

January 30, 2019  
W-P Project No. 13918B

Mr. Arik Jones  
Superintendent  
Rye Water District  
60 Sagamore Road  
Rye, NH 03870

Subject: Geophysical Exploration – Rye Water District, Rye, New Hampshire

Dear Arik:

Wright-Pierce (WP) recently completed a second phase of groundwater exploration to develop a new groundwater source capable of providing up to 400 gpm for the Rye Water District (RWD). Per request of the WP conducted electrical resistivity geophysical surveys at three sites that were determined to have good potential for the development of a new bedrock well source. The sites were identified during the first phase of work and were based on property size and geometry, fracture trace/lineament analysis, permission to access properties, proximity to existing infrastructure, contaminant threats and drill rig access. The favorable areas are referred to as Conservation Land 1, Conservation Land 2, and private property (**Figure 1, Attachment A**). The following is a summary of the findings and recommendations of the recently completed electrical resistivity geophysical surveys for RWD.

### **Electrical Resistivity Surveys & Target Drilling Locations**

Electrical resistivity surveys were conducted at the following properties to evaluate the most favorable locations for drilling a bedrock well. These surveys are a two-dimensional representation of the modeled electrical resistivity (how well subsurface soils and rock conduct electricity). A total of five survey lines were completed as a part of this work and are included in **Attachment B. Figure 2** shows the locations of the electrical resistivity lines, target drilling locations, their 400-foot radii, and surrounding parcels.

The area within a 400-foot radius of a well source is considered the sanitary protective radius and must be controlled by the water supplier through ownership or easement. Activities within this radius must be non-threatening to the water system. **Table 1** (below) displays the additional parcels that would be included in the 400-foot radius of each target. It is important to consider the outreach of the radius into additional parcels and ability to control the area within the radius and prioritizing drill targets by the ability of RWD to control the land or to obtain a waiver from NHDES for areas extending onto other properties that are undevelopable due to wetlands, town ordinance, etc. Some of these locations could serve as monitoring wells required by NHDES to assess impacts during regulatory pump testing where the 400 foot radius extends over septic systems, houses or other structures not permitted within the 400 foot sanitary radius. Furthermore, drill targets that are more difficult to permit due to ownership issues could be preliminarily tested and set aside for future source development.



**TABLE 1**  
**SUMMARY OF PARCELS IN 400-FOOT RADIUS**

Drilling Target	Meters from Start of Electrical Resistivity Line	Drill Location Parcel	Additional Parcels in 400-Foot Radius
L1-1	100	016-071-022 Conservation Land 1	-
L1-2	280	016-071-022 Conservation Land 1	-
L2-1	130	004-014-002 Conservation Land 2	004-018-002 Residential Land-Undevelopable 004-011-000 Single Family 004-012-000 Single Family
L2-2	220	004-014-002 Conservation Land 2	004-018-002 Residential Land-Undevelopable 004-011-000 Single Family 007-116-000 Single Family 007-113-000 Residential Land-Developable 004-015-000 Town of Rye 004-016-000 Town of Rye 004-017-000 Privately Owned-Wetland*
L2-3	340	004-016-000 Town of Rye	004-014-002 Conservation Land 2 007-116-000 Single Family 007-113-000 Residential Land-Developable 004-015-000 Town of Rye 004-017-000 Privately Owned-Wetland*
L3-1	108	004-016-000 Town of Rye	004-014-002 Conservation Land 2 004-015-000 Town of Rye 007-113-000 Residential Land-Developable 004-017-000 Privately Owned-Wetland*
L3-2	285	004-014-002 Conservation Land 2	004-019-000 Single Family 007-093-000 Town of Rye 004-017-000 Privately Owned-Wetland*
L3-3	227	004-014-002 Conservation Land 2	004-019-000 Single Family 007-093-000 Town of Rye 004-017-000 Privately Owned-Wetland* 004-015-000 Town of Rye 004-016-000 Town of Rye
L4-1	82	003-002-000 Private Property	003-024-003 Single Family 003-024-002 Single Family 003-024-001 Single Family 003-001-000 Land Trust
L4-2	118	003-002-000 Private Property	003-001-000 Land Trust
L5-1	120	003-002-000 Private Property	003-011-000 Single Family 003-003-000 Accessory Land Improved
L5-2	172	003-002-000 Private Property	003-011-000 Single Family

*\*Properties flagged with wetlands are generally undevelopable and there is a potential to get a waiver for the 400 – foot radius from NHDES.*



*Conservation Land 1 (Parcel #016-071-022)*

One 400-meter-long electrical resistivity survey profile (**Attachment B, Line 1**) was conducted on property referred to as Conservation Land 1. Two primary drill targets were identified on this electrical resistivity profile were identified as drilling targets. These drilling targets 400-foot radius required for ownership/control by NHDES are within the conservation land parcel.

*Conservation Land 2 (Parcel #004-014-002)*

Two 400-meter-long electrical resistivity survey profiles (**Attachment B, Lines 2 & 3**) were conducted on property referred to as Conservation Land 2. Line 2 begins off Cedar Run and extends northeast through the conservation property and Town of Rye municipal property. Three location on Line 2 were identified as drilling targets.

The 400-foot radius for drilling target L2-1 would extend onto adjacent parcels #004-018-002 to the southeast which is privately owned and #004-011-000 to the northwest which is privately owned. The 400-foot radius for L2-2 would extend onto adjacent parcels #004-018-002 to the south, #004-011-000 to the west, #007-116-000 to the northwest, #007-113-000 to the north, all privately owned, and the Town of Rye municipal parcel #004-015-000, and conservation land parcel #004-016-000. Exact drilling location could cause the 400-foot radius to extend onto privately owned parcel #004-017-000. L2-3 is a secondary drilling target on conservation land parcel #004-016-000. The 400-foot radius for this target would extend onto adjacent parcels to the west. These include privately owned parcel #007-116-000 and #007-113-00, to the east privately owned parcel #004-017-000, Rye municipal parcel #004-015-000 and conservation land parcel #004-014-002 to the south, and privately owned #004-011-000 to the southwest.

Three features from the electrical resistivity profile for (**Attachment B, Line 3**) were identified as drilling targets. L3-1 is a primary drilling target on the border of the conservation land parcel #004-016-000 and privately-owned parcel #004-017-000. The 400-foot radius for this target would extend onto the privately-owned land to the northwest #007-113-000, Town of Rye municipal parcel #004-015-000, and conservation land parcel #004-016-000. L3-2 is a primary drilling target on conservation land #004-014-002. The 400-foot radius for this target would extend south to privately owned parcel #004-019-000, north to Town of Rye owned parcel #007-093-000, and west to privately owned parcel #004-017-000. L3-3 is a primary drilling target on conservation land #004-014-002. The 400-foot radius for this target would extend south to privately owned parcel #004-019-000, west to privately owned parcel #004-017-000, southwest to Town of Rye owned parcel #004-015-000 and could extend northeast to Town of Rye owned parcel #007-093-000.

