JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

November 5, 2019

Trappe East Holding Business Trust
c/o Mr. Robert D. Rauch, P.E.
Rauch, Inc.
106 North Harrison Street
Easton, Maryland 21601

Re: Updated Final Report of Hydrogeologic Evaluation Services
Lakeside aka Trappe East
Trappe, Maryland
Project No.: JDH-10/19/409

Dear Mr. Rauch:

John D. Hynes & Associates, Inc. is pleased to present this updated final report of Hydrogeologic Evaluation services for the above referenced property. The services were generally performed as we discussed. The report follows generally accepted format and practices for the completion of hydrogeologic evaluations. The evaluation was completed to determine if site conditions were suitable for the discharge of treated wastewater using spray irrigation. This updated report was prepared to address modifications to the proposed treatment system in the time since the original report was prepared in 2004 (Project Number JDH-10/02/265).

The results of the evaluation indicate that approximately 107 acres on the property are acceptable for spray irrigation. Approximately 85 acres has been designated as the primary spray area. Approximately 22 acres has been designated as the reserve area. The primary spray area meets MDE requirements for up to 2 inches of spray irrigation on a weekly basis. Based on an anticipated maximum flow of 540,000 gallons per day, treated wastewater can be discharged over the 85 acres at a rate of approximately 2 inches per week. The spray rate and spray area were calculated based on a 10 month spray period.

John D. Hynes & Associates, Inc. appreciates the opportunity to be of service to you. If you have any questions regarding this report or if we may be of further assistance, please contact our office.

Respectfully,

JOHN D. HYNES & ASSOCIATES, INC.

Richard D. Rhoads
Environmental Project Manager

John D. Hynes, P.E.
President

STATE OF MARYLAND
JOHN DAVID HYNES
No. 16233
REGISTERED
PROFESSIONAL ENGINEER

RDR: JDH/jsl

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UPDATED FINAL REPORT OF HYDROGEOLOGIC EVALUATION FOR PROPOSED SPRAY IRRIGATION SYSTEM

LAKESIDE AKA TRAPPE EAST
TRAPPE, MARYLAND

PREPARED FOR
TRAPPE EAST HOLDING BUSINESS TRUST
AND TOWN OF TRAPPE

NOVEMBER 5, 2019
PROJECT NO.: JDH-10/19/409

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HYNES

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this hydrogeologic evaluation is to evaluate whether spray irrigation of treated wastewater is a feasible sewage disposal option for the proposed residential and commercial development project to be located on the property of Trappe East Holding Business Trust (TEHBT). On August 27, 2019, the Maryland Department of the Environment (MDE) issued a Notice of Tentative Determination for State Discharge Permit 19DP3460. A final determination will be made after the public comment period, which ended on September 30, 2019.

The scope of work included characterizing and describing soils on the property, evaluating the geologic and hydrologic conditions at the site by conducting research of published information and by performing field testing, and evaluating the overall suitability of a spray irrigation system for the site. The work was completed in general accordance with the published "Guidelines for Land Treatment of Municipal Wastewaters" prepared by the Maryland Department of the Environment (MDE), dated July 2002 and amended April 2010.

1.2 Limitations and Exceptions of Site Evaluation

This Hydrogeologic Evaluation has been performed for the exclusive use of TEHBT and their agents. This evaluation has been completed in accordance with generally accepted environmental practices. This report should in no way be construed as a recommendation to develop or not develop the referenced site.

The conclusions and recommendations are based upon information provided to us by others and our site exploration data. Rauch, Inc. provided information regarding the design of the proposed system. We are not responsible for the accuracy of the information provided by others.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Location and Property Description

The proposed Lakeside aka Trappe East Project is located on property owned by TEHBT. The property, encompassing approximately 800 acres, is located between Barber Road and Backtown Road, east of U.S. Route 50 in Talbot County, east of Trappe, Maryland. The area of study encompasses approximately 115 acres. Refer to Appendix 9.1 *Project Location Map: Drawing JDH-10/19/409-A* for the general site location. The Lakeside aka Trappe East Project is herein referred to as the subject project.

The project site is predominantly undeveloped agricultural and woodland area. The area of study includes approximately 107 acres of predominantly agricultural land. The study area is divided into two separate areas. The areas include approximately 85 acres that is designated the Proposed Spray Area and approximately 22 acres that is designated the Proposed Reserve Area. The proposed spray area is further divided into North and South sections. Refer to Appendix 9.2 *Proposed Spray Area: Drawings JDH-10/19/409-B* for the locations of the study areas.

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2.2 Present and Future Land Use

Currently, the project site is predominantly undeveloped agricultural and woodland area. Approximately 15 acres of the 107 acre study area is wooded. The study area is proposed to be utilized as the spray irrigation and reserve areas for a wastewater treatment system that will be built in conjunction with the planned mixed residential and commercial development that meets the goals and standards of the Town of Trappe Comprehensive Master Plan. The proposed development is planned to commence in 2020. Development of the Trappe East Growth Area is scheduled to be completed within approximately 10 years.

3.0 PROPOSED LAND TREATMENT STRATEGY

3.1 Wastewater Treatment

Full development of the Lakeside mixed use development is estimated to be completed by 2030. It is further estimated that 540,000 gallons per day of wastewater will be generated by the fully built-out development. MDE requires wastewater treatment for spray irrigation to meet Class II effluent standards. Minimum effluent permit limits, related buffers, ground cover and application rates are all established based on these minimum requirements. The proposed Lakeside wastewater treatment plant will be designed to exceed Class II limits to further ensure compliance with all water quality standards. A Smith & Loveless ENR MBR Phased Wastewater Treatment Plant (WWTP) is proposed for the Lakeside development. ENR quality effluent will be achieved with a 4-stage biological treatment process and membrane filtration. Treated effluent from the proposed ENR MBR WWTP will typically meet or exceed Class III effluent standards. The system will be designed based on the following Influent Design Values (all concentrations in mg/L):

BOD = 250
TSS = 250
Nitrogen = 60
Phosphorus = 8

After treatment and prior to land application via spray irrigation, the wastewater will be managed in a phased storage lagoon located adjacent to the WWTP. The lagoon capacity will be increased in phases to coincide with the phased construction of the treatment plant. The lagoon has been designed to provide seasonal storage for 60 days of treated effluent as required by MDE and specified in the discharge permit. The lagoon will, also, be used during periods of permitted spray irrigation for proper management during limited periods of restricted discharge and spray sequencing. The location of the lagoon and the treatment facility are depicted in the Proposed Lagoon Location Exhibit: Drawing JDH-10/19/409-C that is included as Appendix 9.3.

3.2 Land Treatment Technique

After treatment, the wastewater will be applied to the land surface using spray irrigation. Based on the planned residential and commercial development, a maximum of approximately 540,000 gallons (0.54 MGD) of wastewater will be treated and discharged over the 85 acre spray area on a daily basis when the proposed development is completed. The maximum estimated discharge rate will not be reached until the project is completed in 2030.

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Based on an anticipated flow of 540,000 gpd, a projected spray rate of 2 inches per week and assuming 60 days for storage, a spray area of approximately 85 acres will be required for the treatment system. Based on 10 months of spray application (43.5 weeks), approximately 87 inches of treated effluent will discharge during one year. The spray area will be divided into two or three zones. Each zone will be sprayed one day per week. This schedule will allow 4 to 5 days per week for rain, saturated soil conditions and maintenance. The zones will be set up to be sprayed at approximately ¼ inch per hour for 8 hours each. The wastewater will be sprayed using a combination of conventional agricultural pivot systems and solid-set type sprinkler heads.

4.0 GEOLOGY, SOILS AND HYDROLOGY

4.1 General Site Geology

The site is underlain by unconsolidated sediments of the Atlantic Coastal Plain. Based on information provided in a boring log from a well drilled approximately one mile north of the site (Maryland Geological Survey – Report of Investigation No. 72, 2001), the sediments underlying the site consist of approximately 70 feet of sands and silts of the Columbia Group. These materials are underlain by approximately 275 feet of Miocene Age sands and silts, which have been identified as the Choptank and Calvert Formations of the Chesapeake Group.

4.2 Site Soils

Based on information provided on the USDA online Web Soil Survey, the shallow soils in the area of the project site consist of Ingleside, Hambrook-Sassafras, and Woodstown soils. The majority of the site is mapped as Hambrook-Sassafras sandy loams and loams, with slopes up to 10 percent. Small areas of the site are mapped as Ingleside loamy sands and Woodstown loams. The Soil Survey Map: Drawing JDH-10/19/409-D is included as Appendix 9.4.

Ingleside Series soils consist of well-drained to somewhat excessively drained sandy soils. These soils do not have a fluctuating high water table. The water table remains below a depth of 5 feet all year. The permeability of these soils is "moderately rapid".

Woodstown Series soils consist of moderately well drained sandy soils. These soils typically have a fluctuating water table that can be as high as 1.5 feet below the ground surface in some areas of the County. As will be discussed later in this report, the depth to groundwater in the study area is greater than 5 feet in all areas. The permeability of these soils is "moderate".

Sassafras Series soils consist of deep, well-drained sandy soils with significant amounts of silt and clay. These soils do not have a fluctuating high water table. The water table remains below a depth of 5 feet all year. The permeability of these soils is "moderate".

The mapped soils meet the minimum USDA texture specifications for a slow rate land treatment system (clay loam to sandy loams). In addition, the published range of permeabilities of the mapped soils (0.2 to >6.3 in./hr.) meets MDE guidelines for a slow rate system. The slope of the mapped soils (10 percent or less) is less than the MDE guideline of 15 percent.

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Observations and testing completed on-site support the suitability of a portion of the site to be utilized for spray irrigation. On April 23, 2002, Dr. Ching-Tzone Tien, Chief of the Groundwater Discharge Permits Division for the Maryland Department of the Environment (MDE), observed the excavation of ten test pits at the site (TP-MD1 through TP-MD10). A letter generated by MDE documenting their site observations is included in Appendix 9.5. The letter states that the areas adjacent to each test pit, with the exception of TP-MD5, appear to be feasible for spray irrigation. The locations of the MDE test pits are shown on the *Test Pit Boring and Piezometer Location Map: Drawing JDH-10/19/409-E1 and E2* that is included as Appendix 9.6.

To more fully characterize site soils, 23 soil borings, 6 test pits, and 18 infiltration tests were completed by Hynes & Associates in the study area. We note that 16 of the soil borings were converted to piezometers. The borings are labeled with a 'B' designation, the boring/piezometers are labeled with a 'P' or 'PZ' designation and the test pits are labeled with a 'TP' designation. The locations denoted with 'TP-H_' designations are infiltration test locations. We note that the borings and piezometers that are located within the study area are not labeled sequentially. Several borings, test pits and piezometers were completed in other areas of the site that are not included in this study. Test pit, boring and piezometer locations are depicted in the Test Pit and Piezometer Location Maps: Drawings JDH-10/19/409-E1, E2 and F.

Subsurface soils were visually classified in accordance with the Unified Soil Classification System (USCS) as SANDs with some to trace silts and clays (SM, SC and SP) and SILTS with some sand (ML). The soils were classified as Sand, Loamy sand, Sandy loam and Silt loam in accordance with the U.S. Department of Agriculture (USDA) classification system. Keys to the Classification systems are attached. The boring logs are included as Appendix 9.7. Cross Sections that depict the subsurface lithology are included in Appendix 9.8.

The observed characteristics of the subsurface soils suggest that there are minimal features that will inhibit the downward infiltration of wastewater. Below the 2 foot treatment zone, the most limiting soil horizons consist of Silt loam. Based on infiltration data that is presented later in this study, and based on the similar characteristics of the shallower soils, these deeper horizons likely exhibit permeabilities of greater than 0.64 centimeters per hour.

4.3 Site Hydrology

4.3.1 Regional Climate

The climate of Talbot County, along with the rest of Maryland's Eastern Shore, is characterized by a humid, semi-continental climate. Based on available climatological data collected by the National Weather Service in Royal Oak, Maryland, the average monthly temperatures range from 36 degrees Fahrenheit in January to 78.5 degrees Fahrenheit in July. Rainfall data from the NOAA reporting station in Salisbury, Maryland was used. A total of 54.29 inches of rainfall was reported in 2018.

Using this climatic data, and using data for the approximate percent of annual daytime hours for each month for the approximate latitude of the site, the potential evapotranspiration (PET) was calculated for the site. The PET was calculated using the Blaney-Criddle Method (PET=KF), where K = the Crop use coefficient and F = the Consumptive use factor. A conservative value of 0.78 was used for the K value. Typical K values range from 0.78 for wheat, up to approximately 1.0 for conifer trees. The value of F takes into account the average monthly temperatures and the percent of daytime hours. A table listing the input variables and monthly PET values is included in Appendix 9.9. A total PET of 42.31 inches per year was calculated for the site.

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Based on the proposed wastewater application rate of approximately 87 inches per year (2 inches per week for 10 months), yearly precipitation of 54.29 inches and PET of 42.31 inches, an average of approximately 7,391 gallons of water per acre will enter the groundwater system on a daily basis in the study area. Prior to reaching the groundwater system, the nitrogen load will be reduced to zero. A portion of the treated water will percolate through the water table aquifer and may recharge underlying aquifers. Treated water will, also, enter the groundwater system, through the subsurface, and eventually enter surface water streams. The water will then flow into the nearby Choptank River. A summary of the Hydrologic Balance data is included in Appendix 9.9.

4.3.2 Surface Phenomena

The majority of the site is covered by agricultural crops, including corn, soybeans and wheat. Approximately 15 acres of the east side of the primary spray site is wooded. The topography of the agricultural and wooded portions of the site is gentle, with slopes of 0 to 5%. Some areas within the wooded portions of the site are characterized by steeper slopes of 15%. These areas, which border two creeks located in the eastern and central portions of the primary spray area, will not be utilized for spray irrigation. The proposed reserve area is characterized by slopes of 0 to 2%. Minimal site erosion was observed in the proposed spray areas. The spray and reserve areas, and the locations of the streams, are shown on Drawings JDH-10/19/409-B.

The spray system will initially be installed in the existing crop and woodland (mixed hardwood) areas. As the property is developed, portions of the agricultural areas may be converted to mixed hardwood or loblolly pine stands. The agricultural areas will be planted using a rotation of corn, soybean, wheat and/or rye. For purposes of this study, all required calculations have been made assuming the most conservative site conditions. For example, in the PET calculations, the crop coefficient for wheat was used because the number represented the lowest crop coefficient value of any of the proposed crops or trees.

4.3.3 Soil Permeability

To evaluate the infiltration capacity of the surface soils and to estimate the vertical hydraulic conductivity of subsurface soils, double ring infiltration tests were completed at 15 locations on the site. Four of the tests were completed in areas that will not be utilized for the spray field. These areas were designated as development areas. Nine of the tests were completed in the primary spray area and two tests were completed in the proposed reserve area. The testing was completed in general accordance with the Double Ring Infiltrometer Method.

At least one test was performed in the most restrictive soil horizon in each of the nine identified soil mapping units within the proposed spray area. The locations, test depths, USDA classification and infiltration rate for each of the tests is summarized in a Table of Infiltration Rates which is included in Appendix 9.10.

Results of the testing indicate that a spray rate of approximately 2 inches per week is achievable at each of the tested locations. The minimum soil permeability that was measured in the proposed spray area was 0.64 centimeters per hour (cm/hr) at location MD-3. The soil at this location was classified as a Silt loam. The location is in an area that is mapped as Woodstown loam. Approximately seven percent of the proposed spray area is mapped as Woodstown loam.

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4.3.4 Groundwater Occurrence

Groundwater in the study area occurs under water table conditions at depths ranging from approximately 5 to 25 feet below the ground surface. The site is underlain by water bearing sediments of the unconfined Surficial (Columbia) Aquifer. Based on a well search completed by the State of Maryland, no wells are located within ¼ mile of the proposed spray area.

