WORK PLAN

FINAL INTERIM CORRECTIVE MEASURE WORK PLAN

SOLID WASTE MANAGEMENT UNIT S: FORMER B001 WASTE TCA TANKS

Former IBM Kingston Facility
Site #356002
Order on Consent Index No. D3-10023-6-11

Submitted To: New York State Department of Environmental Conservation
Bureau of Hazardous Waste and Radiation Management
625 Broadway
9th Floor
Albany, NY 12233-7250

Submitted By: International Business Machines Corporation
8976 Wellington Road
Manassas, VA 20109

Distribution:

2 Copies	NYS Dept. of Environmental Conservation (2 bound, 3 e-copies)
1 Copy	NYS Dept. of Health (1 bound copy, 2 e-copies)
1 Copy	International Business Machines Corporation (1 bound copy, 1 e-copy)
	TechCity Properties (1 bound copy, 2 e-copies)
	O'Brien & Gere (1 bound copy, 1 e-copy)
	TRS Group Inc. (1 e-copy only)
	ERM Inc. (1 e-copy only)
2 Copies	Golder Associates Inc.

September 2014 **Project No.: 083-87071.05**

A world of capabilities delivered locally

Table of Contents

List of Figures

List of Appendices

1.0 INTRODUCTION

Golder Associates Inc. (Golder) prepared this Interim Corrective Measure Work Plan (ICM Work Plan), on behalf of International Business Machines Corporation (IBM), for the in situ thermal desorption (ISTD) interim corrective measure (ICM) selected to address a continuing groundwater source area identified at Solid Waste Management Unit (SWMU) S: Former Building B001 Waste 1,1,1-Trichloroethane (TCA) Tanks (SWMU S) at the former IBM Kingston Facility (site), located at 300 Enterprise Drive, Kingston, Ulster County, New York (see Figure 1).

This final ICM Work Plan was developed in accordance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation-10 (DER-10) guidance and is based upon the findings of the alternatives analysis presented in the *Supplemental Feasibility Study: Solid Waste Management Unit S: Former B001 Waste TCA Tanks* (SWMU S FS), dated March 21, 2013, the 30%-level design description of the SWMU S ICM provided by the ISTD contractor as presented in the *Basis of Design–ISTD Remedy–SWMU S Letter*, dated September 11, 2013 (30% BOD), and comments received from NYSDEC on the *Interim Corrective Measure Work Plan: SWMU S Former B001 Waste TCA Tanks,* dated June 6, 2014 (90% BOD).

1.1 Site Description and Background

The site is located north of the City of Kingston in the Town of Ulster, Ulster County, New York and is bounded by John M. Clarke Drive and Route 9W to the east, Old Neighborhood Road and Route 209 to the north, Esopus Creek to the west, and Boices Lane to the south (see Figure 2). The portion of the site located east of Enterprise Drive is referred to as the East Campus and includes the majority of the buildings at the site, many of which are vacant. The approximately 258-acre property was first developed by IBM from farmland during the 1950s. IBM's primary activities included the manufacturing of electric typewriters and the development, manufacture and testing of computer systems and related components and technologies. IBM ceased operations during the early-1990s and the property was subsequently subdivided into multiple parcels. In 1998, IBM sold the site to AG Properties of Kingston, LLC and Ulster Business Complex, LLC. The site is currently managed by TechCity.

The entire site was previously listed as a Class 4 Site (Site # 356002) in the Registry of Inactive Hazardous Waste Disposal sites in New York State and was managed in compliance with an October 4, 1996 Hazardous Waste Management Permit #3-5154-00067/00090 (Part 373 Permit) until Administrative Order on Consent Index No. D3-10023-6-11 (Order) was signed with NYSDEC by IBM and TechCity (the Respondents) on July 8, 2011. The Order supersedes and replaces the former Part 373 Permit, and divides the site into ten Operable Units (OUs), as illustrated on Figure 2.

Prior to the execution of the Order, IBM completed extensive Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) beginning in the 1990s through 2002 to delineate the occurrence and extent of volatile organic compounds (VOCs) in groundwater beneath the site. The site-wide VOC groundwater plume comprises three distinct groundwater plumes (GSC, 1997a) that have been described as follows (Figure 3):

- **North Parking Lot Area Plume (NPLA):** located to the north of Buildings B001 and B003, primarily composed of trichloroethylene (TCE) and TCA, and to a lesser degree tetrachloroethene (PCE). Based on previous investigations, the primary historical source appears to be associated with sections of the Industrial Waste (IW) sewer lines north of Building B001 and Building B003 (i.e., SWMU T and SWMU U).
- **Building B005 Plume:** located beneath Buildings B001, B002, B003, B004 and B005, primarily composed of TCE and TCA. The plume is believed to have originated from historical manufacturing activities in Buildings B001, B003, B004 and B005S. The primary historical source appears to be associated with the IW sewer lines located in Building B003 (i.e., SWMU M) and SWMU S.
- **Industrial Waste Treatment Facility (IWTF) Plume:** located in the vicinity of the former IWTF near Building B036, primarily composed of low-level concentrations of TCE and TCA. The residual VOCs observed in groundwater in this area are not likely to have originated from the IWTF, but are believed to have migrated from the NPLA plume on the eastern campus along the permeable bedding material associated with the underground utility pipes prior to the installation of the utility trench barrier wall (see Figure 2).

Corrective measures implemented by IBM prior to the execution of the Order include the operation and maintenance of a perimeter control system that intercepts the site-wide groundwater plume. The perimeter control system consists of two stormwater sewer systems, an unsaturated portion of the Surficial Sand Unit that underlies the western portion of the site, a utility trench barrier wall, and a groundwater collection system (see Figure 2). IBM currently performs groundwater quality monitoring to evaluate the effectiveness of the existing corrective measures (GSC, 1993).

The majority of groundwater impacts at the site are interpreted to originate beneath Operable Unit 3 (OU-3) which comprises the former IBM manufacturing areas (see Figure 3) and is restricted to future commercial use as defined by the Order. Currently active SWMUs in OU-3 include the following:

- M: Portions of the IW Sewer Lines (B001 and B003)
- S: Former Waste TCA Tanks (B001)
- T: Former Waste Oil Tank (B003)
- U: North Parking Lot Area Plume

The Order requires supplemental investigations of accessible SWMUs to evaluate for the potential presence of remaining sources of VOC impacts to groundwater. Pursuant to the Order, IBM undertook supplemental remedial investigations in accessible areas to better define the nature and extent of soil and groundwater impacts at remaining SWMUs, including SWMU S in October 2011 and March 2012. Specifically, the Order requires the Respondents to “delineate and evaluate source removal” in the SMWU S area.

The results of the SWMU S Supplemental Remedial Investigation (SRI), as documented in the *SWMU S Supplemental Remedial Investigation Report* (SRIR, Golder 2012a), included identification and delineation of a dense (i.e., a liquid with a greater density than water) non-aqueous phase liquid (DNAPL) source area, predominately composed of TCA, approximately 90-feet long and approximately 40-feet wide located largely beneath Building B001. The presence of DNAPL is attributed to the downward migration of solvent from the former waste tank infrastructure to the southeast along the slope of the contact between the Surficial Sand Unit and the Transition Zone, where it then accumulated within a localized depression identified in the lower-permeability Transition Zone soils beneath Building B001 (Figure 4). The results of the SWMU S SRI are presented in the SWMU S SRIR and are further summarized in Section 3.0.

1.2 Purpose and Objective

The purpose of this final ICM Work Plan is to present the 100%-level Basis of Design (BOD) provided by the ISTD contractor that will be implemented as the SWMU S ICM to achieve the remedial action objective (RAO), that is *"to remove and/or treat DNAPL located in the SWMU S area (to the extent practicable) that serves as a source of impact to downgradient groundwater"*. In addition to achieving the RAO, the ISTD contractor will be required to demonstrate that concentrations of SWMU S compounds of concern in soil within the treatment area meet NYSDEC Subpart 375-6 Soil Cleanup Objectives for Commercial Use.

Potential exposure pathways to human receptors identified at the site include dermal absorption, ingestion, and/or inhalation of VOC-impacted soil or groundwater. Potential exposure pathways to environmental receptors include groundwater migration to surface water bodies. The combination of corrective measures previously implemented by IBM and the institutional and engineering controls required by the Order eliminate the potential threats to human health and the environment posed by the direct contact, vapor intrusion, and groundwater ingestion pathways in OU-3 and the SWMU S area. However, the DNAPL identified in the subsurface in the SWMU S area serves as a continuing source of dissolved-phase VOC impacts to groundwater within and downgradient of OU-3.

Therefore, consistent with the Order, the SWMU S FS established the SWMU S ICM RAO and evaluated potential remedial alternative technologies considered capable of achieving the RAO (i.e., in-situ chemical oxidation, in-situ chemical reduction, and ISTD). Based upon the review of these remedial alternatives, IBM recommended implementation of ISTD using electrical resistance heating (ERH) technology to meet the RAO for the SWMU S area based on the following FS findings:

- ISTD has the shortest implementation schedule
- ISTD is likely to achieve the RAO for SWMU S in a single treatment and can typically be implemented without pilot testing, therefore expediting remedy implementation

- Remedy effectiveness can be evaluated shortly after treatment completion

The selection of ISTD as the preferred ICM, the identification of the RAO for the SWMU S ICM, and the schedule for implementation following receipt of access to the area by the property owner were presented in the 30% BOD that was approved by NYSDEC and the New York State Department of Health (NYSDOH) in a letter dated April 8, 2014 (Appendix A). NYSDEC's April 8, approval letter required submittal of a 90% BOD to NYSDEC, which was submitted on June 6, 2014. NYSDEC provided comments to the 90% BOD during a meeting with IBM on July 31, 2014. IBM documented and responded to the meeting comments in a letter to NYSDEC dated August 14, 2014. NYSDEC subsequently approved IBM's comment response letter in an e-mail dated August 26, 2014 and requested that modifications be incorporated into a final ICM Work Plan to be re-submitted to NYSDEC.

This final ICM Work Plan, prepared in accordance with guidelines presented in NYSDEC DER-10 Section 5.3 and 6 New York Codes, Rules, and Regulations (6NYCRR) Part 375 *Environmental Remediation Programs,* presents the 100% BOD, summary descriptions of the design components that comprise the ISTD system, the associated monitoring requirements to evaluate ISTD system performance and the monitoring requirements to evaluate the potential for environmental impacts to receptors during implementation of the ICM, including:

- A history of the site and the SWMU S area
- A summary of the Conceptual Site Model
- A detailed description of the ICM, including:
  - The location and description of temporary treatment units necessary to implement the ICM
  - A description of vapor control and air monitoring procedures to be implemented during ICM activities
  - A description of ICM performance and confirmation sampling
  - An ICM-specific health and safety plan
  - A description of procedures for demobilizing and dismantling temporary structures and/or equipment and a site restoration plan
- An ICM Contingency Plan
- A proposed a schedule for ICM implementation

Section 2.0 of this final ICM Work Plan presents a summary of the history and use of the SWMU S area. Section 3.0 presents the Conceptual Site Model and summarizes key findings of the SWMU S SRI (Golder 2012a). Section 4.0 presents a comprehensive description of the selected remedial technology and the approach to implementing the ICM. Section 5.0 presents the ICM Contingency Plan and Section 6.0 summarizes the reporting activities that will be performed throughout ICM implementation. Section 7.0 summarizes the necessary permits and/or authorizations, Section 8.0 presents a general schedule for ICM implementation, and Section 9.0 identifies the roles and responsibilities of the Project Team.

2.0 SWMU S DESCRIPTION AND HISTORY

SWMU S includes a former 4,000-gallon TCA waste underground storage tank (UST) and associated 1,000-gallon supply UST (TCA tanks), which were co-located on the west side of Building B001 north of Building B021, between Buildings B001 and B023 (see Figure 4). The steel tanks were installed circa 1955 and were used in the manufacture of printed circuit cards through 1967. TCA was pumped into Building B001 from these tanks for use in multiple manufacturing operations, including use by the operation known as the "carousel", a series of solvent-filled dip tanks located in northern Building B001, and the TCA Recovery Unit (SWMU AB)[1], located on the concrete floor along the western wall of Building B001 (see Figure 4).

The former TCA tanks area was initially investigated using a gridded soil gas survey performed by Groundwater Sciences Corporation (GSC, 1996) that included installation of temporary groundwater monitoring wells. TCA and associated degradation compounds (i.e., 1,1-dichloroethene [1,1-DCE] and 1,2-dichloroethane [1,2-DCA]) were detected during this investigation. Elevated concentrations of TCA in groundwater were subsequently detected in a temporary monitoring well (TMP-8) located approximately 400 feet downgradient of the TCA tanks.

To further investigate the Building B001 area downgradient of SWMU S, GSC installed five monitoring wells (MW-275S through MW-279S) in 1996. Soil samples collected from the borings for these wells were analyzed for VOCs. Analytical results from vadose zone soil samples did not indicate constituent levels above applicable NYSDEC criteria (GSC, 1997b). Analytical results for groundwater samples collected from these wells indicated constituent concentrations greater than applicable New York State Groundwater Quality Standards (NYSGWQS).

Based upon the continued detection of elevated dissolved-phase TCA concentrations in groundwater samples collected downgradient of SWMU S and pursuant to requirements in the Order to perform a supplemental investigation to evaluate the potential for a source of VOC impacts to groundwater in the vicinity of SWMU S, IBM initiated the SWMU S SRI that resulted in the identification of DNAPL beneath Building B001 as described further in Section 3.0.

[1] SWMU AB was investigated concurrently with the March 2012 SWMU S investigation in accordance with the NYSDEC approved 2009 *RCRA Facility Investigation Work Plan Solid Waste Management Unit AB: Former B001 TCA Waste Recovery Unit*. Investigation results and findings for SWMU AB were presented to NYSDEC in the *Supplemental Remedial Investigation Report: Solid Waste Management Unit (SWMU) AB: Former B001 TCA Recovery Unit* dated October 31, 2012 (Golder, 2012b).

3.0 SWMU S CONCEPTUAL SITE MODEL

Pursuant to requirements in the Order, IBM retained Golder to conduct a supplemental remedial investigation to better evaluate soil and groundwater impacts near SWMU S. The following describes the conceptual site model specific to the SWMU S area developed based on the results of the SWMU S SRI.

SWMU S is located within the central portion of the East Campus where the Surficial Sand Unit ranges in thickness from approximately 17 to 25 feet. The absence of the intermittent silty-clay zones, observed in the Surficial Sand Unit in other areas of the site, allowed DNAPL to migrate from the former TCA tanks infrastructure through the Surficial Sand Unit to the contact with the Transition Zone and/or the Varved Clay Units.

The Transition Zone in the vicinity of SWMU S consists of generally finer-grained sediments (i.e., a greater percentage of clay than silt) and is generally denser than observed in other areas of the site; however localized areas of greater sand content were observed. Diffusion of VOCs into the Transition Zone appears limited and DNAPL is prevented from further vertical migration by the low permeability of the base of the Transition Zone.

In SWMU S, the upper portion of the Varved Clay Unit (i.e., within 10 feet of the contact with the Transition Zone) consists of gray plastic clay with variable amounts of fine sand above the typically red-brown and gray clay generally observed in other areas of the site. The Varved Clay Unit, which serves as an aquitard where present across the site, was typically encountered between 23 to 28 feet below ground surface (feet bgs) in the SWMU S area, with greater or lesser depths of first occurrence in localized areas.

The base of the Surficial Sand Unit (i.e., the top of the Transition Zone) and the top of the Varved Clay Unit dip to the south and east of the former SWMU S tanks and create a localized depression north of Building B021 that extends to the northeast under Building B001 (see Figure 4). The geometry of these lithologic units (see Figure 5) strongly influences the migration and occurrence of DNAPL, which in turn influences the distribution of dissolved-phase VOC impacts in and downgradient of the SWMU S investigation area, as DNAPL has the tendency to migrate under gravitational forces through unsaturated and saturated porous media and then accumulate and spread laterally when encountering lower permeability material.

As identified in the SWMU S SRI, DNAPL, composed predominately of TCA, is located in an area estimated as approximately 90-feet long and 40-feet wide (Figure 5). The presence of DNAPL was indicated by positive hydrophobic dye testing results, observations of NAPL in purge water collected from monitoring wells and detections of TCA in groundwater samples at concentrations greater than 25% of the single component solubility threshold of TCA in an area comprising approximately 2,500 square feet

[ft^2]). The DNAPL is attributed to a release from the former TCA tanks infrastructure that migrated downward and to the southeast along the slope of the contact between the Surficial Sand Unit and the Transition Zone, where it then accumulated within a localized depression observed in the lower-permeability Transition Zone soils beneath Building B001.

The highest total VOC concentrations in groundwater (i.e., greater than 200,000 micrograms per liter [µg/l]) were detected in samples collected within the Transition Zone south and east of the former waste TCA tank, immediately adjacent to areas of observed or suspected DNAPL. Total VOC concentrations attenuate rapidly within the Transition Zone and Varved Clay Unit indicating the vertical diffusion of VOCs into the Transition Zone and/or Varved Clay Unit is limited (i.e., generally less than two vertical feet) in areas where DNAPL is present.

The DNAPL provides a source of dissolved-phase impacts to groundwater in the vicinity and downgradient of SWMU S. Historical detections of TCA in groundwater samples collected from monitoring wells located more than 400 feet downgradient of the SWMU S area at concentrations greater than 300 µg/l are attributed to the presence of the DNAPL in the SWMU S area. The reported detections of 1,1-dichloroethane (1,1-DCA), 1,1-DCE, and 1,2-DCA in the groundwater sample collected from a well located downgradient of the DNAPL is attributed to degradation of TCA, the primary DNAPL component.

4.0 ICM DESCRIPTION AND DESIGN

The following sections describe the ISTD technology selected as the ICM for SWMU S. Engineering design drawings, including environmental monitoring component construction details, are included in Appendix B. ISTD system construction and operation will be conducted in accordance with the Health and Safety Plan (HASP) prepared by O'Brien & Gere, included as Appendix C, and the ICM-specific Community Air Monitoring Plan (CAMP) and the Performance Monitoring and Waste Management Plan (PMWM Plan), included as Appendices D and E, respectively.

4.1 In-situ Thermal Desorption

The ISTD ICM is designed to remove DNAPL and treat associated impacted soil and groundwater via contaminant hydrolysis and volatilization, soil vapor extraction, increased biological degradation and chemical dechlorination. ISTD will be implemented by TRS Group, Inc (TRS) utilizing ERH. Primary components of the SWMU S ISTD system include:

- The ERH electrode array
- A vapor control and treatment system
- An hydraulic control and treatment system

The 100% BOD developed by TRS, included as Appendix B, provides an engineering level description of each of these ISTD treatment system components. The proposed layout of the primary ISTD system components is illustrated on Figure 6.

ERH introduces a flow of electrical current between electrodes installed in the subsurface to elevate subsurface temperatures to up to 100 degrees Celsius [°C] using the natural resistance of subsurface materials (i.e., sands, silts, and clays). Heating of the soil vaporizes groundwater, soil moisture, and constituents of concern. The resulting steam acts as a carrier gas that transports VOCs to the vapor recovery system wells. The captured steam and VOCs are cooled, phase separated, and then treated utilizing activated carbon.

Volatilization and hydrolysis are the primary mechanisms through which contaminants are treated during the ERH process. The DNAPL observed in the SWMU S area is predominantly composed of TCA, a chlorinated alkane that readily undergoes hydrolysis (i.e., the chemical decomposition process by which a chemical reacts with water and produces other compounds) at the induced temperatures created by the ERH system. Liquid TCA azeotropically boils at 65 ºC when in contact with water and TCA has a degradation half-life (i.e., the time required for the measured quantity of a compound to decrease by half) of approximately one day at a temperature of 65ºC. Therefore, hydrolysis and azeotropic boiling of TCA will occur simultaneously.

Three-phase 220-volt electricity will be obtained from the municipal utility provider and routed to a power control unit that will utilize 60-hertz utility transformers to distribute electrical current through the subsurface electrode array installed in the treatment area. The electrode array has been designed such that adjacent electrodes are in electrical contact but out of phase with each other, causing the electrical current to flow between adjacent electrodes. Heat is generated by the intrinsic resistance to the flow of electrical current by native subsurface materials. The flow of electrical current heats the subsurface until the compounds are destroyed by hydrolysis or the azeotropic boiling point of the compound is reached and the contaminant is vaporized. Total mass removed will be evaluated by summing the mass of contaminants removed as DNAPL and in the dissolved and vapor phases.

4.2 ICM Implementation

Preliminary mass balance estimates indicate that the ISTD system will need to be operated for approximately 120 days to achieve the RAO. ISTD system operation duration estimates will be modified based on evaluation of system performance data and analytical sample results collected in accordance with the PMWM Plan (Appendix E). Implementation of the ISTD ICM includes the installation of the following components, as illustrated on Figure 6:

- approximately 66 electrodes to distribute energy throughout the treatment area
- six temperature monitoring points to allow for continuous monitoring of subsurface temperatures
- approximately 60 vapor recovery wells to capture and control volatilized contaminants and steam
- seven vacuum pressure piezometers for subsurface vapor pressure monitoring
- four hydraulic control wells to capture groundwater and control the migration of potentially impacted groundwater downgradient of the treatment area
- five sentinel groundwater monitoring wells to monitor the effectiveness of hydraulic

A description of each of the ISTD system components is presented in the following sections. Engineering design drawings are included in Appendix B.

4.2.1 ERH Electrode Array

ERH electrodes will be installed in 12-inch diameter boreholes advanced to depths varying between approximately 25 to 34 feet bgs using hollow stem auger (HSA) drilling techniques. Electrodes installed in the center of the treatment area, where TCA impacts are the highest, will be placed more closely together than electrodes installed on the periphery of the treatment area. A higher density of electrodes in the areas where there is a higher contaminant mass will enable a larger amount of energy to be directed to these areas to increase treatment efficiency. The increased electrode density also provides increased control over the distribution of energy and ensures that the necessary energy to overcome the heat-sink effects of the high groundwater flux (i.e., up to 2 feet per day) in the saturated Surficial Sand

Unit is met. TRS estimates that approximately 1,920,000 kilowatt-hour of electrical energy will be required to achieve the RAO.

Temperature monitoring probes will be installed to a depth of approximately 30 feet bgs using HSA drilling techniques to provide continuous temperature monitoring data. Temperature monitoring points will be constructed using 1.25-inch chlorinated polyvinyl chloride (CPVC) pipe and will include string of temperature sensors that monitor temperatures installed on five foot centers between ground surface and 30 ft bgs. The electrodes and associated piping and cables will be completed above grade.

Vacuum monitoring piezometers will be installed adjacent to each of the temperature monitoring probe locations to a depth of approximately 6 feet bgs using HSA drilling techniques. Piezometers will be constructed of 1.5-inch CPVC well screen and a #3 sand pack. Vacuum piezometers will provide subsurface pressure monitoring capabilities to confirm that negative pressure is maintained for capture of the steam vapors generated during ISTD treatment system. A concrete seal will be used to isolate the piezometer screen from the overlying casing. Caps will be glued to the top of each piezometer casing and valve hose-barb fittings will be installed into each cap to facilitate the collection of vacuum readings utilizing a digital manometer.

4.2.2 Vapor Control System

The vapor control system will consist of approximately 60 vapor recovery wells, a vapor collection and treatment system, and associated piping and controls. Vapor recovery wells will be installed to a depth of approximately 25 feet bgs using HSA drilling techniques and will be constructed of 4-inch perforated CPVC pipe. TRS estimates a recovered airflow of 800 standard cubic feet per minute (scfm) and a steam recovery rate of approximately 300 to 350 scfm during ISTD system operation. Vapor recovery well piping will be constructed of chemical-resistant hoses and fiberglass piping. The chemical resistant hoses and fiberglass piping will be converted to CPVC piping for pipe sizes of four-inch diameter or greater.

The vacuum will be provided by a 40 horsepower positive displacement blower. Recovered vapors will be passed through a condenser, a heat exchanger, and two cooling towers. An automatic shutdown alarm will be incorporated into the vapor control system that will de-energize the system in the event that a low vacuum is detected in the manifold to the electrode array. As an additional precautionary measure, a bypass damper will be installed on the main header of the vapor treatment system outside Building B001 such that in the event of a treatment system shutdown or blower failure, vapor flow can be temporarily diverted from the treatment system to ambient air until the system is back to normal operation.

Condensed steam will be directed through two knock-out tanks and will be recovered for use as process cooling water. Based on the energy balance, it is anticipated that the volume of water evaporated from the cooling tower may be approximately equivalent to the volume of steam that is condensed. A portion of the recovered condensate will be recycled as drip water at each of the electrodes to help maintain the desired moisture content.

Vapor will be treated using a steam regenerated granular activated carbon (SRGAC) system. Based upon an assumed vapor composition of 98% TCA with the remaining 2% comprising the subsidiary compounds identified in the SWMU S SRIR, the anticipated carbon loading rate is estimated at 8%. The SRGAC system will consist of two 1,400-pound carbon vessels that will operate in alternating cycles. While one unit is used for vapor treatment, the second unit will undergo steam regeneration.

The SRGAC system will include a chilled condenser assembly at the intake of the carbon vessels to adjust the temperature and humidity of the influent vapor stream, if necessary. Each carbon vessel is designed to adsorb approximately 75 pounds of VOCs before it requires regeneration. This assumes that only two-thirds of the available carbon bed is utilized between each cycle. Assuming a maximum contaminant recovery rate of approximately 330 pounds per day (lbs/day), it is anticipated that the SRGAC system may cycle through the regeneration process approximately five times per day. A regeneration cycle consists of a 45 minute steam purge followed by a 30 minute dry-air cool down period. Therefore the total regeneration cycle requires 75 minutes to complete. Based upon the assumed maximum recovery rate (i.e., 330 lbs/day or 13.75 pounds per hour [lbs/hr]), each carbon vessel would be on standby for approximately four hours following a steam regeneration cycle prior to use as the active treatment vessel.

The steam utilized to regenerate the SRGAC vessels will be produced by a propane-fired boiler that will have the capacity to deliver up to 680 lbs/hr of steam. Steam passing through the carbon vessel during regeneration will be condensed in a shell-and-tube heat exchanger and the condensed vapors will be processed through a decanter to separate liquid effluent waste streams (i.e., water and DNAPL). Recovered DNAPL will be transferred to stainless steel storage containers for off-site disposal. Recovered water condensate will be transferred to the front end of the vapor recovery process in a closed-piping system for further processing at the ERH condenser. In addition, the vapor treatment system will include a 2,000-lb vapor granular activated carbon (VGAC) vessel that will provide final contaminant removal on the treated SRGAC effluent air prior to discharge to the atmosphere.

4.2.3 Hydraulic Control System

To reduce the potential for downgradient migration of VOCs during ISTD system operation, hydraulic control of the treatment area will be maintained by the installation of four groundwater recovery wells (Figure 6). Each groundwater recovery well will be installed to a depth of approximately 25 feet bgs using HSA drilling techniques. Groundwater recovery wells will be constructed using 4-inch stainless steel casing and 0.020-inch wire mesh well screen and will contain a pump capable of a five gallons per minute (gpm) removal rate, for a total combined maximum pumping capacity of approximately 15 to 19 gpm. An initial pumping rate of 1.0 to 3.0 gpm per well is anticipated.

The hydraulic control system will include the installation of five sentinel groundwater monitoring wells. Sentinel wells will be installed to a depth of approximately 25 feet bgs using HSA drilling techniques. Sentinel wells will be constructed using 2-inch CPVC casing and 0.020-inch machine-slotted well screen and will include co-located temperature monitoring points constructed of 1-inch CPVC pipe with thermocouples positioned at five foot intervals. The approximate locations of groundwater recovery and sentinel monitoring wells are illustrated on Figure 6.

The effectiveness of the hydraulic control system in creating a zone of capture and controlling the migration of dissolved-phase VOCs downgradient of the ISTD treatment area will be evaluated based on the following data collected from select groundwater monitoring wells:

- Groundwater temperature
- Water table drawdown
- Dissolved-phase concentration of VOCs in groundwater

The hydraulic control system performance monitoring program is included in Appendix E.

Groundwater collected during operation of the recovery wells will be directed through the SRGAC system. Treated effluent will be discharged to the existing Groundwater Treatment System via new subsurface piping prior to discharge under the existing State Pollutant Discharge Elimination System (SPDES) permit. In accordance with site management protocols, discrete depth soil samples will be collected from two and three feet bgs at five locations along the conveyance piping route prior to the installation of the new subsurface piping for soil characterization purposes. Soil samples collected from along the conveyance piping route will be submitted for analysis of the site-specific VOC list and analytical results will be used to evaluate soil reuse and/or disposal options.

4.3 Operation and Performance Monitoring

The following monitoring activities will be conducted during ISTD system operation:

- ERH System Operation Monitoring
- Hydraulic Control System Monitoring
- Vapor Control System Monitoring
- Process Waste Monitoring
- ISTD System Performance Monitoring

Programmable logic controller (PLC)-based control panels will be installed as an element of the ISTD operating system to monitor and control system components based on temperature, pressure and flow through the water and vapor treatment equipment, as well as the status of safety controls such as pressure and level switches, motor operated valves, etc. The control panels will be networked and will convey data to a main PLC, which will record system data. The main PLC logging system will be accessible remotely, allowing the project team to adjust the PLC and monitor system performance. In the event of an ISTD system component alarm or abnormal condition, the PLC will immediately report the alarm and initiate any required actions. The main PLC will be equipped with an autodial capability to notify the system operator and the project team in the event of an alarm or abnormal condition.

The following sections summarize ISTD system operation and performance monitoring activities. A detailed description of performance monitoring activities is presented in the PMWM Plan included as Appendix E

4.3.1 ERH System Operation Monitoring

TRS will perform system startup and testing over an estimated two to four week period. Once system optimization is complete, the application of energy to the ERH system will be continuous, with the exception of system adjustments, routine maintenance, and scheduled soil and groundwater sampling events. TRS will provide an on-site ERH system operator during normal business hours (i.e., Monday through Friday between 8 AM and 5 PM) and will monitor the ERH system remotely outside of normal business hours and on weekends. The frequency and duration of ERH system operator site visits will be adjusted as necessary. An Operations & Maintenance manual will be prepared by TRS for use by system operations personnel. System operation monitoring will include the manual or automated collection of the following information at the frequency indicated:

- Daily
  - Subsurface temperatures
  - ERH voltage, current, and energy
  - Energy input
- Weekly
  - Total vapor recovery system airflow
  - Individual electrode currents
  - ERH equipment inspection

These data will be recorded in field log books or forms and uploaded on a routine basis to the project database website. TRS will evaluate system operation data and manage the ERH system to maintain appropriate distribution of electrical energy to the treatment area and/or apply additional energy to select areas, as necessary. Weekly volumes of the extracted streams (i.e., DNAPL and process water/vapor) will be used in conjunction with the collected screening level information (Section 4.3.3.) and analytical data (Section 4.3.4) to estimate chemical mass removal and mass removal rates.

4.3.2 Hydraulic Control System Monitoring

Hydraulic control system monitoring will include monitoring groundwater temperature, relative drawdown, and groundwater sampling of the hydraulic recovery and sentinel wells described in Section 4.2. Collected information will be utilized to confirm that hydraulic control has been achieved. A detailed description of the hydraulic control monitoring program is included in the PMWM Plan (Appendix E).

4.3.3 Vapor Control System Monitoring

Vapor control system monitoring will include monitoring vacuum pressures at the seven vacuum pressure piezometers. Four of the vapor pressure monitoring piezometers will be located within the treatment area and three vapor pressure monitoring points will be installed along the western perimeter of the treatment area, as illustrated on Figure 6. A detailed description of the vapor control system monitoring program is included in the PMWM Plan (Appendix E).

4.3.4 Process Waste Monitoring

Total vapor phase discharges will be monitored utilizing a handheld PID twice per day and vapor grab samples will be collected periodically from the process vapor stream for analysis of VOCs. Similarly, process water grab samples will be collected on a bi-weekly basis from the process water stream at influent, midfluent and effluent locations and submitted for analysis of the site-specific VOC list via EPA Method 8260C. A detailed description of process waste monitoring activities is included in the PMWM Plan (Appendix E).

Process vapor and water analytical sampling will be conducted coincident with the bi-weekly perimeter ambient air sampling performed in accordance with ICM-specific CAMP (Appendix D). Analytical results from these system performance monitoring samples will be used to evaluate the effectiveness of process waste treatment measures and the need for replacement of the vapor and liquid-phase carbon in the appropriate treatment units.

4.3.5 ISTD System Performance Monitoring

ISTD system performance monitoring will include the following components:

- Mass removal estimates
- Interim soil and groundwater sampling
- Preliminary completion evaluation sampling
- Confirmation completion sampling

To evaluate ISTD performance, total organic chemical mass removal will be evaluated based on DNAPL mass recovery and the calculated mass of contaminants removed in the dissolved and vapor phases, computed based on the results of process vapor and water analytical results. IBM will conduct one interim round of performance monitoring soil and groundwater sampling at the estimated 50% to 60% completion point of ISTD system operation based upon energy usage and mass balance calculations.

A preliminary round of completion soil and groundwater sampling will be conducted at the anticipated 95% completion point of ISTD system operation to evaluate remedy completion and the appropriateness of conducting the full completion confirmation sampling event. The timing and number of performance sampling events will be modified as necessary based upon review of the monitoring data collected during ISTD system operations.

Successful completion of remedial actions will be evaluated based upon meeting the ICM performance criteria and achieving the RAO. A detailed description of the ICM performance and confirmation monitoring program summarized herein is included in the PMWM Plan (Appendix E).

4.4 Environmental Controls

The following sections discuss the environmental controls that will be employed to monitor ISTD system security and evaluate ambient air quality in the vicinity of the treatment system.

4.4.1 Treatment Area Security

To control public access and secure infrastructure integrity, a perimeter security fence will be constructed around the treatment area and associated ISTD system infrastructure. Treatment area security will include video monitoring and motion sensing devices within the interior of the fence. The ISTD system will be automatically de-energized when the motion sensing devices detect an unauthorized breach of the perimeter during unattended operation.

4.4.2 Community Air Monitoring

The ICM-specific CAMP includes air monitoring requirements upwind and downwind of the treatment area and at the site perimeter, air action levels for VOCs, and corrective action measures that will be implemented in the event action levels are exceeded. The air monitoring program includes:

- a weather station to collect air temperature, wind speed, and wind direction data
- multiple, continuous VOC monitoring stations
- bi-weekly analytical air sampling at the continuous monitoring stations
- periodic indoor air quality sampling at locations inside Buildings B021 and Building B023

A detailed description of air monitoring activities is presented in the ICM-specific CAMP, included as Appendix D, which will be incorporated as an addendum to the existing site-wide CAMP.

4.5 IDW Management

IDW is expected to include construction and demolition debris (C&D), personal protective equipment (PPE), trash, and wastes generated during site preparation and operation of the ISTD system. IDW will be managed in accordance with the existing *RCRA Facility Investigation Management Plans* (Golder, 2009), *SOP-8 Investigative Derived Waste Procedures*, and supplemented by the ICM-specific IDW management procedures described in the PMWM Plan (Appendix E). A summary of expected waste streams is provided in Table E-4 of Appendix E.

4.6 Site Restoration

Following confirmation that the RAO has been achieved, above grade structures, equipment and piping will be decontaminated and removed from the site. ERH electrodes, temperature monitoring points, vapor recovery wells, groundwater containment pumping wells, and sentinel wells will be decommissioned. Monitoring wells will be decommissioned in accordance with *SOP-10 Borehole and Temporary Well Decommissioning Procedures*. The need to replace site monitoring wells located in the SWMU S area decommissioned prior to ICM implementation will be evaluated with respect to the site-wide groundwater monitoring program following ICM completion.

System piping and fittings will be dismantled, decontaminated, and disposed appropriately. Cables, solenoid valves and specific drip-system components will be dismantled, decontaminated, and reused or recycled. . The temporary construction fence erected to secure the treatment area will be removed and the post holes will be back-filled or patched. Treatment area surfaces will be restored to pre-ICM conditions, to the extent practicable. The concrete slab inside Building B001 will be repaired to match the existing surface and structural integrity prior to ICM implementation.

The temporary access road installed along the western edge of the treatment area and associated gravel pads will be removed. Topsoil that was disturbed during construction activities will be restored to original grade. Gravel imported to construct the temporary road and pads will remain on site at a location designated by the property owner. Asphalt-paved areas will be replaced using cold patch or with new pavement, as necessary. Topsoil, seed and mulch will be used to restore grass-covered areas. Trees, shrubs and landscape items damaged or destroyed as a result of the construction operations will be replaced with similar species and size, as required based on consultation with the property owner.

5.0 CONTINGENCY PLAN

ISTD system design will include multiple contingency features to address the potential for the following environmental control interruptions:

- Loss of power supply
- Failure of the vapor control system
- Failure of the hydraulic control system

The following sections describe the contingency plan for each of these conditions. ERH system operation contingencies are addressed in TRS's system Operations and Monitoring (O&M) Plan.

5.1 Loss of Power Supply

Under normal operating conditions, power will be obtained from the municipal utility provider. The ISTD treatment system will include an emergency generator that will have adequate capacity to energize the PLC, the contingency vapor treatment system, the hydraulic control system and the associated treatment systems. An initial start-up test will be conducted on the emergency generator prior to ISTD system start-up and monthly generator tests will be conducted thereafter.

Should municipal power supply fail, the following will occur automatically:

- The ERH electrodes will shut down.
- System operator and Project Team will be notified.
- The emergency generator will startup within 30 seconds of energy loss to provide power to the PLC, vapor control system, hydraulic control system and associated treatment systems.
- A member of the Project Team will report to the site within four (4) hours.

During ISTD system contingency operation utilizing the backup generator, the ERH electrode array will be de-energized and vapor and hydraulic control systems will be operated at a minimum level sufficient to maintain vapor and hydraulic control until energy is restored.

Because vapor and hydraulic control will be maintained during any power failure, potential impact to human health and the environment is not anticipated. Normal system operation will resume upon restoration of municipal power supply service.

5.2 Vapor Collection and Treatment System Failure

The vapor control system has been designed with redundant treatment components and contingency features to maintain emissions below permit and regulatory requirements. The conservatively sized vapor treatment train includes contingency equipment for possible system failures, including:

- Blower failure
- Piping ruptures

- Loss of vacuum
- Condenser failure
- Heat exchange failure

The vapor treatment system includes automatic controls to deactivate extraction systems as the default response to system failure. The project team will respond to system alarms (as described in the system O&M Plan), evaluate the situation, and have the ability to direct process vapor through the backup carbon treatment unit if the source of the alarm cannot be immediately identified and resolved.

Vapor treatment system capacity has been designed to treat contaminants removed from the subsurface at a greater mass removal rate than is anticipated to be achieved at the site. Thus it is unlikely that vapor treatment system capacity will be exceeded. As discussed in Section 4.3 and the PMWM Plan (Appendix E), daily monitoring and routine analytical sampling will be conducted at numerous locations along the process vapor treatment system to monitor the fluctuations in mass removal rate and mass loading.

In the event that the vapor treatment system is deactivated due to vapor recovery blower or other system component failure, equipment repair and/or maintenance, the main control valve on the vapor extraction line will be closed, effectively isolating the vapor extraction well system and vapor flow will be temporarily diverted from the treatment system to ambient air until the system is back to normal operation as described in Section 4.2.2.

5.2.1 Hydraulic Control System

The hydraulic control system will be used to prevent the migration of potentially impacted groundwater out of the treatment area and to treat captured groundwater and recovered process water during ISTD system operation. Possible hydraulic control system failures include:

- Groundwater extraction well pump failure
- Air stripper failure
- Piping ruptures

The hydraulic control system includes automatic controls that will de-energize the ERH electrode array and reduce or discontinue operation of the hydraulic control system. The project team will respond to system alarms (as described in the system O&M Plan), evaluate the situation, and have the ability to continue ISTD system operation without active hydraulic controls if performance monitoring data collected in accordance with the PMWM Plan (Appendix E) indicates hydraulic controls are unnecessary to mitigate the migration of dissolved-phase VOCs from the treatment area. Process water generated during hydraulic control system shut-down will be stored in the 2,000 gallon water holding tank until the water treatment system is restored to normal operation.

6.0 ICM REPORTING

During ISTD system implementation and operation, daily reports will be maintained documenting significant activities. Daily report information will be summarized in weekly progress reports that will include subsurface temperature data, system operations data, and environmental control monitoring data information. These data will be uploaded to the project website for remote viewing by project team personnel.