*Private Property (Parcel #003-002-000)*

Two electrical resistivity survey profiles were conducted on private property. One profile was 600 meters (**Attachment B, Line 4**) and another profile was 400 meters (**Attachment B, Line 5**). Line 4 begins on a private property off South Road and goes northeast. Three features from the electrical resistivity profile for Line 4 were identified as secondary drilling targets. Drilling Targets L4-1 and L4-2 are in the southern part of private property parcel #003-002-000 which creates a 400-foot radius containing the house, South Road, and private properties south of the road. The proximity of the drilling location to the road would make establishing a 400-foot radius difficult, making both secondary targets.



Two features from Line 5 were identified as primary drilling targets. Drilling target L5-1 is a feature of the electrical resistivity profile that spans from 100-130 meters down the line. The drilling target is shown at 120 meters on Figure 2 but can be moved for drilling conditions or for the 400-foot radius. The 400-foot radius for L5-1 extends onto privately owned properties including parcel #003-011-000 and #003-003-000. Drilling Target L5-2 is on private land parcel #003-002-000. The privately-owned parcels that would compose the 400-foot radius for targets L5-1 and L5-2 appear to be forested with wetlands and could be undevelopable and therefore possibly eligible for NHDES waiver or to obtain control due to an inability to develop the land.

### **Potential Contaminant Sources**

Potential sources of contamination in the Town of Rye were identified during the first phase of this project. Periodic updates to this data is important given the potential impact to water quality and the cost of developing a groundwater source in New Hampshire. Contaminant threats are shown on **Figure 3**.

Perfluorinated chemicals (PFAS) have been identified as an emerging contaminant of concern and have been associated with the Coakley Landfill Site and are of particular concern in the area. The Coakley Landfill is a USEPA Superfund Site located in the adjacent Town of Hampton. NHDES currently is developing a database of samples for these chemicals statewide. A map showing sample locations and concentrations of perfluorinated chemicals is shown on **Figure 4**.

Currently the standard for PFAS is 70 parts per trillion (ppt) per EPA Drinking Water Health Advisories for PFOA and PFOS from 2016 and water systems are required to monitor them under the third Unregulated Contaminant Monitoring Rule (UCMR 3). The State of New Hampshire is expected to pass new legislation to lower water quality standard to below 70 ppt. On December 31, 2018, NHDES initiated rulemaking to establish Maximum Contaminant Levels (MCLs) and Ambient Groundwater Quality Standards (AGQS) for PFAS. The proposed drinking water standards are 38 ppt for perfluorooctanoic acid (PFOA), 70 ppt for perfluorooctanesulfonic acid (PFOS), 23 ppt for perfluorononanoic acid (PFNA) and 85 ppt for perfluorohexanesulfonic acid (PFHxS). Samples exceeding the water quality standards are shown in purple and red. Generally, these exceedances are in close proximity to the Coakley Landfill site.

### **Test Well Exploration**

Based on the findings of the geophysical investigation, Wright-Pierce recommends groundwater exploration using test well drilling. The following steps for test well drilling are recommended to identify a suitable location with adequate volume and quality for a new source:

- 1) Each of the properties have 'woods roads/fire roads nearby potential drill targets. A site walk should be performed to identify the feasibility of drill rig access to each location.
- 2) Engage the Town of Rye and Conservation commission for an agreement to conduct test well drilling activities. WP can work with the Town to minimize the potential impacts to the property by developing an acceptable work plan which would include: installing erosion and siltation control measures, controlling water produced during drilling, minimizing tree trimming and access related activities to access drill sites, and post drilling site restoration.
- 3) Conduct a test drilling program to determine the potential for the development of a new groundwater well. This includes logging borings, short term pump testing, limited water quality





analysis (includes PFAS). Test wells will be constructed with the potential for conversion to production wells. Large diameter casing will be used and a six-inch bore will be advanced to reduce costs. The bore can later be reamed to convert the well to a production well to accommodate larger pump size.

- 4) Provide a technical memorandum summarizing the findings of the test well drilling, water quality and yield potential and outline the next steps of the project.

## Conclusions and Recommendations

WP has identified multiple potential high-yield bedrock well targets on the three properties where geophysical surveys were conducted. The bedrock appears to be highly fractured which is not surprising given the results of the previous lineament analysis and known high yield bedrock wells in Rye. The following is a summary of our conclusions and recommendations regarding the development of a new groundwater source for the RWD:

- Multiple drill targets have been identified at each of the favorable properties that have good to excellent potential for the development of a high yield bedrock well source. The goal of the project is the development of a 400 gpm source. There is potential that this could come from one bedrock well. However, it is likely that meeting the project goal may require more than one production well. It is recommended that RWD drill new sources at two or more of the sites to maximize project success and to identify sources with the best water quality.
- Obtain option agreements/easements with property owners prior to drilling test wells on the property.
- RWD should engage the Town of Rye and the Conservation Commission to obtain permission to perform test well drilling at each of the Town owned properties. Both properties have existing woods/fire roads that would require little improvement to facilitate drill rig access to drill targets. Flagging the precise drill locations in the field and a site walk with the driller/town would be a worthwhile intermediary step.
- Once viable groundwater source(s) have been identified, a Preliminary Report, regulatory pump test and Final Report will need to be completed under the Large Groundwater Withdrawal Permit process in order to permit the new source(s).

WP is very excited for the next phase of work and we anticipate some very interesting fractured bedrock well drilling. Thank you and please don't hesitate to call me with any questions.

