Pennytown Village
Wastewater System Evaluation

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Appendices

Executive Summary

Pennytown Village is an existing commercial site located on Rt. 31 in Hopewell Township (Lot 1.02, Block 33) that consists of five distinct buildings each containing multiple uses such as restaurant, office, residential and retail space. The buildings are currently underutilized with many being vacant. The site is served by onsite water supply via two wells and onsite wastewater management via a wastewater system that includes a combination of grease traps, sewer collection pipes, a Rotating Biological Contactor (RBC) style treatment plant and groundwater recharge trenches for disposal of treated wastewater effluent. The wastewater system was approved by the NJDEP and is regulated under a New Jersey Pollutant Discharge Elimination System (NJPDES) permit as a discharge to groundwater (DGW). The wastewater system was constructed in 2004 as part of an Administrative Consent Order aimed at alleviating malfunctioning septic systems that served the various buildings up until that time. Hopewell Township intends to redevelop the site for residential affordable housing and this report specifically evaluates the wastewater system for the proposed future residential use.

A review of the wastewater system components, permits and requirements for the proposed future use was conducted and resulted in the following key points:

1. The NJPDES allows a maximum discharge capacity of 14,210 GPD but the hydrogeologic work that supports the permit rated the existing disposal trench capacity as 7,700 GPD. Analysis of historic monitoring data for the facility indicates capacity of the existing disposal system is approximately 5,000 GPD. Subsequent onsite testing was performed and resulted in an estimated total site capacity of approximately 14,000 GPD which could only be accommodated by expanding and reconfiguring the groundwater recharge system. This site capacity would need to be verified by further testing to confirm whether onsite conditions support the assumptions made in the groundwater flow model. Field testing and subsequent modeling revisions will need to be outlined once a conceptual layout of the proposed system becomes available. The costs for the expansion of the groundwater recharge system to accommodate the full 14,210 GPD as initially intended is approximately $160,000 to $200,000 as a preliminary budgetary estimate, assuming the treatment plant effluent quality remains unchanged and that the recharge system is expanded via additional recharge trench length of approximately 2,000 LF. This cost estimate is heavily dependent on the extent of select fill required in the recharge trench design. Additionally, NJDEP has historically been reluctant to permit wastewater discharges within Tier 1 wellhead protection areas for public water supply wells, so portions of the site may be removed from consideration once the ongoing water supply analyses are completed.

2. Transfer of the NJPDES permit to Hopewell Township for this proposed future residential use will require a major permit revision which may involve a revocation and reissuance. The permit would only allow the residential redevelopment which would be accommodated by the total site capacity stated in item 1 above as calculated under

current NJDEP wastewater flow standards. Assuming that the future residential use is not age restricted, the current NJDEP standard for wastewater flow is as set forth below and the number of units would be limited accordingly:

a. 1 Bedroom Unit 150 gpd
b. 2 Bedroom Unit 225 gpd
c. 3+ Bedroom Unit 300 gpd

3. During the revision process, a groundwater flow and dilution model will have to be performed under current NJDEP requirements to show the revised wastewater design flows can be discharged on site; the wastewater effluent quality may be upgraded as a result. Whereas, this is not anticipated, it remains a possibility which would increase the cost for upgrade of the treatment process as indicated herein.

4. In order for the property use to be changed from commercial to residential, the Wastewater Management Plan (WMP) for Hopewell Township would have to be amended to properly reflect the proposed use before the NJPDES permit would be revised. The existing WMP does not properly include Pennytown Village because the current NJPDES permit was issued under an Administrative Consent Order without a WMP amendment. New WMP rules now place the responsibility for this amendment upon the Mercer County Planning Department which is in the process of preparing an updated WMP by September 9, 2009. It would appear that Mercer County could readily accommodate the amendment changing the use of Pennytown Village to residential within this current amendment process if the Township so requests. Once completed, the WMP amendment should be reviewed and approved by DEP in approximately 6 months, or by approximately March 2010. Failing to include this change of use in this current amendment process would result in a longer revision process that could take two years to complete.

5. The treatment mechanisms that exist on site were constructed as a repair to the failing septic systems and the facility was designed and built without some safeguards typically required in a system intended for municipal type use. Inclusion of emergency power and redundancy of key process equipment is necessary to allow for periodic system down time for repair and maintenance. Upgrading the treatment plant to be completely suitable for the intended municipal use at the originally intended 14,210 GPD capacity will cost approximately $ 338,000 as a preliminary budgetary estimate assuming the wastewater effluent quality remains unchanged.

6. Water reuse for toilet flushing, irrigation and cooling could provide a means of reducing the residential wastewater discharge by up to 30% depending on the details of the buildings and site plan. The details of this alternative would require further investigation with the DEP and the DOH, once a building configuration and site plan are developed.

In summary, the site poses some challenges for the intended use, most of which can be overcome by taking the proper steps to acquire permits and upgrade and expand the systems accordingly.

1.0 Introduction

The Township of Hopewell is evaluating the possible purchase of the Pennytown Village property with the intent of using the existing wastewater treatment facility to serve a proposed development of 70 affordable housing units generating a wastewater flow of approximately 14,200 gallons per day. This is the current permitted peak daily flow as identified in the existing wastewater treatment system permits. The existing mixed-use commercial operations at the site included retail, office space, restaurant and residential uses all located primarily in five (5) buildings. These structures are now mostly abandoned and deteriorating and would be eliminated as part of the new development. One small wastewater treatment facility, using rotating biological contactor technology now serves to treat the wastewater produced from the on-site buildings with the treated effluent being recharged into the ground through two subsurface recharge trenches. This treatment system is relatively new having been built in 2004 as a means of replacing multiple failing septic systems that had served the various buildings previously.

This report evaluates the condition of the existing wastewater system and the status of the existing permits with regards to the proposed future use. The information that supports the findings herein was developed from a combination of site inspection, on-site testing, review of available records and conversations with various regulatory authorities. Information was obtained from the current owner, Bruce Meier and engineering and operations consultants, CMX, Hill Environmental and Quest Environmental and the treatment equipment manufacturer, Seprotech. Most of this information was related to current system operations and the system design and applicable permits such as the New Jersey Pollutant Discharge Elimination System-Discharge to Ground Water (NJPDES-DGW) and Treatment Works Approval (TWA). This information included, but was not necessarily limited to the following:

- Final NJPDES permit #NJ0101028, renewed effective 5/1/08;
- TWA application and Engineer's Report dated November 2002;
- Design Plans prepared by Hill Environmental Group last revised 1/9/03
- Discharge Monitoring Reports (DMR's);
- NJDEP Compliance Evaluation and Assistance Inspections
- RBC Installation and Operators Manual – Rotordisk Aerobic Treatment Plant Model M-175 manufactured by Seprotech Systems Inc.;
- Communications with Seprotech regarding design parameters and recommended upgrades;
- Laboratory data and on-site measurements regarding depth to groundwater
- Miscellaneous correspondence regarding site and system testing

In addition to the above, a site visit was conducted on January 6, 2009. A representative of the current operator, CMX Engineering, was present during the site visit. Subsequent hydrogeologic testing was conducted in March and April, 2009.

2.0 Site Description

Pennytown Village is situated on Lot 1.02, Block 33 in Hopewell Township and has frontage on State Highway Route 31, Hopewell Pennington Road and Marshalls Corner-Woodsville Road. The treatment plant is located in a steel arch type structure at the southeastern corner of the large parking lot along Route 31. The longer of the two recharge trenches (680 feet long) is located in an open field to the southeast of the treatment plant. The shorter trench (300 feet long) is located in the open field between Building 2 and Building 5.

The underlying geology is composed of shale, siltstone and argillite and a small stream identified as a Branch of the Stony Brook bisects the site flowing from west to east toward the main branch of the Stony Brook. This stream also feeds and drains a pond on the property and all site drainage flows generally into this stream. The topography of the site consists of very gentle slopes mostly less than 5 percent.

The wastewater system serves the area located north of the Branch of the Stony Brook and this area contains all of the buildings and site improvements. Adjoining parcels located south of the stream are served by individual wells and septic systems. The improvements included in the wastewater system are:

Building #1	Office – 14,916 SF
Building #2	Motel – 23 rooms and apartments with 6 bedrooms
Building #3	Restaurant with 40 seats and motel with 20 rooms
Building #4	Retail 13,187 SF and apartments with 7 bedrooms
Building #5	Restaurant with 125 seats and apartments with 3 bedrooms

3.0 Status of Existing Permits

All wastewater permits required for the operation of the wastewater facilities at Pennytown Village appear to be current and active. The Pennytown Village wastewater treatment facility operates under a New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Groundwater Permit No. NJ0101028 (P.I. ID# 47452). The current permit expires on April 30, 2013 having just been renewed in 2008. Under the permit, the facility is required to report discharge flow rate, depth to groundwater, total nitrogen, pH, fecal coliform and total volatile organics on a monthly basis. Sludge characteristics, including nutrient and metal content, as well as total disposal volume and location, must be submitted annually.