Golder will prepare and submit monthly status reports to IBM. Monthly status reports will include:

- A description of activities completed.
- A summary of the quantities and types of IDW generated.
- An estimate of the total mass of contaminants removed in each phase (i.e., vapor, liquid, and NAPL).
- Schedule updates and a revised estimate for system operation duration.
- Tables summarizing the results of analytical sampling performed.
- A description of the results of the perimeter air monitoring program and an explanation for alarms or ISTD system shut downs, if encountered.

Following confirmation that the RAO has been achieved, IBM will prepare a final Construction Completion Report (CCR) in accordance with NYSDEC DER-10 guidance Section 5.8(a)(1) that will include the following:

- A description of the ICM, as constructed, pursuant to this final ICM Work Plan.
- A detailed description of the treatment area.
- The RAO(s) applied to the remedial action.
- A summary of completed remedial actions.
- Tables and figures containing pre- and post-remedial action analytical
- "As-built" diagrams
- Identification of the applicable institutional controls employed
- A description of restoration actions.

7.0 PERMITS AND AUTHORIZATIONS

The site currently qualifies as a Small Quantity Generator (SQG) of hazardous wastes under EPA Identification Number NYD001359694. Hazardous wastes generated during ISTD system construction and operation will be transported and disposed utilizing this identification number on manifests and/or bills of lading. The estimated volume of hazardous waste likely to be generated is anticipated to result in the facility exceeding the Large Quantity Generator (LQG) threshold of 1,000 kilograms per month. In compliance with EPA requirements for qualified hazardous waste generators, accumulated hazardous wastes will be removed by a licensed contractor within 90 days of generation and transported to an appropriately permitted disposal facility.

Vapor recovery treatment system air emissions are exempt from air emission control permitting under 6 NYCRR Part 201 201-3 *Permit Exempt and Trivial Activities* Section 201-3.3(c)(29) "*Air strippers and soil vents required under the provisions of an Order on Consent or stipulation agreement, or in operation at a superfund site"*. Therefore, no air permit is required to operate the vapor recovery treatment system during ISTD ICM implementation. Operation of the steam boiler, utilized in the steam regeneration process for the carbon vessels (SRGAC), is exempt under Section 201-3.2(c)(1)(i) for *"portable combustion installations with a maximum rated heat input capacity less than 10 million Btu/hr burning fuels other than coal or wood"*.

The estimated pumping rate of the groundwater containment system is 15 to 19 gpm. Treated groundwater will be discharged to the existing trench collection system and further treated in the Groundwater Treatment System. Discharge from the Groundwater Treatment Facility to Outfall 01A is governed by existing SPDES Permit NY 010 8138. The combined discharge from the Groundwater Treatment Facility, consisting of groundwater and process water generated as a result of ISTD system operations and the normal operation of the Perimeter Control System, to Outfall 01A, is not expected to exceed the current authorized discharge capacity of 120,000 gallons per day. However, if monitoring indicates that the permitted daily maximum discharge allowance for Outfall 01A has the potential to be exceeded during a short term, high precipitation event, the existing site Groundwater Treatment System will be temporarily shut down until the end of the day to allow the ISTD system to continue operation.

A new electrical supply line consisting of a temporary, pole-mounted overhead wire originating from the existing, IBM-owned electric pole on Old Neighborhood Road will be installed across the North Parking Lot Area to the SWMU S area. A Commercial Electrical Service Request and a preliminary electrical design have been submitted to Central Hudson Gas & Electric Corporation (CHGE&C) for the temporary overhead service. Preliminary discussion with CHGE&C has indicated that a new service will be approved based upon the acceptance of a finalized design, Preliminary review of Town of Ulster Code indicates local permits may be required for the construction and implementation of the ICM, including:

- General building permit
- Site Plan approval
- Electrical permits with third party inspection
- Fence installation permit
- Demolition permit

However, ministerial actions covered under a NYSDEC consent order such as building permits, which require no act of discretion by the approving authority, are considered Type II (Exempt) actions under the State Environmental Quality Review Act (SEQRA). Therefore, upon final development of Issued for Construction drawings and approval from NYSDEC, IBM representatives will attend a pre-application meeting with the Town of Ulster Code Enforcement Officer to obtain consensus on the required permits necessary, if any, to construct and operate the ISTD system.

8.0 SCHEDULE

IBM submitted the 30% BOD for the proposed SWMU S ISTD ICM, describing the associated construction, vapor and groundwater controls, and air monitoring activities, to NYSDEC on September 11, 2013. NYSDEC posted a notice describing the proposed ISTD ICM and associated environmental controls for public comment on January 27, 2014. NYSDEC did not receive any comments during the public comment period, which closed on February 27, 2014.

As indicated in the 30% BOD, IBM is prepared to implement the selected remedy when the property owner confirms the interior portion of the treatment zone is rendered safe for IBM and its contractors and vendors (i.e., free of electric or other energized sources, free of asbestos containing materials, etc.). A preliminary schedule is included as Figure 7, which has been updated to reflect the significant progress made since submittal of the 30% BOD and presents the estimated timeline for remedial execution upon IBM receiving unencumbered access to the treatment zone

In summary, the SWMU S ICM is anticipated to be completed over a period of approximately 280 days following receipt of safe access from TechCity and receipt of written NYSDEC/NYSDOH approval of this final ICM Work Plan, including approximately 120 days for mobilization and infrastructure construction, 120 days for actual ISTD system operation, and 40 days for demobilization/site restoration.

9.0 ISTD ICM IMPLEMENTATION PROJECT TEAM

The following sections identify the organizations and individuals responsible for site management, ISTD ICM implementation, operation, and monitoring and summarizes their respective responsibilities.

9.1 Site Access

The site is owned by AG Properties of Kingston, LLC and Ulster Business Complex, LLC and is managed by TechCity. TechCity is a co-Respondent on the Order and is responsible for providing IBM and its contractors with unencumbered access to the treatment area.

9.2 Project Team Personnel

The ISTD ICM will be implemented by a diverse team. The following section identifies the project team members and their respective roles. A project organization chart is included as Figure 8.

IBM

- Kevin Whalen, Corporate Environmental Affairs Project Manager

Golder Associates

- Christopher Hemingway, Project Manager
- Patrick Martin, Technical Lead/New York State Licensed Professional Engineer
- Daniel Gorman, Technical Lead/Project Coordinator
- Golder Staff, Database Manager, Community Air Monitoring Program and ISTD System Performance Sampling

O'Brien & Gere

- James Cavotta, Project Manager
- Darcy Sachs, Project Coordinator
- O'Brien & Gere Staff, Full-time on-site System Monitor

TRS Group

- Chris Blundy, Senior Project Supervisor
- Bob Poulin, Project Supervisor
- TRS Group Staff, Full-time on-site ISTD System Operations Supervisor

9.3 Project Team Responsibilities

The following lists the responsibilities of each organization associated with the ISTD ICM:

IBM

- Co-Respondent on Order, responsible for remediation of SWMU S
- Obtaining unencumbered access to SWMU S area from TechCity

Golder Associates

- Supervising SWMU S ISTD ICM implementation and operation
- Managing the air monitoring program, including maintaining the air quality database, collecting analytical air samples, and confirming compliance with requirements presented in the ICM-specific CAMP
- Notifying IBM, TechCity, and NYSDEC of ICM-specific air action level alarm exceedances and subsequent response actions
- Collecting process waste stream vapor and water performance evaluation samples
- Conducting interim ISTD ICM interim and confirmation performance monitoring to verify ICM completion
- Overseeing ISTD system demobilization and site restoration activities
- Liaison to the NYSDEC Case Manager
- Documentation and Reporting

O'Brien & Gere

- Managing the ISTD ERH subcontractor (TRS)
- Obtaining applicable permits for the installation and operation of the ISTD treatment system
- Performing ISTD system electrical, civil, mechanical, and structural design
- Managing ISTD ICM infrastructure construction, installation, de-mobilization, and site restoration
- Collecting process vapor waste stream PID readings during ISTD system operation
- Performing vapor control pressure monitoring during ISTD system operation
- Documentation and Reporting

TRS Group

- Construction and installation of ERH system components, including electrode array, vapor extraction, groundwater containment, and influent waste stream treatment
- Maintaining ISTD system operations and performing necessary maintenance and adjustments to optimize system performance
- Providing site security and reporting air monitoring program action level alarms to Golder
- Documentation and Reporting

10.0 REFERENCES

Golder Associates, 2009, “RCRA Facility Investigation Management Plans” 26 May, 2009.

Golder Associates, 2012a, “Supplemental Remedial Investigation Report: Solid Waste Management Unit S: Former B001 Waste TCA Tank”, 29 October, 2012.

Golder Associates, 2012b, “Supplemental Remedial Investigation Report: Solid Waste Management Unit AB: Former Building B003 Waste Oil Tank”, 31 October, 2012.

Groundwater Sciences Corporation, 1993 “Corrective Action For Solid Waste Management Units RCRA Facility Investigation Scope of Work, Volume V, Appendix K-L, Groundwater Sampling and Analysis Plan”, 13 August, 1993.

Groundwater Sciences Corporation, 1996, “IBM Kingston RCRA Facility Investigations Soil Gas Surveys and Sewer Systems Sampling”, 12 April 1996.

Groundwater Sciences Corporation, 1997a “RCRA Facility Investigation Groundwater Plumes and Sources”, 14 March, 1997.

Groundwater Sciences Corporation, 1997b “RCRA Facility Assessments Newly Identified Solid Waste Management Units”, 14 March, 1997.

NYSDEC, 1996, “6 NYCRR Part 201 Permits and Regulations Subparts 201-1 to 201-3”, 7 June, 1996, amended 23 January, 2013.

NYSDEC, 1998, “Technical and Operational Guidance Series (1.1.1) “Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations”, June 1998.

NYSDEC, 1999, “6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations”, 4 August, 1999.

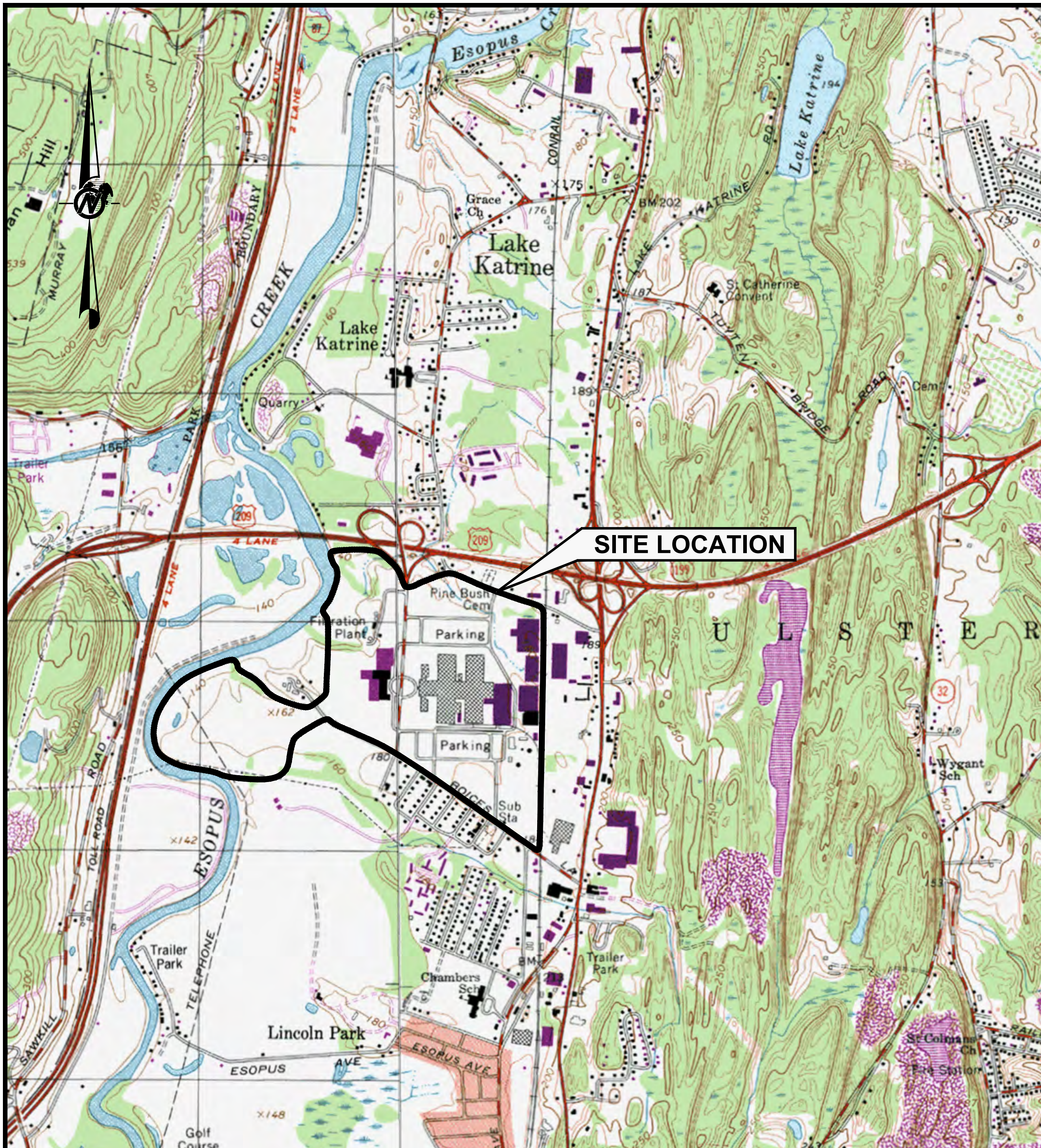
NYSDEC, 2006 “6 NYCRR Part 375 Environmental Remediation Programs, Subparts 375-1 to 375-4 & 375-6”, 14 December, 2006.

NYSDEC, 2010, “DER-10 Technical Guidance for Site Investigation and Remediation, Appendix B Guidance for the Development of Data Usability Summary Reports”, 3 May, 2010.

NYSDEC, 2011, “Order on Consent, Index Number D3-10023-6-11, Site Number 356002”, 18 July 2011.

TechCity, 2011, “Interim Site Management Plan, NYSDEC Site Number 356002”, 20 October, 2011.

FIGURES



REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SITE LOCATION MAP

2000 0 2000

SCALE FEET

REFERENCE

1.) BASE MAP TAKEN FROM USGS 7.5 MINUTE SERIES QUADRANGLES OF KINGSTON EAST, NY, DATED 1963, PHOTOREVISED 1980, AND KINGSTON WEST, NY, DATED 1997.

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

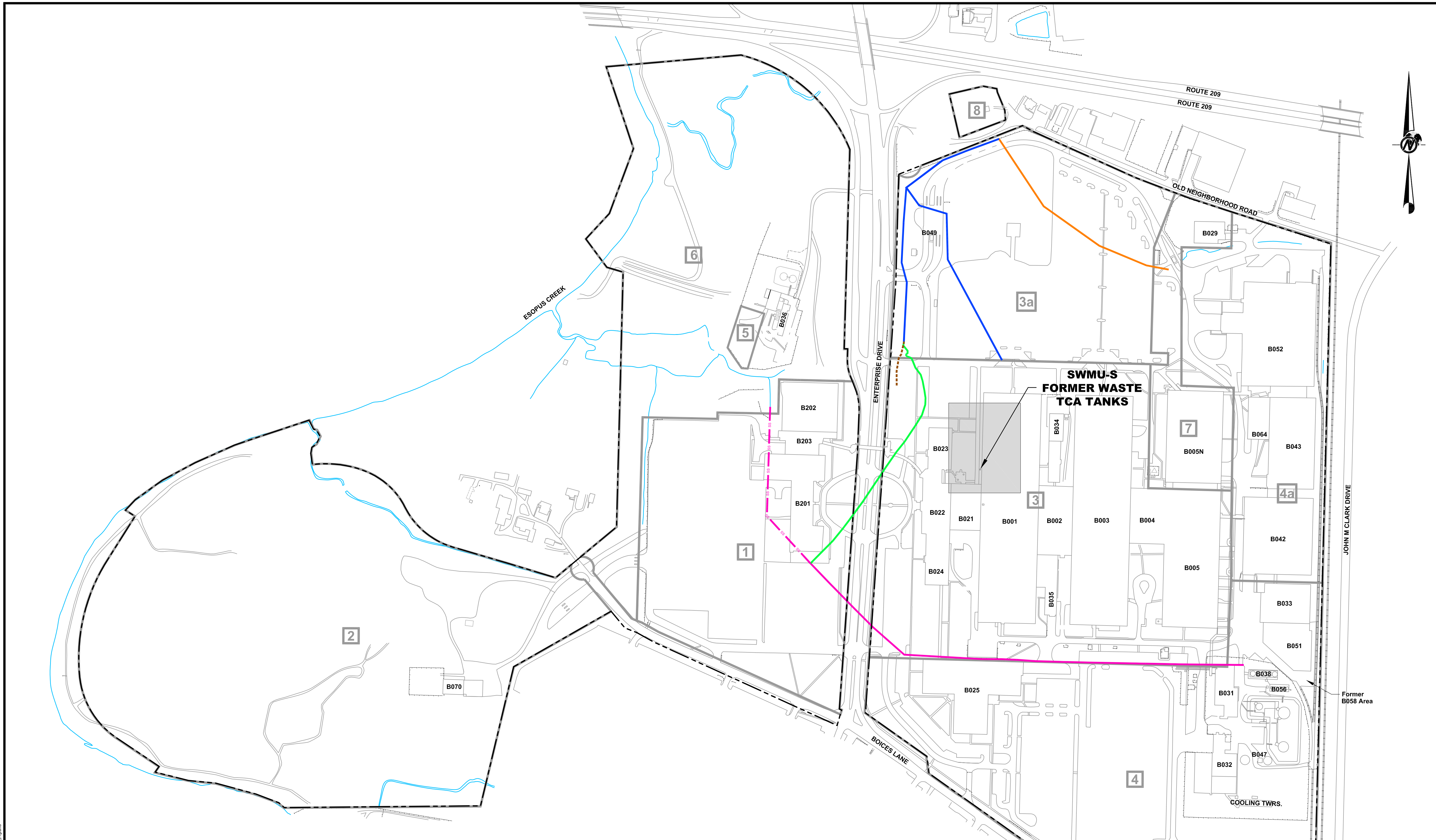
PROJECT No.		083-87071
DESIGN	DPG	05/22/14
CADD	RG	05/22/14
CHECK	DPG	05/22/14
REVIEW	CDH	05/22/14

FILE No. 08387071AA01

SCALE AS SHOWN REV. 0

FIGURE 1

Drawing file: 08387071AA01.DWG May 22, 2014 - 11:46am



LEGEND

	PROPERTY/PARCEL BOUNDARY
	RIVER/STREAM
	42-INCH DIAMETER SEWER SYSTEM (SITE PERIMETER CONTROL SYSTEM)
	UNSATURATED SURFICIAL SAND UNIT (SITE PERIMETER CONTROL SYSTEM)
	GROUNDWATER COLLECTION SYSTEM (SITE PERIMETER CONTROL SYSTEM)
	60-INCH DIAMETER SEWER SYSTEM (SITE PERIMETER CONTROL SYSTEM)
	UTILITY TRENCH BARRIER WALL
	STORM SEWER LINE
B003	BUILDING NUMBER
1	OPERABLE UNIT (OU)
	SWMU S INVESTIGATION AREA

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE 3002-10843.DWG, DRAWING NUMBER 93002-10843 ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) OPERABLE UNIT BOUNDARIES DIGITIZED FROM A HARDCOPY FILE ENTITLED "Operable Unit Composite MAP_2011-0830.pdf," PREPARED BY BRINNIER & LARIOS, P.C.

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

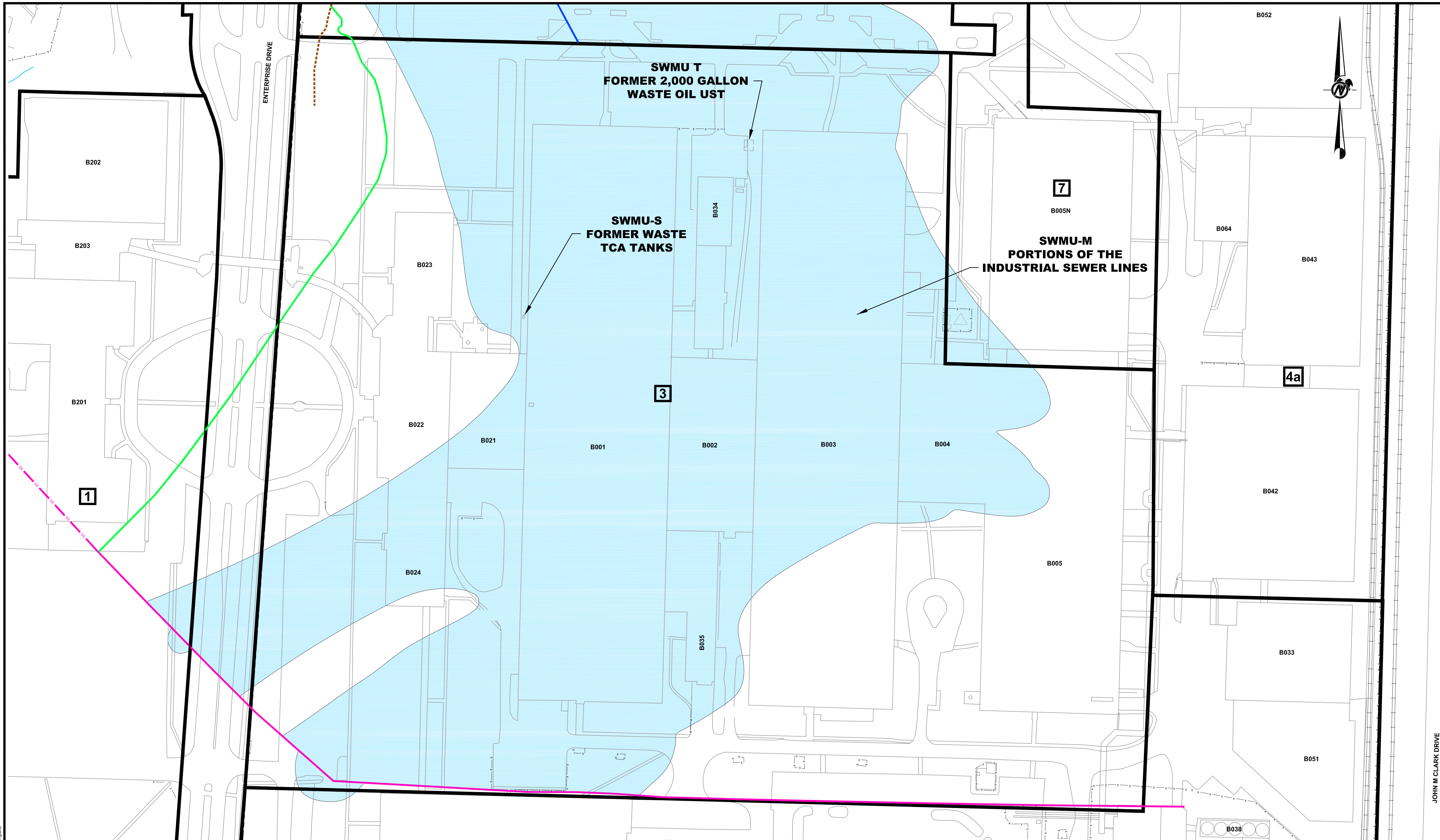
FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SITE LAYOUT

PROJECT No.		083-87071
FILE No.		08387071AA02
REV. 0	SCALE	AS SHOWN
DESIGN	DPG	05/22/14
CADD	RG	05/22/14
CHECK	DPG	05/22/14
REVIEW	CDH	05/22/14

FIGURE 2



LEGEND

(property line symbol)	PROPERTY/PARCEL BOUNDARY	B003	BUILDING NUMBER
(river line symbol)	RIVER/STREAM	1	OPERABLE UNIT (OU)
(sewer line symbol)	42-INCH DIAMETER SEWER SYSTEM (SITE PERIMETER CONTROL SYSTEM)	(shaded box)	GENERALIZED AREA OF VOC GROUNDWATER PLUME
(sand unit line symbol)	UNSATURATED SURFICIAL SAND UNIT (SITE PERIMETER CONTROL SYSTEM)		
(collection line symbol)	GROUNDWATER COLLECTION SYSTEM (SITE PERIMETER CONTROL SYSTEM)		
(dotted line symbol)	UTILITY TRENCH BARRIER WALL		
(storm sewer line symbol)	STORM SEWER LINE		

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE 3002-108-I3.DWG, DRAWING NUMBER 93002-108-I3 ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) OPERABLE UNIT BOUNDARIES DIGITIZED FROM A HARDCOPY FILE ENTITLED "Operable Unit Composite MAP_2011-0830.pdf," PREPARED BY BRINNIER & LARIOS, P.C.

3.) GENERALIZED AREA OF VOC GROUNDWATER PLUME COMPILED FROM DIGITAL CONSTITUENT FILES FROM THE 2010 ANNUAL GROUNDWATER MONITORING REPORT, DATED MARCH 30, 2011, PREPARED BY GROUNDWATER SCIENCES CORPORATION.

80 0 80 160
SCALE FEET

Golder Associates
Newark, New Jersey

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

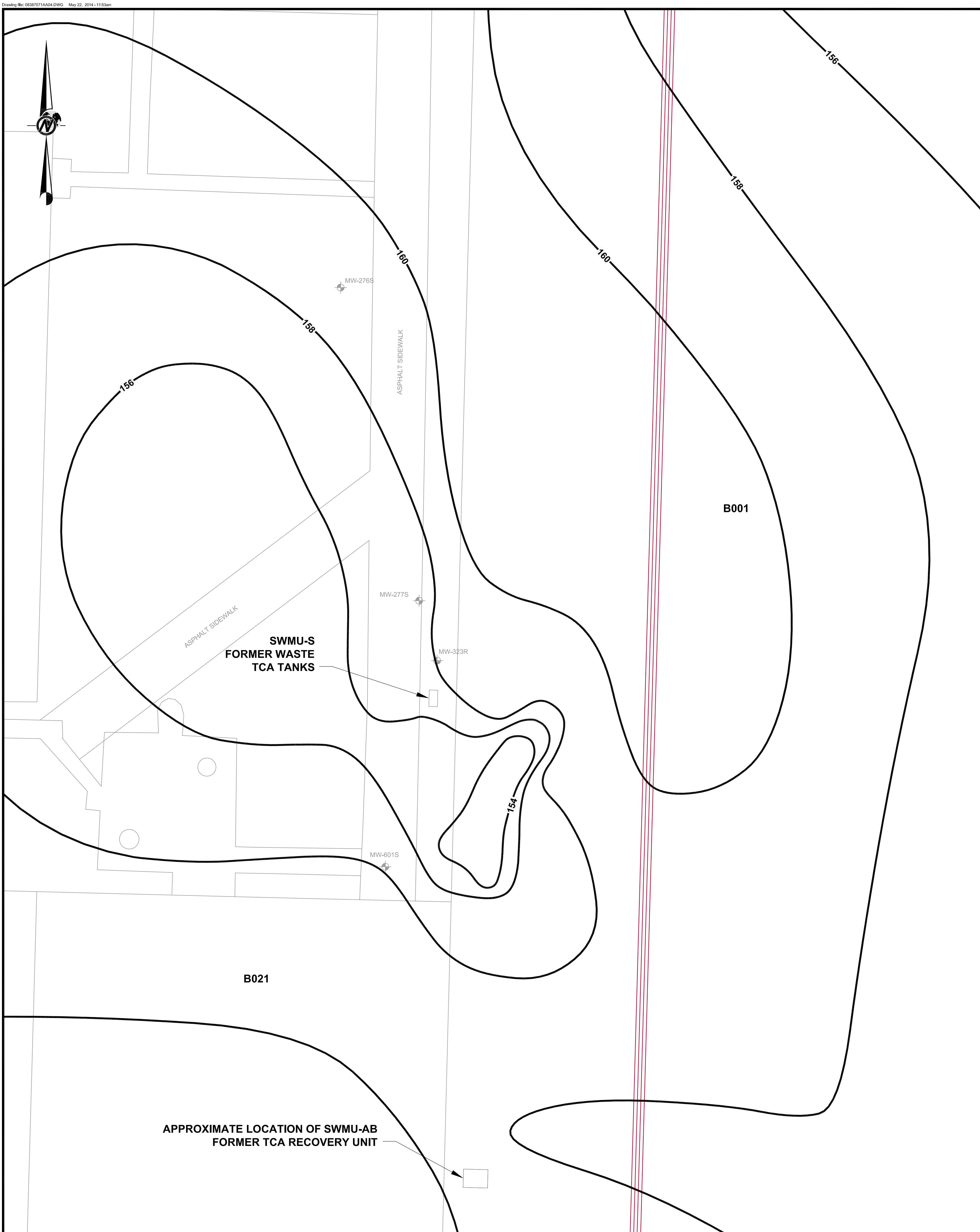
PROJECT
FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE
OU-3 LAYOUT

PROJECT No.	083-87071
FILE No.	08387071AA03
REV. 0	SCALE AS SHOWN
DESIGN DPG	05/22/14
CADD RG	05/22/14
CHECK DPG	05/22/14
REVIEW CDH	05/22/14

FIGURE 3

Drawing file: 08387071AA04.DWG May 22, 2014 - 11:53am



LEGEND

(red line)	INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES
B005	BUILDING NUMBER
(symbol)	EXISTING MONITORING WELL
—170—	BASE OF SURFICIAL SAND CONTOUR (FT. MSL)

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE SITEMAP.DWG, DRAWING NUMBER 93002-SITEMAP/2 ENTITLED "SITE MAP," DATED MAY 9, 2005, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES TAKEN FROM DIGITAL FILE 3002-108-I3.DWG, ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PREPARED BY GROUNDWATER SCIENCES CORPORATION.

3.) ASPHALT SIDEWALK DIGITIZED FROM A HARDCOPY FILE ENTITLED "SITE PLAN WITH ELECTRODE LOCATIONS," SHEET Y-1, DATED OCTOBER 18, 2013, PREPARED BY TRS.

15 0 15 30
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

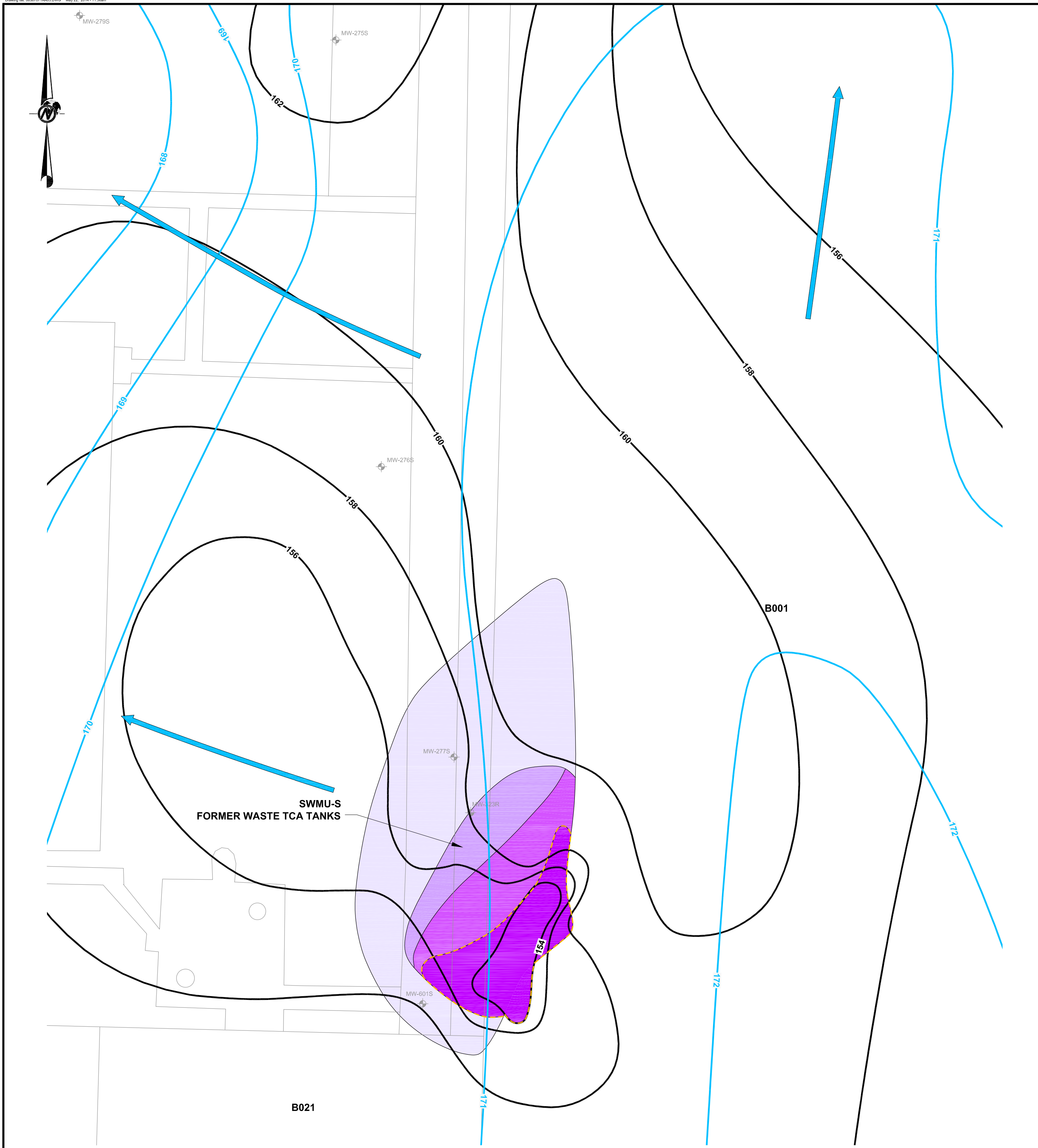
TITLE

SWMU S AREA LAYOUT

Golder Associates
Newark, New Jersey
NJ Authorization #24GA28029100

PROJECT No.		083-87071	FILE No.	08387071AA04
DESIGN	DPG	05/22/14	SCALE AS SHOWN	REV. 0
CADD	RG	05/22/14		
CHECK	DPG	05/22/14	**FIGURE 4**	
REVIEW	CDH	05/22/14		

Drawing file: 08387071AA05.DWG May 22, 2014 - 11:56am



LEGEND

B005	BUILDING NUMBER
	EXISTING MONITORING WELL
170	BASE OF SURFICIAL SAND CONTOUR
170	INTERPRETED GROUNDWATER TABLE ELEVATION CONTOUR
	INTERPRETED GROUNDWATER FLOW DIRECTION
	EXTENT OF OBSERVED DNAPL

DNAPL COMPONENT SOLUBILITY CONCENTRATIONS

- > 1%
- 10-25%
- 25-50%
- > 50%

REFERENCE

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE SITEMAP.DWG, DRAWING NUMBER 93002-SITEMAP/2 ENTITLED "SITE MAP," DATED MAY 9, 2005, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

15 0 15 30
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

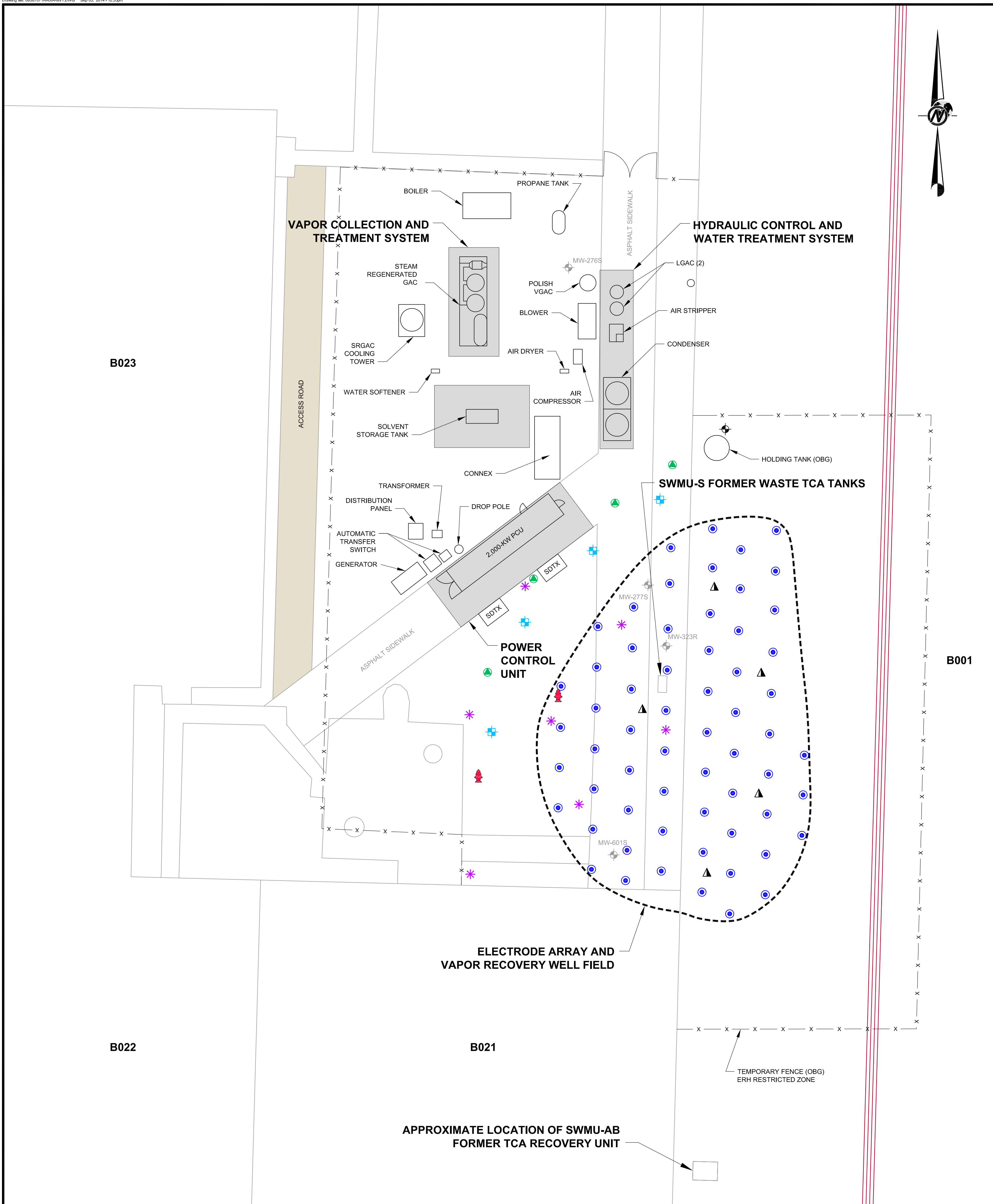
DNAPL OCCURRENCE SOLUBILITY DISTRIBUTION MAP

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

PROJECT No.		083-87071	FILE No.	0838707AA05
DESIGN	DPG	05/22/14	SCALE AS SHOWN	REV. 0
CADD	RG	05/22/14	**FIGURE 5**	
CHECK	DPG	05/22/14		
REVIEW	RG	05/22/14		

Drawing file: 08387071AA06-Rev1.DWG Sep 03, 2014 - 12:35pm



LEGEND

(red line)	INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES
B005	BUILDING NUMBER
	EXISTING MONITORING WELL
(dashed line)	SWMU S ISTD TREATMENT AREA
	CO-LOCATED ELECTRODE AND VAPOR RECOVERY WELL LOCATION
	SENTINEL WELL
	GROUNDWATER RECOVERY WELL
	TEMPERATURE MONITORING POINT
	FIRE HYDRANT
	NEW MONITORING WELL
	VAPOR PRESSURE MONITORING LOCATION

NOTE

1.) ALL LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED AS APPROPRIATE BASED ON ACTUAL FIELD CONDITIONS.

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE SITEMAP.DWG, DRAWING NUMBER 93002-SITEMAP/2 ENTITLED "SITE MAP," DATED MAY 9, 2005, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES TAKEN FROM DIGITAL FILE 3002-108-I3.DWG, ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PREPARED BY GROUNDWATER SCIENCES CORPORATION.

3.) ASPHALT SIDEWALK, TEMPORARY FENCE, SECONDARY CONTAINMENT STRUCTURES, ELECTRODES, TEMPERATURE MONITORING POINTS, SENTINEL WELLS, GROUNDWATER RECOVERY WELLS, FIRE HYDRANTS AND TREATMENT AREA DIGITIZED FROM A HARDCOPY FILE ENTITLED "SITE PLAN WITH ELECTRODE LOCATIONS," SHEET Y-1, DATED ,MAY 9, 2014, PREPARED BY TRS.