To measure the depth to groundwater and to evaluate the groundwater flow direction, Hynes & Associates installed 18 piezometers within or near the study area. Piezometers P-18 and P-19 are located just to the west of the primary spray area. The piezometer locations are shown on the attached *Test Pit and Piezometer Location Sketch: Drawings No.: JDH-10/19/409-E1, E2 and F* (Appendix 9.6). The piezometers were installed to depths ranging from a depth of 12.5 to 30 feet below the ground surface. Each piezometer was installed with 5 feet of 2 inch diameter screen. The piezometers were completed with enough casing to provide a riser extending above the ground surface.

During this study, the piezometers were gauged six times between November 2002 and October 2003. Groundwater gauging data is summarized in the Gauging Data table that is included in Appendix 9.10. Refer to the Groundwater Elevation Sketches: Drawings No.: JDH-10/19/409-G and H for maps depicting the elevation data, groundwater flow direction and depth to groundwater data for two gauging events. The maps are included in Appendix 9.12. In general, the gauging data collected on February 27, 2003 depicts the highest groundwater levels that were recorded. The September 15, 2003 data depicts the lowest groundwater levels that were observed. Groundwater was calculated to flow to the east-southeast on the north side of the primary spray area. Groundwater was calculated to flow to the northeast on the south side of the primary spray area. We note that the north and south sides of the primary spray area are separated by an unnamed stream.

To evaluate the potential for groundwater mounding in the proposed spray area, we calculated the theoretical groundwater mound beneath a circular recharge area using the Groundwater Mounding Calculator developed by HydroSOLVE, Inc. The calculator was run assuming a recharge rate of 2 inches/day over a one day period in an aquifer with an estimated specific yield of 0.1. In accordance with data provided by MDE, the surficial aquifer is estimated to be 70 feet thick, with a permeability (K) of 195 feet per day. Based on these parameters, a mound of 0.14 feet will develop beneath the recharge area during a one day spray application. The mound will decay between spray events. Six days after the 1 day application, the mound will be 0.005 feet. Based on the observed depth to groundwater in the proposed spray area (shallowest depth to groundwater was 4.31 feet in P-18), the calculations indicate that mounding will not be a limiting factor in utilization of spray irrigation at the site. The mounding equations are summarized in Appendix 9.13.

4.3.5 Nitrate-Nitrogen Balance

The proposed spray irrigation system will disperse treated wastewater from the proposed wastewater treatment system. The proposed system must be designed so that the nitrogen concentration in the treated water will be reduced to 0 milligrams per liter (mg/L) when the wastewater reaches the nearby surface waters (via groundwater). In order to estimate the necessary level of treatment, Hynes & Associates used the nitrogen mass balance equation developed by J. E. Stone (1976) as referenced in Appendix D of the MDE "Guideline for Land Treatment of Municipal Wastewaters". The equation and input parameters are included in Appendix 9.13.

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The proposed spray irrigation system will irrigate land that will be planted with either agricultural crops (wheat, corn, soybeans and/or rye) or with trees (mixed hardwood or loblolly pine). Based on input parameters specified by MDE, a nitrogen uptake of 167 pounds per acre – year (corn) was used in the equation. The treatment system will be designed to reduce the nitrogen content in the wastewater to at least 8 mg/L prior to discharge via the spray system. The proposed treatment system is capable of reducing the nitrogen concentration to 3 mg/L.

Based on these input parameters specified in the draft permit, and based on the input parameters listed in Appendix 9.12, a maximum spray rate of 92 inches per year is permitted by MDE. The proposed spray rate of 87 inches per year is less than the allowable maximum. Therefore, the proposed spray system will be capable of meeting current MDE nitrogen discharge criteria.

5.0 FACILITY PLAN OF OPERATION

5.1 Application Rates

After treatment, the treated effluent will be directed to the proposed spray fields. Based on an anticipated maximum flow of 540,000 gpd, a projected spray rate of 2 inches per week and assuming 60 days for storage, a spray area of 85 acres will be required for the treatment system. The spray area will be divided into two or three zones. Each zone will be sprayed one day per week. This schedule will allow 4 to 5 days per week for rain, saturated soil conditions and maintenance. The zones will be set up to be sprayed at approximately ¼ inch per hour for 8 hours each.

5.2 Loading Rates

The treatment plant will be designed to meet or exceed Class II effluent requirements. The system will be designed based on the following Influent Design Values (all concentrations are in mg/L):

BOD = 250
TSS = 250
Nitrogen = 60
Phosphorus = 8

The proposed ENR MBR Treatment Plant will be designed to achieve or exceed the following discharge criteria:

BOD = 10 mg/L
TSS = 10 mg/L
Nitrogen = 8 mg/L
Phosphorus = 5 mg/L
Fecal Coliform = 3 MPN

The treated water will be discharged to the ground surface using spray irrigation.

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5.3 Lagoon Specifications

Irrigation of treated wastewater cannot take place during periods of precipitation, high winds, freezing conditions, or saturated soil. The storage facility will be designed to hold treated wastewater during periods when irrigation cannot take place. The storage facility will be capable of containing wastewater generated during no less than 60 days of normal operation of the wastewater facility, plus 14 inches of precipitation. The storage facility will, also, be designed to provide a 3 foot freeboard and will be sealed or constructed to prevent the direct seepage of stored waters into groundwaters beneath the site. The lagoon will encompass approximately 16 acres. The proposed location of the lagoon is shown in the Lagoon Location Plan that is included as Appendix 9.3. The proposed lagoon cross section is shown on the Lagoon Location Plan.

6.0 MONITORING-SURVEILLANCE SYSTEM

During operation of the proposed treatment system, groundwater and surface water conditions in the areas near the proposed spray fields will be monitored to evaluate the efficiency of the system. To monitor the groundwater conditions in the spray areas, eleven groundwater monitoring wells have been installed. The well locations are depicted in the *Proposed Monitoring Point Location Plan: Drawing JDH-10/19/409-K* that is included in Appendix 9.14. The locations of the wells were selected based on input from MDE.

The monitoring wells have been installed by a Maryland licensed well driller in accordance with current State of Maryland guidelines. Each well extends approximately 10 feet into the water table aquifer. The wells have been constructed using 4 inch diameter PVC well materials.

In addition to groundwater monitoring, five surface water monitoring stations are proposed along the streams that border the site to the east of the proposed spray area. One station will be set up at the upstream property boundary near the northeast corner of the site. Two stations will be set up near the junction of two streams on the east side of the property, and one station will be set up upstream of the southernmost spray area. One station will, also, be set up on the stream that flows between the north and south spray areas. Grab water samples will be collected from the approximate center of the stream at each monitoring location. The proposed monitoring stations are shown on the attached *Proposed Monitoring Point Location Plan: Drawing JDH-10/19/409-K* that is included in Appendix 9.14.

Prior to system installation, water samples will be collected from each monitoring well and surface water station to evaluate background water quality in the area of the proposed spray fields. A minimum of six samples will be collected from each monitoring location during a one year period prior to the initiation of spraying. The samples will be analyzed by a laboratory for parameters specified by MDE.

7.0 CONCLUSIONS

The purpose of this Hydrogeologic Evaluation was to evaluate whether spray irrigation of treated wastewater was a feasible sewage disposal option for the proposed residential and commercial development project to be located on the property of Trappe East Holdings Business Trust (TEHBT). A preliminary evaluation, completed by the Maryland Department of the Environment (MDE), indicated that several areas of the property appeared to be suitable for land treatment of wastewater. A Draft Permit (19-DP-3460) has been issued by MDE.

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The scope of work included characterizing and describing soils on the property, evaluating the geologic and hydrologic conditions at the site by conducting research of published information and by performing field testing, and evaluating the overall suitability of a spray irrigation system for the site. Rauch, Inc. provided the conceptual plans and design criteria for the treatment system. The work was completed in general accordance with the published "Guidelines for Land Treatment of Municipal Wastewaters" prepared by the Maryland Department of the Environment (MDE), dated July 2002 and amended April 2010.

Based on the results of the evaluation, the proposed spray areas are suitable for land treatment of wastewater. Approximately 85 acres of land has been identified for the proposed spray fields. The soils in these areas were evaluated to receive spray rates of up to 2 inches per week. An additional 22 acres has been set aside as a reserve area. The proposed system will irrigate 85 acres at a rate of approximately 2 inches per week. The system will discharge to a storage lagoon during non-spray periods, typically during the winter months of December, January and February. Initially, the treated wastewater will be applied to both agricultural crops and woodland. During the development of the property, the vegetative cover in the spray areas may be changed to woodland (mixed hardwoods or loblolly pines). Our evaluation indicates that the proposed system will be effective with either crop cover or woodland cover.

Our evaluation indicates that there are few, if any, factors that may limit the effectiveness of the proposed system. With proper equipment maintenance and land management, the proposed spray areas should remain functional for the life of the wastewater treatment system. We note that the proposed system discharge will not reach 540,000 gallons per day until development is completed in 2030. During the ten years leading up to project completion, the effectiveness of the land treatment system will be evaluated. If there is evidence to suggest that the proposed land treatment system is not functioning in a manner that is consistent with the findings presented in this document, then alternate plans can be developed to alleviate the deficiencies before the maximum system discharge is reached.

8.0 SIGNATURES OF ENVIRONMENTAL STAFF

This report includes the findings and conclusions of the Hydrogeologic Evaluation conducted by John D. Hynes & Associates, Inc. for the subject property, as observed, researched and reviewed by the following:

Richard D. Rhoads
Environmental Project Manager

John D. Hynes, P.E.
President

STATE OF MARYLAND
JOHN DAVID HYNES
No. 16233
REGISTERED
PROFESSIONAL ENGINEER

RDR: JDH/jsl

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9.1 Project Location Map

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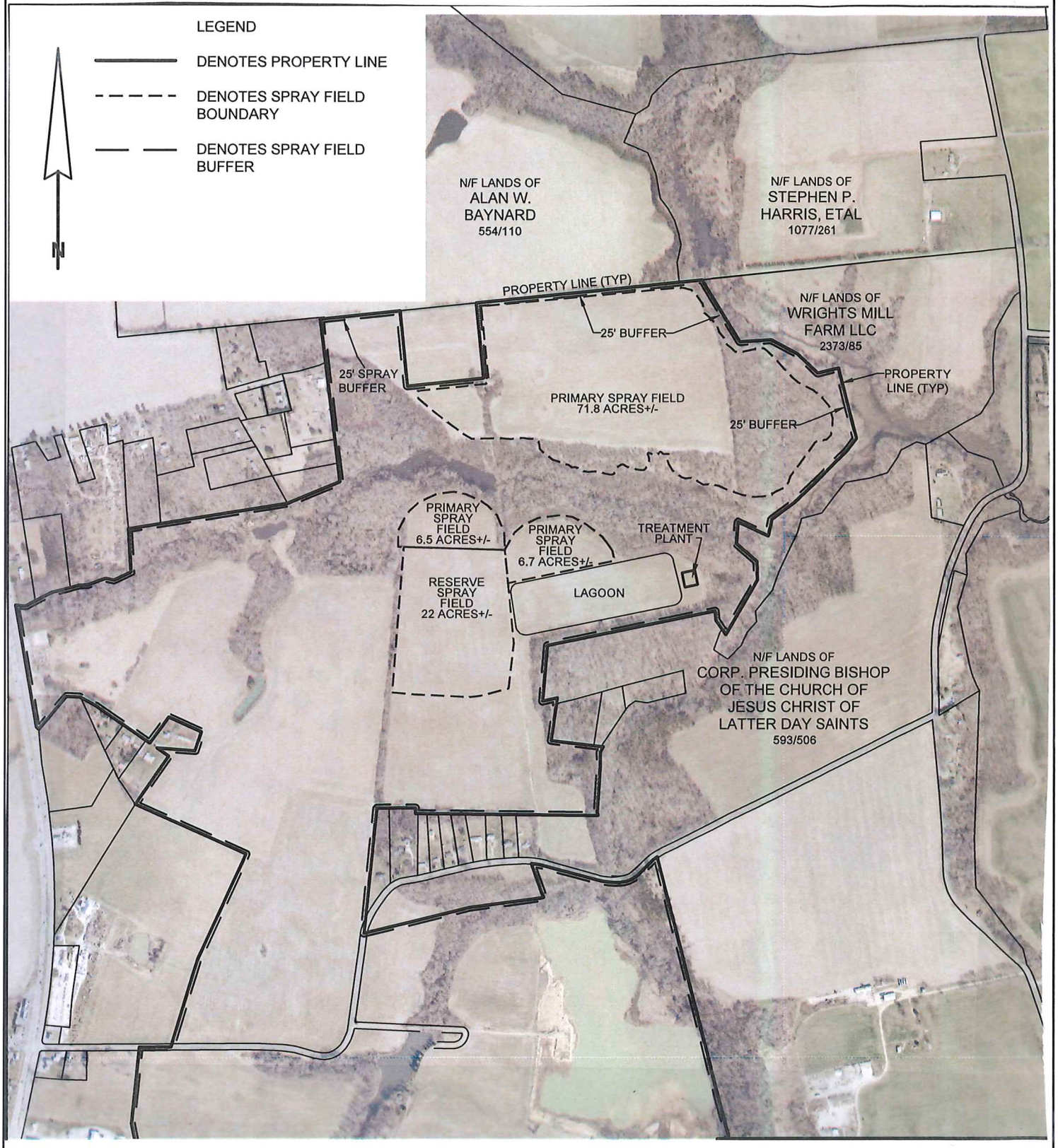

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Date: October 26, 2019	
Scale: 1 in. = 1,000 ft.	
Drawn: ADC Maps	
Project Location Map Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-A**

9.2 Proposed Spray Areas

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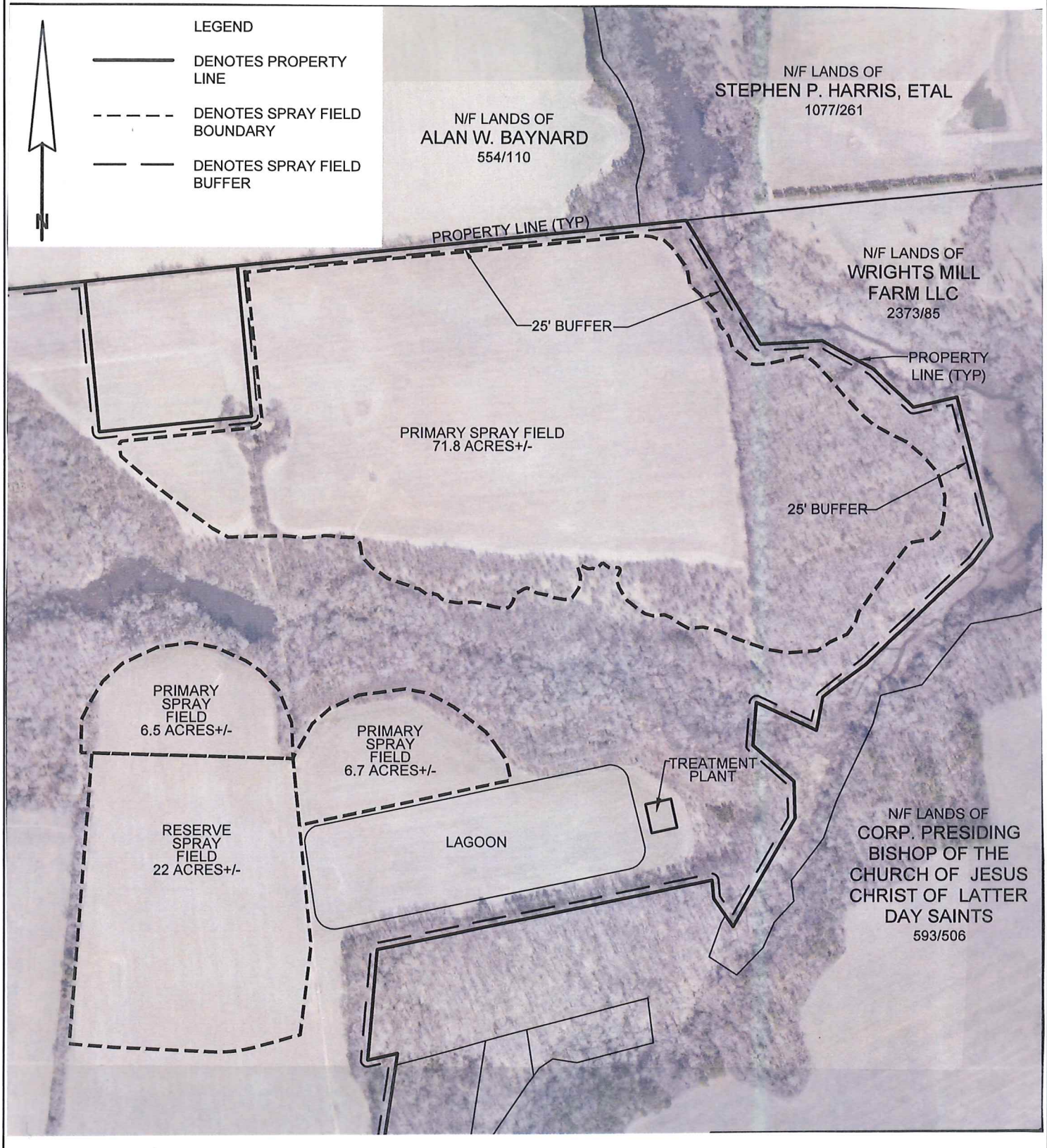