Sincerely,  
WRIGHT-PIERCE

Christopher Berg, P.E.  
Project Manager

Greg Smith, PG, CG  
Lead Hydrogeologist

## **ATTACHMENT A**

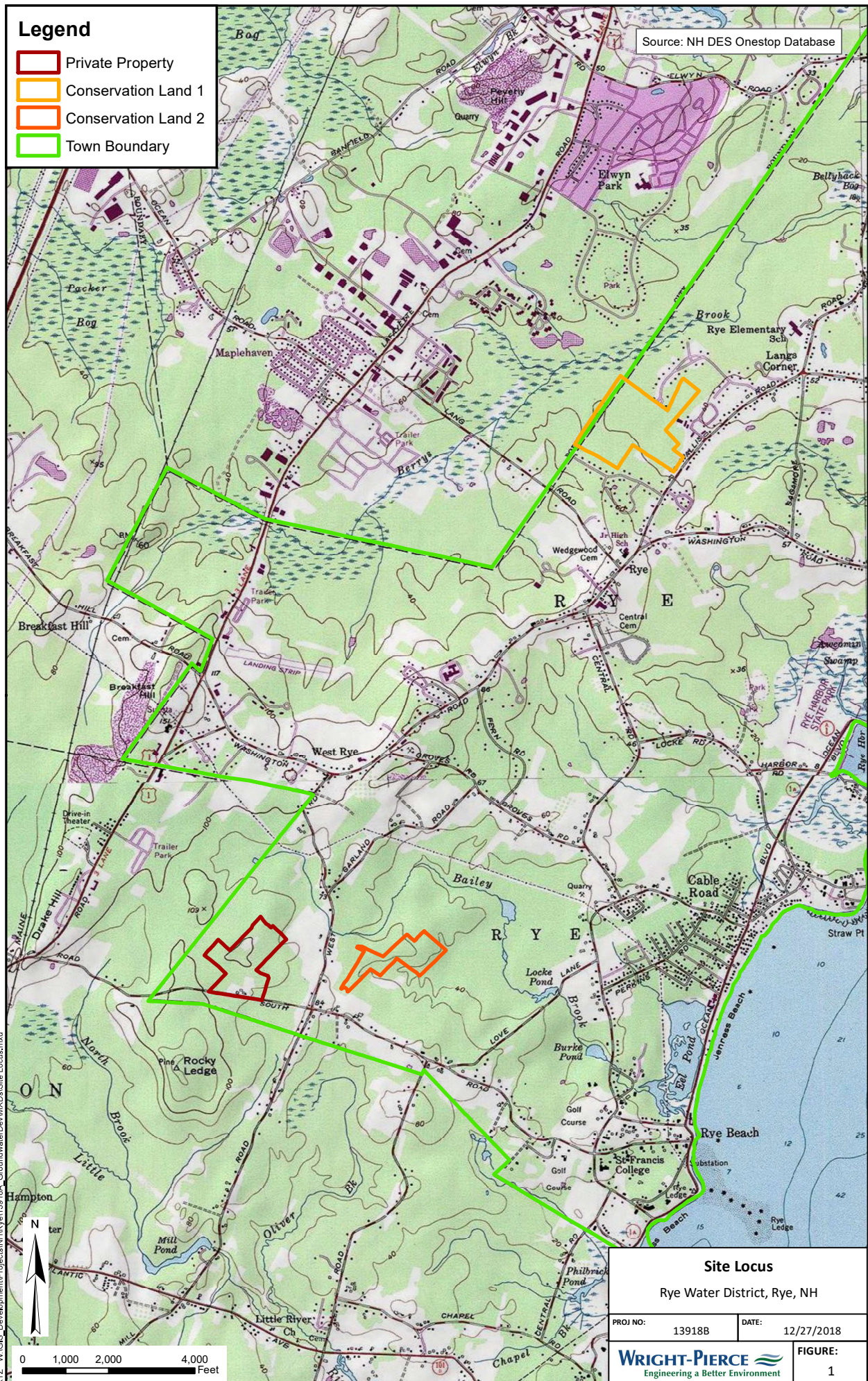
### **Figures**



# Legend

- Private Property
- Conservation Land 1
- Conservation Land 2
- Town Boundary

Source: NH DES Onestop Database



XYZ: W:\GIS Development\Projects\NH\Rye\13918A\_GroundwaterDev\MXDs\Site Locus.mxd



0 1,000 2,000 4,000 Feet

## Site Locus

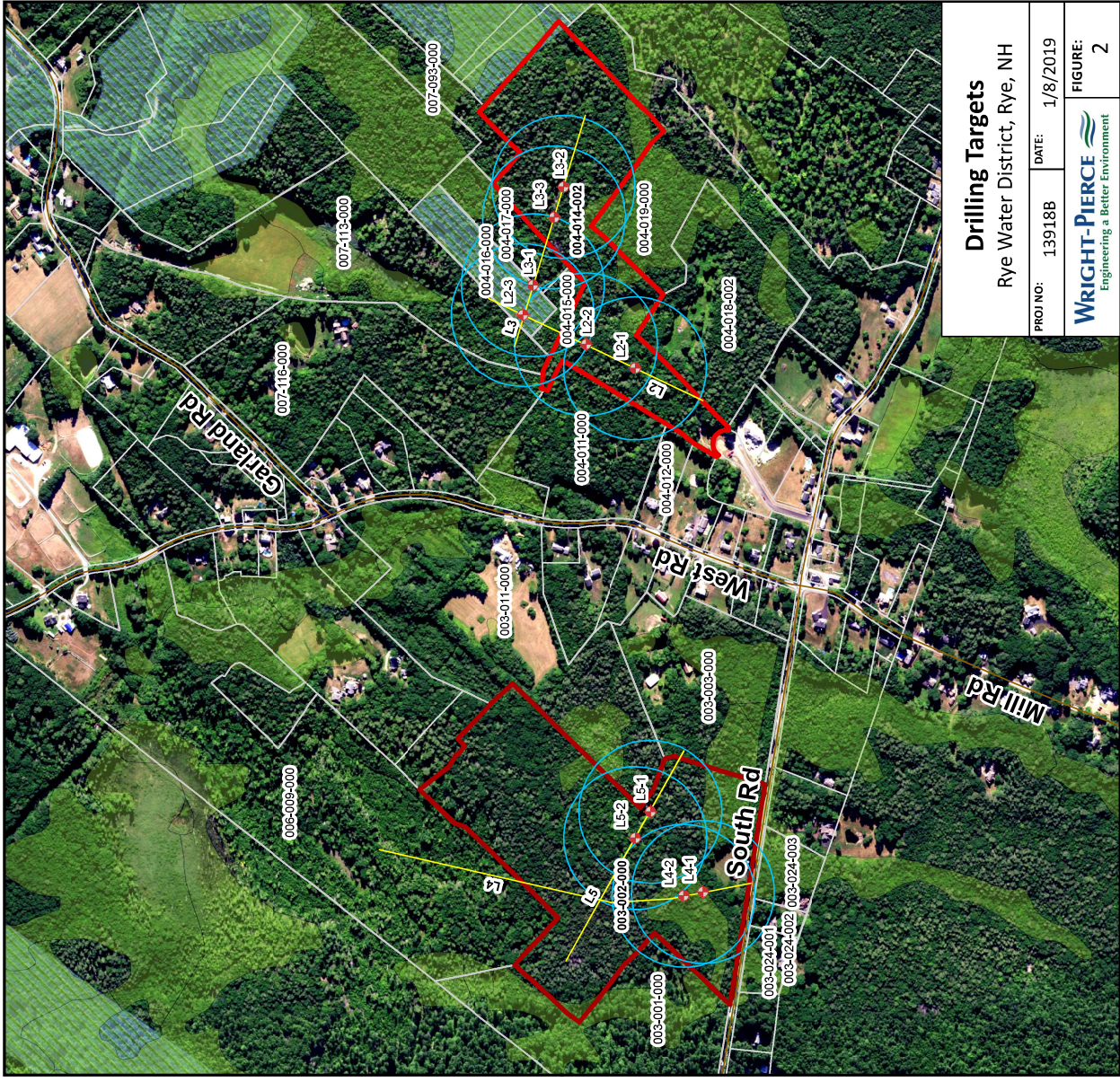
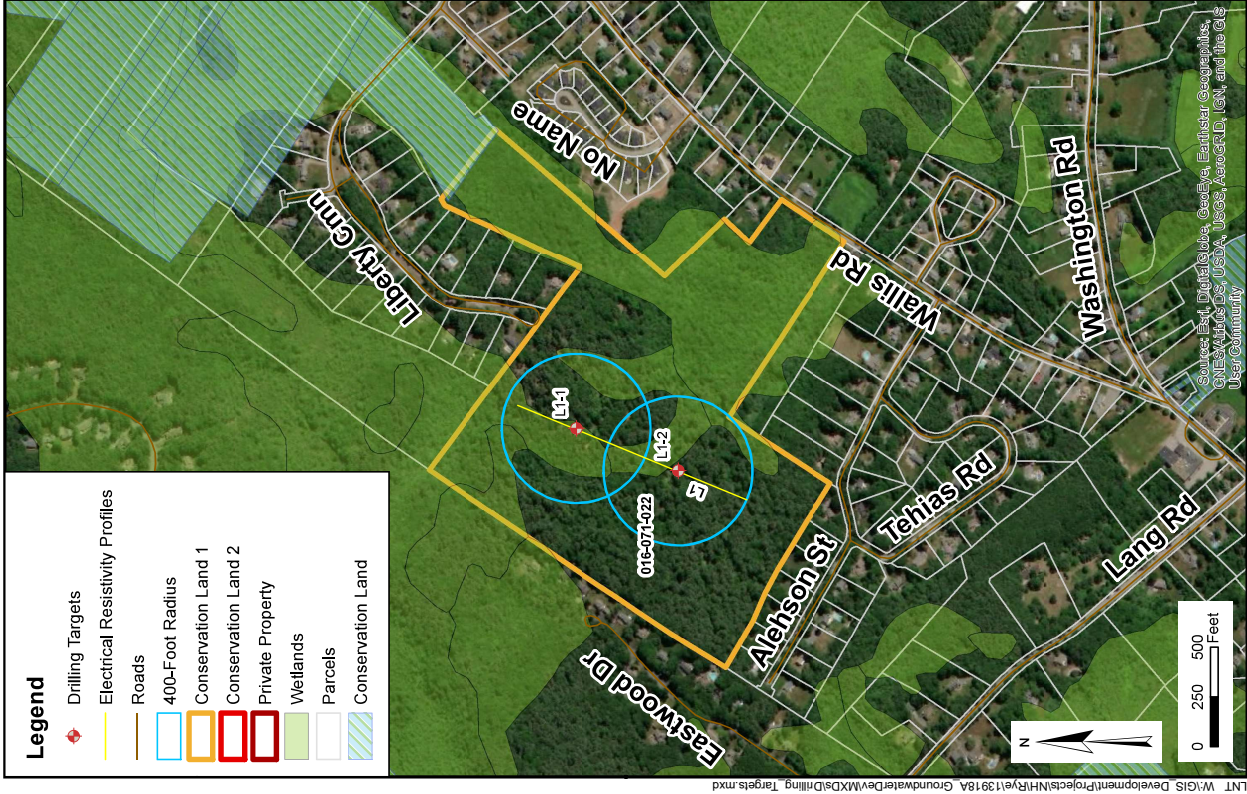
Rye Water District, Rye, NH