15 0 15 30
SCALE FEET

1	09/03/14	DPG	ADDED NOTE 1	RG	DPG	CDH
REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SWMU S TREATMENT AREA AND REMEDY DESIGN LAYOUT

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

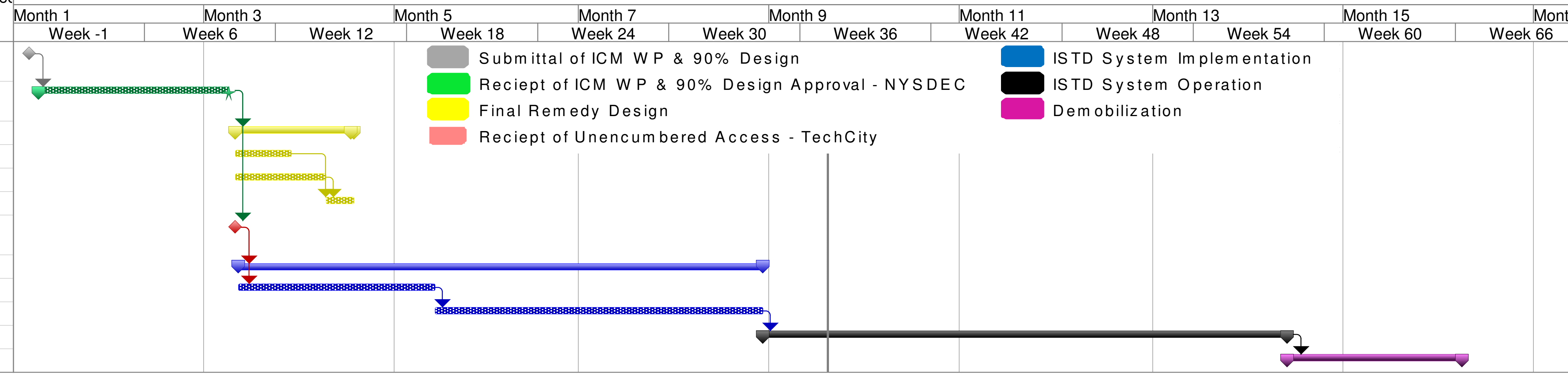
PROJECT No.		083-87071
DESIGN	DPG	05/22/14
CADD	RG	05/22/14
CHECK	DPG	05/22/14
REVIEW	CDH	05/22/14

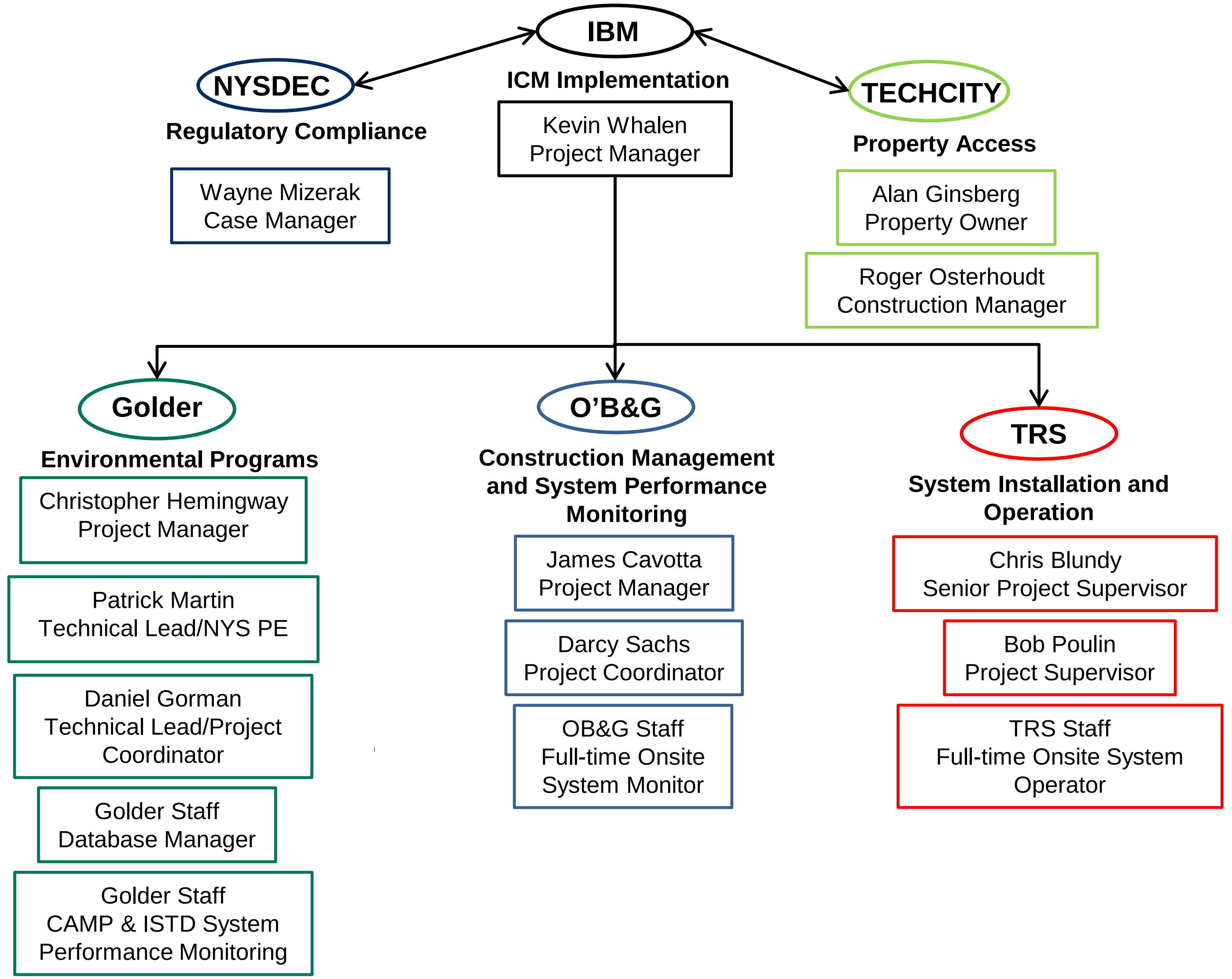
FILE No. 08387071AA06
SCALE AS SHOWN REV. 1

FIGURE 6

Figure 7: SWMU S ISTD Remedy Implementation Schedule

ID	Task Name	Duration	Predec
1	**Submit SWMU S Interim Corrective Measure (ICM) Work Plan and 90% Remedy Design to NYSDEC for Approval**	1 day	
2	**Receive NYSDEC Approval of ICM Work Plan and 90% Remedy Design**	45 days	1
3	**Final Remedy Design**	**27 days**	**2**
4	Electrical Design	14 days	
5	Site Civil Design	21 days	
6	100% Design and Submittal	7 days	5,4
7	**Receipt of Unencumbered Access to Building B001 from TechCity**	1 day	2
8	**Remedy Implementation**	**120 days**	**7**
9	Procurement	45 days	7
10	Construction & Start-up	75 days	9
11	**Remedy Operation**	120 days	10
12	**Demobilization**	40 days	11





CLIENT/PROJECT

Former IBM Kingston Facility
Kingston, New York

Golder Associates
Newark, New Jersey

TITLE

SWMU S Interim Corrective Measure Project Team

LOCATION	CREATED	CHECKED	REVIEWED	DATE	SCALE	JOB NO.	FIGURE
300 Enterprise Drive	DPG	CDH	APTM	09/04/2014	NA	083-87071-05	8

APPENDICES

APPENDIX A

NYSDEC BASIS OF DESIGN APPROVAL LETTER

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway, Albany, New York 12233-7014
Phone: (518) 402-9662 • **Fax:** (518) 402-9679
Website: www.dec.ny.gov

Joe Martens
Commissioner

April 8, 2014

Michael Kominek
IBM
8976 Wellington Road
Manassas, VA 20109

Re: ICMP – In Situ Work Plan – ISTD
IBM Kingston, Site No. 356002, Town of Ulster, Ulster County

Dear Mr. Kominek:

The New York State Department of Environmental Conservation (Department) and the New York State Department of Health (NYSDOH) have reviewed the Basis of Design, which serves as the Interim Corrective Measures Work Plan,for the in situ thermal desorption (ISTD) remediation of solid waste management unit (SWMU) S, dated September 11, 2013. The thirty day public comment period closed with no public comments received. This Basis of Design is hereby approvedwith the following modification:

A 90% Remedial Design (RD) will be submitted within sixty (60) within of receipt of this letter.

In accordance with the Order on Consent and 6 NYCRR 375-1.6(d), please indicate within thirty (30) days whether you will submit the 90% design. Please ensure that all copies of this Basis of Design include this approval letter, and place copies in the document repositories.

If you have any questions, please call me at (518) 402-9657.

Sincerely,

Wayne Mizerak
Project Manager
Division of Environmental Remediation

APPENDIX B

TRS GROUP 100% REMEDIAL DESIGN

O’BRIEN & GERE REMEDIAL CONSTRUCTION PLANS

O’BRIEN & GERE ELECTRICAL SPECIFICATION

TRS GROUP 100% REMEDIAL DESIGN

ELECTRICAL RESISTANCE HEATING DESIGN PACKAGE

Prepared by:

TRS
Accelerating Value

SEPTEMBER 2014

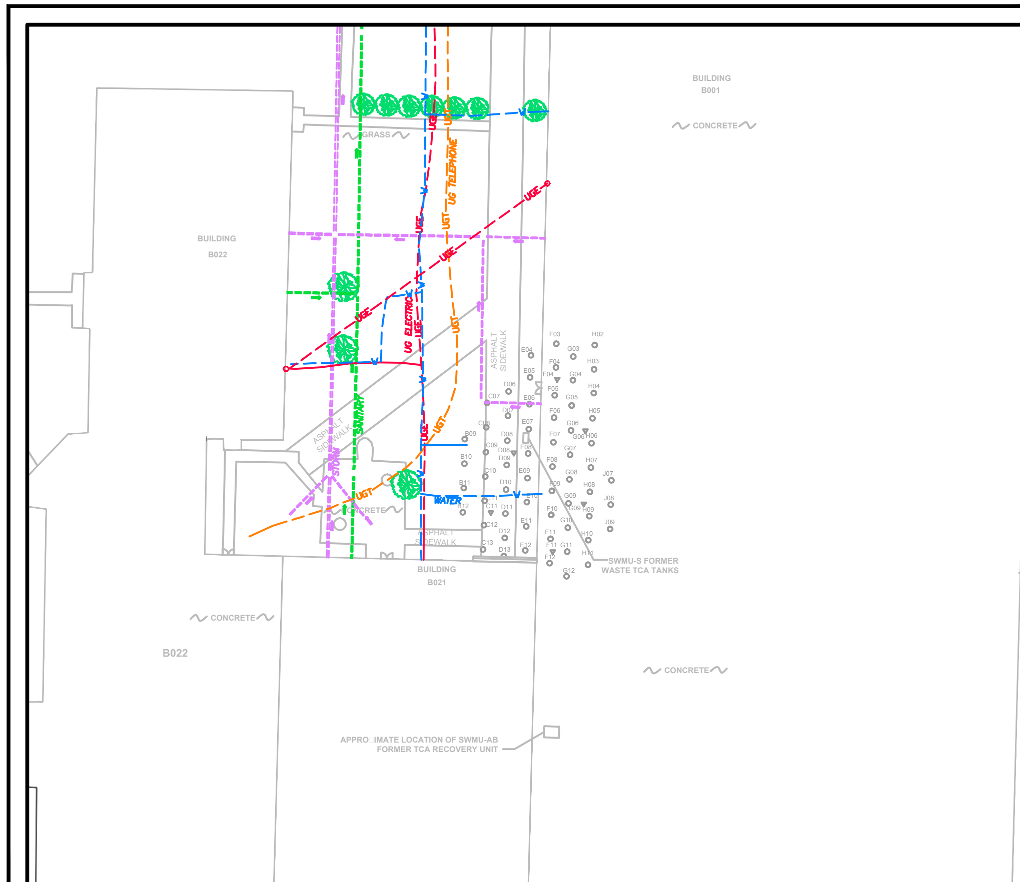
FORMER IBM FACILITY
KINGSTON, NEW YORK

SHEET INDEX

DRAWING NUMBER	TITLE AND DESCRIPTION
Y–1	SITE PLAN
Y–2	VAPOR RECOVERY PIPING PLAN
Y–3	HYDRAULIC CONTROL WELL AND COMPRESSED AIR PIPING PLAN
Y–4	TEMPERATURE MONITORING POINT WIRING PLAN
Y–5	SECURITY PLAN
Y–6	CONDENSATE, BLOWDOWN, AND DISCHARGE PIPING PLAN
Y–7	POTABLE AND MAKE UP WATER CONNECTION PLAN
Y–8	EQUIPMENT PIPING PLAN
Y–9	HAZARD CLASSIFICATION AREAS
Y–10	CABLE ROUTING PLAN
Y–11	CONFIRMATORY SAMPLING LOCATIONS
M–1	INTERIOR ELECTRODE DETAIL
M–2	EXTERIOR ELECTRODE DETAIL
M–3	INTERIOR TMP DETAIL
M–4	EXTERIOR TMP DETAIL
M–5	HYDRAULIC CONTROL WELL DETAIL
M–6	SENTINEL WELL DETAIL
M–7	SECURITY FENCE DETAIL
M–8	SENTINEL WELL HEAD DETAIL
M–9	VACUUM MONITORING POINT HEAD DETAIL
P–1	LEGEND
P–2	VAPOR RECOVERY AND CONDENSING PROCESS FLOW DIAGRAM
P–3	PROCESS FLOW MASS BALANCE
P–4	FIELD PROCESS AND INSTRUMENTATION DIAGRAM
P–5	CONDENSER PROCESS AND INSTRUMENTATION DIAGRAM
P–6	COOLING TOWER PROCESS AND INSTRUMENTATION DIAGRAM
P–7	SRGAC COOLING TOWER PROCESS AND INSTRUMENTATION DIAGRAM
P–8	BLOWER PROCESS AND INSTRUMENTATION DIAGRAM
P–9	SRGAC PROCESS AND INSTRUMENTATION DIAGRAM
P–10	CONDENSER AND DECANTER PROCESS AND INSTRUMENTATION DIAGRAM
P–11	POLISH VGAC PROCESS AND INSTRUMENTATION DIAGRAM
P–12	WATER TREATMENT PROCESS AND INSTRUMENTATION DIAGRAM
P–13	BOILER WATER PRECONDITIONING PROCESS AND INSTRUMENTATION DIAGRAM
P–14	STEAM DELIVERY SYSTEM TO SRGAC PROCESS AND INSTRUMENTATION DIAGRAM
P–15	COOLING WATER DELIVERY TO SRGAC PROCESS AND INSTRUMENTATION DIAGRAM
P–16	PNEUMATIC PROCESS FLOW DIAGRAM
E–1	ELECTRICAL ONE LINE
E–2	LOAD CHART

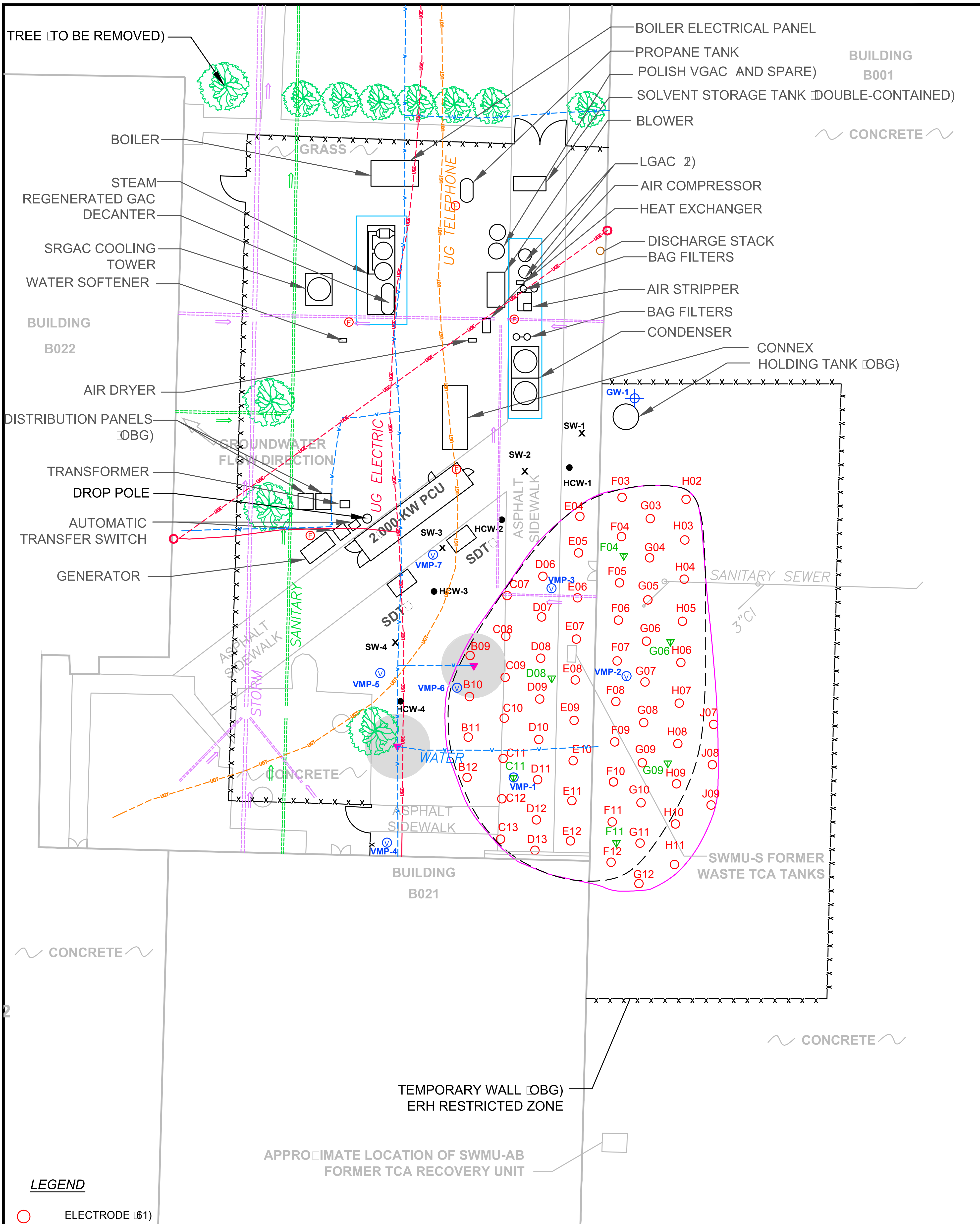
SITE LOCATION MAP

N



EXTENDED SITE PLAN

N



LEGEND

- ELECTRODE (61)
- TEMPERATURE MONITORING POINT (5)
- CO-LOCATED TEMPERATURE AND VACUUM MONITORING POINT (1)
- RFP TREATMENT AREA
- TRS EXPANDED TREATMENT AREA
- SENTINEL WELL (4)
- GROUNDWATER RECOVERY WELL (4)
- SECONDARY CONTAINMENT
- FIRE HYDRANT (2)
- GRAVEL BASE
- STAND ALONE VACUUM MONITORING POINT (6)
- MONITORING WELL (1)
- FIRE EXTINGUISHER LOCATION

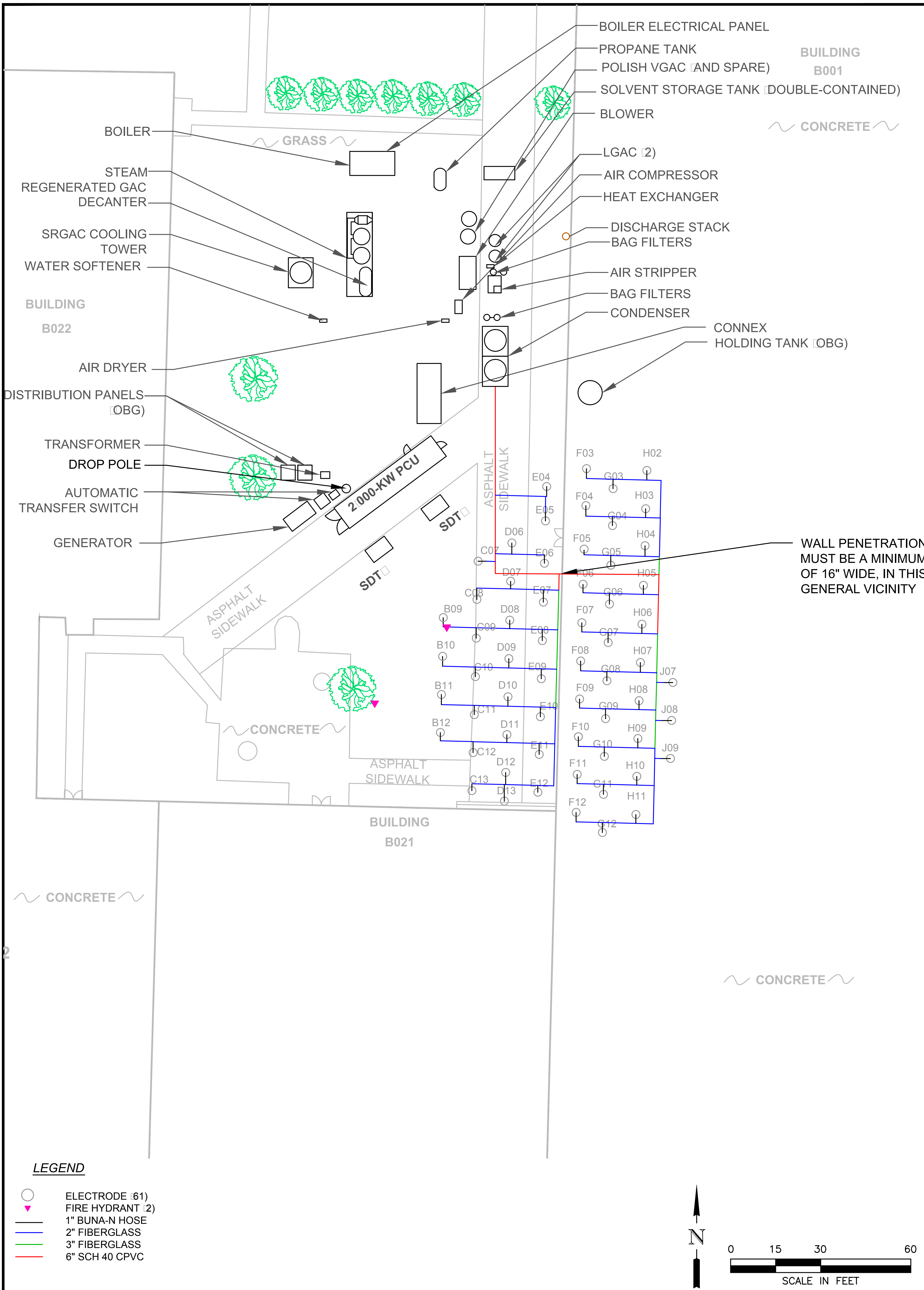
N

0 15 30 60

SCALE IN FEET

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	SITE PLAN WITH ELECTRODE LOCATIONS
PROJECT MANAGER B. POULIN	
APPROVED FOR IMPLEMENTATION BY ____ FOR ____ DATE	DATE 9/5/14 PROJECT KIN41 SHEET Y-1



TRS
Accelerating Value

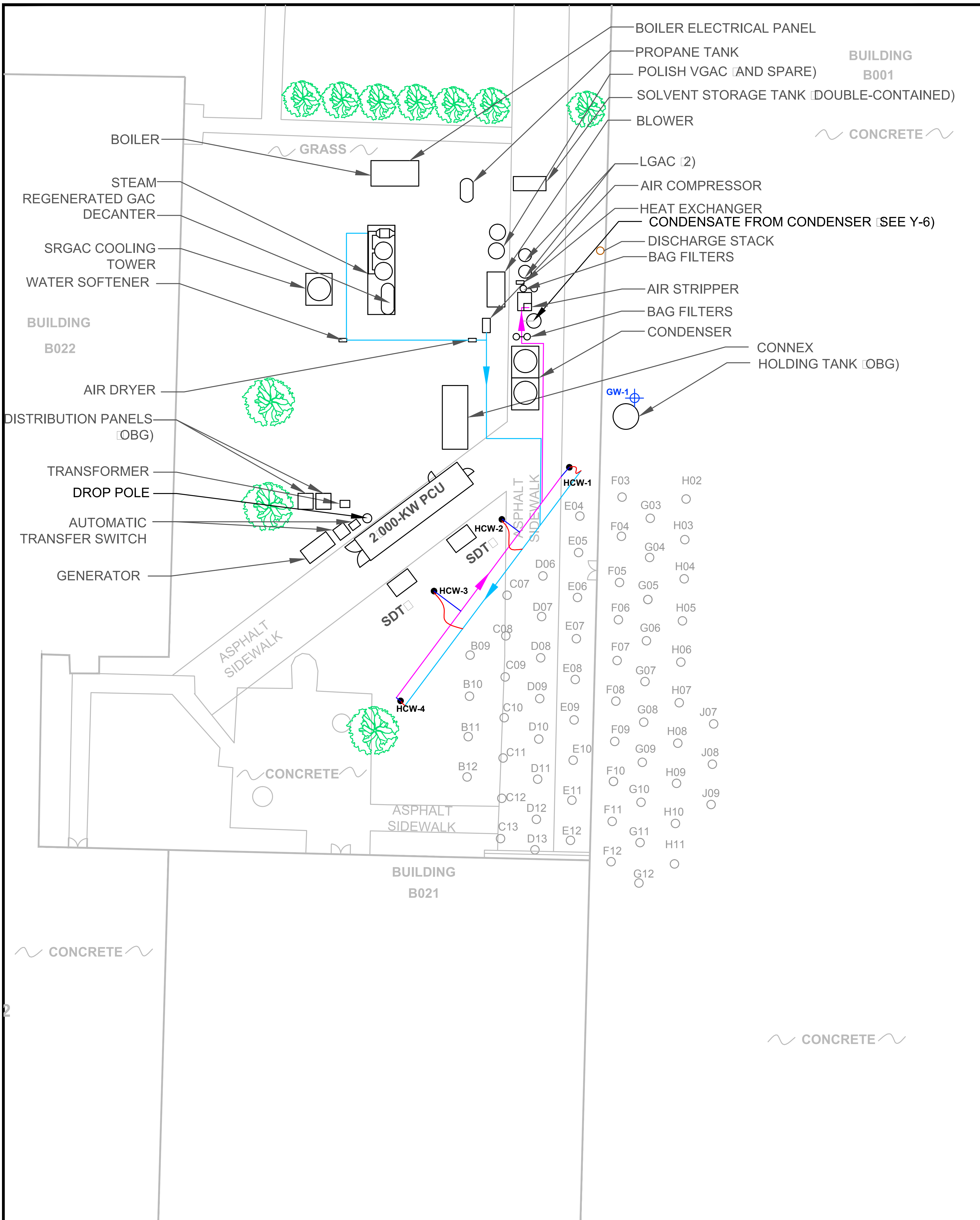
DESIGNED BY M. NANISTA	FOR	FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA		VAPOR RECOVERY PIPING PLAN
CHECKED BY NOT CHECKED		
PROJECT MANAGER B. POULIN		

APPROVED FOR IMPLEMENTATION

BY ______________________

FOR ______________________ DATE

DATE	9/5/14	PROJECT	KIN41
SHEET	Y-2		



LEGEND

- ELECTRODE (61)
- GROUNDWATER RECOVERY WELL (4)
- 1" AIR HOSE
- ½" AIR HOSE
- ¾" SCH 80 CPVC
- 2" SCH 80 CPVC
- MONITORING WELL

NOTES:

1. EACH HYDRAULIC CONTROL WELL WILL HAVE A BALL VALVE AND CHECK VALVE ON THE ¾" CPVC LINE TO CONTROL FLOW.
2. WATER LINES WILL BE HEAT TRACED AND INSULATED AS NECESSARY.

N

0 15 30 60
SCALE IN FEET

TRS Accelerating Value

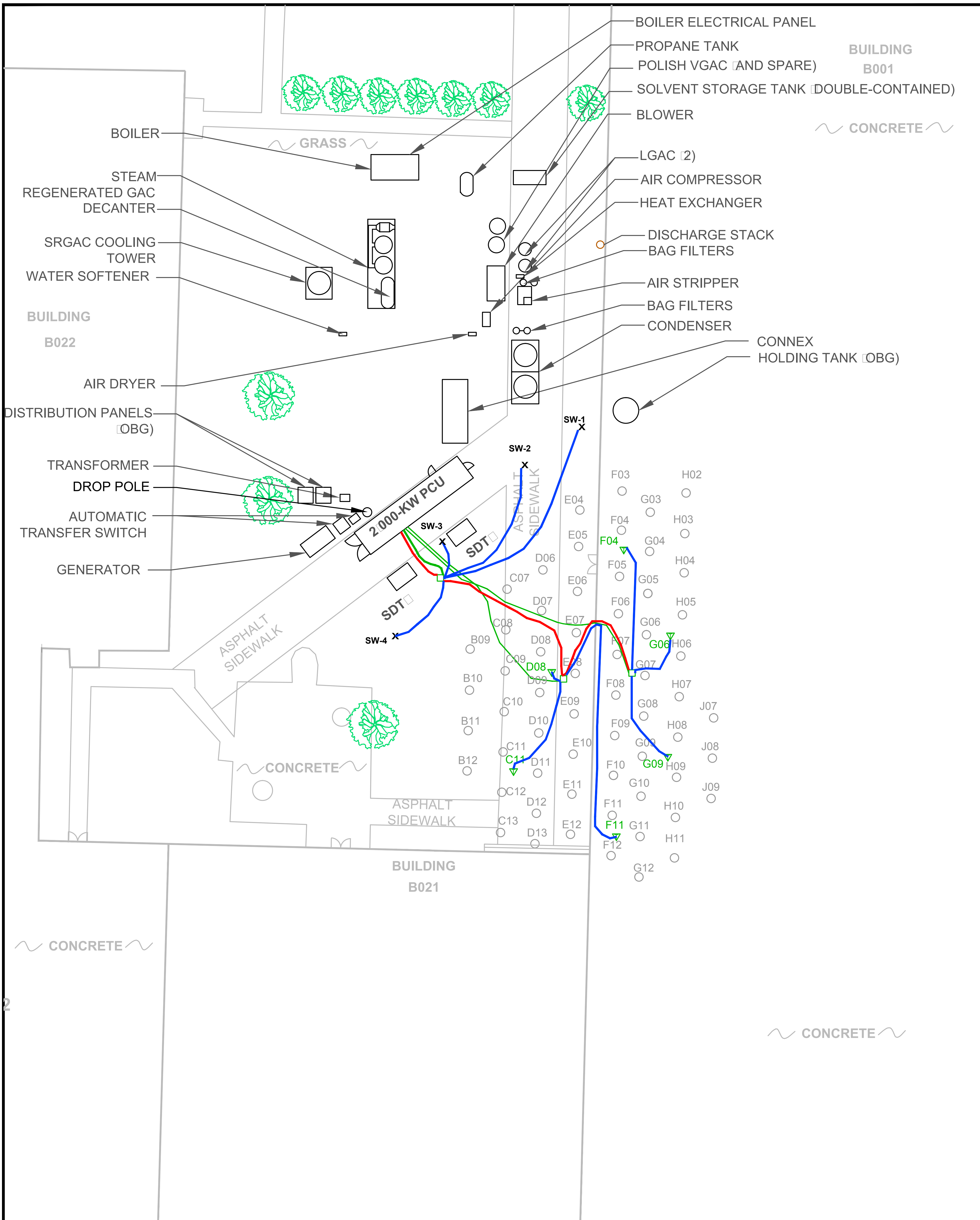
DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN

FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

HYDRAULIC CONTROL WELL AND COMPRESSED AIR PIPING PLAN

APPROVED FOR IMPLEMENTATION
BY ______
FOR ______ DATE

DATE	9/5/14	PROJECT	KIN41
SHEET	Y-3		



LEGEND

ELECTRODE (61)
TEMPERATURE MONITOIRNG POINT (6)
SENTINEL WELL (3)
TMP FIELD BOX (3)
ETHERNET WIRE
18/2 SOW POWER CABLE
THERMOCOUPLE BUNDLE

N

0 15 30 60
SCALE IN FEET

TRS
Accelerating Value

CONFIDENTIAL INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND THE PROPERTY OF TRS GROUP, INC. NO INFORMATION CONTAINED HEREIN MAY BE DUPLICATED, USED OR DISTRIBUTED WITHOUT THE EXPRESSED WRITTEN PERMISSION OF TRS GROUP, INC. LONGVIEW, WA.

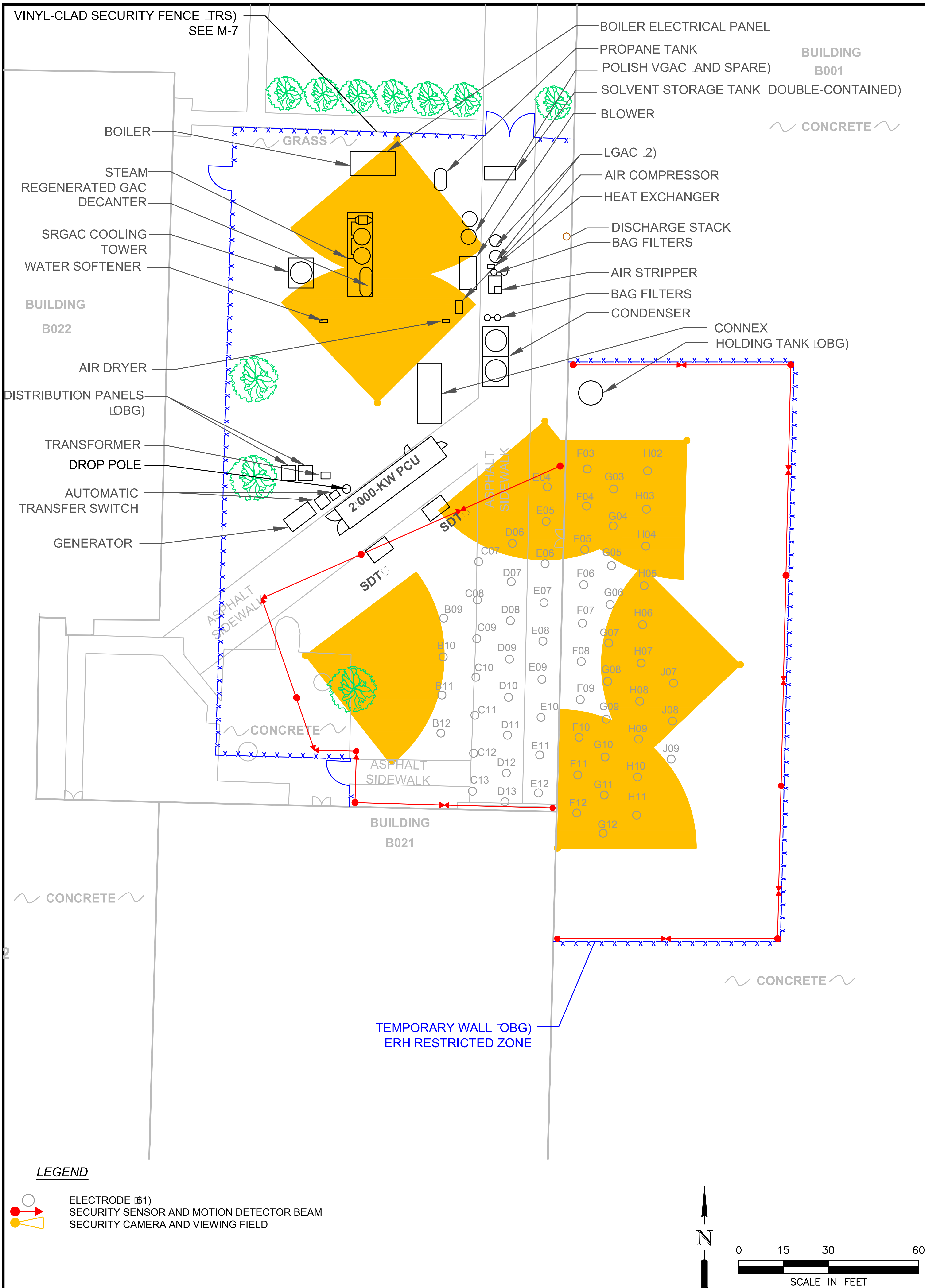
DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	TEMPERATURE MONITORING POINT WIRING PLAN
PROJECT MANAGER B. POULIN	

APPROVED FOR IMPLEMENTATION

BY

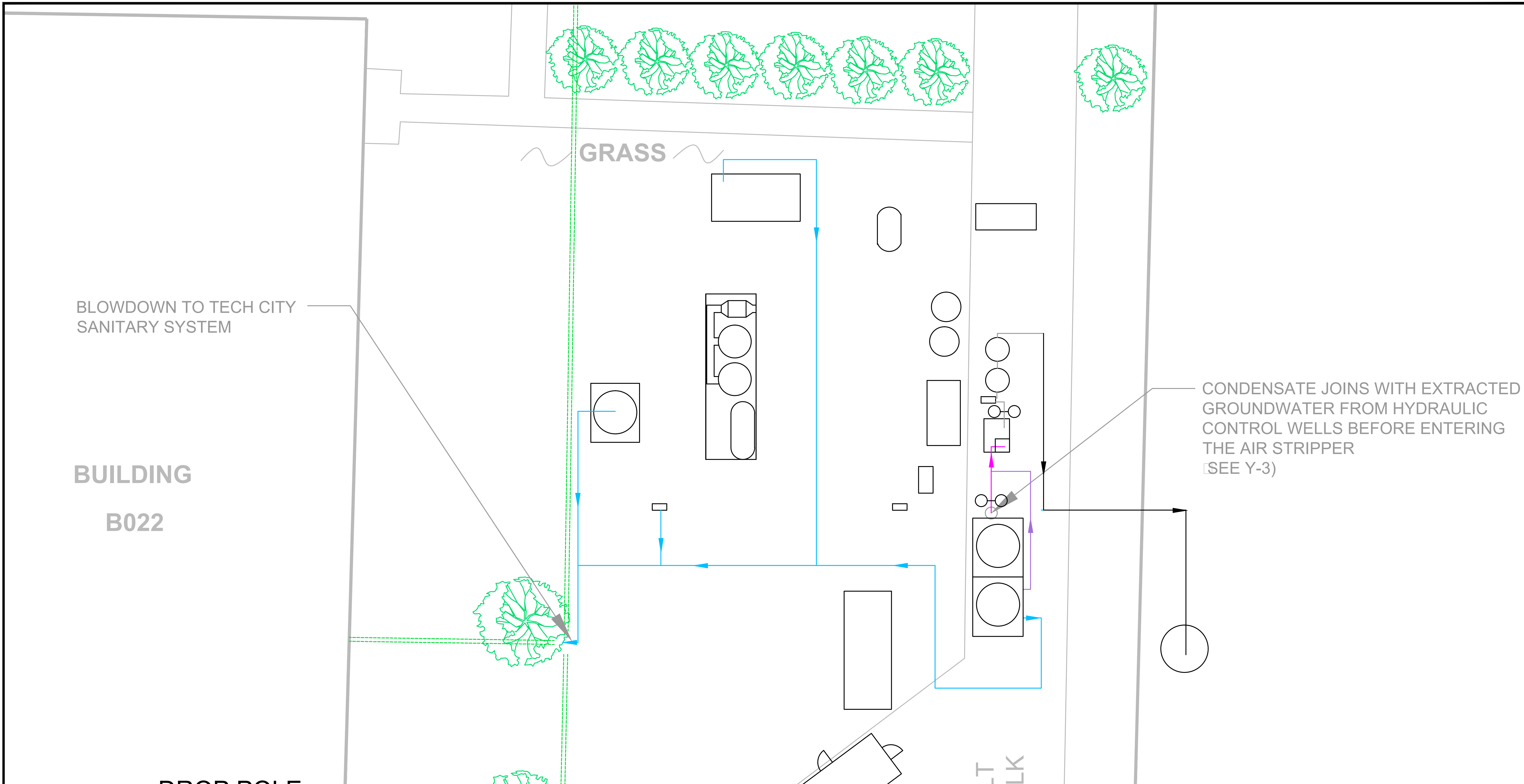
FOR DATE

DATE 9/5/14	PROJECT KIN41
SHEET	Y-4



TRS *Accelerating Value*

DESIGNED BY: M. NANISTA	FOR: FORMER IBM FACILITY, KINGSTON, NEW YORK
DRAWN BY: M. NANISTA	
CHECKED BY: NOT CHECKED	SECURITY PLAN
PROJECT MANAGER: B. POULIN	
APPROVED FOR IMPLEMENTATION BY ______ FOR ______ DATE	DATE: 9/5/14; PROJECT: KIN41; SHEET: Y-5



LEGEND

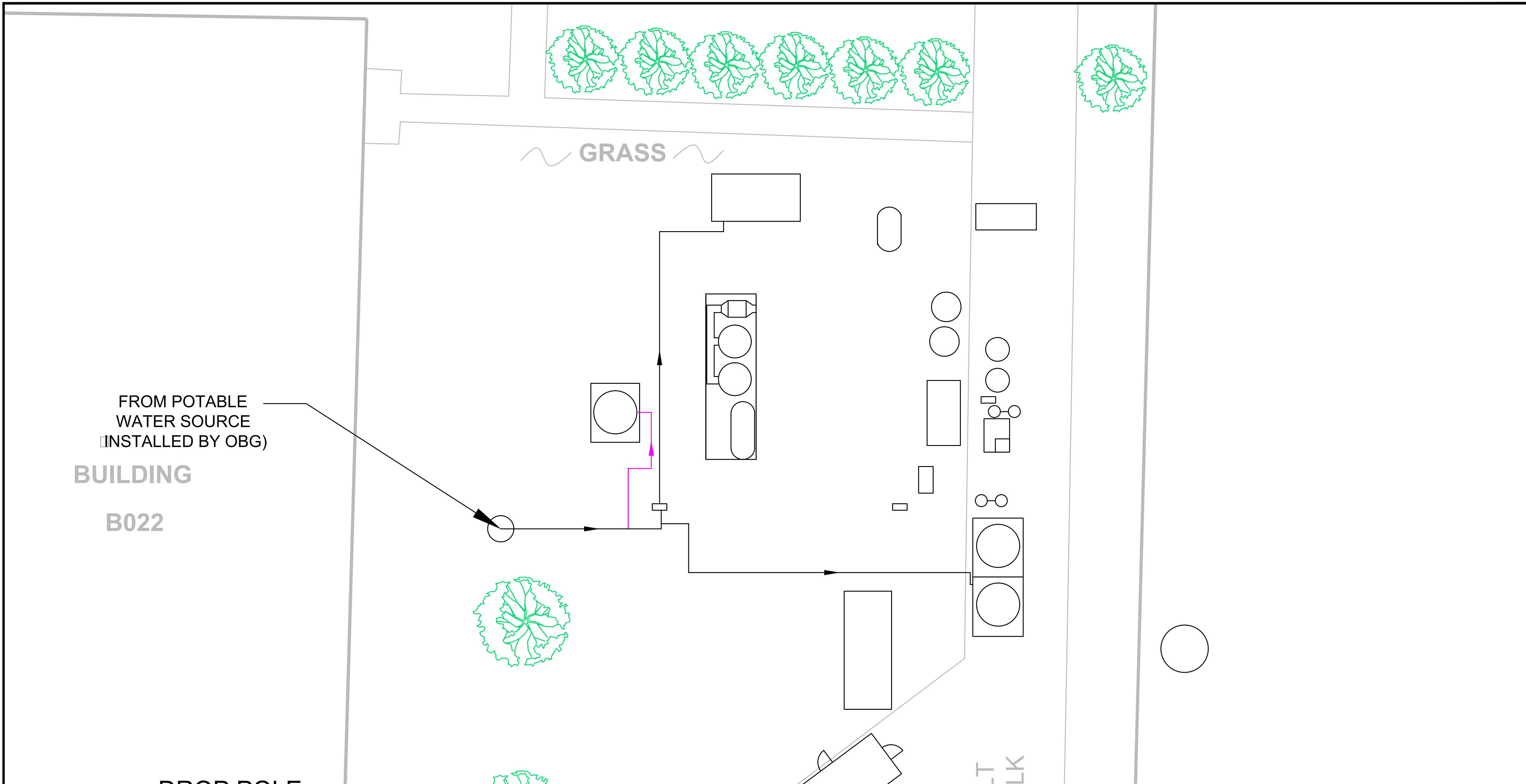
½" PEX	
¾" PEX	
2" SCH 40 PVC	
2" SCH 80 CPVC	

NOTES:

1. WATER LINES WILL BE HEAT TRACED AND INSULATED AS NECESSARY.

TRS *Accelerating Value*

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
	CONDENSATE, BLOWDOWN, AND DISCHARGE PIPING PLAN
APPROVED FOR IMPLEMENTATION	BY ____ FOR ____ DATE ____
DATE	9/5/14
PROJECT	KIN41
SHEET	Y-6



LEGEND

- ¾" PEX
- 1" SCH 40 PVC

NOTES:
1. WATER LINES WILL BE HEAT TRACED AND INSULATED AS NECESSARY.

