Via Email

December 2, 2016
File No. 04.0190030.02

Mr. Paul Rydel, P.G.
New Hampshire Department of Environmental Services
29 Hazen Drive, P.O. Box 95
Concord, New Hampshire 03301

Re: Remedial Design Plans and Construction Specifications Report
Dartmouth College, Rennie Farm Site
Hanover Center Road
Hanover, New Hampshire
NHDES Site No. 201111109, DES Project No. 277737

Dear Mr. Rydel:

GZA GeoEnvironmental, Inc. (GZA) prepared this letter report on behalf of Dartmouth College (Dartmouth), to provide the New Hampshire Department of Environmental Services (NHDES) with additional information regarding the proposed remedial alternative for the Rennie Farm property in Hanover, New Hampshire (site). The remedial alternative for the site was proposed in GZA’s Remedial Action Plan1 (RAP) dated September 1, 2016, and includes groundwater extraction and on-site treatment of 1,4-dioxane contaminated groundwater. The RAP was approved by NHDES in its letter2 dated September 27, 2016.

This letter report includes information required under State of New Hampshire Code of Administrative Rules Env-Or 606.16 (Design Plans and Construction Specifications), as applicable. In addition, responses to NHDES’s comments included in its September 27, 2016 letter are provided.

REMEDIAL OBJECTIVES

The remedial objectives of the groundwater extraction and treatment systems include capture and treatment of 1,4-dioxane contaminated groundwater within the former animal carcass burial area, and removal of 1,4-dioxane from groundwater within soil and bedrock proximate and downgradient of the former animal carcass burial area. The remedial design includes use of infiltration galleries within the

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1 Report by GZA titled “Remedial Action Plan Report, Dartmouth College, Rennie Farm Site, Hanover, New Hampshire, NHDES Site No. 201111109, DES Project No. 277737.”
2 Letter by NHDES titled "Hanover – Dartmouth College Rennie Farm Site, Hanover Center Road, DES Site #201111109, Project #27737, Report – Remedial Action Plan, prepared by GZA GeoEnvironmental, Inc. (GZA), and dated September 1, 2016.”
source area to flush retained pore water and, if present, mobilize 1,4-dioxane on soil to groundwater for capture and treatment. The remedial objectives/design are focused on prevention of further transport of 1,4-dioxane from the site, thereby limiting future off-site transport of 1,4-dioxane and the potential for capture of 1,4-dioxane by water supply wells.

REMEDIAL SYSTEM DESCRIPTION

This section provides a description of the groundwater extraction and treatment systems including information required under Env-Or 601.16. Revised plans illustrating the systems are attached; a plan set prepared by Emerging Compounds Treatment Technologies (ECT) is also attached. Please note that, due to the desired schedule for startup of the system during the first week of January 2017, certain remedial system components have been or are currently being constructed, as noted in the description of the components. Importantly, the design of the system assumes an observational approach so that potential modifications could be made in the future to meet the remedial objectives including:

- The number and location of wells;
- Pump type and flow rate; and
- Total system flow rate and treatment system capacity.

The layout of the primary components of the groundwater extraction and treatment systems are illustrated on Sheet 1 and Sheet 2, and include:

- Seven overburden groundwater extraction wells installed at the locations illustrated on Sheet 2. The locations of the wells are based on the estimated direction of 1,4-dioxane transport in overburden groundwater and elevation of the bedrock surface. Each well has been constructed using 6-inch internal diameter PVC including a sump installed within bedrock, such that the pump intake can be constructed approximately 1 foot below the top of bedrock. Wells have been screened within the overburden and highly weathered bedrock. Each well will be equipped with a pneumatically driven level maintaining pump.

- Five bedrock groundwater extraction wells installed at approximately the locations illustrated on Sheet 1 and Sheet 2. Wells will consist of approximately 6-inch-diameter open bedrock borings with casings seated into bedrock. Each well will be equipped with a pneumatically driven level maintaining pump. Subsurface conduit will be installed to provide for future use of level controlled electric submersible pumps based on observed well yield and flow rate needed to meet the performance goals.