PROJ NO: 13918B DATE: 12/27/2018

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Engineering a Better Environment

FIGURE:  
1



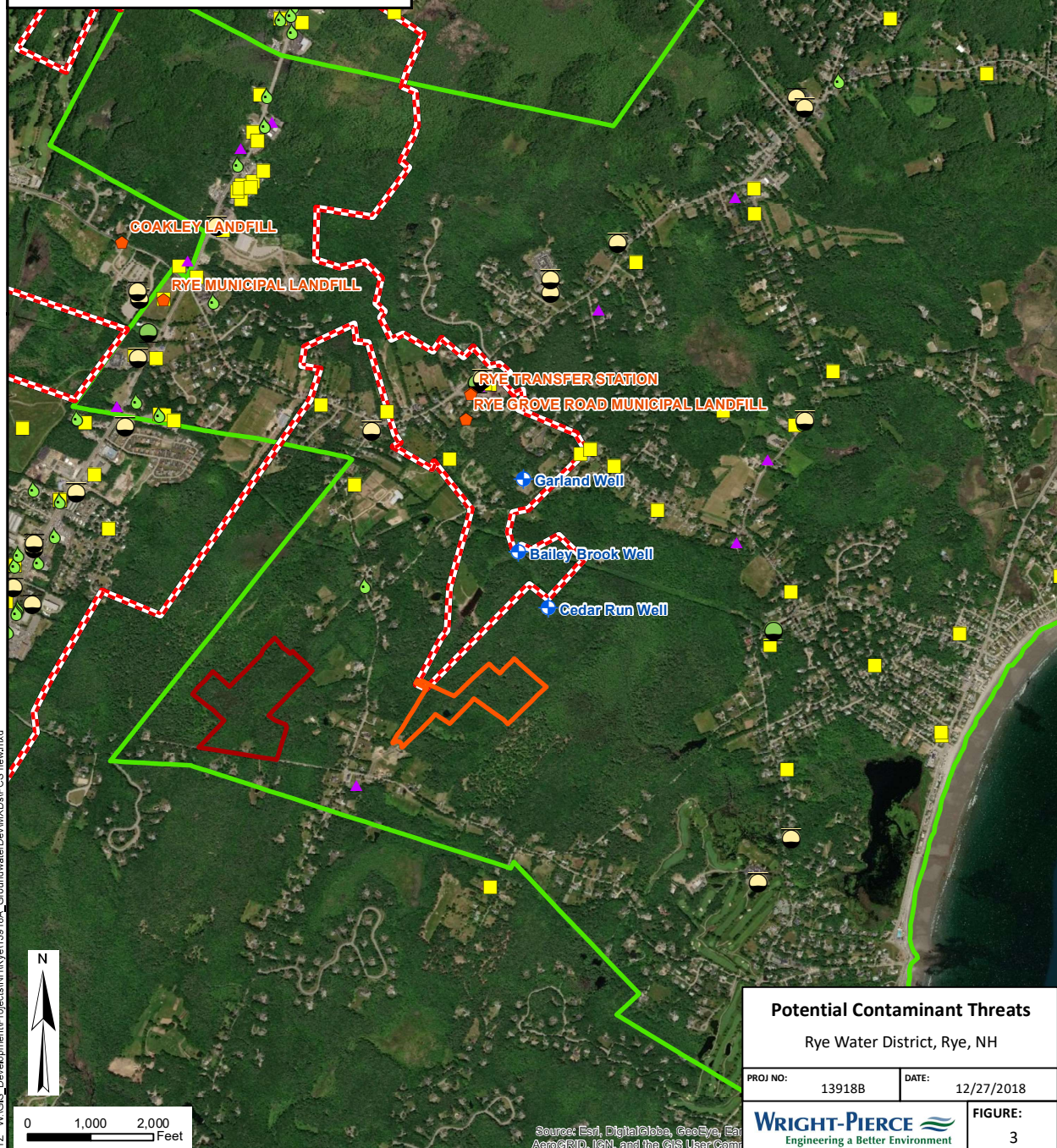




## Legend

- Private Property
- Conservation Land 1
- Conservation Land 2
- ◆ Solid Waste Facilities
- Underground Storage Tank Sites
- Aboveground Storage Tank Sites
- ▲ Asbestos Disposal Sites
- ◆ Automobile Salvage Yards
- Hazardous Waste Generators
- ▲ Local Potential Contamination Sources
- Remediation Sites
- PFAS Sampling Area
- Town Boundary
- + RWD Wells

