	< 5.0	50.0	32.2	64.4 *	75-125
Chromium	52.3	200	237	93.9	75-125
Lead	104	20.0	137	110	75-125
Mercury	0.58	1.0	1.4	88.6	75-125
Selenium	7.5	10.0	3.8	21.7 *	75-125
Silver	< 10.0	50.0	33.6	66.0 *	75-125

MW-12 (field duplicate)
3161-124

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
TOTAL METALS:					
Arsenic	< 10.0	40.0	31.4	78.5	75-125
Barium	< 200	2,000	2,030	101	75-125
Cadmium	< 5.0	50.0	30.7	61.4 *	75-125
Chromium	< 10.0	200	198	98.8	75-125
Lead	13.3	20.0	20.1	60.7 *	75-125
Selenium	< 5.0	10.0	9.2	92.0	75-125
Silver	< 10.0	50.0	36.8	73.6 *	75-125

NOTES:
< - indicates that the following value is an instrument detection limit.
* = Outside QAPP Recovery Objective.

Table F.2 LABORATORY MATRIX SPIKES continued

	MW-14 3161-114					DUPLICATE		
	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
EXPLOSIVES:								
HMX	< 1.30	13.0	11.3	87.2	75-125	12.1	93.4	75-125
RDX	< 0.63	6.29	5.69	90.4	75-125	6.02	95.5	75-125
Tetryl	< 0.66	6.60	5.51	83.5	75-125	5.56	84.2	75-125
2,4,6 TNT	< 0.78	7.80	6.39	81.9	75-125	6.43	82.4	75-125
2,6 DNT	< 0.55	5.50	4.50	81.8	75-125	4.54	82.6	75-125
2,4 DNT	< 0.60	6.00	5.04	83.9	75-125	5.04	83.9	75-125

	MW-22 3161-122					DUPLICATE		
	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
EXPLOSIVES:								
HMX	< 1.30	13.0	11.0	84.9	75-125	11.9	91.5	75-125
RDX	< 0.63	6.29	5.79	91.9	75-125	5.89	93.5	75-125
Tetryl	< 0.66	6.60	5.40	81.8	75-125	6.20	93.9	75-125
2,4,6 TNT	< 0.78	7.80	6.52	83.7	75-125	6.65	85.3	75-125
2,6 DNT	< 0.55	5.50	4.70	85.7	75-125	4.77	86.8	75-125
2,4 DNT	< 0.60	6.00	5.05	84.1	75-125	5.20	86.7	75-125

NOTES:

< - indicates that the following value is an instrument detection limit.

Table F.2 LABORATORY MATRIX SPIKES continued

MW-4
3161-104

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)
Mercury	< 0.20	1.0	1.3	132 *	75-125

MW-28
3161-128

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)	DUPLICATE SAMPLE & SPIKE (ug/l)	DUPLICATE RECOVERY (%)	DUPLICATE QAPP Objective (%)	Relative Difference (%)	QAPP Precision Objective
PETN	< 4.5	133	116	87.1	75-125	93.7	70.3*	75-125	21.3	< 30

MW-26
3161-126

	SAMPLE CONCENTRATION (ug/l)	SPIKED AMOUNT (ug/l)	SAMPLE & SPIKE (ug/l)	RECOVERY (%)	QAPP Objective (%)	DUPLICATE SAMPLE & SPIKE (ug/l)	DUPLICATE RECOVERY (%)	DUPLICATE QAPP Objective (%)	Relative Difference (%)	QAPP Precision Objective
PETN	< 4.5	133	94.7	71.0*	75-125	109	81.5	75-125	13.7	< 30

NOTES:

$$\text{Relative Percent Difference} = \frac{\text{Range}}{\text{Mean}} \times 100.$$

< - indicates that the following value is an instrument detection limit.
* = Recovery is outside the QAPP Objective.

Table F.3 LABORATORY REPLICATES

MW-1
3161-101

	INITIAL RESULT	REPLICATE	RELATIVE DIFFERENCE (%)	QAPP Precision Objective (%)
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	511	549	7.2	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	52.3	56.6	7.9	< 20
Lead	104	109	4.7	< 20
Mercury	0.58	0.58	0	< 20
Selenium	7.5	< 5.0	40 *	< 20
Silver	< 10.0	< 10.0	0	< 20

MW-9
3161-109

	INITIAL RESULT	REPLICATE	RELATIVE DIFFERENCE (%)	QAPP Precision Objective (%)
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	< 200	< 200	0	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	< 10.0	< 10.0	0	< 20
Lead	< 5.0	< 5.0	0	< 20
Mercury	< 0.20	< 0.58	0	< 20
Selenium	5.6	< 5.0	11.3	< 20
Silver	< 10.0	< 10.0	0	< 20

MW-12 (duplicate)
3161-125

	INITIAL RESULT	REPLICATE	RELATIVE DIFFERENCE (%)	QAPP Precision Objective (%)
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	< 200	< 200	0	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	< 10.0	< 10.0	0	< 20
Lead	5.9	5.1	14.5	< 20
Selenium	< 5.0	< 5.0	0	< 20
Silver	< 10.0	< 10.0	0	< 20

MW-4
3161-125

	INITIAL RESULT	REPLICATE	RELATIVE DIFFERENCE (%)	QAPP Precision Objective (%)
TOTAL METALS:				
Mercury	< 0.20	< 0.20	0	< 20

< - indicates that the following value is an instrument detection limit.

$$\text{Relative Percent Difference} = \frac{\text{Range}}{\text{Mean}} \times 100$$

* = Outside QAPP percision objective.

Table F.1 FIELD DUPLICATE ANALYSIS continued

MONITORING WELL SAMPLES:	MW-17 3161-117 ug/L	MW-17 Field Duplicate 3161-122 ug/L	Relative Percent Difference (%)	QAPP Precision Objective
TOTAL METALS:				
Arsenic	< 10.0	< 10.0	0	< 20
Barium	< 200	< 200	0	< 20
Cadmium	< 5.0	< 5.0	0	< 20
Chromium	< 10.0	10.0	0	< 20
Lead	9.9	11.6	16	< 20
Mercury	< 0.2	< 0.2	0	< 20
Selenium	< 5.0	< 5.0	0	< 20
Silver	< 10.0	< 10.0	0	< 20
EXPLOSIVES:				
PETN	< 4.5	< 4.5	0	< 20
HMX	< 1.30	< 1.30	0	< 20
RDX	< 0.63	< 0.63	0	< 20
Tetryl	< 0.66	< 0.66	0	< 20
2,4,6 TNT	< 0.78	< 0.78	0	< 20
2,6 DNT	< 0.55	< 0.55	0	< 20
2,4 DNT	< 0.60	< 0.60	0	< 20
PETROLEUM HYDROCARBONS:	< 1000	6800	149 *	< 30

NOTES:

< - indicates that the following value is an instrument detection limit.

$$\text{Relative Percent Difference} = \frac{\text{Range}}{\text{Mean}} \times 100$$

* = Outside QAPP precision objective.

APPENDIX G
IN-SITU HYDRAULIC CONDUCTIVITY CALCULATIONS

In-Situ Permeability Calculations

In-situ permeability was calculated using the Hvorslev method. A plot of the normalized recovery data $H-h/H-h_o$ on the log scale versus time describes the basic time lag. Hydraulic conductivity (K) in feet/day is calculated using the Hvorslev equation as follows:

$$K = \frac{r^2 \ln \ (L/R)}{2L \ t_o}$$

K = permeability (ft/day)

r = radius of the well casing (ft)

R = radius of the borehole (ft)

*L = average length of saturated sandpack experienced during the test.

t_o = basic time lag, graphically derived (days)

H = total head, static conditions

H_o = head at start of test

h = head experienced while test is in progress

* Note: Most wells tested had an unsaturated intake during the recovery test. Under these conditions only small head changes were introduced and L, saturated intake length, was averaged. These changes will decrease the error in finding K, using the Hvorslev equation.

CALCULATION OF AVERAGE L

	Bottom Sand (ft)*	Water Level at End of Test (ft)*	Water Level at Beginning of Test (ft)*	$\frac{Ho-He}{2}$	He+ $\frac{Ho-He}{2}$	Average L
MW8	12.02	7.47	8.05	.29	7.76	4.26
MW9	9.65	4.35	5.96	.805	5.155	4.50
MW10	11.65	6.63	7.68	.525	7.155	4.50
MW11	12.05	6.38	7.3	.46	6.84	5.21
MW12	9.67	4.05	5.85	.9	4.95	4.72
MW13	10.67	4.96	6.23	.635	5.595	5.08
MW14	10.96	5.55	6.93	.69	6.24	4.72
MW15	9.06	3.4	6.35	1.475	4.875	4.19
MW16	9.03	5.45	6.62	.585	6.035	3.0
MW17	12.08	4.25	6.63	1.19	5.44	6.64

L = Length of Average Saturated Sandpack.

$$L = \text{Bottom of Sandpack} - [(He) + (\frac{H_o - H_e}{2})$$

H_e = water level at end of test.

H_o = water level at beginning of test (directly after bailing).

* Measurements from top of casing.