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	Date: October 26, 2019
	Scale: 1 in. = 500 ft.
	Drawn: Rauch, Inc.
Proposed Spray Areas Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-B**

9.3 Proposed Lagoon Location Sketch

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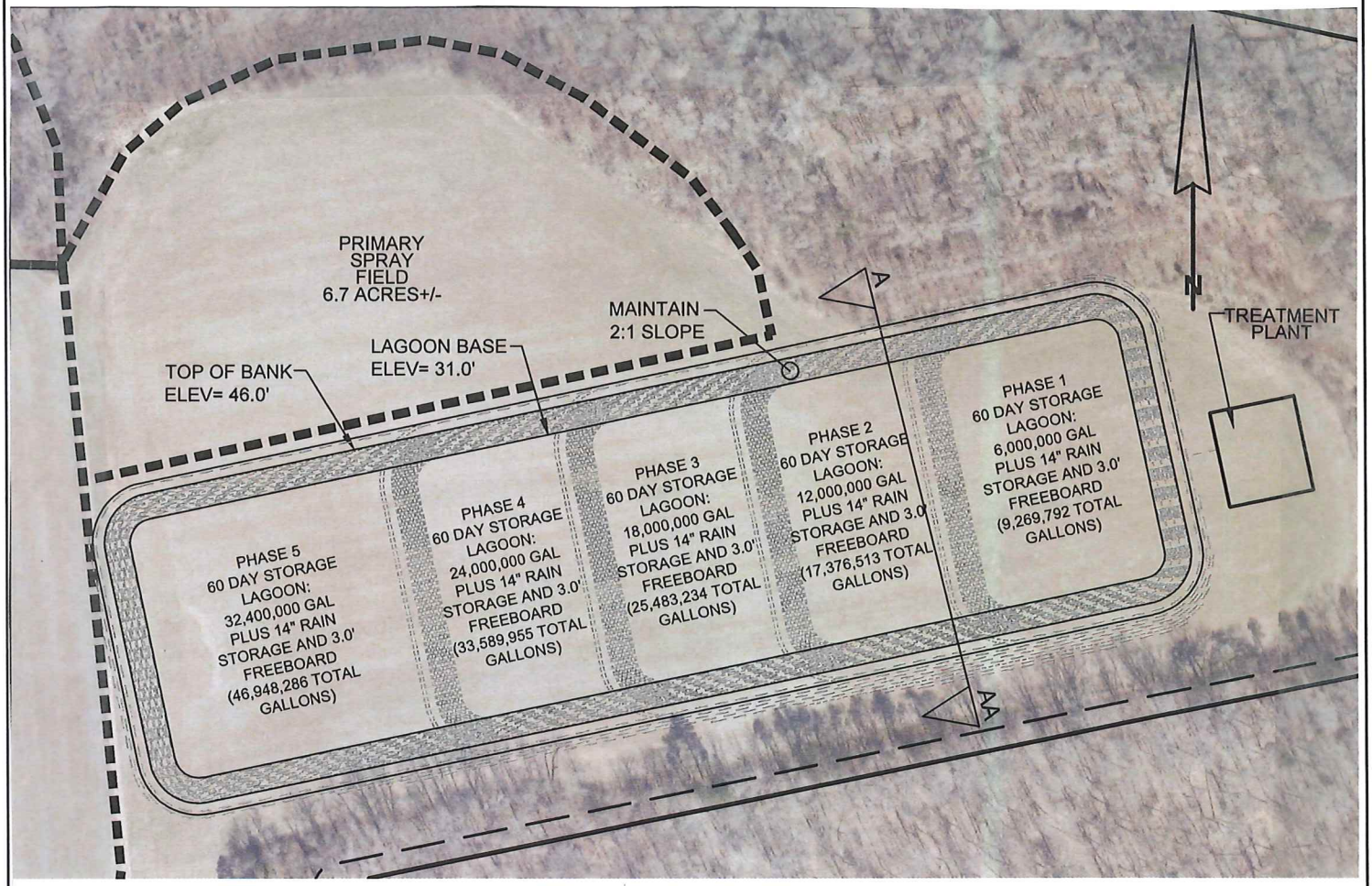
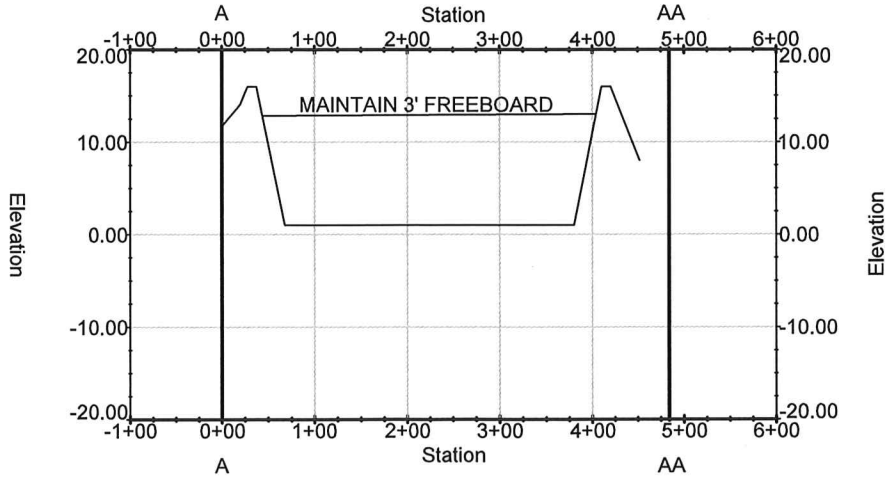


TYPICAL LAGOON PROFILE



HYNES

JOHN D. HYNES & ASSOCIATES, INC.

32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: October 26, 2019

Scale: 1 in. = 200 ft.

Drawn: Rauch, Inc.

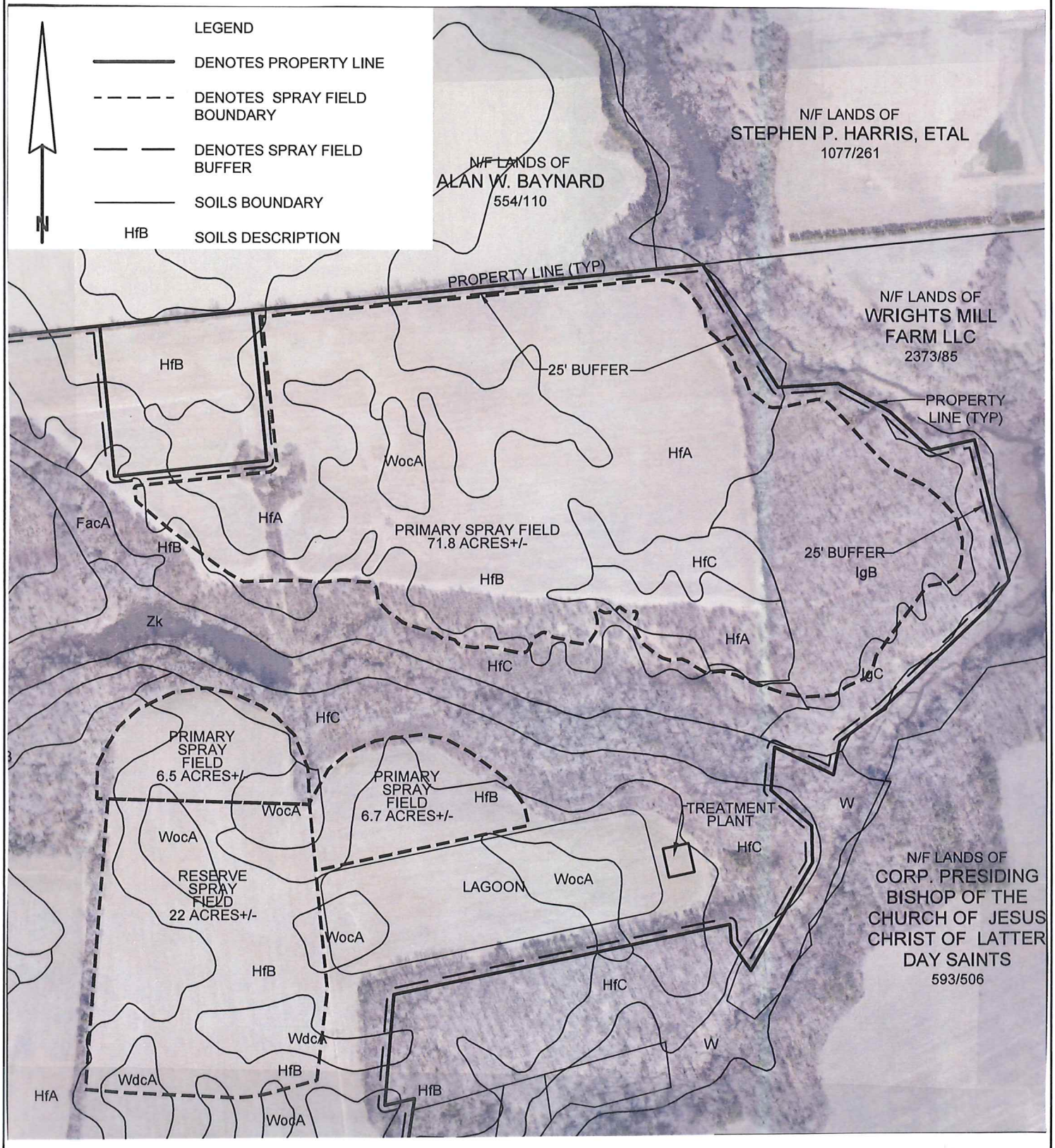
Proposed Lagoon Sketch
Lakeside aka Trappe East Project
Trappe, Maryland

DWG. No.

JDH-10/19/409-C

9.4 Soil Survey Map

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com



JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

	Date: October 26, 2019
	Scale: 1 in. = 500 ft.
	Drawn: Rauch, Inc.
Soil Survey Map Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-D**

HYNES

9.5 MDE Letter

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

410-537-3662

MARYLAND DEPARTMENT OF THE ENVIRONMENT

2500 Broening Highway • Baltimore, Maryland 21224
(410) 631-3000 • 1-800-633-6101 • http://www.mde.state.md.us

Parris N. Glendening
Governor

Merrylin Zaw-Mon
Acting Secretary

May 2, 2002

Robert D. Rauch, P.E.
Robert D. Raugh & Associates Inc.
28466 Waterview Drive
Easton, Maryland 21601

Dear Mr. Rauch:

This is to inform you about the results of the spray irrigation site evaluation conducted on April 23, 2002 at Town of Trappe for a proposed golf course spray irrigation system. The site has been proposed for the disposal of 500,000 gallons per day treated wastewater effluent from the proposed 2000 residential units and a 60-acre regional commercial park.

A total of ten (10) backhoe test pits (TPs) were dug at the proposed sites. The approximate locations of the test pits are shown on the attached map.

As shown in Table 1 Group A, soils in TPs 1,2,3,4,8,9 and 10 possess similar characteristics in texture and color, with heavy sandy loams or sandy loams identified to be the most limiting layers for permeability. No groundwater tables were detected at test pits in Group A. Soils in Group B (TPs 6 and 7) possess similar characteristics in texture and color, with silty clay loams identified to be the most limiting layers for permeability. No groundwater tables were detected at test pits in Group B. Very dense and compacted sandy clay was identified as the most limiting layer for permeability in TP 5 of Group C. No groundwater tables were detected at TP5 in Group C.

From our preliminary soil evaluation, it appears that areas adjacent to test pets in Group A and Group B possess the most favorable soil characteristics and groundwater table conditions for spray irrigation of treated wastewater. Areas next to TP5 in Group C may not be suitable for spray irrigation due to impermeable sandy clay soil. For your reference, soil characteristics and groundwater table information are included in the attached soil description sheets. Should you decide to proceed with the spray irrigation system, a detailed

hydrogeological study should be conducted to determine the accurate irrigation rate, to define the precise boundary of suitable areas for irrigation and to address items included in the attached Appendix A of " Guidelines for Land Treatment of Municipal Wastewater". Please be informed that the groundwater table depths are not at normal levels in this year due to a drought condition. If a hydrogeological study is to be conducted during drought period, proper adjustments to the water table measurements to reflect normal groundwater table condition are necessary.

If you have any questions concerning the site evaluation, please call me at (410) 631-3662.

Sincerely,

Ching-Tzone Tien

Ching-Tzone Tien, Ph.D., P.E., Chief
Groundwater Discharge Permits Division

Enclosures

cc: Anne Morse

Table 1. Characteristics of Limiting Layers of 10 Test Pits at Proposed Town of Trappe Spray Irrigation Site

Test pit	Depth (inch)	Soil Texture	Soil Color	Depth to Ground Water Table
		Group A		
1	19-34	Heavy Sandy Loam	7.5YR5/8	>87"
2	24-70	Heavy Sandy Loam	5YR5/8	>87"
3	14-63	Compacted Heavy Sandy Loam	7.5YR 5/8	> 97"
4 (wooded area)	12-43	Heavy Sandy Loam	7.5YR 5/8	>99"
8	15-30	Fine Sandy Loam	5YR6/8	>84"
9	12-32	Compacted Sandy Loam	7.5YR5/8	>78"
10	9-19	Heavy Sandy Loam	10YR5/8	>78"
		Group B		
6	12-29	Silty Clay Loam	10YR5/8	>82"
7	10-30	Silty Clay Loam	7.5YR5/8	>81"
		Group C		
5	36-60	Sandy Clay (Compacted)	10YR5/6	>60"

NAME Town of Trappe COUNTY Talbot FILE NO

SOIL MAP UNIT 0 MAP SYMBOL SeA DATE 4/23/02

GEOLOGIC MATERIAL ELEVATION GRID NO E

NO. 1 DESCRIBED BY C. Tiew N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
Ap	0-10	10YR 3/2		SL				
E+	10-19	10YR 5/3	5YR 5/8	compacted SL				
B	19-34	10YR 5/6		sandy SL				Roots to 24"
C	34+	10YR 5/6		SL-LS				No H2O at 72"

LANDSCAPE

Position

Summit ___ Depression ___
Shoulder ___ Upland ___
Sideslope ___ Terrace ___
Footslope ___ Floodplain ___

Slope

Percent ___
Shape ___

SOIL DRAINAGE CLASS

ED ___ MWD ___ PD ___
WD ___ SPD ___ VPD ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO

SOIL MAP UNIT SaBa MAP SYMBOL DATE 4/23/02

GEOLOGIC MATERIAL ELEVATION GRID NO E

NO. 2 DESCRIBED BY C. Tiew N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
Ap	0-9	10YR 3/2		SL				
Bh	9-24	5YR 3/3		compacted SL			10%	
Bh	24-78	5YR 3/3		sandy SL			5%	Roots w/ Trace amounts
C	78+			LS				No H2O at 87"

LANDSCAPE

Position

Summit ___ Depression ___
Shoulder ___ Upland ___
Sideslope ___ Terrace ___
Footslope ___ Floodplain ___

Slope

Percent ___
Shape ___

SOIL DRAINAGE CLASS

ED ___ MWD ___ PD ___
WD ___ SPD ___ VPD ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO

SOIL MAP UNIT WaA MAP SYMBOL DATE 4/23/02

GEOLOGIC MATERIAL ELEVATION GRID NO E

NO. 3 DESCRIBED BY C. Tien N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
Ap	0-14	10YR 4/3		SL				
B	14-63	7.5YR 5/6		Compacted Loamy SD				Ribbon ½"
C	53-97			Loamy SD				No H2O at 97" but wet.