Source: NH DES Onestop Database



## Potential Contaminant Threats

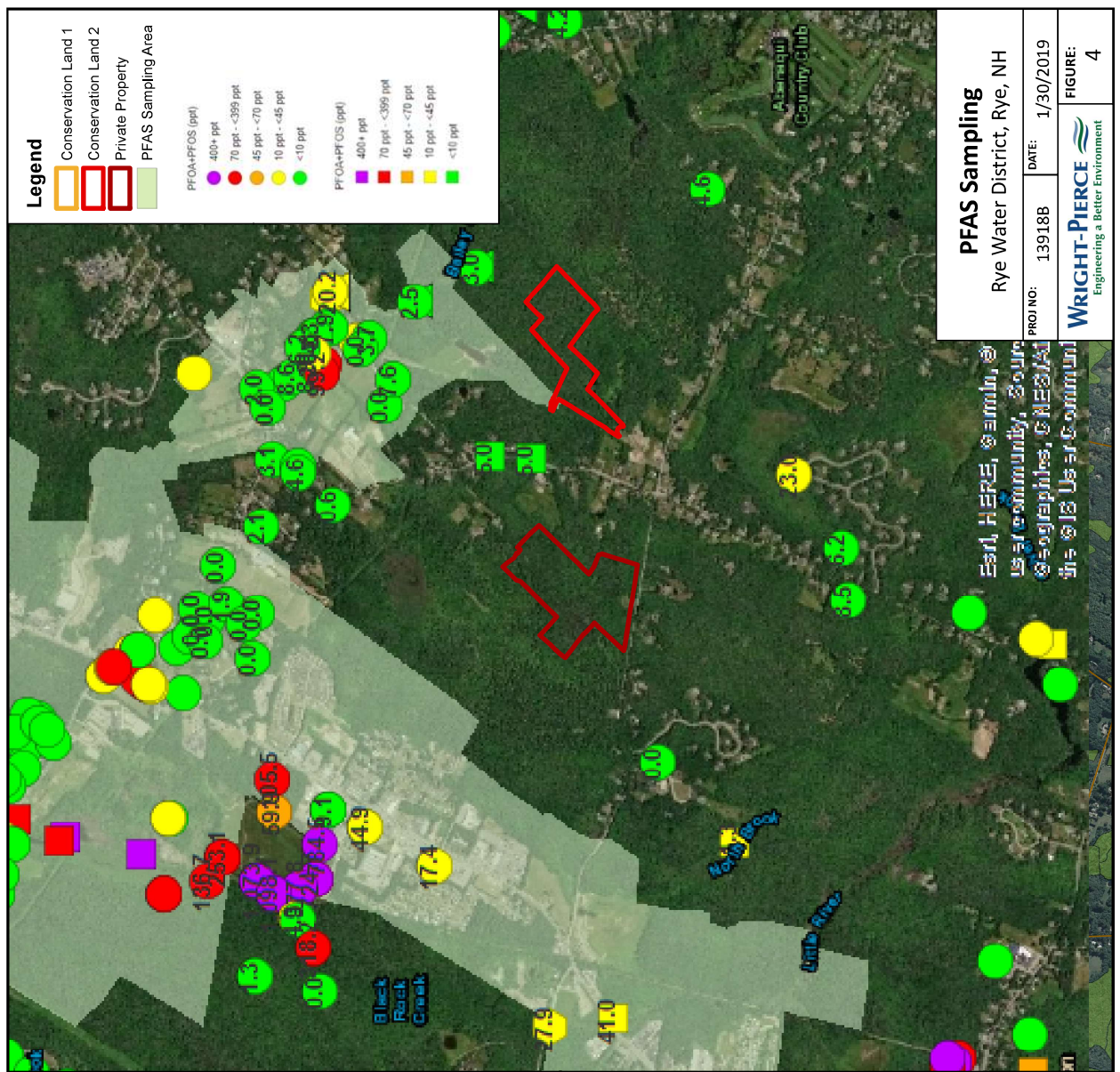
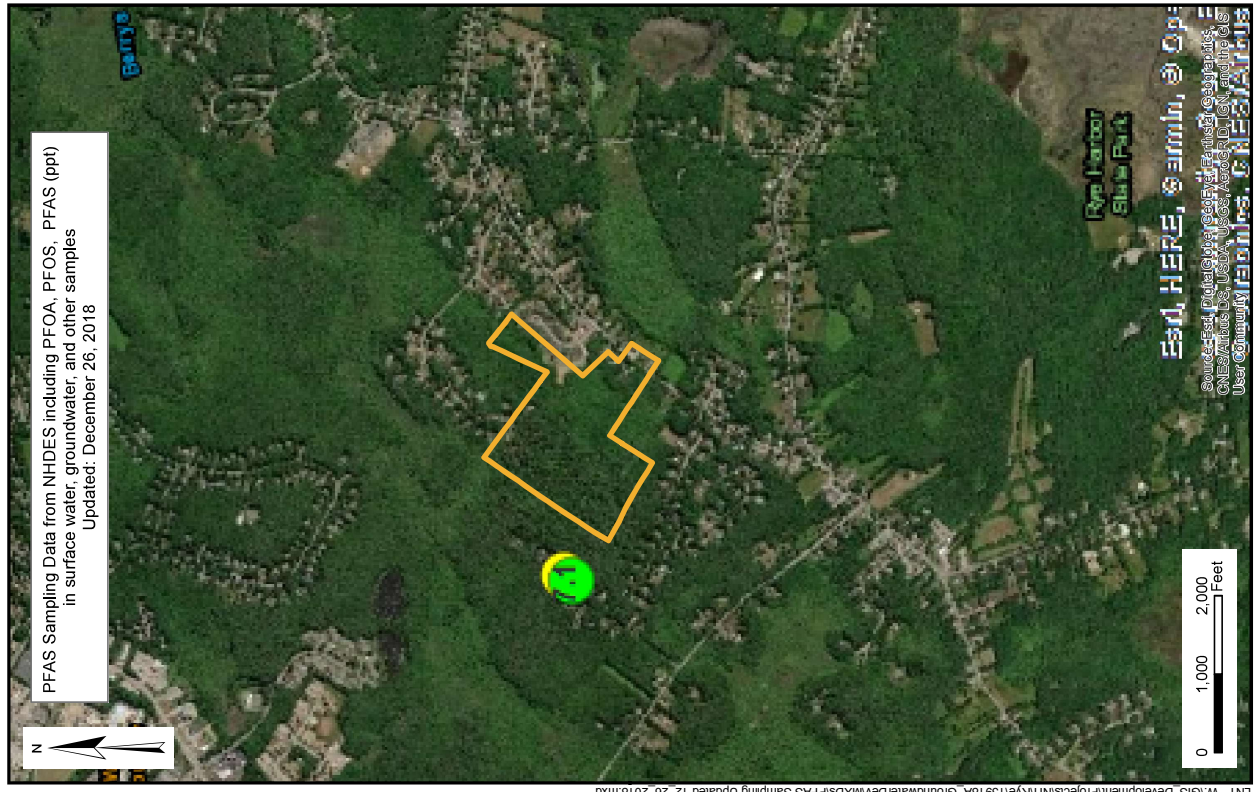
Rye Water District, Rye, NH

