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MEMORANDUM

TO: Melanie Morash
U.S. Environmental Protection Agency Region 9 Remedial Project Manager

FROM: Christopher VanWart
EA Engineering, Science, and Technology, Inc. Project Manager

SUBJECT: Shashi Group Property, 1625 North Shoreline Blvd, Mountain View, California
Off-Property Source Area Investigation for the Teledyne-Spectra Superfund Site

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EA Engineering, Science, and Technology, Inc. (EA) was requested to provide technical review of available data concerning the property located at 1625 North Shoreline Blvd, Mountain View, California (the Property) and provide a summary of technical findings. The Property has been identified as a possible source of groundwater contamination, which may contribute to a plume of contamination related to the nearby Teledyne-Spectra Physics Superfund Site. As such, the owners of the Property have been suggested as potentially responsible parties for the groundwater plume (LFR Levine•Fricke 1991). This memorandum presents the results of the EA's technical review of the available data related to the Property, focusing on data considered to be useful in evaluating whether historical operations at the Property may have contributed to the groundwater plume.

1. Introduction

The Property is approximately 1.33 acres in size and is located 0.5 miles north-northeast of the Teledyne-Spectra Physics Superfund Site. It is located on the east side of the groundwater plume of volatile organic compounds (VOCs) that extends north from the Superfund Site into what is known as North Bayshore Area (Figure 1). The Property, located downgradient/crossgradient from the Superfund Site, is part of the Space Park Way Site, which is one of five "off-property" sources of VOCs identified in the Revised Preliminary Non-Binding Allocation of Responsibility (NBAR) report for the North Bayshore Area plume (LFR Levine•Fricke 1991). The NBAR report was prepared by Teledyne Semiconductor, Inc. and Spectra-Physics Lasers, Inc., the companies responsible for remediation associated with the Superfund Site, to identify other source areas of VOC contamination within the North Bayshore Area.

The Property is currently owned by Shashi Group LLC and is operated as a fitness gym. As part of the Space Park Way Site, the Property is regulated under San Francisco Regional Water Quality Control Board (RWQCB) Case Number 43S1170. Rosso Environmental, Inc. (REI) recently conducted an environmental assessment and investigation of the Property, on behalf of Shashi Group LLC, with the goal of attaining site closure from the San Francisco Bay RWQCB. The results of the investigation were presented in the 26 July 2016 *Environmental Assessment and Investigation* (REI Report) (REI 2016). Planned redevelopment of the site in the near future

includes demolition of the existing building and construction of a hotel with above-ground parking.

2. Statement of Problem and Objectives

Per the revised 1991 NBAR, identification of the Space Park Way Site as an off-property source area was primarily based on elevated concentrations of VOCs downgradient of the Space Park Way Site, in both the Shallow and Upper Intermediate groundwater zones (LFR Levine•Fricke 1991). As part of the remedy associated with the Teledyne-Spectra Physics Superfund Site, the North Bayshore Extraction System pumps groundwater from both the Shallow and Upper Intermediate groundwater zones in the vicinity of the Property. However, no official determination has yet been made by the RWQCB regarding potential contribution of the Property to the VOC contamination observed in the extracted groundwater.

The primary objective of the technical review presented in this memorandum is to assess the available data from the vicinity of the Property, and to identify additional data that could be useful in determining whether historical operations at the Property may have contributed to the groundwater plume, or whether groundwater contamination in the vicinity of the Property is more likely derived from an upgradient source. The sections below present the results of EA's technical review.

3. Property Background

According to the REI Report the existing building was constructed in 1958 and historical use of the Property has included the following:

- Prior to 1958: Agricultural farmland
- 1959 to 1961: Assembly of high powered radar exciters and transmitters, reportedly without chemicals
- 1961 to 1963: Office space and growth of silicon crystals using dry processes
- 1963 to 1968: Site vacant
- 1968 to 1992: Assembly of high frequency antenna equipment; processes included cutting steel and aluminum cables, and attaching fittings to make antenna components
- 1992 to Present: Various commercial businesses, including flight simulators, a dentist, and the fitness gym.