Permit limits are as follows:

Parameter	Limit
Flow Rate	14,210 gpd (daily average each month and daily maximum)
Total Nitrogen	10 mg/l
pH	NA
Fecal Coliform	200 colonies / 100 ml
Total Volatile Organics	NA

The NJPDES permit and the associated wastewater treatment and recharge system at Pennytown Village were the result of an Administrative Consent Order (ACO) between the NJDEP and the then owner. The details of the ACO were not provided and reviewed as part of this report, but all indications are that the requirements of that order were satisfied by the existing system which was built in 2003 - 2004. However, because the existing system is the result of the ACO and was part of an effort to repair failing septic systems it's applicability to other uses is somewhat limited. The key limitations are as follows:

1. The NJPDES permit states a daily maximum flow of 14,210 gpd but the groundwater recharge modeling accompanying the permit only supports an average flow of 7,700 gpd. Based on this earlier model, use of the facility that would create an average flow greater than 7,700 gpd is likely to result in failure of the groundwater recharge system, so in reality the earlier site work and modeling indicates the present system only has a capacity of 7,700 gpd.

2. Because the system was permitted via an ACO, it was never completely referenced in the Wastewater Management Plan (WMP). Whereas, the site is illustrated in the Hopewell Township WMP as an existing sewer service area, there is no accompanying description of the system provided. The only system description provided is that found in the NJPDES permit and it specifically includes the five buildings and uses listed above in Section 2 of this report. Amendment of both the NJPDES permit and the WMP would be required to change the use of the system.

4.0 Findings and Observations Relative to Permits

There are limitations with the use of the existing wastewater treatment plant for anything other than the current commercial uses. These limitations were placed on the NJPDES permit by NJDEP when the permit was first issued because the site hydrogeologic testing did not fully address the site's projected wastewater flow and DEP relaxed their typical sizing criteria based on data which measured the then current flow to be much less than standard projections would suggest. In essence, the maximum daily flow of 14,210 gpd approximates the total flow DEP standards would generally anticipate for the uses and building sizes that existed but being the

site was generating less than 5,000 GPD of wastewater, they accepted the groundwater recharge system sizing which demonstrated a site capacity to routinely accommodate 7,700 gpd of flow.

In addition, because the NJPDES was issued via an Administrative Consent Order, the typical Wastewater Management Planning requirements were also waived. DEP adheres to a policy wherein permits issues under and Administrative Consent Order are automatically deemed consistent with the applicable WMP. Once the ACO is fulfilled, DEP revises the WMP accordingly as an internal document update. As it now stands however, the ACO has been fulfilled, but DEP has not yet updated the WMP. Conversations with DEP indicate that Pennytown Village may have been omitted from the WMP in error and it now will be incorporated in the next plan update.

Under the newly enacted Water Quality Management Rules, authority for the Hopewell Township WMP now rests with Mercer County and the County is required to have an update of the WMP prepared and submitted to DEP by September 2009. The County is currently in the process of collecting information relative to this WMP update and it will modify the permitted uses for Pennytown Village if so requested by Hopewell Township. That being the case, the Township could proceed presently with identifying the site for future residential or mixed uses and thereby have the WMP amended at this time to establish future consistency. It should be reasonably anticipated that this process will take approximately 6 months to complete after the filing by Mercer County. However, this anticipated change in use from commercial to residential will not be approved by NJDEP without evidence being submitted in advance that the site can accommodate the required flow anticipated as per DEP standards for the newly proposed use. Therefore, it is important that Hopewell Township complete an application to the Groundwater Permits Section of NJDEP in advance of the WMP Amendment such that this proposed change is readily accepted and does not delay the amendment process. Failing the Township to so request the change in use or to submit the required site capacity documentation, the WMP will most likely be updated to reflect the Pennytown Village site as per the previous ACO and current NJPDES permit. If that were to occur, any future changes would have to be handled via future amendments through Mercer County and could take considerable time to complete, possibly several years.

5.0 Wastewater Treatment System Components

The existing buildings on site were previously served by individual septic tanks, grease traps and disposal fields. These components were abandoned when the treatment plant was constructed in 2004. Grease traps were kept in place for the two buildings containing restaurants and new collection system piping was installed at that time to transport wastewater to the newly built treatment plant.

Wastewater from the existing buildings is conveyed to the treatment plant through a network of both pressure and gravity collection piping that eventually funnels into an 8” diameter pipe

near the plant. Just prior to the entering the plant, wastewater passes through a 200 gallon tank containing a bar screen that removes large solids. From this tank, wastewater enters the treatment plant. The system utilizes the Rotordisk Aerobic Treatment Plant Model M-175 manufactured by Seprotech Systems, Inc. of Ontario, Canada. This system is a biological process that employs rotating disks as an aerobic and anoxic growth medium. The bacteria serve to break down the waste in the effluent while the rotating motion helps to aerate the water. This principle biological treatment unit also contains several rotating disks that act as the de-nitrification unit which reduces nitrogen via growth of facultative bacteria which thrive in the absence of oxygen. The rotating disks have differing levels of liquid submergence and media density specifically designed for waste decomposition and denitrification.

Bacteria grow to form a slime layer on the rotating disks which periodically sloughs off and settles in the RBC tank forming a semi-solid sludge byproduct (secondary sludge). A final clarifier tank follows the RBC tank and serves as another means of secondary solids separation. This secondary sludge is recycled back to the RBC unit via a pump that draws the sludge off of the tank bottom. Periodically, sludge is removed from the system in a liquid form and hauled off site in a tank truck for disposal at a municipal facility.

Treatment concludes with disinfection of the clarified water by an ultraviolet radiation unit. The clarified water passes over ultraviolet light bulbs which destroy the bacteria and any pathogenic organisms that are present in this effluent. The treated effluent is then pumped to below grade trenches for groundwater recharge. The RBC unit and subsequent secondary settling and disinfection units are enclosed in a corrugated metal Quonset hut approximately 40 feet by 18 feet in size. A separate small shed contains electrical equipment.

6.0 Historical Compliance Record

The facility has been reported as being out of compliance in 14 instances since its construction in 2004. A summary of the monthly Discharge Monitoring Reports from September 2004 to November 2008 is provided in Appendix A.

6.1 Flow Compliance:

The total flow exceeded the limit of 14,210 gpd on several occasions.

- Average Daily Flow: October 2005 (15,135 gpd)
- Maximum Daily Flow: June 2005 (91,392 gpd)
  October 2005 (43,798 gpd)
  August 2006 (14,242 gpd)
  April 2007 (14,405 gpd)

The facility was deemed out of compliance in a NJDEP inspection report dated November 2, 2005 for the flow exceedences during 2005. The inspection report indicates that infiltration was the cause of the high flow into the treatment system. Later inspection reports did not mention the high flows that occurred in 2006 and 2007 as these flows were only slightly higher

than the permitted amount. The average daily flow over the 51 months for which readings were provided is 6,353 gpd and the average maximum flow is 11,238 gpd. The source of the infiltration or inflow was not investigated in detail as part of this investigation due to the fact that the existing collection system will be abandoned as part of the future development. If not, any portions of the collection system remaining in place should be televised to locate any damaged or misaligned pipes or inappropriate connections that might be the source of infiltration.

6.2 Nitrogen Compliance:

The total nitrogen exceeded the limit of 10 mg/l twice since the plant went into service, in April 2005 (11.3 mg/l) and in June 2007 (18.5 mg/l). These exceedences were not noted as compliance issues in any inspection reports by NJDEP and there was no information provided regarding the cause of these problems. The average nitrogen reading over the reporting period is 6.7 mg/l.

6.3 Fecal Coliform Compliance:

The fecal coliform limit of 200 colonies/100 ml was also exceeded on several occasions.

March 2005	(14,800)
February 2006	(800)
October 2006	(1,100)
June 2007	(580)
July 2007	(600)
November 2007	(310)
August 2008	(230)

6.4 Compliance Summary

Only the most recent exceedance in August 2008 was noted as out of compliance in the NJDEP inspection report although it was only slightly over the limit. The reason for this noncompliance event was reported as laboratory sampling error. There was no information provided that explained the earlier readings that were out of compliance.

A sample of the effluent was taken from the treatment plant effluent line during the Jan 6, 2009 site inspection for analysis of total nitrogen and fecal coliform. The results showed a total nitrogen result of 0.05 mg/l and fecal coliform of <2 colonies/100 ml, both well within the permit limits.

Overall, the reported information indicates that the plant has not performed very well, particularly considering the fact that it is not fully loaded and generally operates at only half the rated capacity. There were 14 instances where sample results indicated noncompliance:

- 7 Fecal Coliform
- 2 Nitrogen
- 5 Flow

It is not evident if these reported noncompliance events were the result of design or operation problems or a combination of both. Throughout this period however, the flow to the facility was well below the design levels on average and only occasionally reached or exceeded the design capacity. It would be expected that the plant performance would be less acceptable if the flows and wastewater loads were at or near the design flow of 14,200 GPD.

7.0 Findings and Observations Regarding Existing Treatment Plant

After review of the available documentation, correspondence with the manufacturer, current operator and design engineer, and the site visit on January 6, 2009, the following represents a summary of the findings relative to the treatment plant components. It is important to recognize that the existing system was constructed as a repair to failing septic systems that serviced the various buildings and that the entire system is owned and controlled by a single entity. Accordingly, the current system was built such that it only include the most essential elements required to comply with code with the understanding that the owner has the ability to somewhat affect the discharge by controlling the activities within the individual buildings. Under the proposed future use as a residential development with individual residential unit owners, that scenario will change and the facility must include safeguards to provide continuous performance under severe conditions with the owner no longer being able to directly affect the discharges from the buildings. The following observations and findings take this change in use and owner responsibility into consideration.