- Underground piping between the groundwater extraction wells and treatment system and between the treatment system and discharge locations (see Sheet 3 for details).

- A groundwater treatment system (see Sheet 2, Sheet 3, and ECT Plan Set) to remove 1,4-dioxane from groundwater. The treatment system will include pretreatment to remove total iron and manganese consisting of bag filters and granular activated carbon. Pretreatment is intended to limit the fouling of the treatment system. Treatment of 1,4-dioxane will be by absorption using Ambersorb media. The treatment system will be designed for an influent flow rate of 15 gallons per minute (gpm), and will be expandable to 25 gpm. The system includes periodic steam regeneration of the Ambersorb media to remove the 1,4-dioxane. The resulting condensate will be periodically disposed of off site.
• A crushed stone pad to support the aboveground components of the groundwater extraction and treatment systems (see Sheet 2). The pad will be enclosed within an 8-foot-high chain-link fence. Components within the pad area include: two Conex boxes housing groundwater extraction and treatment equipment (see Sheet 3 for interior details); a 55-KW generator used to supplement a 200-amp electrical service during regeneration of the Ambersorb media; a 1,000-gallon propane tank used to fuel the 55-KW generator and a boiler also used during Ambersorb regeneration; and an air dryer and chiller used to support the treatment system. The generator, propane tank, air dryer, and chiller will be placed on concrete pads constructed within the crushed stone pad.

• A primary treated water discharge point (see Sheet 1 and Sheet 2). The discharge will be made into a subsurface rip rap constructed area up slope of the intermittent stream located on-site and downgradient of the source area.

• A secondary treated water discharge consisting of two approximately 50-foot by 50-foot leaching galleries constructed using leaching chambers (see Sheet 1). The intent of the secondary discharge system is to flush treated water through the saturated zone to accelerate the removal of dissolved-phase 1,4-dioxane. Based on mounding evaluations performed by GZA, the estimated total discharge capacity of the infiltration galleries is approximately 1 gpm. The actual infiltration rate will be maximized as allowed by the subsurface conditions and the need to capture groundwater within the source area. The infiltration galleries will be used following the startup of the treatment system to allow for documentation of groundwater capture by the system. We anticipate construction of the infiltration galleries during early 2017 with potential initial use during April 2017.

• A dry well will be used to discharge approximately 33 gallons of boiler blow down water per regeneration cycle. Anticipated boiler blow down water quality is summarized in the following table.

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The dry well location is illustrated on Sheet 2.

DESIGN PLANS AND CONSTRUCTION SPECIFICATIONS

The following provide applicable information required under Env-Or 606.16 (Design Plans and Construction Specifications). The information is provided in the order listed in Env-Or 606.16.
(1) A description of the purpose and function of the remedial treatment system or source removal project;

Please see Remedial Objectives section for this discussion.

(2) A list of applicable design criteria for the remedial treatment system or source removal project including, but not limited to:

- **Site limitations:**
  
  Site limitations include: relatively remote location; topography (>200-foot change in elevation within 1,4-dioxane transport area); limited access to electrical service (limited to 200-amp single phase service). Roadway construction and construction of an electrical service and supplemental electrical power through use of a generator required to construct and operate the proposed remedial system.

  Low hydraulic conductivity site soils and the fractured bedrock also represent site limitations.

- **Physical properties of the soil and aquifer:**
  
  Refer to RAP for detailed information. Site hydrogeology includes glacial till (geometric mean K = 6.88x10^-5 cm/sec) overlying fractured bedrock. Bedrock fractures generally steeply dipping and oriented to the northeast.

- **Space restrictions:**
  
  None

- **Subsurface obstacles, barriers, or both:**
  
  Boulders within glacial till.

- **Noise restrictions:**
  
  Town of Hanover ordinance requires maximum permissible weighted sound level measured at the adjoining property line to be 60 decibels (7 am to 7 pm) and 50 decibels (7 pm to 7 am).

