

Appendix G

**SUBSURFACE INVESTIGATION
WORK PLAN**

d/b/a GeoDesign, Inc. P.C.

October 4, 2006

File No. 321-05

New York City Department of Environmental Protection
465 Columbus Avenue
Valhalla, NY 10595
Attn: Mr. Matt Giannetta
Via e-mail mgiannetta@dep.nyc.gov

and

Putnam County Department of Health
1 Geneva Road
Brewster, New York 10509
Attn: Mr. Michael Budzinski, P.E.
Via e-mail mike.budzinski@putnamcountyny.com

Re: Preliminary Site Hydrogeological Investigations Workplan
Stateline Retail Center
U.S. Route 6, Southeast, NY

Dear Messrs. Giannetta and Budzinski,

This document details the workplan for proposed preliminary hydrogeological investigations (including field explorations) at the Stateline Retail Center site in Southeast, New York. The purpose of the investigations is to determine preliminary design groundwater levels and hydrogeologic design parameters for use in the selection of suitable subsurface disposal areas at the site. GeoDesign has prepared this work plan on behalf of P.L.I., LLC and Mr. Paul Camarda and is submitting it to your offices to allow you to review and comment on it, and provide your staff an opportunity to witness the acquisition of field data. The investigations envisioned in this document are preliminary in nature. However, it is our intent that all data obtained during this investigation, will be reused during the eventual site hydrogeological that will be prepared in support of the design of a subsurface sewage treatment system at the site as part of proposed site development.

At the present time, the proposed development's sewage flow rate has yet to be determined, but is expected to be in excess of 5,000 gallons per day. The subject study is intended to obtain preliminary data that can be used to determine the suitability of the site to accept and treat sewage flows.

Background

Two target areas for onsite disposal are currently under consideration, based on results of preliminary test hole explorations. These areas are termed "East Area" and "West Area" and are depicted on the attached Proposed Exploration Location Plan (Drawing No. 1). Both areas will be evaluated for their potential for onsite sewage disposal.

Ultimately, if onsite disposal is pursued, a final investigation of the selected area(s) will be performed, including additional explorations, testing and analysis of the aquifer at the site under existing conditions.

Existing Data

The site was preliminarily explored by the project civil engineer (Insite Engineering, Surveying and Landscape Architecture, P.C.) in 2004. Insite excavated and logged 12 deep test holes (test pits) on December 10 and 13, 2004 in a portion of the proposed East disposal area. Insite also excavated and logged about 18 deep test holes (test pits) in December 2004 in a portion of the proposed West disposal area. Excavation depths reached to seven maximum feet in these pits. Bedrock was encountered in some of the test pits and not in others to depth of up to about 7 feet. Some bedrock outcroppings are present in portions of the site. The shallow soils are generally described a "Fine Sandy Silt" or "Fine Sandy Silt and Gravel" and locally as "Fine Sand". No gradation tests are presently available.

None of these explorations were witnessed by either NYC DEP or Putnam County Department of Health personnel. Thus, the data from these explorations is not attached, and we do not intent to rely on them for future studies. However, they were considered in the selection of locations for the presently envisioned testing.

Proposed Investigations

Monitoring Well Installation

In order to determine subsurface characteristics of the two possible sewage disposal areas, subsurface explorations and testing will be performed, including test borings, bedrock coring, installation of groundwater monitoring wells, and in-situ permeability tests.

We will drill 12 to 18 test borings and install three 2-inch diameter PVC groundwater observation wells in the study areas. The range in the number of borings is provided to allow tailoring the field investigations to the actual conditions encountered. We expect that the number of borings/wells will trend toward the lower end of the range if more uniform conditions are encountered and, conversely, toward the upper end if more variable conditions exist.

The approximate proposed locations of the borings and wells are depicted on the attached plan. The intent of these wells is to estimate hydraulic gradients at each area. We expect, based on site topography, that the general flow direction will be generally aligned with the proposed well alignment. This assumption will be reviewed based on the data obtained.