N

0 7.5 15 30
SCALE IN FEET

TRS
Accelerating Value

CONFIDENTIAL: INFORMATION CONTAINED IN THIS DOCUMENT IS CONFIDENTIAL AND THE PROPERTY OF TRS GROUP, INC. NO INFORMATION CONTAINED HEREIN MAY BE DUPLICATED, USED OR DISTRIBUTED WITHOUT THE EXPRESSED WRITTEN PERMISSION OF TRS GROUP, INC. LONGVIEW, WA.

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN

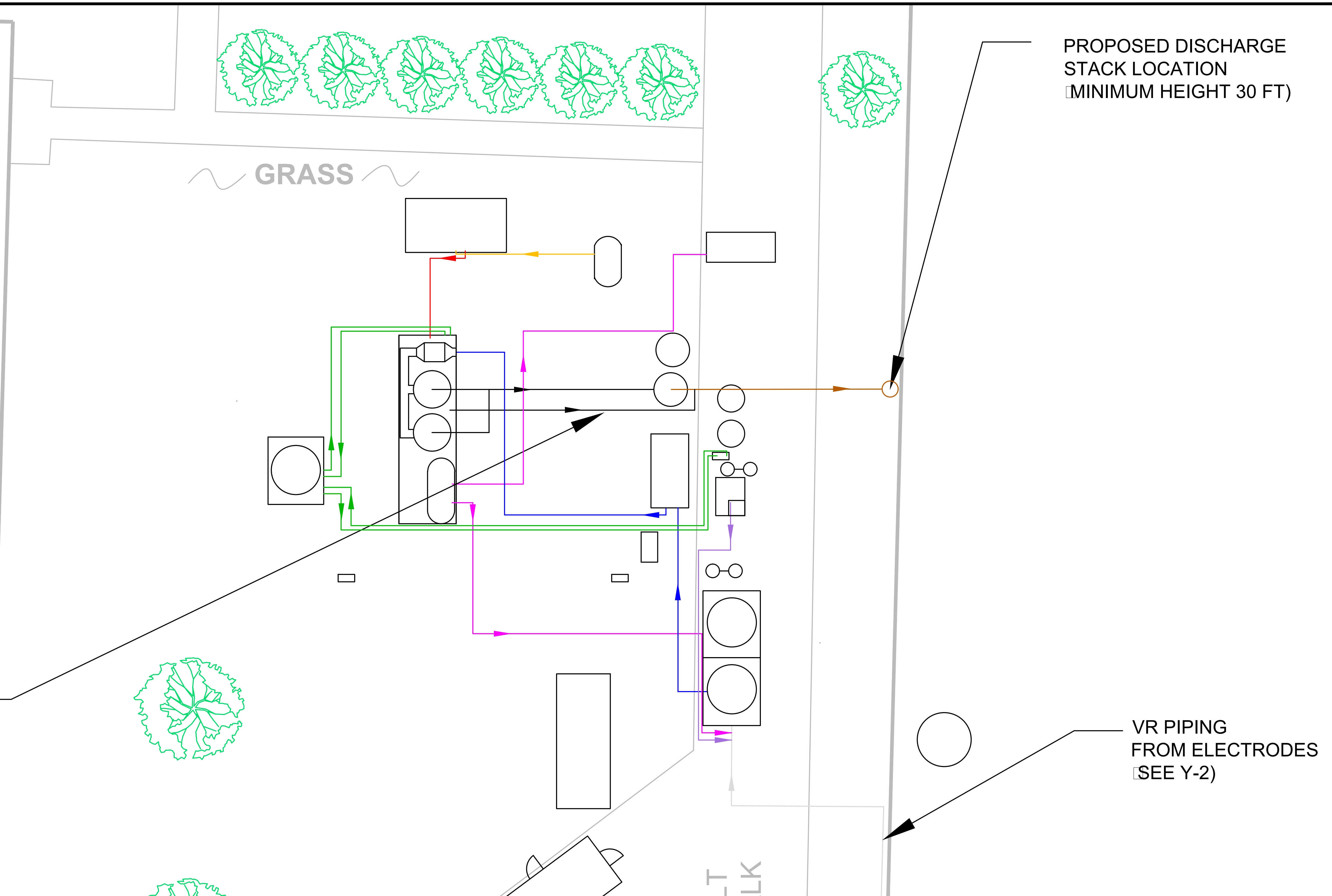
FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

POTABLE AND MAKEUP WATER
CONNECTION PLAN

APPROVED FOR IMPLEMENTATION
BY
FOR DATE

DATE	9/5/14
PROJECT	KIN41
SHEET	Y-7

NOTES:
1. THE POLISH VGAC DISCHARGE AND THE BED DRYING AIR (BOTH 8" CPVC) WILL JOIN TOGETHER FOR A COMMON DISCHARGE STACK (10" CPVC).
2. THE PROPANE TANK SHOULD BE 1,000 GALLONS.
3. THE DISCHARGE STACK WILL BE SECURED TO THE SIDE OF BUILDING B001 WITH UNISTRUT AND CLAMPS.
4. THE NAPL PIPING FROM THE DECANTER TO THE DNAPL STORAGE TANK WILL BE DOUBLE CONTAINED.
5. WATER LINES WILL BE HEAT TRACED AND INSULATED AS NECESSARY.
6. STEAM LINES WILL BE INSULATED.

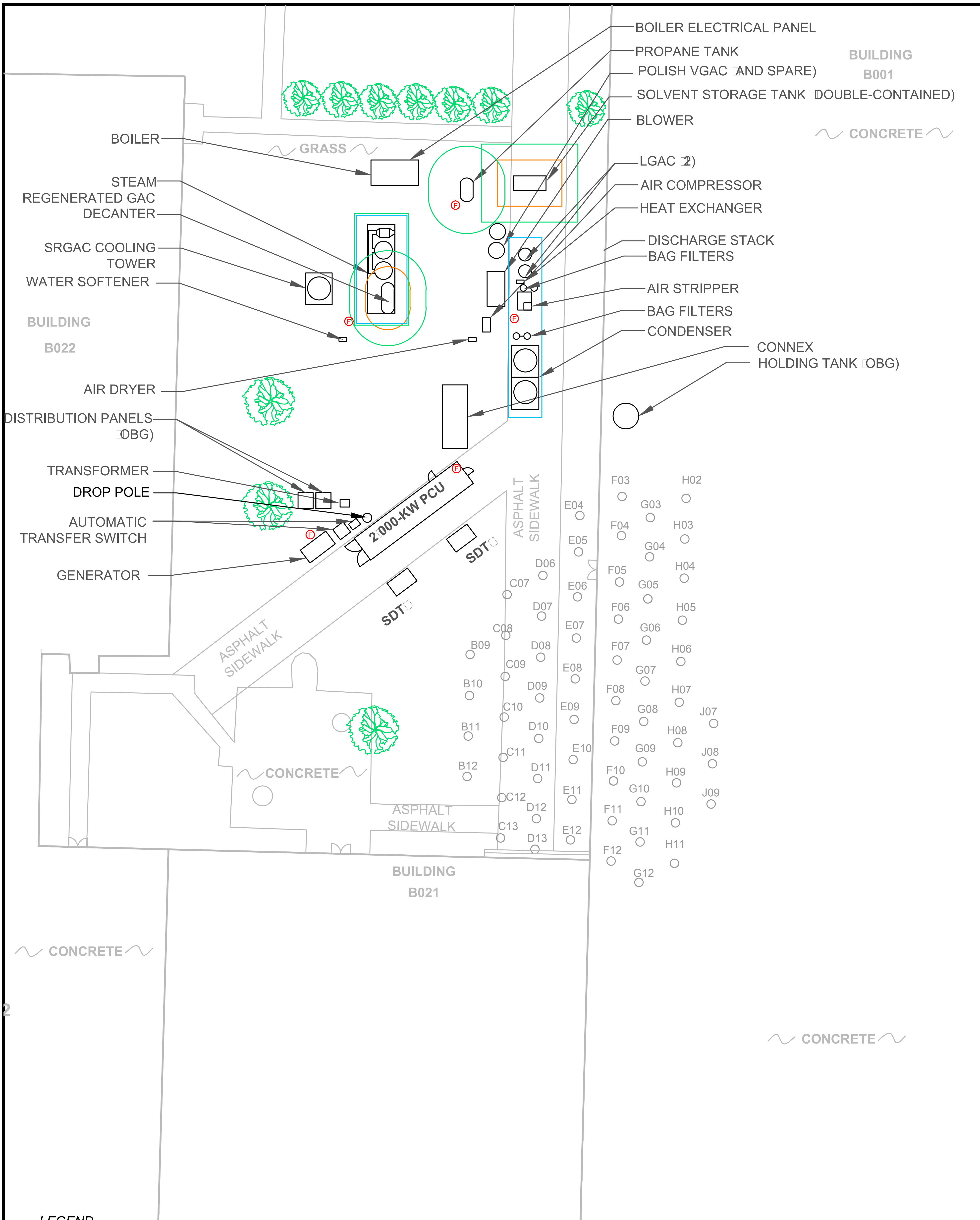


LEGEND

- ½" COPPER (PROPANE)
- 2" STEEL
- 1" TEFLON
- 2" SCH 40 PVC
- 3" SCH 40 CPVC
- 6" SCH 40 CPVC
- 6" STAINLESS STEEL
- 8" SCH 40 CPVC
- 10" SCH 40 CPVC

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	EQUIPMENT PIPING PLAN
PROJECT MANAGER B. POULIN	
APPROVED FOR IMPLEMENTATION BY ______ FOR ______ DATE	DATE 9/5/14 PROJECT KIN41 SHEET Y-8



LEGEND

ELECTRODE (61)
SECONDARY CONTAINMENT (SEE NOTE 1)
CLASS I, DIVISION I AREA
CLASS I, DIVISION II AREA
FIRE EXTINGUISHER LOCATION

N

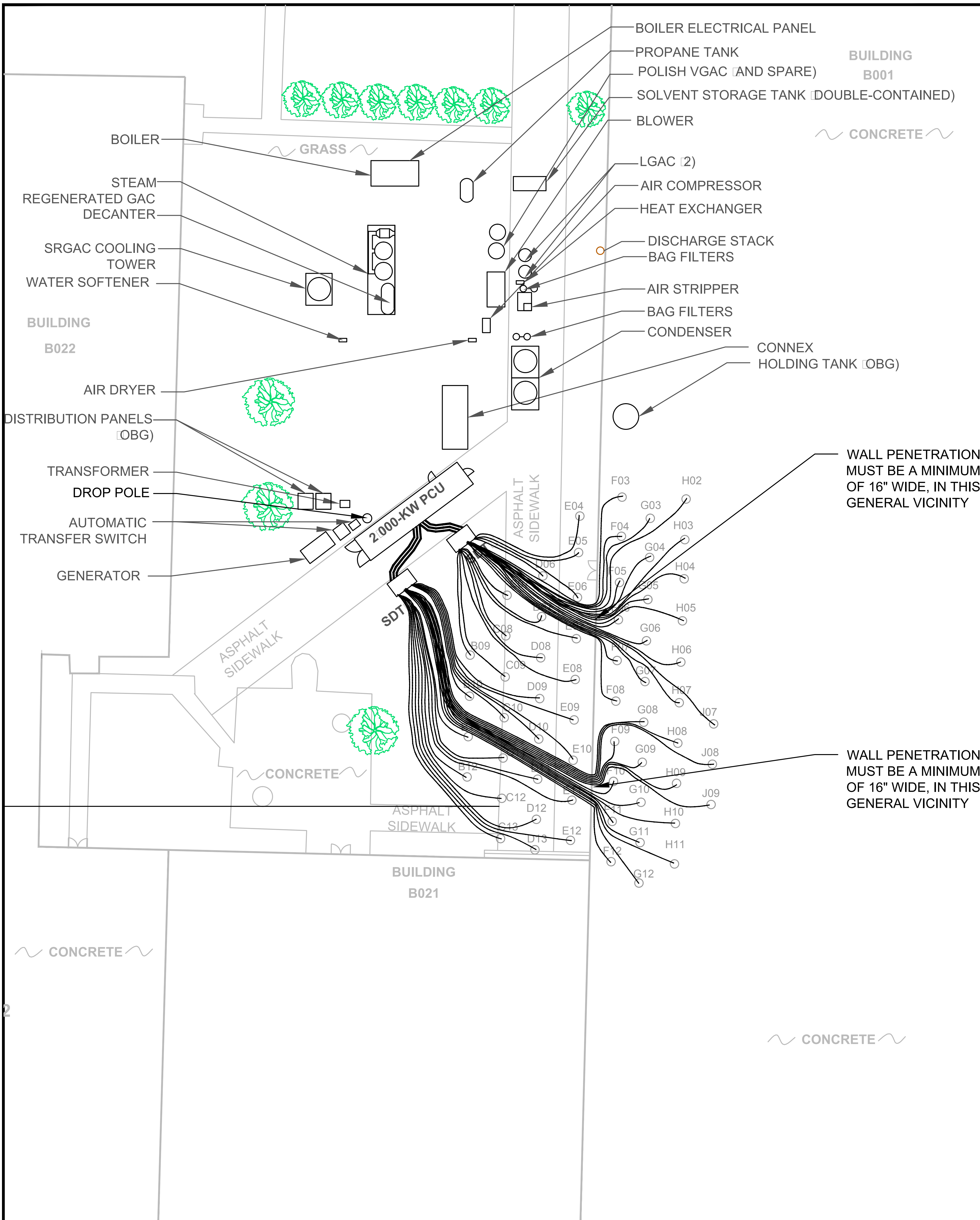
0 15 30 60
SCALE IN FEET

NOTES:

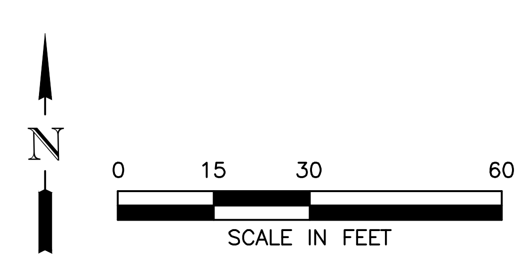
1. THE SECONDARY CONTAINMENT AREAS AROUND THE SRGAC AND NAPL STORAGE TANK WILL ALSO BE CLASS I, DIVISION II UP TO THE HEIGHT OF THE BERM.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	HAZARD CLASSIFICATION AREAS
PROJECT MANAGER B. POULIN	
APPROVED FOR IMPLEMENTATION BY ______ FOR ______ DATE	DATE 9/5/14 · PROJECT KIN41 · SHEET Y-9

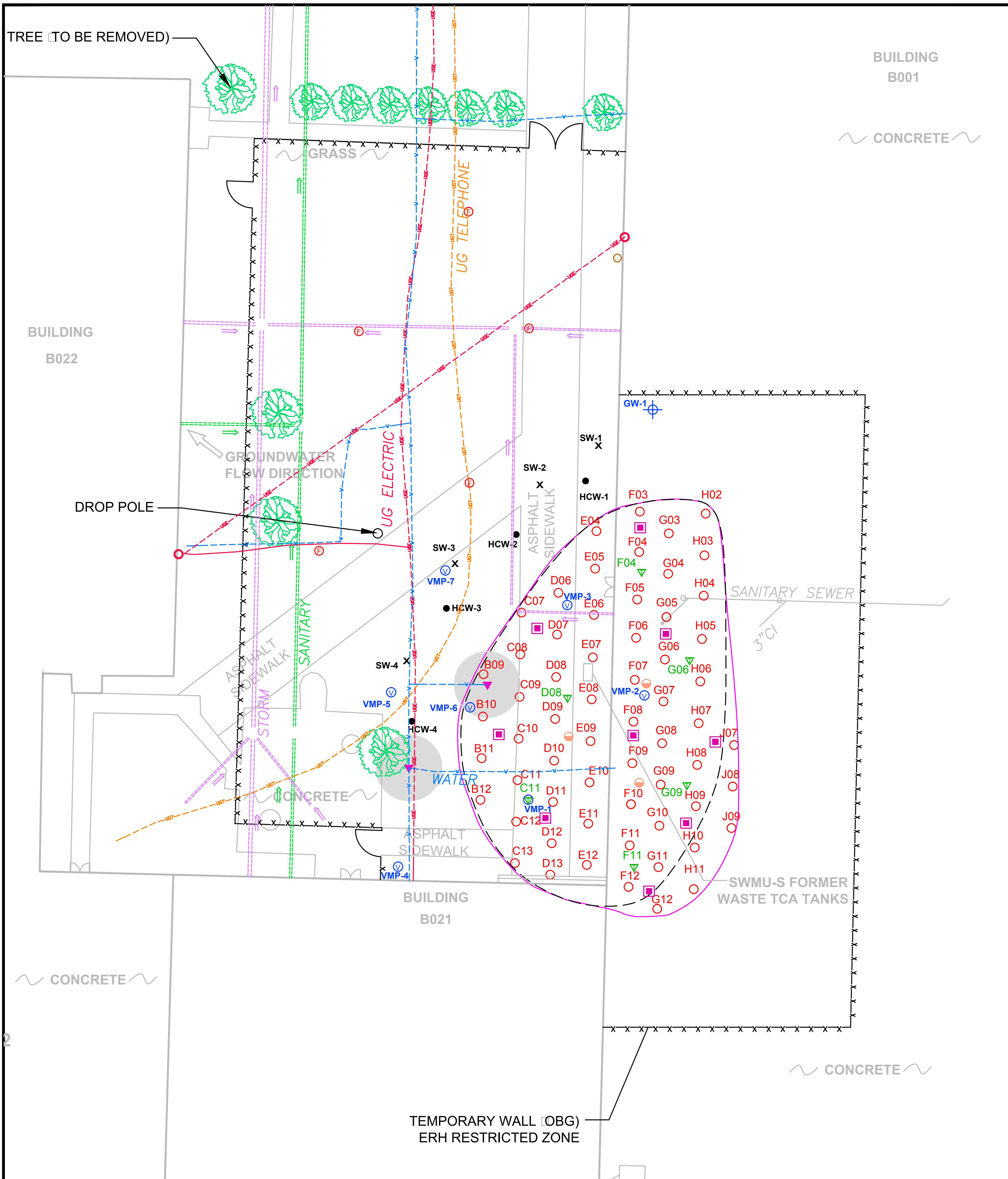


NOTES:
1. CABLES TO THE STEP DOWNS SHOULD BE 350 MCM (TYPE W).
2. CABLES TO THE ELECTRODES SHOULD BE 2/0 (TYPE W)



TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR	FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA		
CHECKED BY NOT CHECKED		CABLE ROUTING PLAN
PROJECT MANAGER B. POULIN		
APPROVED FOR IMPLEMENTATION BY ____ FOR ____ DATE	DATE 9/5/14	PROJECT KIN41
	SHEET	Y-10



LEGEND

- ELECTRODE (61)
- TEMPERATURE MONITORING POINT (5)
- CO-LOCATED TEMPERATURE AND VACUUM MONITORING POINT (1)
- RFP TREATMENT AREA
- TRS EXPANDED TREATMENT AREA
- SENTINEL WELL (4)
- GROUNDWATER RECOVERY WELL (4)
- SECONDARY CONTAINMENT
- FIRE HYDRANT (2)
- GRAVEL BASE
- STAND ALONE VACUUM MONITORING POINT (6)
- MONITORING WELL (1)
- FIRE EXTINGUISHER LOCATION
- INTERIM PERFORMANCE MONITORING SAMPLING LOCATION
- PRELIMINARY AND CONFIRMATION COMPLETION PERFORMANCE MONITORING SAMPLING LOCATION

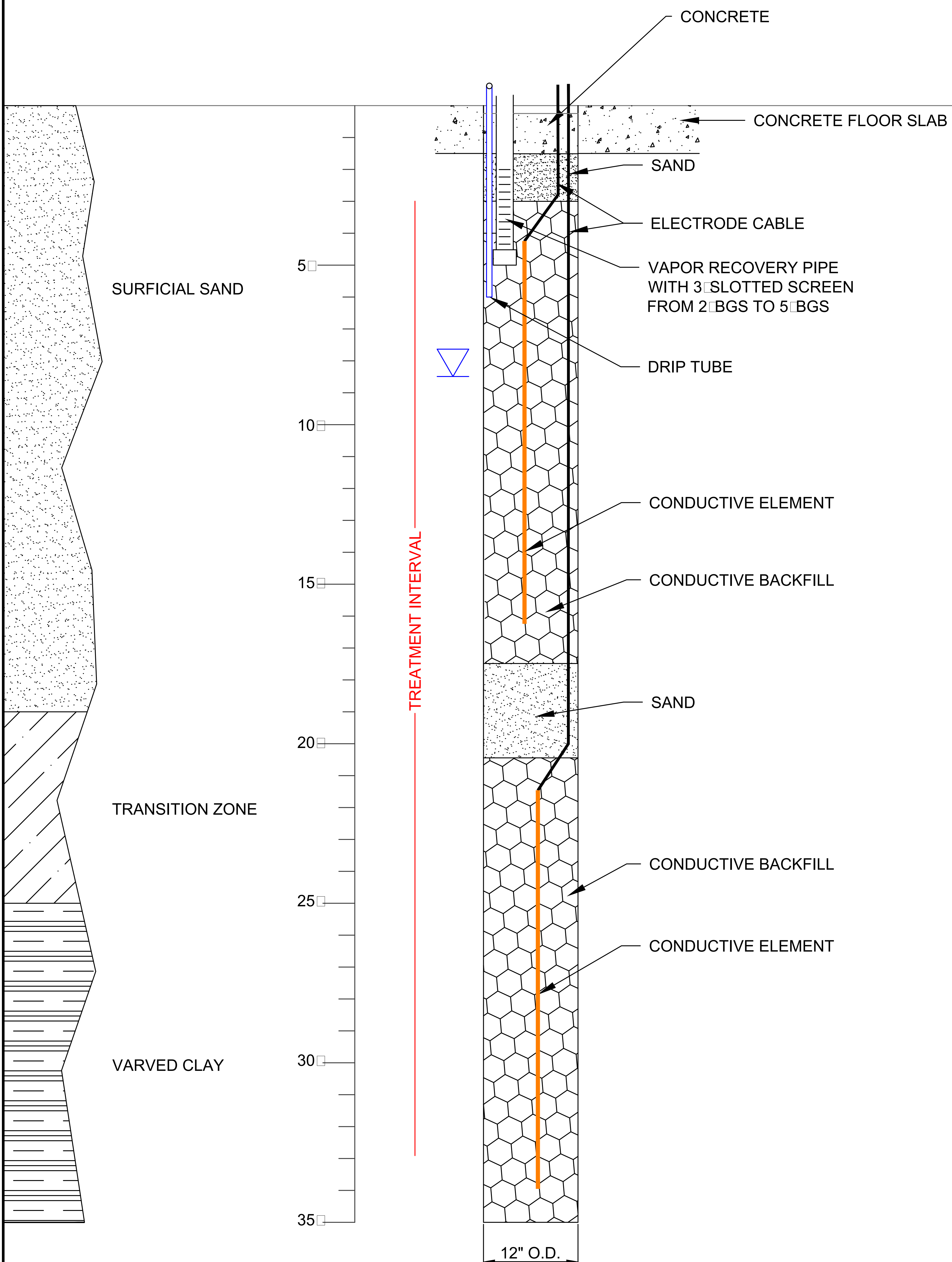
N

0 15 30 60
SCALE IN FEET

TRS
Accelerating Value

DESIGNED BY: M. NANISTA	FOR: FORMER IBM FACILITY, KINGSTON, NEW YORK
DRAWN BY: M. NANISTA	CONFIRMATORY SAMPLING LOCATIONS
CHECKED BY: NOT CHECKED	
PROJECT MANAGER: B. POULIN	
APPROVED FOR IMPLEMENTATION BY ____ FOR ____ DATE ____	DATE: 9/5/14 PROJECT: KIN41 SHEET: Y-11

INTERIOR ELECTRODE
(TYPICAL OF 33)



TRS
Accelerating Value

DESIGNED BY M. NANISTA
DRAWN BY A. PEABODY
CHECKED BY NOT APPROVED
PROJECT MANAGER B. POULIN

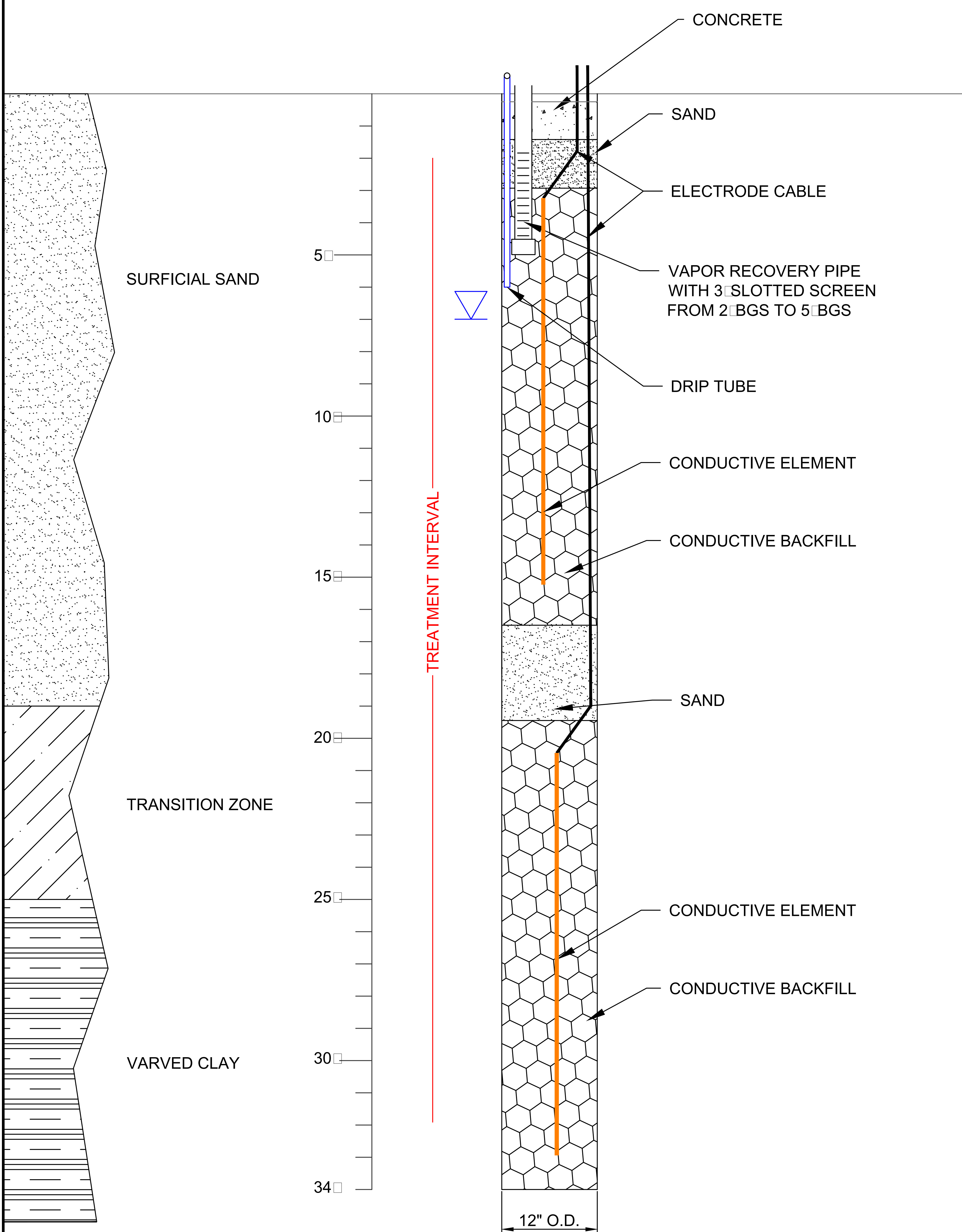
FOR FORMER IBM FACILITY
KINGSTON, NEW YORK

INTERIOR ELECTRODE DETAIL

APPROVED FOR CONSTRUCTION
BY
DATE

DATE 9/5/14
PROJECT KIN41
SHEET M-1

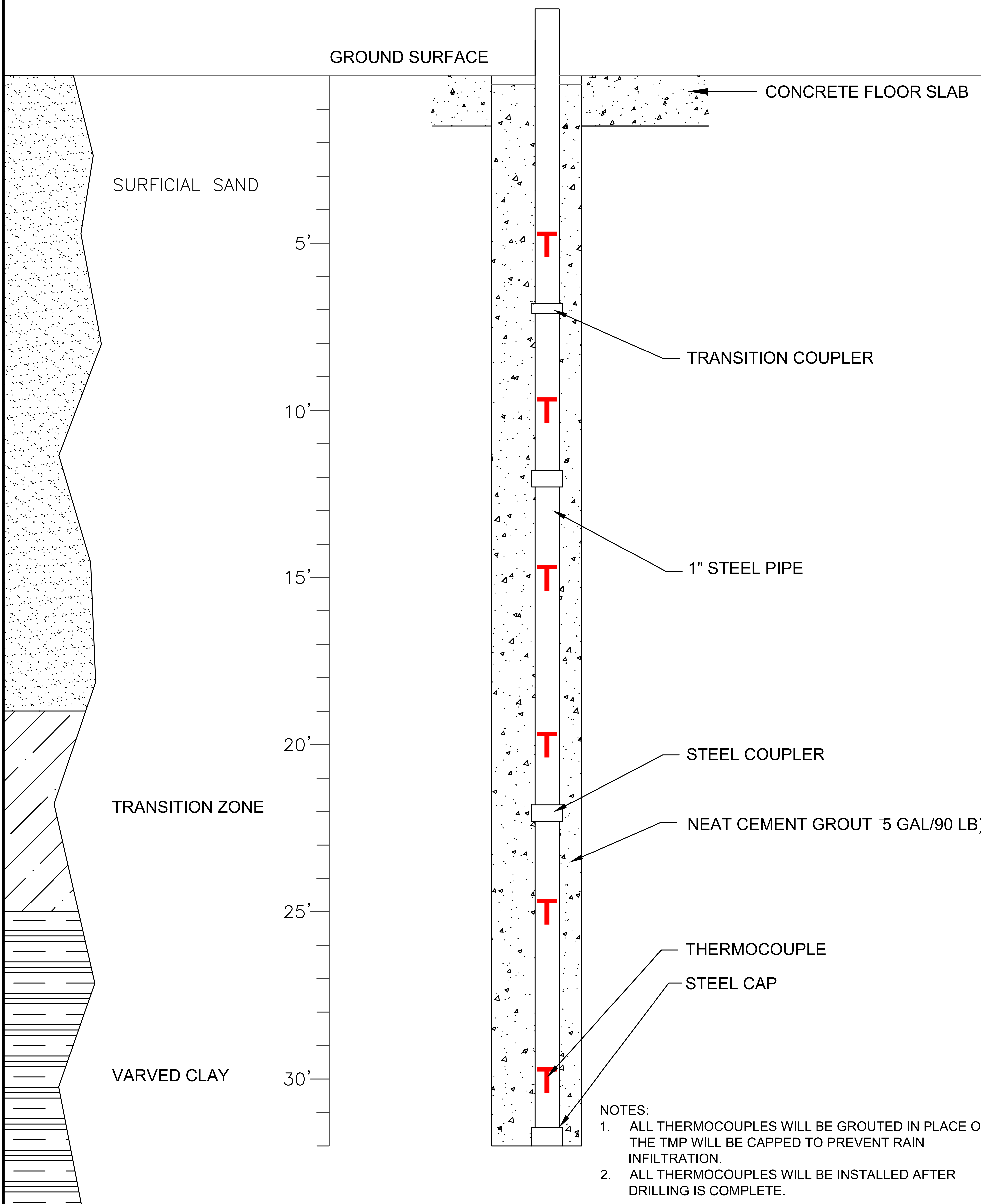
EXTERIOR ELECTRODE
(TYPICAL OF 28)



DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY A. PEABODY	
CHECKED BY NOT APPROVED	EXTERIOR ELECTRODE DETAIL
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14 · PROJECT KIN41 · SHEET M-2

TRS Accelerating Value

INTERIOR TEMPERATURE MONITORING POINT (TYPICAL OF 4)

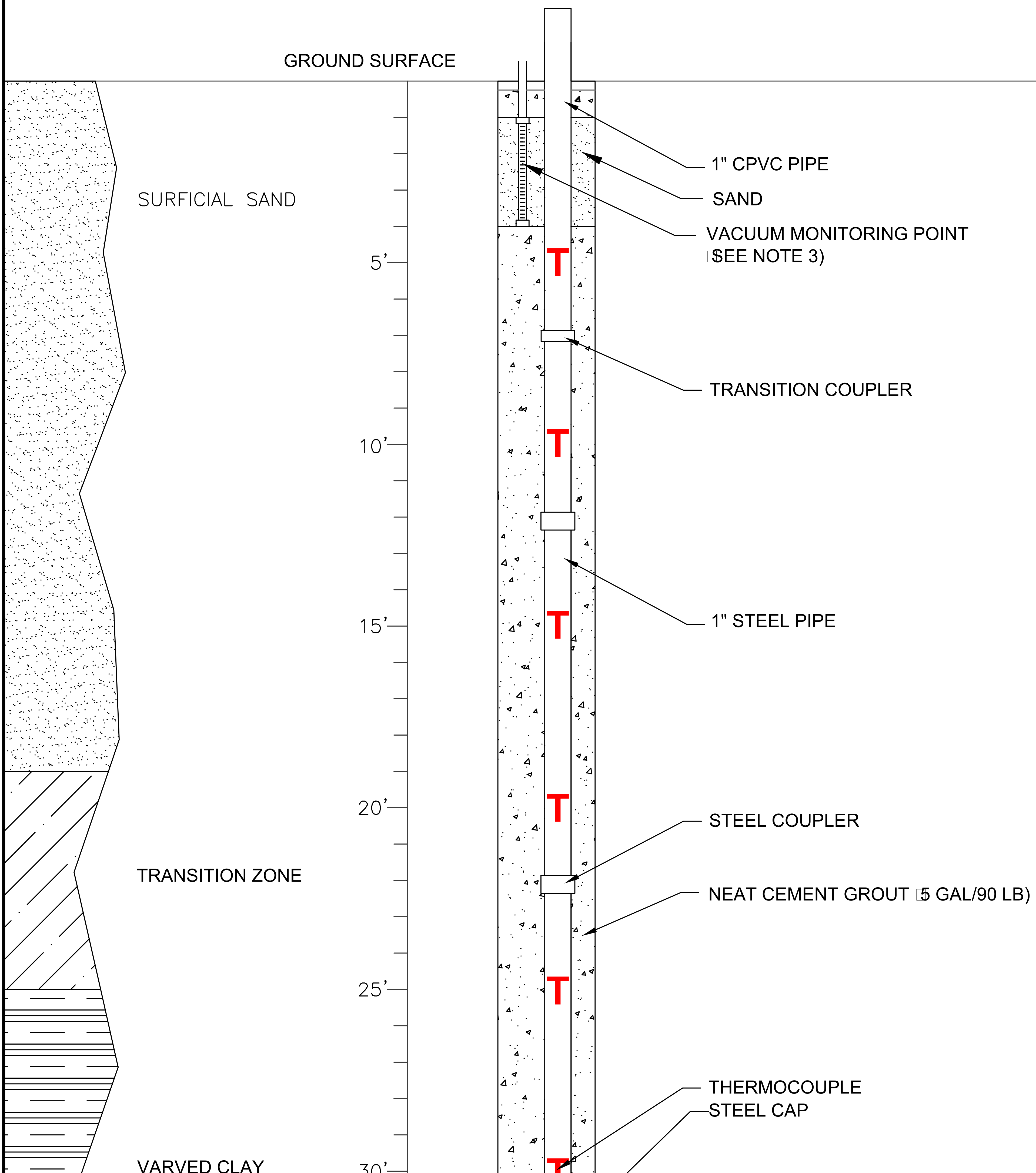


NOTES:
1. ALL THERMOCOUPLES WILL BE GROUTED IN PLACE OR THE TMP WILL BE CAPPED TO PREVENT RAIN INFILTRATION.
2. ALL THERMOCOUPLES WILL BE INSTALLED AFTER DRILLING IS COMPLETE.