The only operation reported to have used chlorinated solvents was the antenna assembly business that operated between 1968 and 1992. The property owner was permitted to store 25 gallons of 1,1,1-trichloroethane (TCA) between approximately 1984 and 1988. A shed for flammable materials storage was present off the southeast corner of the building in 1988. Purchase records indicate 50 or more gallons of TCA purchased between 1985 and 1992. Freon was also reportedly purchased for use at the Property, in 5-gallon cans, for application to cleaning rags.

Cleaning of aluminum parts using retail detergent and water, with discharge to the public sewer, was also reported. The Property currently has one sanitary sewer connection extending west from the building and connecting to a main line under North Shoreline Boulevard. No use or storage of trichloroethene (TCE) or tetrachloroethene (PCE) was reported at the Property (REI 2016).

4. Summary of Available Data

As summarized in the REI Report, environmental assessments were conducted at and adjacent to the Property between the late 1980s and 2014. These investigations assessed whether releases of VOCs had occurred at the Property and evaluated soil and groundwater quality. Historical sampling locations at the Property were concentrated around the building. The 2016 environmental investigation and assessment activities, conducted with the objective of attaining site closure, collected data covering all areas of the Property through the use of a grid system.

The REI Report presents a summary of available data from the property, as well as data from other nearby properties, to evaluate how VOC concentrations in soil and groundwater at the Property relate to concentrations reported at other nearby properties. Data collected from the Property and upgradient areas, as identified in the REI Report, are summarized below and discussed in Section 5. Groundwater data associated with monitoring of the VOC plume in the North Bayshore Area are also included in the summary.

Upgradient Data (south/southwest of the Property)

From the southern adjoining property, 1599 and 1601 North Shoreline Blvd (also part of the Space Park Way Site):

- Groundwater samples collected from five borings (PES Environmental, Inc. [PES] 1994)
- Soil and groundwater samples collected from eight borings (reportedly documented in a 2006 Supplemental Environmental Testing Report).

From approximately 300 feet upgradient of the Property, in the vicinity of 1360 L'Avenida (RWQCB Case# 43-1821) and 1401 North Shoreline Boulevard (RWQCB Case#T0608502118):

- Groundwater samples collected from 3 monitoring wells and 15 borings in the Shallow groundwater zone (reportedly documented in a Preliminary Site Assessment dated 1988 and a Soil and Groundwater Testing Report dated 1993)
- Soil sampling from at least 13 locations (reportedly documented in a Preliminary Site Assessment dated 1988 and Soil and Groundwater Testing report dated 1993).

From along Plymouth Street, southwest (crossgradient/upgradient) of the Property:

- Routine groundwater sampling from Shallow zone extraction wells E-4, E-5, and E-6 and Intermediate zone extraction wells E-11 and E-12, documented in reports associated with the Superfund Site (e.g., Arcadis 2016a and 2016b)

- Intermediate zone groundwater well GMW-2I was installed at the intersection of North Shoreline Blvd and Plymouth Street (adjacent to and crossgradient of the Property) and was sampled in 2016 (Arcadis 2016b).

On-Site Property Data

- Four Shallow zone groundwater samples (PES 1994)

- Twenty-two soil borings with 43 soil samples ranging from 2 to 10 feet below ground surface (bgs) (Phase II Soil Investigation report dated 1995)

- Eight boring locations with 20 soil samples ranging from 2 to 15 feet bgs and 8 Shallow zone groundwater samples (Phase II Soil Investigation dated 2012)

- Twelve borings locations with 18 soil samples ranging from 1.5 to 11 feet bgs and 5 Shallow zone groundwater samples (2014 report included as Appendix A of REI 2016)

- Forty boring locations with 80 soil samples ranging from 2 to 6 feet bgs, 40 Shallow zone groundwater samples, and 40 soil vapor samples (REI 2016).