7.1 Structural Components

The treatment system structural and principle mechanical components appear to be in good working order. There were no apparent signs of structural failure, the tanks were not cracked, the building structure appeared sound and the metal gratings were in place and viable. However, corrosion appears to have taken a considerable toll on hardware such as doors, connectors and many electrical components and other equipment. The metal fasteners which connect the building panels are also badly rusted and it appears that much of the corrosion is a result of high moisture levels within the building (see discussion below under Humidity).

7.2 Grease Build-Up

The site visit revealed excessive build-up of grease on the first disk of the RBC. This buildup can produce added stress to the disk shaft and can cause shaft failure. Although each building with a restaurant at the site is supplied with a grease trap, grease is making its way to the treatment plant and may also be getting trapped within the collection system. The grease on the disks should be removed to enhance treatment efficiency and reduce uneven stress on the shaft. The existing grease traps for the restaurants should be maintained under a more rigorous schedule to help alleviate this condition. It is important to ensure that further grease not accumulate on the disks and that grease management be improved if the restaurant operation continues. To further address this condition, the pipes in the collection system connected to

the active restaurant should be inspected for grease build-up and cleaned if necessary to further avoid grease discharge.

7.3 Equalization and Influent Pretreatment

The system is not equipped with an equalization tank prior to the treatment plant to balance the flow over the course of the normal daily variations. As per the manufacturer's recommendations, the RBC system performance is greatly enhanced by the addition of an equalization tank to avoid extreme load variations. An equalization tank would also facilitate the ability to take the RBC mechanism off-line for routine service or to address an emergency operating situation that resulted from failure of key components which required pumping and hauling of wastewater for off-site disposal. As currently designed, if the main treatment device required service, bypassing the system would be quite difficult due to lack of any separate liquid storage.

Assuming that the food service uses are to remain, improved influent pretreatment would help alleviate the current grease problem and is recommended. It is typical that facilities with heavy food service loads experience grease problems and the increased detention time would allow for better grease separation and collection. In this case, the simplest pretreatment would entail including a trash trap which would simultaneously collect debris and grease. An equalization tank with an integrated trash trap could be constructed underground outside the WWTF building but due to the existing hydraulic profile of the facility, it would likely require the addition of a pumping mechanism to transfer wastewater into the treatment plant as opposed to the current gravity flow arrangement.

7.4 Filter

The WWTF has no filter prior to the UV system as would typically be expected to assure good quality disinfection. During the site visit, significant solids build-up prior to the UV system near the effluent weir were observed suggesting that the disinfection capability of the process could be compromised. Proper operation of the UV system requires low suspended solid levels for good light transmittance through the liquid and to keep the UV bulbs clean. The lack of filtration could affect the ability of the system to consistently meet fecal coliform limits if the system were operating at the full design load. Review of the DMR results show that the system does generally meet the disinfection requirement but the flow is also consistently less then 50% of the 14,200 GPD permit capacity. It is recommended that a filter be installed prior to the UV system to assure effective performance at full load. The exact method for filtration would be a matter of system upgrade design which would have to address constraints associated with space limitations and hydraulic flow patterns. There are various forms of filtration that would be acceptable and need to be considered.

7.5 Humidity and HVAC System

The treatment plant building shows signs of corrosion even though the building is only 4 years old. Humidity inside the building was very high during the site visit and condensation was dripping throughout. The metal panels appeared to be in good condition, however the panel fasteners and internal untreated metal components are badly rusted. Temperature inside the building at the time of the site visit was very low and no heat was provided and the building is uninsulated. The size of the heater at the plant appeared too small to adequately heat the building and to remove the moisture generated by the treatment units and it was questionable if the heating unit was operational. The exhaust fan in the building was not operational at the time of the site visit and appeared unsafe due to poor electrical connections that are badly corroded. The plant requires a new HVAC system to provide proper heating, moisture control and ventilation of the building interior. This will reduce moisture and corrosion and prolong the life of the building and equipment. Given the energy consumption that this would entail, the building should be insulated as part of any HVAC upgrade.

Even though the specifications call out explosion proof electrical components, in many cases corrosion was evident and all electrical components in the building need to be checked and cleaned or replaced if corrosion is too advanced. The principle motor control center and distribution panel is located outside the treatment building in a separate cabinet enclosure and the components within this cabinet appear to be in acceptable condition. However, this cabinet and the related motors are not in visual sight of each other and local disconnect switches were not observed thereby requiring a formal lock-out tag-out program for safe servicing of the equipment. As the system is upgraded, local disconnect switches should be provided as required by current electrical codes. The building plans call for two explosion proof 300 watt light fixtures that are present but not operational. It was not possible to readily determine if these are not functioning simply because of failed light bulbs or if the switching or wiring has malfunctioned. At the time of inspection there was almost no lighting in the building making service to the equipment difficult. Repairs to the system should include appropriate repairs to the lighting system.

7.6 RBC System

The Rotating Biological Contactor system includes partially submerged media that rotates around one central horizontal shaft that extends across the entire tank being supported on either end by heavy duty pillow block bearings. There are two sections to the RBC unit, one for nitrification via growth of aerobic bacteria and one for denitrification via growth of facultative bacteria under anoxic conditions. The aerobic section is open to the atmosphere while the anoxic section is covered by fiberglass covers to limit aeration.

The mechanical drive for the RBC is a critical component for operation of the biological system. The biological media must rotate continuously and smoothly for sound operation. Catastrophic failure can be caused by failure of a mechanical or structural component or simply from the unit failing to rotate for a period of time such that one side dries out while the other remains saturated with heavy solids thereby creating an imbalance. Maintaining the drive equipment in top condition is critical to assure continuous system performance and longevity. The drive

system consists of a 3 HP close coupled motor, a Unicase Helical Bevel Gearbox, Falk steelflex couplings, a steel drive shaft and pillow block bearings. During site inspection, no obvious mechanical problems with the drive system were observed and the mechanisms were operating smoothly with no abnormal noise or vibration.

7.7 System Redundancy

The treatment facility is a single train system with no redundancy to any of the unit processes. If the system were to go off line because of mechanical, electrical or structure problems, pumping and hauling of wastewater for off-site disposal would be the only available option to maintain permit compliance. As discussed above under paragraph 7.3 Equalization and Influent Pretreatment, the addition of an equalization tank would provide a means of holding wastewater during an emergency situation and provide some mitigation to the lack of redundancy should an emergency occur. A more robust arrangement would provide a second RBC unit capable of accommodating full design flow for a period of time to act as a backup to the current system. In municipal wastewater systems designed to provide long term wastewater management, key components are typically provided with dual or standby capability to address equipment down time. With appropriate redundancy, the system could operate without the need for costly pumping and hauling for off-site disposal. The addition of such redundancy would be at considerable expense in this case and is not included herein because it is not a code requirement.

7.8 Flow Meter

The system monitors flow using an ultrasonic level detector installed above the outlet trough prior to the UV system. The licensed operator indicated that the flow measurement device had been calibrated but this could not be verified. Visual observation of the effluent flow corresponded to the expected flow shown on the monitoring system and daily flow patterns were consistent with the facility operation. The flow meter equipment was in need of cleaning and an updated calibration is recommended to assure that the flow readings are valid. This is particularly important given that meter readings indicate flows have been well below the design level and accurate flow measurement is a critical aspect of this system performance evaluation. If the meter were calibrated and found to be inaccurate, some of the observations contained in this report would likely change as a result.

7.9 Emergency Power

Because the current system serves only one user it does not include an emergency power back-up system. For the treatment system to serve a public customer base, emergency power would be required to operate all of the key treatment components.

7.10 Water Breakout

It was noted that there was an area between Building 2 (Hotel) and the large parking lot along Route 31 where water was coming to the surface and ponding. This area is the location of a

former septic disposal field that was reportedly taken out of service during the system upgrade in 2004. The ponded water did not appear to be septic but the source of the water breakout should be investigated to determine if this is from existing groundwater, surface water, existing septic discharge, or short-circuiting of groundwater through the abandoned septic components. Depending on the findings, this may have implications on the final layout of the proposed development and new system components. Any abandoned septic components that may be contributing to this condition should be plugged or removed.

8.0 Considerations for Future Use of Existing Treatment Plant

It is anticipated that the proposed residential use of the site will include approximately 70 affordable housing units with a total wastewater flow of approximately 14,200 gpd. It is most likely that the existing buildings, wastewater collection system and grease traps will be of little value for the future development, so it is assumed that they will all be abandoned. The existing treatment plant however will have continuing value as will the existing groundwater recharge system and these are likely to remain to accept wastewater flow, at least for the early phases of the project. Of course, this depends greatly on the ability to continue service under the existing NJPDES permit conditions and with the existing permit effluent limitation. Whereas, it is not anticipated at this time that these permit limits will be modified as a result of the change in use of the property, the requisite reopening of the permit for the change in use from commercial to residential would allow DEP the opportunity to make more stringent permit limits based on dilution modeling or other considerations. If the permit is upgraded to a higher standard, the usefulness of the existing treatment plant is diminished and would need to be reconsidered under the new requirements.

The manufacturer of the RBC facility, Seprotech Systems, Inc., was contacted to determine the original process design basis and to consider how a change in use from commercial to residential may affect the system, assuming the proposed residential use produced an expected influent wastewater strength of 250 mg/l biochemical oxygen demand (BOD), 45 mg/l total nitrogen and 250 mg/l total suspended solids (TSS). Seprotech responded that the current system can treat wastewater of this strength and should be able to meet the permit requirement of <10 mg/l for total nitrogen under the following conditions:

- The flow to the plant be limited to 12,000 gpd as presently configured
- The maximum flow to the plant could increase to 16,200 gpd with the installation of an internal recycling pump to recycle treatment plant contents from the outlet of the de-nitrification section back to the inlet of the primary settling tank. This recycling pump system was not incorporated into the system that currently exists at the site.