LANDSCAPE

Position

Summit		Depression	
Shoulder		Upland	
Sideslope		Terrace	
Footslope		Floodplain	

Slope

Percent

Shape

SOIL DRAINAGE CLASS

ED HWD PD

VD SPD VPD

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

LANDSCAPE

Position

Summit		Depression	
Shoulder		Upland	
Sideslope		Terrace	
Footslope		Floodplain	

Slope

Percent

Shape

SOIL DRAINAGE CLASS

ED HWD PD

VD SPD VPD

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO

SOIL MAP UNIT MAP SYMBOL DATE

GEOLOGIC MATERIAL ELEVATION GRID NO E

NO. 4 (inside bldg) DESCRIBED BY C. Tien N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
A	0-12	10YR 2/1		loam				
Bt	12-42	7.5YR 5/6		Loamy SD				Ribbon = ½", Wet
BC	42-48			Sandy SD				
C	48-84			Sandy SD				No H2O at 99"

SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO

SOIL MAP UNIT SBD3 MAP SYMBOL DATE 4/23/02

GEOLOGIC MATERIAL ELEVATION CRIB NO E

NO. 5 DESCRIBED BY C. Ilch N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
A	0-9	7.5YR 3/2		SL				
B1	9-36	10YR 5/6	5YR 5/2	Cosl				
B2	36-60	10YR 5/4	5YR 6/2	Sicl				1/2" Rocks at 60"

LANDSCAPE

Position

Summit ___ Depression ___
Shoulder ___ Upland ___
Sideslope ___ Terrace ___
Footslope ___ Floodplain ___

Slope

Percent ___
Shape ___

SOIL DRAINAGE CLASS

ED ___ MWD ___ PD ___
WD ___ SPD ___ VPD ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

NAME Town of Trappe SOIL DESCRIPTION

SOIL MAP UNIT WaA COUNTY Talbot FILE NO

GEOLOGIC MATERIAL MAP SYMBOL DATE 4/23/02

NO. 1 ELEVATION GRID NO E

DESCRIBED BY C. Tien N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
Ap	0-10	10YR 5/1		L				
B	10-30	7.5YR 5/8	10YR 6/1	SiCl				Compacted
B.3s	30-41	7.5YR 5/8	10YR 6/1	heavy SiCl				1/2" Ribbon
C	41-81"			Sandy Silt Loam				1/3 Horiz at 81"

LANDSCAPE

Position: Summit ___ Shoulder ___ Sideslope ___ Footslope ___ Depression ___ Upland ___ Terrace ___ Floodplain ___

Slope: Percent ___ Shape ___

SOIL DRAINAGE CLASS: ED ___ HWD ___ PD ___ UD ___ SPD ___ VPD ___ QA ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

LANDSCAPE

Position: Summit ___ Shoulder ___ Sideslope ___ Footslope ___ Depression ___ Upland ___ Terrace ___ Floodplain ___

Slope: Percent ___ Shape ___

SOIL DRAINAGE CLASS: ED ___ HWD ___ PD ___ UD ___ SPD ___ VPD ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

SOIL DESCRIPTION

NAME Town of Trappe SOIL MAP UNIT WaA GEOLOGIC MATERIAL NO. 2

COUNTY Talbot MAP SYMBOL ELEVATION DESCRIBED BY C. Tien

FILE NO DATE 4/23/02 GRID NO E N

Horizon	Depth in.	Color		Texture	Structure		% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
		Matrix	Mottles		Grade	Type		
Ap	0-15	10YR 5/1		L				
B	15-24	7.5YR 5/8		SiCL				
C	24-81"	7.5YR 7/2		SiCL				Has 1/3 at 81"

SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO
SOIL MAP UNIT SaB2 MAP SYMBOL DATE 4/23/02
GEOLOGIC MATERIAL ELEVATION GRID NO E
NO. 9 DESCRIBED BY C. Tien N

Horizon	Depth in.	Color Matrix	Color Mottles	Texture	Structure Grade	Structure Type	% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
Ap	0-12	10YR5/4		SL				
B	12-32	7.5YR5/6		SL				
C1	32-48	7.5YR5/6		LS				Compacted
C2	48-78"			LS				No H2O at 78"

LANDSCAPE

Position
Summit ___ Depression ___
Shoulder ___ Upland ___
Sideslope ___ Terrace ___
Footslope ___ Floodplain ___

Slope
Percent ___
Shape ___

SOIL DRAINAGE CLASS
ED ___ MWD ___ PD ___
WD ___ SPD ___ VPD ___

WATER TABLE

LIMITING ZONE

SOIL CLASSIFICATION

SOIL CLASSIFICATION

LIMITING ZONE

SOIL DRAINAGE CLASS
ED ___ MWD ___ PD ___
WD ___ SPD ___ VPD ___

WATER TABLE

Slope
Percent ___
Shape ___

Position
Summit ___ Depression ___
Shoulder ___ Upland ___
Sideslope ___ Terrace ___
Footslope ___ Floodplain ___

LANDSCAPE

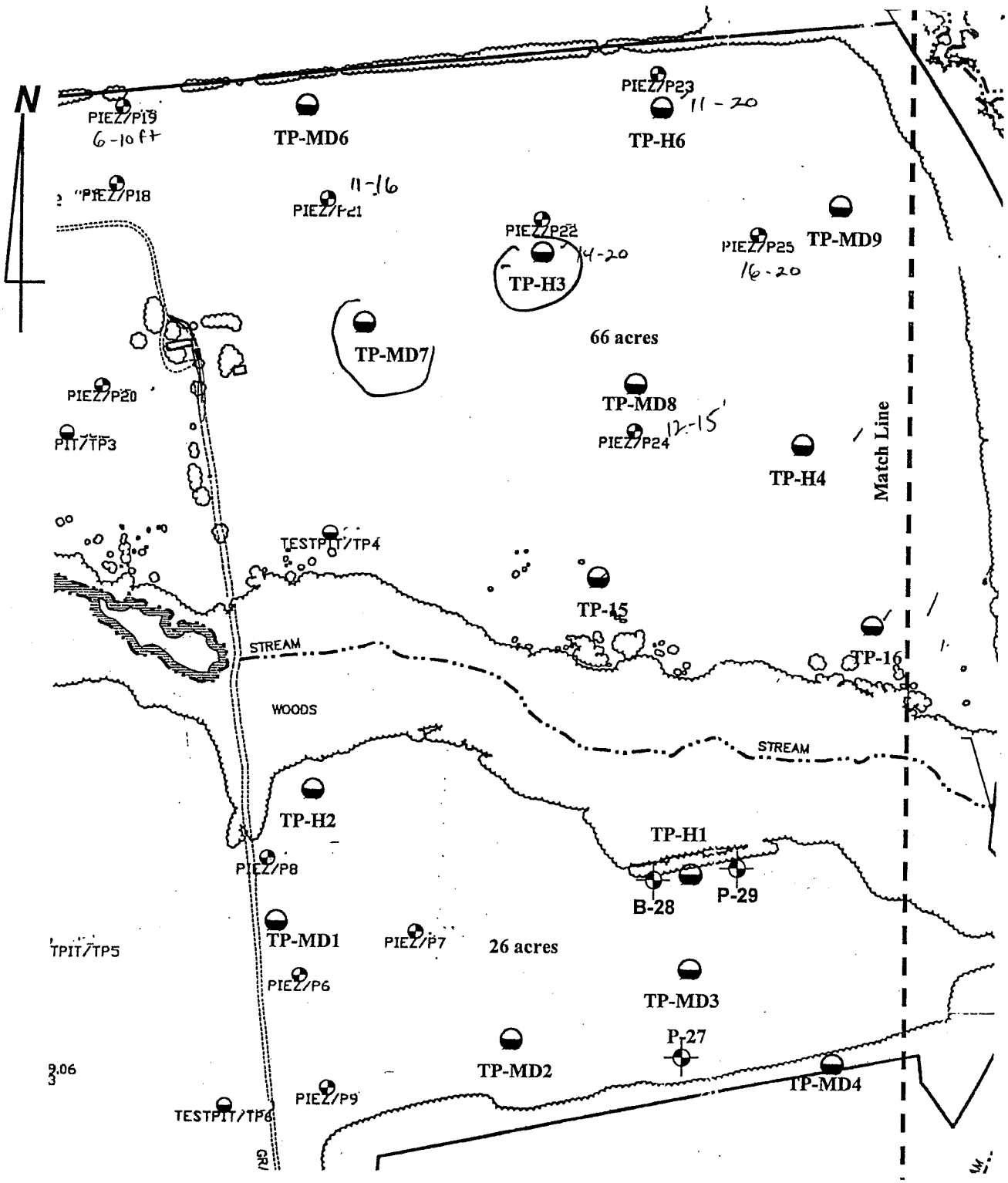
SOIL DESCRIPTION

NAME Town of Trappe COUNTY Talbot FILE NO
SOIL MAP UNIT SaB2 MAP SYMBOL DATE 4/23/02
GEOLOGIC MATERIAL ELEVATION GRID NO E
NO. 9 DESCRIBED BY C. Tien N

Horizon	Depth in.	Color Matrix	Color Mottles	Texture	Structure Grade	Structure Type	% Rock Fragments	Notes (Moisture, Density, Biopores, Seepage)
Ap	0-9	10YR5/4		SL				
B	9-19	7.5YR5/6		SL				
C1	19-32	7.5YR5/6		LS				Compacted
C2	32-48"			LS				No H2O at 78"

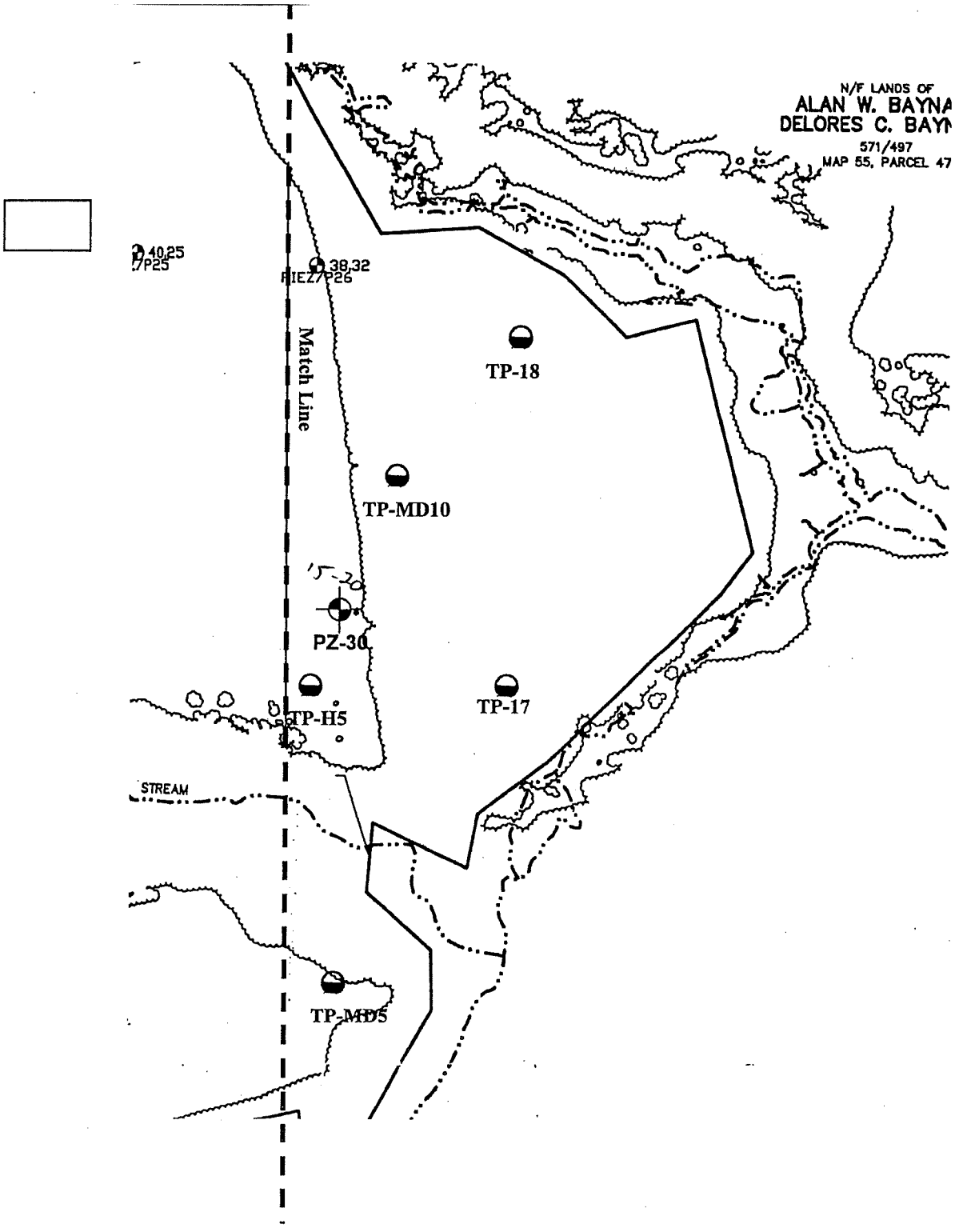
9.6 Test Pit, Boring, and Piezometer Location Maps

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com



JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: October 26, 2019	
Scale: 1 in. = 350 ft.	
Drawn: Hynes & Assoc.	
Boring, Test Pit and Piezometer Location Sketch (Sheet 1 of 2) Lakeside aka Trappe East Project Trappe, Maryland	DWG. No. JDH-10/19/409-E-1