PROJ NO: 13918B DATE: 12/27/2018

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FIGURE:  
3



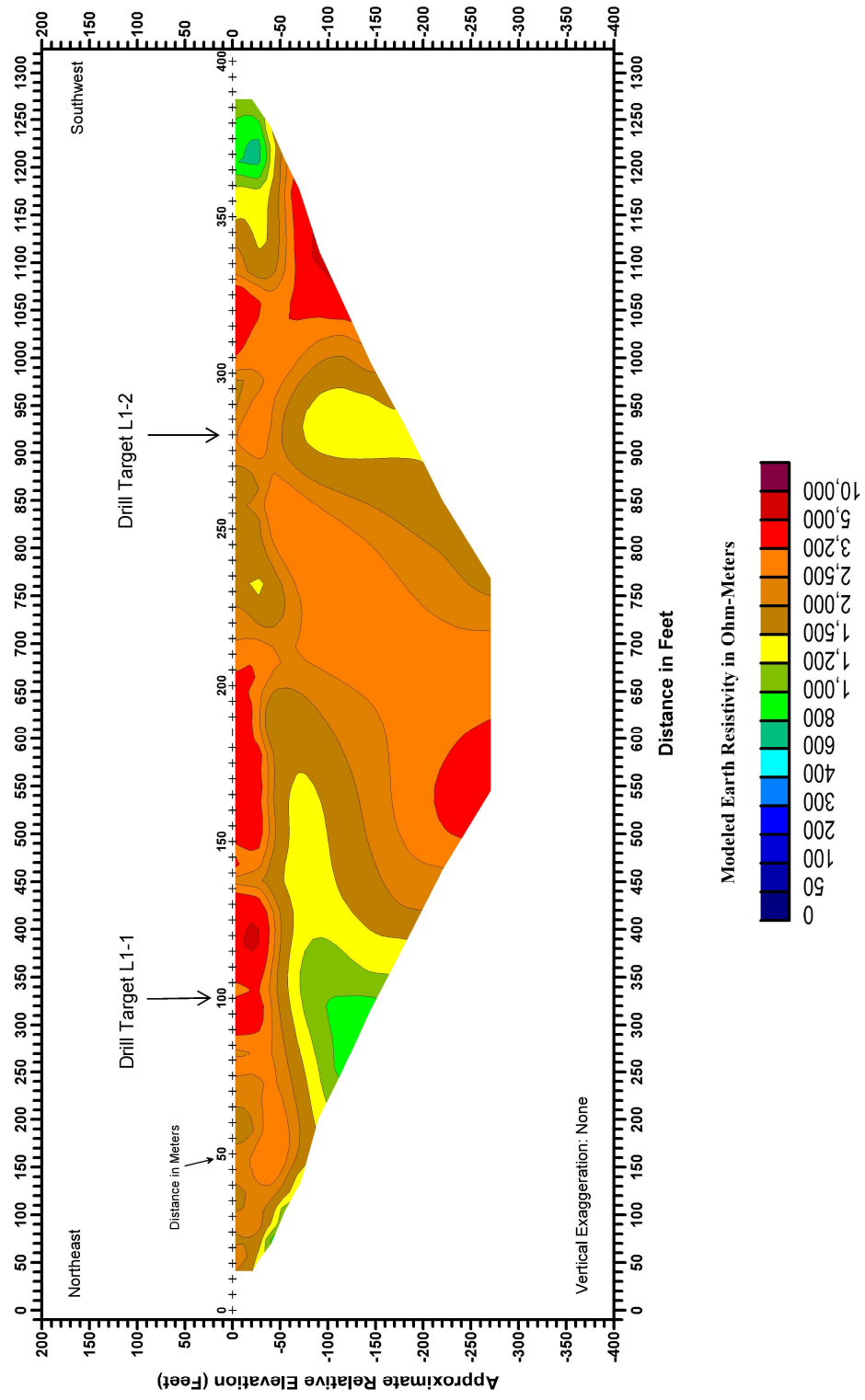


<b>PFAS Sampling</b> Rye Water District, Rye, NH	
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FIGURE:	4