Installation of the recycling pump is to accommodate full flow and greater total nitrogen content than what was assumed in the original design. Design documents from the manufacturer that illustrate the relevant calculations and assumptions to support these

characteristics have been provided and appear consistent with the above indications. That being the case, the existing plant with the suggested manufacturer upgrades could potentially serve the future use, again assuming the DEP does not alter the effluent limitations.

To accommodate a higher variability of BOD in domestic waste, it is recommended that a carbon feed system be installed that can provide additional carbon (in the form of sugar) when BOD in the wastewater influent is low. Keeping a consistent input of carbon into the system optimizes the growth of the bacteria on the RBC and thereby the treatment process.

The following items summarize the recommended upgrades to the treatment plant to accommodate the future use appropriately:

1. Internal system recycling pumps, piping and ancillary equipment
2. Carbon feed system
3. Equalization tank and trash trap
4. Filtration prior to disinfection
5. HVAC upgrades
6. Emergency Generator

9.0 Groundwater Recharge System

Previous work completed to evaluate the site capabilities indicated a carrying capacity of 7,700 GPD which was the basis of the current NJPDES permit and recharge system configuration developed as part of the of the septic system repair. Supplemental testing including the installation of 6 shallow test wells and 6 soil borings, pump testing, background groundwater quality sampling, soil profile logging, soil permeability testing, soil laboratory analyses and preliminary groundwater flow modeling was completed for the current evaluation.

The test wells and borings were installed at locations distributed around the undeveloped portion of the property. Each well was drilled to approximately 25 feet below ground surface to characterize the shallow weathered bedrock. Wells with an adequate volume of water were subsequently pump tested to determine hydraulic properties of the shallow weathered bedrock aquifer. Results of this testing indicate shallow depths to bedrock and generally low hydraulic conductivities across most of the site. An area of higher hydraulic conductivity was observed in the northeast portion of the site, in the vicinity of the water supply test wells installed by others.

Soil profiles were described in 6 excavations at various locations around the undeveloped portion of the property to determine soil types and limiting conditions within the soils and uppermost bedrock. Permeability testing was conducted within 3 of these excavations and laboratory analyses were performed on 8 samples collected from the profile logs. Results of this testing indicate low permeability and limiting conditions exist in the soil and uppermost fractured bedrock across most of the site. An area of higher permeability was observed in the northeast portion of the site, in the vicinity of the water supply test wells installed by others.

Analysis of the DMR data and preliminary groundwater flow modeling suggests the existing disposal system can accommodate approximately 5,000 GPD. Furthermore, these analyses suggest that additional flow during the wet season could cause the mounded groundwater to encroach within 2 feet of the trenches' infiltrative surfaces. NJDEP requires that this 2-foot buffer be maintained as an unsaturated zone in order to produce final renovation of the effluent. It should be noted that these analyses assumed even distribution of existing flows between the 2 existing trenches. These analyses suggest that the system capacity may be increased if more flow were directed to Trench 1, since there appears to be a larger unsaturated zone below that trench.

10.0 Site Capability to Support Future Development

The Pennytown site can best accommodate the intended wastewater discharge most readily through groundwater recharge of the treated effluent. This is the current alternative employed at the site and is the approach most consistent with current NJDEP programs. Discharge of treated wastewater to a surface water body is another alternative that is legally possible, but not practical considering the small size stream that traverses the site. Discharge to this stream would require significant proof of environmental impact on the surface water quality and is generally believed to be impractical from an operating cost perspective. A third alternative is to provide treated wastewater that meets the requirements for non-potable water reuse thereby reducing the need for discharge from the site. Each of these alternatives is discussed below:

10.1 Groundwater Recharge

As discussed earlier, both the site investigation and the groundwater modeling performed as part of the current NJPDES permit, demonstrated that the design loading rate could not be greater than 7,700 GPD. Please note, the site was not fully tested at that time. More recent supplemental testing conducted as part of this study, described above, was used to evaluate both the capacity of the existing system and the entire site's potential capacity.

According to preliminary groundwater modeling performed under the supplemental testing, the disposal system would have to be expanded with approximately 2,000 additional linear feet of disposal trench to accommodate the full permitted flow of 14,200 GPD. Alternatively, a drip irrigation system could also be a viable option for wastewater disposal. Based on soil types and permeabilities, approximately 2 to 5 acres of land, not including additional land for design buffers and infrastructure, would be necessary for this disposal method.

Because large areas of the site are currently inaccessible due to buildings and subsurface infrastructure, additional site testing in the areas selected for expansion of the trenches or drip fields would be necessary to confirm assumptions made in the current model. This testing is beyond the scope of this report since it would require conceptual site plan details of the proposed project and access into the developed portion of the property. The initial modeling completed to date could not be used in support of a standard NJPDES application without this

additional testing. Please note that additional testing will also necessitate further model development since new data collected during field testing will need to be incorporated into the updated model.

The results of the supplemental testing were found to be generally consistent with those identified by the earlier site testing that was conducted in the areas immediately surrounding the existing disposal trenches. The results of these tests also indicate that the disposal system will have to be expanded to accommodate the maximum discharge of 14,200 GPD which is established within the NJPDES permit. Although there appears to be adequate area on the property to accommodate this expansion, it is unknown if the available area will be reduced because of water supply protection concerns. Because the intended use will likely also include an on-site public community water supply system, large portions of the property could be eliminated from wastewater disposal consideration depending on the size and orientation of the Tier 1 wellhead protection area. Water supply testing and analyses are currently being conducted by others and the wellhead protection area has not been determined. NJDEP has historically been reluctant to permit wastewater discharges within Tier 1 wellhead protection areas.

10.2 Surface Water Discharge

The small Branch of the Stony Brook stream which traverses the property is classified as FW2-NT which would provide the ability for a surface water discharge, although the practicality of this alternative is very limited. The stream at this point is very small and any discharge would have to meet antidegredation requirements meaning the water quality of the stream could not be affected in any way as a result of the discharge. To achieve this antidegradation standard, the wastewater effluent would have to completely match the stream water quality characteristics at the effluent pipe. Water quality characteristics such as salinity and temperature would be variable and difficult to achieve. In addition, it is likely that evaluation of the stream would indicate zero flow during the 7-day, 10-year low flow period, complicating this aspect further, Therefore, whereas it is technically feasible to provide a surface water discharge, it is impractical and not an alternative that should be further considered at this time.

10.3 Water Reuse

Water reuse is a concept gaining widespread application as a method to manage water resources in a more sustainable manner. Water reuse entails treating the wastewater to a sufficient level so that it safe for direct use for non-potable purposes such as toilet flushing, cooling, laundry and irrigation. This treated reuse quality water is then stored and distributed to specific uses via a nonpotable reuse water piping network that is separate from the potable water supply. There are water reuse systems that have been functioning in New Jersey for over 20 years, but they all serve commercial or institutional facilities such as offices, shopping centers and schools. There are also a number of water reuse systems in NJ that supply irrigation water to golf courses. There currently are no direct water reuse facilities serving residential structures in New Jersey, but there are a number of these in New York and other states.

New Jersey has adopted guidelines referred to as Category 1 Recycled Water for Beneficial Reuse – Public Access which set forth the water quality parameters that would most likely apply to a direct use requirement in residential applications. In discussion with NJDEP about the potential for water reuse in residential buildings, they indicate that this would be allowable but being there have been no such projects to date, the State Department of Health and possibly the State Department of Community Affairs would have to be consulted with regards to any special public health or construction code issues that may apply respectively. The current NJDEP standards for beneficial reuse are tabulated below:

NJDEP Category 1 Recycled Water for Beneficial Reuse - Public Access Systems

Parameter	RWBR Requirement	Sample Type
Flow Rate		Continuous
Total Nitrogen	<10 mg/L*	Grab
Total Suspended Solids (TSS)	5 mg/L	Grab
Fecal Coliform	14 col/100 ml (2.2 weekly avg.)	Grab
Turbidity	2 NTU**	Continuous
Disinfection	100 mJ/cm^2 (UV) / 1 mg/L (CPO)	Continuous

Notes:

** The NJDEP may impose a total nitrogen concentration limitation greater than 10 mg/L if the permittee can demonstrate that a concentration greater than 10 mg/L is protective of the environment.*

*** A statistically significant correlation between turbidity and TSS shall be established prior to commencement of the RWBR program. For UV disinfection, in no case shall the level of turbidity exceed 2 NTU while still maintaining the 5 mg/L maximum level for TSS.*

These standards are more stringent than the current NJPDES permit for the existing Pennytown wastewater facility, particularly with regards to solids content, turbidity and disinfection and as such would require significant upgrades to the treatment plant beyond that necessary to meet the current groundwater recharge requirements. Most direct water reuse systems of this nature that are successfully operating today employ some form of membrane filtration as a key component. Other treatment processes are being advanced for direct water reuse currently, but being the first residential direct reuse project in NJ would suggest using the most well

proven technology. Given that perspective, moving towards direct water reuse would likely require completely rebuilding the current wastewater treatment system.