TRS Accelerating Value

DESIGNED BY M. NANISTA	FOR	FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY A. PEABODY		
CHECKED BY NOT APPROVED		INTERIOR TMP DETAIL
PROJECT MANAGER B. POULIN		
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14	PROJECT KIN41
	SHEET M-3	

EXTERIOR TEMPERATURE MONITORING POINT (TYPICAL OF 2)

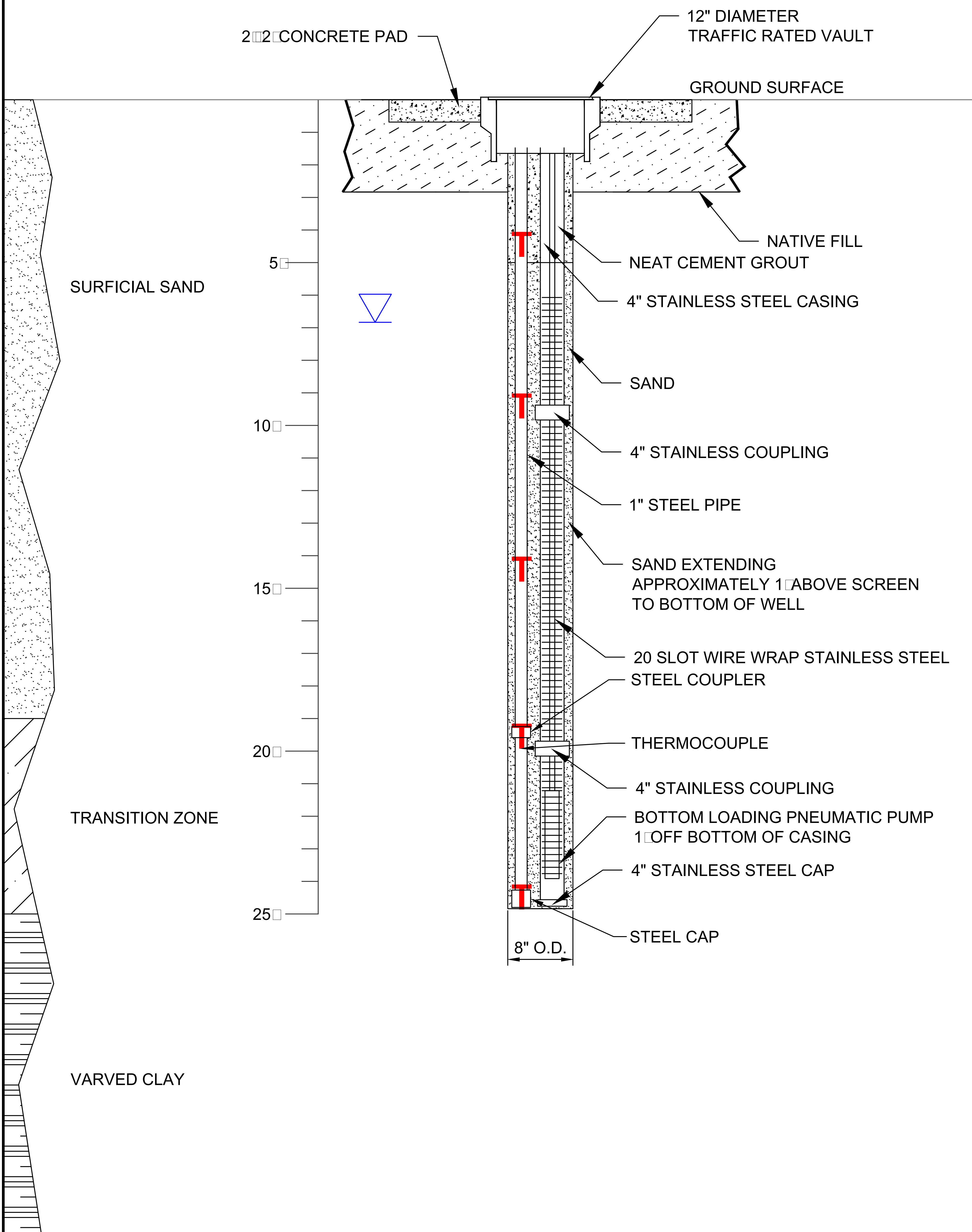


NOTES:
1. ALL THERMOCOUPLES WILL BE GROUTED IN PLACE OR THE TMP WILL BE CAPPED TO PREVENT RAIN INFILTRATION.
2. ALL THERMOCOUPLES WILL BE INSTALLED AFTER DRILLING IS COMPLETE.
3. A VACUUM MONITORING POINT IS TO BE CO-LOCATED WITH TMP C11 (SEE Y-1 AND M-9).

TRS Accelerating Value

DESIGNED BY: M. NANISTA	FOR: FORMER IBM FACILITY, KINGSTON, NEW YORK				
DRAWN BY: A. PEABODY					
CHECKED BY: NOT APPROVED	EXTERIOR TMP DETAIL				
PROJECT MANAGER: B. POULIN					
APPROVED FOR CONSTRUCTION		DATE	9/5/14	PROJECT	KIN41
BY ____		SHEET	M-4		
DATE ____					

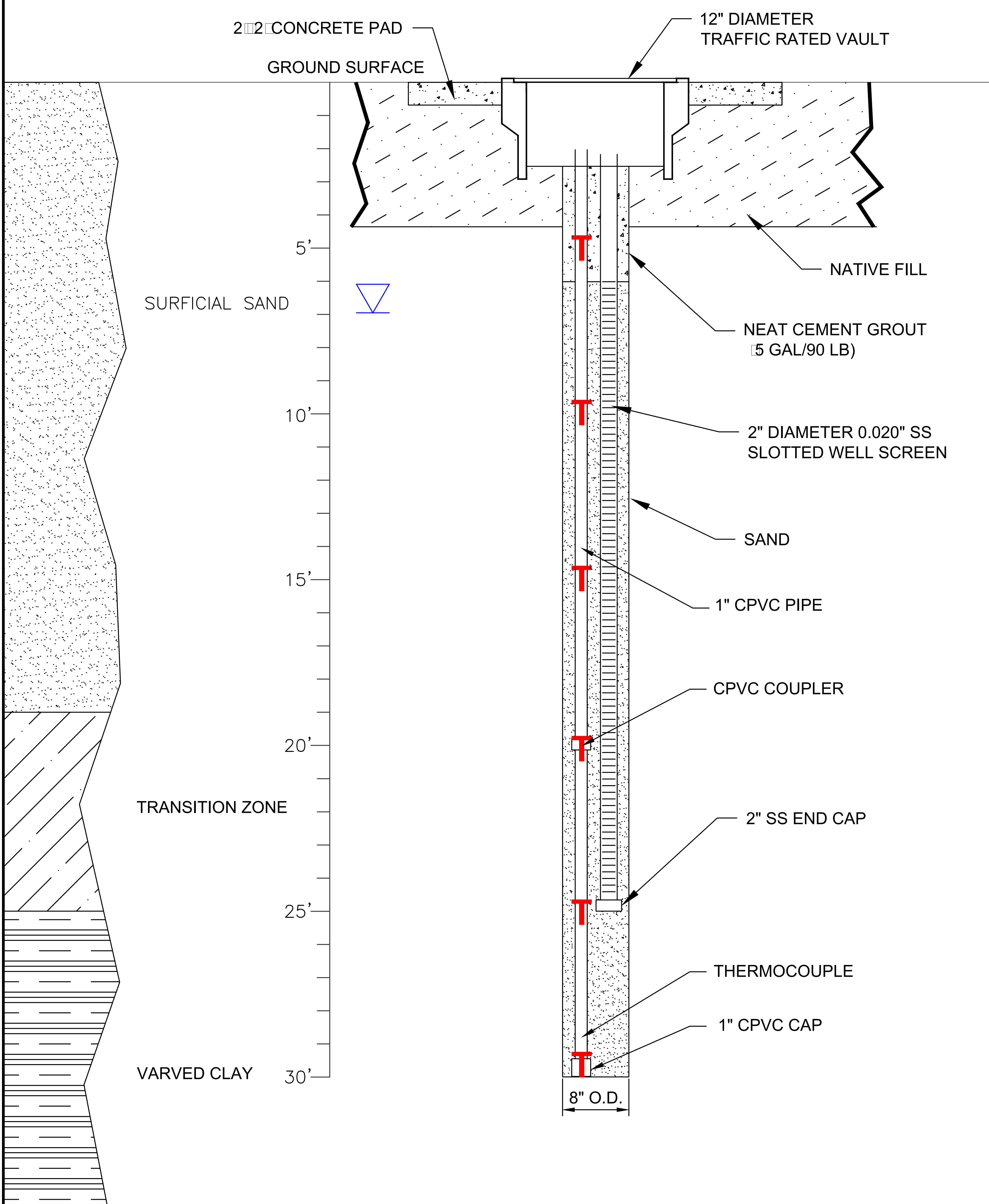
HYDRAULIC CONTROL WELL DETAIL



TRS Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK		
DRAWN BY A. PEABODY			
CHECKED BY NOT APPROVED	HYDRAULIC CONTROL WELL DETAIL		
PROJECT MANAGER B. POULIN			
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14	PROJECT KIN41	
	SHEET M-5		

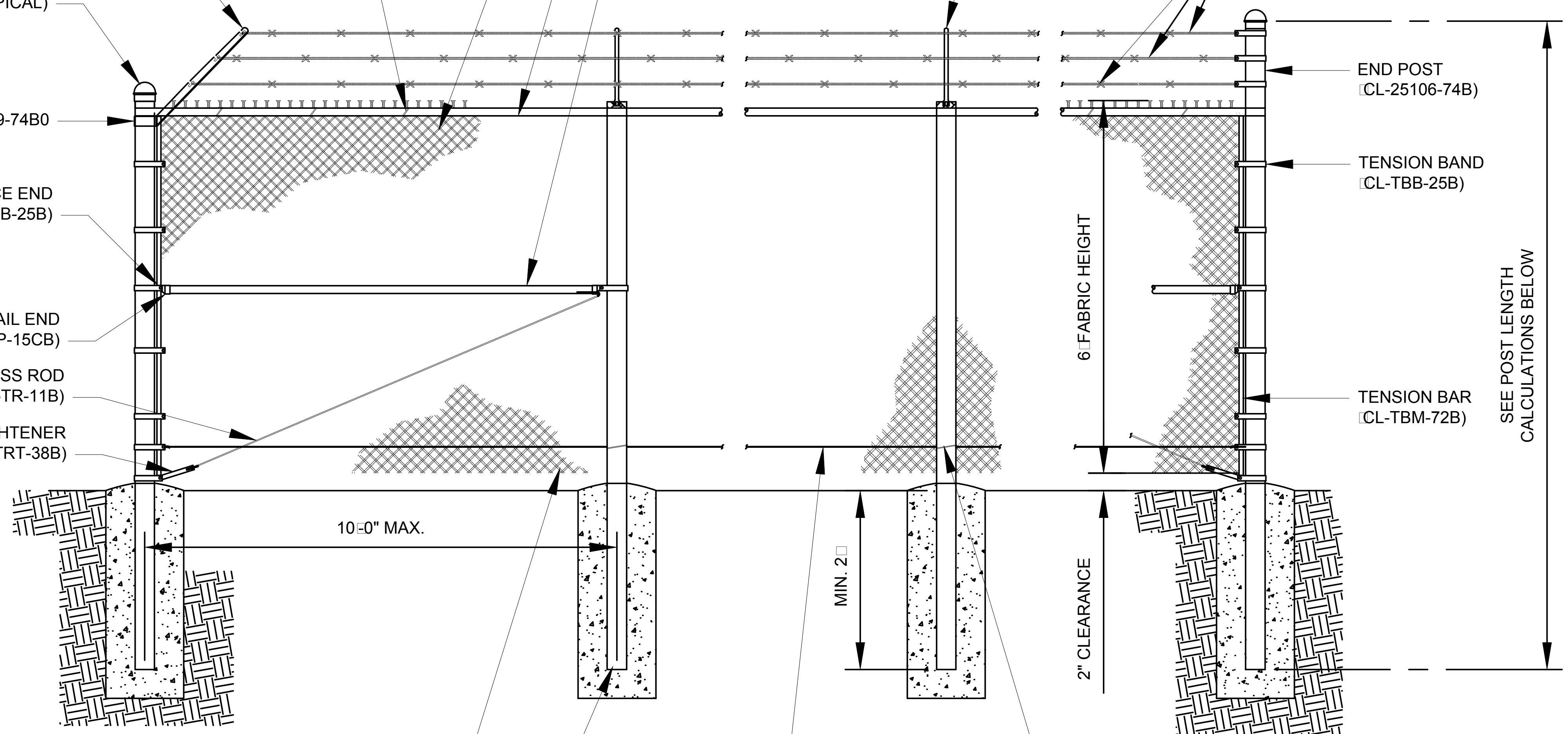
SENTINEL WELL DETAIL



TRS Accelerating Value

DESIGNED BY: M. NANISTA	FOR: FORMER IBM FACILITY, KINGSTON, NEW YORK
DRAWN BY: A. PEABODY	
CHECKED BY: NOT APPROVED	SENTINEL WELL DETAIL
PROJECT MANAGER: B. POULIN	
APPROVED FOR CONSTRUCTION	DATE: 9/5/14 — PROJECT: KIN41
BY ______ DATE ______	SHEET: M-6

ALL POSTS*, FABRIC, BRACES, BANDS, AND BARBED WIRE MUST BE VINYL-CLAD.
*POSTS CAN BE VINYL-CLAD OR WOOD.



OPTIONAL PART NUMBERS:
HOG RINGS (CL-HR-9SB)
DROP ROD (CL-DD-IMPB)
TOP RAIL SLEEVES (CL-SL-156B)

NOTES:

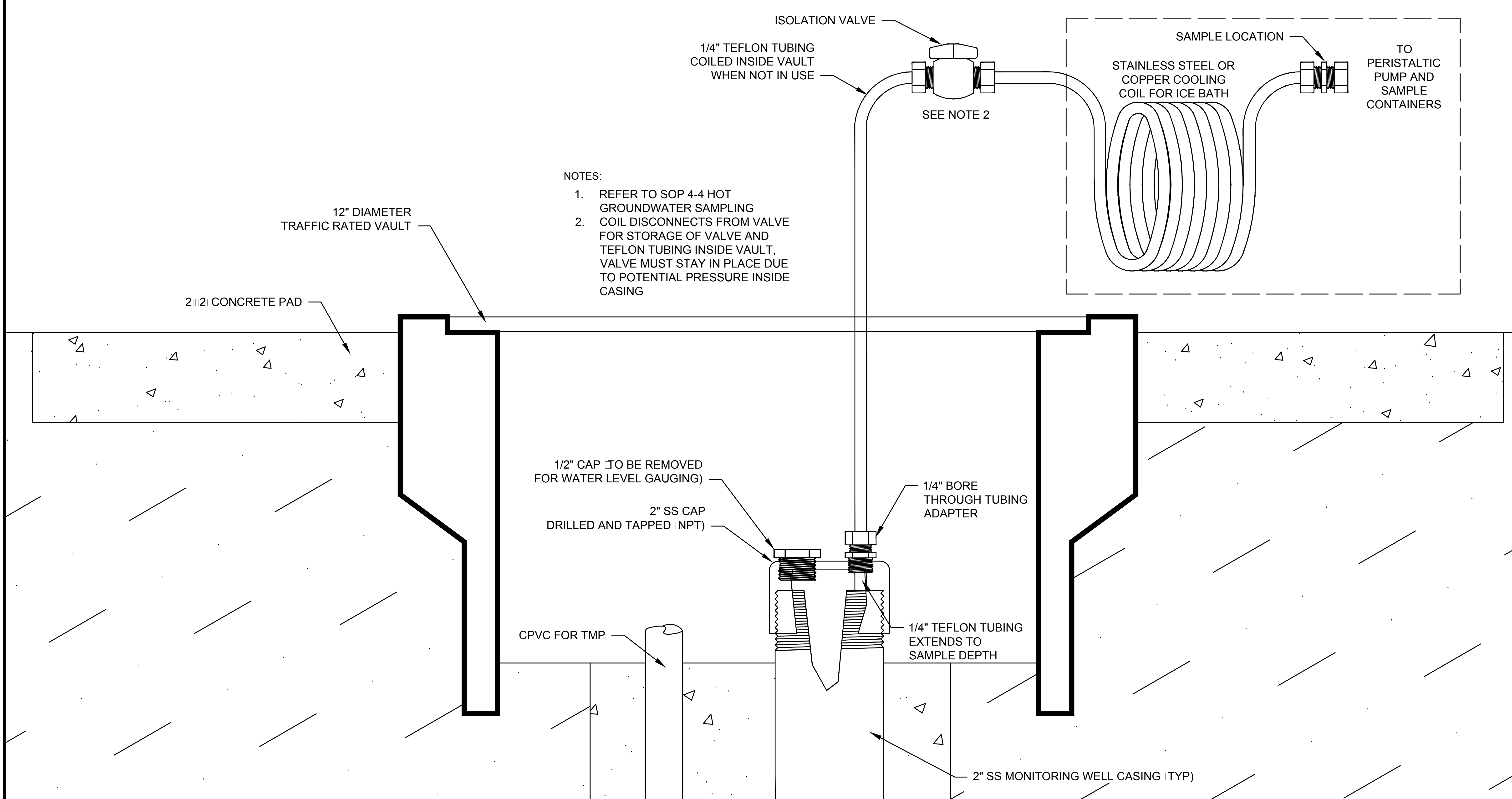
1. THIS DETAIL DOES NOT INCLUDE PRIVACY DETAILS.
2. SITE FENCING WILL INCLUDE PRIVACY SLATS OR WINDSCREEN.
3. BRACE AND TOP RAILS CAN BE CUT TO THE DESIRED LENGTH.
4. LINE, CORNER AND END POSTS CAN BE CUT TO THE DESIRED LENGTH/HEIGHT.
5. ANY GATES MUST BE BONDED TOGETHER.
6. OLD AND NEW SECTIONS OF FENCE SHOULD BE BONDED TOGETHER.

POST LENGTH CALCULATIONS FOR STANDARD DESIGN/NORMAL CONDITIONS:

1. LINE POSTS = FABRIC HEIGHT + 2'-8" = 8'-8"
2. CORNER POST WITH CORNER ARM = FABRIC HEIGHT + 3'-0" = 9'-0"
3. END POSTS INTENDED 1'-0" FOR BARBED WIRE = FABRIC HEIGHT + 4'-0" = 10'-0"

TRS Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
TITLE	SECURITY FENCE DETAIL
APPROVED FOR CONSTRUCTION	BY ______ DATE ______
DATE	9/5/14
PROJECT	KIN41
SHEET	M-7

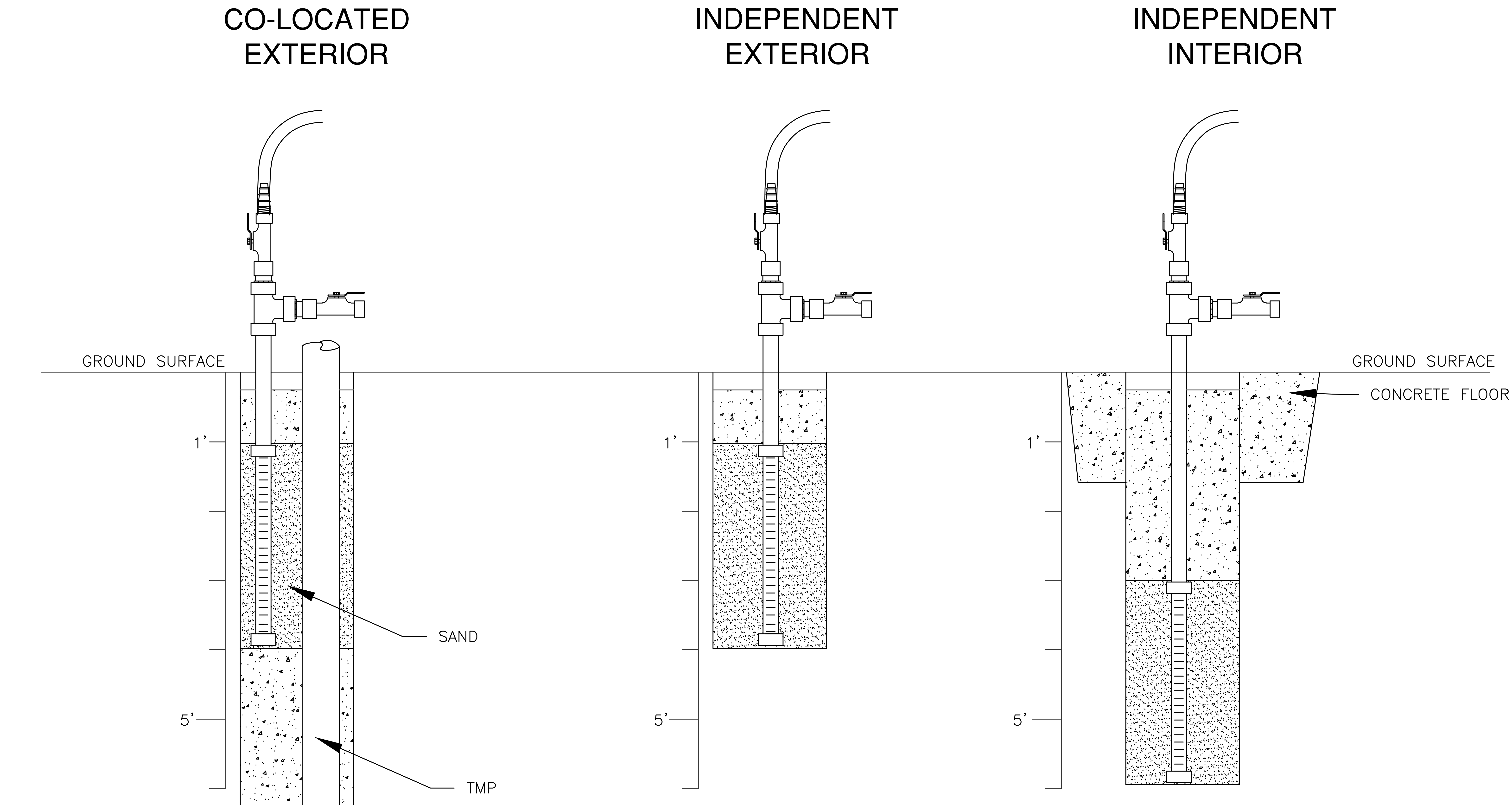


NOTES:

1. REFER TO SOP 4-4 HOT GROUNDWATER SAMPLING
2. COIL DISCONNECTS FROM VALVE FOR STORAGE OF VALVE AND TEFLON TUBING INSIDE VAULT, VALVE MUST STAY IN PLACE DUE TO POTENTIAL PRESSURE INSIDE CASING

TRS
Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY KINGSTON, NEW YORK
	SENTINEL WELL HEAD DETAIL
APPROVED FOR CONSTRUCTION	BY DATE
DATE	9/5/14
PROJECT	KIN41
SHEET	M-8



NOTES:

1. SEE Y-1 FOR VACUUM MONITORING POINT LOCATIONS AND TYPES.

TRS Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY A. PEABODY	VACUUM MONITORING POINT HEAD DETAIL
CHECKED BY NOT APPROVED	
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY DATE	DATE 9/5/14 PROJECT KIN41 SHEET M-9

LEGEND

ELECTRONIC SIGNAL

ELECTRICAL CABLE

3 PROCESS LINE LABELING
SEE SHEET P-2 FOR DESCRIPTION

S SOLENOID

GATE VALVE

BALL VALVE

M ACTUATOR VALVE

BUTTERFLY VALVE

SAMPLE PORT

CHECK VALVE

VACUUM RELIEF VALVE

PRESSURE RELIEF VALVE

SELF-CONTAINED
PRESSURE REGULATOR

SPIGOT

BACKFLOW PREVENTER

COMPRESSED AIR FILTER

FLANGE

XX XX PIPING SPEC. # CHANGE

IMMERSION HEATER

DIAPHRAGM PUMP

PUMP

BLOWER

ROTARY LOBE BLOWER

VIBRATION DAMPER

RUPTURE DISC

T	THERMOCOUPLE
CS	CARBON STEEL
CPVC	SCH 40. CPVC PIPE
PEX	PEX TUBING
FCV	FLOW CONTROL VALVE

CITY/SOFTENED WATER (MAKE-UP)

PROCESS WATER

SOLVENT

AIR/STEAM

STEAM

AIR

BLOWDOWN

COOLING WATER

YC 1 COMPUTER OPERATED MONITORING,
DATA COLLECTION AND CONTROLS

YC 2 HARDWIRE CONTROLS

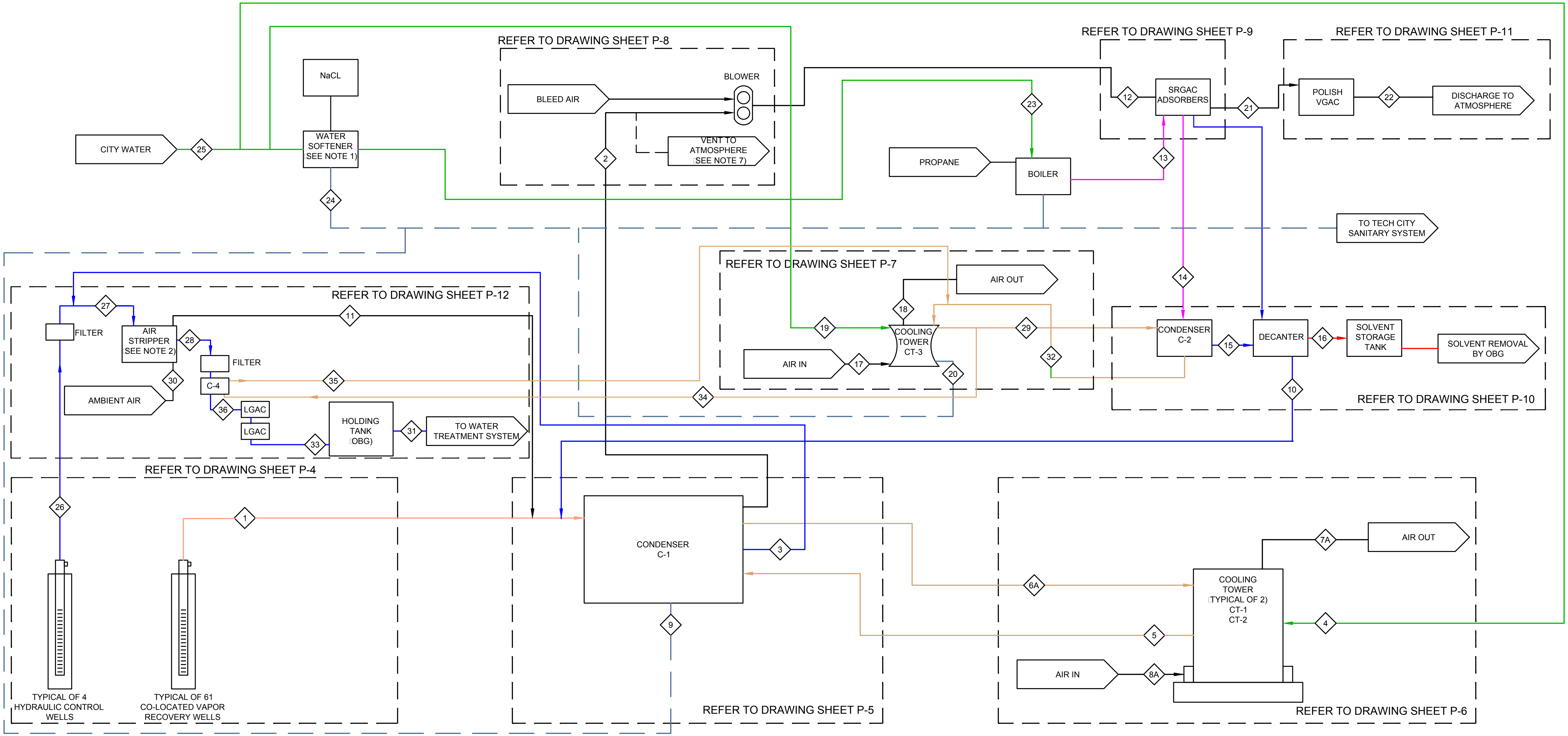
PI	PRESSURE INDICATOR
PCV	PRESSURE CONTROL VALVE
FE	FLOW ELEMENT
FI	FLOW INDICATOR
FQI	FLOW QUANTITY INDICATOR
FT	FLOW TRANSMITTER
FQI	FLOW QUANTITY INDICATOR
LI	LEVEL INDICATOR
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW-LOW
SS	STAINLESS STEEL
TAH	TEMPERATURE ALARM HIGH
TE	TEMPERATURE ELEMENT
TSL	TEMPERATURE SWITCH LOW
TI	TEMPERATURE INDICATOR
TSH	TEMPERATURE SWITCH HIGH
YC	CONTROLLER

NOTES:

1. THIS IS AN ALL INCLUSIVE LEGEND SHEET. NOT ALL SYMBOLS WILL APPEAR ON EACH SHEET.
2. WATER LINES WILL BE HEAT TRACED AND INSULATED AS NECESSARY.
3. STEAM LINES WILL BE INSULATED.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK		
DRAWN BY M. NANISTA			
CHECKED BY NOT CHECKED	PROCESS AND INSTRUMENTATION DIAGRAM LEGEND		
PROJECT MANAGER B. POULIN			
APPROVED FOR CONSTRUCTION BY ______ DATE ______		DATE 9/5/14	PROJECT KIN41
		P-1	



NOTES:

1. REFER TO WATER SOFTENER SPECIFICATIONS PACKAGE (EVERSOFT MODEL C-72F9801)
2. QED MODEL EZ-4.4SS
3. PROCESS LINE 6A SPLITS WITH HALF THE TOTAL FLOW (PROCESS LINE 6) GOING TO EACH COOLING TOWER (SEE P-6)
4. PROCESS LINE 7A IS THE COMBINATION OF PROCESS LINES 7 (ONE FROM EACH COOLING TOWER, SEE P-6).
5. PROCESS LINE 8A IS THE COMBINATION OF PROCESS LINES 8 (ONE TO EACH COOLING TOWER, SEE P-6).
6. C-4 IS A WATER TO WATER SHELL AND TUBE HEAT EXCHANGER.
7. AUTOMATED BYPASS VENT IN THE EVENT THE VAPOR RECOVERY BLOWER SHUTS DOWN.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	VAPOR RECOVERY AND CONDENSING PROCESS FLOW DIAGRAM
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14 PROJECT KIN41
	P-2

Process Stream	Location	Air		Water Vapor		Water		CVOCs		Temperature		Pressure
Description	#	(lb/min)	(scfm)	(lb/min)	(scfm)	(lb/min)	(gpm)	(lb/min)	(ppm)	°C	°F	(Δ from barometric)
Extracted air and steam from vapor recovery wells	1	53	700	10.7	228	10	1.3	0.225	813	65	149	2" Hg Vac
Discharge air from condenser after steam removal	2	68	900	1.35	29	0	0	0.238	862	25	77	4" Hg Vac
Condensate discharge from condenser	3	0	0	0	0	29.7	3.57	0.001	42	40	104	10 psig
Make-up water to cooling towers	4	0	0	0	0	16.8	2.02	0	0	20	68	25 psig
Cooling water to heat exchanger	5	0	0	0	0	4998	600	0	0	18	64	10 psig
Cooling water return to each cooling tower	6	0	0	0	0	2499	300	0	0	25	77	10 psig
Air exhaust from each cooling tower	7	750	10000	9.7	206	0	0	0	0	18	64	N/A
Air inlet to each cooling tower	8	750	10000	2	48	0	0	0	0	3	37	N/A
Blowdown from condenser	9	0	0	0	0	2.0	0.24	0	0	18	64	N/A
Water from decanter to condenser	10	0	0	0	0	9.4	1.128	0.010	1050	25	77	N/A
Air exhaust from air stripper	11	15	200	0.55	11.66	0	0	0.005	73	35	95	N/A
Discharge air from rotary lobe blower	12	68	900	1.35	29	0	0	0.238	862	45	113	2 psig
Steam from boiler to SRGAC	13	0	0	9.4	200	0	0	0	0	100	212	25 psig
Regeneration steam & CVOCs from SRGAC to condenser C-2	14	0	0	9.4	200	0	0	0.215	3559	100	212	0.5 psig
Condensed water & NAPL from SRGAC condenser to decanter	15	0	0	0	0	9.4	1.128	0.215	Saturated	25	77	N/A
DNAPL to storage tanks	16	0	0	0	0	0.0205	0.002	0.205	DNAPL&Water	25	77	N/A
Air inlet to SRGAC cooling tower	17	600	8000	1.8	39	0	0	0	0	3	37	N/A
Air exhaust from SRGAC cooling tower	18	600	8000	7.8	165	0	0	0	0	18	64	N/A
Make-up water to SRGAC cooling tower	19	0	0	0	0	6.9	0.83	0	0	20	68	25 psig
Blowdown from SRGAC cooling tower	20	0	0	0	0	1	0.12	0	0	35	95	N/A
Discharge air from SRGAC	21	68	900	1.33	29	0	0	0.024	86	35	95	0.5 psig
Discharge air from polish VGAC	22	68	900	1.33	29	0	0	0.005	17	30	86	10 psig
Softened water to boiler	23	0	0	0	0	9.4	1.128	0	0	20	68	25 psig
Regeneration water from softener	24	0	0	0	0	1.4	0.17	0	0	20	68	N/A
City water demand	25	0	0	0	0	34.6	4.15	0	0	20	68	25 psig
Extracted groundwater from hydraulic control wells	26	0	0	0	0	125.0	15.00	0.004	31	50	122	30 psig
Water into air stripper	27	0	0	0	0	154.7	18.57	0.005	33	45	113	N/A
Water out of air stripper	28	0	0	0	0	154.2	18.51	0.001	3	41	105	N/A
Cooling water to SRGAC Shell and Tube Condenser	29	0	0	0	0	416.5	50.00	0	0	18	64	N/A
Air inlet to air stripper	30	15	200	0.05	0.97	0.0	0.00	0	0	3	37	N/A
Discharge water from holding tank	31	0	0	0	0	154.2	18.51	0.000001	0.008	32	90	N/A
Cooling water return to SRGAC Cooling Tower	32	0	0	0	0	416.5	50.00	0	0	22	72	N/A
Water to OBG holding tank	33	0	0	0	0	154.2	18.51	0	0	32	90	N/A
Cooling Water from SRGAC Cooling Tower to C-4	34	0	0	0	0	416.5	50.00	0	0	18	64	N/A
Cooling Water Return from C-4 to SRGAC Cooling Tower	35	0	0	0	0	416.5	50.00	0	0	21	70	N/A
Water out of C-4 to LGAC	36	0	0	0	0	154.2	18.51	0.001	3	32	90	N/A

NOTES:

1. LOCATIONS INDICATED IN THIS TABLE CORRESPOND TO THE LOCATION NUMBERS PROVIDED ON SHEET P-2.

TRS Accelerating Value

DESIGNED BY M. NANISTA
DRAWN BY M. NANISTA
CHECKED BY NOT CHECKED
PROJECT MANAGER B. POULIN

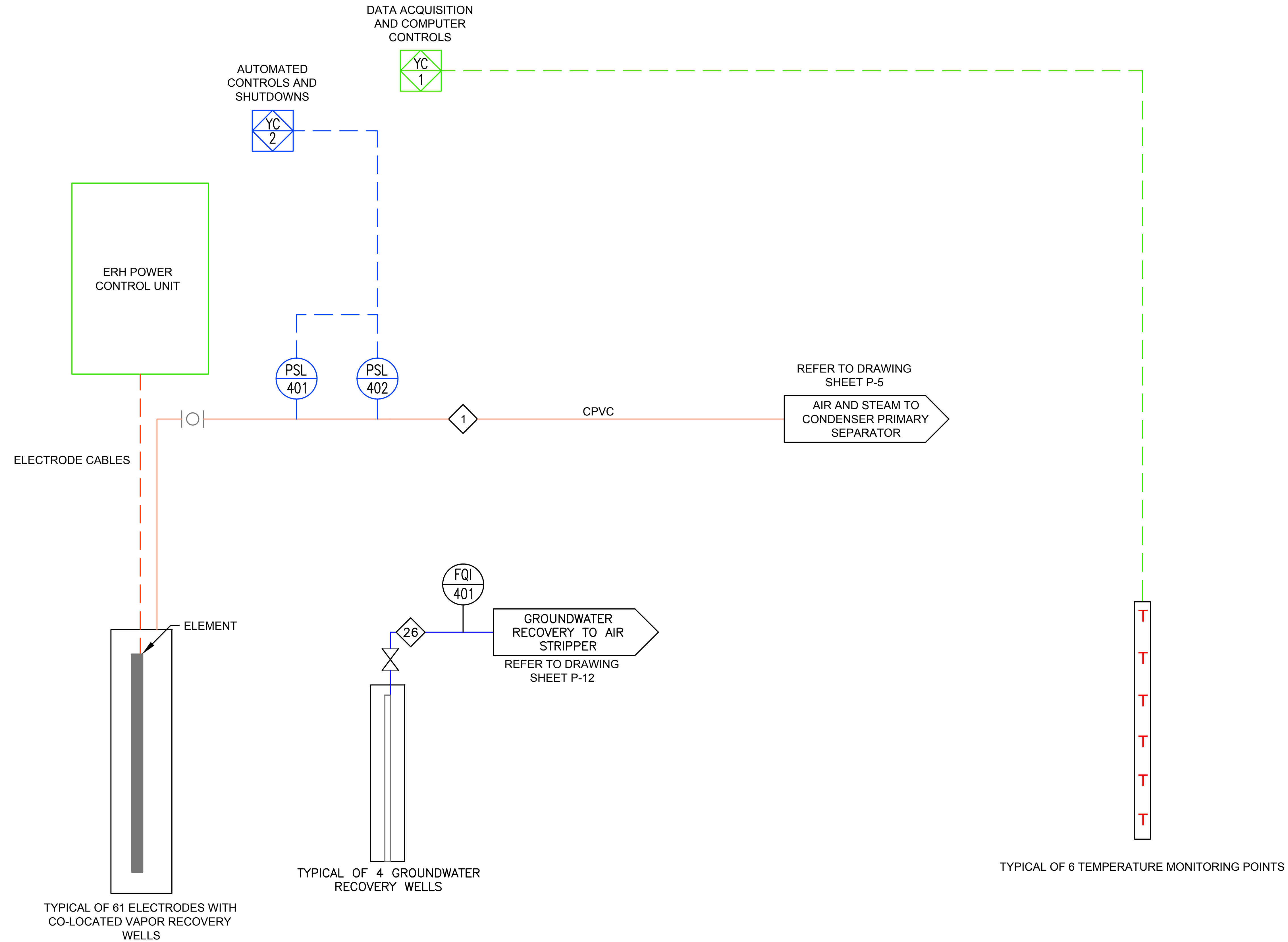
FOR FORMER IBM FACILITY
KINGSTON, NEW YORK

PROCESS FLOW MASS BALANCE

APPROVED FOR CONSTRUCTION
BY
DATE

DATE 9/5/14
PROJECT KIN41

P-3



NOTES:

1. SEE THE ELECTRODE AND TEMPERATURE MONITORING POINT DETAILS FOR MORE INFORMATION ON THEIR CONSTRUCTION.
2. PSL-401 AND PSL-402 WILL SHUT DOWN THE PCU IN THE EVENT OF A LOW FIELD VACUUM (LESS THAN 2" $H_2$0).
3. PSL-401 WILL BE LOCATED BETWEEN ELECTRODES C13 AND D13 OUTSIDE THE BUILDING.
4. PSL-402 WILL BE LOCATED BETWEEN ELECTRODES F12 AND G12 INSIDE THE BUILDING.