- **Air and water discharge permit requirements:**
  
  Issuance by NHDES of a State of New Hampshire Temporary Groundwater Discharge Permit required for discharge of treated groundwater to infiltration galleries; authorization to discharge under the United States Environmental Protection Agency (EPA) Region 1 Remediation General Permit (RGP) required for discharge of treated groundwater to the primary discharge point.

- **Remedial treatment system flow rates; and**
  
  Estimated treatment system flow rate ranges from 10 gpm to 15 gpm. System is expandable to 25 gpm, if needed. Based on the site conditions and project schedule, an observational approach to total flow and individual well flow rates is necessary.

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3 Section 514.1 of Section 514 (Noise Standards) of Town of Hanover Zoning Ordinance 2016, dated May 10, 2016.
The estimated system flow rate of 10 gpm to 15 gpm considers the results of the constant head withdrawal test of well GZ-14L, which demonstrated a drawdown of 2.3 feet at a distance of 44 feet from the pumping well with a withdrawal rate of 1.5 gpm, the geometric mean source area overburden hydraulic conductivity of $6.88 \times 10^{-5}$ cm/sec, and our experience at similar sites. In general, we have assumed a yield, on average, of 0.5 gpm for each of the seven overburden groundwater extraction wells and 2 gpm for each of the five bedrock groundwater extraction wells.

**h. Remedial treatment system efficiency;**

*Not applicable.*

**(3) Remedial treatment system performance standards;**

Treatment system performance standards include:

- State of New Hampshire Ambient Groundwater Quality Standards (NH AGQS);
- A laboratory reporting limit of 0.25 micrograms per liter (ug/L) for 1,4-dioxane using EPA Method 8260 SIM; and
- Effluent Limitations to be included with the EPA authorization to discharge under the RGP.

**(4) Characteristics, quantities, and locations of environmental media and contaminants to be treated or removed;**

The media to be treated is groundwater. The quantity to be extracted and treated will be a function of the time to meeting the remedial objectives. 1,4-dioxane is the only site-related contaminant of concern. Low, below AGQS, concentrations of other volatile organic compounds have been detected (please refer to the RAP for additional information).

**(5) Expected waste products that will be generated and their means of disposal;**

Liquid phase granular activated carbon (LGAC) containing 1,4-dioxane from regeneration of the Ambersorb media is the only anticipated waste that will be generated. Each change out of LGAC results in a volume of approximately 7 cubic feet of material for disposal. ECT preliminarily estimates approximately seven changeouts of the LGAC per year (to be refined based on startup and operational data). Disposal will be off site with the location and method based on the results of waste characterization profiling of the media.

**(6) Pilot test results used in the preparation of the design;**

The treatment system is under construction and has not been pilot tested. However, the remedial technology (filtration using Ambersorb media) has been successfully used for the removal of 1,4-dioxane from groundwater to concentrations below 0.25 ug/L. The regeneration frequency of the media can be varied based on flow rate, influent concentration, and performance monitoring to increase removal efficiency.

**(7) Manufacturer’s data describing the equipment in the design.**

Please refer to attached ECT plan set.
(b) Construction plans and specifications required pursuant to Env-Or 606.15(b) shall provide sufficient detail for construction of the remedial system or source removal project.

Please refer to attached Sheet 1 through Sheet 3 and ECT plan set.

CONSTRUCTION SCHEDULE

As noted above, certain components of the remedial system have been or are under construction to meet the startup schedule. Work completed at this time includes:

- Construction of the crushed stone and concrete pads;
- Roadway improvements;
- Tree cutting for roadway improvements and excavation;
- Installation of overburden groundwater extraction wells;
- Installation of three of the five overburden extraction wells; and
- Performance monitoring wells (described in the RAP and illustrated on Sheet 2) is ongoing.

Construction of the aboveground components of the groundwater extraction system is ongoing at the site. Construction of the groundwater treatment system components is ongoing off site, with arrival at the site scheduled for December 19, 2016. The electrical service will be constructed during December.

The intent of the schedule is to complete the construction of the system before the end of December 2016.