PERMEABILITY CALCULATIONS

MW8

$$t_o = \frac{4{,}700 \text{ sec.}}{86{,}400 \text{ sec/day}} = .0543 \text{ days}$$

$$K = \frac{(1/12)^2 \ (\frac{4.26}{0.42})}{2(4.26)\ (.0543)} = 0.15 \text{ ft/day}$$

MW9

$$t_o = \frac{210 \text{ sec.}}{86{,}400 \text{ sec/day}} = .00243 \text{ days}$$

$$K = \frac{(1/12)^2 \ (\frac{4.50}{0.42})}{2(4.50)\ (.00243)} = 0.75 \text{ ft/day}$$

MW10

$$t_o = \frac{6{,}600 \text{ sec.}}{86{,}400 \text{ sec/day}} = .0764 \text{ days}$$

$$K = \frac{(1/12)^2 \ \text{Ln}(\frac{4.50}{0.42})}{2(4.50)\ (0.764)} = 0.02 \text{ ft/day}$$

MW11

$$t_o = \frac{200 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.00231 \text{ day}$$

$$K = \frac{(1/12)^2 \ \text{Ln}(\frac{5.21}{0.42})}{2(5.21)\ (0.00231)} = 0.72 \text{ ft/day}$$

MW12

$$t_o = \frac{138 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.0016 \text{ day}$$

$$K = \frac{(1/12)^2 \ \text{Ln}(\frac{4.72}{0.42})}{2(4.72)\ (0.0016)} = 1.10 \text{ ft/day}$$

MW13 $$t_o = \frac{420 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.00486 \text{ day}$$

$$K = \frac{(1/12)^2 \ Ln(\frac{5.08}{0.42})}{2(5.08)\ (0.00486)} = 0.04 \text{ ft/day}$$

MW14 $$t_o = \frac{1{,}200 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.0139 \text{ day}$$

$$K = \frac{(1/12)^2 \ Ln(\frac{4.72}{0.42})}{2(4.72)\ (0.0139)} = 0.13 \text{ ft/day}$$

MW15 $$t_o = \frac{685 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.0079 \text{ day}$$

$$K = \frac{(1/12)^2 \ Ln(\frac{4.19}{0.42})}{2(4.19)\ (0.0079)} = 0.24 \text{ ft/day}$$

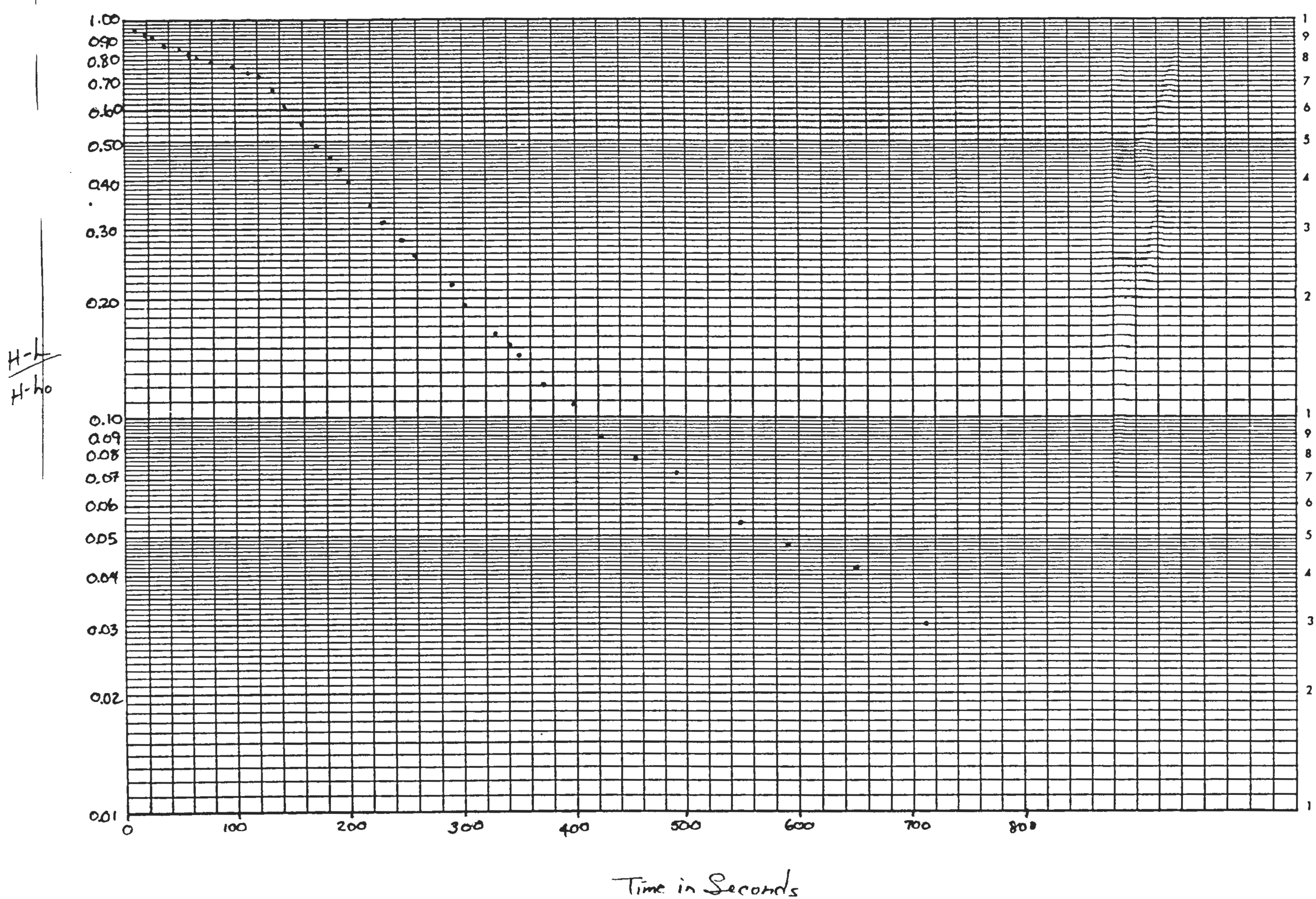
MW16 $$t_o = \frac{516 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.00597 \text{ day}$$

$$K = \frac{(1/12)^2 \ Ln(\frac{3.0}{0.42})}{2(3.0)\ (0.00597)} = 0.38 \text{ ft/day}$$

MW17 $$t_o = \frac{85 \text{ sec.}}{86{,}400 \text{ sec/day}} = 0.00098 \text{ day}$$

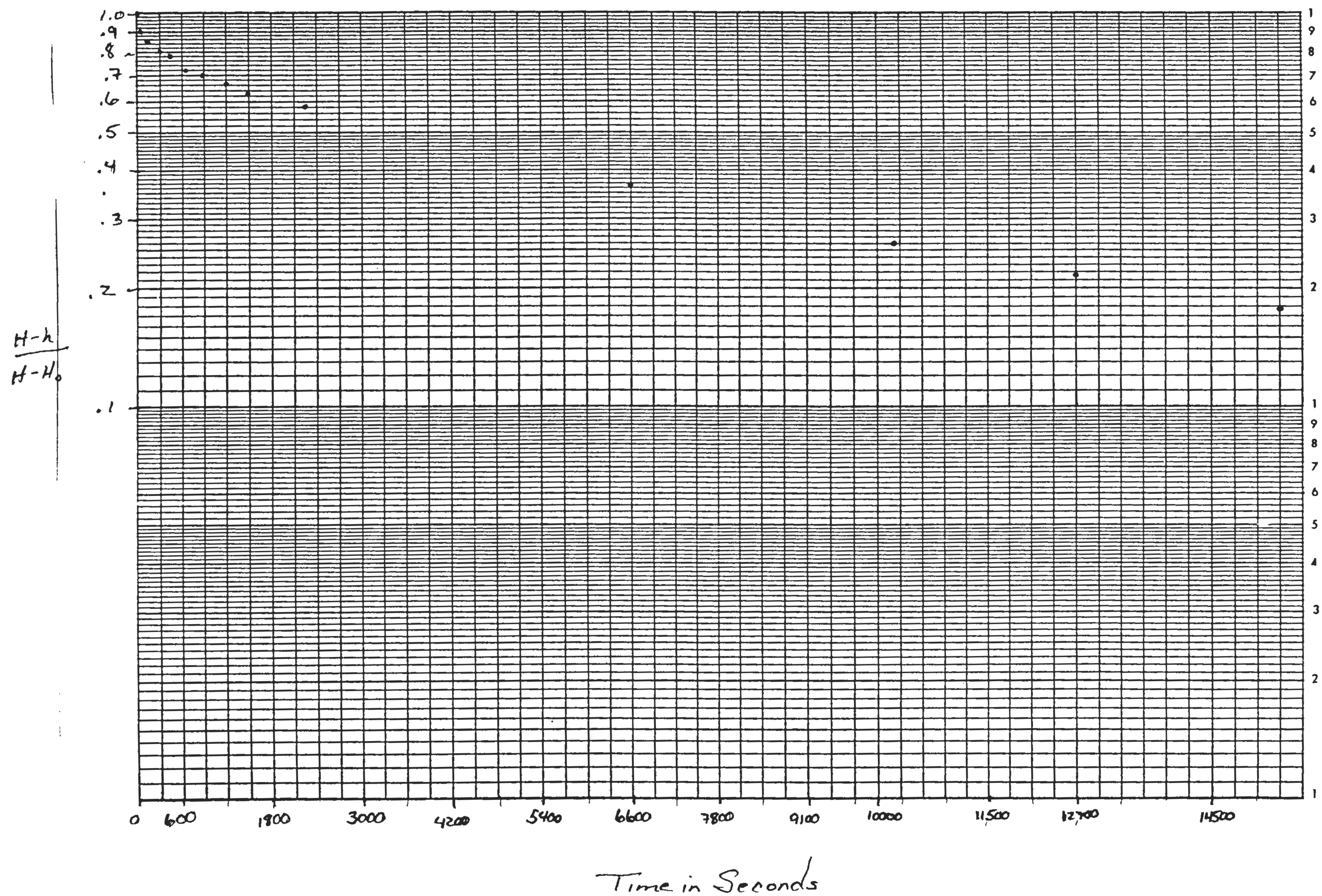
$$K = \frac{(1/12)^2 \ Ln(\frac{6.64}{0.42})}{2(6.64)\ (0.00098)} = 1.47 \text{ ft/day}$$