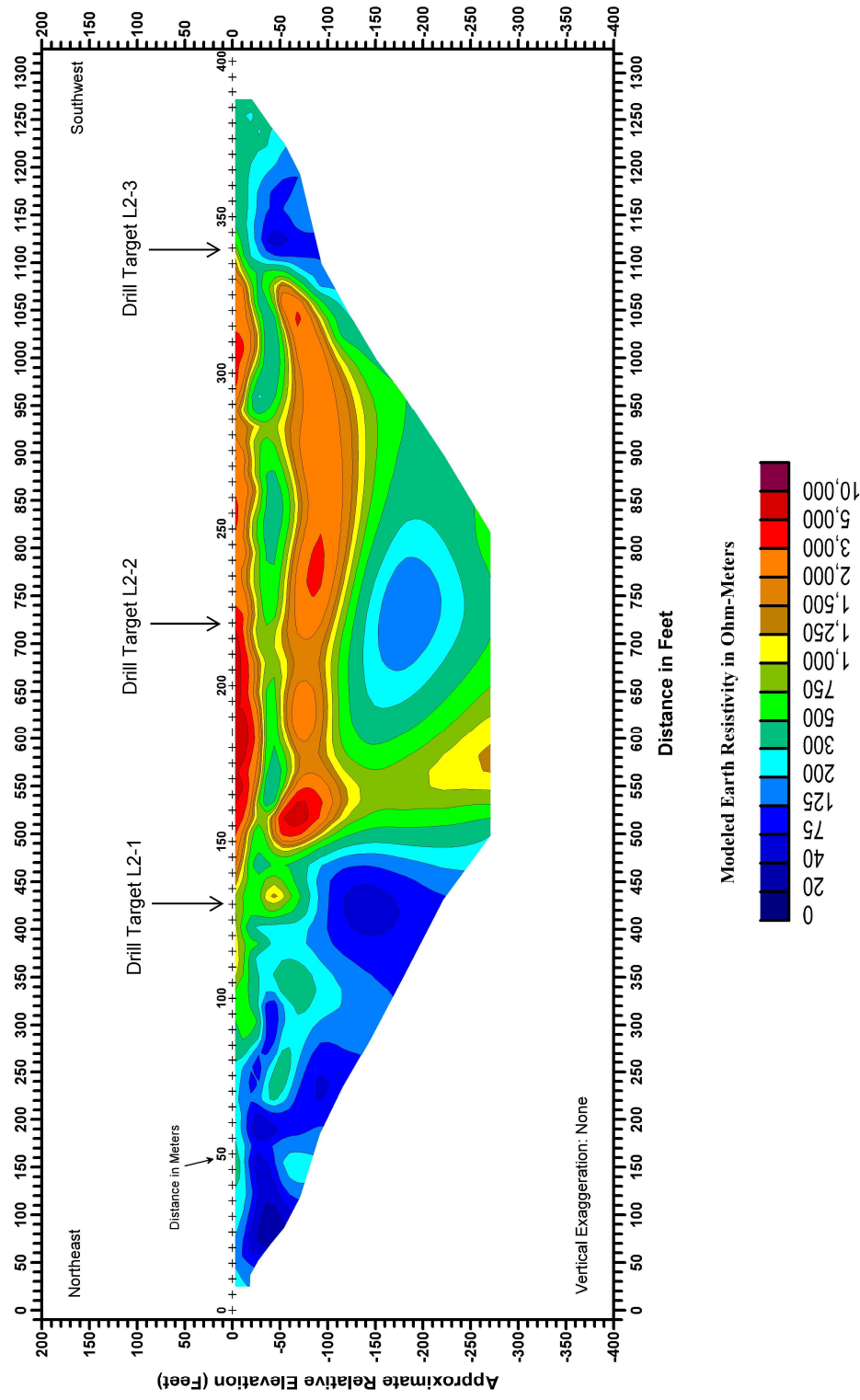


**ATTACHMENT B**  
**Resistivity Profiles**

Modeled Electrical Resistivity  
Line 1 - Gradient Array - Normal Inversion  
Rye, NH



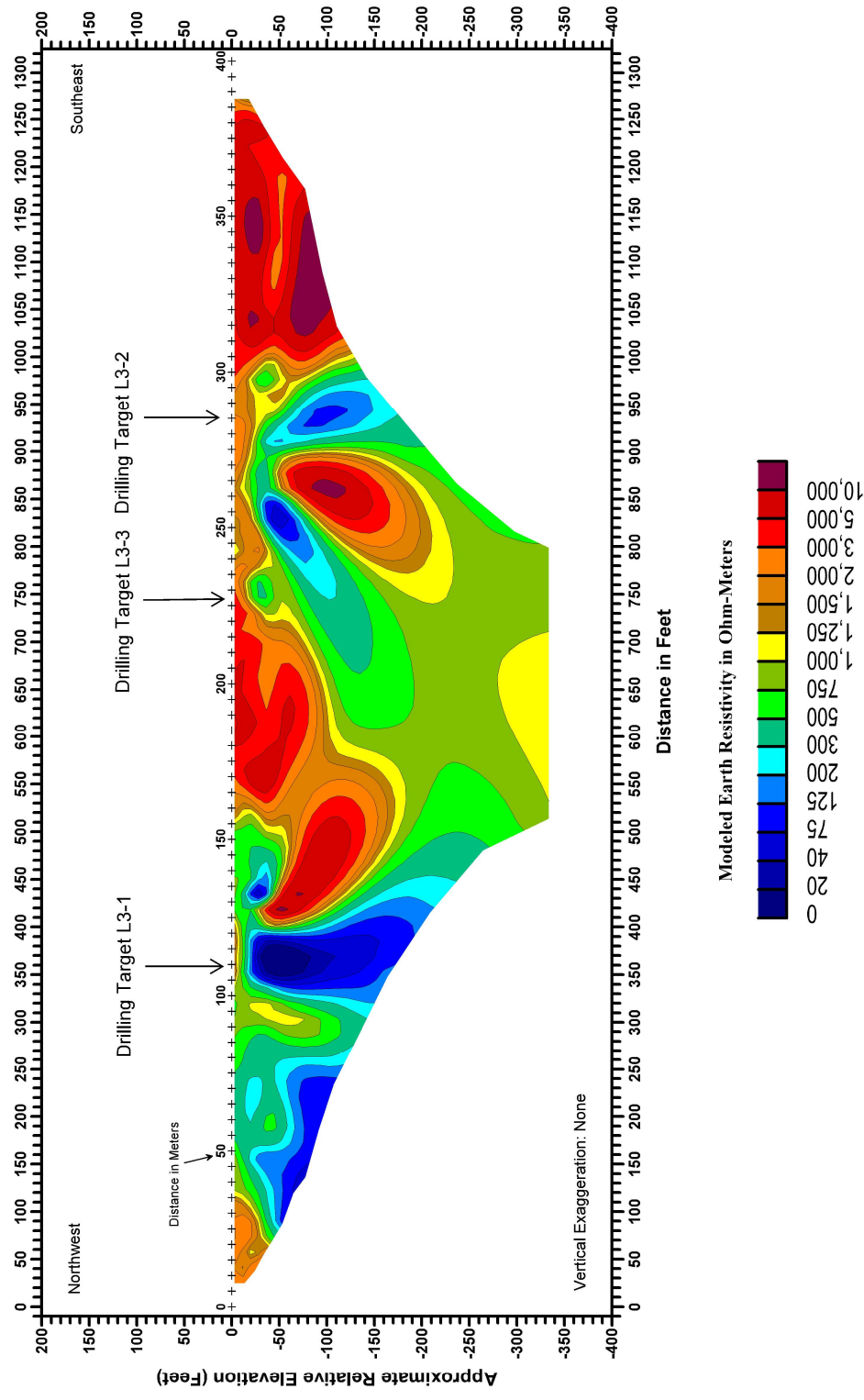
# Modeled Electrical Resistivity Line 2 - Dipole-Dipole Array - Normal Inversion Rye, NH



Surveyed: 12/03/2018 by:

*Northeast Geophysical Services*

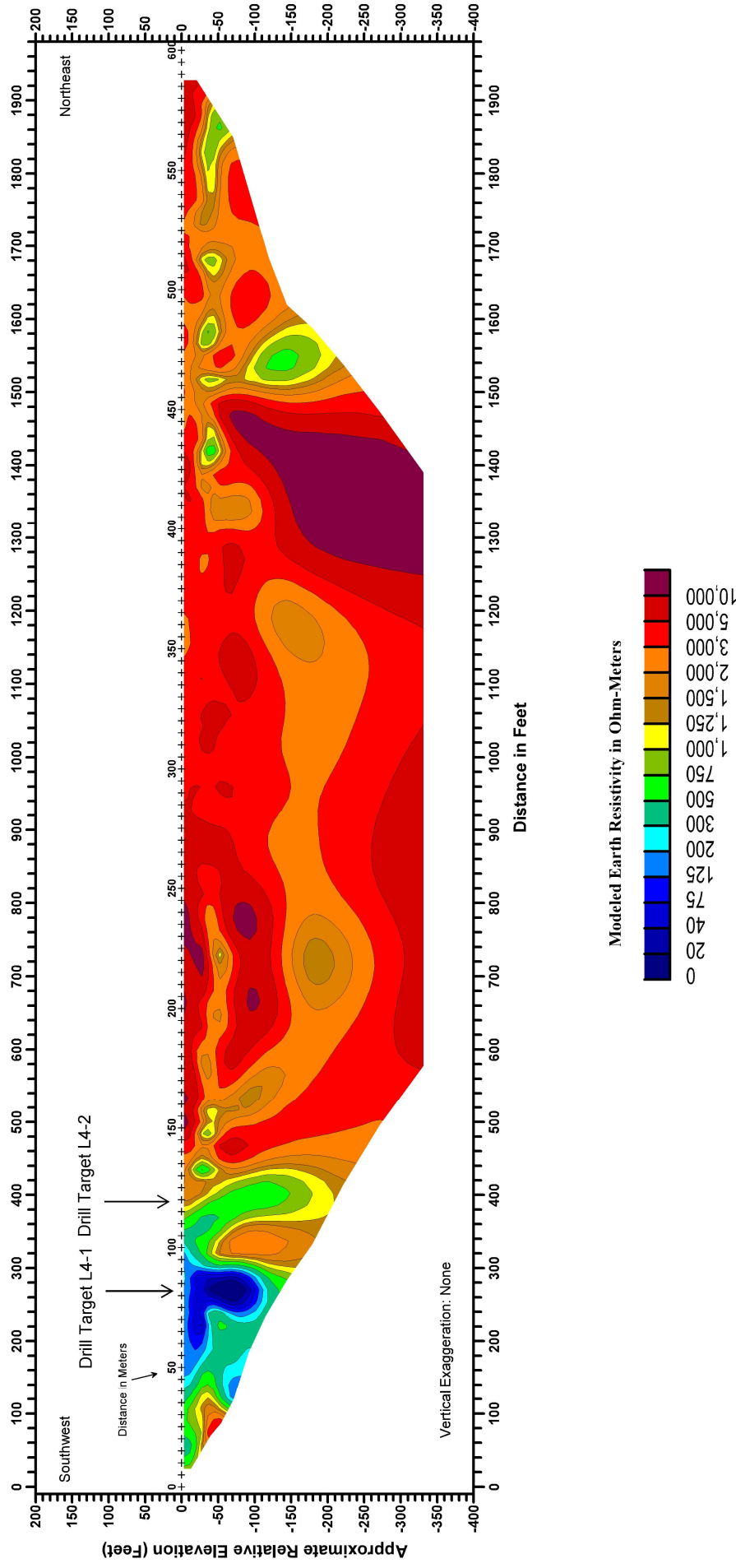
# Modeled Electrical Resistivity Line 3 - Dipole-Dipole Array - Normal Inversion Rye, NH



Surveyed: 12/04/2018 by:

*Northeast Geophysical Services*

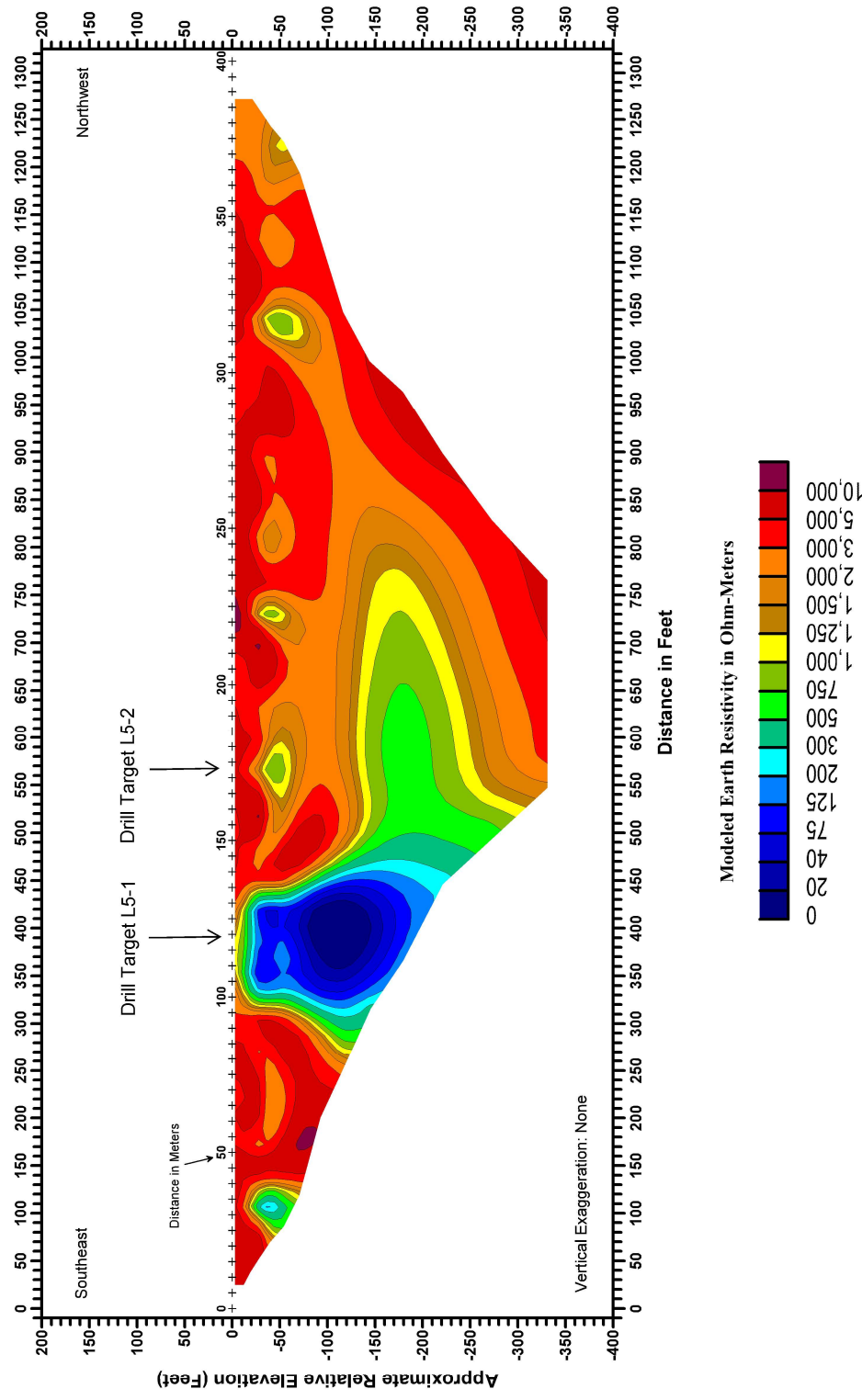
# Modeled Electrical Resistivity Line 4 - Dipole-Dipole Array - Normal Inversion Rye, NH



Surveyed: 12/04/2018 by:

*Northeast Geophysical Services*

# Modeled Electrical Resistivity Line 5 - Dipole-Dipole Array - Normal Inversion Rye, NH



Surveyed: 12/05/2018 by:

*Northeast Geophysical Services*