GZA and Dartmouth understand that startup of the treatment system is contingent on EPA authorization to discharge under the RGP.

RESPONSES TO NHDES COMMENTS

The following subsections provide responses to the comments provided by NHDES in its letter dated September 27, 2016. NHDES comments are included below in italics in the order and under the headings in which they appear in NHDES’s September 27, 2016 letter providing comment on the RAP.

TECHNICAL COMMENTS AND REQUESTS FOR FURTHER INFORMATION

Bullet #4 under item #1 states that iron and manganese will be removed from groundwater using bag filters and granular activated carbon (GAC) as a pre-treatment step prior to treatment to remove 1,4-dioxane. The Department expects that bag filters may remove only suspended iron and manganese particulates, and that neither the bag filters nor GAC would substantially reduce the concentrations of dissolved iron or manganese. Please discuss.

The bag filters and GAC are intended to remove particulate iron and manganese to limit the potential for fouling of the Ambersorb. We do not anticipate significant precipitation of iron and manganese within the treatment
system between the filtration and the Ambersorb. If iron and manganese fouling becomes problematic relative to operation of the treatment system, iron and manganese sequestration would be added to the system.

The design flow rate for the groundwater treatment system is indicated as 15 gallons per minute (gpm), expandable to 25 gpm. However, there is nothing in the preceding sections that justifies the design flow rate. Please explain the justification for the flow rate.

The design flow rate considers the results of the constant head withdrawal test of well GZ-14L, which demonstrated a drawdown of 2.3 feet at a distance of 44 feet from the pumping well with a withdrawal rate of 1.5 gpm, the geometric mean source area overburden hydraulic conductivity of 6.88x10^{-5} cm/sec, and our experience at similar sites. In general, we have assumed a yield, on average, of 0.5 gpm for each of the seven overburden groundwater extraction wells and 2 gpm for each of the five bedrock groundwater extraction wells.

Importantly, due to the expedited nature of the remedial program, and uncertainty inherently associated with groundwater flow within fractured bedrock, implementation of the groundwater extraction and treatment assumes an observational approach with potential modification of the groundwater extraction and/or treatment system components as needed to achieve the remedial objectives.

The Department assumes that the specifications and sizing of the Ambersorb contactors are based on adsorption of the 1,4-dioxane; please confirm/discuss.

The specifications and sizing of the Ambersorb contactors are based on an average influent concentration of 26 ug/L (Bulk Source Area-1 sample; see Section 3.6 [Hydraulic Testing]) and an influent flow rate of 15 gallons per minute. The Bulk Source Area-1 sample represents the 1,4-dioxane concentration in a 250-gallon container of water purged from source area well GZ-14L during hydraulic testing. Importantly, the regeneration rate, assumed weekly, of the Ambersorb vessels can be varied to accommodate various influent flow rates and 1,4-dioxane concentrations.

Bullet #6 calls for a treated water discharge to filtration beds. The total discharge capacity of the infiltration galleries is indicated to be “approximately 1 gpm” and is reported to be based on an evaluation of groundwater mounding. The two beds each have an area of 2,500 square feet (SF), for a total area of 5,000 SF. The stated 1 gpm capacity for the 5,000 SF infiltration galleries thus equates to less than 0.3 gallons per day per square foot, and appears low. However, since the primary discharge point for the treatment system is indicated to be the intermittent stream to the east of the source area (discharge to be permitted under a Remediation General Permit [RGP] from the US Environmental Protection Agency [USEPA]), the Department assumes that treated effluent flows will be adjusted to maximize the discharge capacity of the infiltration galleries (?); please discuss.

The treated flows to the infiltration galleries will be adjusted to maximize the amount of treated water infiltrated within the source area as limited by groundwater mounding and the maintenance of the groundwater capture zone. The water levels within the existing monitoring wells and performance monitoring well network illustrated on Sheet 2 will be monitored for evidence of mounding and documentation of maintenance of the groundwater capture zone.