TRS
Accelerating Value

DESIGNED BY: M. NANISTA
DRAWN BY: M. NANISTA
CHECKED BY: NOT CHECKED
PROJECT MANAGER: B. POULIN

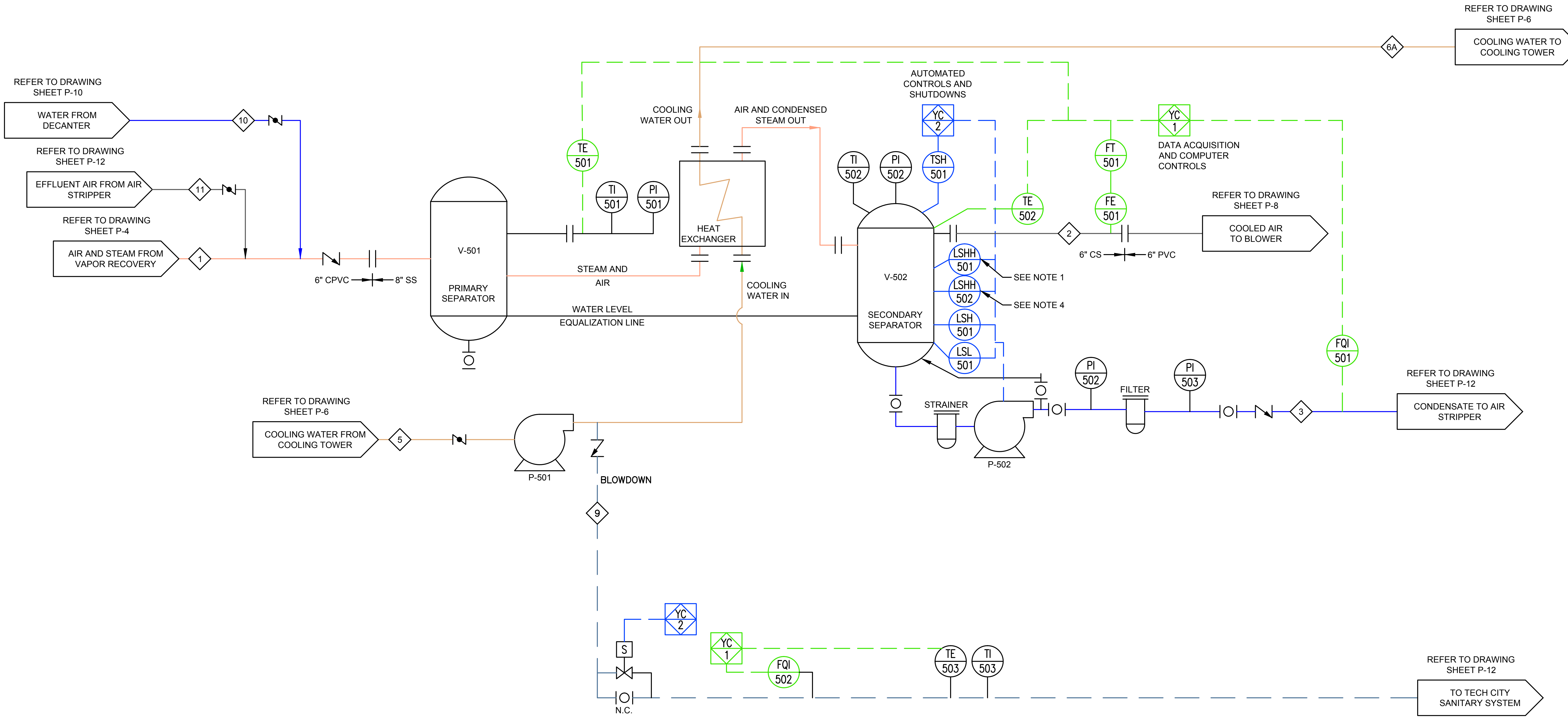
FOR: FORMER IBM FACILITY
KINGSTON, NEW YORK

FIELD
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION
BY ____
DATE ____

DATE: 9/5/14
PROJECT: KIN41

P-4

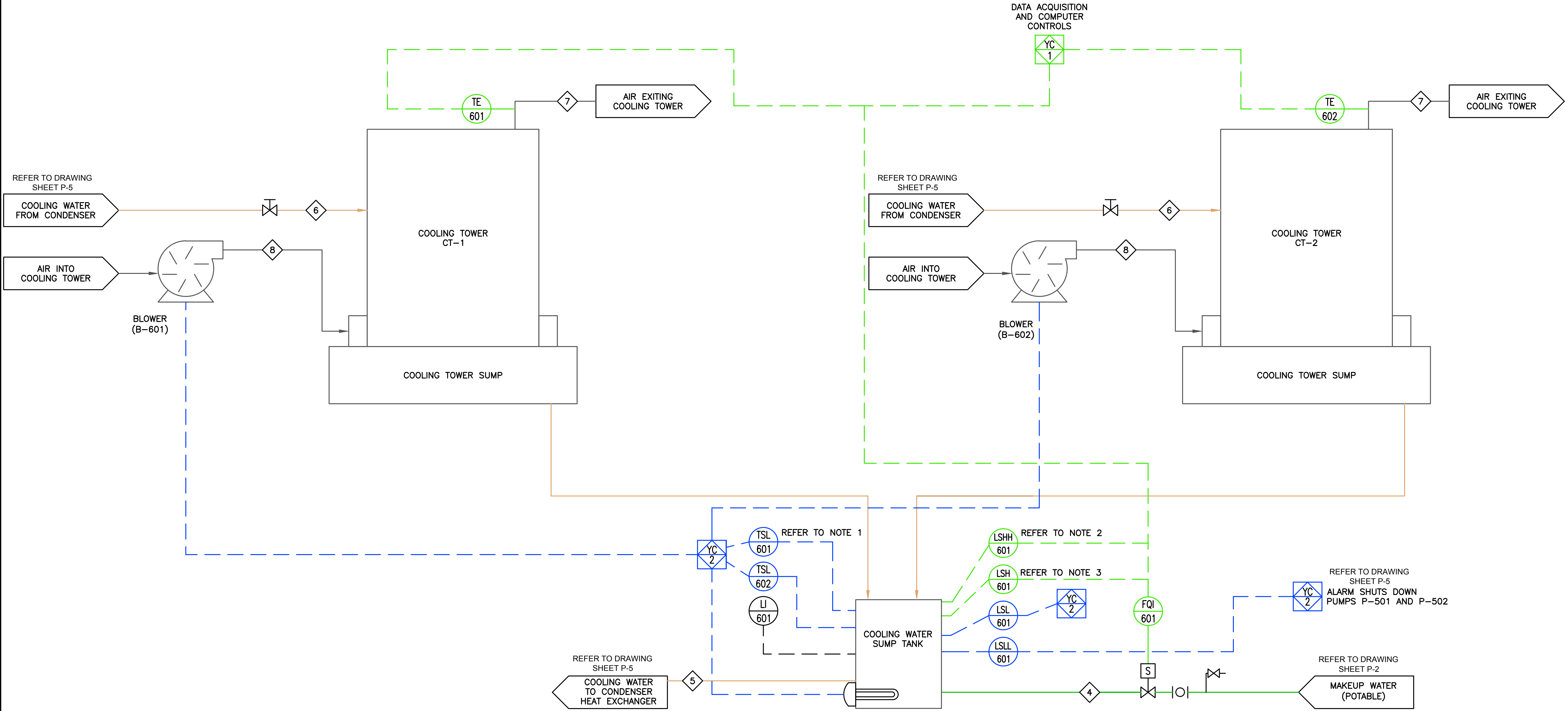


NOTES:

1. LSHH-501 WILL SHUT DOWN THE VAPOR RECOVERY BLOWER (B-801).
2. TSH-501 WILL SHUT DOWN THE VAPOR RECOVERY BLOWER (B-801). TEMPERATURE SET POINT IS 140°F
3. PROCESS LINE 6A SPLITS WITH HALF THE TOTAL FLOW (PROCESS LINE 6) GOING TO EACH COOLING TOWER (SEE P-6).
4. LSHH-502 WILL SHUT DOWN POWER TO THE ELECTRODES.
5. THE HEAT EXCHANGER IS ASME 2 RATED.

TRS Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	CONDENSER PROCESS AND INSTRUMENTATION DIAGRAM
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION	DATE 9/5/14 — PROJECT KIN41
BY	P-5
DATE	

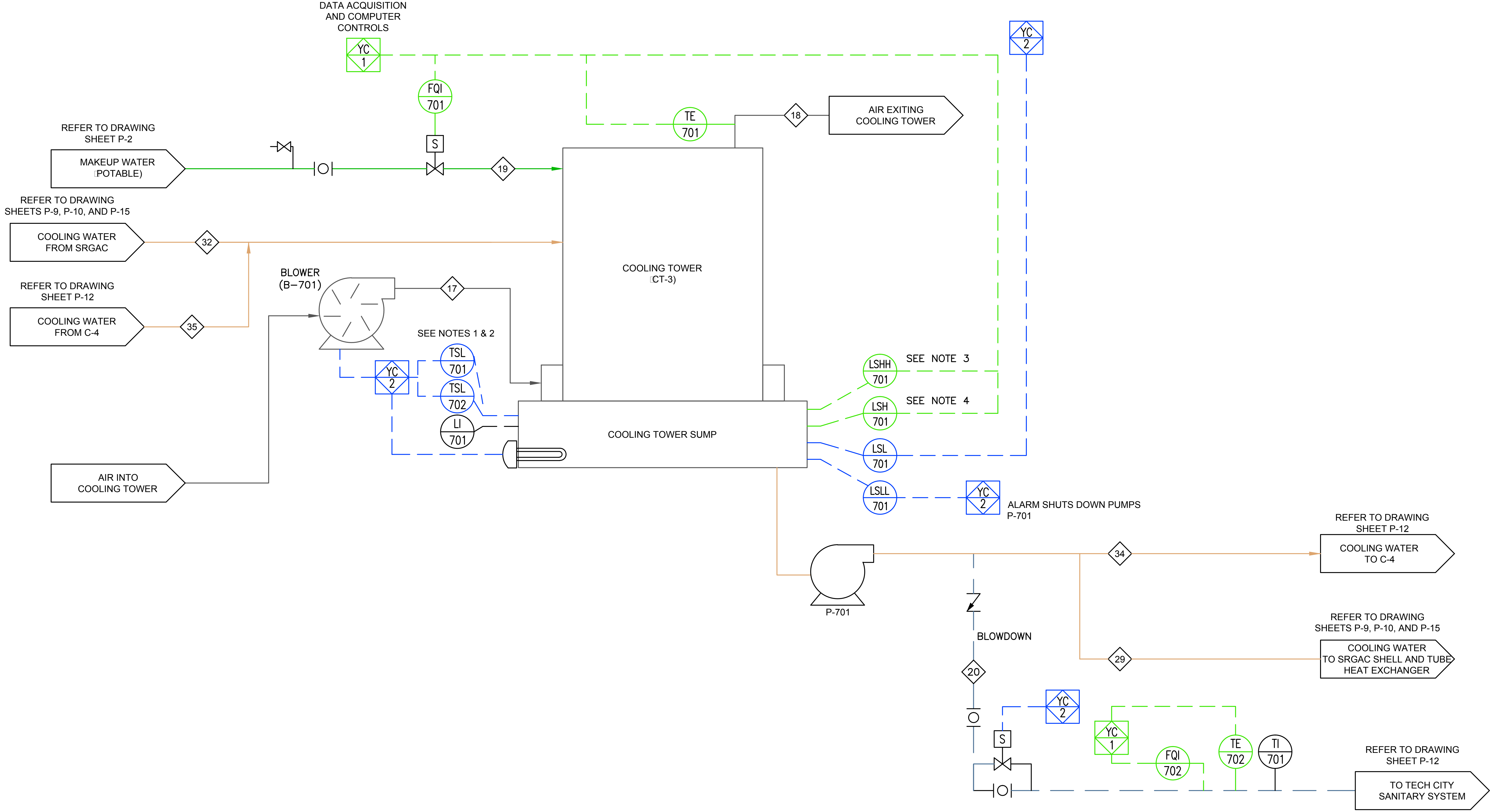


NOTES:

1. TSL-601 AUTOMATICALLY SHUTS DOWN THE COOLING TOWER FAN AT 45° F. TSL-602 TURNS ON AN IMMERSION HEATER IN THE COOLING TOWER SUMP.
2. LSHH SHUTS DOWN SYSTEM.
3. LSH OPENS BLOWDOWN SOLENOID AT CONDENSER.
4. LSL-601 MUST BE AT LEAST 2 FEET ABOVE PUMP INTAKE.
5. PROCESS LINE 6A SPLITS WITH HALF THE TOTAL FLOW (PROCESS LINE 6) GOING TO EACH COOLING TOWER (SEE P-2 AND P-5).
6. PROCESS LINE 7A IS THE COMBINATION OF PROCESS LINES 7 (ONE FROM EACH COOLING TOWER, SEE P-2).
7. PROCESS LINE 8A IS THE COMBINATION OF PROCESS LINES 8 (ONE TO EACH COOLING TOWER, SEE P-2).
8. POTABLE MAKEUP WATER IS SUPPLIED TO THE COOLING WATER SUMP TANK AT AN AVERAGE RATE OF 3-5 GPM IN 30 SECOND INCREMENTS.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	COOLING TOWER PROCESS AND INSTRUMENTATION DIAGRAM
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14 · PROJECT KIN41 · P-6

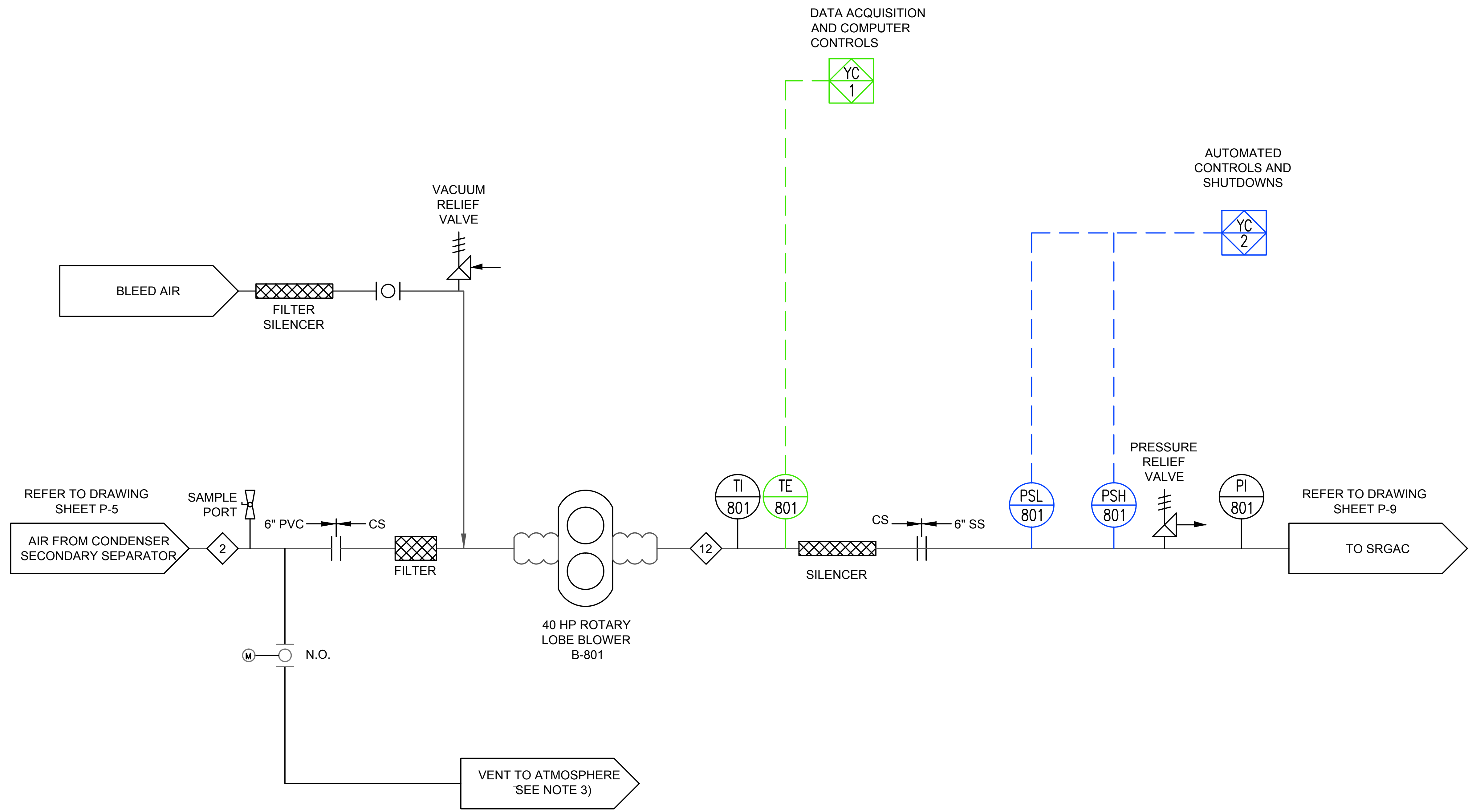


NOTES:

1. TSL-701 AUTOMATICALLY SHUTS DOWN THE COOLING TOWER FAN AT 45° F. TSL-702 TURNS ON AN IMMERSION HEATER IN THE COOLING TOWER SUMP.
2. LSHH SHUTS DOWN SYSTEM.
3. LSH OPENS BLOWDOWN SOLENOID AT CONDENSER.
4. LSL-701 MUST BE AT LEAST 2 FEET ABOVE PUMP INTAKE.
5. POTABLE MAKEUP WATER IS SUPPLIED TO THE COOLING TOWER AT AN AVERAGE RATE OF 3-5 GPM IN 30 SECOND INCREMENTS.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	SRGAC COOLING TOWER PROCESS AND INSTRUMENTATION DIAGRAM
CHECKED BY NOT CHECKED	
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14 PROJECT KIN41
	P-7

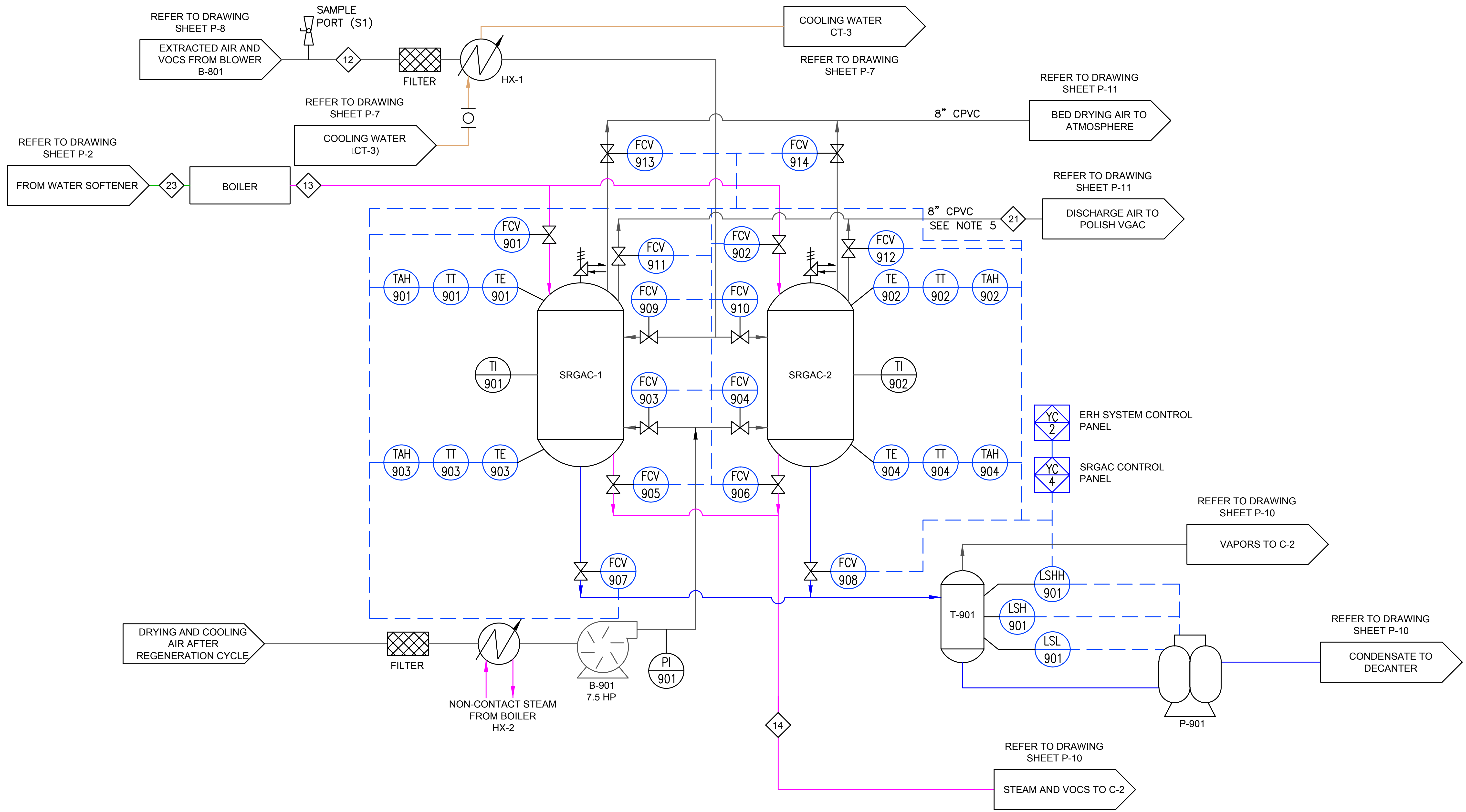


NOTES:

1. PSH-801 AND PSL-801 WILL SHUT DOWN THE BLOWER IN THE EVENT OF A HIGH OR LOW BLOWER DISCHARGE PRESSURE. PSL-801 WILL HAVE A SET POINT OF 1" WC AND PSH-801 WILL HAVE A SET POINT OF 2 PSIG.
2. THE KUNKLE VALVE WILL BE SET AT 11" HG.
3. AUTOMATED BYPASS VENT IN THE EVENT THE VAPOR RECOVERY BLOWER SHUTS DOWN.

TRS
Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
TITLE	BLOWER PROCESS AND INSTRUMENTATION DIAGRAM
APPROVED FOR CONSTRUCTION	BY ______ DATE ______
DATE	9/5/14
PROJECT	KIN41
SHEET	P-8

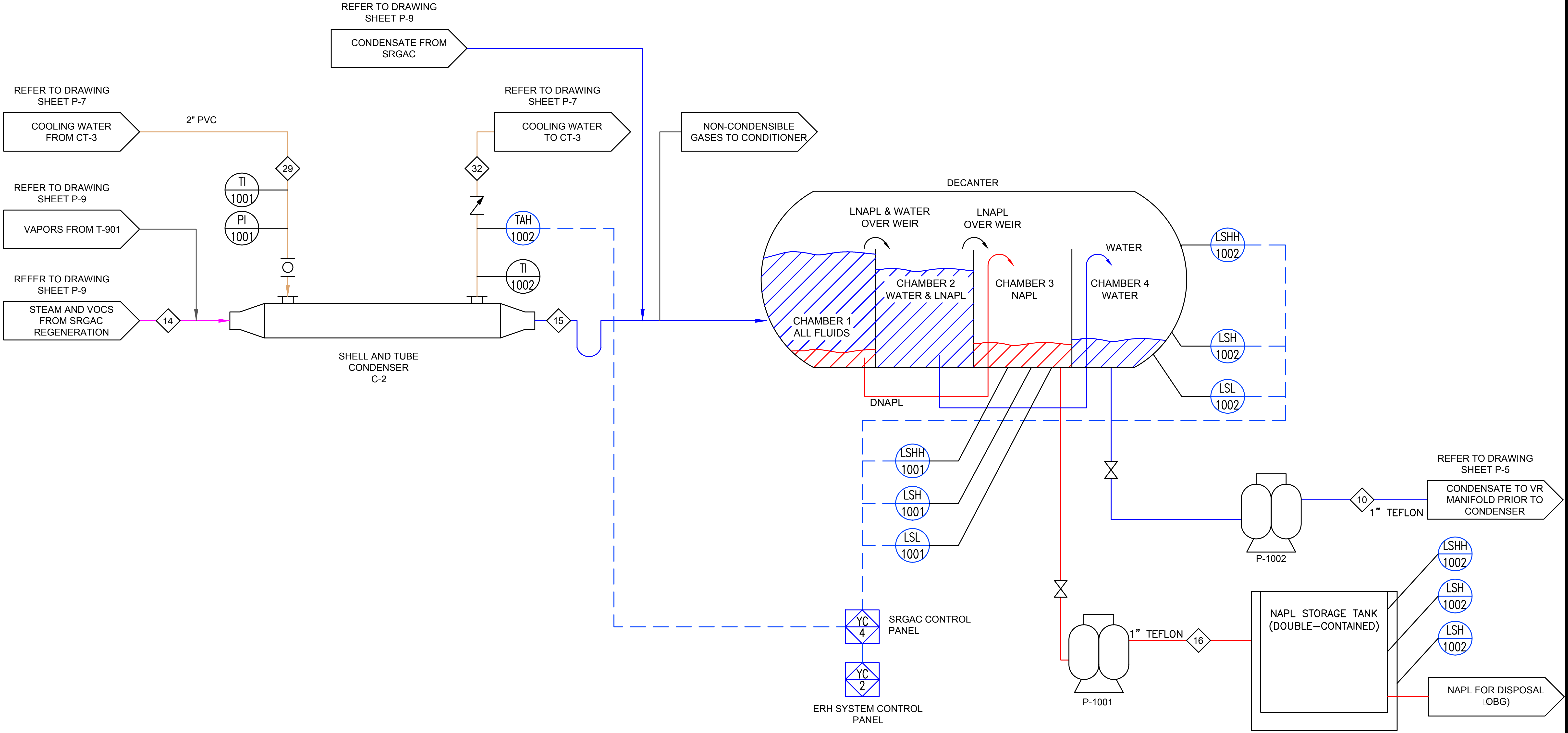


NOTES:

1. ALL FLOW CONTROL VALVES FOR THE SRGAC FAIL CLOSED.
2. TAH-901 AND TAH-902 HAVE VARIABLE SETPOINTS DEPEDING ON THE PROCESS STAGE. DURING ADSORPTION THE ALARM POINT IS 125°F, THE SHUT DOWN IS 140°F. DURING STEAMING AND DRYING THE ALARM IS 250°F, THE SHUT DOWN IS 275°F. DURING COOLING THE ALARM IS 200°F, THE SHUT DOWN IS 220°F.
3. PSA-901 AND PSA-902 HAVE SETPOINTS OF 2" PSI. THIS WILL SHUT DOWN THE SRGAC SYSTEM.
4. LSHH-901 WILL SHUT DOWN THE SRGAC SYSTEM.
5. PRESSURIZED CPVC LINES THAT DO NOT VENT DIRECTLY TO ATMOSPHERE WILL BE INSULATED INCLUDING A RIGID JACKET.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK	
DRAWN BY M. NANISTA		
CHECKED BY NOT CHECKED	SRGAC PROCESS ANDINSTRUMENTATION DIAGRAM	
PROJECT MANAGER B. POULIN		
APPROVED FOR CONSTRUCTION	DATE 9/5/14	PROJECT KIN41
BY	P-9	
DATE		



NOTES:

1. ALL COMPONENTS SHOWN ARE PART OF A VENDOR-SUPPLIED BOILER SYSTEM.
2. THE NAPL PIPING FROM THE DECANTER TO THE DNAPL STORAGE TANK WILL BE DOUBLE CONTAINED.
3. THE CONDENSATE PIPING FROM THE DECANTER TO THE CONDENSER INLET WILL BE DOUBLE CONTAINED.
4. LSHH-1002 WILL SHUT DOWN THE SRGAC SYSTEM AND TERMINATE POWER TO THE ELECTRODES.
5. LSH-1002 WILL PROVIDE LEAK DETECTION TO ALARM IF THE PRIMARY CONTAINMENT IN THE NAPL TANK FAILS.

TRS
Accelerating Value

DESIGNED BY: M. NANISTA
DRAWN BY: M. NANISTA
CHECKED BY: NOT CHECKED
PROJECT MANAGER: B. POULIN

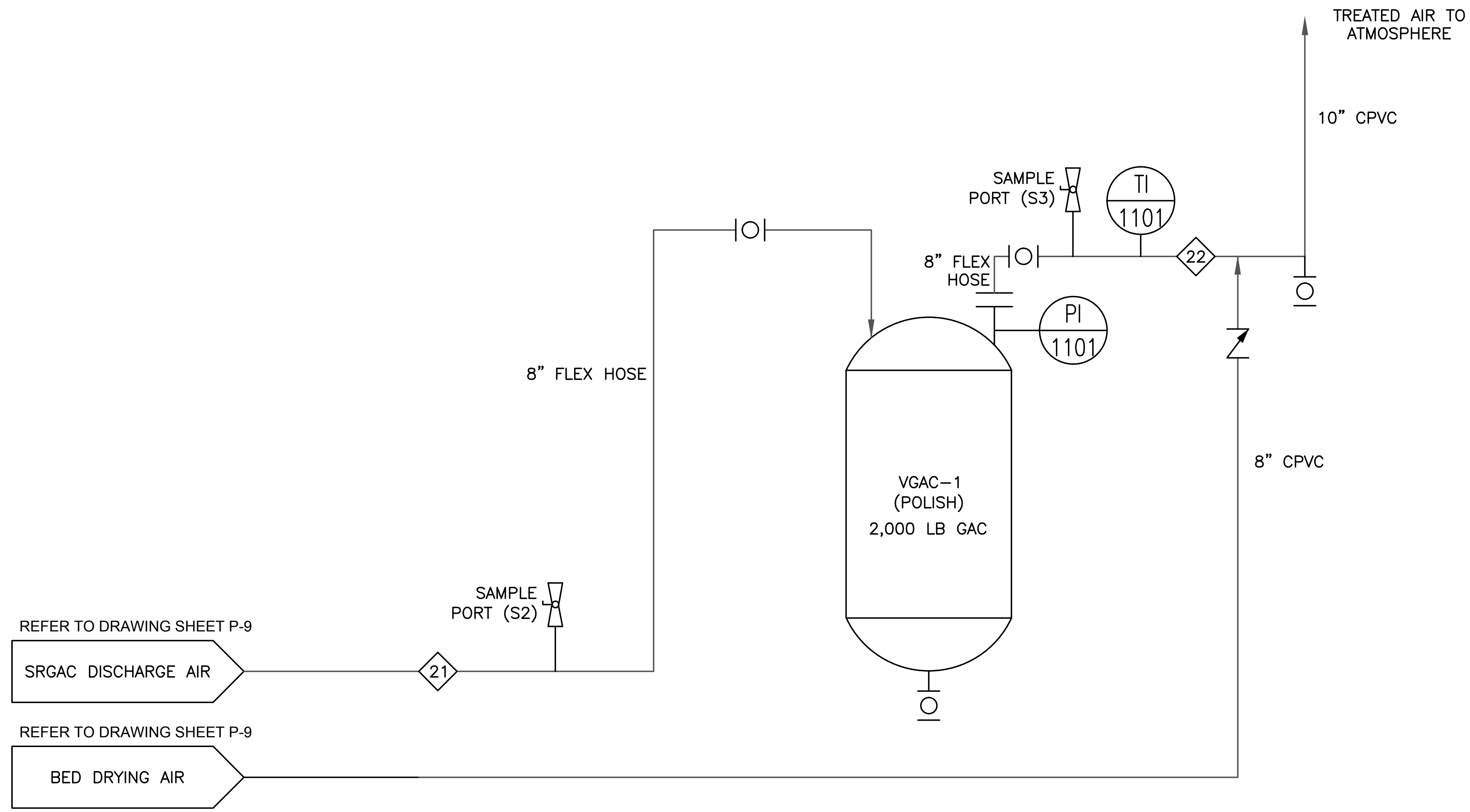
FOR: FORMER IBM FACILITY
KINGSTON, NEW YORK

CONDENSER AND DECANTER
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION
BY
DATE

DATE: 9/5/14
PROJECT: KIN41

P-10



TRS Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN

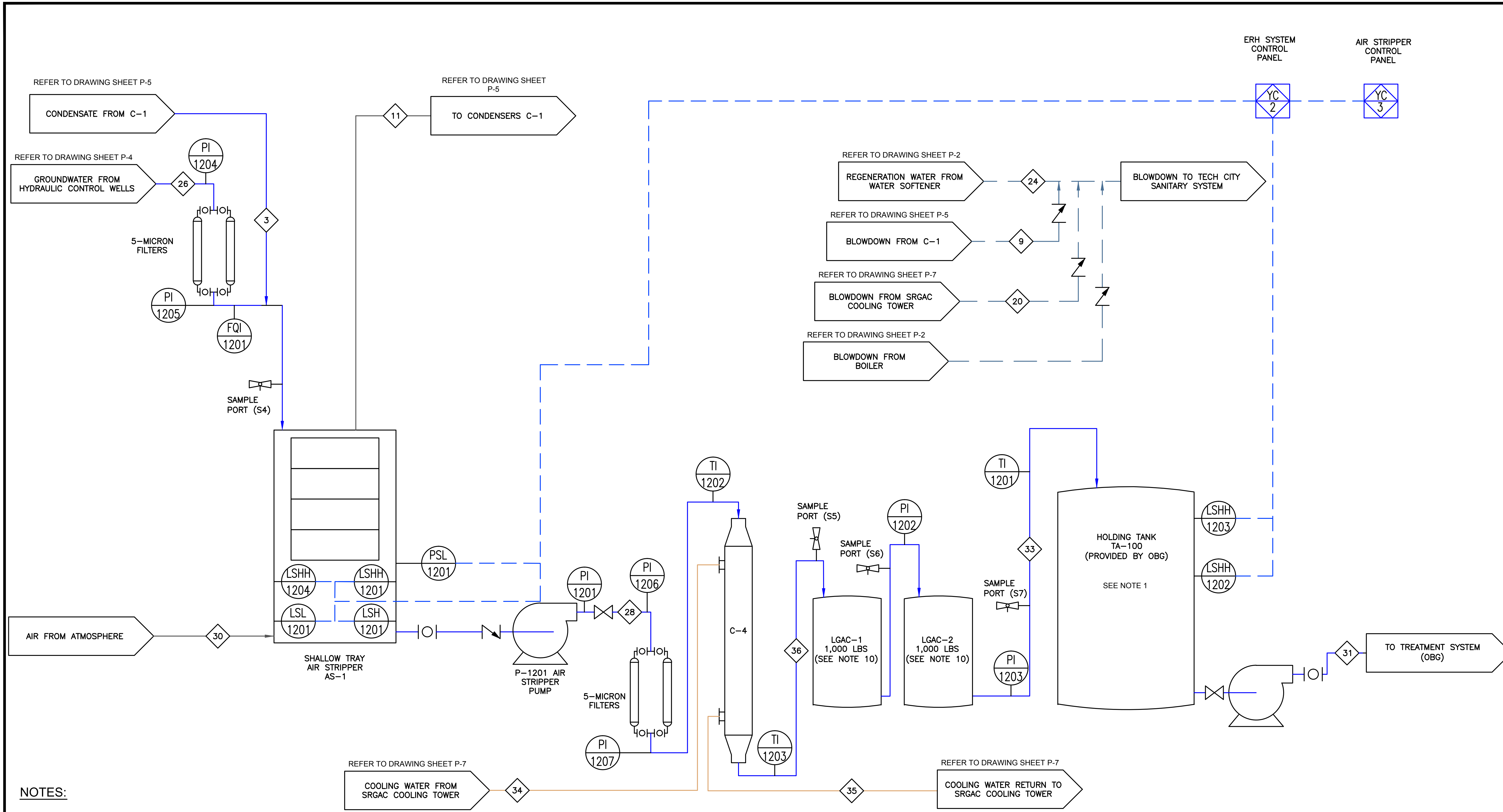
FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

POLISH VGAC
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION
BY ____________
DATE ____________

DATE	PROJECT
9/5/14	KIN41

P-11



NOTES:

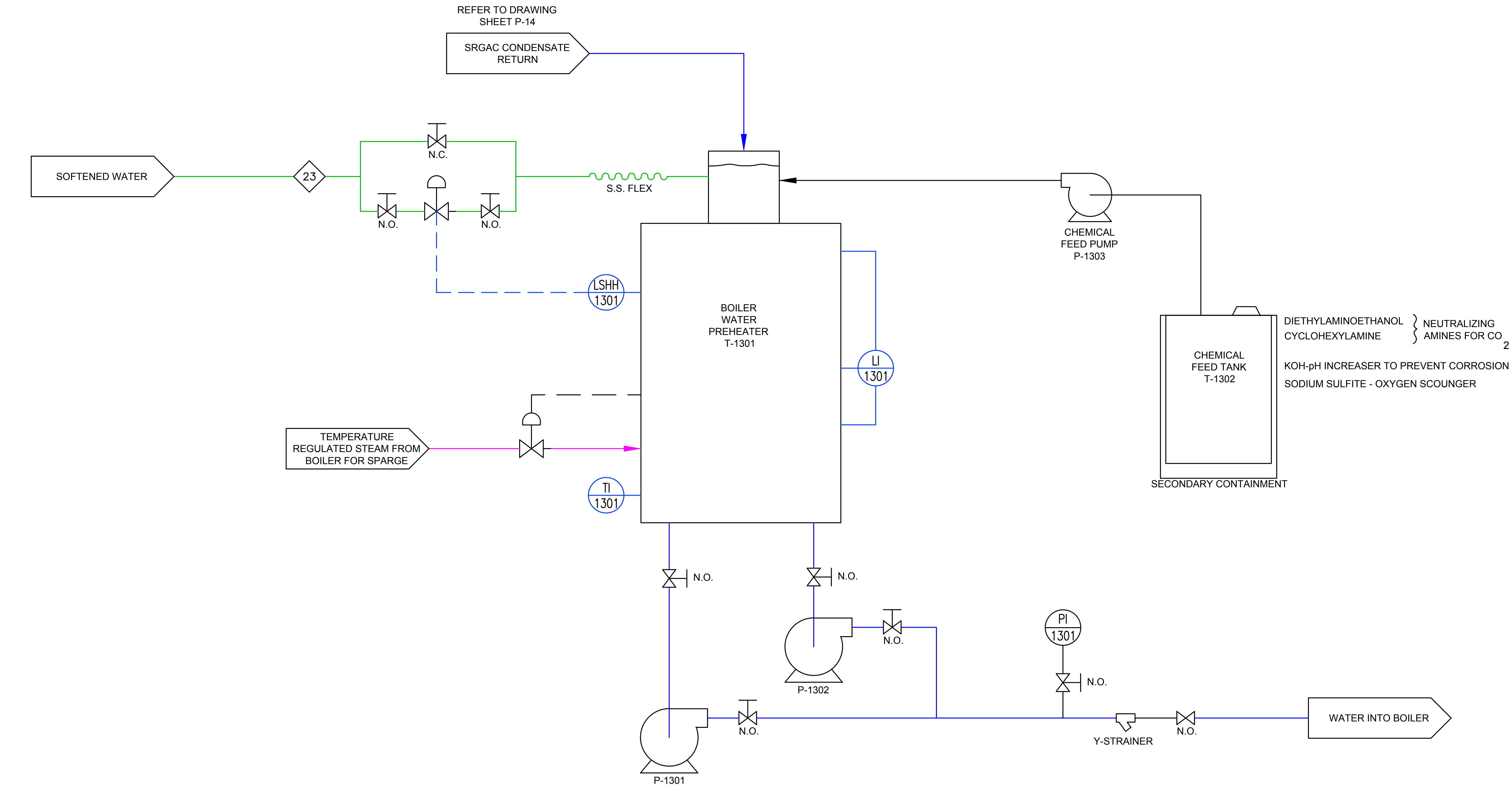
1. ALL INSTRUMENTATION AND CONTROLS DOWNSTREAM OF THE HOLDING TANK WILL BE PROVIDED BY OBG.
2. LEVELS IN THE OBG HOLDING TANK AND IN THE MANHOLE (FINAL DISCHARGE LOCATION) WILL BE MONITORED.
3. LSHH-1203 WILL SHUT DOWN POWER TO THE ELECTRODES.
4. LSHH-1202 WILL SHUT DOWN THE VR BLOWER, THE AIR STRIPPER PUMP, THE HYDRAULIC CONTROL WELLS, AND ALL BLOWDOWN.
5. TEMPERATURES INTO THE LGAC ARE NOT TO EXCEED 140°F.
6. ALL PIPING FOR THE WATER TREATMENT SYSTEM WILL BE CPVC.
7. PSL-1201 HAS A PRESSURE SETPOINT OF 10" WC. THIS WILL SHUT DOWN THE AIR STRIPPER.
8. LSHH-1201 WILL SHUT DOWN THE GROUNDWATER EXTRACTION WELL PUMPS (AIR SUPPLY).
9. LSHH-1204 WILL SHUT DOWN THE ELECTRODES AND DISABLE CONDENSATE AND BLOWDOWN.
10. LGAC VESSELS WILL EITHER BE ASME RATED OR THEY WILL BE OVERSIZED AND OPERATED AT LESS THAN 15 PSIG.