Downgradient Data (north of the Property)

- Routine groundwater sampling from Shallow zone well W-3 and Intermediate zone well E-13, both of which are approximately 50 feet downgradient of the Property (Figure 1) (e.g., Arcadis 2016 a and 2016b)

5. Discussion of Analytical Results

Soil

Soil samples collected between 1994 and 2016 have indicated detectable TCE and PCE concentrations in surface and subsurface soil, indicating that these solvents were likely used at the Property. However, out of more than 160 samples collected from the Property, only one reported concentration exceeded the Tier 1 Environmental Screening Levels (ESLs) promulgated by the RWQCB (most recent update in February 2016). The reported Tier 1 ESL exceedance was for PCE in one subsurface soil sample collected from below the groundwater table in 2012. Recent data (2016) indicate that soil concentrations of TCE and PCE, ranging from 3.7 to 46 micrograms per kilogram (µg/kg), are at least an order of magnitude less than the Tier 1 ESLs.

The majority of soil samples with detections of TCE and PCE, including the one with a reported ESL exceedance, were collected from locations under the building and outside the southeast corner of the building, in the general vicinity of the flammable materials storage shed that was reportedly present in 1988.

Shallow Groundwater

Results from groundwater samples collected from shallow borings between 1994 and 2016 identified detectable concentrations of TCE and PCE in Shallow zone groundwater located upgradient, beneath, and downgradient of the Property. Exceedances of the Tier 1 ESLs for TCE (5 micrograms per liter [µg/L]) and PCE (3 µg/L) were reported throughout this period.

Historically, TCE concentrations detected in Shallow zone groundwater downgradient of the Property have been similar to concentrations detected in Shallow zone groundwater upgradient of the property, indicating that the primary source of TCE is upgradient of the Property, and the Property is unlikely to be an ongoing source of TCE to Shallow zone groundwater. This is supported by an evaluation of the more recent data presented in the REI Report (REI 2016) and the draft Focused Feasibility Study for the Superfund Site (Arcadis 2016a), which also suggest that the Property does not appear to be contributing TCE to Shallow zone groundwater.

The 1994 report of potential sources of groundwater contamination at the Space Park Way Site also reported elevated PCE concentrations in Shallow zone groundwater, with the highest concentrations detected beneath the Property (PES 1994). Review of available data from 1994 to 2016 indicate that the Property may in fact be a contributor of PCE to Shallow zone groundwater, as upgradient concentrations have been reported at less than 15 µg/L, whereas PCE concentrations in groundwater beneath the Property are up to 170 µg/L. Because the 2016 investigation only included sampling from under the Property, the results do not allow comparison to the current condition of groundwater under adjacent properties. Additionally, the most likely source of PCE on the Property appears to be along the upgradient border, southeast of the building, in the vicinity of the former shed. Data from Shallow groundwater upgradient of the Property is therefore necessary to further assess the whether the Property acts as an ongoing source of PCE.

Intermediate Groundwater

Intermediate zone groundwater TCE concentrations in the vicinity of the Property are higher than concentrations in the Shallow zone, and also higher than upgradient concentrations. Before pumping of nearby extraction wells began in 1990, the TCE concentrations in three Intermediate wells located less than 100 feet downgradient of the Property, including well E-13, were more than 3,000 µg/L, three times the Shallow zone concentrations, and an order of magnitude greater than concentrations in crossgradient/upgradient Intermediate wells. This increase in TCE concentrations downgradient of the Property, relative to crossgradient/upgradient, appears to be the primary rationale for identification of the Space Park Way Site as an off-property source of VOCs.