MW 9



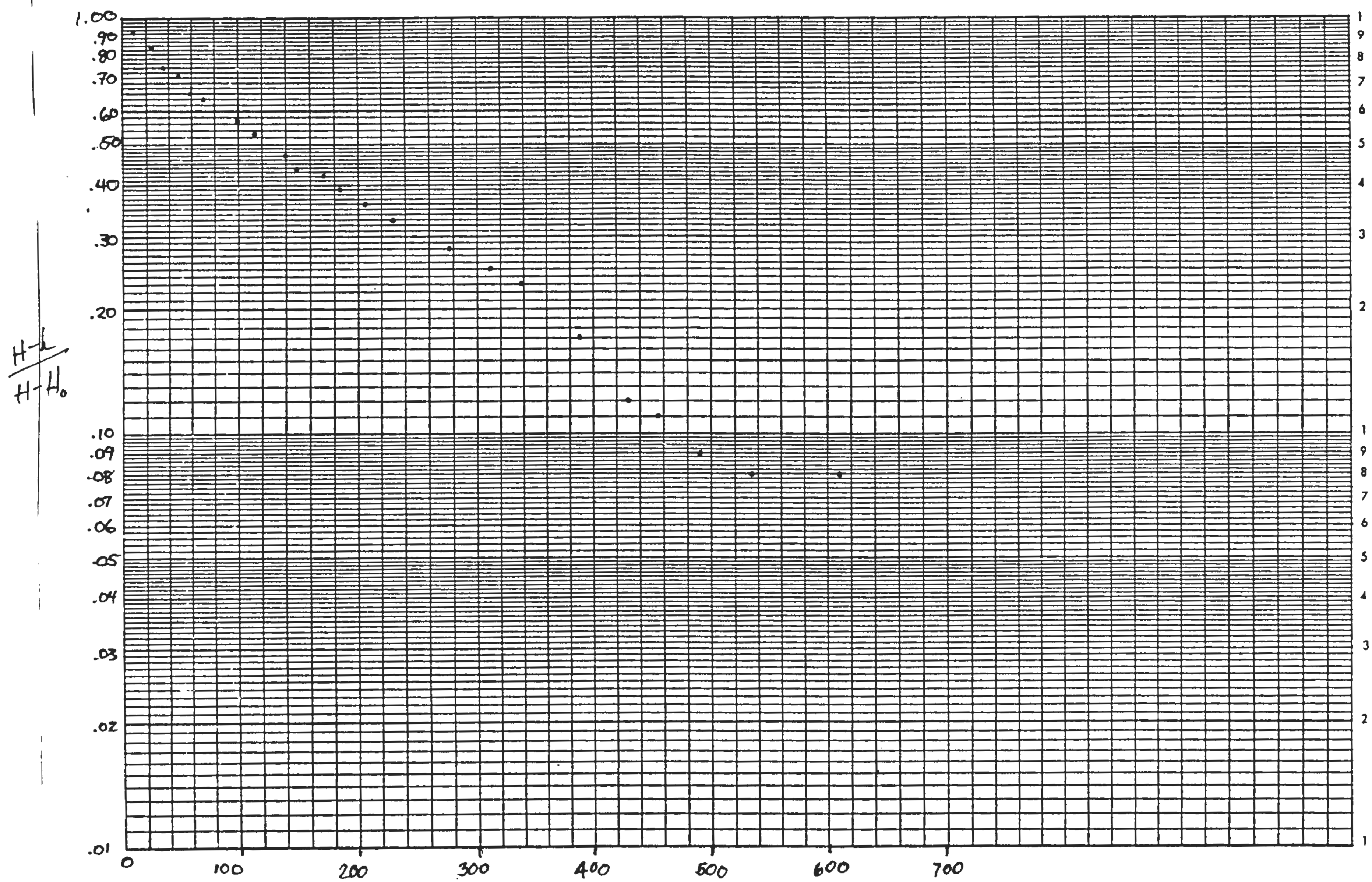
$\frac{H-h}{H-h_o}$
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
800
Time in Seconds

MW10



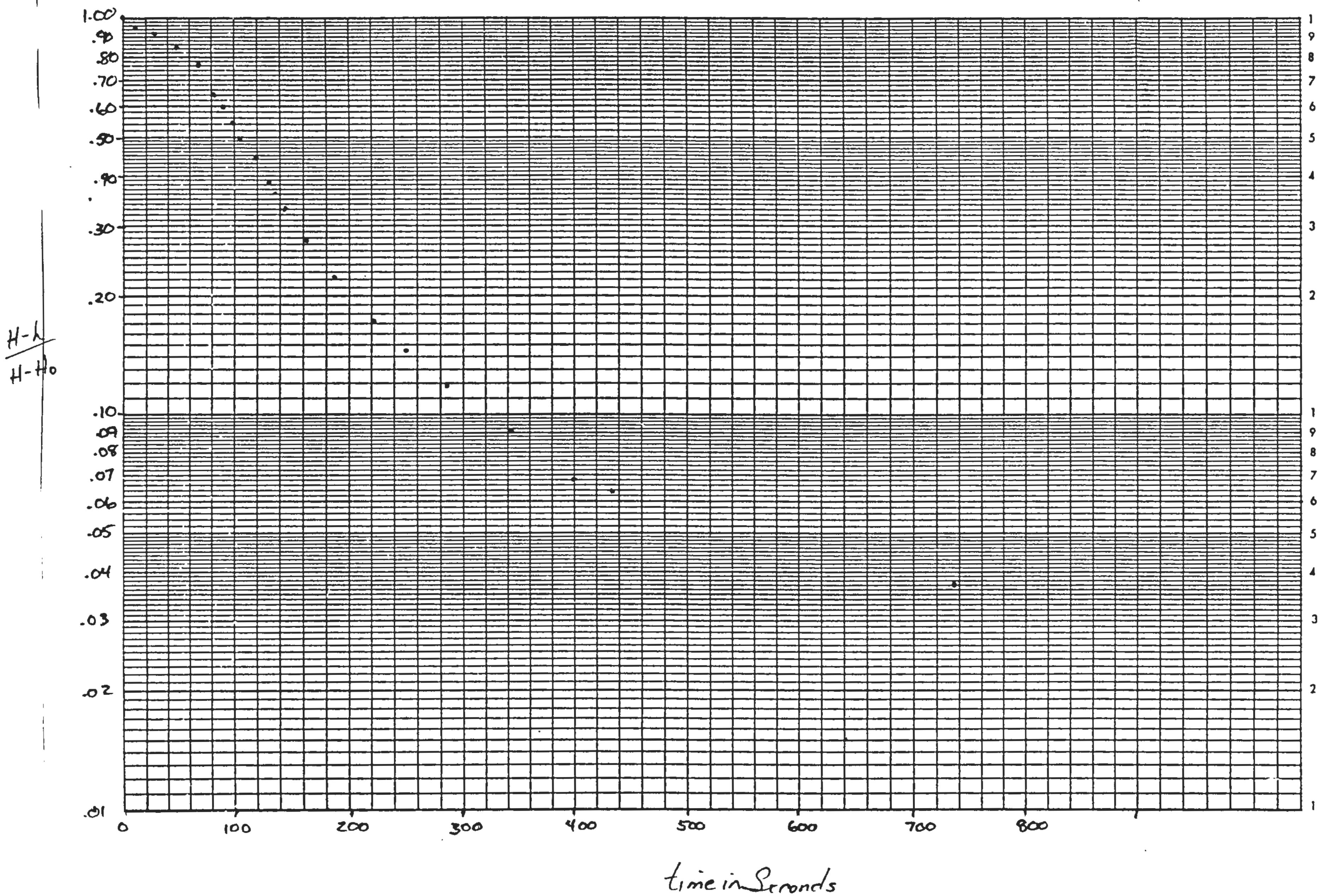
$\frac{H-h}{H-H_0}$
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
600
1800
3000
4200
5400
6600
7800
9100
10000
11,500
12,700
14,500
Time in Seconds

MW 11



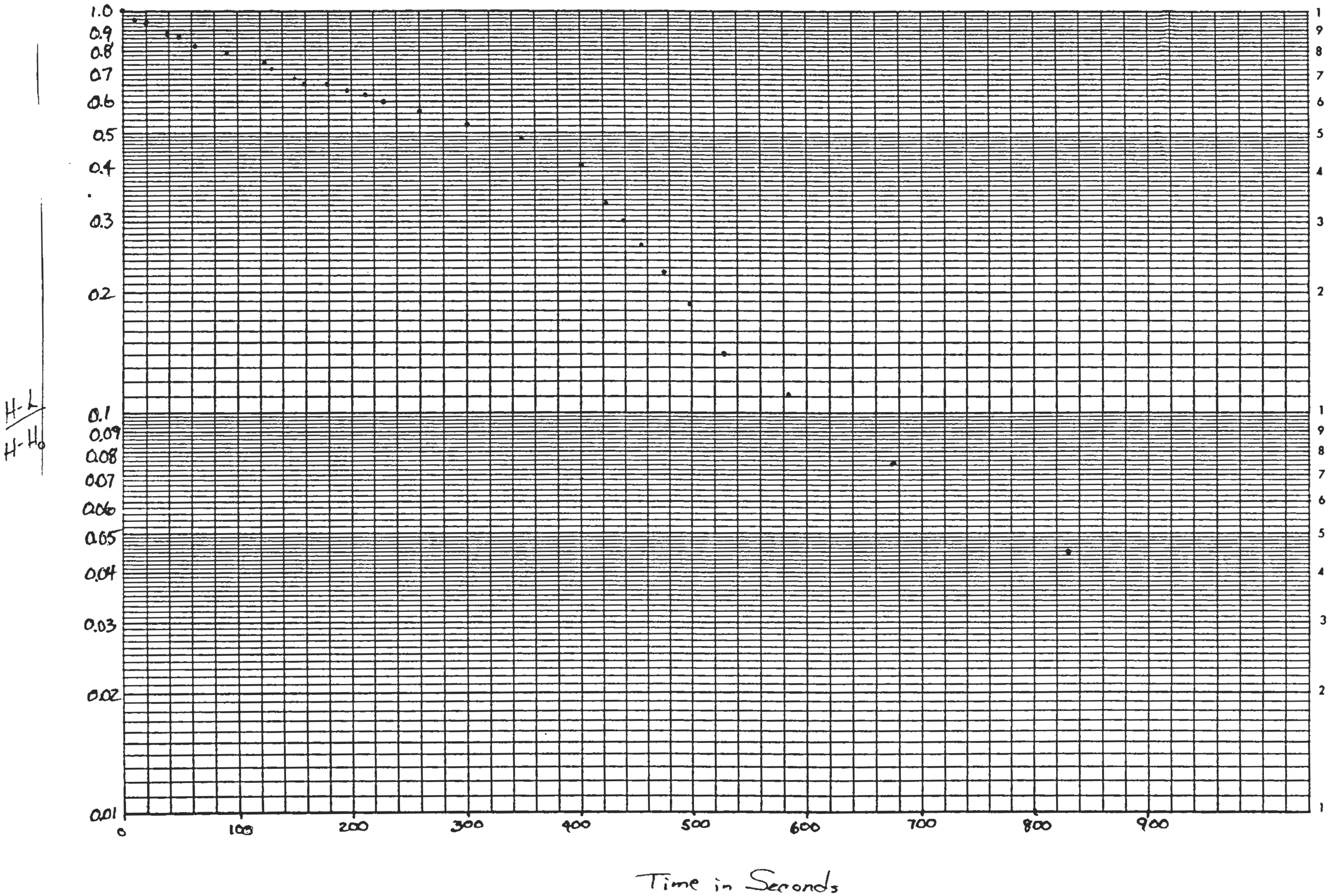
$\frac{H-h}{H-H_0}$
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
100
200
300
400
500
600
700