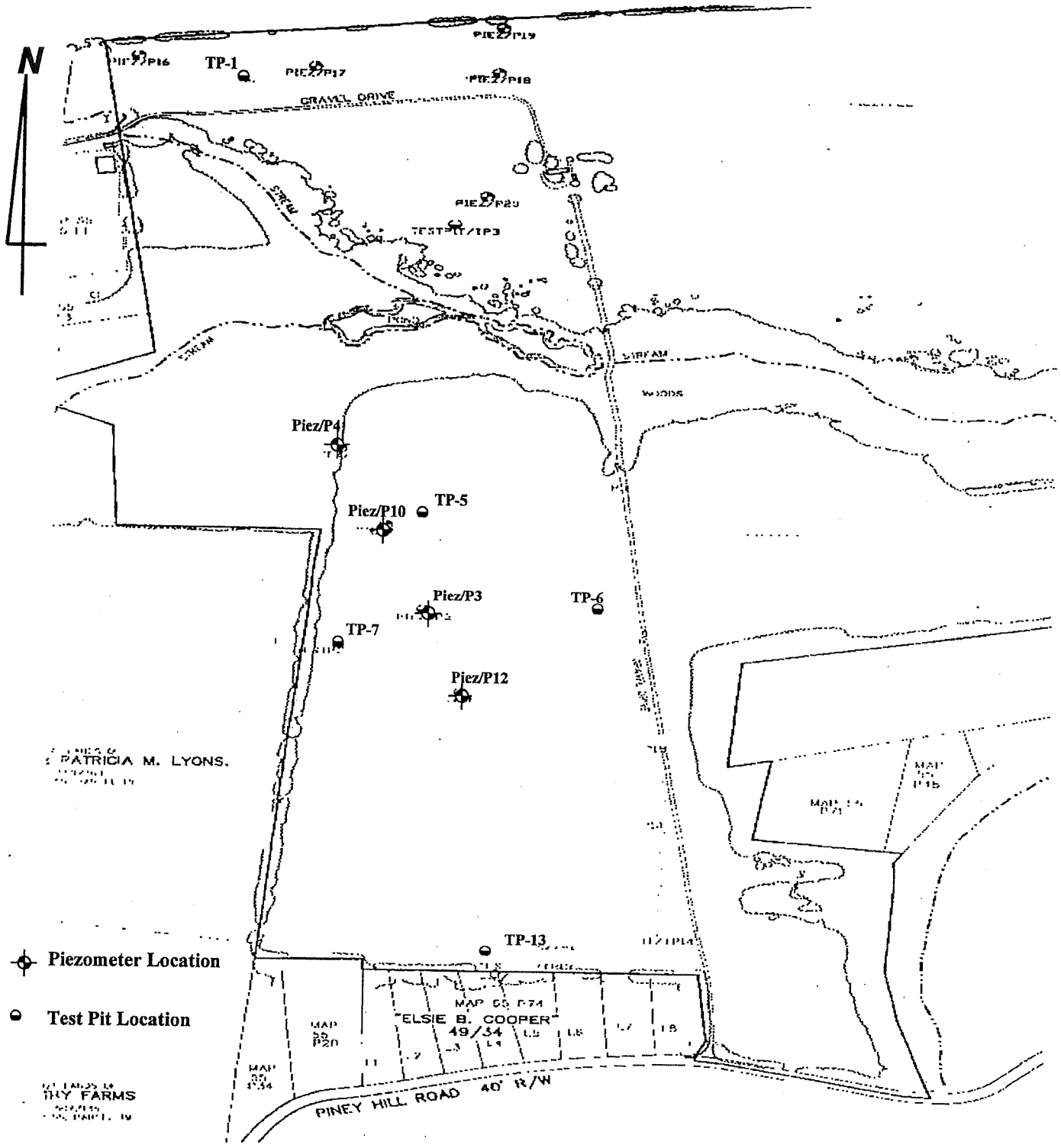


HYNES

JOHN D. HYNES & ASSOCIATES, INC.

32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Date: October 26, 2019	
Scale: 1 in. = 300 ft.	
Drawn: Hynes & Assoc.	
Boring, Test Pit and Piezometer Location Sketch (Sheet 2 of 2) Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-E-2**



JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

Boring, Test Pit and Piezometer Location Sketch (East Side of Site) Lakeside aka Trappe East Project Trappe, Maryland	**Date: October 26, 2019** **Scale: 1 in. = 560 ft.** **Drawn: Hynes & Assoc.** **DWG. No.** **JDH-10/19/409-F**

9.7 Boring Logs

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

HYNES & ASSOCIATES

LOG OF BORING P-6

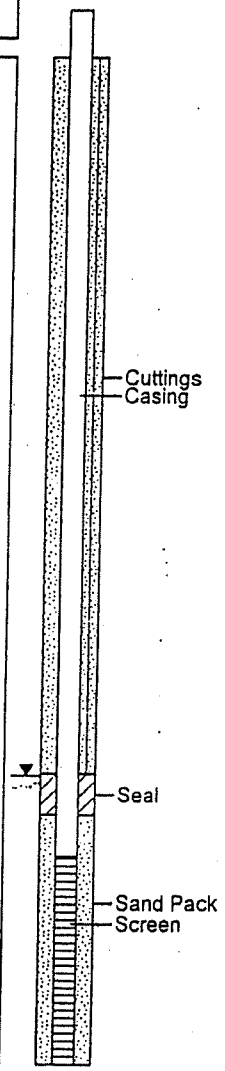
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/22/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/22/02	Total Depth:	: 24.0 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with trace to little silt (Loamy Sand)		SM	1	1-4-2-3	Scale 1" ~ 6 feet
2	Brown, wet, fine to coarse SAND, with some silt (Sandy Loam)			2	4-3-3-3	Approximately 12 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 20 feet during drilling operations
6			SM			Water level reading 11/27/02
8						
10	Light brown, wet, fine SAND, with some silt (Sandy Loam)			3	3-3-3	
12			SM			
14	Light brown, wet, fine to medium SAND, with trace silt (Sand)			4	4-3-7	
16						
18			SP			
20	Brown, saturated, fine to medium SAND, with trace silt (Sand)			5	14-20-22	
22			SP			
24	Boring terminated at 24.0 feet					
26						
28						
30						

Well: P-6



06-18-2003 S:\Mtech2002\TrapEastProj-02265\P-6.bor

HYNES & ASSOCIATES

LOG OF BORING P-7

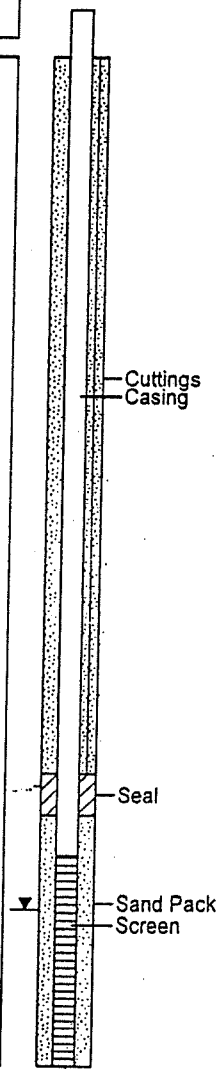
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/22/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/22/02	Total Depth:	: 24 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)		SM	1	2-2-2-3	Scale 1" ~ 6 feet
2				2	2-2-2-2	Approximately 14 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 20 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with trace to little silt (Loamy Sand)		SM	3	5-6-7	
12						
14	Gray, wet, SILT, with some fine sand (Silt Loam)		ML	4	5-7-12	
16						
18				5	2-4-4	
20						
22						
24	Boring terminated at 24 feet					
26						
28						
30						

Well: P-7



06-18-2003 S:\Mtech2002\TrapEast\Proj-02265\P-7.bor

HYNES & ASSOCIATES

LOG OF BORING P-8

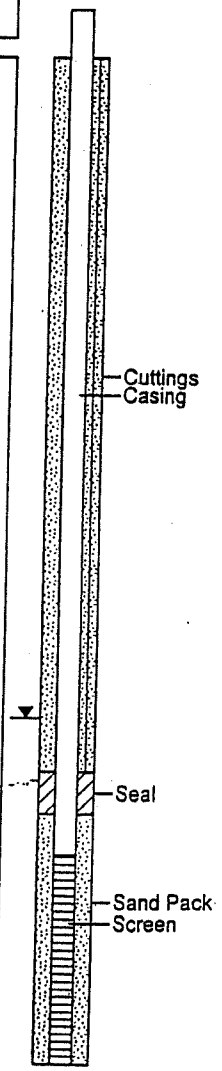
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/22/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/22/02	Total Depth:	: 24 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to coarse SAND, with some silt (Sandy Loam)		SM	1	2-2-3-3	Scale 1" ~ 6 feet
2						Approximately 12 inches of organic bearing soil encountered at ground surface
	Brown, wet, fine to medium SAND, with silt (Sandy Loam)			2	6-10-11-8	
4						Groundwater was encountered at 20 feet during drilling operations
6			SM			Water level reading 11/27/02
8						
	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)			3	4-5-4	
10						
12						
14			SM	4	3-5-5	
16						
18						
20	Brown, saturated, fine to medium SAND, with little silt (Loamy Sand)			5	4-5-6	
22			SM			
24	Boring terminated at 24 feet					
26						
28						
30						

Well: P-8



10-22-2003 S:\Mtech2002\TrapEastProj-02265\P-8.bor

HYNES & ASSOCIATES

LOG OF BORING P-9

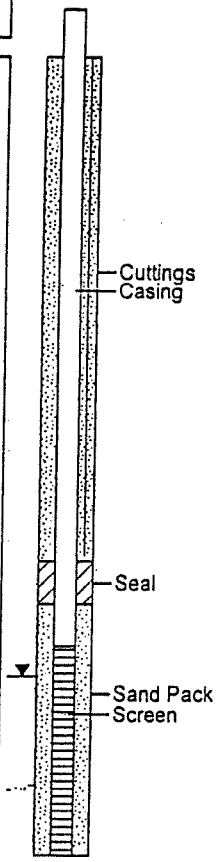
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/22/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/22/02	Total Depth:	: 19 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with trace to little silt (Loamy Sand)		SM	1	4-3-4-4	Scale 1" ~ 6 feet
2	Brown, wet, fine to medium SAND, with some silt (Sandy Loam)		SM	2	5-4-4-6	Approximately 12 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 15 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with some silt (Sandy Loam)		SM	3	4-5-4	
12						
14				4	5-5-4	
16	Brown, saturated, fine to medium SAND, with some silt (Sandy Loam)		SM			
18						
	Boring terminated at 19 feet					
20						
22						
24						
26						
28						
30						

Well: P-9



06-18-2003 S:\Mtech2002\TrapEastProj-02265\P-9.bor

HYNES & ASSOCIATES

LOG OF BORING P-18

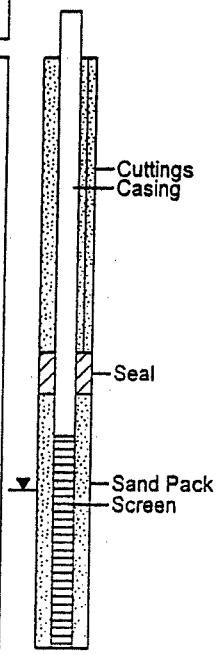
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: M. Hynes
Start Date:	: 11/23/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/23/02	Total Depth:	: 14 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, SILT, with some fine to medium sand (Silt Loam)		ML	1	1-1-2-2	Scale 1" ~ 6 feet
2				2	2-2-3-3	Approximately 9 inches of organic bearing soil encountered at ground surface
4	Brown, wet, fine to medium SAND, with little silt (Sandy Loam)		SM			Groundwater was encountered at 10 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to coarse SAND, with trace silt (Sand)		SP	3	2-2-4	
12						
14	Boring terminated at 14 feet					
16						
18						
20						
22						
24						
26						
28						
30						

Well: P-18



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HYNES & ASSOCIATES

LOG OF BORING P-19

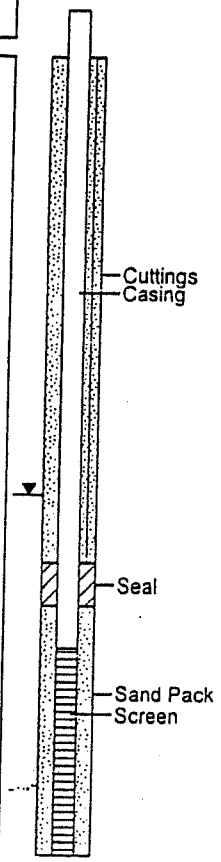
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: M. Hynes
Start Date:	: 11/23/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/23/02	Total Depth:	: 19 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, SILT, with some fine to medium sand (Silt Loam)		ML	1	1-2-2-3	Scale 1" ~ 6 feet
2				2	5-9-10-13	Approximately 6 inches of organic bearing soil encountered at ground surface
4	Brown, wet, fine to medium SAND, trace to little silt (Sandy Loam)		SM			Groundwater was encountered at 14 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with silt (Sandy Loam)		SM	3	5-6-7	
12						
14	Brown, saturated, fine to medium SAND, with little silt (Loamy Sand)		SM	4	2-3-3	
16						
18						
	Boring terminated at 19.0 feet					
20						
22						
24						
26						
28						
30						

Well: P-19



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HYNES & ASSOCIATES

LOG OF BORING P-21

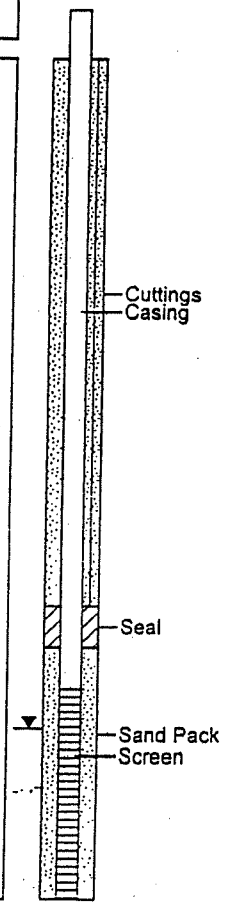
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/23/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/23/02	Total Depth:	: 20 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, SILT, with some fine to medium sand (Silt Loam)		ML	1	1-1-2-2	Scale 1" ~ 6 feet
2				2	3-5-10-10	Approximately 7 inches of organic bearing soil encountered at ground surface
4	Brown, wet, fine to medium SAND,with some silt (Sandy Loam)		SM			Groundwater was encountered at 16.0 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to coarse SAND, with little silt (Loamy Sand)			3	6-12-12	
12			SM			
14				4		
16	Brown, saturated, fine to coarse SAND, with trace silt (Sand)		SP			
18						
20	Boring terminated at 20 feet					
22						
24						
26						
28						
30						

Well: P-21



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HYNES & ASSOCIATES

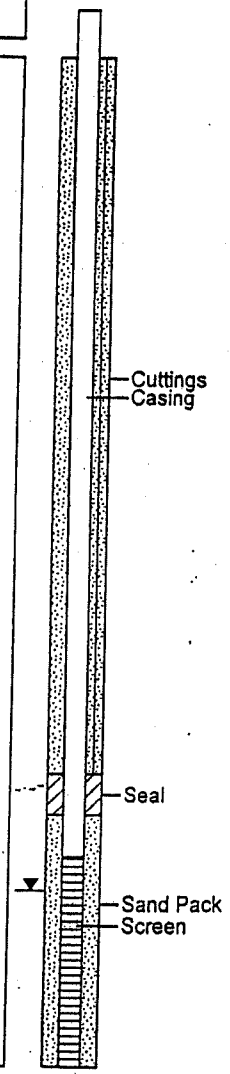
LOG OF BORING P-22

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/25/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/25/02	Total Depth:	: 24 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with little to some silt (Loamy Sand)		SM	1	1-1-2-1	Scale 1" ~ 6 feet
2						Approximately 7 inches of organic bearing soil encountered at ground surface
4	Light brown, wet, fine to medium SAND, with some silt (Sandy Loam/Loamy Sand)			2	1-2-3-5	
6			SM			Groundwater was encountered at 21 feet during drilling operations
8						Water level reading 11/27/02
10	Gray-brown, silty SAND, with little clay (Sandy loam)			3	4-4-3	
12						
14			SM	4	7-7-9	
16						
18	Brown, wet to saturated, fine to coarse SAND, with little silt (Loamy Sand)					
20				5	4-4-3	
22			SM			
24	Boring terminated at 24 feet					
26						
28						
30						