No samples of groundwater from the Intermediate zone have been collected from under the Property or immediately upgradient of the Property to the southeast. As part of the 2016 *North Bayshore Area Plume Extent Investigation Summary Report* (Arcadis 2016b), produced on behalf of the companies responsible for remediation associated with the Superfund Site, Intermediate zone groundwater monitoring well GMW-2I was installed adjacent to and crossgradient (south-southwest) of the Property, along North Shoreline Blvd (Figure 1). Groundwater samples collected from this well in July 2016 contained less than 1 µg/L TCE, whereas the TCE concentration in well E-13, downgradient of the Property, was 380 µg/L in June 2016.

Compared to data from more than 20 other Intermediate zone wells in the North Bayshore Area, well E-13 had the highest reported concentrations during the 2015 and 2016 sampling events. TCE concentrations in this extraction well, located at the eastern mid-plume edge of the North Bayshore Area TCE plume, are therefore higher than the concentrations along the longitudinal axis of the plume associated with the Superfund Site. This suggests an additional source of TCE along the eastern edge of the plume; however, the available data are not sufficient to identify whether the Property is responsible for these observed concentrations.

Soil Vapor

The soil vapor results from the REI Report identified detectable concentrations TCE and PCE at the Property, with one PCE concentration near the southeast corner of the building exceeding the commercial/industrial ESL (REI 2016).

6. Assessment of Property Owner's Interpretation of Available Data

The REI Report suggests that contaminant concentrations observed in soil at the Property are related to vapor deposition and/or capillary rise into the vadose zone from impacted groundwater (REI 2016). However, the report does not present any evidence or calculations to substantiate the claim that PCE concentrations exceeding 50 µg/kg at depths of 1.5 to 4 feet bgs could result from these sources, given that the groundwater table is located at depths of 7 to 10 feet bgs. The report also points to PCE detections in upgradient soil and shallow groundwater from the adjacent property to the south, as evidence that the PCE is derived from a limited source to the south/southeast of the Property. However, reported PCE concentrations in both soil and groundwater from the Property are higher than the reported PCE concentrations from the upgradient property to the south.

Based on an assessment of groundwater elevations in the vicinity of E-13, and the differing concentrations of contaminants detected in Shallow and Intermediate groundwater zones, the REI Report concludes that the hydraulic connection between these two zones is not "significant", thereby suggesting that a release at the Property is unlikely to be the source of Intermediate zone groundwater contamination. However, EA believes that a release of pure TCE to the subsurface in this vicinity could migrate downward through the aquifer zones and clay layers to result in Intermediate zone contamination, independent of hydraulic connectivity.

The REI Report asserts that TCE in Shallow and Intermediate zone groundwater is migrating under the Property from broad upgradient sources, with plumes that extend to the south and west upgradient of the Property (REI 2016). The report describes deposits of sand with gravel that suggest preferential streams/paleo channels within the Shallow zone, and references a 1993 investigation of upgradient properties (Aquifer Sciences, Inc. 1993). The 1993 investigation identified similar paleo-channels in both the Shallow and Intermediate zones, including two distinct streams/paleo channels about 300 feet upgradient of the Property in the Intermediate zone. The REI Report asserts that complex variations in groundwater flow direction may exist due to these preferential pathways (REI 2016). Although the REI Report did not include a figure depicting these channels, a graphic (Figure 2) was provided separately by Jon Rosso, in an email to Roger Papler of the RWQCB, dated 8 September 2016. This figure depicts roughly north-south-oriented channels in the Upper Intermediate groundwater zone that appear to trend toward the Property (identified on the figure as "Site"). However, no evidence has been provided to indicate that channels in the Lower Intermediate (or Shallow) zones follow a similar alignment.