MW12



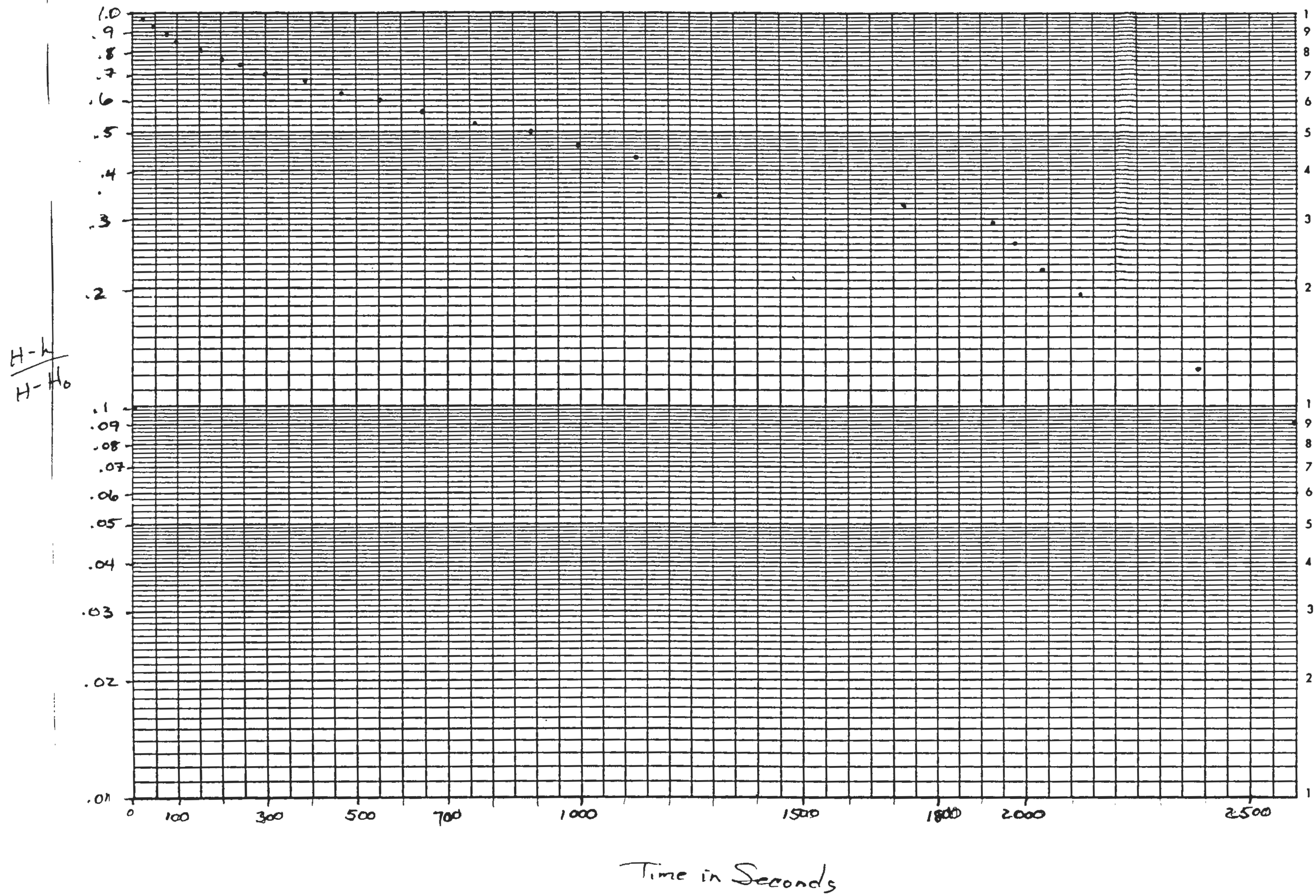
$\frac{H-h}{H-H_0}$
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
100
200
300
400
500
600
700
800
time in Seconds

MW 13



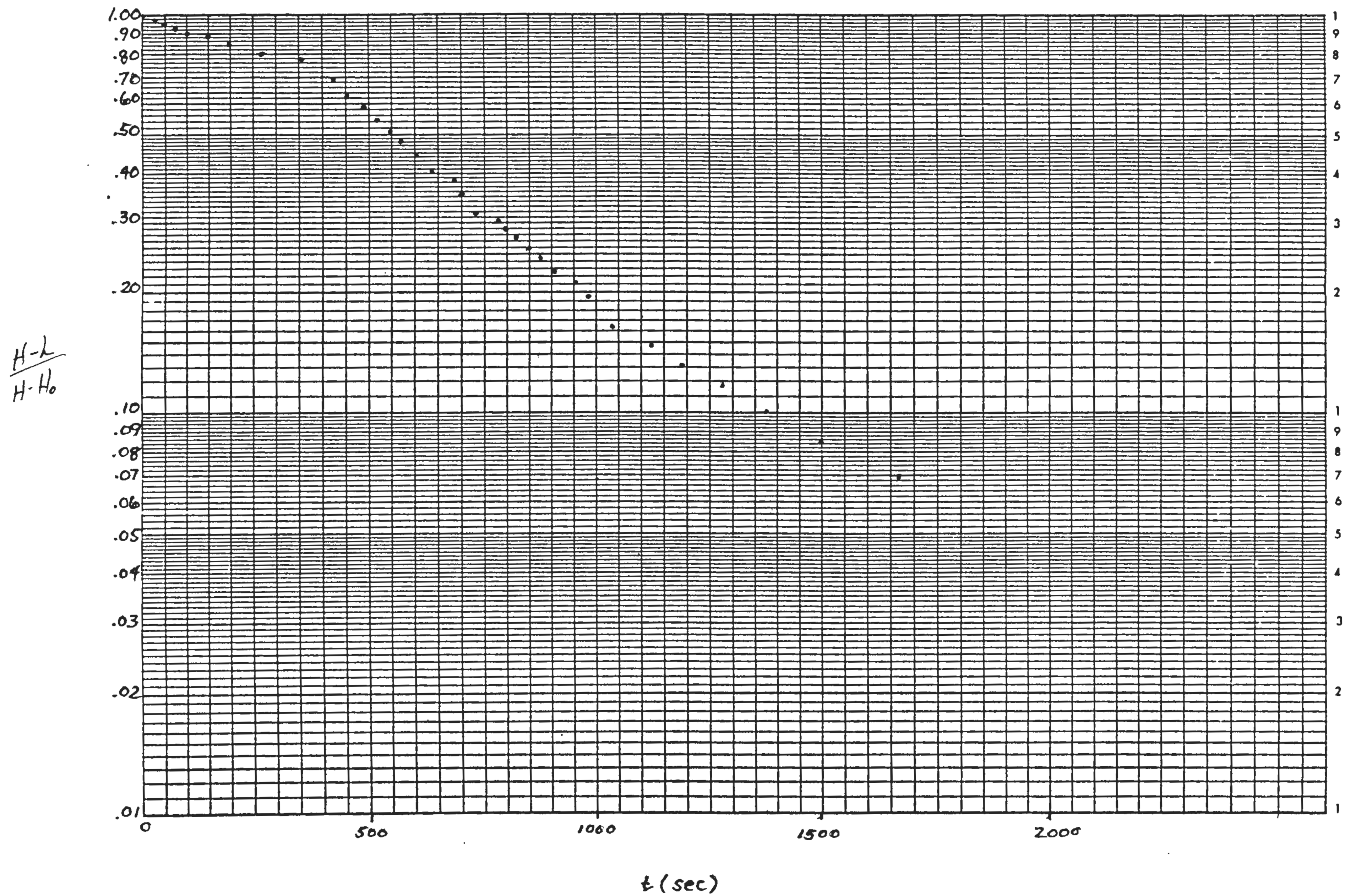
$\frac{H-L}{H-H_0}$
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
800
900
Time in Seconds

MW 14



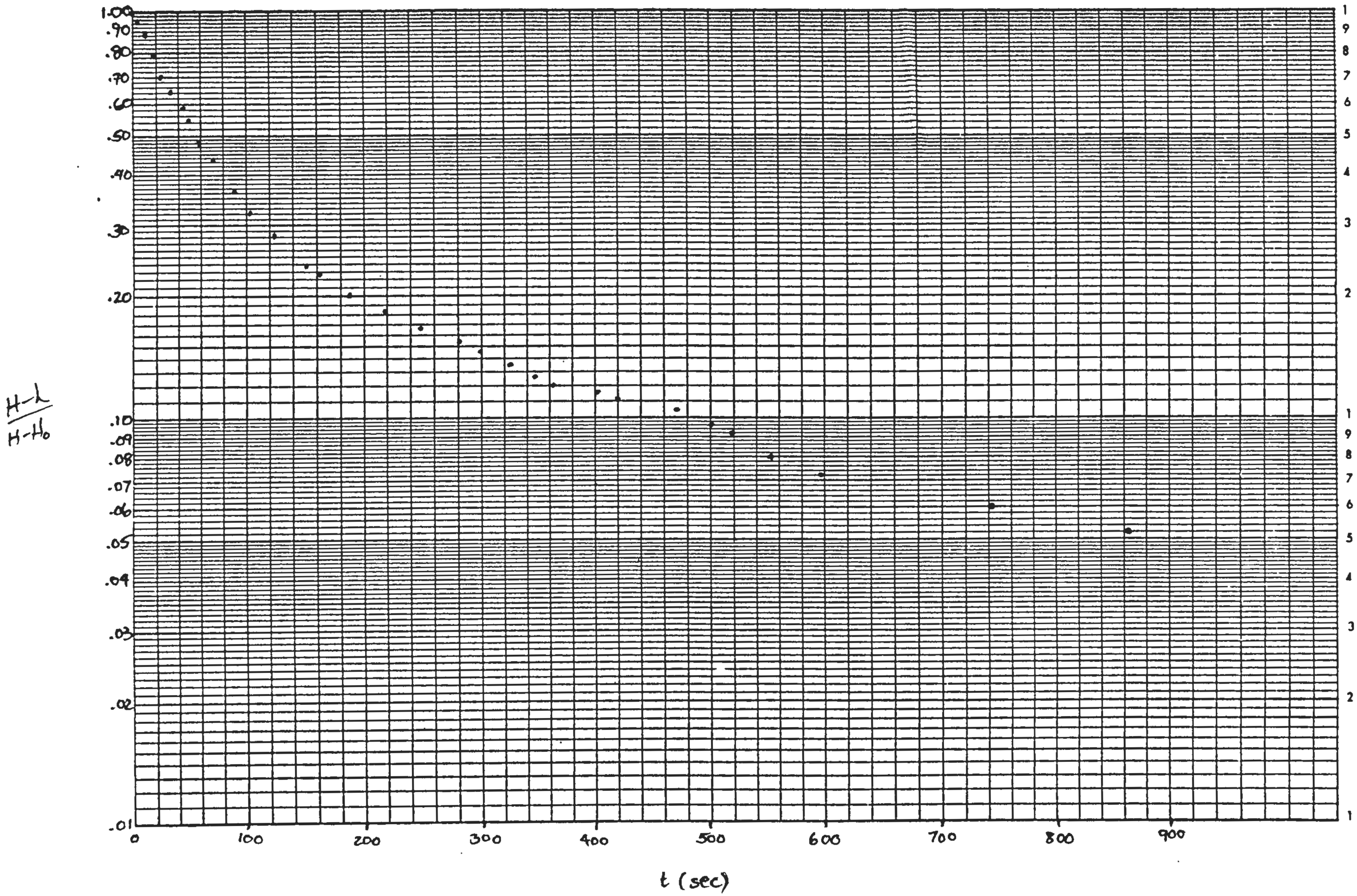
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
.09
.08
.07
.06
.05
.04
.03
.02
.01
H-h / H-Ho
0
100
300
500
700
1000
1500
1800
2000
2500
Time in Seconds