Well: P-22



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HYNES & ASSOCIATES

LOG OF BORING P-23

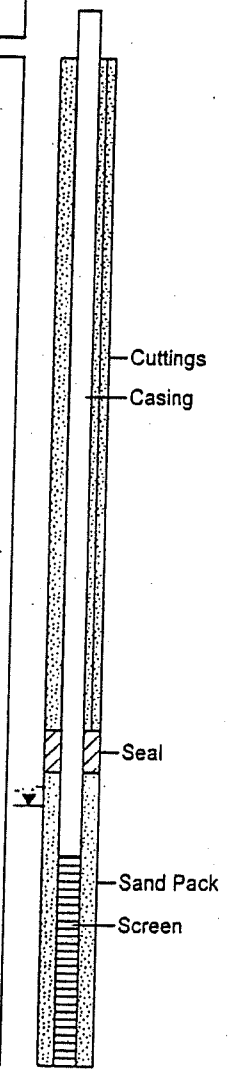
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/25/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/25/02	Total Depth:	: 24 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Dark brown, wet, fine to medium SAND, with little to some silt (Sandy Loam)		SM	1	1-1-2-1	Scale 1" ~ 6 feet
2	Gray, wet, fine to coarse SAND, with trace silt (Sand)		SP	2	2-2-5-7	Approximately 10 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 19 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with some silt (Sandy Loam)		SM	3	4-6-4	
12						
14	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)		SM	4	4-5-5	
16						
18						
20				5	3-4-4	
22						
24	Boring terminated at 24 feet					
26						
28						
30						

Well: P-23



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HYNES & ASSOCIATES

LOG OF BORING P-24

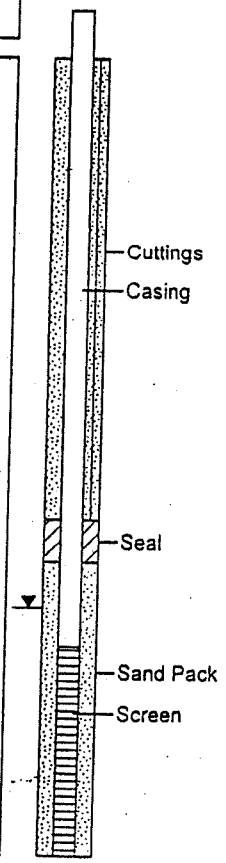
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/25/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/25/02	Total Depth:	: 19 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to coarse SAND, with trace to little silt (Loamy Sand)		SM	1	1-1-3-4	Scale 1" – 6 feet
2				2	2-2-5-7	Approximately 6 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 15 feet during drilling operations
6						Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with trace silt (Sand)		SP	3	4-5-5	
12						
14				4	6-6-5	
16	Brown, saturated, fine to coarse SAND, with little silt (Loamy Sand)		SM			
18						
	Boring terminated at 19 feet					
20						
22						
24						
26						
28						
30						

Well: P-24



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LOG OF BORING P-25

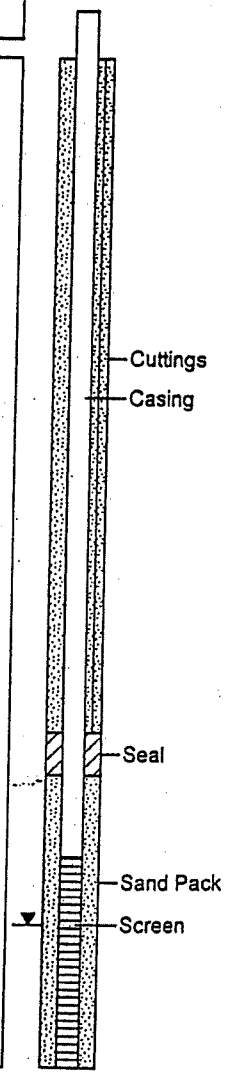
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/25/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/25/02	Total Depth:	: 24 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)		SM	1	1-1-2-1	Scale 1" ~ 6 feet
2	Brown, wet, fine to coarse, silty SAND (Sandy Loam)			2	2-1-4-4	Approximately 8 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 22 feet during drilling operations
6						Water level reading 11/27/02
8						
10			SM	3	3-5-6	
12						
14				4	5-6-5	
16						
18						
20	Brown, saturated, fine to medium SAND, with some silt (Sandy Loam/Loamy Sand)			5	7-7-9	
22			SM			
24	Boring terminated at 24 feet					
26						
28						
30						

Well: P-25



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LOG OF BORING P-26

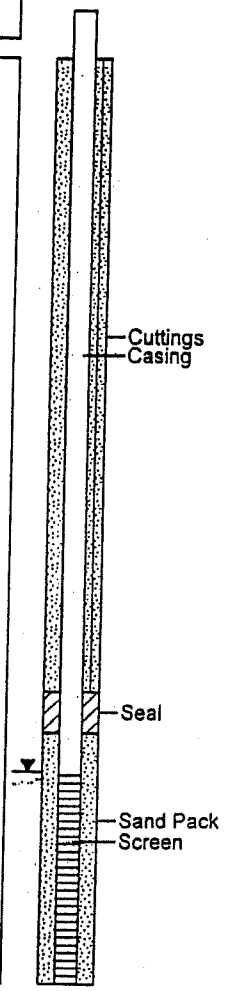
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: B. Melvin
Start Date:	: 11/25/02	Drilling Method:	: HSA (Mobile B-47)
End Date:	: 11/25/02	Total Depth:	: 22 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	Blows per 6 inches	REMARKS
0	Brown, wet, fine to medium SAND, with some silt (Sandy Loam/Loamy Sand)		SM	1	1-2-1-1	Scale 1" ~ 6 feet
2	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)			2	2-3-3-3	Approximately 8 inches of organic bearing soil encountered at ground surface
4						Groundwater was encountered at 18 feet during drilling operations
6			SM			Water level reading 11/27/02
8						
10	Brown, wet, fine to medium SAND, with trace to little silt (Loamy Sand)			3	7-7-10	
12						
14				4	6-8-7	
16			SM			
18						
20				5	7-7-8	
22	Boring terminated at 22 feet					
24						
26						
28						
30						

Well: P-26



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HYNES & ASSOCIATES

LOG OF BORING P-27

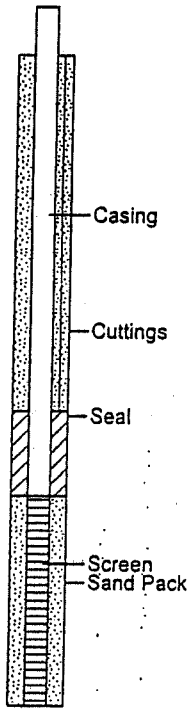
(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: P. Sellers
Start Date:	: 06/05/03	Drilling Method:	: Hand Auger
End Date:	: 06/05/03	Total Depth:	: 15.5 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	REMARKS
0	Brown, wet, SILT, with some fine to medium sand (Silt Loam)		ML	1	Scale 1" ~ 6 feet
2	Brown, wet, fine to medium SAND, with little silt (Sandy Loam)		SM	2	Approximately 10 inches of organic bearing soil encountered at ground surface
4	Gray, wet, SILT, with fine to coarse sand (Silt Loam)		ML	3	Groundwater was encountered at 13.5 feet during drilling operations
6					
8					
10	Light brown, wet, fine to medium SAND, with little to some silt (Sandy Loam)		SM	4	
12					
14	Light brown-orange, saturated, fine to medium SAND, with little silt (Sandy Loam)		SM	5	
				6	
	Gray, saturated, fine to medium SAND, with trace silt (Sand)		SP		
16	Boring terminated at 15.5 feet				
18					
20					
22					
24					
26					
28					
30					

Well: P-27



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HYNES & ASSOCIATES

LOG OF BORING P-28

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name:	: Trappe East Project	Logged By:	: P. Sellers
Project Number:	: JDH-10/02/265	Driller:	: P. Sellers
Start Date:	: 06/05/03	Drilling Method:	: Hand Auger
End Date:	: 06/05/03	Total Depth:	: 21 feet

Depth in Feet	DESCRIPTION	GRAPHIC	USCS	Sample No.	REMARKS
0	Brown, wet, fine to medium SAND, with little silt (Loamy Sand)		SM	1	Scale 1" ~ 6 feet
2	Brown, wet, fine to medium SAND, with silt (Sandy Loam)		SM	2	Approximately 3 inches of organic bearing soil encountered at ground surface
	Brown, wet, fine to medium SAND, with trace silt (Sand)		SP	3	
4					Groundwater was not encountered during drilling operations
6	Brown-orange, wet, fine to coarse SAND, some fine to medium gravel, and little silt (Sandy Loam)		SM	4	Auger refusal at 21 feet
8					
10	Brown-orange, wet, fine to medium SAND, with little to some silt		SM	5	
12					
14	Light brown, wet, fine to medium SAND, wtih trace silt		SP	6	
16					
18					
20					
	Boring terminated at 21 feet				
22					
24					
26					
28					
30					

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HYNES & ASSOCIATES

LOG OF BORING TP-2

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 11/7/02	Drilling Method	: Backhoe
End Date	: 11/7/02	Total Depth	: 96 inches

Depth in Inches	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, SILT, with sone fine to medium sand Silt loam (10 YR 6/6 Brownish Yellow) Mottles few, fine and faint	ML		1	Scale 1" ~ 1.5 feet Approximately 11 inches of organic bearing soil was encountered at ground surface Groundwater was not encountered during test pit operations
12					
24					
36					
48	Brown, wet, fine to medium SAND with trace to little silt Loamy sand (10YR 6/8 Brownish Yellow) Mottles few, fine and faint	SM		2	
60					
72	Gray, wet, sandy SILT Sandy clay (10YR 8/3Very Pale Brown) Mottles few, fine and faint	ML		3	
84					
96	Gray, wet, fine to coarse SAND with little to some silt Sandy clay loam (10YR 8/2 Very Pale Brown)	SM		4	
	Test pit terminated at 96 inches				
108					
120					

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HYNES & ASSOCIATES

LOG OF BORING TP-4

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 11/7/02	Drilling Method	: Backhoe
End Date	: 11/7/02	Total Depth	: 90 inches

Depth in Inches	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, fine to medium SAND with trace to little silt Laomy sand (10 YR 7/4 Very Pale Brown) Mottles few, fine and faint	SM		1	Scale 1" ~ 1.5 feet Approximately 7 inches of organic bearing soil was encountered at ground surface Groundwater was encountered at 84 inches during test pit operations
12					
24					
36	Grey, wet, fine to medium SAND with little silt Loamy sand (10YR 8\2 Very Pale Brown) Mottles few, fine and faint	SM		2	
48					
60	Light brown, wet, fine to medium SAND with little silt Sandy loam (10YR 8/3 Very Pale Brown) Mottles common, fine and faint	SM		3	
72					
84	Brown, wet to saturated, fine to coarse SAND with trace silt Sand (10YR 8/3 Very Pale Brown) Mottles common, medium and destinct	SP		4	
	Test pit terminated at 96 inches				
96					
108					
120					

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HYNES & ASSOCIATES

LOG OF BORING TP-15

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 08/01/03	Drilling Method	: Hand Auger
End Date	: 08/01/03	Total Depth	: 6 feet

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, fine to medium SAND, with some silt (Sandy loam)	SM		1	Scale 1" ~ 1.5 feet Approximately 8 inches of organic bearing soil was encountered at ground surface Groundwater was not encountered during test pit operations
4	Brown, wet, fine to medium SAND, with little silt (Loamy sand)	SM		2 3	
6	Test pit terminated at 6 feet				
8					
10					

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HYNES & ASSOCIATES

LOG OF BORING TP-16

(Page 1 of 1)

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 08/01/03	Drilling Method	: Hand Auger
End Date	: 08/01/03	Total Depth	: 6 feet

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, fine to medium SAND, with little silt (Loamy sand)	SM		1	Scale 1" ~ 1.5 feet Approximately 10 inches of organic bearing soil was encountered at ground surface Groundwater was not encountered during test pit operations
2					
4	Brown, wet, fine to medium SAND, with little to some silt (Sandy loam)	SM		2	
6	Test pit terminated at 6 feet				
8					
10					

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HYNES & ASSOCIATES

LOG OF BORING TP-17

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 08/01/03	Drilling Method	: Hand Auger
End Date	: 08/01/03	Total Depth	: 6 feet

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, fine to medium SAND, with trace silt (Sand)	SM		1	Scale 1" ~ 1.5 feet Approximately 8 inches of organic bearing soil was encountered at ground surface Groundwater was not encountered during test pit operations
4	Brown, wet, fine to medium SAND, with some silt (Sandy loam)	SM		2	
6	Test pit terminated at 6 feet				
8					
10					

10-20-2003 S:\Mtech2002\TrapEastProj-02265\TP-16.bor

HYNES & ASSOCIATES

LOG OF BORING TP-18

Robert D. Rauch & Associates
24466 Waterview Drive
Easton, Maryland 21601

Project Name	: Trappe East	Logged By	: P. Sellers
Project Number	: JDH-10/02/265	Driller	: P. Sellers
Start Date	: 08/01/03	Drilling Method	: Hand Auger
End Date	: 08/01/03	Total Depth	: 6 feet

Depth in Feet	DESCRIPTION	USCS	GRAPHIC	Samples	REMARKS
0	Brown, wet, fine to medium SAND, with little silt (Loamy sand)	SM		1	Scale 1" ~ 1.5 feet Approximately 10 inches of organic bearing soil was encountered at ground surface Groundwater was not encountered during test pit operations
2					
4	Brown, wet, fine to medium SAND, with some silt (Sandy loam)	SM		2	
6	Test pit terminated at 6 feet				
8					
10					