From experience with other residential water reuse projects, it is likely that a 30% to 40% reduction in wastewater discharge could be anticipated, depending on the types of nonpotable water uses employed. Accordingly, a use that would anticipate a wastewater discharge of 14,000 gpd without reuse would subsequently require 8,500 gpd to 9,800 gpd of discharge capability with reuse. Also, reuse of treated nonpotable water for irrigation could improve this further if there is space available to accommodate adequate irrigation water storage. Consideration of irrigation as a reuse component would require evaluation of future landscaping and site plan details of the project that are beyond the scope of this report. In addition, mixed uses that incorporate commercial or institutional uses together with residential uses would also potentially improve the water reuse component giving higher percentages of non-potable water applications. Details of this nature would require evaluation during the project planning phase.

11.0 Ownership and Management Alternatives

Ownership of wastewater systems in New Jersey can take several forms that offer differing capabilities and complexities. The form of ownership of the future Pennytown Village wastewater facility should be considered as soon as possible in the acquisition process so that the actions taken to control and upgrade the facility fulfill the operating protocol of the future owner. Whereas, these objectives will be similar with regards to the environmental attributes, they could differ with regards to the details of the facility functions and methods of financing. It is not necessary to have the water supply and wastewater infrastructure owned by the same entity, but there are advantages that can be gained by combining these assets together. Combining the wastewater and water systems under one operating entity provides for more efficient labor and customer service and avoids potential duplication that results from overlapping aspects of these related asset functions.

The form of ownership of the developed property may also influence the wastewater and water asset ownership decision. How the property will be owned, as fee simple subdivided tracts, as a condominium form of common ownership or held by one owner as rental property will influence the most likely form of wastewater and water asset ownership. The typical wastewater and water ownership options include the following:

11.1 Municipal

Hopewell Township could own the wastewater and water assets as a part of the municipal infrastructure and operate the system as a separate utility under the municipal governing body or as a part of the public works department. Municipal ownership offers some advantage with regards to access to public financing, but is somewhat more complicated with regards to civil service employment regulations, procurement regulations and the influence of local politics on the system management. Having the backing of the municipality's taxing power is

advantageous for financial security and ability to qualify for low interest funding, but having the infrastructure be financially self sufficient and fully supported by customer rate charges is normally desired. The taxing power of the municipality should only support the financing and not supplement the system operation.

11.2 Authority

The formation of a wastewater or combined water and wastewater authority provides a quasi-governmental management alternative that generally qualifies for all of the financial benefits offered by municipal ownership and carries many of the same procurement and management characteristics. The governing body of an authority is generally appointed by the municipal government and secures independent financing by loans and bonds that are backed by the general obligation of the municipality's taxing power. Under this alternative, the assets must be fully financed by the revenue from rate payers and the debt is generally outside of the municipal spending caps. The independent authority has the advantage of being somewhat independent of the political climate of the municipality but this sometimes presents difficulties if the authority develops ambitions that differ from those of the governing body. The operating charter of the authority is defined in the initial formation but then is difficult to change once bonds and loans are secured. It is therefore not a flexible asset management mechanism unless defined as such initially.

11.3 Association

A homeowner's or landowner's association can be formed as an operating nonprofit entity supported by association fees paid by property owners for operation and maintenance of the facilities. The association can be a special purpose entity focused only on the management of the wastewater/water assets or it can be an entity that controls all common elements of the development. An association form of ownership separates the municipality for the financial responsibility of the facility's operation and management but this form of ownership is not favored by regulatory agencies due to a history of homeowner associations failing to adequately maintain systems. Associations often have difficulty managing complex assets effectively and can experience financial problems if funding and maintenance are not adequate. Ultimately, if an association falls into financial difficulty the municipality is the next logical entity in line to provide assistance, so even though there is no legal liability there is a practical responsibility that can implicate the municipality should problems arise.

11.4 Private Utility

A private utility can own and operate both wastewater and water assets in New Jersey under the jurisdiction of the New Jersey Board of Public Utilities which regulates the financial and service aspects of utilities. A private utility is the most independent form of ownership wherein the municipality does not have any financial or physical obligations for the asset management. The municipality does have the ability to control the service area of the utility by defining the service area via approval of a franchise area that defines the geographical limit and type of the service provided. The private utility is financed by private equity and a combination of private and public debt financing. As a stand-alone facility, the Pennytown Village service area is too

small to support an independent private utility, but it could readily be combined with other utility assets that a company may own in New Jersey.

11.5 Other Options

There are other ownership options that are possible but not likely for Pennytown Village. Ownership by an existing regional authority is possible but to our knowledge none currently exist that would logically be interested in this asset. Also a non-profit cooperative could be formed to provide a special service to the property owners in this service area but this would be essentially the same as the property association form of ownership described in paragraph 11.3 above in this instance because of the small limited size of the service area.

12.0 Cost Evaluation

The table below provides a summary of the estimated budgetary costs for the upgrades recommended in Section 7 and 8 of this report.

Recommended Upgrade	Need for Upgrade	Report Section	Budgetary Estimate
Recycling Pump and Piping	Allow higher flow through plant	8	$8,000.00
Carbon Feed System	Provide supplementary nutrient source	8	$12,000.00
Equalization Tank and Trash Trap	Pretreatment and storage capacity	7.3	$110,000.00
Filtration Prior to Disinfection	Enhance disinfection	7.4	$100,000.00
HVAC Upgrades	Temperature control and moisture reduction	7.5	$8,000.00
Emergency Generator	Backup power source	7.9	$100,000.00
Treatment Plant Subtotal			**$338,000**
Additional Disposal Trenches	Accommodate groundwater recharge of additional flow	9	$200,000
		Total	**$538,000**

Budgetary estimates provided above include costs for engineering design. Costs do not include permitting.

As a comparison to the above upgrades to the existing system, a budgetary estimate for construction of a completely new municipal utility grade treatment plant based on membrane filtration technology which would produce reuse quality water is approximately $750,000

including engineering design and all appurtenances. This cost is for replacement of the plant itself, and does not include the upgrades needed to the disposal system.

13.0 Conclusion

The Pennytown Village Wastewater treatment system is a viable operating system which as presently configured can support an average daily flow of approximately 5,000 GPD based on review of operating records and testing of the site soils and hydrogeology. The current groundwater mounding analysis suggests the site has the potential to support a total flow of approximately 14,000 GPD with an expanded recharge area that would consist of approximately 2,000 LF of additional recharge trench. The approximate cost of the additional recharge trench is $200,000 plus the cost of permits. Please note that a number of parameters are currently characterized as assumptions in the groundwater flow model, and that these parameters allow the model to show how the site might support a total load rate of 14,000 GPD. Additional field testing and model development will be necessary to confirm and further define these parameters in areas currently inaccessible to testing. Additionally, this estimation assumes that the entire site is available for wastewater disposal expansion, while in reality a large portion of the site may be excluded to protect the proposed on-site public water supply.

The treatment plant itself is in need of some upgrades to the process and mechanical components which would provide emergency power, backup capacity and process improvements to meet the requirements for the full 14,000 GPD capacities intended. The approximate cost of the recommended upgrades is $338,000 plus the cost of permits. Upgrading the plant to produce reuse quality water would cost approximately $750,000 and would provide a system which required less recharge capacity thereby allowing additional development or requiring less recharge trench area.

The required permits for the change in use from commercial to residential and the full realization of the 14,000 GPD design capacity will require a revocation and reissuance of the New Jersey Pollution Discharge Elimination System (NJPDES) permit, Treatment Works Approval and amendment of the Hopewell Township Wastewater Management Plan by Mercer County. The permit process could result in increased effluent limitations thereby increasing the projected costs, although this is not anticipated at this time. Time is of the essence in the permitting process because Mercer County is currently preparing a Wastewater Management Plan Update that is to be completed by September 9, 2009. Further amendment of this plan after that time could cause a considerable delay in the permitting process. The cost to amend the permits is dependent upon the final development concept for the property, but it is likely that all of the recent site testing would provide adequate evidence of the site capacity once compiled and submitted to NJDEP as part of an application for their review.

In conclusion, there are options available that would allow the full use of the property to the intended 14,000 GPD of residential use capacity. The best alternative approach for this transformation is the subject of the system design analysis that takes into consideration a more detailed evaluation of the development components and placement on the property.