MW15



1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
500
1000
1500
2000
t (sec)

MW17

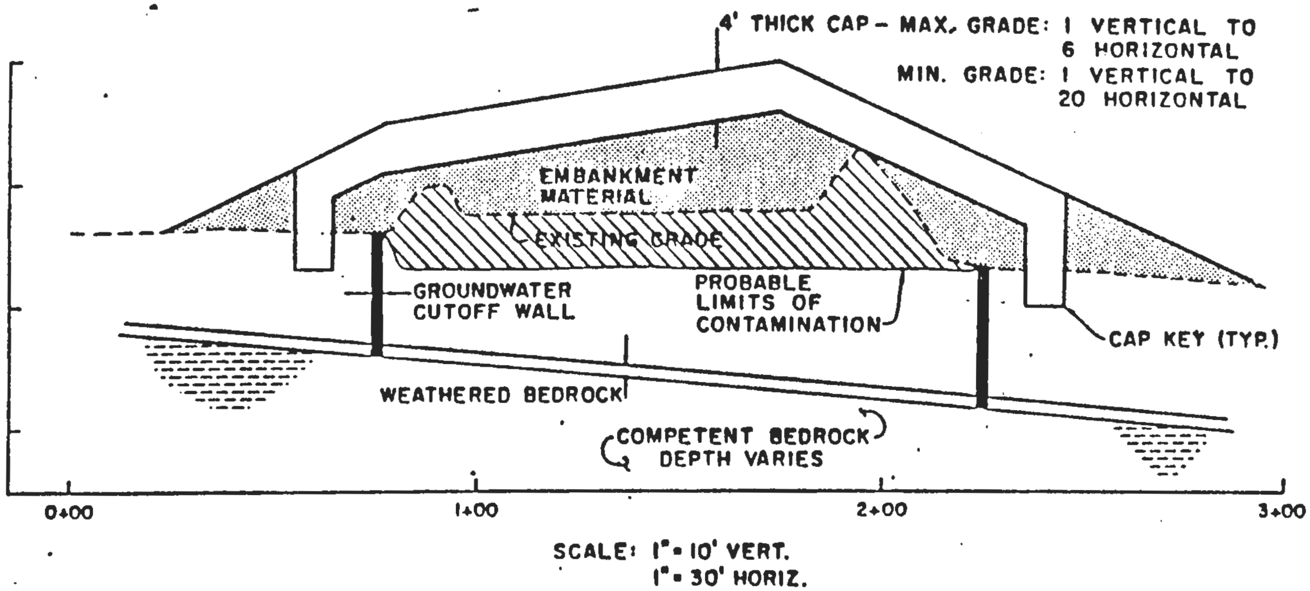


$\frac{H-h}{H-H_0}$
1.00
.90
.80
.70
.60
.50
.40
.30
.20
.10
.09
.08
.07
.06
.05
.04
.03
.02
.01
0
100
200
300
400
500
600
700
800
900
t (sec)

APPENDIX H

SUPPORT INFORMATION AND CALCULATIONS: EVALUATION OF IN-PLACE CONTAINMENT

FIGURE 8



Source: O'Brien & Gere, May 1985

BURNING PADS "B" & "H"
CLOSURE

SENECA ARMY DEPOT

OPEN BURNING PAD "H"

CONCEPTUAL CROSS SECTION SHOWING IN-PLACE CONTAINMENT

O'BRIEN & GERE ENGINEERS INC

Source: O'Brien & Gere, May 1985

TABLE 9

PRELIMINARY COST ESTIMATE FOR IN-PLACE CONTAINMENT INCLUDING A GROUNDWATER CUTOFF WALL AND CAP BURNING PADS B AND H SENECA ARMY DEPOT

Original O'Brien & Gere Cap Construction

Work Item	Quantity	Unit Cost	Total Cost
Mobilization/Demobilization	L.S.	--	$ 14,200
Surface Preparation	11,000 SY	.50	5,500
Groundwater Cutoff Wall	16,800 VSF	10.00	168,000
Embankment Material	8,500 CY	5.00	42,500
24" of 1×10^{-7} cm/sec Soil	5,300 CY	10.00	53,000
20 mil Synthetic Liner	78,000 SF	.60	46,800
6" of Bedding Material	1,350 CY	6.00	8,100
Filter Fabric	17,400 SY	1.00	17,400
12" of 1×10^{-3} cm/sec Drainage Layer	2,700 CY	10.00	27,000
Topsoil and Seed Entire Site	4,600 SY	2.50	11,500
Safety Program	L.S.	--	45,000
Decontamination	L.S.	--	50,000
		Subtotal	$489,000
		Contingency (20%)	$ 98,000
		Total Estimated Construction Cost	$587,000

30 Year Maintenance And Monitoring Cost

1. Site Inspection and Routine Maintenance	
a. Inspection - quarterly, 4 mandays/year @ $100/manday	$ 400
b. Mowing - 4 mowings, 1 mandays/mowing @ 100/manday	400
2. Groundwater Sampling Collection - 4 trips/year @ $100/trip	400
3. Laboratory Analyses - 32 samples/year @ $10/analysis	320
4. Miscellaneous Erosion Control and Grading Work - 1 manday/month @ $100/manday; also $1,000/year for materials	2,200
Annual Post Closure Maintenance and Monitoring Cost	3,720
30 Year Maintenance and Monitoring Cost	111,600
Total Estimated Construction and 30 Year Maintenance and Monitoring Cost	$698,600

Notes

1) All costs based on 1984 dollars.

2) Annex C sampling and analysis costs have not been developed in and are, therefore, not included. In any case, Annex C costs will be the same for any alternative selected.

Project: Seneca Army Depot — Acct. No. 003288-3161 — Page 1 of 7
Subject: Criteria Development Report — Comptd. By: D. Peters — Date: Feb. 28, 198·
Detail: Burning Pad Closure — Ck'd. By: — Date:

METCALF & EDDY, ENGINEERS

Summary of Soil Quantities

Burning Pad	Area of Contaminated Soil (ft^2) *1	Perimeter Length (ft)	Berm Characteristics: Base Width, b (ft)	Berm Characteristics: Height, h (ft)	Berm Characteristics: Length, ℓ (ft)	Volume of Berm Soil (yd^3) *2	Volume of Subsurface Soil (yd^3) *3	Total Volume of Excavated Soil (yd^3) *4
A	9,050	390	15	6	240	400	1,006	1,768
B	8,350	370	15	6	210	350	928	1,609
C	10,700	420	15	10	250	694	1,189	2,344
D	7,500	350	15	10	200	556	833	1,722
E	9,000	380	15	6	220	367	1,000	1,722
F	25,300	650	20	6	420	933	2,811	4,727
G	75,600	1,250	20	8	690	2,044	8,400	13,271
H	23,500	620	15	6	400	667	2,611	4,161
J	64,500	1,180	15	10	660	1,833	7,167	11,425
Site Totals	233,500	5,610	—	—	—	7,844	25,945	42,749

Notes:

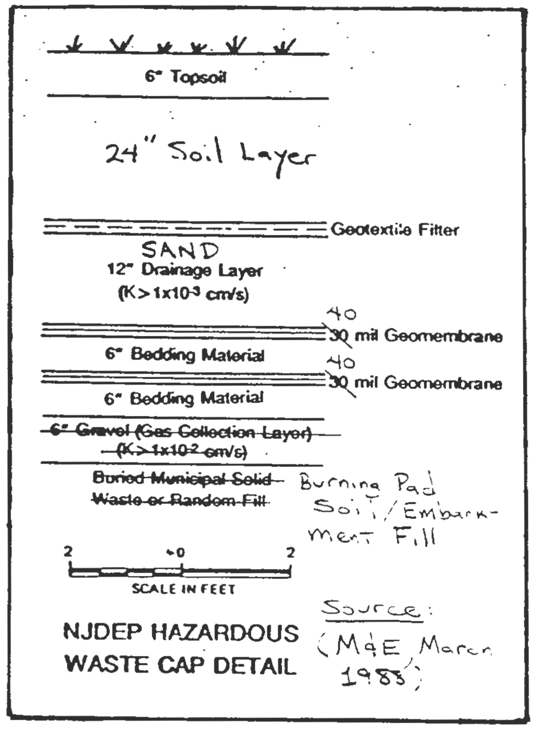
1. Areas based on 5 foot distance away from outer edge of berm.
2. Volume of berm soil soil calculated using $V = \frac{1}{2}(b)(h)(\ell)$. Volumes listed are bank measure.
3. Volume of subsurface soil = (Area of soil) x (depth). Depth assumed = 3 feet. Volumes listed are bank measure.
4. Total Volume includes both berm and subsurface soil. Volumes listed are excavation measure. A 15% expansion or "fluff" factor was applied to berm soil while a 30% factor was applied to subsurface soil.

Estimation of Engineering Quantities

Alternative #1 In-Place Capping / Containment (O'Brien & Gere Option)

O'Brien & Gere cap upgraded to full hazardous waste cap. Cap construction taken from Metcalf & Eddy, March 1988.