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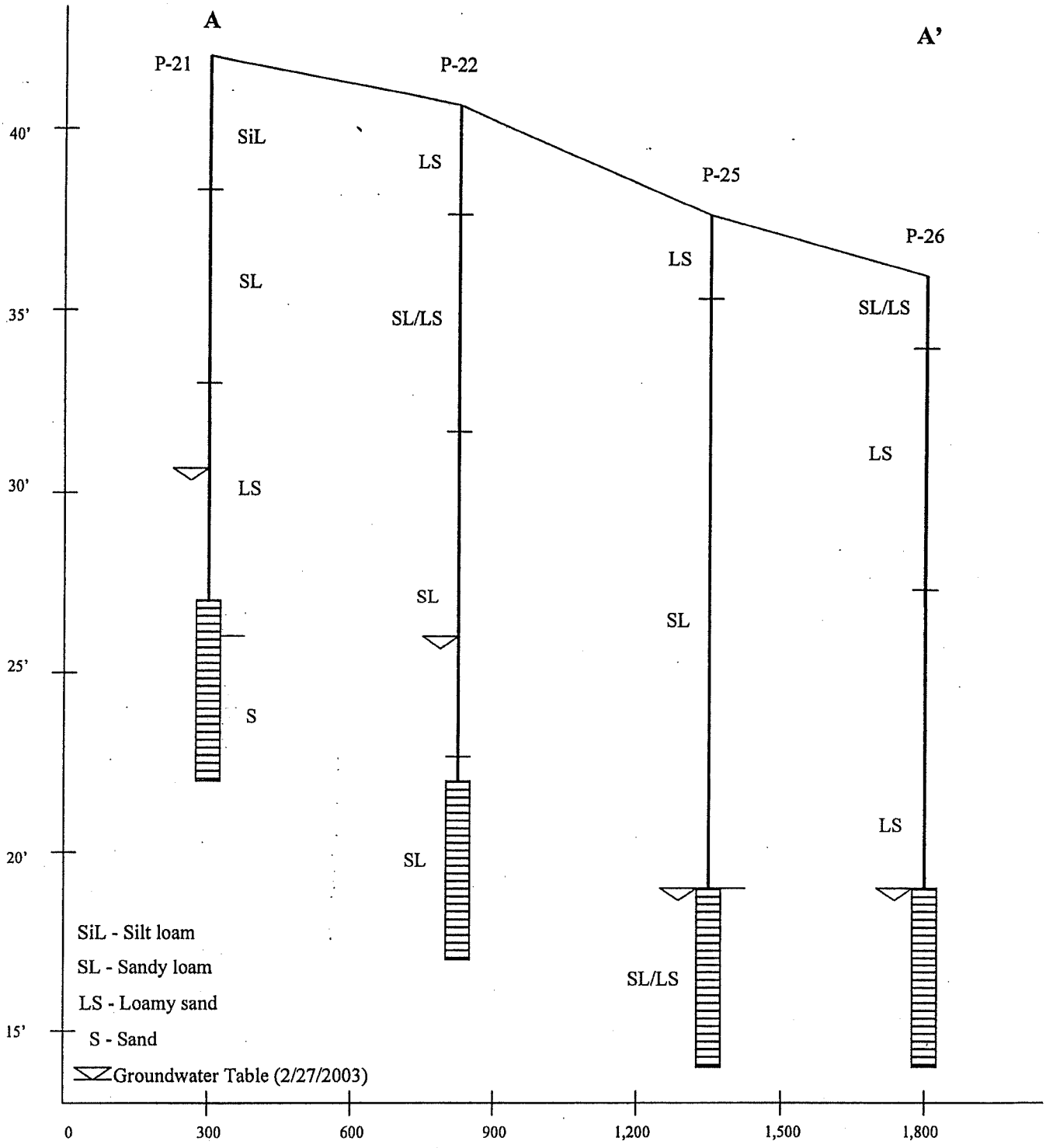
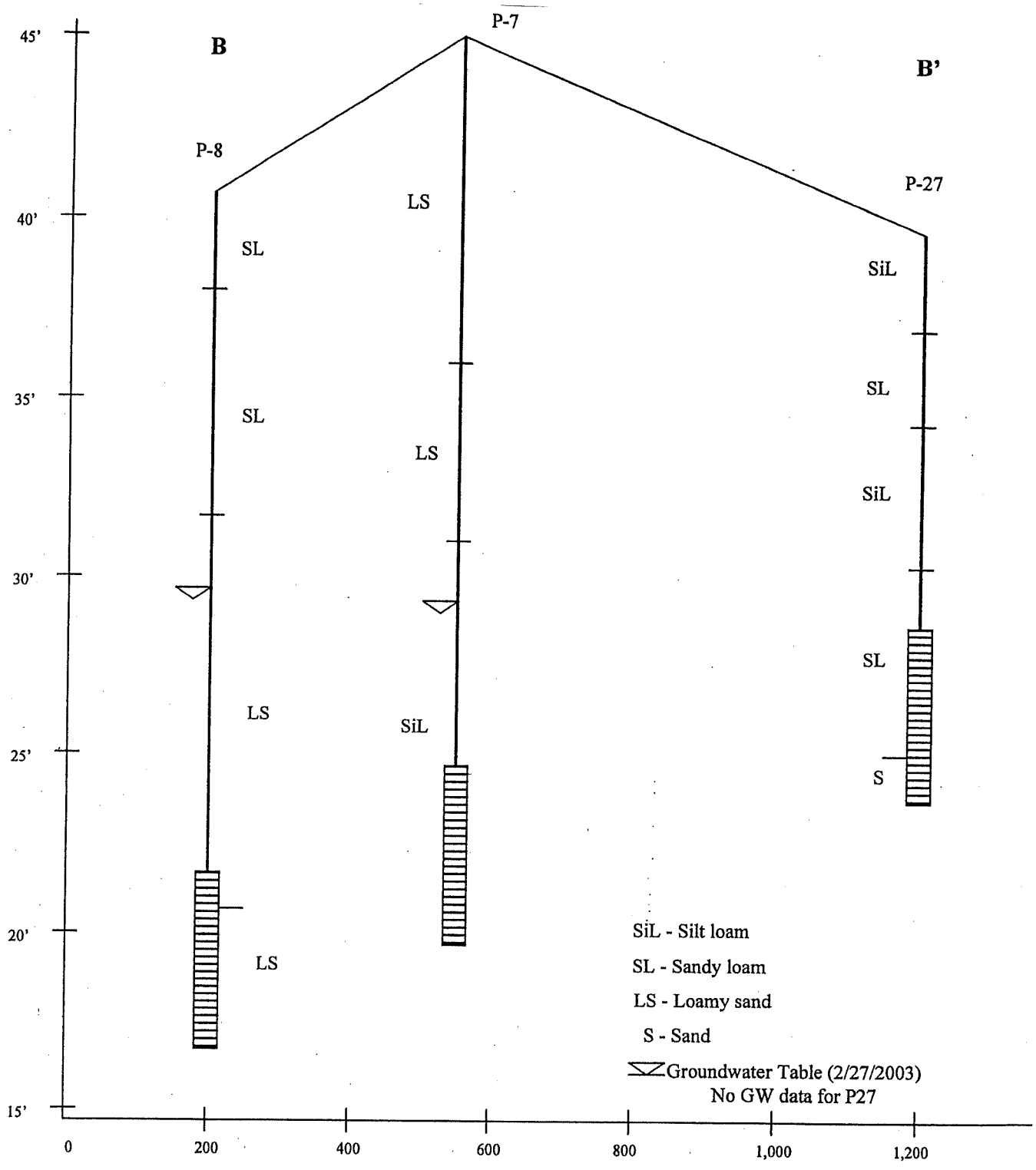
9.8 Cross Sections

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com



JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

	Date: October 1, 2003
	Scale: As Indicated
	Drawn: Hynes & Assoc.
Cross Section A – A' Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409**



JOHN D. HYNES & ASSOCIATES, INC.
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 / Fax: 410-548-5346

	Date: October 1, 2003
	Scale: As Indicated
	Drawn: Hynes & Assoc.
Cross Section B – B' Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409**

9.9 PET and Hydrologic Balance Tables

32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
Email: jdh@jdhynesinc.com

Potential Evapotranspiration (PET) Calculations

Lakeside aka Trappe East Project
Trappe, Maryland

Month	Average Monthly Temp. (F)	% Annual Daytime Hrs (approx.)	Crop Use Coeff.	Consumptive Use Factor (Col 2xCol 3)/100	PET (inches)
January	36.0	6.78	0.1	2.44	0.24
February	38.5	6.74	0.39	2.59	1.01
March	46.5	8.3	0.78	3.86	3.01
April	56.5	8.94	0.78	5.05	3.94
May	65.5	9.99	0.78	6.54	5.10
June	74.5	10.03	0.78	7.47	5.83
July	78.5	10.17	0.78	7.98	6.23
August	76.5	8.52	0.78	6.52	5.08
September	70.5	8.39	0.78	5.91	4.61
October	59.5	7.76	0.78	4.62	3.60
November	50.0	6.75	0.78	3.38	2.64
December	40.0	6.55	0.39	2.62	1.02

Note: % Daytime hours based on location @39 degrees, 30 minutes, which is slightly north of our location. Crop use coefficient of 0.78 is conservative. The seasonal average value for wheat and sorghum is 0.78. The value for beans is 0.79 and the value for corn is 0.82.

Calculation of Water Entering Groundwater System - 60 day storage

Lakeside aka Trappe East Project
Trappe, Maryland

Month	Natural Precipitation (inches)[1]	Wastewater Loading (inches)[2]	Potential ET (inches)	Entering Groundwater (inches)
January	3.53	0.00	0.24	3.29
February	2.72	4.36	1.01	6.07
March	3.04	8.71	3.01	8.74
April	2.31	8.71	3.94	7.08
May	9.79	8.71	5.10	13.40
June	4.17	8.71	5.83	7.05
July	4.74	8.71	6.23	7.22
August	2.26	8.71	5.08	5.89
September	5.26	8.71	4.61	9.36
October	8.67	8.71	3.60	13.78
November	4.50	8.71	2.64	10.57
December	3.30	4.36	1.02	6.64
Annual	54.29	87.11	42.31	99.09

Notes:

[1] Represents precipitation during 2018, which was 1 of the 2 wettest years during the period from 2009 through 2018, based on rainfall data collected at the official NOAA station in Salisbury, Maryland. The other wettest year was 2016.

[2] Monthly loading based on a max application rate of 2"/week.
7,372 gallons/acre per day entering system (Avg over 365 days)

Lakeside aka Trappe East Project
Trappe, Maryland
JDH-10/19/409

Calculation of Potential Evapotranspiration:

Blaney-Criddle Method

PET = KF

Where:

PET = Potential ET in inches per unit area,
K = Crop use coefficient,
F = Consumptive use factor.

$$F = \frac{tp}{100}$$

Where:

t = mean monthly temperature (°F),
p = percent of annual daytime hours occurring during each month of the year
(Latitude for example site N39", 30').

9.10 Infiltration Rates Table

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Table
Infiltration Rates
Lakeside aka Trappe East Project
Trappe, Maryland
JDH-10/19/409

Test Location	Test Depth (in)	Soil Mapping Unit	USDA Classification	Infiltration Rate (cm/hr)[1]	Average Infiltration Rate [2]	Spray Rate (in/week)
TP-1	18	Hfb	Loam	0.83	--	>2.0
TP-3	18	Hfc	Sandy loam	0.63	2.2	1.67
TP-6	24	WocA[3]	Silt loam	0.64	0.84	1.69
TP-7	20	Hfa	Silt loam	2.54	2.04	>2.0
TP-13	18	WdcA	Silt loam	8.25	--	>2.0
MD-3	20	WocA[3]	Silt loam	0.64	0.68	1.69
MD-4	18	Hfb	Silt loam	0.0	0.0	0
MD-7	16	Hfc	Silty clay loam	2.54	3.81	>2.0
MD-10	14	IgB	Sandy clay loam	5.07	6.63	>2.0
H-1	18	Hfb	Loamy sand	1.90	3.54	>2.0
H-2	16	Hfc	Loamy sand	0.79	3.00	>2.0
H-3	18	Hfa	Loamy sand	0.79	1.73	>2.0
H-4	18	Hfc	Loamy sand	6.99	10.92	>2.0
H-5	18	Hfa	Loamy sand	2.38	4.37	>2.0
H-6	18	Hfa	Loamy sand	5.73	11.2	>2.0

Notes: Spray rate calculated using the following equation: (cm/hr)*(1 in./2.54 cm)*(24 hr/day)*(7 days/wk)*0.04
The steady state infiltration rate was used to calculate the spray rate.
Test Locations TP-1, 3, 13 and MD-4 are located in areas that will not be used for spray irrigation
(1) Infiltration rate based on steady state reading.
(2) Infiltration rate based on an average of all readings collected during testing.
(3) WocA soils comprise approximately 6 acres of the 85 acres identified for spray irrigation.

9.11 Gauging Data

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Gauging Data
Lakeside aka Trappe East Project
Project No.: JDH-10/19/409

Piezometer	PVC Stickup (ft.)	Casing Elevation (ft)	Date								
			November 27, 2002			February 27, 2003			May 13, 2003		
			Depth to Water (ft.) (1)	Groundwater Elevation (ft.) (2)	Depth Below Ground Surface (ft.) (2)	Depth to Water (ft.) (1)	Groundwater Elevation (ft) (2)	Depth Below Ground Surface (ft) (2)	Depth to Water (ft.) (1)	Groundwater Elevation (ft) (2)	Depth Below Ground Surface (ft) (2)
P-6		47.68	20.01	27.67	20.01	15.78	31.90	15.78	14.15	33.53	14.15
P-7	3.13	48.14	23.15	24.99	20.02	18.90	29.24	15.77	17.61	30.53	14.48
P-8	3.03	44.71	18.75	25.96	15.72	15.13	29.58	12.10	13.93	30.78	10.90
P-9	3.2	46.21	17.71	28.50	14.51	13.49	32.72	10.29	11.98	34.23	8.78
P-18	3.1	46.23	13.22	33.01	10.12	7.41	38.82	4.31	9.27	36.96	6.17
P-19	2.8	46.33	12.63	33.70	9.83	7.99	38.34	5.19	8.57	37.76	5.77
P-21	3	44.35	18.91	25.44	15.91	14.00	30.35	11.00	14.35	30.00	11.35
P-22	2.94	43.2	22.35	20.85	19.41	17.57	25.63	14.63	16.99	26.21	14.05
P-23	**1.35**	33.33	20.81	12.52	19.46	13.25	20.08	11.90	12.51	20.82	11.16
P-24	3.13	39.25	16.00	23.25	12.87	15.87	23.38	12.74	16.35	22.90	13.22
P-25	2.83	40.25	23.18	17.07	20.35	21.16	19.09	18.33	19.17	21.08	16.34
P-26	2.83	38.32	19.71	18.61	16.88	19.15	19.17	16.32	20.13	18.19	17.30
P-27											
P-29	2.84	46.41	NG	NG	NG	NG	NG	NG	NG	NG	NG
P-30	2.07	35.7	NG	NG	NG	NG	NG	NG	NG	NG	NG
PZ-1	5.6	65	NG	NG	NG	NG	NG	NG	NG	NG	NG
PZ-2	3.87	60.21	NG	NG	NG	NG	NG	NG	NG	NG	NG
PZ-3	3.11	58.89	NG	NG	NG	NG	NG	NG	NG	NG	NG

Notes: (1) Depth to water measurements taken from top of PVC casing
(2) Corrected depth to water represents the depth to groundwater from the land surface
NG - Piezometer was not gauged

Gauging Data (continued)
Lakeside aka Trappe East Project
Project No.: JDH-10/19/409

Piezometer	PVC Stickup (ft.)	Casing Elevation (ft)	Date								
			June 5, 2003			September 15, 2003			October 13, 2003		
			Depth to Water (ft.) (1)	Groundwater Elevation (ft.) (2)	Depth Below Ground Surface (ft.) (2)	Depth to Water (ft.) (1)	Groundwater Elevation (ft) (2)	Depth Below Ground Surface (ft) (2)	Depth to Water (ft.) (1)	Groundwater Elevation (ft) (2)	Depth Below Ground Surface (ft) (2)
P-6	3.25	47.68	13.14	34.54	9.89	15.41	32.27	12.16	14.61	33.07	11.36
P-7	3.13	48.14	17.89	30.25	14.76	18.65	29.49	15.52	17.73	30.41	14.60
P-8	3.03	44.71	13.20	31.51	10.17	15.03	29.68	12.00	11.49	33.22	8.46
P-9	3.2	46.21	10.80	35.41	7.60	12.98	33.23	9.78	12.63	33.58	9.43
P-18	3.1	46.23	9.51	36.72	6.41	9.85	36.38	6.75	NG	NG	NG
P-19	2.8	46.33	8.50	37.83	5.70	9.31	37.02	6.51	NG	NG	NG
P-21	3	44.35	15.01	29.34	12.01	14.65	29.70	11.65	14.63	29.72	11.63
P-22	2.94	43.2	18.01	25.19	15.07	**15.93**	N/A	14.52	15.91	N/A	14.50
P-23	**1.35**	33.33	11.25	22.08	9.90	**10.25**	N/A	9.75	9.90	N/A	8.05
P-24	3.13	39.25	17.13	22.12	14.00	16.35	22.90	13.22	16.62	22.63	13.49
P-25	2.83	40.25	20.61	19.64	17.78	19.71	20.54	16.88	19.63	20.62	16.80
P-26	2.83	38.32	20.75	17.57	17.92	20.46	17.86	17.63	20.31	18.01	17.48
P-27	2.7		17.35	14.65	14.65						
P-29	2.84	46.41	NG	NG	NG	27.90	18.51	25.06	27.00	19.41	24.16
P-30	2.07	35.7	NG	NG	NG	19.10	16.60	17.03	19.31	16.39	17.24
PZ-1	5.6	65	NG	NG	NG	NG	NG	NG	14.00	51.00	8.40
PZ-2	3.87	60.21	NG	NG	NG	NG	NG	NG	10.62	49.59	6.75
PZ-3	3.11	58.89	NG	NG	NG	NG	NG	NG	8.67	50.22	5.56

Notes: (1) Depth to water measurements taken from top of PVC casing
(2) Corrected depth to water represents the depth to groundwater from the land surface
NG - Piezometer was not gauged
The casings for P-22 and P-23 were broken. Therefore, we inlcude only the depth to water informatiion for the September 15 and October 13 gauging events.
Piezometer P-27 was destroyed before the Setember 15 gauging event.