Boreholes will be advanced using hollow stem augers or casing, and split spoon samples will be obtained at about five foot intervals within the unconsolidated deposits. In bedrock, the hole will be advanced either by roller bit or by coring. Where rock coring is used, rock core samples will be retrieved. Rock core recovery and rock quality designation will be recorded, providing characterization of the bedrock.

We expect that some of the borings will extend up to five to ten feet into bedrock to insure that they reach the groundwater and/or characterize bedrock conditions (unless bedrock is excessively deep).

Wells will be installed in each of the drilled test holes, and will consist of 2-inch diameter flush-joint PVC pipe to allow measurement of stabilized groundwater levels in each boring. Wells will be constructed of 0.01-inch slotted screens, five to 10 feet in length and PVC riser. Each well will be developed by bailing three times the volume of the water in the well, or until sediment free water is produced. Details of observation well installation, as well as a description of the water level reading equipment, are attached.

Well locations and elevations (ground surface and top of riser) will be surveyed by the project surveyor (Insite) following well installation.

Aquifer Testing

We will perform in-situ permeability tests (falling head, rising head, or constant head K-tests) in unconsolidated materials in selected borings to estimate in-situ permeability of soils. A summary of the procedure for borehole permeability testing is attached. In the event that groundwater is not encountered in the unconsolidated deposits in at least some of the borings, we propose a contingency to perform limited packer testing in the bedrock at one or more locations. This data would be used to estimate hydrogeologic characteristics of the bedrock.

We will also perform six gradation tests of selected soil samples to confirm visual classification of representative soil samples and determine D_{10} size.

We will measure at least three sets of stabilized groundwater levels, summarize data and plot groundwater surface levels, and determine groundwater flow gradient and direction at each proposed area (East and West).

Analyses and Reporting

We will analyze the data and prepare a report presenting the data and discussing their implications on the site's potential for sewage treatment and disposal. A copy of the report will be forwarded to the NYC DEP and to the Putnam County Department of Health. This report will, in part, form the basis for additional hydrogeological investigation of the site, and the data acquired in its preparation will be re-used in future investigations.

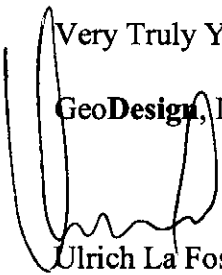
Schedule

GeoDesign and/or Insite have already contacted the NYC DEP and PCDOH offices to notify you of the following proposed field-testing schedule. We intend to mobilize two drill rigs (one at each test area) starting at 9:30 a.m. on Thursday October 5th and likely continuing through most of next week – depending on weather and work progress. This notice was intended to allow your staff the opportunity to be present on-site during any portion of the drilling and testing. This schedule is intended to allow drilling to occur before cold weather and to allow determination of ground water levels during the Fall season.

If you have any questions, or would like to provide us with review comments on this workplan, please call the undersigned at (203)-758-8836, Ext. 2.

Very Truly Yours,

GeoDesign, Inc.



Ulrich La Fosse, P.E.
Sr. Principal

Attachments: Figure No. 1 - Proposed Exploration Location Plan
 Observation Wells, Rainfall/Precipitation Data, and Equipment
 SOP for Borehole Permeability Tests

PC Paul Camarda and Fred Koelsch
 Jeff Contelmo, P.E. and Theresa Ryan (Insite)

M:\CL\321\05\workplan.doc

Observation Wells, Rainfall/Precipitation Monitoring, and Equipment

Groundwater Observation Wells

Groundwater observation wells will consist of PVC pipes installed in boreholes. These consist of PVC pipes that are 2 inch (2") diameter. Well depths will vary depending on depth to bedrock. Five or ten foot long sections of 0.010 inch slotted screen sections with solid risers and tightly fitting bottom caps and vented top caps will be used in well installed in soil. Shallow refusal may require shortening of the screen and riser lengths. The wells will be installed with 4-1/2" inch diameter hollow stem augers or 4-inch flush joint casing. The screens will be bedded in filter sand and the risers will be sealed with a bentonite seal placed 12 to 18 inches below ground surface to exclude infiltration of surface and/or rainwater. Existing ground surface and top of riser elevations at each well will be established based on survey by Insite Engineering.