Figure 3 shows an interpretation of the subsurface stratigraphy, via a roughly east-west cross section in the vicinity of the Property. This depiction shows the distinct and higher concentrations of TCE (larger orange dots) in the Intermediate zone relative to the Shallow zone. Note that the data available data do not appear to support the patchy nature of TCE contamination in the Shallow zone that is depicted in the cross section. The cross section also indicates that well E-13 is screened across the Upper and Lower Intermediate zones. Thus, the report indicates that the high TCE concentrations observed in well E-13 are the result of high TCE concentrations in a preferential flow channel in the Lower Intermediate zone, similar to the channels depicted on Figure 2. However, data from the Lower Intermediate zone that might help confirm this hypothesis are very limited. Jon Rosso's email to Roger Papler on 8 September 2016 indicates that well P-3 (not depicted on Figure 3), which had reported historical TCE concentrations similar to those reported in well E-13, is screened in the Lower Intermediate zone. Thus, Mr. Russo concluded in his email that "the source(s) of TCE that affects well E-13 is significant, migrating through a deep and highly permeable channel in the separate and distinct Lower Intermediate zone, and originating somewhere other than the [Property]."

7. Discussion and Data Gaps

Based on review of the documentation made available to EA, it does not appear that the source(s) of contamination within the Space Park Way Site have been identified. Despite extensive shallow soil and groundwater sampling conducted onsite, available data are not sufficient to conclusively determine whether the Property is contributing to VOC concentrations exceeding the Tier 1 ESLs in Shallow and/or Intermediate zone groundwater in the vicinity of the Space Park Way Site.

Installation and sampling of clustered wells screened in the Shallow, Upper Intermediate, and Lower Intermediate groundwater zones along the upgradient and downgradient edges of the Property would provide strong evidence of whether concentrations increase beneath the Property, or whether the contamination originates from an upgradient source as asserted. For example, if shallow groundwater samples from a clustered well installed to the south (upgradient) of the southern Property boundary contain PCE concentrations of the same magnitude as those reported

beneath and downgradient of the Property, this would provide evidence for an upgradient source of PCE. If Lower and/or Upper Intermediate zone groundwater samples collected from along the northern (downgradient) and southern (upgradient) property boundaries indicate similar TCE concentrations, this would similarly provide evidence that the Property is not a significant source of TCE to the North Bayshore Area plume.

Collection of groundwater samples from upgradient and downgradient of the Property for compound-specific isotope analysis could also help determine whether a distinct source of TCE and/or PCE has been introduced to groundwater beneath the Property.

Additionally, in order to adequately characterize contaminant distribution in the Lower Intermediate zone, it may be necessary to conduct additional investigation into the geometry of the buried channels that are reported to act as preferential flow pathways in the vicinity of the Property.

8. References Cited

Aquifer Sciences, Inc. 1993. Soil and Groundwater Testing, Former Coastside Nursery and Adjacent Properties, Mountain View, California. 7 January.

Arcadis. 2016a. *Draft Revised Focused Feasibility Study, Former Spectra-Physics and Former Teledyne Semiconductor Sites, Mountain View, California.* Prepared for TDY Industries, LLC, Thermo Fisher Scientific, Inc. February.

———. 2016b. *North Bayshore Area Plume Extent Investigation Summary Report*. Prepared for TDY Industries, LLC, Thermo Fisher Scientific, Inc. September.

LFR Levine•Fricke. 1991. *Revised Proposed Nonbinding Preliminary Allocation of Responsibility*. May 8.

PES Environmental, Inc. (PES). 1994. *Investigation of Potential Sources of Groundwater Contamination, Space Park Way and North Shoreline Boulevard, Mountain View, California.* Prepared for the Regional Water Quality Control Board on behalf of Teledyne Semiconductor and Spectra-Physics Lasers. 29 July.

Rosso Environmental, Inc. (REI). 2016. *Environmental Assessment and Investigation, 1625 North Shoreline Boulevard, Mountain View, Santa Clara County, California*. Prepared for Shashi Group LLC. July.