9.12 Groundwater Elevation Sketches

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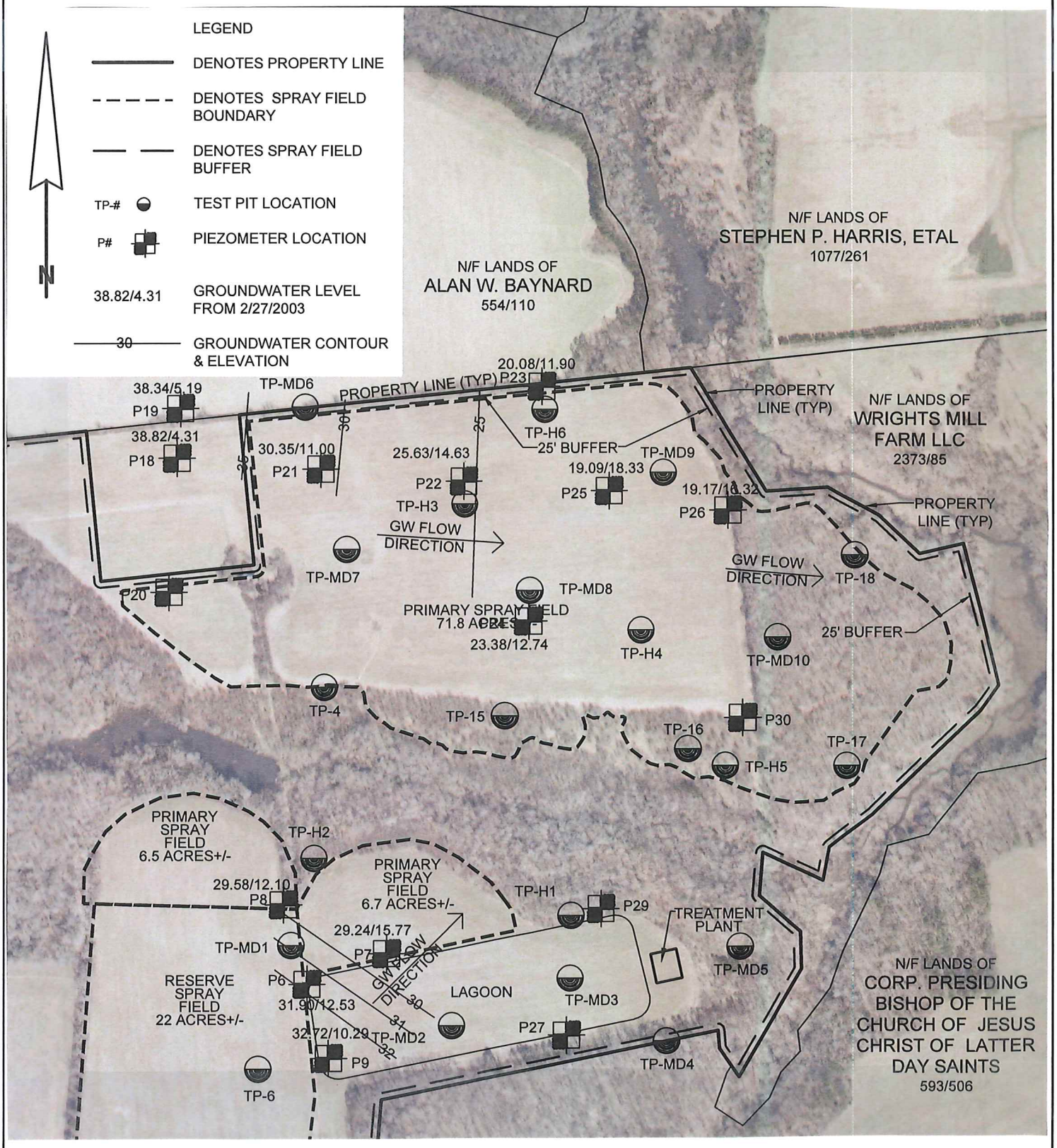

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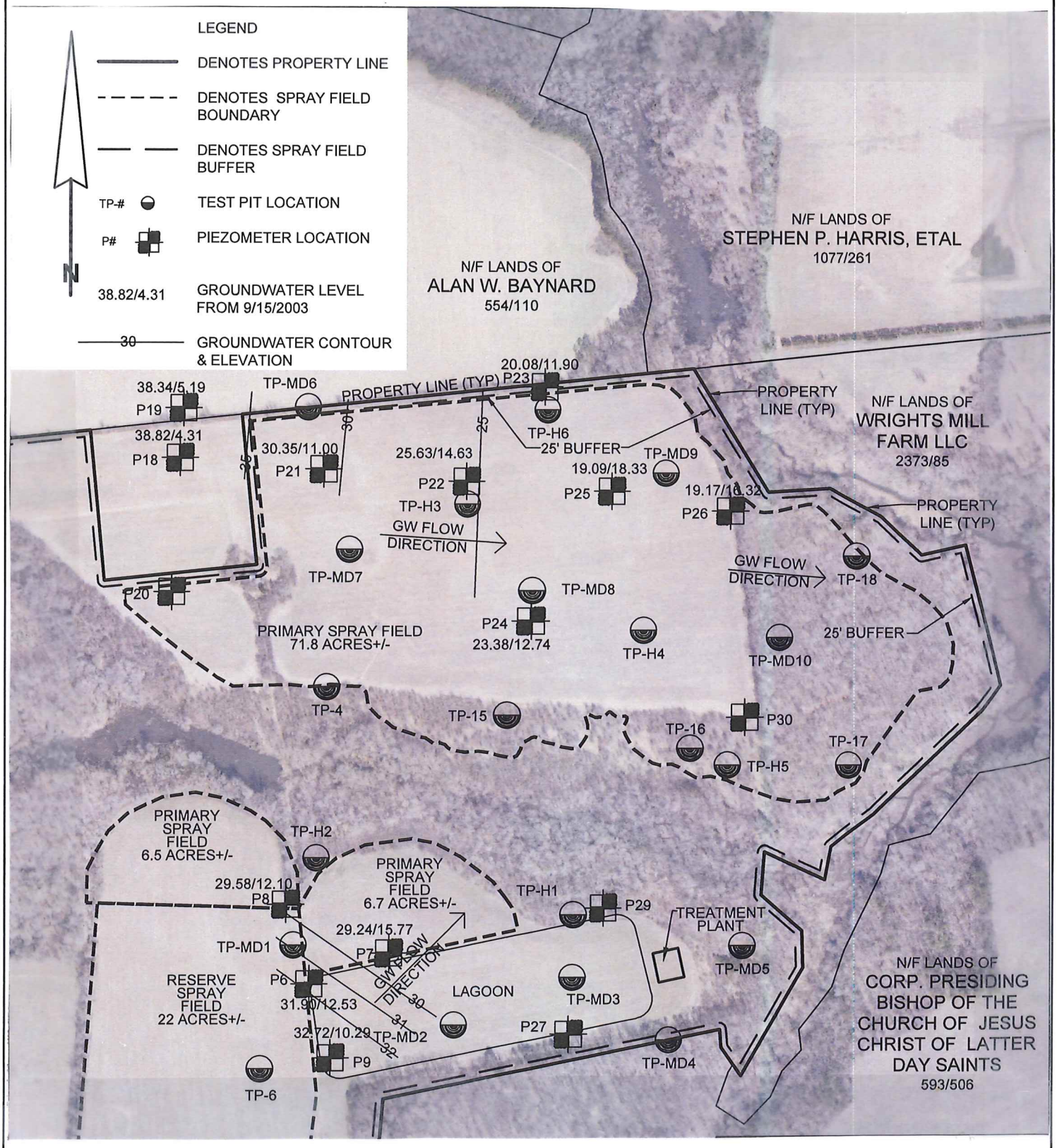
	Date: October 26, 2019
	Scale: 1 in. = 500 ft.
	Drawn: Rauch, Inc.
Groundwater Elevation Sketch – 02/27/03 Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-G**



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	Date: October 26, 2019
	Scale: 1 in. = 500 ft.
	Drawn: Rauch, Inc.
Groundwater Elevation Sketch – 09/15/03 Lakeside aka Trappe East Project Trappe, Maryland	**DWG. No.** **JDH-10/19/409-H**

9.13 Mounding and Nitrogen Equations

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Calculation of Nitrogen Balance

Total N in wastewater + N in precipitation = N removal in crops + Leaching Loss + denitrification + Ammonia Volatilization

The above equation assumes:

1. any short term increase in nitrogen storage in the soil has already occurred, and
2. there is no significant additions of nitrogen through nitrogen fixation by leguminous plants growing on site.

When the nitrogen mass balance is combined with a simplified water balance (volume of water leaving site equaling precipitation plus wastewater loading minus evapotranspiration) and solved for the wastewater loading, the following equation is derived:

$$W = \frac{4.43C + a(P-ET) - cP}{y-a-y(d+n)} = 92$$

W = wastewater loading (acre-inch/acre-year)
C = removal of nitrogen in crop (lbs/acre-year) = 167
a = allowable nitrogen concentration in percolation or runoff water (mg/L) = 0
P = precipitation (acre-inch/acre-year) = 54.29
ET = potential evapotranspiration (assumes that P + W will allow potential ET to be realized in all cases) (acre-inch/acre-year) = 42.31
c = concentration of nitrogen in precipitation (mg/L) =0.5
y = concentration of nitrogen in wastewater (mg/L) = 8
d = fraction of nitrogen which is denitrified (% x 10^{-2}) = 0
n = fraction of nitrogen which is volatilized as ammonia (% x 10^{-2}) = 0

Lakeside per MDE Criteria max mound.txt

Transient Water-Table Rise Beneath a Circular Recharge Area
Groundwater Mounding Solution by Hantush (1967)

Aquifer Properties:
Hydraulic conductivity, K = 195 ft/day
Specific yield, Sy = 0.1
Initial saturated thickness, h(0) = 70 ft

Recharge Area Properties:
Recharge rate, W = 0.17 ft/day
Simulation time, t = 1 day
Time when recharge stops, t(0) = 1 day
X coordinate at center of recharge area, X = 0 ft
Y coordinate at center of recharge area, Y = 0 ft
Radius of recharge area, R = 100 ft

Water-Table Rise at Center of Recharge Area:

t (day)	h (ft)
0.1	0.0687616
0.2	0.0889626
0.3	0.10111
0.4	0.109823
0.5	0.11662
0.6	0.122195
0.7	0.12692
0.8	0.13102
0.9	0.134642
1	0.137886

Report generated by AQTESOLV v4.51.007 (www.aqtesolv.com) on 10/25/19 at 16:17:50.

Maximum Mound

Lakeside per MDE Criteria.txt

Transient Water-Table Rise Beneath a Circular Recharge Area
Groundwater Mounding Solution by Hantush (1967)

Aquifer Properties:
Hydraulic conductivity, K = 195 ft/day
Specific yield, Sy = 0.1
Initial saturated thickness, h(0) = 70 ft

Recharge Area Properties:
Recharge rate, W = 0.17 ft/day
Simulation time, t = 7 day
Time when recharge stops, t(0) = 1 day
X coordinate at center of recharge area, X = 0 ft
Y coordinate at center of recharge area, Y = 0 ft
Radius of recharge area, R = 100 ft

Water-Table Rise at Center of Recharge Area:

t (day)	h (ft)
0.7	0.12692
1.4	0.0384908
2.1	0.0200073
2.8	0.0136989
3.5	0.0104429
4.2	0.00844511
4.9	0.0070917
5.6	0.00611336
6.3	0.00537282
7	0.00479262

Note: recovery begins after 1 day.

Residual Mound

9.14 Proposed Monitoring Point Location Plan

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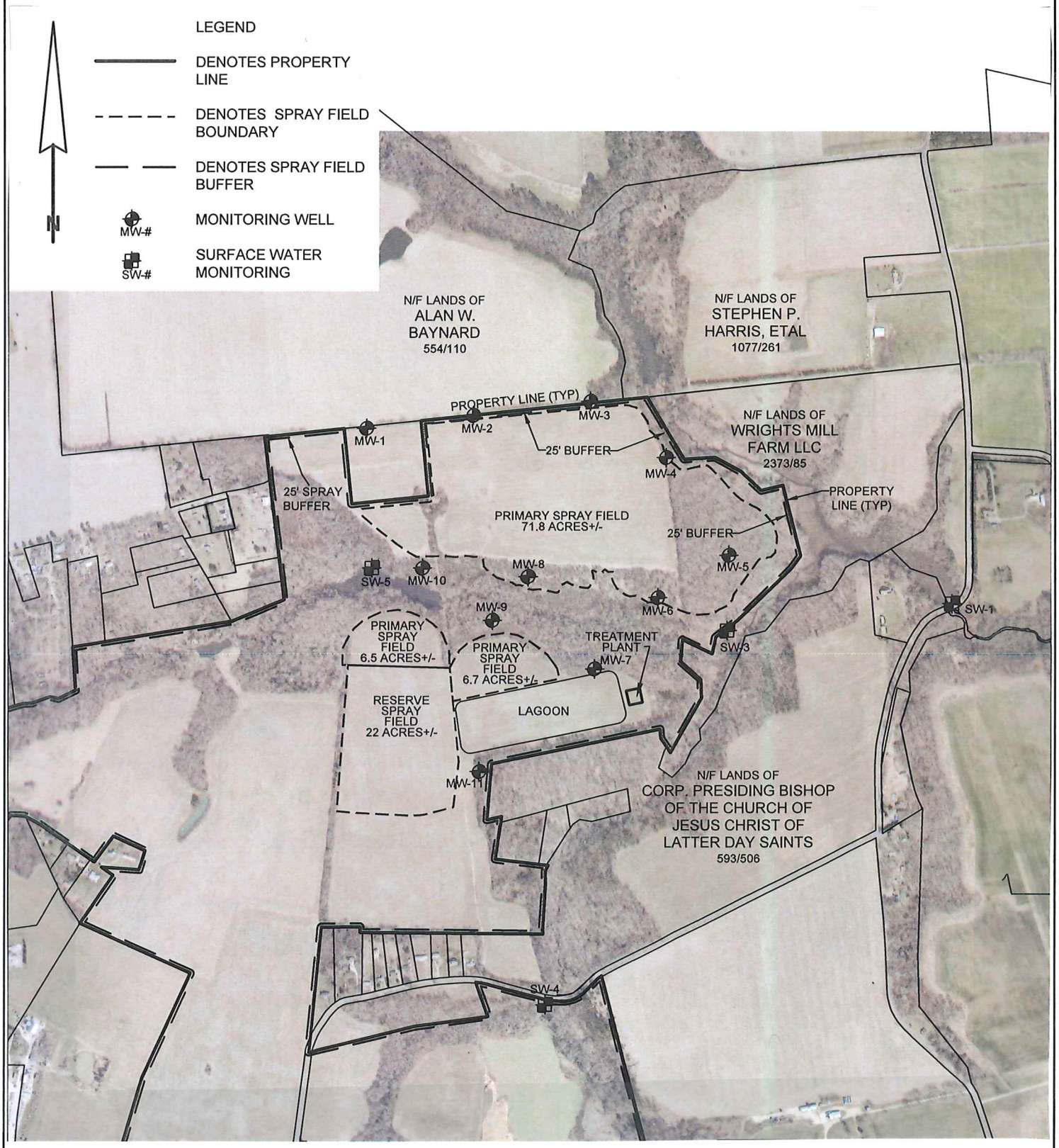

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Date: October 26, 2019

Scale: 1 in. = 1,000 ft.

Drawn: Rauch, Inc.

Proposed Monitoring Point Location Plan
Lakeside aka Trappe East Project
Trappe, Maryland

DWG. No.

JDH-10/19/409-K