Appendix A – Discharge Monitoring Report Summary

Pennytown Village Discharge Monitoring Reports NJPDES NJ0101028 GW						
Date	Flow		Total Nitrogen	pH	Fecal Coliform	Volatile Organics
	Avg gal/day	Max gal/day	mg/l	SU	#/100ml	µg/l
Limit	Report	14,210	10 max	Report	200	Report
Sep-04	4,700	5,065	4.04	7.15	30	
Oct-04	4,184	4,273	5.44	7.12	1	
Nov-04	4,751	8,993	4.59	7.35	13	
Dec-04	4,766	8,367	4.6	7.3	4	
Jan-05	3,823	6,803	8.4	7.22	1	
Feb-05	4,370	5,882	5	7	11	
Mar-05	4,460	6,304	4.2	6.99	14800	
Apr-05	4,011	6,304	11.3	7.05	23	
May-05	4,796	6,485	6.7	7.1	4	
Jun-05	8,069	91,392	7.9	7.18	13	
Jul-05	6,288	7,811	5.2	7.15	7	
Aug-05	6,602	7,858	8.6	7.32	11	
Sep-05	8,022	11,607	5.2	7.24	2	
Oct-05	15,135	43,798	6.6	7.57	33	
Nov-05	7,541	9,517	5.5	7.39	10	
Dec-05	7,750	8,964	5.6	7.22	35	0.5
Jan-06	7,757	9,441	4.8	7.13	31	
Feb-06	7,774	11,605	4.2	7.19	800	
Mar-06	9,675	13,478	5.7	7.29	4	
Apr-06	4,477	10,039	6.8	6.98	1	
May-06	7,528	10,900	5.61	7.75	8	
Jun-06	12,133	14,190	6	6.94	2	
Jul-06	10,691	12,939	8.9	6.96	40	
Aug-06	10,439	14,242	7.4	7.04	2	1.9
Sep-06	9,782	13,280	8	7.34	4	
Oct-06	7,130	11,109	10	7.01	1100	
Nov-06	7,874	11,770	6.21	7.18	120	
Dec-06	7,508	10,152	5.4	7.16	90	

Appendix A – Continued

Date	Flow		Total Nitrogen	pH	Fecal Coliform	Volatile Organics
	Avg gal/day	Max gal/day	mg/l	SU	#/100ml	µg/l
Limit	Report	14,210	10 max	Report	200	Report
Jan-07	6,598	10,524	6.08	7.12	10	
Feb-07	5,961	9,233	5.75	6.9	30	
Mar-07	4,299	6,730	8.48	7.14	20	
Apr-07	5,574	14,405	8.8	7.15	10	
May-07	4,866	7,022	10	7.06	10	
Jun-07	4,633	6,732	18.5	6.9	580	
Jul-07	5,207	7,844	9.8	7.08	600	
Aug-07	5,469	9,194	6.5	7.18	10	
Sep-07	5,183	6,326	8.5	6.95	10	
Oct-07	5,108	6,643	6.09	6.97	10	
Nov-07	4,852	8,667	0.66	7.67	310	
Dec-07	5,324	9,764	5.85	7.15	10	
Jan-08	5,200	7,808	6	7.35	10	
Feb-08	5,135	6,996	6.45	7.4	10	
Mar-08	4,733	8,168	7.87	7.16	10	
Apr-08	4,860	6,455	6.2	7.08	10	
May-08	4,711	6,072	7.56	7.14	10	
Jun-08	6,643	10,577	9.2	7.16	10	
Jul-08	7,985	10,825	7.02	7.26	10	
Aug-08	4,946	6,116	6.06	7.44	230	
Sep-08	4,998	6,134	4.6	7.3	10	
Oct-08	5,531	9,807	4.01	7.42	10	
Nov-08	4,162	8,538	2.75	7.28	10	
Average	6,353	11,238	6.7	7.2	375	1.2
Median	5,324	8,964	6.1	7.2	10	1.2
Max	15,135	91,392	18.5	7.8	14,800	1.9
Min	3,823	4,273	0.7	6.9	1	0.5

Denotes permit limit exceedance.

Appendix B – Well Test/Soil Test Data

Legend

- 100 ft Buffer (Water Supply)
- Water Supply Test Well
- Compliance Piezometer
- Wastewater Test Well
- Soil Profile Log

Existing - Disposal Trench

A & B = 5,000 gpd
A. Approx. 300' x 2'
B. Approx. 680' x 2'

Proposed - Disposal Trench

C & D = 9,000 gpd
C. 1010' x 3'
D. 1010' x 3'
*Assuming onsite conditions support modeling assumptions.

Date: 4-20-09	Job Number: E01286AA	N W E S	Disposal Trench Locations (NTS) Pennytown Village WWTF Evaluation Hopewell Township, Mercer County, New Jersey	AMERICAN WATER Applied Water Management 2 Clerico Lane, Hillsborough, NJ 08844
Author: AWM-Geo	Figure 1 of 1			

MONITORING WELL RECORDS

New Jersey Department of Environmental Protection
Bureau of Water Allocation

Well Permit Number P200901416

MONITORING WELL RECORD

Atlas Sheet Coordinates 2715114

OWNER IDENTIFICATION HOPEWELL TOWNSHIP

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-1

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-01

WELL USE Monitoring

DATE WELL STARTED 3/4/09

DATE WELL COMPLETED 3/4/09

WELL CONSTRUCTION

Total Depth Drilled 23 ft.

Finished Well Depth 23 ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed? [X] Yes [ ] No

Static Water Level after drilling 6 ft.

Water Level was Measured Using m-scope

Well was developed for 1 hours

at 1 gpm

Method of development Submersible pump

Pump Capacity _____ gpm

Pump Type _____

Drilling Fluid Air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	2	3	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	3	23	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	2	3	8x4	#00 gravel	
Gravel Pack	3	23	8x4	#2 gravel	
Grout	0	2	8x4	Neat Cement Bentonite	94 lbs _____ lbs

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' - 5' Soil
5' - 23' Weathered shale

AS-BUILT WELL LOCATION (NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 556564 EASTING: 409015

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077J Date 3 /16 / 09

ORIGINAL: DEP *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

New Jersey Department of Environmental Protection
Bureau of Water Allocation

Well Permit Number
P200901417

MONITORING WELL RECORD

Atlas Sheet Coordinates
2715114

OWNER IDENTIFICATION HOPEWELL TOWNSHIP

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-2

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-02

WELL USE Monitoring

DATE WELL STARTED 3/5/09

DATE WELL COMPLETED 3/6/09

WELL CONSTRUCTION

Total Depth Drilled 23 ft.

Finished Well Depth 23 ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed? [X] Yes [ ] No

Static Water Level after drilling 6 ft.

Water Level was Measured Using m-scope

Well was developed for 1 hours at 1.5 gpm

Method of development Submersible pump

Pump Capacity _____ gpm

Pump Type _____

Drilling Fluid Air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	2	3	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	3	23	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	2	3	8x4	#00 gravel	
Gravel Pack	3	23	8x4	#2 gravel	
Grout	0	2	8x4	Neat Cement Bentonite	94 lbs ___ lbs

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' - 4' Soil
4' - 23' Weathered shale

AS-BUILT WELL LOCATION (NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 556836 EASTING: 409345

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077.1 Date 3/16/09

ORIGINAL: DEP. *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

New Jersey Department of Environmental Protection
Bureau of Water Allocation

Well Permit Number
P200901418

MONITORING WELL RECORD

Atlas Sheet Coordinates
2715114

OWNER IDENTIFICATION HOPEWELL TOWNSHIP

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-3

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-03

WELL USE Monitoring

DATE WELL STARTED 3/4/09

DATE WELL COMPLETED 3/4/09

WELL CONSTRUCTION

Total Depth Drilled 23'9" ft.

Finished Well Depth 23'9" ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed? [X] Yes [ ] No

Static Water Level after drilling 6 ft.

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	2	3'9"	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	3'9"	23'9"	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	2'9"	3'9"	8x4	#00 gravel	
Gravel Pack	3'9"	23'9"	8x4	#2 gravel	
Grout	0	2'9"	8x4	Neat Cement Bentonite	94 lbs ___ lbs

Water Level was Measured Using m-scope

Well was developed for 1 hours

aBeapagegpm

Method of development Submersible pump

Pump Capacity ___ gpm

Pump Type ___

Drilling Fluid air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' - 5' Soil
5' - 23'9" Weathered Shale

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077J Date 3 / 16 / 09

AS-BUILT WELL LOCATION
(NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 555993 EASTING: 409023

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

ORIGINAL: DEP *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

Bureau of Water Allocation

P200901419

MONITORING WELL RECORD

Atlas Sheet Coordinates

OWNER IDENTIFICATION HOPEWELL TOWNSHIP 2715114

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-4

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-04

WELL USE Monitoring **DATE WELL STARTED** 3/6/09

DATE WELL COMPLETED 3/6/09

WELL CONSTRUCTION

Total Depth Drilled 25 ft.

Finished Well Depth 25 ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed? [X] Yes [ ] No

Static Water Level after drilling Dry ft.

Water Level was Measured Using m-scope

Well was developed for — hours

at — gpm

Method of development —

Pump Capacity — gpm

Pump Type —

Drilling Fluid Air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt/Rating (lbs/sch no.)
Single/Inner Casing	2	5	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	5	25	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	4	5	8x4	#00 gravel	
Gravel Pack	5	25	8x4	#2 gravel	
Grout	0	4	8x4	Neat Cement Bentonite	94 lbs ___ lbs

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' - 4' Soil

4' - 25' Weathered shale

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077J Date 3 /16 / 09

AS-BUILT WELL LOCATION (NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 556592 EASTING: 409548

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

ORIGINAL: DEP *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

New Jersey Department of Environmental Protection
Bureau of Water Allocation

Well Permit Number
P200901420

Atlas Sheet Coordinates
2715117

MONITORING WELL RECORD

OWNER IDENTIFICATION HOPEWELL TOWNSHIP

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-5

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-05

WELL USE Monitoring

DATE WELL STARTED 3/5/09

DATE WELL COMPLETED 3/6/09

WELL CONSTRUCTION

Total Depth Drilled 25 ft.

Finished Well Depth 25 ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed?
[X] Yes [ ] No

Static Water Level after drilling Dry ft.