Figure 1: Site Location
(base figure from REI 2016)

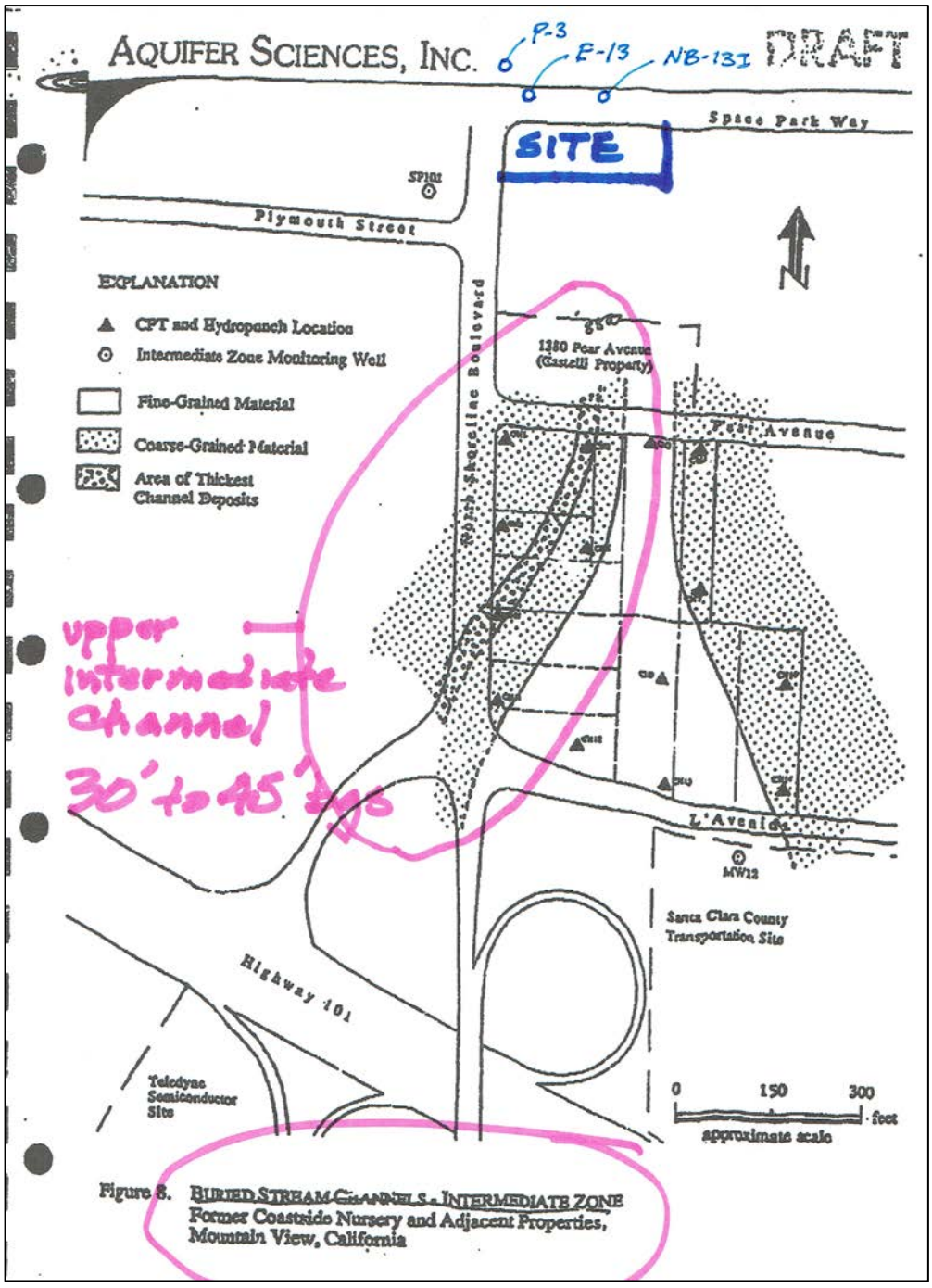

Figure 2: Buried Channels
(base map from Aquifer Sciences 1993; marked up figure provided by Jon Rosso via email, 8 September 2016)