TRS
Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN
APPROVED FOR CONSTRUCTION	BY ______ DATE ______
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
DATE	9/5/14
PROJECT	KIN41

WATER TREATMENT
PROCESS AND INSTRUMENTATION DIAGRAM

P-12



NOTES:

1. ALL COMPONENTS SHOWN ARE PART OF A VENDOR-SUPPLIED BOILER SYSTEM.
2. P-1301 AND P-1302 ARE PART OF A DUPLEX PUMP SYSTEM CONTROLLED BY LEVEL SWITCHES IN THE BOILER.
3. THE BOILER VENDOR IS CLEAVER BROOKS.

TRS Accelerating Value

DESIGNED BY
M. NANISTA

DRAWN BY
A. PEABODY

CHECKED BY
NOT APPROVED

PROJECT MANAGER
B. POULIN

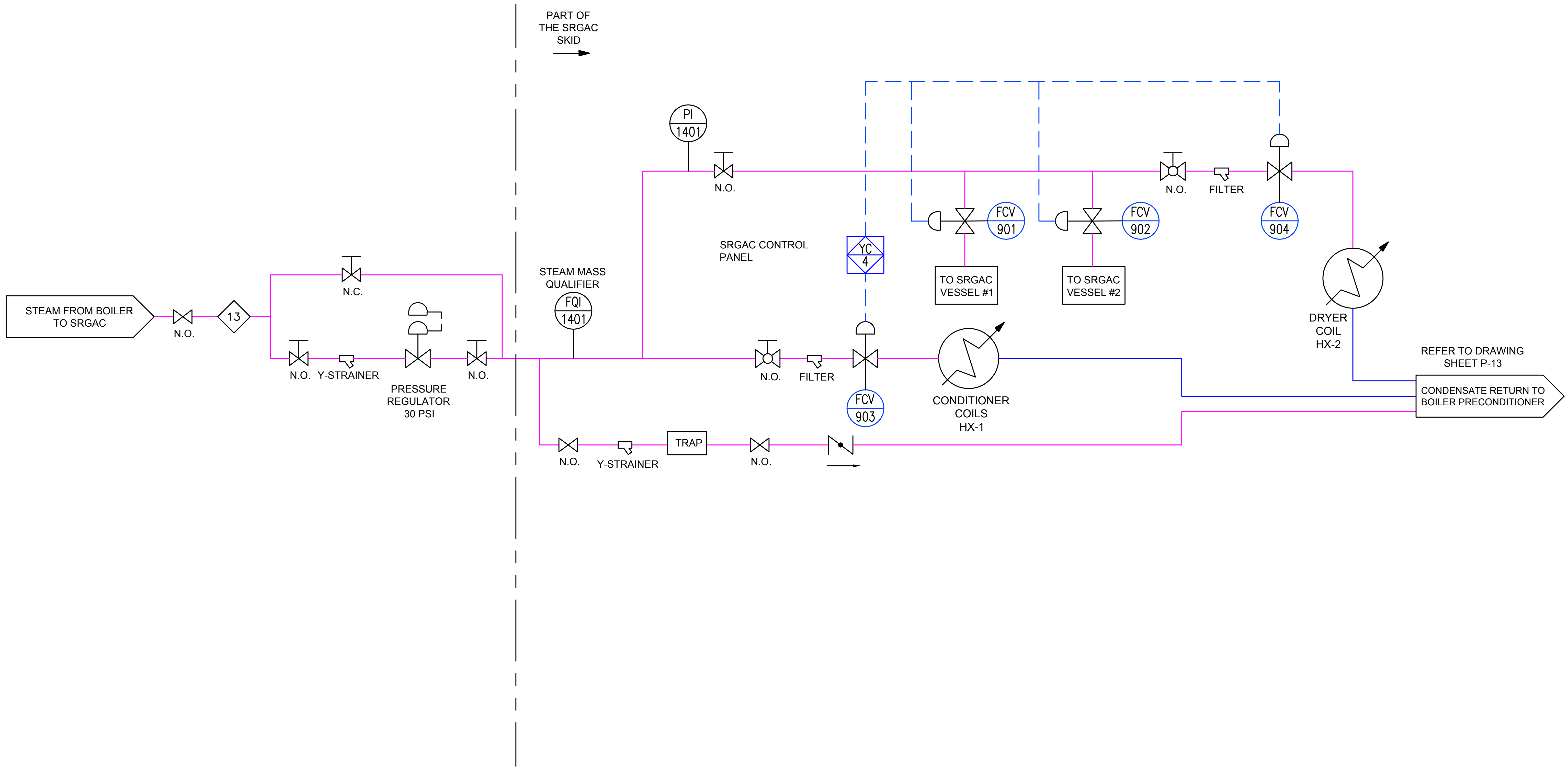
FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

BOILER WATER PRECONDITIONING
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION
BY
DATE

DATE 9/5/14
PROJECT KIN41

P-13



NOTES:

1. THE MAXIMUM STEAM PRESSURE FROM THE BOILER IS 150 PSIG.

TRS
Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN

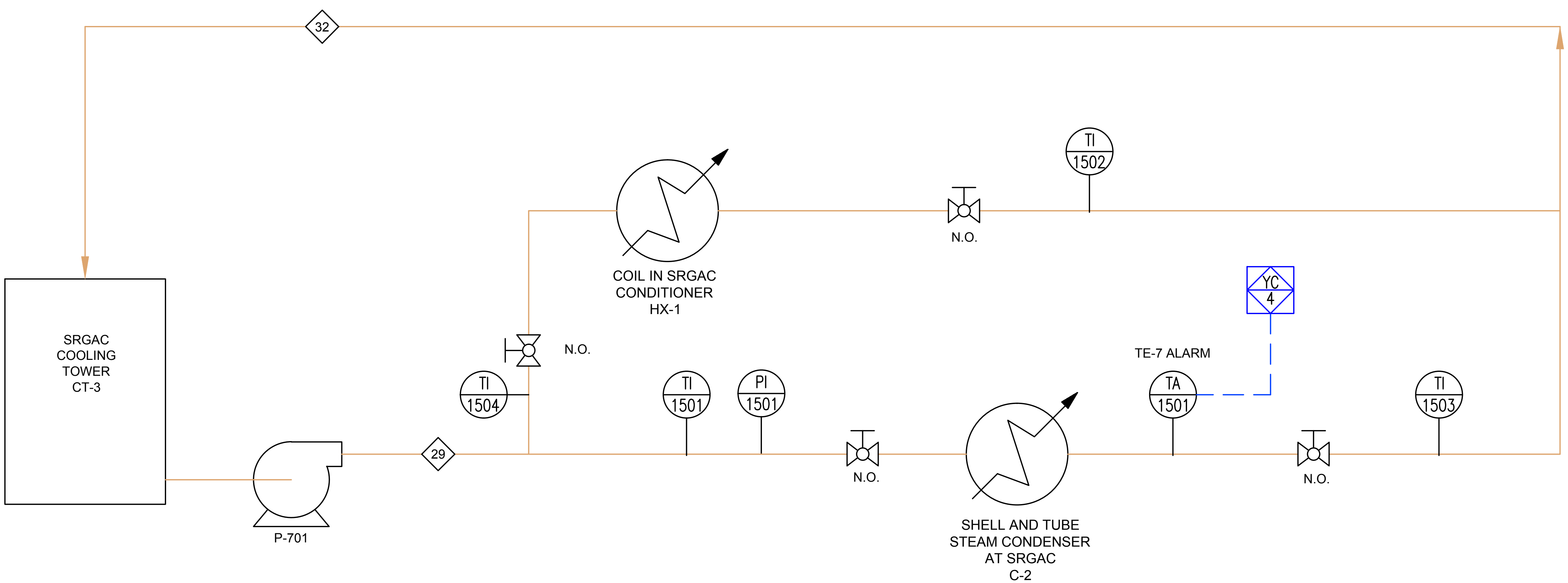
FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

STEAM DELIVERY SYSTEM TO SRGAC
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION
BY
DATE

DATE 9/5/14
PROJECT KIN41

P-14



TRS Accelerating Value

DESIGNED BY
M. NANISTA

DRAWN BY
A. PEABODY

CHECKED BY
NOT APPROVED

PROJECT MANAGER
B. POULIN

FOR
FORMER IBM FACILITY
KINGSTON, NEW YORK

COOLING WATER DELIVERY TO SRGAC
PROCESS AND INSTRUMENTATION DIAGRAM

APPROVED FOR CONSTRUCTION

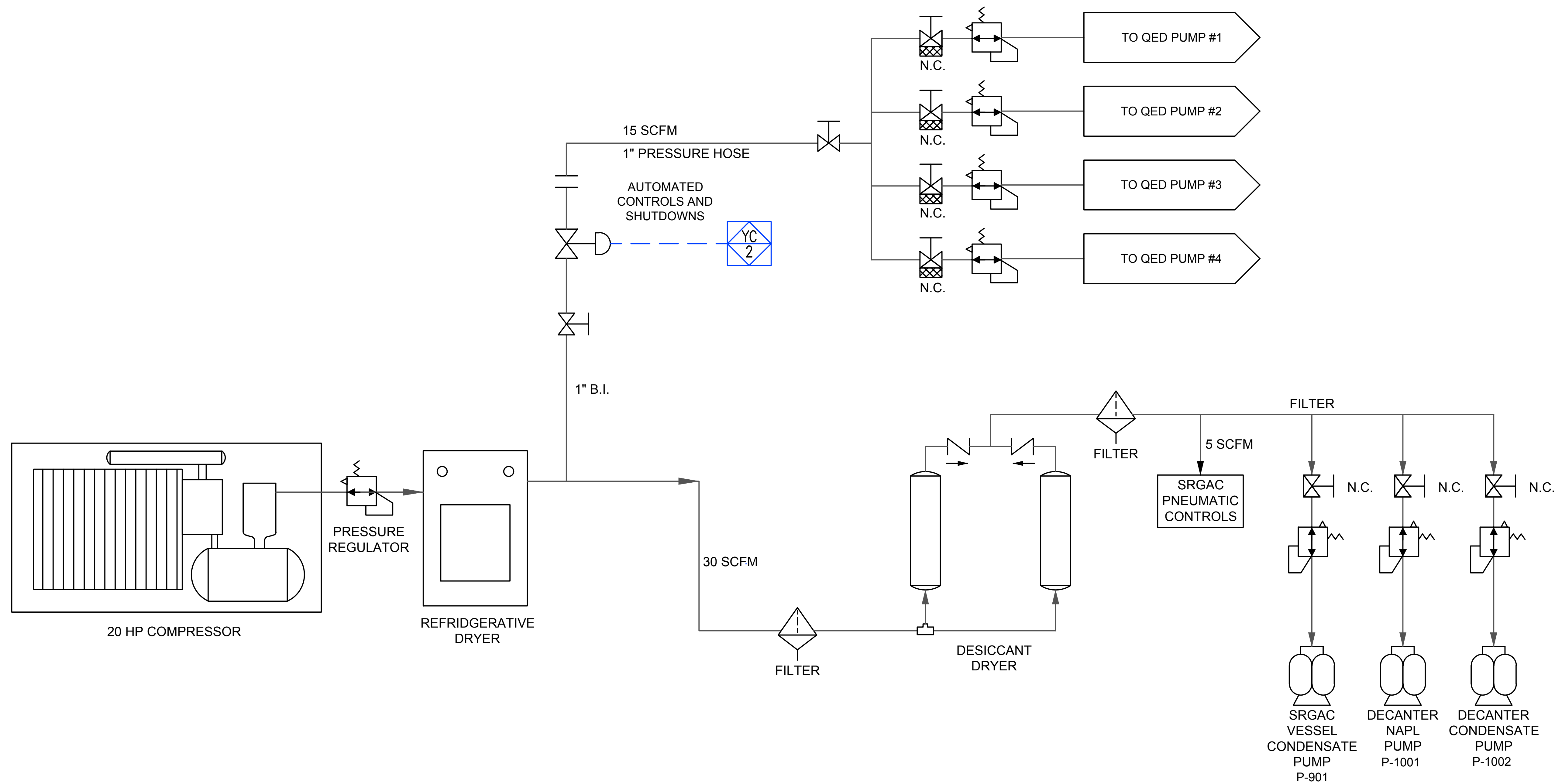
BY

DATE

DATE 9/5/14

PROJECT KIN41

P-15

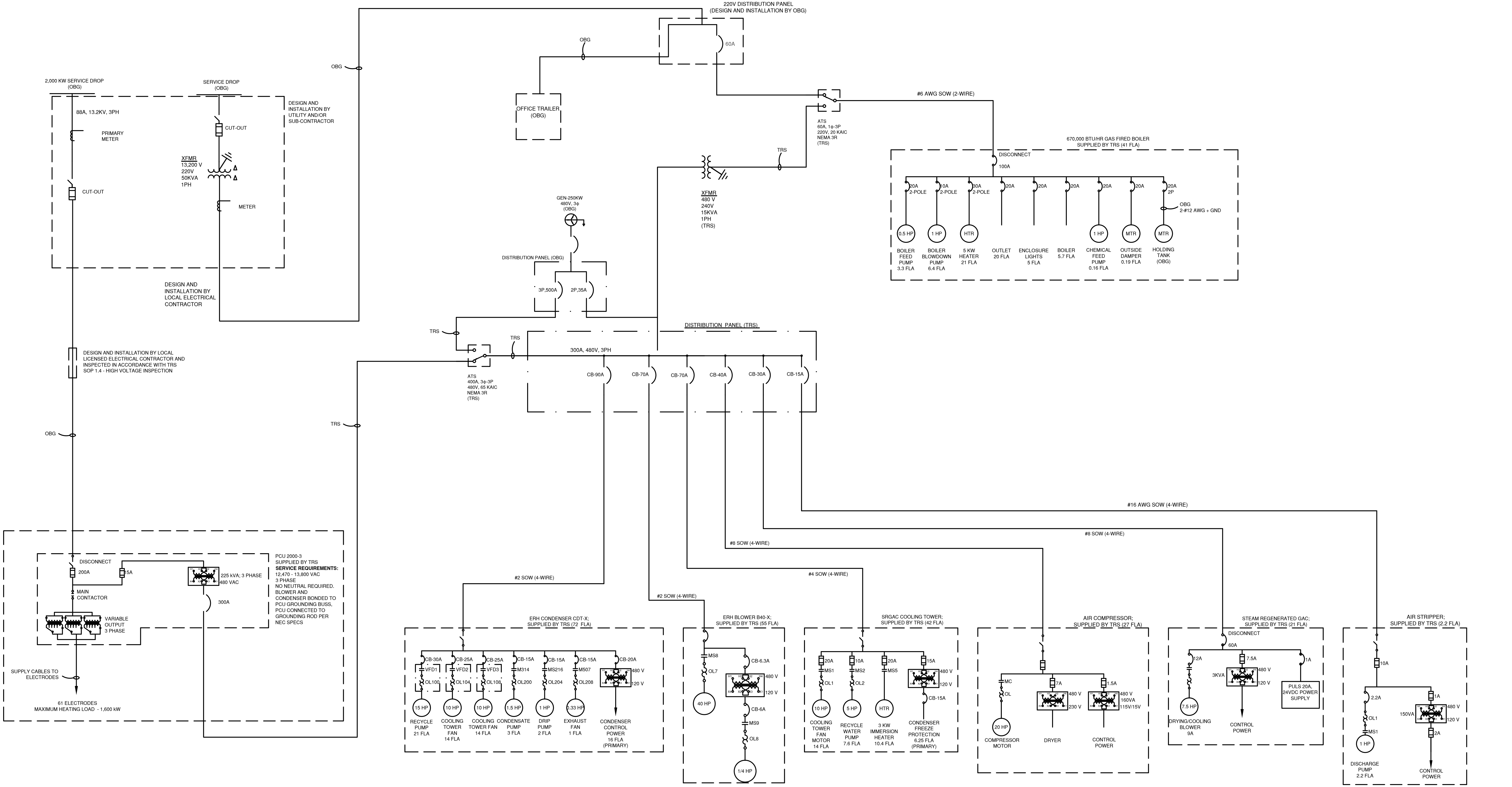


NOTES:

1. THE COMPRESSOR IS RATED FOR 217 PSIG.

TRS Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN
APPROVED FOR CONSTRUCTION	BY ______ DATE ______
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
	PNEUMATIC PROCESS FLOW DIAGRAM
DATE	9/5/14
PROJECT	KIN41
	P-16



NOTE:

1. THIS DRAWING ASSUMES THE UTILITY LINE VOLTAGE IS 13,200V. IF A DIFFERENT VOLTAGE IS TO BE PROVIDED, THE DRAWING WILL BE UPDATED.

TRS
Accelerating Value

DESIGNED BY M. NANISTA	FOR FORMER IBM FACILITY KINGSTON, NEW YORK
DRAWN BY M. NANISTA	
CHECKED BY NOT CHECKED	ELECTRICAL ONE-LINE DIAGRAM
PROJECT MANAGER B. POULIN	
APPROVED FOR CONSTRUCTION BY ______ DATE ______	DATE 9/5/14 PROJECT KIN41 SHEET E-1

Load Chart	Voltage/Phase	FLA*	kW
Condenser	**480V, 3Φ**	**72**	**60**
Recycle Pump	480V, 3Φ	21	10.1
Cooling Tower Fan	480V, 3Φ	14	6.7
Sooling Tower Fan	480V, 3Φ	14	6.7
Condensate Pump	480V, 3Φ	3	1.4
Drip Pump	480V, 3Φ	2	1.0
Exhaust Fan	480V, 3Φ	1	0.5
Auxiliary Transformer	120V, 1Φ	16*	7.7
Blower	**480V, 3Φ**	**55**	**46**
Blower Motor	480V, 3Φ	52	25.0
Auxiliary Transformer	120V, 1Φ	2*	2.8
SRGAC Cooling Tower	**480V, 3Φ**	**42**	**35**
Cooling Tower Fan Motor	480V, 3Φ	14	6.7
Recycle Water Pump	480V, 3Φ	7.6	3.6
Immersion Heater	480V, 3Φ	10.4	5.0
Auxiliary Transformer	120V, 1Φ	6.25*	3.0
Air Compressor	**480V, 3Φ**	**27**	**47**
Compressor Motor	480V, 3Φ	27	13.0
Dryer	230V, 1Φ	1.2*	0.6
Auxiliary Transformer	115V, 1Φ	0.33*	0.2
SRGAC	**480V, 3Φ**	**21**	**36**
Drying/Cooling Blower	480V, 3Φ	9	4.3
Auxiliary Transformer	120V, 1Φ	6.25*	3.0
DC Converter	24VDC	1*	0.5
Air Stripper	**480V, 3Φ**	**2.2**	**0.4**
Discharge Pump	480V, 3Φ	2.2	1.1
Auxiliary Transformer	120V, 1Φ	0.31*	0.1
Boiler	**220V, 1Φ**	**41**	**9**
Boiler Feed Pump	240V, 1Φ	3.3	0.8
Boiler Blowdown Pump	240V, 1Φ	6.4	1.5
Heater	240V, 1Φ	21	5.0
Outlet	120V, 1Φ	20	2.4
Enclosure Lights	120V, 1Φ	5	0.6
Boiler	120V, 1Φ	5.7	0.7
Chemical Feed Pump	120V, 1Φ	0.16	0.02
Outside Damper	120V, 1Φ	0.19	0.02
Electrodes	**Variable Voltage, 3Φ**	**-**	**1300 (max)**

* The full load amps provided are on the primary side of any transformers/converters.

This load chart includes details on the TRS-supplied equipment.

TRS Accelerating Value

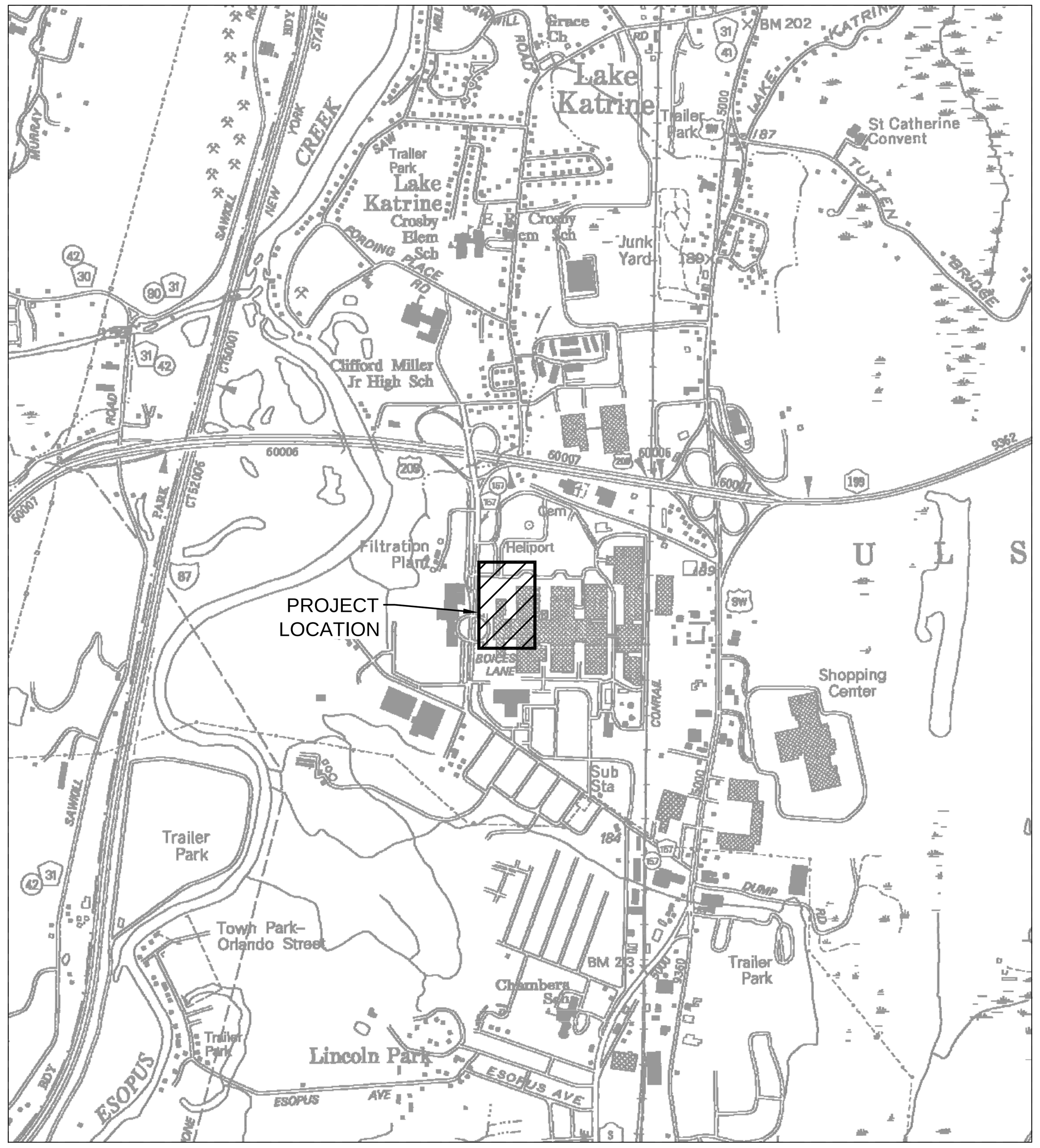
DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
	LOAD CHART
APPROVED FOR IMPLEMENTATION	BY ____ FOR ____ DATE
DATE	9/5/14
PROJECT	KIN41
SHEET	E-2

O'BRIEN & GERE REMEDIAL DESIGN CONSTRUCTION PLANS

9/5/2014 2:01 PM

CONTRACT DRAWINGS

SWMU-S THERMAL REMEDIATION PROJECT



LOCATION PLAN

NOT TO SCALE

TRUE NORTH

IBM CORPORATION
KINGSTON, NY

SEPTEMBER 2014

O'BRIEN & GERE

SYRACUSE
333 WEST WASHINTON STREET
SYRACUSE, NY 13202
SYRACUSE, NY 13221-4873
PHONE: 315-437-6100

INDEX TO DRAWINGS

2516.50682-000

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\T-000.DWG

SAVED: 9/5/14 1:59 PM

GENERAL NOTES:

1. THE BASE MAP INFORMATION IS FROM A DRAWING ENTITLED "SUBSURFACE UTILITY INVESTIGATION" DATED MAY 6, 2014 BY THEW ASSOCIATES.
2. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION OPERATIONS WITH ANY AND ALL OTHER CONSTRUCTION ACTIVITIES WHICH MAY BE OCCURRING SIMULTANEOUSLY IN THE VICINITY OF THE SITE. LACK OF COORDINATION ON THE CONTRACTOR'S PART RESULTING IN EXTRA WORK OR SCHEDULE DELAYS SHALL NOT CONSTITUTE A CHANGE ORDER.
3. THE CONTRACTOR WILL BE HELD RESPONSIBLE FOR ALL DAMAGE CAUSED BY HIS OPERATIONS TO EXISTING UTILITIES AND FACILITIES WHICH ARE NOT INCLUDED AS PART OF THE INTENDED WORK. ALL DAMAGE TO THE EXISTING FACILITIES WHICH ARE NOT A PART OF THE INTENDED WORK SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR TO THE SATISFACTION OF THE OWNER'S REPRESENTATIVE AND/OR UTILITY OWNER, AT NO ADDITIONAL COST.
4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PERTINENT TO THE WORK OF THIS CONTRACT IN THE FIELD. IF THE CONTRACTOR FINDS DISCREPANCIES BETWEEN THE PLANS AND PHYSICAL CONDITIONS OF THE SITE, OR ANY ERRORS OR OMISSIONS IN THE PLANS, THE CONTRACTOR SHALL IMMEDIATELY INFORM THE OWNER'S REPRESENTATIVE.
5. CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL BE IN ACCORDANCE WITH CURRENT STATE AND LOCAL GOVERNMENT AGENCY REQUIREMENTS.

GENERAL UTILITY:

1. THE APPROXIMATE LOCATION OF ALL KNOWN EXISTING UNDERGROUND UTILITIES ARE SHOWN ON THE PLANS. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING DIMENSIONS OF EXISTING SITE FEATURES PRIOR TO WORK BEING PERFORMED.
2. THE CONTRACTOR SHALL CONTACT "DIG SAFELY NEW YORK" AT LEAST 72 HOURS PRIOR TO INITIATION OF CONSTRUCTION ACTIVITIES.

DRAINAGE NOTES:

1. EXISTING DRAINAGE FACILITIES TO REMAIN SHALL BE MAINTAINED FREE OF DEBRIS AND FOREIGN MATTER AND OPERATIONAL THROUGHOUT THE DURATION OF THE CONTRACT.
2. CATCH BASINS WITHIN WORK AREA SHALL HAVE EROSION CONTROL SEDIMENT PROTECTION PER DETAIL.
3. FACILITIES WHICH ARE TO REMAIN OR BE MODIFIED FOR REUSE UNDER THIS CONTRACT SHALL BE FIELD VERIFIED AS TO ACTUAL LOCATION, ELEVATIONS, SIZE, TYPE AND CONDITION. ANY DISCREPANCIES BETWEEN ACTUAL FIELD CONDITIONS AND THE PLANS SHALL BE REPORTED TO THE OWNER'S REPRESENTATIVE WHO SHALL DETERMINE IF MODIFICATION TO THE PLANS ARE REQUIRED.

MAINTENANCE & PROTECTION OF TRAFFIC:

1. THE CONTRACTOR TO PROVIDE FLAGMEN WHEN AND WHERE NECESSARY.
2. THE CONTRACTOR SHALL KEEP TO A MINIMUM MOVEMENTS OF CONSTRUCTION VEHICLES AND EQUIPMENT IN AND OUT OF DESIGNATED TRAVEL LANES. ONLY NECESSARY OR AUTHORIZED VEHICLES AS DETERMINED BY THE ENGINEER SHALL BE ALLOWED TO ENTER ANY PHASE WORK AREA.
3. WHERE DIRECT ACCESS TO PARKING LOTS IS NOT POSSIBLE DUE TO NECESSARY CONSTRUCTION OPERATIONS, THE CONTRACTOR SHALL PLAN ALTERNATE MEANS OF ACCESS AND SUBMIT SUCH PLANS TO THE OWNER FOR APPROVAL BEFORE OPERATIONS COMMENCE.
4. THE CONTRACTOR IS RESPONSIBLE FOR MAINTAINING SAFE AND PROPER ACCESS TO BUILDINGS IN THE VICINITY OF CONSTRUCTION.

CONSTRUCTION NOTES:

1. CERTAIN AREAS OF THE SITE WILL REQUIRE TRANSITIONING EXISTING ASPHALT PAVEMENT AREAS INTO NEW ASPHALT PAVEMENT. PRIOR TO MAKING THESE TRANSITIONS THE CONTRACTOR SHALL PROCEED AS FOLLOWS:
   - A. FIELD VERIFY THE ELEVATIONS OF EXISTING PAVEMENT.
   - B. MILL EXISTING ASPHALT PAVEMENT WHERE SPECIFIED.
   - C. CLEAN EXISTING SURFACES, SEAL ALL CRACKS WITH AC-20; HOT ASPHALT EMULSION.
   - D. INSTALL PETROTAC MEMBRANE AND ASPHALT COURSES AS SPECIFIED.
   - E. SEAL ALL PAVEMENT JOINTS WITH AC-20; HOT ASPHALT EMULSION.

DURING THE MILLING OPERATIONS, CONTRACTOR TO VERIFY SLOPES WILL GRADE TO RESPECTIVE CATCH BASINS - ELIMINATING ISOLATED "PONDING" AREAS.

2. EXISTING ASPHALT PAVEMENT TO BE MILLED 1 1/2". PAVEMENT SURFACE TO BE CLEANED WITH CRACKS FILLED AND SEALED PER NYSDOT STANDARD SECTION 633. CRACKS LARGER THAN 1/4" WIDE SHALL HAVE PETROTAC MEMBRANE INSTALLED. RESURFACE WITH NEW ASPHALT PAVEMENT.
3. TACK COAT-NYSDOT ITEM NO. 407.0101 TO BE USED ON ALL EXISTING PAVEMENT PRIOR TO APPLYING NEW TOP COAT.
4. SHIM COURSE-TYPE 5 NYSDOT ITEM NO. 403.15 SHALL BE USED AS REQUIRED TO OBTAIN PAVEMENT SLOPES.

LEGEND

EXISTING

- BUILDING
- CHAIN LINK FENCE
- 843 CONTOUR LINE
- PROPERTY LINE
- EASEMENT
- CREEK ℄
- ST STORM SEWER
- W WATER MAIN
- UE UNDERGROUND ELECTRIC
- OVERHEAD ELECTRIC
- UGT UNDERGROUND TELEPHONE
- UTILITY POLE
- E ELECTRIC BOX
- E ELECTRIC MANHOLE
- U UTILITY MANHOLE
- CB CATCH BASIN
- C/O CLEANOUT
- D DMH DRAINAGE MANHOLE
- HYDRANT
- W WATER VALVE
- MONITORING WELL
- SIGN

PROPOSED

- CHAIN LINK FENCE
- 843 CONTOUR LINE
- RESURFACE PAVEMENT
- UPPER MONITORING WELL REMOVAL AND RESTORATION AREA
- ELECTRODE AREA RESTORATION

STATE OF NEW YORK · G. CANNERELLI · No. 054338 · LICENSED PROFESSIONAL ENGINEER

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

CIVIL

NOTES AND LEGEND

FILE NO. 2516.50682-001

DATE SEPTEMBER 2014

C-1

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-001-C1.DWG

SAVED: 9/5/14 1:59 PM

PLAN
SCALE: 1"=80'
80' 0 80'

TRUE NORTH

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

CIVIL

OVERALL EXISTING SITE PLAN

FILE NO. 2516.50682 - 002

DATE SEPTEMBER 2014

C-2

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-002-C2.DWG

SAVED: 9/5/14 1:59 PM

PLAN

SCALE: 1"=30'

30' 0 30'

TRUE NORTH

PLAN NOTES:

1. CONTRACTOR SHALL RESTORE LANDSCAPE AREAS IN KIND. A MIN. OF 4" TOPSOIL & SEED MIX TO BE APPLIED TO DISTURBED AREAS.

SEED MIX SHALL BE: 50% KENTUCKY BLUEGRASS
30% CREEPING RED FESCUE
20% MANHATTAN PENNFINE RYEGRASS

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

CIVIL

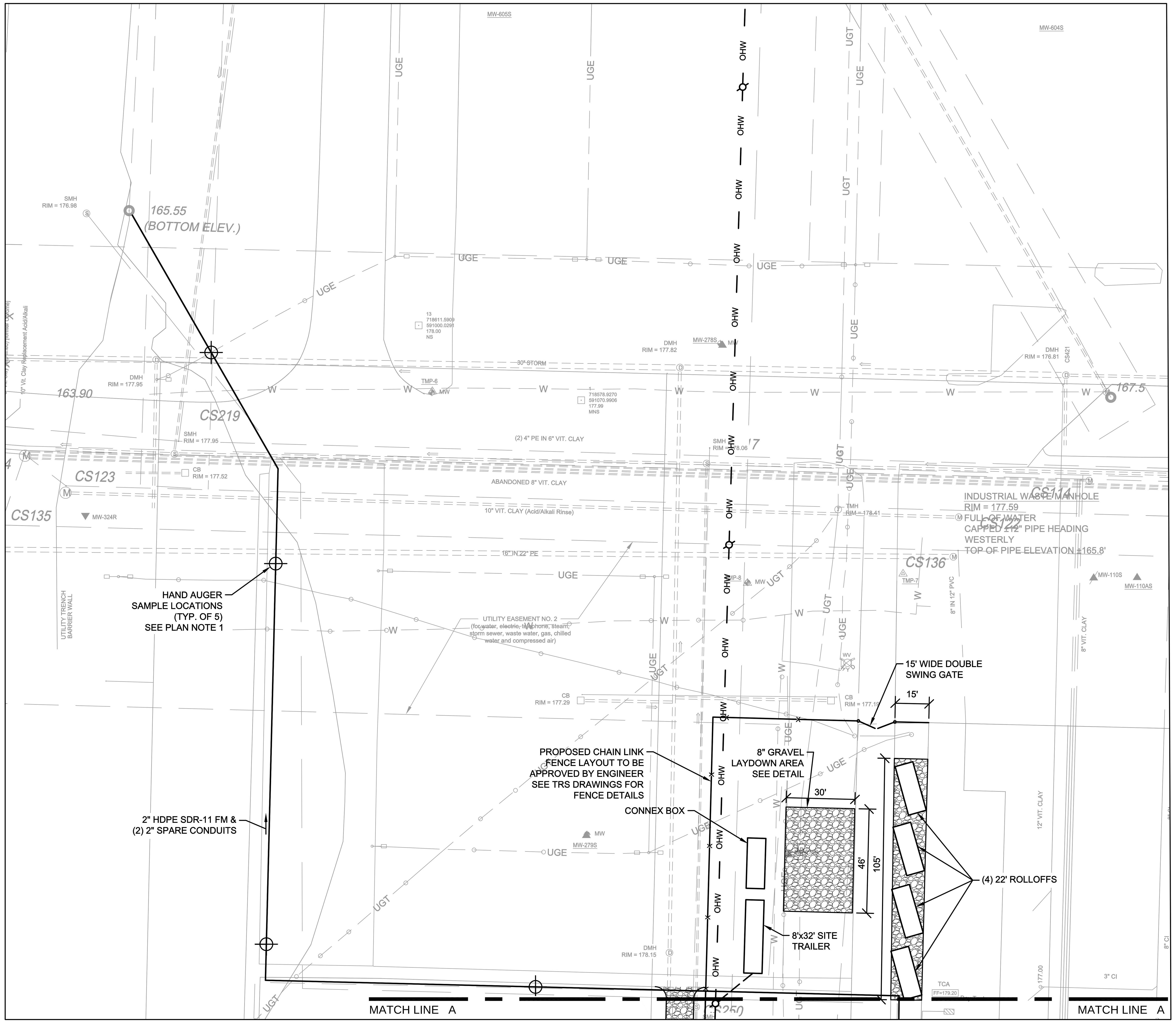
SITE PLAN

FILE NO. 2516.50682 - 004

DATE SEPTEMBER 2014

C-3

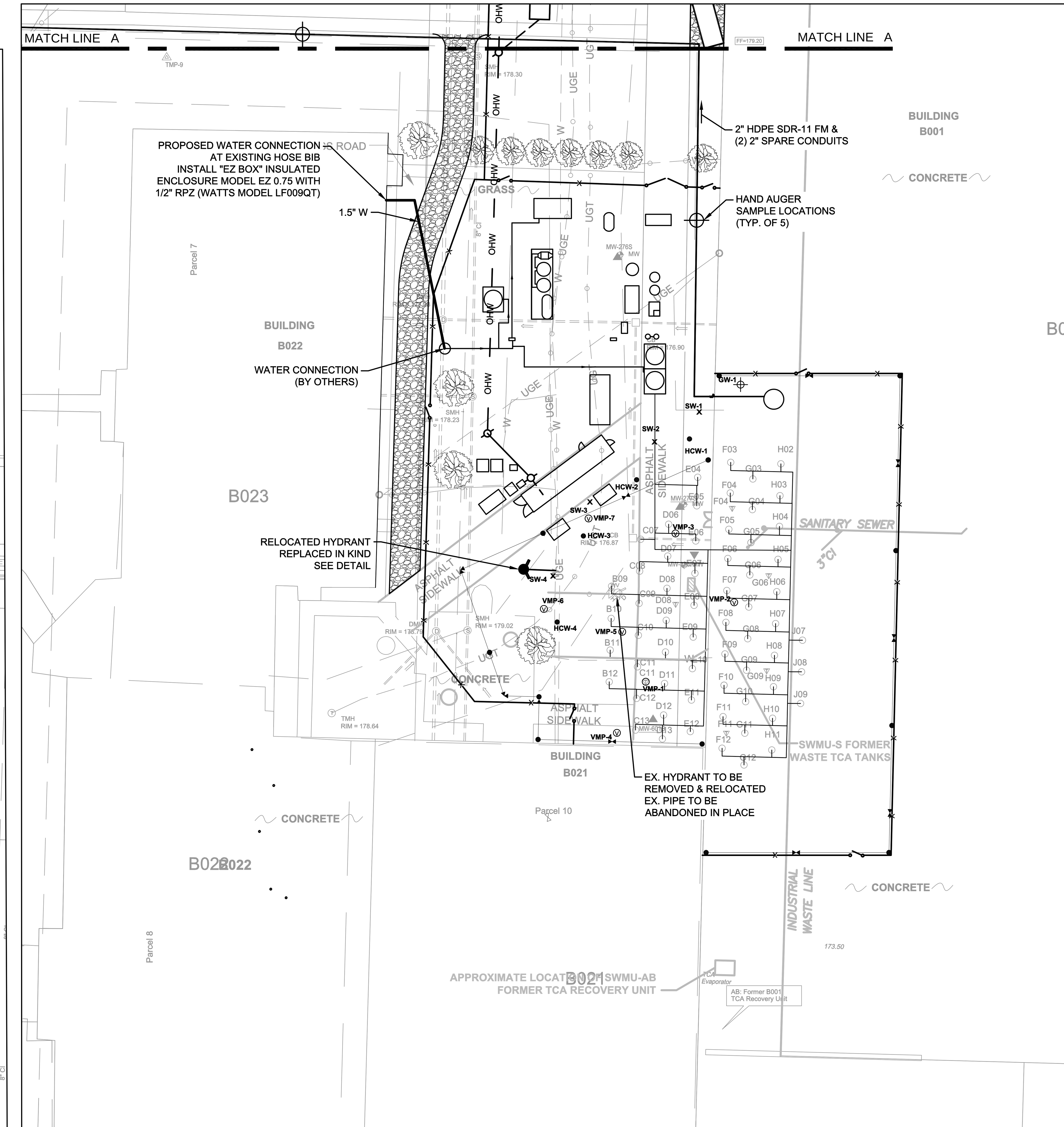
I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-004-C4.DWG