No estimation of the mass of 1,4-dioxane to be removed in the treatment system is provided in the report. How were the sizes of the Ambersorb contactors determined and the frequency of steam regeneration estimated without an estimate for the mass of 1,4-dioxane being removed per day/week/month?
As noted above, the specifications and sizing of the Ambersorb contactors are based on an average influent concentration of 26 ug/L (Bulk Source Area-1 sample; see Section 3.6 [Hydraulic Testing]) and an influent flow rate of 15 gallons per minute. The Bulk Source Area-1 sample represents the 1,4-dioxane concentration in a 250-gallon container of water purged from source area well GZ-14L during hydraulic testing. Importantly, the regeneration rate, assumed weekly, of the Ambersorb vessels can be varied to accommodate various influent flow rates and 1,4-dioxane concentrations.

Additional investigations should include estimating the individual well yields for the recovery wells and an overall flow to the treatment system.

Estimation of the individual well yields will be completed during the startup of the system.

With regard to Figure 9 (Proposed Groundwater Extraction and Treatment System Layout), it appears the proposed most-northerly “plume” bedrock extraction well (separated from the other wells) is to be installed in the vicinity of existing monitoring well GZ-9. For clarity, Figure 9 should include a detail to show the new well’s specific location and its proximity to well GZ-9; please provide. Also, it appears the treatment equipment is to be installed on a concrete pad; please confirm. Note that the concrete pad, if installed, will require provisions for handling stormwater.

The proposed “plume” bedrock groundwater extraction well is located approximately 100 feet southwest of monitoring well triplet GZ-9U/L/D. The proposed well location is illustrated on attached Sheet 1.

The final design of the pad to support the above ground components of the groundwater extraction and treatment systems includes an approximate 70-foot by 55-foot compacted stone and geotextile pad. The larger Conex boxes for the groundwater extraction and treatment components will be placed directly on the stone pad. Four small concrete pads will be constructed to support a generator, chiller, air dryer, and propane tank. The four small concrete pads sit within the larger stone pad as illustrated on Sheet 2.

With regard to Figure 10 (Proposed Groundwater Treatment System Details/Equipment Plan):

- Please provide an index for the letter symbols used in the instrumentation;

Please see ECT Sheet P-100 for the requested index.

- Tank 5300 is identified as a NAPL container storing the desorbed 1,4-dioxane. Please show how the liquid dioxane is transferred into the tank;

The NAPL container has been eliminated from the design. The desorbed 1,4-dioxane will be stored in the T-5000 Decanter/Condensate tank (see ECT Sheet E-102)

- ECT2 appears to have designed the treatment system and layout. Please confirm; and note that the plans will need to be stamped by a NH-licensed Professional Engineer (P.E.);

ECT designed the treatment system. Please refer to ECT Sheet E-102 for the required NH-licensed Professional Engineer (P.E.) stamp.
o Figure 11 (see comments below) shows an air compressor to operate the extraction wells, but the air compressor is not shown on Figure 10. Where is the compressor to be located? Also, please show the air lines to the wells; Please refer to Sheet 3 for the location of the compressor and air lines.

o Figure 10 shows P1001 sump pump. It is assumed the pump is to pump spillage from the containment around the bag filters. Where does the discharge go? It is not shown in Figure 11; and,

The sump pump is not needed and has been removed (see ECT Sheet E-102).

o Figure 11 indicates that the discharge from the Ambersorb contactors is directed to a treated water tank, and then pumped to the infiltration galleries or to a discharge point on the brook. There is no treated water tank shown in Figure 10 or a pump to discharge water to the infiltration beds from the tank.

The treated water tank and discharge pump are located in the groundwater treatment system Conex box (see Sheet 3).