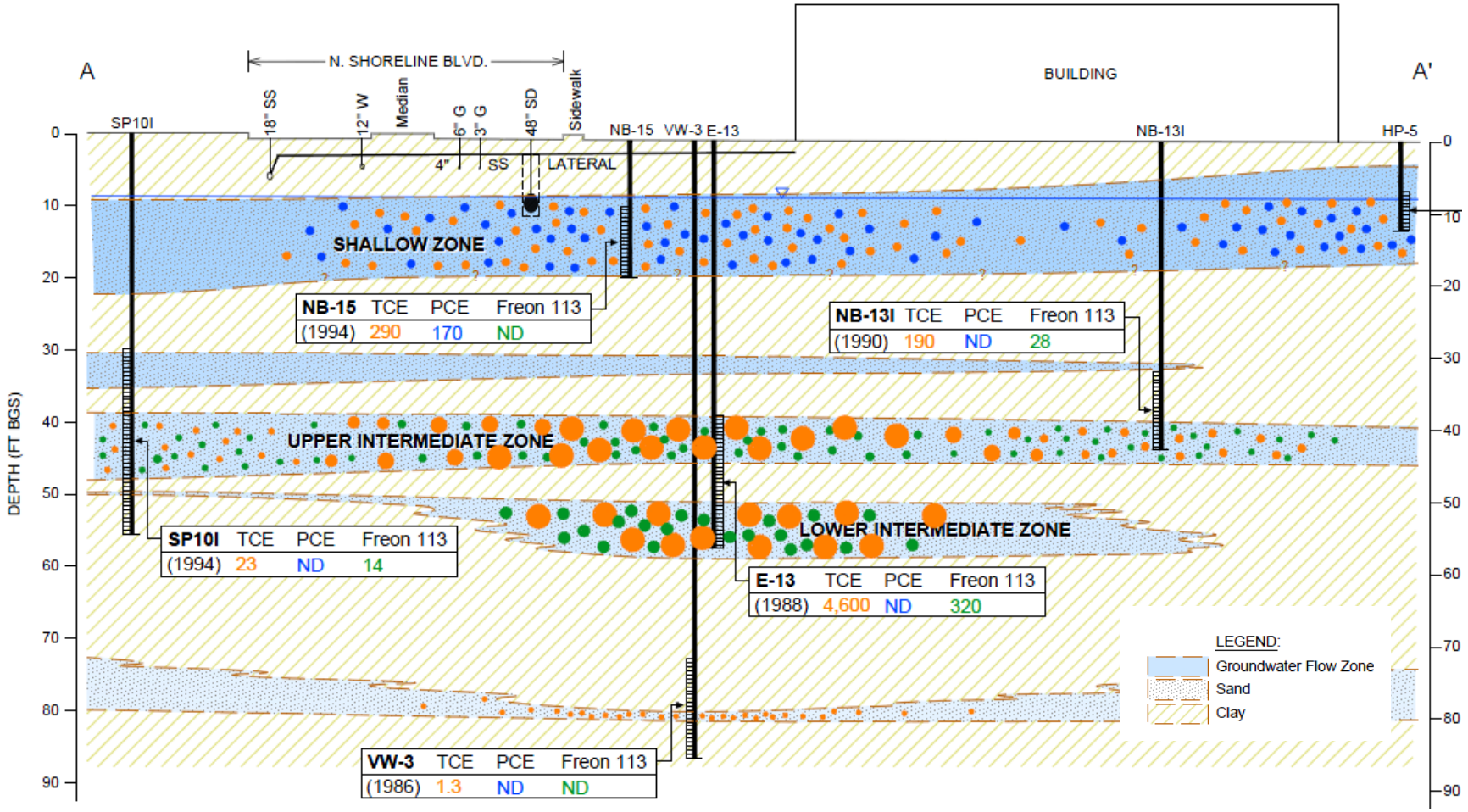

Figure 3: Cross Section
orange dots = TCE, blue dots = PCE, green dots = Freon 113
(from REI 2016)