A. Haz. Waste Cap



Regrading/Revegetation:

$$(233{,}500\ ft^2)\times\left(\frac{640\ acres}{1\ mile^2}\right)\left(\frac{1\ mile}{5{,}280\ ft}\right)^2$$

from Summary of Soil Quantities

$= 5.36$ acres

Topsoil: 6 inch deep

$$(233{,}500\ ft^2)(0.5\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 4{,}324\ yd^3$$

Soil Layer: 24 inch deep

$$(233{,}500\ ft^2)(2\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 17{,}296\ yd^3$$

Geotextile filter: $233{,}500\ ft^2$

Sand Drainage layer: 12 inch deep

$$(233{,}500\ ft^2)(1\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 8{,}648\ yd^3$$

Geomembrane 40 mil 2 layers:

$$2\times 233{,}500\ ft^2 = 467{,}000\ ft^2$$

Bedding sand 2 layers 6 inch depth each

$$(2)(233{,}500\ ft^2)(0.5\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 8{,}648\ yd^3$$

Embankment fill: Source: O'Brien & Gere, May 1985, Table 9. 8,500 yd^3 of embankment material needed to bring Pads B & H up to grade prior to capping.

NONREPRODUCIBLE GRID FORM 145

METCALF & EDDY, ENGINEERS

A. Haz. Waste Cap (cont'd)

Embankment Fill (cont'd)

Area of contaminated soil, Pads B & H = 8,350 ft^2 + 23,500 ft^2
= 3,539 yd^2

$$\text{Fill Ratio} = \frac{8{,}500 \text{ yd}^3 \text{ fill}}{3{,}539 \text{ yd}^2 \text{ capped area}}$$

$$= \left(2.40 \frac{\text{yd}^3 \text{ fill}}{\text{yd}^2 \text{ cap}}\right) \times (233{,}500 \text{ ft}^2)\left(\frac{\text{yd}^2}{9 \text{ ft}^2}\right)$$

Embankment fill Required = 62,267 yd^3

B. Slurry Wall

From page 4 (and the M&E boring logs) the average depth of the overburden soil is 8 feet. A thickness of 3 feet is common and has been assumed (Environmental Law Institute, October, 1987)

Surface area req'd = (5,610 ft)(8 ft) = 44,880 ft^2

Total perimeter distance of all burning pads, from "Summary of Soil Quantities" p. 1.

C. Grout Curtain

A thickness of 3 feet has been assumed (Environmental Law Institute October 1987). M&E found significant rock fractures into all rock drilled into (only drilled to 5 ft depths, however). USAEHA, October 1985 alludes to Seneca AD bedrock shale having groundwater in joints and bedding planes at depths of 1 - 23 feet

Assume depth of grout curtain = 15 feet.

Surface area req'd = (5,610 ft)(15 ft) = 84,150 ft^2

D. Burning Pad Wells : used to act as ~~both~~ pumping wells to initially remove ground water; then to act as piezometers. One well per pad except for Pads G & J which require 2 each. Eleven (11) wells total. Quantities are derived from diagram on p. 5

M&E
from boring logs

TABLE 3-3. WELL AND WATER LEVEL ELEVATIONS AND HYDRAULIC CONDUCTIVITY VALUES AT SENECA ARMY DEPOT, ROMULUS, NEW YORK

Depth to Rock from land surface (ft)	Well No.	Land Surface Elevations (msl)	Top of Casing (msl)	Water Elevation (msl)	Hydraulic Conductivity (ft/day)	Depth to GW from Land Surface (ft)
9.5	MW-8	120.06	122.08	115.12	0.15	4.91
7.0	MW-9	115.74	117.89	113.59	0.75	2.15
9.0	MW-10	120.09	122.24	115.84	0.02	4.25
9.0	MW-11	111.40	113.95	107.65	0.72	3.75
7.0	MW-12	105.57	107.74	103.76	1.10	1.81
8.0	MW-13	111.83	114.00	109.10	0.04	2.73
8.5	MW-14	105.47	107.43	101.96	0.13	3.51
6.5	MW-15	102.95	105.01	101.83	0.24	1.12
6.5	MW-16	103.70	105.73	100.41	0.38	3.29
9.5	MW-17	105.81	107.89	103.77	1.47	2.04

Avg. = 8.05 ft ⇒ 8 ft

avg = 2.96 ⇓ 3 ft

3.3.7 Hydraulic Conductivities

Recovery tests were conducted on the ten monitoring wells following the collection of analytical groundwater samples in accordance with the COE Approved Final Well Installation Plan. In-situ hydraulic conductivity values based on these tests are presented in Table 3-3.

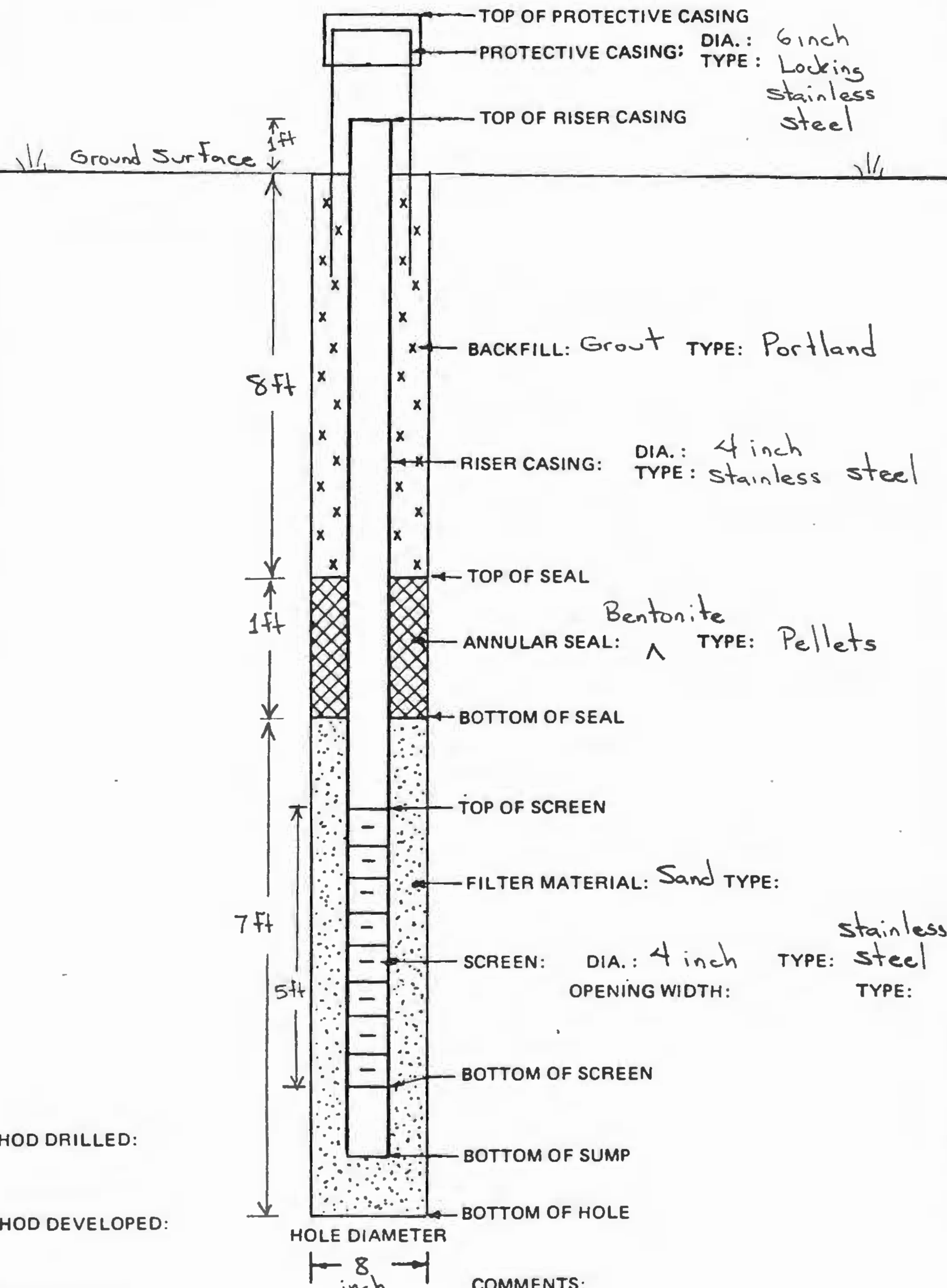
Tests were conducted in the following manner: The static water level in the monitoring well was noted; an instantaneous change in head was caused by bailing a known volume of water from the well; water level recovery was monitored using an electronic well tape. The rate of recovery is a function of the aquifer

GROUND WATER INSTALLATION	PROJECT:	JOB NO.	WELL NO.
DRILLING CONTRACTOR:	COORDINATES:	p. 5 of 9	
BEGUN: / FINISHED:	SUPERVISOR: / DRILLER:	WELL SITE:	WATER LEVEL: DEPTH/ELEV.

REFERENCE POINT & ELEVATION:

DEPTH IN	ELEV. IN

GENERALIZED GEOLOGIC LOG



METHOD DRILLED:

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

Metcalf & Eddy

D. Burning Pad Wells (cont'd)

Disposal of Ground water trapped within slurry wall/grout curtain.

The effective porosity of the overburden soil is assumed equal to 5%.

Volume of ground water to be removed & disposed = (0.05)(Volume of saturated soil)

$= (0.05)(233{,}500\ ft^2)(\underset{\substack{\text{Avg. depth}\\ \text{to rock}\\ \text{(p. 4)}}}{8\ ft} - \underset{\substack{\text{Avg. depth}\\ \text{to g.w.}\\ \text{(p. 4)}}}{3\ ft})$

$= (58{,}375\ ft^3)\left(7.4805\ \frac{gal}{ft^3}\right) = 436{,}674\ gal$

Alternative #2 Chemical Solidification/Stabilization and Capping

A. Chemical Solidification/Stabilization

Excavate Contaminated Soil:

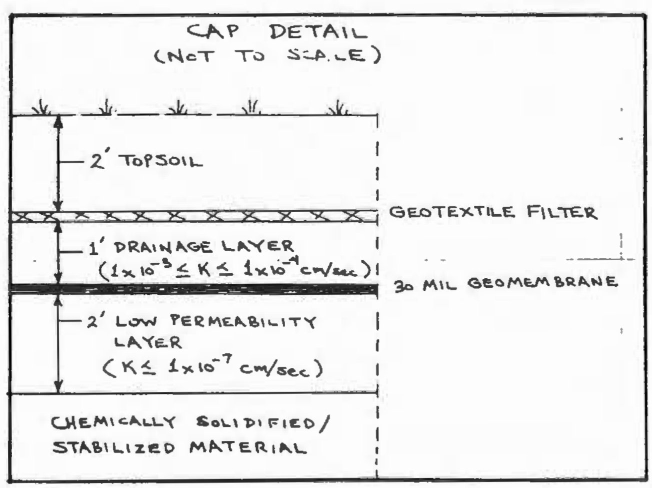
7,844 yd³ berm soil + 25,945 yd³ subsurface soil = 33,789 yd³ soil as bank measure