Water Level was Measured Using –

Well was developed for – hours

at – gpm

Method of development –

Pump Capacity gpm

Pump Type

Drilling Fluid Air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	2	5	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	5	25	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	4	5	8x4	#00 gravel	
Gravel Pack	5	25	8x4	#2 gravel	
Grout	0	4	8x4	Neat Cement Bentonite	94 lbs ___ lbs

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' – 4' Soil
4' – 25' Weathered shale

AS-BUILT WELL LOCATION
(NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 556075 EASTING: 409567

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077J Date 3 /16 / 09

ORIGINAL: DEP *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

New Jersey Department of Environmental Protection
Bureau of Water Allocation

Well Permit Number P200901421

MONITORING WELL RECORD

Atlas Sheet Coordinates 2715117

OWNER IDENTIFICATION HOPEWELL TOWNSHIP

Address 201 WASHINGTON CROSSING-PENNINGTON ROAD

City Titusville State New Jersey Zip Code 08560

WELL LOCATION - If not the same as owner please give address **Owner's Well No.** OW-6

County Mercer Municipality Hopewell Twp Lot No. 1.02 Block No. 33

Address 145 RT 31 NORTH PENNYTOWN SHOPPING VILLAGE / OW-06

WELL USE Monitoring

DATE WELL STARTED 3/5/09

DATE WELL COMPLETED 3/6/09

WELL CONSTRUCTION

Total Depth Drilled 25 ft.

Finished Well Depth 25 ft.

Borehole Diameter:

Top 8 in.

Bottom 8 in.

Well was finished: [X] above grade [ ] flush mounted

If finished above grade, casing height (stick up) above land surface 2 ft.

Steel protective casing installed? [X] Yes [ ] No

Static Water Level after drilling 8 ft.

Note: Measure all depths from land surface	Depth to Top (ft.)	Depth to Bottom (ft.)	Diameter (inches)	Material	Wgt./Rating (lbs/sch no.)
Single/Inner Casing	2	5	4	PVC	Sch 40
Middle Casing (for triple cased wells only)					
Outer Casing (largest diameter)					
Open Hole or Screen (No. Used .020)	5	25	4	PVC	Sch 40
Blank Casings (No. Used)					
Gravel Pack	4	5	8x4	#00 gravel	
Gravel Pack	5	25	8x4	#2 gravel	
Grout	0	4	8x4	Neat Cement Bentonite	94 lbs ____ lbs

Water Level was Measured Using m-scope

Well was developed for 1 hours

at Seapage gpm

Method of development Submersible

Pump Capacity ____ gpm

Pump Type ____

Drilling Fluid Air Type of Rig Reichdrill 650

Health and Safety Plan Submitted? [X] Yes [ ] No

Level of Protection used on site (circle one) None (D) C B A

Grouting Method Pressure grout w/tremie line

Drilling Method Air rotary

GEOLOGIC LOG

Note each depth where water was encountered in consolidated formations

0' - 4' Soil

4' - 25' Weathered shale

I certify that I have constructed the above referenced well in accordance with all well permit requirements and applicable State rules and regulations.

Drilling Company SAMUEL STOTHOFF CO INC

Well Driller (Print) Jim Kintzel

Driller's Signature Jim Kintzel

Registration No. 1077J Date 3 / 16 / 09

AS-BUILT WELL LOCATION (NAD 83 HORIZONTAL DATUM)

NJ STATE PLANE COORDINATE IN US SURVEY FEET

NORTHING: 555696 EASTING: 409496

OR

LATITUDE: ° ' " LONGITUDE: ° ' "

ORIGINAL: DEP *COPIES: DRILLER* *OWNER* *HEALTH DEPARTMENT*

SOIL PROFILE
TEST PIT LOGS

AMERICAN WATER
Applied Water Management

2 Clerico Lane
Suite # 1
Hillsborough, NJ 08844
T 908.359.5501
F 908.359.8286

SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0325-1
		Total Depth (in-bgl)	85
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 20-50°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-6	7.5YR 4/3	Brown	(0-6") Loam, subangular blocky, soft with 10 percent shale gravel, gradual and smooth boundary.
			6-12	7.5YR 4/3	Brown	(6-12") Silt loam, subangular blocky and platy, soft with 20 to 30 percent shale and siltstone gravel and cobble, clear and wavy boundary.
5	60		12-47	5YR 4/4	Reddish Brown	(12-47") Silty clay loam, angular blocky, friable, 30 to 40 percent shale and siltstone gravel with many, medium, and distinct 7.5YR 4/1and 7.5YR 4/6 (dark gray and strong brown, respectively) mottles between 12 and 47 inches below grade, clear and wavy boundary.
			47-74	5YR 4/2-4/3	Dark Reddish Gray to Reddish Brown	(47-74") Silty clay to clay, massive, firm with few, coarse, and distinct 10YR 6/2 (light brownish gray) mottles between 60 and 74 inches below grade.
			74-85		Brownish Red	(74-85") Shale, open with fines, 10 to 20 percent reddish brown silty clay fillings, moderately fractured, tight.
10	120					End of Soil Test Pit Test Stopped 85 (in-bgl) - Machine Refusal Seepage (Slight) - 56 to 74 in-bgl Seepage (Moderate) - 74 to 85 in-bgl
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*58.5 After: 24 Hours*
Seepage (bgl - in.)	*56 - 85*
Permeability Tests (Y/N):	*Y (PB0326-2)*

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

AMERICAN WATER
Applied Water Management

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SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0325-2
		Total Depth (in-bgl)	72
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 20-50°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-10	7.5YR 4/4	Brown	(0-10") Loam, subangular blocky, loose with 10 percent shale gravel, gradual and wavy boundary.
			10-40	5YR 4/3	Reddish Brown	(10-40") Silt loam, subangular blocky, soft with 40 to 50 percent siltstone gravel and cobbles, staining and weathering of cobble rinds observed between 30 and 40 inches below ground level, clear and wavy boundary.
5	60		40-72		Reddish Brown	(40-72") Siltstone, open with fines, up to 20 percent 5YR 4/3 (Reddish Brown) silt loam fillings, moderately fractured with mineral stains throughout, tight.
						End of Soil Test Pit
						Test Stopped 72 (in-bgl) - Machine Refusal No Groundwater or Seepage Encountered
10	120					
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*n/a* *After: - - Hours*
Seepage (bgl - in.)	*n/a*
Permeability Tests (Y/N):	*Y*

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

AMERICAN WATER
Applied Water Management

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SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0325-3
		Total Depth (in-bgl)	83
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 20-50°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-10	7.5YR 4/4	Brown	(0-10") Loam, crumb, loose with 10 percent shale and siltstone gravel, gradual and wavy boundary.
			10-32	5YR 4/4	Reddish Brown	(10-32") Silt loam, subangular blocky, soft to slightly hard with 30 to 40 percent red, gray and olive shale and siltstone gravel and cobble, gradual and irregular boundary.
5	60		32-83		Reddish Brown and Purplish Gray	(32-83") Shale and siltstone, open with fines, 30 percent 5YR 5/4 (brown) silt loam fillings with mineral staining throughout. Red shale is blocky and moderately fractured. Gray shale is flaggy and highly fractured.
						End of Soil Test Pit Test Stopped 83 (in-bgl) - Machine Refusal Seepage (Very Slight) - 83 in-bgl
10	120					
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*n/a*	*After: - - Hours*
Seepage (bgl - in.)	*83*	
Permeability Tests (Y/N):	*N*	

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

AMERICAN WATER
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SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0325-4
		Total Depth (in-bgl)	124
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 20-50°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-6	7.5YR 4/3	Brown	(0-6") Loam, crumb, loose, clear and smooth boundary.
			6-12	7.5YR 4/3	Brown	(6-12") Silt loam, subangular blocky and platy, slightly hard with 10 percent shale gravel, gradual and wavy boundary.
5	60		12-27	5YR 5/6	Yellowish Red	(12-27") Silt loam to silty clay loam, angular blocky and platy, slightly hard with 10 to 20 percent shale and siltstone gravel, clear and wavy boundary.
			27-48	2.5YR 4/4-3/4	Reddish Brown to Dark Reddish Brown	(27-48") Silt loam to silty clay loam, subangular blocky, slightly hard to hard with 30 percent red, tan and gray siltstone and shale gravel, gradual and irregular boundary.
			48-124		Reddish Brown	(48-124") Shale and siltstone, open with fines, up to 30 percent 2.5YR 3/4 (dark reddish brown) silty clay loam fillings.
10	120					End of Soil Test Pit Test Stopped 124 (in-bgl) - Machine Refusal Seepage (Moderate) - 68 to 83 in-bgl Seepage (Rapid) - 83 to 124 in-bgl
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*70.5 After: 24 Hours*
Seepage (bgl - in.)	*68 - 124*
Permeability Tests (Y/N):	*Y (PB0326-3)*

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

AMERICAN WATER
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SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0325-5
		Total Depth (in-bgl)	72
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 20-50°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-9	7.5YR 4/4	Brown	(0-9") Silt loam to silty clay loam, crumb to subangular blocky, loose with 20 to 30 percent rounded quartzite gravel; non-native; gradual and smooth boundary.
			9-16	5YR 4/4	Reddish Brown	(9-16") Silty clay loam, angular blocky and platy, slightly hard with 10 percent shale gravel, smooth and wavy boundary.
5	60		16-62	7.5YR 5/6	Strong Brown	(16-62") Silty clay loam, angular blocky, firm, 10 percent shale gravel, with common, coarse to medium, and distinct 7.5YR 6/2 to 7.5R 6/3 (pinkish gray to light brown) mottles between 16 and 62 inches below ground level.
			62-72		Reddish Brown	(62-72") Siltstone and shale, open with fines, 10 to 20 percent 2.5YR 4/3 (reddish brown) silty clay loam fillings, tight.
10	120					End of Soil Test Pit Test Stopped 72 (in-bgl) - Machine Refusal Seepage (Slight) - 70 in-bgl
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*58*	*After: 24 Hours*
Seepage (bgl - in.)	*70*	
Permeability Tests (Y/N):	*Y (PB0326-1)*	