With regard to Figure 11 (Proposed Remedial System Process Diagram):

o The condensate pump is shown to discharge to LGAC1, and LGAC2 is also shown as discharging to LGAC1. This appears to be in error (i.e., there is no discharge shown out of LGAC1). Please confirm;

The arrow was shown in the wrong direction between LGAC1 and LGAC2; this has been corrected as shown on ECT Sheet P-102.

o The Bag Filters discharge to LGAC pretreatment, but no discharge from LGAC pretreatment is shown. Please revise the figure;

The arrow was shown in the wrong direction between Bag Filters and LGAC Pretreatment, this has been corrected in revised, as shown on ECT Sheet P-102.

o Tank 5300, NAPL Container, is shown in Figure 10 but not in Figure 11. It is assumed that this tank will hold the desorbed 1,4-dioxane. Please confirm and, if so, please show the method that will be used to place 1,4-dioxane into the tank;

No NAPL is anticipated and therefore T-5300 has been eliminated, see ECT Sheet-E-102.

o The Dry Cooler pump is shown in Figure 10 but not in Figure 11. Please revise; and,

Please see ECT Sheet P-102 for the requested revision.
Please label, or show in the symbol panel, the steam lines, water softener lines, and groundwater treatment lines. To maintain consistency, please show discharge from lag Ambersorb vessel in blue.

Please see ECT Sheet P-102 for the requested revisions.

**ADDITIONAL CHARACTERIZATION OF BEDROCK HYDROGEOLOGIC CONDITIONS**

Responding to the following NHDES comment and inquiry regarding the status of the previously-proposed geophysical logging and discrete-zone sampling of the #9 Rennie Road well.

*As stated in Section 4.6.2, the Department understands that geophysical logging has not yet been completed at the #9 Rennie Road bedrock supply well. As such, key factors such as the depth of the contributing fractures and total well depth are not yet known for this well. Accordingly, as noted in Section 4.6.2 of the report, we concur that geophysical logging and discrete-zone sampling of the #9 Rennie Road well are needed. Please provide an update as to the status of these previously-proposed activities.*

On behalf of Dartmouth College, GZA reiterated our request for access to perform the geophysical logging and discrete-zone sampling of the #9 Rennie Road well in an email communication on October 5, 2016. The property owners responded in an email communication on October 7, 2016 that they were still unwilling to grant access to the well.

**ERRATA AND TEXT CORRECTIONS**

Responding to the comments under the Errata and Text Corrections section of NHDES September 27, 2016 letter.

*Consistent with the prior reporting, the RAP Report refers to a total of 43 historical burial plots that we [sic] previously excavated as part of the prior remedial efforts. However, based on the historical documentation provided (Appendix E), it appears that 42 plots were historically used at the site. Please clarify.*

Please refer to Figure 1 for the location of burial plot 43.

*Under Section 3.2 (Source Area Groundwater Screening), the reported concentrations of 1,4-dioxane detected in the groundwater samples collected from the direct-push (GZG-series) sampling points is indicated to range up to 660 ug/l (at GZG-11). Based on the data provided on Figure 6 and the laboratory reports in Appendix D, it appears that the highest concentration (670 ug/l) was found in the groundwater sample from GZG-23. Please confirm.*

The highest concentration of 1,4-dioxane detected was 670 ug/L.

*In Section 3.5.3 (and 4.7), the 1,4-dioxane concentration recently detected in the surface water sample collected from the “Stream-3” sampling location is reported as 5.2 ug/l; the Department understands that the correct value is 0.52 ug/l. Please confirm.*

The detected concentration of 1,4-dioxane in the referenced sample collected from surface water sampling location Stream-3 is 0.52 ug/L.
Under Section 3.6 (Hydraulic Testing), the constant head test is indicated to have been performed on overburden monitoring well GZ-14U; also, the twelfth bullet point under Section 5.0 (Conclusions) states that the constant head was performed on bedrock well GZ-20L. The Department believes the references should be to bedrock well GZ-14L as the pumping well used for the constant head test. Please confirm.

The constant head test was performed on well GZ-14L.

Bullet item #3 in Section 6.0 (Recommendation) discusses monitoring wells to be installed and shown on “Figure 13.” This appears to refer to Figure 12. Please confirm.

The correct figure reference within the RAP is Figure 12. The monitoring wells described in the bullet item #3 in Section 6.0 have been amended as described in GZA’s September 28, 2016 Work Plan Addendum4 and shown on the attached Figure 2.