From summary of soil quantities

Sort and Chemical S/S

42,749 yd³ From Summary of Soil Quantities, p. 1

B. Cap



Regrading/Revegetation:

Will be conducted on area of chemical S/S fill as well as the backfilled burning pads A-E and J. Area of chemical S/S fill = (500 ft)(650 ft) = 325,000 ft²

Project Seneca A.D. Acct. No. ______ Page 7 of 9
Subject ______ Comptd. By D. Peters Date June 21 1-3-
Detail ______ Ck'd. By ______ Date ______

NONREPRODUCIBLE GRID FORM 145

METCALF & EDDY, ENGINEERS

5. Cap (cont'd)

Regrading/Revegetation (cont'd)

From summary of soil quantities Area of Pads A-E and J = 109,100 ft²

$$\text{Total} = 325{,}000 + 109{,}100 = \frac{434{,}100\ ft^2 \mid 640\ acres}{1\ mi^2} \left|\ \frac{1\ mile}{5{,}280\ ft}\right.^2$$

$$= 9.96\ acres$$

Topsoil:
$$\text{Volume req'd} = (325{,}000\ ft^2)(2.0\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 24{,}074\ yd^3$$

Topsoil to be taken from on-site and off-site sources. Existing top 1 foot of soil within proposed chemical s/s fill (but outside of burning pads) to be on-site source.

$$\text{Volume of on-site Topsoil} = \left[\begin{pmatrix}\text{Area of}\\ \text{Chemical}\\ \text{s/s fill}\end{pmatrix} - \begin{pmatrix}\text{Area of}\\ \text{Pads F,}\\ \text{G \& H}\end{pmatrix}\right](1\ ft\ depth)$$

$$= [(325{,}000\ ft^2) - (124{,}400\ ft^2)](1\ ft)\left(\frac{yd^3}{27\ ft^3}\right)$$

$$= 7{,}429\ yd^3 \quad \text{conservatively, say} \quad 7{,}000\ yd^3$$

Topsoil (on-site source): 7,000 yd³
Topsoil (off-site source): 24,074 yd³ - 7,000 yd³ = 17,074 yd³

Drainage (Sand) Layer:

$$(325{,}000\ ft^2)(1.0\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 12{,}037\ yd^3$$

Geotextile: 325,000 ft² of filter fabric

Geomembrane: 325,000 ft² of 30 mil HDPE

Low Permeability (Clay) Layer:

$$(325{,}000\ ft^2)(2.0\ ft)\left(\frac{yd^3}{27\ ft^3}\right) = 24{,}074\ yd^3$$

Place Chemical s/s material: Assume a 35% increase in volume due to the chemical s/s processing

$$= (42{,}749\ yd^3\ \text{excavated soil})(1.35) = 57{,}711\ yd^3$$

NONREPRODUCIBLE GRID FORM 145

METCALF & EDDY, ENGINEERS

D. Restoration

Backfill Excavated Pads: Backfill clean fill into excavated holes of pads A-J. Assume 20% consolidation.

$$\text{Fill req'd} = \text{Area of Pads A-J} \; (\underbrace{3\text{ft}}_{\text{depth}})(1.20)\left(\frac{yd^3}{27ft^3}\right)$$

$$= (233{,}500\ ft^2)(3ft)(1.20)\left(\frac{yd^3}{27ft^3}\right)$$

$$\text{Fill req'd} = 31{,}133\ yd^3$$

Regrading & Revegetation

$$\text{Area of all pads} = \frac{233\,500\ ft^2}{} \left| \frac{640\ \text{acres}}{1\ mi^2} \right| \left(\frac{1\ \text{mile}}{5280\ ft}\right)^2 = 5.36\ \text{acres}$$

09:33 AM

METCALF & EDDY, INC.
COST ESTIMATE

JOB NO :	003288-3161	CLIENT :	US ARMY
DATE :	24-Jun-89	PROJECT :	SENECA ARMY DEPOT
LOCATION :	SENECA FALLS, NY	CAPACITY:	
PREPARED BY:	GJ ARNO	ACCURACY:	± 30 %

A L T E R N A T E 1
ENR INDEX = 4593

ACCOUNT	DESCRIPTION		MANHOURS	MATERIAL	LABOR	TOTAL
1.	GENERAL REQUIREMENTS					0
2.	SITEWORK		79,036	2,659,637	2,766,243	5,425,880
3.	FOUNDATIONS & CONCRETE					0
4.	MASONRY					0
5.	METALS					0
6.	WOOD & PLASTICS					0
7.	MOISTURE, THERMAL PROTECTION					0
8.	DOORS, WINDOWS, GLASS					0
9.	FINISHES					0
10.	SPECIALTIES					0
11.	EQUIPMENT					0
12.	FURNISHINGS					0
13.	INSTRUMENTATION					0
14.	CONVEYING SYSTEMS					0
15.a.	MECHANICAL EQUIPMENT					0
b.	PLUMBING					0
c.	HVAC					0
d.	PROCESS PIPE					0
16.	ELECTRICAL					0
	SUBTOTAL DIRECT COSTS		79,036	2,659,637	2,766,243	5,425,880
	CONTRACTOR OVERHEAD & PROFIT	22.00%				1,193,693
	CONSTRUCTION EQUIPMENT					
	MISCELLANEOUS					
	ENGINEERING (ALLOWANCE)	10.00%				542,588
	SUBTOTAL DIRECT & INDIRECT COSTS					7,162,161
	ENR CITY COST INDEX	0.00%				0
	CONTINGENCY	25.00%				1,790,540
	GRAND TOTAL					8,952,701

DATE PRINTED : 23-Jun-89

JOB #:	003288-3161	METCALF & EDDY ENGINEERS	CLIENT :	US ARMY
DATE:	24-Jun-89	COST ESTIMATE	PROJECT :	SENECA ARMY DEPOT
LOCATION:	SENECA FALLS, NY		CAPACITY:	
PREPARED BY	GJ ARNO	A L T E R N A T E 1	ACCURACY:	± 30 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	MANHOURS MHR/ UNIT	MANHOURS TOTAL MH	MATERIAL UNIT COST	MATERIAL TOTAL MATL	LABOR WAGE RATE	LABOR TOTAL LABOR	TOTAL DIRECT COST
-2-	SITEWORK									
A	HAZARDOUS WASTE CAP ===================================									
	REGRADING & REVEGETATION	5.36	AC	60.00	322	1,000.00	5,360	35.00	11,256	16,616
	TOPSOIL (6" DEEP)	4,320	CY	0.20	864	13.00	56,160	35.00	30,240	86,400
	SOIL LAYER (24" DEEP)	17,300	CY	0.20	3,460	11.00	190,300	35.00	121,100	311,400
	GEOTEXTILE FILTER	233,500	SF	0.05	11,675	0.40	93,400	35.00	408,625	502,025
	SAND LAYER (12" DEEP)	8,650	CY	0.15	1,298	10.00	86,500	35.00	45,413	131,913
	GEOMEMBRANE (40 MIL HDPE)	467,000	SF	0.05	23,350	1.50	700,500	35.00	817,250	1,517,750
	BEDDING SAND (12" DEEP)	8,650	CY	0.15	1,298	10.00	86,500	35.00	45,413	131,913
	EMBANKMENT FILL	62,270	CY	0.15	9,341	10.00	622,700	35.00	326,918	949,618
B	SLURRY WALL ===================================									
	OVERBURDEN SOIL - BENTONITE SLURRY WALL (3' THICK)	44,880	SF	0.035	1,571		0	35.00	54,978	54,978
C	GROUT CURTAIN ===================================									
	BEDROCK GROUT CURTAIN (3' THICK)	84,150	SF	0.30	25,245	9.00	757,350	35.00	883,575	1,640,925

JOB #: 003288-3161 METCALF & EDDY ENGINEERS
DATE: 24-Jun-89 COST ESTIMATE
LOCATION: SENECA FALLS, NY
PREPARED BY GJ ARNO

A L T E R N A T E 1

CLIENT : US ARMY
PROJECT : SENECA ARMY DEPOT
CAPACITY:
ACCURACY: ± 30 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	MANHOURS MHR/ UNIT	MANHOURS TOTAL MH	MATERIAL UNIT COST	MATERIAL TOTAL MATL	LABOR WAGE RATE	LABOR TOTAL LABOR	TOTAL DIRECT COST
D	BURNING PAD WELLS ===================================									
	6" DIA PROTECTIVE CASING	11	EA	24.00	264	1,000.00	11,000	35.00	9,240	20,240
	6.25" HSA DRILLLING	176	LF	0.30	53	12.00	2,112	35.00	1,848	3,960
	4" SS RISER PIPE	121	LF	2.20	266	25.00	3,025	35.00	9,317	12,342
	4" SS SCREEN	55	LF	0.20	11	15.00	825	35.00	385	1,210
	GROUT	16	CF	1.00	16	10.00	160	35.00	560	720
	BENTONITE PELLETS	3	CF	0.20	1	15.00	45	35.00	21	66
	BEDDING SAND	15	CF	0.20	3		0	35.00	105	105
	TRUCKING & DISPOSAL OF GROUND WATER 5 MILE ROUND TRIP	437,000	GA		0	0.10	43,700	35.00	0	43,700
	SUBTOTAL SITEWORK				79,036		2,659,637		2,766,243	5,425,880

02:49 PM

METCALF & EDDY, INC.
COST ESTIMATE

JOB NO : 003288-3161
DATE : 24-Jun-89
LOCATION : SENECA FALLS, NY
PREPARED BY: GJ ARNO

CLIENT : US ARMY
PROJECT : CHEMICAL STABILIZ'N & CAPPING
CAPACITY: 33,790 CY
ACCURACY: ± 30 %

ALTERNATE 2
ENR INDEX = 4593

ACCOUNT	DESCRIPTION		MANHOURS	MATERIAL	LABOR	TOTAL
1.	GENERAL REQUIREMENTS					0
2.	SITEWORK		81,767	4,526,430	2,901,942	7,428,372
3.	FOUNDATIONS & CONCRETE					0
4.	MASONRY					0
5.	METALS					0
6.	WOOD & PLASTICS					0
7.	MOISTURE, THERMAL PROTECTION					0
8.	DOORS, WINDOWS, GLASS					0
9.	FINISHES					0
10.	SPECIALTIES					0
11.	EQUIPMENT					0
12.	FURNISHINGS					0
13.	INSTRUMENTATION					0
14.	CONVEYING SYSTEMS					0
15.a.	MECHANICAL EQUIPMENT					0
b.	PLUMBING					0
c.	HVAC					0
d.	PROCESS PIPE					0
16.	ELECTRICAL					0
	SUBTOTAL DIRECT COSTS		81,767	4,526,430	2,901,942	7,428,372
	CONTRACTOR OVERHEAD & PROFIT	22.00%				1,634,242
	CONSTRUCTION EQUIPMENT					
	MISCELLANEOUS					
	ENGINEERING (ALLOWANCE)	10.00%				742,837
	SUBTOTAL DIRECT & INDIRECT COSTS					9,805,451
	ENR CITY COST INDEX	0.00%				0
	CONTINGENCY	25.00%				2,451,363
	GRAND TOTAL					12,256,814