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

AMERICAN WATER
Applied Water Management

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SOIL PROFILE TEST PIT LOG

Project	Pennytown Village WWTP Evaluation	Soil Log ID No.	SL0327-1
		Total Depth (in-bgl)	52
Township	Hopewell Township	Location	As Noted
County / State	Mercer County, New Jersey	Weather	Clear, 40-60°
AWM Project #	E01286AA	Date	4/28/2009

DEPTH (FT-BGL)	DEPTH (IN-BGL)	SYMBOL	INTERVAL DEPTH (IN-BGL)	MUNSELL COLOR NOTATION	MUNSELL COLOR NAME	IDENTIFICATION OF SOILS AND LITHOLOGY
0	0		0-7	7.5YR 3/3	Dark Brown	(0-7") Silty clay loam, crumb, friable with 10 percent shale gravel, gradual and wavy boundary.
			7-20	5YR 4/6	Yellowish Red	(7-20") Silty clay loam, angular blocky, friable with 20 to 30 percent shale gravel and few, fine, and faint 5YR 6/3 (light reddish brown) mottles between 7 and 20 inches below ground level.
5	60		20-30	5YR 4/6	Yellowish Red	(20-30") Silt loam to silty clay loam, angular blocky, slighty hard to hard with 30 to 40 percent shale and siltstone gravel and cobbles with many, coarse, and distinct 5YR 6/4 (light reddish brown) mottles between 20 and 30 inches below ground level, gradual and irregular boundary.
			30-52		Reddish Brown	(30-52") Siltstone, open with fines, up to 30 percent 5YR 4/6 (yellowish red) silt loam fillings, tight.
10	120					End of Soil Test Pit Test Stopped 52 (in-bgl) - Machine Refusal Seepage (Slight) - 18 in-bgl Seepage (Very Slight) - 41 in-bgl
15	180					
20	240					
25	300					

GROUNDWATER INFORMATION

Static Water Level (bgl - in.)	*n/a*	*After: - - Hours*
Seepage (bgl - in.)	*18; 41*	
Permeability Tests (Y/N):	*N*	

Soils Evaluator	D. Geddes
Excavating Equipment	Komatsu PC-130
Excavating Operator	M. Sacek

FIELD CONDUCTIVITY
TEST SUMMARY

AMERICAN WATER
Applied Water Management

2 Clerico Lane
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Summary of Field Conductivity Tests

Date	*4/28/2009*
Project	*Pennytown Village WWTF Evaluation*
Township	*Hopewell*
County / State	*Mercer / New Jersey*
AWM Project No.	*E01286AA*

Single Well Pumping Tests

Test Date	Pumping Test ID	Well ID	Pumping Rate (gpm)	Transmissivity (ft^2 / d)			Saturated Thickness (ft)	Hydraulic Conductivity (ft / d)		
				Drawdown [1]	Recovery [2]	Average		Drawdown	Recovery	Average
3/11/2009	PT0311-1	OW-2	3.19	521.28	964.43	742.86	19.75	26.39	48.83	37.61
	PT0311-2	OW-1	0.52	2.06	2.04	2.05	19.33	0.11	0.11	0.11
3/12/2009	PT0312-1	OW-3	0.18	1.19	1.11	1.15	20.31	0.06	0.05	0.06
	PT0312-2	OW-6	0.28	2.89	3.15	3.02	17.68	0.16	0.18	0.17
3/13/2009	PT0313-1	OW-2	3.39	512.45	823.49	667.97	19.49	26.29	42.25	34.27

Notes:
(1) Drawdown data analyzed according to Cooper-Jacob (1946)
(2) Recovery data analyzed according to Jacob (1963)

Pit Bailing Tests

Test Date	Pit Bailing Test ID	Reference Soil Log	Final Permeability Calculations (in/hr)			Recalculated Permeability (in/hr)	Total Rise (in)
3/26/2009	PB0326-1	SL0325-5	11.68	3.08	0.00	0.00	5.75
	PB0326-2	SL0325-1	2.26	2.03	2.25	2.26	9.75
	PB0326-3	SL0325-4	16.38	17.76	18.98	19.35	13.25

Notes:
(1) Tests conducted and analyzed in general accordance with N.J.A.C. 7:9A-6.5

SOIL PARTICLE SIZE ANALYSIS REPORTS

AMERICAN WATER

2 Clerico Lane
Suite # 1
Hillsborough, NJ 08844
T 908.359.5501
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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	1
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-1 12-47"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	536.9	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	129.1	grams
	24.0	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	38.40	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	31.0	
Corrected Hydrometer Reading, R1' =	26.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	14.0	
Corrected Hydrometer Reading, R2' =	9.0	
% Sand =	**32.3**	%
% Clay =	**23.4**	%
% Silt =	**44.3**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	10.30	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	5.30	grams
% Fine and Very Fine Sand =	**51.5**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

AMERICAN WATER

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	2
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-1 47-74"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	490	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	0.8	grams
	0.2	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	40.00	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	38.0	
Corrected Hydrometer Reading, R1' =	33.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	13.0	
Corrected Hydrometer Reading, R2' =	8.0	
% Sand =	**17.5**	%
% Clay =	**20.0**	%
% Silt =	**62.5**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	2.70	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	1.70	grams
% Fine and Very Fine Sand =	**63.0**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

AMERICAN WATER

2 Clerico Lane
Suite # 1
Hillsborough, NJ 08844
T 908.359.5501
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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	3
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-2 10-40"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	677.4	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	375.3	grams
	55.4	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	39.40	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	29.0	
Corrected Hydrometer Reading, R1' =	24.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	14.0	
Corrected Hydrometer Reading, R2' =	9.0	
% Sand =	**39.1**	%
% Clay =	**22.8**	%
% Silt =	**38.1**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	12.40	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	5.00	grams
% Fine and Very Fine Sand =	**40.3**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	4
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-3 10-32"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	758.6	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	477.0	grams
	62.9	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	39.20	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	30.0	
Corrected Hydrometer Reading, R1' =	25.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	14.0	
Corrected Hydrometer Reading, R2' =	9.0	
% Sand =	**36.2**	%
% Clay =	**23.0**	%
% Silt =	**40.8**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	11.40	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	3.20	grams
% Fine and Very Fine Sand =	**28.1**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	27
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-4 12-27"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	362	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	8.5	grams
	2.3	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	38.40	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	35.0	
Corrected Hydrometer Reading, R1' =	30.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	15.0	
Corrected Hydrometer Reading, R2' =	10.0	
% Sand =	**21.9**	%
% Clay =	**26.0**	%
% Silt =	**52.1**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	3.60	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	1.90	grams
% Fine and Very Fine Sand =	**52.8**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	28
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-4 27-48"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	390.1	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	32.1	grams
	8.2	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	37.60	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	27.0	
Corrected Hydrometer Reading, R1' =	22.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	14.0	
Corrected Hydrometer Reading, R2' =	9.0	
% Sand =	**41.5**	%
% Clay =	**23.9**	%
% Silt =	**34.6**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	13.60	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	4.90	grams
% Fine and Very Fine Sand =	**36.0**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	29
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-5 9-16"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	333.9	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	41.3	grams
	12.4	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	37.90	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	33.0	
Corrected Hydrometer Reading, R1' =	28.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	13.0	
Corrected Hydrometer Reading, R2' =	8.0	
% Sand =	**26.1**	%
% Clay =	**21.1**	%
% Silt =	**52.8**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	5.30	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	2.10	grams
% Fine and Very Fine Sand =	**39.6**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.

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SOIL PARTICLE SIZE ANALYSIS REPORT

Date Collected:	03/25/2009	**Job #:**	E01286AA
Collected By:	DG	**Client:**	Alliance Environmental, LLC
Tested By:	MS	**Lab Tray #:**	30
Block:	33	**Municipality:**	Hopewell
Lot:	1.02	**County / State:**	Mercer / NJ

Test Number: 1 **Replicate (Letter):** A

Sample Identification: SL0325-5 16-62"

Coarse Fragment Content:

Total Weight of Sample, (W.T.) =	329.9	grams
Weight of Material Retained on 2 mm sieve, (W.C.F.) =	9.5	grams
	2.9	%

Hydrometer Analysis:

Oven Dry Weight (24 hrs @ 105°C) of 40 gram Air Dry Sample, Wt. =	38.50	grams
Hydrometer Calibration, Rc =	5.0	
Hydrometer Reading - 40 seconds, R1 =	37.0	
Corrected Hydrometer Reading, R1' =	32.0	
Hydrometer Calibration - 2 hours, Rc' =	5.0	
Hydrometer Reading - 2 hours, R2 =	15.0	
Corrected Hydrometer Reading, R2' =	10.0	
% Sand =	**16.9**	%
% Clay =	**26.0**	%
% Silt =	**57.1**	%

Sieve Analysis:

Oven Dry Weight (2 hrs., 105°C) Total Sand Fraction (Soil Retained on 0.047 mm Sieve) =	2.80	grams
Weight of Fine Plus Very Fine Sand Fraction (Soil Passing 0.25 mm Sieve) =	1.70	grams
% Fine and Very Fine Sand =	**60.7**	%

Test conducted in strict conformance with procedure identified in ASTM D 422-63 "Standard Test Method for Particle-Size Analysis of Soils.