Rainfall/Precipitation Monitoring

Local rainfall/precipitation will be determined by using the records from the NOAA/FAA weather station located at the Danbury Airport (approximately four miles from the site)

Water Levels

Manual Readings will be made during well installation and permeability testing, and at other times, using a SINCO electric water level indicator (0.01 foot gradations ~ 0.2 inch accuracy accounting for operator tolerance).

Hydraulic Conductivity Analyses

In-Situ soil permeability will be estimated by the following methodologies:

- A) Representative soil samples obtained in borings will be analyzed for gradation using laboratory gradation tests. This data will be used together with estimates of in-situ density based on correlation with standard penetration test results to estimate permeability using Kozeny-Carman empirical relationships.
- B) Falling head hydraulic conductivity tests will be performed in selected borings per the attached **STANDARD OPERATION PROCEDURE FOR BOREHOLE PERMEABILITY TESTS** for details on this testing. Raw field data together with the results of the analyzed data will be submitted.

STANDARD OPERATION PROCEDURE FOR BOREHOLE PERMEABILITY TESTS

1. Purpose

In-situ determination of coefficient of soil permeability of soil during drilling.

2. Equipment and Materials

- Drill rig, tooling and flush joint threaded casing supplied by drilling contractor
- Measuring tape with sounding device or electric water level reader
- Stopwatch or watch with second hand
- Bucket with water or hose attached to driller's pump

3. Procedures

- A. A split spoon soil sample is taken in the normal manner.
- B. The geologist / field technician, based on the sample taken in (A) above, decides whether or not to perform a borehole permeability test.
- C. The geologist / field technician, determines the static water level in the borehole either by allowing the water level sufficient time to stabilize in the borehole and/or by measuring water level in a nearby boring / observation well.
- D. The flush-joint casing is driven below the bottom of the split spoon sampler (to the point of maximum split spoon penetration).
- E. The casing is washed out to the bottom and flushed with water until all sediment is removed (i.e. wash water runs clear).
- F. For wick tests, a predetermined amount of Filter Pack Material is introduced into the casing. For soil formations containing gravel and coarse sand, filter pack should consist of ¼ to 3/8 inch nominal diameter peastone. For soil formations containing fine silty sand or finer soils, filter pack should consist of Ottawa sand.
- G. The number of measuring cups required to fill a pre-determined length of casing should be determined (calibrated) by averaging three trials.
- H. The casing is extracted a distance based on the quantity of filter pack material introduced into the casing the casing.
- I. The casing is filled with water and the rate of drop of the water is recorded on previously prepared forms. The forms should include the following information:
 - Date and Time
 - Boring number
 - Depth and geometry of wick
 - Stabilized water level
 - Test data (Heads and corresponding time intervals)
 - Any unusual information during the test

4. Analysis of Data

The data are analyzed using the following relations (Hvorslev, 1951):

A Falling Head Wick tests

$$K_h = \frac{d^2 \cdot \ln(2mL/D)}{8 \cdot L \cdot (t_1 - t_2)} \ln \frac{H_1}{H_2}$$

where $mL/D > 4$

Hvorslev, M. J. 1951, Time Lag and Soil Permeability in Groundwater Observations. U.S. Army Corps Engineers Waterways Exp. Sta. Bull. 36, Vicksburg, Miss.

B. Notation

D =	diameter of intake (length)
d =	diameter of stand pipe (length)
L =	length of intake (length)
H _c =	Maintained piezometric head minus static head (length)
H ₁ =	Piezometric head for t = t ₁ (length)
H ₂ =	Piezometric head for t = t ₂ (length)
q =	Flow rate of water (length ³ /time)
t =	Time (time)
K _v =	Vertical permeability (length/time)
K _h =	Horizontal permeability (length/time)
K _m =	Mean permeability = K _h K _v (length/time)
m =	Transformation ratio = $\sqrt{K_h/K_v}$, (dimensionless)