We appreciate your review of this letter and look forward to receiving any comments you may have. Should you have any questions, please do not hesitate to contact Mr. James M. Wieck at 603-232-8732.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

James M. Wieck, P.G. Ronald A. Breton, P.E.
Senior Project Manager Senior Principal, Consultant/Reviewer

Steven R. Lamb, P.G., C.G.W.P.
Principal

JMW/SRL/RAB:kr

Attachments: Sheets
Figures
Plan Set by ECT

cc: Ms. Maureen O’Leary, PhD, MBA, CBSP, Dartmouth College
Mr. Michael D. Cimis, CIH, CHMM, Dartmouth College
Ellen Arnold, Esq., Dartmouth College

4 Work Plan by GZA titled “Work Plan Addendum, Supplemental Hydrogeologic Investigation – Phase II, Groundwater Management Zone Delineation, Dartmouth College, Rennie Farm Site, Hanover, New Hampshire, NHDES Site No. 20111109, DES Project No. 277737.”
Sheets
EXISTING GRAVEL ROAD

SYSTEM LAYOUT DETAILS
REFER TO SHEET 2 FOR

NEW HAMPSHIRE RURAL RESIDENTIAL

APPROXIMATE PROPERTY BOUNDARY
GROUND SURFACE TOPOGRAPHIC CONTOURS (SEE VARES)
FEMA FLOODPLAIN AREA
APPROXIMATE REMOTE FARMLAND PROPERTIES
GROUND SURFACE TOPOGRAPHIC CONTOURS
WATER SUPPLY WELL
STONE WALL
GROUND SURFACE TOPOGRAPHIC CONTOURS
WATER SUPPLY WELL

GENERAL NOTES:
1. BASED ON SURVEYS BY WSP TRANSPORTATION AND INFRASTRUCTURE.
2. LOCATIONS OF MONITORING WELLS GZ-1 THROUGH GZ-23U, WATER SUPPLY WELL, AND TRENCH DUG WELL (FORMERLY WATER SUPPLY WELL FOR 8 RENNIE ROAD) LOCATIONS OF MONITORING WELLS GZ-1 THROUGH GZ-23U, WATER SUPPLY WELL, AND TRENCH DUG WELL (FORMERLY WATER SUPPLY WELL FOR 8 RENNIE ROAD) ARE SHOWN ON SHEET 2.
3. GROUND SURFACE TOPOGRAPHIC CONTOURS SHOWN ON SHEET 2.
4. DISCHARGE POINT
WATER SUPPLY WELL
8 RENNIE ROAD

TAX MAP 13, BLOCK 81, LOT 1
TAX MAP 13, BLOCK 17, LOT 1

PROJ MGR:

EXPRESS CONSENT OF GZA, WILL BE AT THE USER'S SOLE RISK AND WITHOUT ANY RISK OR LIABILITY TO GZA.
NOTES:
1. TREATMENT SYSTEM AND GROUNDWATER EXTRACTION SYSTEM WILL BE CONSTRUCTED WITHIN STEEL CONEX BOXES IF
   PREFERRED TO BE PROVIDED IN 'A'をしているように、コンセプトの範囲を示すために、以下に示すように作動します。
   PIPING AND ELECTRICAL WIRING SHALL BE PROVIDED IN CONDUIT (EMT) SURFACE MOUNTED UNLESS OTHERWISE REQUIRED.
2. PROVIDE PVC SLEEVE FOR ALL PIPING AND CONDUIT PENETRATIONS IN ENGINEERED PAD & EXTEND THROUGH
   CONEX UNIT FLOOR AS REQUIRED.
3. ALL PIPING TO BE 8" MINIMUM FROM INTERIOR BUILDING WALLS.
4. PROVIDE ALL UNUSED SLEEVES. SEAL AROUND ALL CONDUIT AND PIPE PENETRATIONS WITH FLEXIBLE EPOXY FOAM.
5. SEAL AROUND ALL WALL PENETRATIONS WITH EPOXY.
6. ALL WIRING SHALL BE RUN IN CONDUIT (EMT) SURFACE MOUNTED UNLESS OTHERWISE REQUIRED.
7. PLYWOOD TO BE PAINTED WITH (2) COATS OF FIRE RETARDANT PAINT, 'BURN BARRIER 20-20, INTERIOR FIRE RETARDANT
   PAINT, FIRE HAZARD CLASSIFICATION, CLASS A, AS MANUFACTURED BY FIRE RETARDANTS, INC. CHASKA, MN OR EQUAL.
8. ALL UNUSED SLEEVES. SEAL AROUND ALL CONDUIT AND PIPE PENETRATIONS WITH FLEXIBLE EPOXY FOAM.
9. PROVIDE PVC SLEEVE FOR ALL PIPING AND CONDUIT PENETRATIONS IN ENGINEERED PAD & EXTEND THROUGH
   CONEX UNIT FLOOR AS REQUIRED.
10. ALL WIRING SHALL BE RUN IN CONDUIT (EMT) SURFACE MOUNTED UNLESS OTHERWISE REQUIRED.
11. PLYWOOD TO BE PAINTED WITH (2) COATS OF FIRE RETARDANT PAINT, 'BURN BARRIER 20-20, INTERIOR FIRE RETARDANT
    PAINT, FIRE HAZARD CLASSIFICATION, CLASS A, AS MANUFACTURED BY FIRE RETARDANTS, INC. CHASKA, MN OR EQUAL.
Figures
Plan Set by ECT
# DARTMOUTH/GZA

**RENNIE FARMS**

**SYNTHETIC MEDIA GROUNDWATER TREATMENT SYSTEM**

HANOVER, NH

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<td>6</td>
<td>P-105</td>
<td>P&amp;ID AMBERSORB VESSELS</td>
</tr>
<tr>
<td>7</td>
<td>P-106</td>
<td>P&amp;ID TREATED WATER</td>
</tr>
<tr>
<td>8</td>
<td>P-107</td>
<td>P&amp;ID WATER SOFTENING</td>
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<tr>
<td>9</td>
<td>P-108</td>
<td>P&amp;ID STEAM GENERATION</td>
</tr>
<tr>
<td>10</td>
<td>P-109</td>
<td>P&amp;ID SUPERHEAT</td>
</tr>
<tr>
<td>11</td>
<td>P-110</td>
<td>P&amp;ID COOLING EQUIPMENT</td>
</tr>
<tr>
<td>12</td>
<td>P-111</td>
<td>P&amp;ID CONDENSATE HANDLING</td>
</tr>
</tbody>
</table>
PLC-ECT

T-1040

CARBON PRETREATMENT

3"X2"

V-1046

FROM BAG FILTERS

2"-CPVC-PW-N

V-1047

V-1048

V-1049

V-1050

V-1051

V-1052

V-1053

11 P-103

PW

TO BAG FILTER C

2"-CPVC-PW-N

V-1043

V-1044

V-1045

1-1/4"

2"

3"

PI

1040

1050

AR

PI

1042

V-1041

1042 SP

V-1040

AR

3/4"X1-1/4"

P-1040 09 SEPT 2016

MMS

MMS

AGB

AGB

A 50% DESIGN ECT 9/30/16

1 ISSUE FOR FABRICATION ECT 10/10/16

2 ADDENDUM 1 ECT 10/22/16

3 CLIENT ISSUE ECT 10/27/16

DARTMOUTH/GZA

RENNIE FARMS

GROUNDWATER TREATMENT SYSTEM

P&ID

CARBON PRETREATMENT

P-104
NOTES:
1. REFER TO VENDOR DRAWINGS FOR EQUIPMENT DETAIL.
PLC-ECT

E-3100 SUPERHEATER SKID (PART 1)

NOTES:
1. REFER TO VENDOR DRAWINGS FOR EQUIPMENT DETAIL.
1. LEVEL SWITCH INSTALLED IN CLEAR PVC SIGHT GLASS.