JOB #: 003288-3161 METCALF & EDDY ENGINEERS
DATE: 24-Jun-89 COST ESTIMATE
LOCATION: SENECA FALLS, NY
PREPARED BY GJ ARNO

ALTERNATE 2

CLIENT : US ARMY
PROJECT : CHEMICAL STABILIZ'N & CAPPING
CAPACITY: 33,790 CY
ACCURACY: ± 30 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	MANHOURS MHR/ UNIT	TOTAL MH	MATERIAL UNIT COST	TOTAL MATL	LABOR WAGE RATE	TOTAL LABOR	TOTAL DIRECT COST
-2-	SITEWORK									
A	CHEMICAL SOLIDIFICATION & STABILIZAT ===================================									
	GEOPHYSICAL SURVEY	233,500	SF	0.0114	2,672		0	50.00	133,607	133,607
	EXCAVATE CONTAMINATED SOIL BANK MEASURE	33,790	CY	0.15	5,069		0	35.00	177,398	177,398
	SORT SOIL (EXCAVATED MEASURE)	42,750	CY	0.20	8,550		0	35.00	299,250	299,250
	CHEMICAL SOLIDIFICATION/STABILIZATIO	42,750	CY	0.20	8,550	75.00	3,206,250	35.00	299,250	3,505,500
B	CAP ===================================									
	REGRADING & REVEGETATION	9.96	AC	60.00	598	1,000.00	9,960	35.00	20,916	30,876
	PLACE STABILIZED MATERIAL	57,700	AC	0.20	11,540		0	35.00	403,900	403,900
	TOPSOIL (6" DEEP) ON-SITE SOURCE	7,000	CY	0.20	1,400		0	35.00	49,000	49,000
	TOPSOIL (6" DEEP) OFF-SITE SOURC	17,080	CY	0.20	3,416		0	35.00	119,560	119,560
	GEOTEXTILE FILTER	325,000	SF	0.05	16,250	0.40	130,000	35.00	568,750	698,750
	DRAINAGE (SAND) LAYER (12" DEEP)	12,040	CY	0.15	1,806	10.00	120,400	35.00	63,210	183,610
	GEOMEMBRANE (40 MIL HDPE)	325,000	SF	0.05	16,250	1.50	487,500	35.00	568,750	1,056,250
	K <= 10E-7 SOIL (24" DEEP CLAY)	24,080	CY	0.04	963	14.00	337,120	35.00	33,712	370,832
C	BACKFILL ===================================									
	BACKFILL EXCAVATED PADS	23,520	CY	0.20	4,704	10.00	235,200	35.00	164,640	399,840
	SUBTOTAL SITEWORK				81,767		4,526,430		2,901,942	7,428,372

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METCALF & EDDY, INC.
COST ESTIMATE

JOB NO :	003288-3161	CLIENT :	US ARMY
DATE :	24-Jun-89	PROJECT :	CHEMICAL STABILIZ'N & CAPPING
LOCATION :	SENECA FALLS, NY	CAPACITY:	33,790 CY
PREPARED BY:	GJ ARNO	ACCURACY:	± 30 %

A L T E R N A T E 3
ENR INDEX = 4593

ACCOUNT	DESCRIPTION		MANHOURS	MATERIAL	LABOR	TOTAL
1.	GENERAL REQUIREMENTS					0
2.	SITEWORK		117,417	10,253,505	4,149,685	14,403,190
3.	FOUNDATIONS & CONCRETE					0
4.	MASONRY					0
5.	METALS					0
6.	WOOD & PLASTICS					0
7.	MOISTURE, THERMAL PROTECTION					0
8.	DOORS, WINDOWS, GLASS					0
9.	FINISHES					0
10.	SPECIALTIES					0
11.	EQUIPMENT					0
12.	FURNISHINGS					0
13.	INSTRUMENTATION					0
14.	CONVEYING SYSTEMS					0
15.a.	MECHANICAL EQUIPMENT					0
b.	PLUMBING					0
c.	HVAC					0
d.	PROCESS PIPE					0
16.	ELECTRICAL					0
	SUBTOTAL DIRECT COSTS		117,417	10,253,505	4,149,685	14,403,190
	CONTRACTOR OVERHEAD & PROFIT	22.00%				3,168,702
	CONSTRUCTION EQUIPMENT					
	MISCELLANEOUS					
	ENGINEERING (ALLOWANCE)	10.00%				1,440,319
	SUBTOTAL DIRECT & INDIRECT COSTS					19,012,211
	ENR CITY COST INDEX	0.00%				0
	CONTINGENCY	25.00%				4,753,053
	GRAND TOTAL					23,765,264

DATE PRINTED : 23-Jun-89

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JOB #: 003288-3161 METCALF & EDDY ENGINEERS
DATE: 24-Jun-89 COST ESTIMATE
LOCATION: SENECA FALLS, NY
PREPARED BY GJ ARNO A L T E R N A T E 3

CLIENT : US ARMY
PROJECT : CHEMICAL STABILIZ'N & CAPPING
CAPACITY: 33,790 CY
ACCURACY: ± 20 %

ACCOUNT NO	DESCRIPTION	QUANTITY	UN	M A N H O U R S MHR/ UNIT	TOTAL MH	M A T E R I A L UNIT COST	TOTAL MATL	L A B O R WAGE RATE	TOTAL LABOR	TOTAL DIRECT COST
-2-	SITEWORK									
A	EXCAVATION									
	GEOPHYSICAL SURVEY	233,500	SF	0.0114	2,672		0	50.00	133,607	133,607
	EXCAVATE CONTAMINATED SOIL BANK MEASURE	33,790	CY	0.15	5,069		0	35.00	177,398	177,398
	SORT SOIL (EXCAVATED MEASURE	42,750	CY	0.20	8,550		0	35.00	299,250	299,250
B	TREATMENT									
	INCINERATION	42,750	CY	1.00	42,750	105.00	4,488,750	35.00	1,496,250	5,985,000
	CHEMICL SOLID/STAB. OF ASH	42,750	CY	0.20	8,550	75.00	3,206,250	35.00	299,250	3,505,500
C	DISPOSAL									
	TRANSPORT(300 MILES ROUNDTRIP)	57,700	CY	0.20	11,540	10.00	577,000	35.00	403,900	980,900
	TIPPING FEE, SW LANDFILL	57,700	CY	0.55	31,735	28.85	1,664,645	35.00	1,110,725	2,775,370
D	RESTORATION									
	BACKFILL EXCAVATED PADS	31,150	CY	0.20	6,230	10.00	311,500	35.00	218,050	529,550
	REGRADING & REVEGITATION	5.36	AC	60.00	322	1,000.00	5,360	35.00	11,256	16,616
	SUBTOTAL SITEWORK				117,417		10,253,505		4,149,685	14,403,190

Summary of Operation & Maintenance Costs

1. Cap Maintenance:

Inspection, cap maintenance, regrading etc. assumed = \$1,000/yr·acre

Alternative 1: $\frac{233{,}500 \text{ ft}^2}{} \Big| \frac{\text{acre}}{43{,}560 \text{ ft}^2} \Big| \frac{\$1{,}000}{\text{yr}\cdot\text{acre}} = \$5{,}360/\text{yr}$

Alternative 2: $\frac{325{,}000 \text{ ft}^2}{} \Big| \frac{\text{acre}}{43{,}560 \text{ ft}^2} \Big| \frac{\$1{,}000}{\text{yr}\cdot\text{acre}} = \$7{,}460/\text{yr}$

Alternative 3: No cap maintenance req'd.

2. Groundwater Monitoring:

Based on M&E's field sampling efforts labor and equipment for 1 monitoring well sample = \$680/well

Two rounds of sampling per well per year are required. One of these rounds must determine groundwater quality. Both rounds have to determine groundwater contamination (indicator analyses).

Activity	Costs (\$/well sample) Round 1	Round 2
Sampling Labor/Equipment	680	680
Analytical Testing:		
GW quality: Explosives	550	—
GW quality: Dissolved metals	250	—
GW Contamination Indicators: Total metals	250	250
GW Contamination Indicators: Nitrate-N/other inorganic	50	50
QA/QC (20% of analytical)	220	60
Data Reduction	160	160
	2,160	1,200

Yearly monitoring cost = 2,160 + 1,200 = \$3,360/well

NONREPRODUCIBLE GRID FORM 145

2. Groundwater Monitoring (cont'd)

Alternative 1 Monitor 13 wells annually (for n = 30 years) Long Term Monitoring

$$\frac{13 \text{ wells}}{\text{yr}} \Big| \frac{\$3,360}{\text{well}} = \$43,680/\text{yr}$$

Alternative 2 Monitor 4 wells annually (for n = 30 years) Long Term Monitoring

$$\frac{4 \text{ wells}}{\text{yr}} \Big| \frac{\$3,360}{\text{well}} = \$13,440/\text{yr}$$

Alternative 3 Monitor 13 wells annually (for n = 3 years) Short Term Monitoring

= $43,680/yr

Net Present Worth (NPW)

NPW is calculated using the following formula:

$$\boxed{NPW = \sum_{n=1}^{N} A\,(1+i_{IR})^{n-1} \frac{1}{(1+i_{DF})^{n}}}$$

where NPW: (January 1989 $)

n: year count; N: lifetime (30 years for Alt # 1 & 2, 3 years for Alt # 3)

A: Alternatives' (Jan. 89) total O&M

i_{IR} = inflation rate = 5% = 0.05

i_{DF} = discount factor = 8% = 0.08

Alternative	Cap Maintenance (Jan. 89 $/yr)	GW Monitoring (Jan. 89 $/yr)	A, Total Yearly O&M (Jan. 89 $/yr)
1	5,360	43,680	49,040
2	7,460	13,440	20,900
3	0	43,680	43,680

METCALF & EDDY, ENGINEERS