C. Restated for ease of calculation for m=1 the above equation becomes:

$$k = \frac{R^2}{2L} \cdot \ln(L/R) \cdot \frac{\ln(h_1/h_2)}{t_2 - t_1}$$

where

- R is the wick radius
- L is the wick length
- h₁ is the head at t₁
- h₂ is the head at t₂
- t₁ is the start of the time interval
- t₂ is the end of the time interval

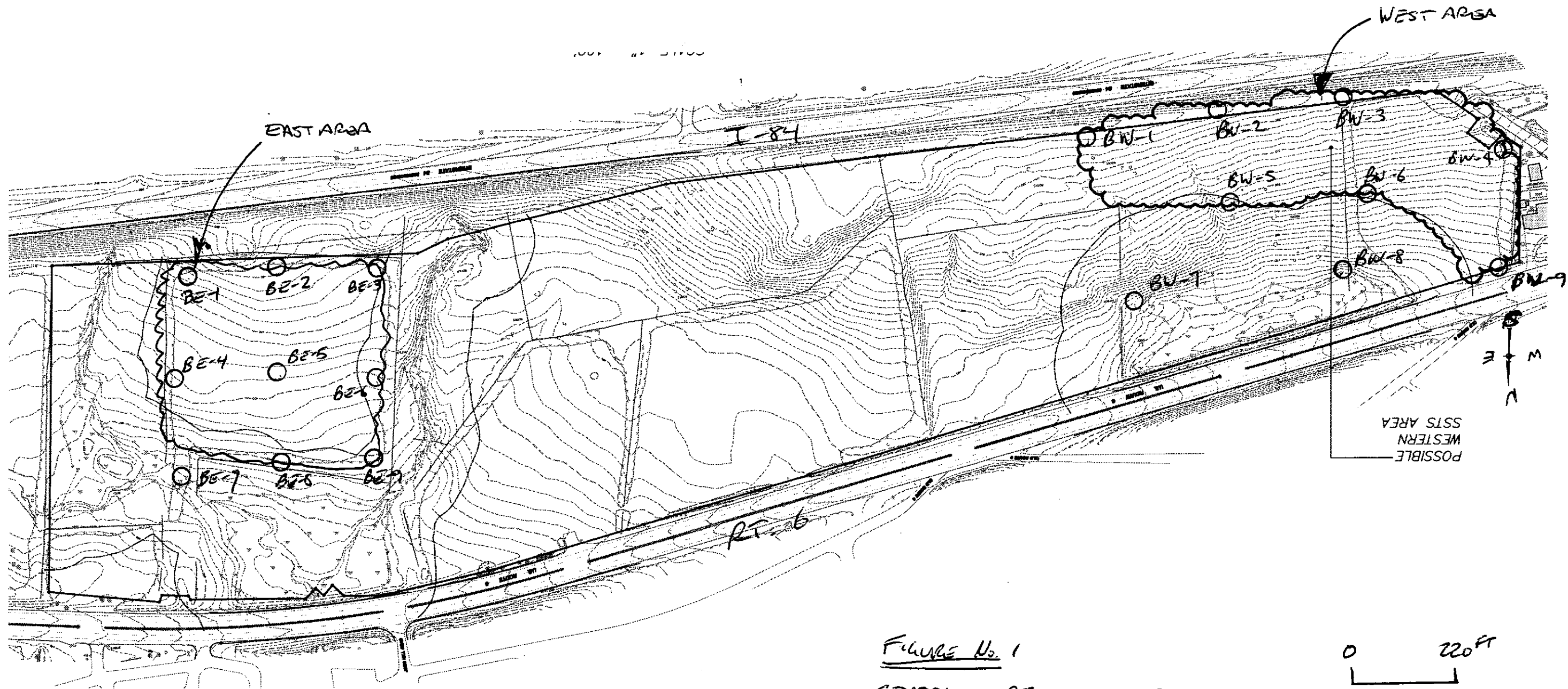


FIGURE No. 1
 STATELINE RETAIL CENTER
 WORK PLAN DRAWS
 TEST BORING LOCATIONS

0 220 FT

1" = 220'

~~APR~~ 1" = 220'

⊕ BE-1 PROPOSED BORING/Well

OCT. 4, 2006