PLAN

SCALE: 1"=30'

TRUE NORTH



PLAN

SCALE: 1"=30'

TRUE NORTH

PLAN NOTES:

1. HAND AUGURED SOIL BORINGS WILL BE COMPLETED IN GRASSY AREAS AT 5 LOCATIONS ALONG THE CONVEYANCE PIPING ROUTE, AS INDICATED. GRAB SAMPLES WILL BE COLLECTED USING ENCORE SAMPLERS AT DEPTHS OF 2 AND 3 FEET BELOW GRADE SURFACE (BGS) AT EACH OF THESE LOCATIONS, TOTALING 10 SAMPLES, AND SUBMITTED FOR ANALYSIS OF THE SITE-SPECIFIC LIST OF VOLATILE ORGANIC COMPOUNDS VIA ENVIRONMENTAL PROTECTION AGENCY METHOD 8260C. RETURN DISTURBED SOIL TO SAMPLE LOCATION AFTER COLLECTING SAMPLE.
2. 2" HDPE SDR-11 FM SHALL BE INSTALLED PER DETAIL. ROUTING SHALL BE VERIFIED IN FIELD TO AVOID POTENTIAL CONFLICTS. CONTRACTOR TO NOTIFY ENGINEER IF ROUTING IS REQUIRED TO BE ADJUSTED.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

STATE OF NEW YORK — No. 054338 — LICENSED PROFESSIONAL ENGINEER

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

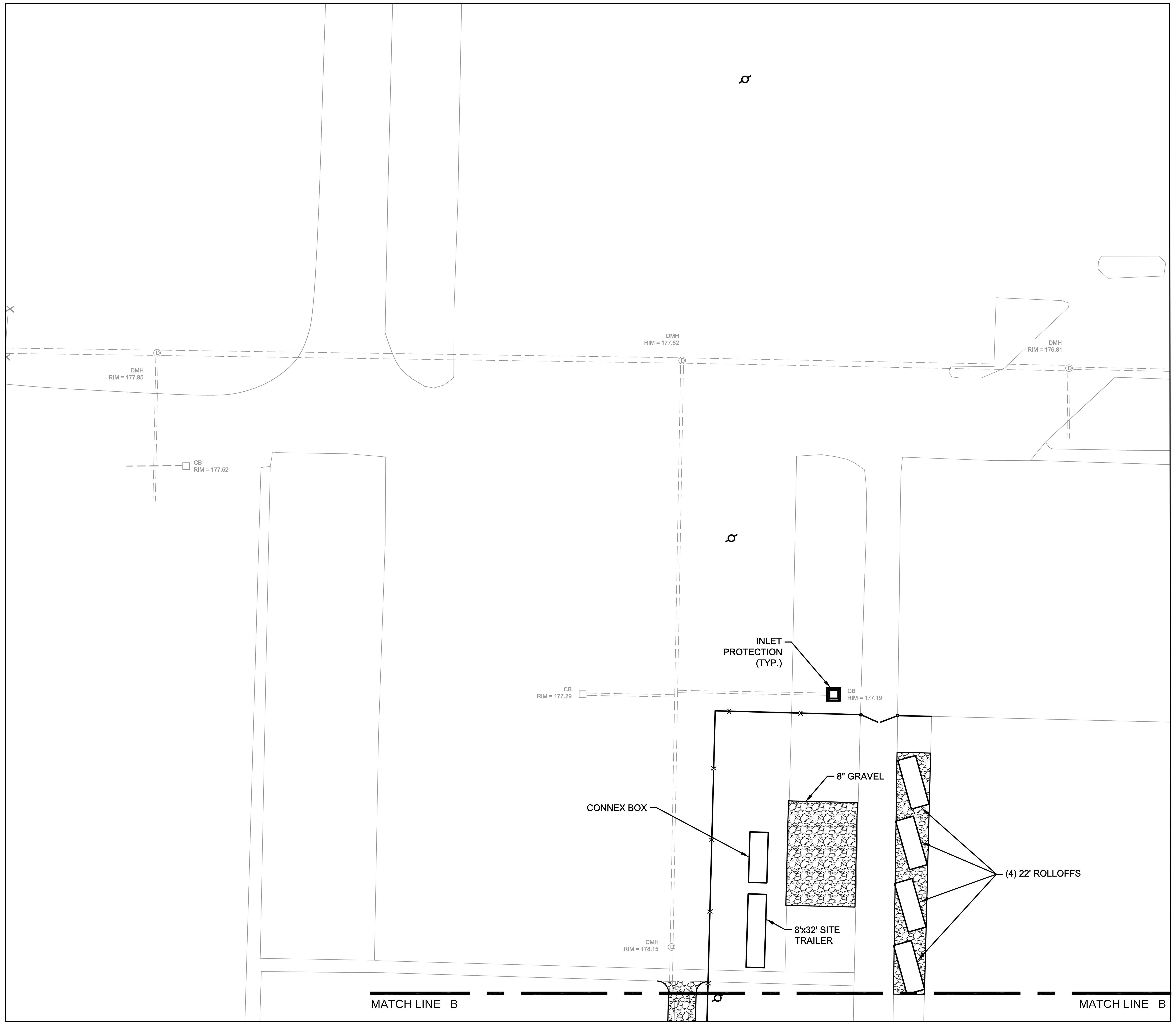
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

CIVIL
UTILITY PLAN

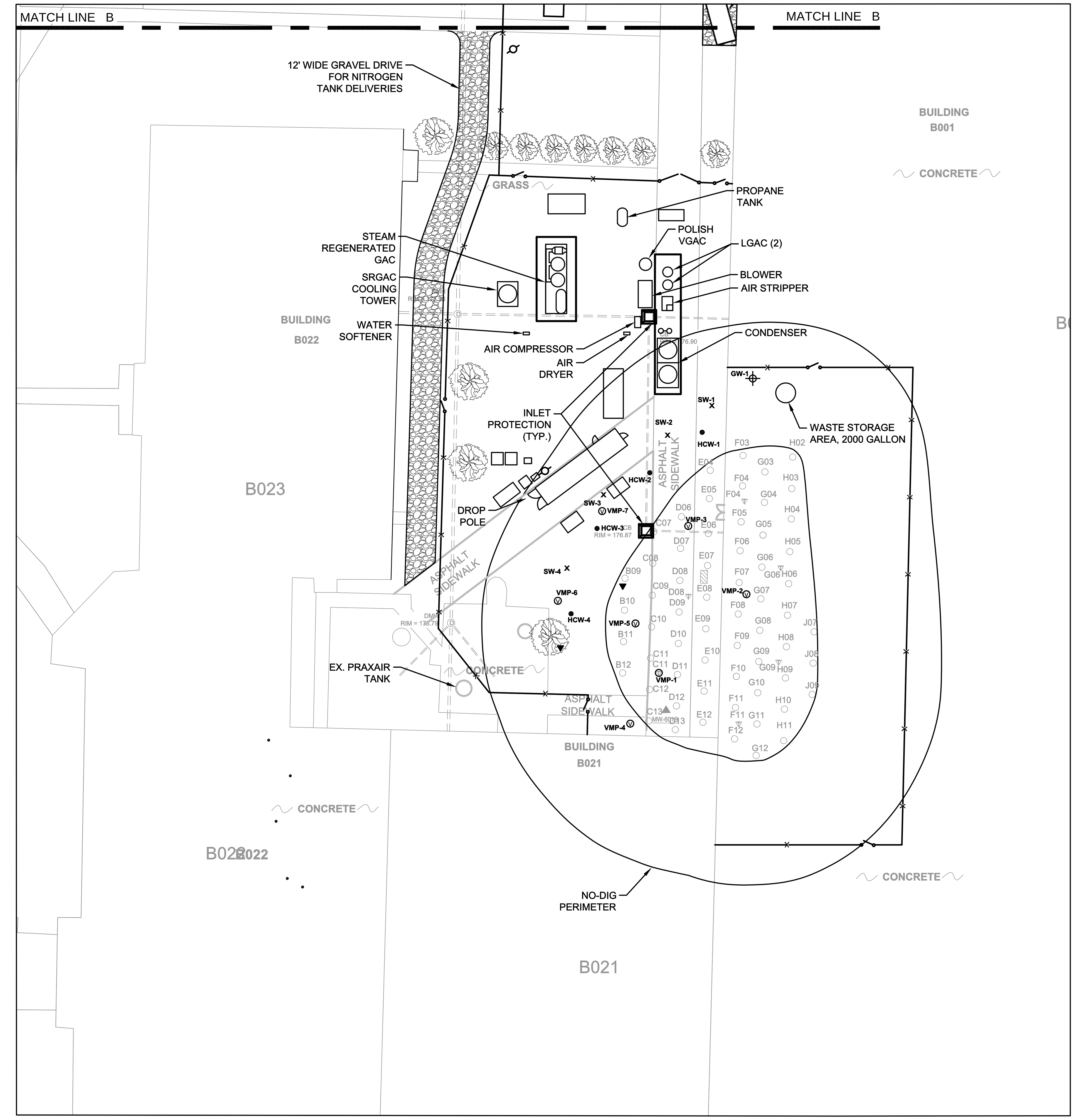
FILE NO. 2516.50682 - 005
DATE SEPTEMBER 2014
C-4

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-005-C5.DWG



PLAN

SCALE: 1"=30'



PLAN

SCALE: 1"=30'

TRUE NORTH

PLAN NOTES:

1. DURING LIQUID WASTE HANDLING, EX. CB'S SHALL BE PROTECTED WITH A "SPILL PROTECTOR" DRAIN COVER BY ENPAC, OR EQUAL, IN ADDITION TO THE SEDIMENT INLET PROTECTION AS DETAILED.
2. SILT FENCE SHALL BE INSTALLED DOWN GRADIENT FROM DISTURBED AREAS.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

CIVIL

EROSION & SEDIMENT CONTROL PLAN

FILE NO. 2516.50682 -006

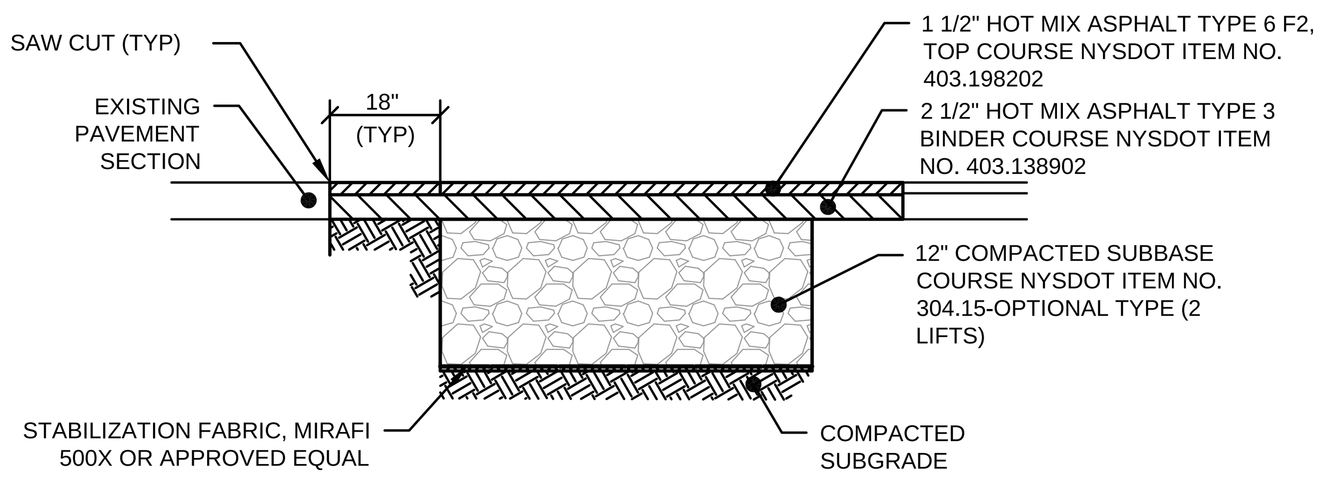
DATE SEPTEMBER 2014

C-5

SAVED: 9/5/14 1:58 PM

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-005-C6.DWG

SAVED: 9/5/14 1:57 PM

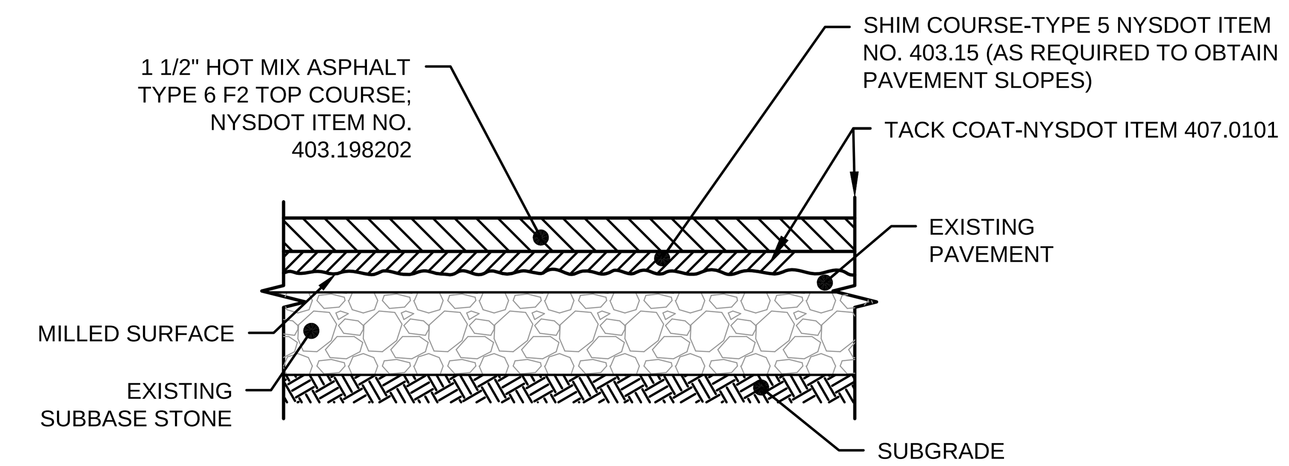


NOTE:

1. CONTRACTOR TO SAWCUT 1.5 FEET EACH SIDE OF TOP OF TRENCH WIDTH PRIOR TO REMOVAL OF EXISTING PAVEMENT AND SUBBASE. PROVIDE TACK COAT ON ALL AREAS TO RECEIVE ASPHALT OVERLAY - NYSDOT ITEM 407.0101 PRIOR TO NEW PAVEMENT SECTION.

A TYPICAL FULL DEPTH PAVEMENT REPAIR DETAIL

NOT TO SCALE

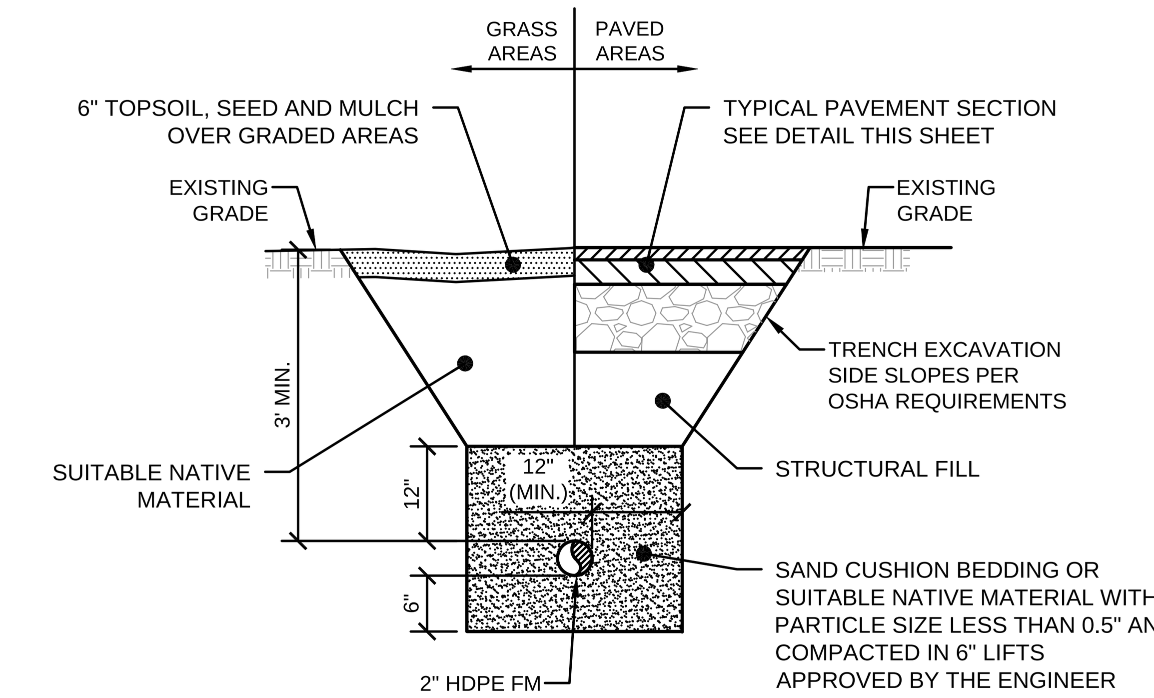


NOTES:

1. SEE TYPICAL PAVEMENT IMPROVEMENT DETAIL IF CRACKS ARE EVIDENT AFTER MILLING OPERATIONS.
2. ALL PAVEMENT CUTS TO BE SAW CUT.
3. TACK COAT SHALL BE INSTALLED AS PER NYSDOT STANDARD SPECIFICATIONS SECTION 407-TACK COAT AND AT THE APPLICATION RATE SPECIFIED.

B TYPICAL PAVEMENT RESURFACING DETAIL

NOT TO SCALE

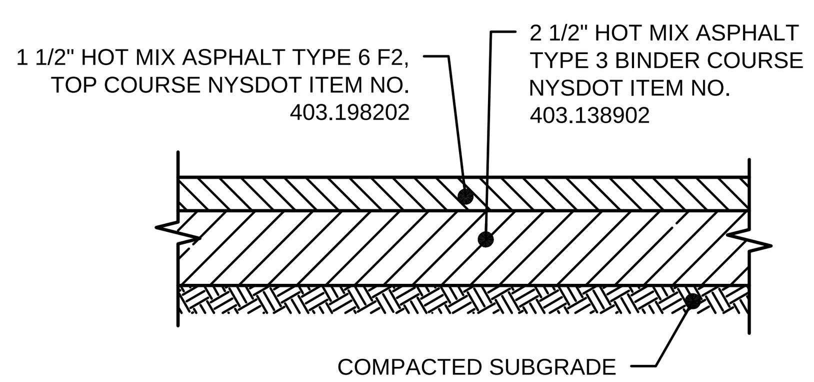


NOTE:

1. FORCEMAIN OPERATION IS ANTICIPATED IN THE MONTHS OF MARCH-MAY WITH CONTINUOUS HOT WATER FLOW, FROST PROTECTION NOT REQUIRED.

C TRENCH SECTION

NOT TO SCALE

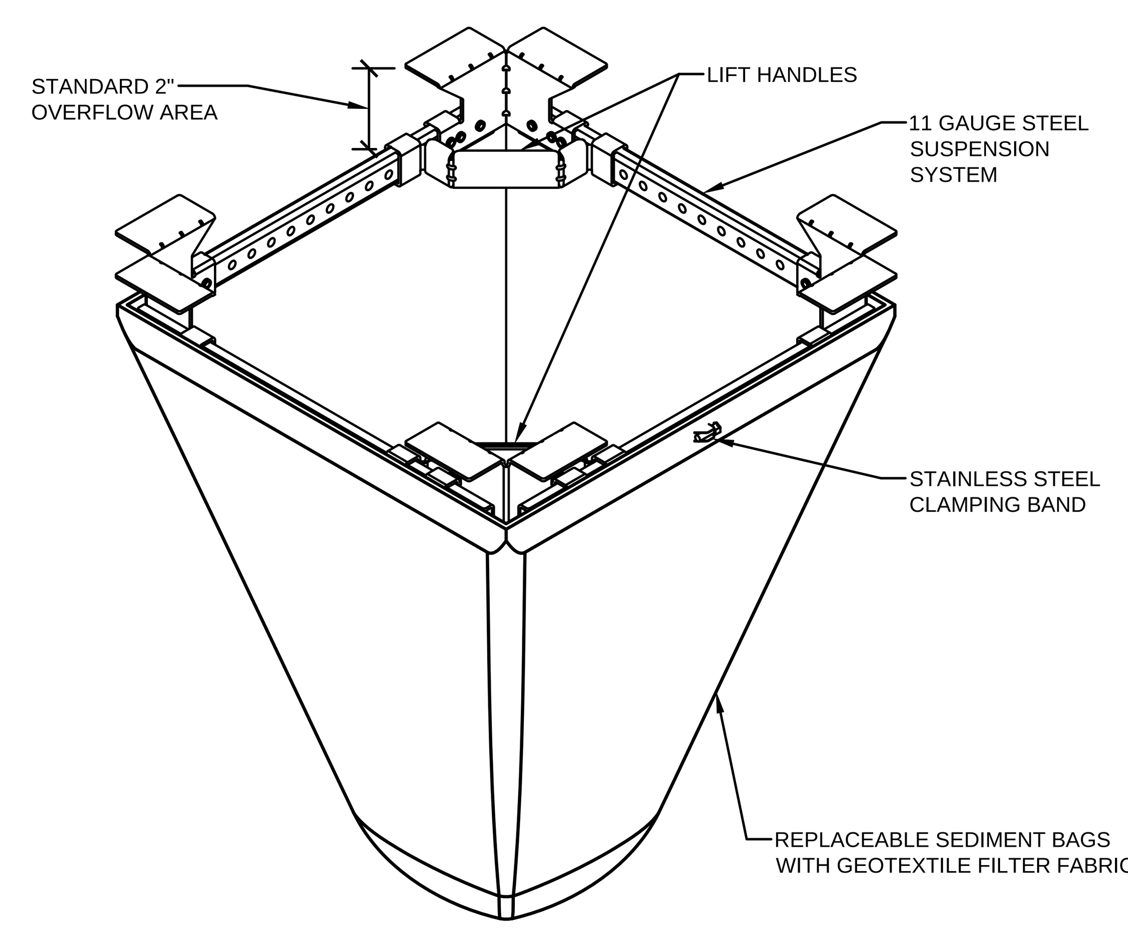


NOTE:

1. ALL PAVEMENT CUTS TO BE SAW CUT.

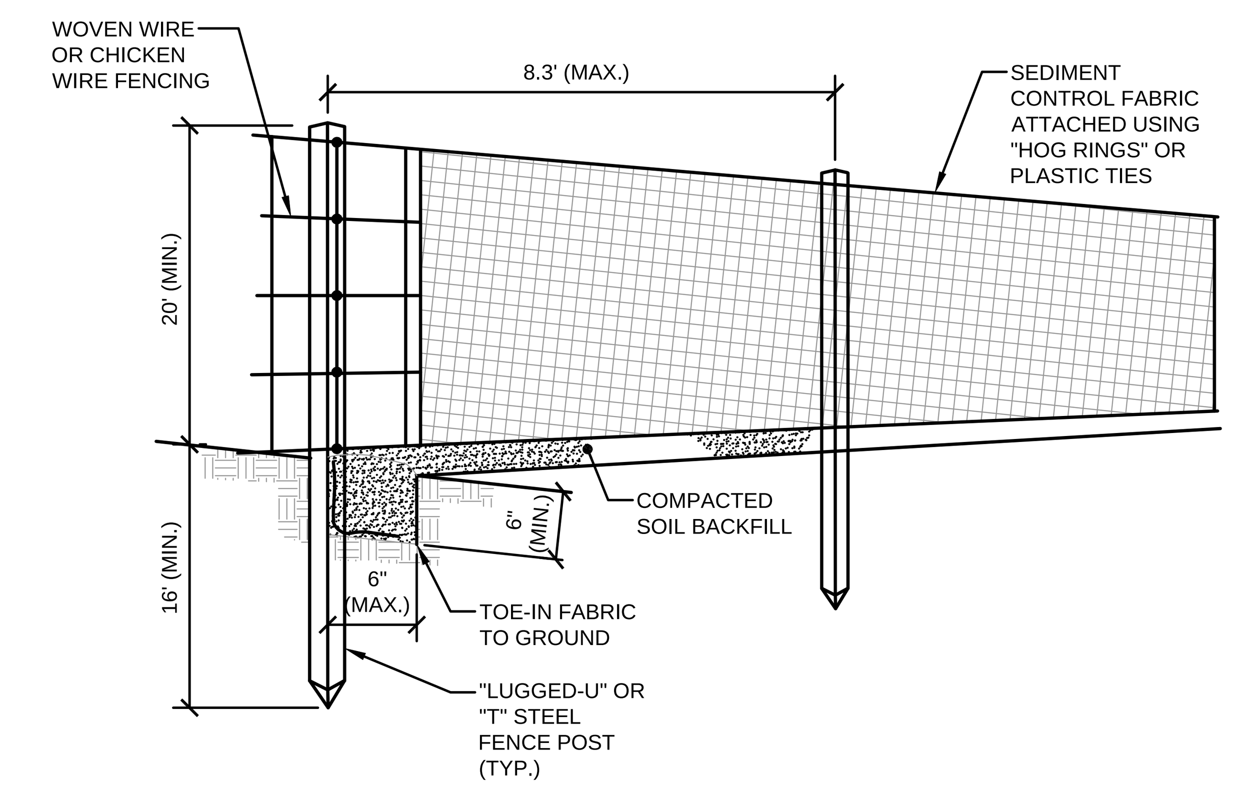
D PAVEMENT RESTORATION DETAIL

NOT TO SCALE



E TYPICAL RECTANGULAR CATCH BASIN INSERT

NOT TO SCALE

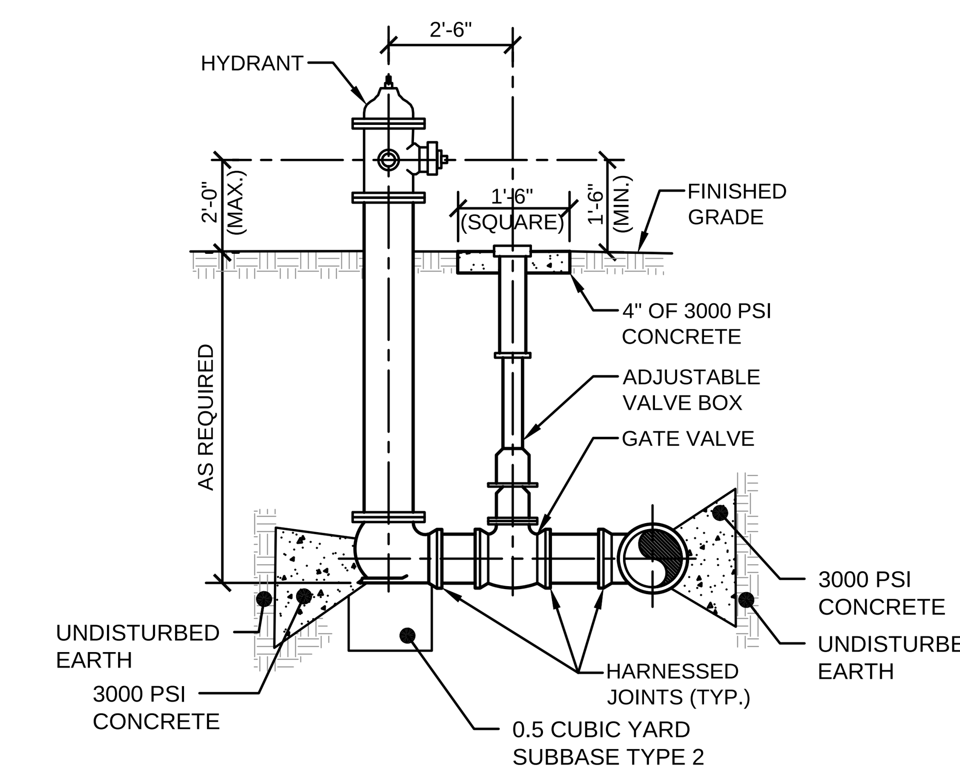


NOTES:

1. SILT FENCE SHALL BE PLACED AS DIRECTED BY ENGINEER.
2. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES.
3. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION.
4. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVER- LAPPED BY SIX INCHES AND FOLDED.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.
6. FENCE TO BE ALIGNED ALONG CONTOUR AS CLOSELY AS POSSIBLE.
7. FENCE SHALL BE DOUBLED AT THE TOE OF ALL SLOPES GREATER THAN 15 PERCENT, AND ADJACENT TO WATER BODIES, WETLANDS AND ALL ENVIRONMENTAL SENSITIVE AREAS.
8. PRE-FABRICATED SILT FENCE MAY BE USED WITH ENGINEER APPROVAL.

F SILT FENCE DETAIL

NOT TO SCALE

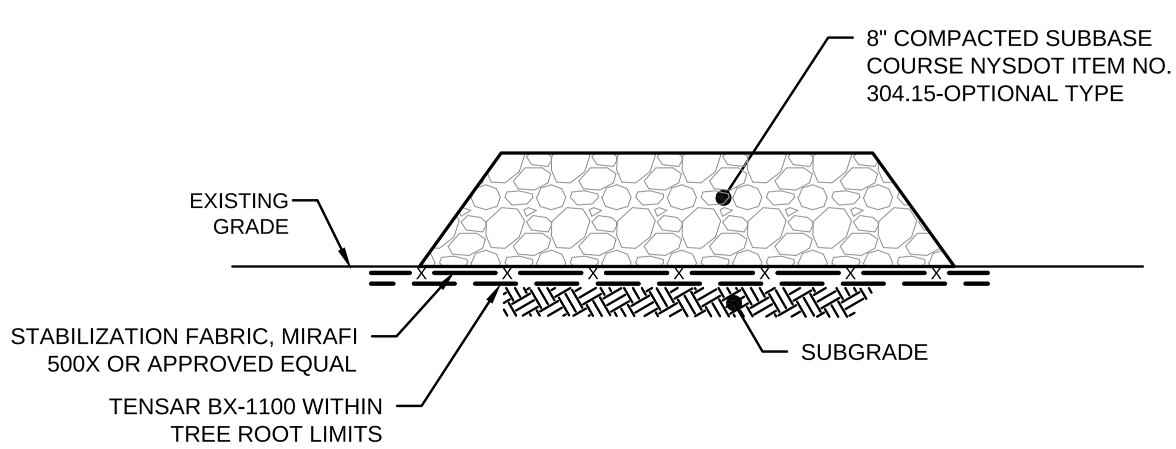


NOTE:

1. DO NOT BLOCK HYDRANT DRAIN PORT WITH CONCRETE.

H TYPICAL HYDRANT INSTALLATION DETAIL

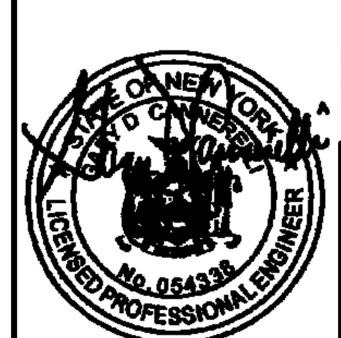
NOT TO SCALE



G GRAVEL ROAD DETAIL

NOT TO SCALE

I:\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-007-C7.DWG



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	G. CANNERELLI
DESIGNED BY	M. LASELL
CHECKED BY	M. PETRIE
DRAWN BY	S. JOHNSON

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

CIVIL

MISCELLANEUS DETAILS

FILE NO. 2516.50682 -007

DATE SEPTEMBER 2014

C-6

GENERAL NOTES

1. ALL EQUIPMENT AND WIRING IS NEW UNLESS OTHERWISE NOTED.
2. EQUIPMENT SHALL BE MOUNTED WITH OPERATING CONTROLS BETWEEN 4'-0" AND 5'-6" ABOVE FINAL GRADE.
3. THE CONTRACTOR SHALL VISIT THE SITE AND BE KNOWLEDGEABLE OF CONDITIONS THEREON. THE CONTRACTOR SHALL NOTIFY THE OWNER OF ANY CONDITION REQUIRING CORRECTION OR MODIFICATION PRIOR TO PROCEEDING WITH THE WORK.
4. THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS, SIZES, CONNECTIONS, GRADES AND LOCATIONS PRIOR TO PERFORMING WORK.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURATE PLACEMENT OF ALL WORK ON THE SITE.
6. ALL DIMENSIONS SHALL HAVE PREFERENCE OVER SCALE. DIMENSIONS SHALL BE VERIFIED IN THE FIELD PRIOR TO PROCEEDING WITH THE WORK. THE OWNER'S REPRESENTATIVE SHALL BE NOTIFIED OF ANY INCONSISTENCIES.
7. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF ALL APPLICABLE CODES AND GOVERNING AUTHORITIES AND SHALL BE PERFORMED TO THE HIGHEST STANDARDS OF PRACTICE FOR EACH TRADE.
8. ALL COST FOR INSPECTIONS, TESTS AND PERMITS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
9. WHERE TRENCHING FOR ELECTRICAL IS REQUIRED, CONTRACTOR SHALL VERIFY THE EXISTENCE OF UNDERGROUND OBSTRUCTIONS PRIOR TO EXCAVATION. ANY SUBSURFACE FACILITIES DAMAGED SHALL BE REPAIRED AT NO ADDITIONAL COST.
10. THE CONTRACTOR SHALL DISPOSE OF ALL UNUSED MATERIALS AS PART OF THIS CONTRACT.
11. THE CONTRACTOR SHALL PROVIDE RECORD DRAWINGS TO THE OWNER AT THE COMPLETION OF THE PROJECT.
12. PROVIDE PULLSTRING IN ALL SPARE CONDUITS, AS PER SPECIFICATIONS.
13. IT IS THE CONTRACTORS RESPONSIBILITY TO COORDINATE AND SCHEDULE ALL WORK WITH THE OWNER, ENGINEER, UTILITIES AND OTHER CONTRACTORS.
14. CONDUIT ROUTINGS SHOWN ARE SCHEMATIC ONLY, CONTRACTOR SHALL ROUTE CONDUITS BASED ON ACTUAL FIELD CONDITIONS AND IN COORDINATION WITH ALL OTHER EQUIPMENT BEING INSTALLED UNDER THIS CONTRACT.
15. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE, LOCAL CODES, AND THE OWNER'S ELECTRICAL STANDARDS. THE CONTRACTOR SHALL HAVE THE COMPLETE INSTALLATION INSPECTED BY THE AUTHORITY HAVING JURISDICTION AND SHALL CORRECT ANY DEFICIENCIES NOTED BY SUCH INSPECTION AT NO ADDITIONAL COST TO OWNER.
16. ALL CONDUIT SHALL BE INSTALLED IN A WORKMANLIKE MANNER IN ACCORDANCE WITH THE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE. MINIMUM CONDUIT SIZE SHALL BE 3/4" UNLESS OTHERWISE NOTED. PROVIDE NYLON PULLSTRING IN ALL SPARE CONDUITS.
17. ALL FEEDER AND BRANCH CIRCUIT CONDUITS SHALL CONTAIN A CODE SIZED GROUND CONDUCTOR UNLESS OTHERWISE NOTED.

ELEMENTARY DIAGRAM SYMBOLS

NOTE:
UNLESS OTHERWISE NOTED, ALL SWITCHES AND CONTACTS ARE SHOWN WITH ACTUATING DEVICES IN THE DE-ENERGIZED, OR NON-OPERATED POSITION.

- FUSE (SIZE AS SHOWN)
- GROUND
- PUSHBUTTON (MOMENTARY, SPRING RETURN, NORMALLY OPEN CIRCUIT, CLOSE UPON ACTUATION)
- PUSHBUTTON (MOMENTARY, SPRING RETURN, NORMALLY CLOSED CIRCUIT, OPEN UPON ACTUATION)
- MULTI-POSITION SELECTOR SWITCH
  X = CONTACT CLOSED
  * = SWITCH POSITIONS AS NOTED
- LIQUID LEVEL ACTUATED SWITCH (FLOAT) (CLOSE ON RISING LEVEL)
- LIQUID LEVEL ACTUATED SWITCH (FLOAT) (OPEN ON RISING LEVEL)
- FLOW ACTUATED SWITCH (CLOSE ON INCREASE IN FLOW)
- FLOW ACTUATED SWITCH (OPEN ON INCREASE IN FLOW)
- TDC or — TIME DELAY CONTACT (NORMALLY OPEN, TIME DELAY CLOSE)
- TDC or — TIME DELAY CONTACT (NORMALLY OPEN, TIME DELAY OPEN)
- TDC or — TIME DELAY CONTACT (NORMALLY CLOSED, TIME DELAY OPEN)
- TDC or — TIME DELAY CONTACT (NORMALLY CLOSED, TIME DELAY CLOSE)
- or — CONTACT (NORMALLY CLOSED)
- or — CONTACT (NORMALLY OPEN)
- INDICATING LIGHT (NON-PUSH-TO-TEST)
- RELAY OR CONTACTOR COIL

* = LENS COLOR:

A	-AMBER	OP	-OPALESCENT
B	-BLUE	P	-PURPLE
C	CLEAR	R	-RED
G	-GREEN	W	-WHITE
NE	-NEON	Y	-YELLOW
O	-ORANGE		

ABBREVIATIONS

A	AMPERE
ABV	ABOVE
AF	AMPERE FRAME
AFG	ABOVE FINISHED GRADE
AT	AMPERE TRIP
AWG	AMERICAN WIRE GUAGE
CDT	CONDUIT
CKT	CIRCUIT
CLF	CURRENT LIMITING FUSE
CM	CONSTRUCTION MANAGER
CU	COPPER
DWG	DRAWING
E	EXISTING
EC	ELECTRICAL CONTRACTOR
FDR	FEEDER
FWE	FURNISHED WITH EQUIPMENT
GC	GENERAL CONTRACTOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
HP	HORSEPOWER
HZ	HERTZ
JB	JUNCTION BOX
KCMIL	THOUSAND CIRCULAR MILS
KVA	KILO-VOLT AMPERES
KW	KILOWATT
MC	MECHANICAL CONTRACTOR
MT	MOUNT
N	NEW
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
TYP	TYPICAL
PH	PHASE
PVC	POLYVINYL CHLORIDE CONDUIT
RGS	RIGID GALVANIZED STEEL
UF	UNDERGROUND FEEDER
V	VOLT
W	WIRE OR WATT
WP	WEATHER PROOF, NEMA 3R
UON	UNLESS OTHERWISE NOTED

ONE LINE DIAGRAM SYMBOLS

- FUSE
- MEDIUM VOLTAGE THREE PHASE, DISCONNECT SWITCH
- THERMAL OVERLOAD
- TWO WINDING TRANSFORMER
- WYE TRANSFORMER WINDING
- DELTA TRANSFORMER WINDING
- SQUIRREL CAGE INDUCTION MOTOR WITH HORSEPOWER
- GROUND
- CIRCUIT BREAKER (SIZE AS SHOWN)
- SURGE ARRESTER
- POLE-MOUNTED FUSED CUTOUT
- POTENTIAL TRANSFORMER
- CURRENT TRANSFORMER
- MOLDED CASE CIRCUIT BREAKER OR MCP (OPEN OR ENCLOSED)
- FUSE
- LOW VOLTAGE (600 VOLT AND BELOW) DISCONNECT SWITCH
- DS-1 — DISCONNECT SWITCH TYPE AS SCHEDULED

GENERAL ELECTRICAL SYMBOLS

- EXPOSED CONDUIT
- CONDUIT ROUTED BELOW FINISHED GRADE
- J — JUNCTION BOX
- ELECTRICAL CONNECTION
- PROVIDED BY OTHERS
- NEW
- OHW — EXISTING OVER HEAD WIRE
- OHW — OVER HEAD WIRE
- G — G — G — G — #4/O BARE COPPER GROUND CONDUCTOR
- UTILITY POLE
- P — POINT OF CONNECTION TO EXISTING SYSTEM
- COPPERWELD GROUND ROD TYPE & SIZE SPECIFIED
- WP/GFCI — DUPLEX RECEPTACLE NEMA 5-20R GROUND FAULT INTERRUPTING WITH WEATHERPROOF COVER
- POLE MOUNTED LIGHT FIXTURE

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

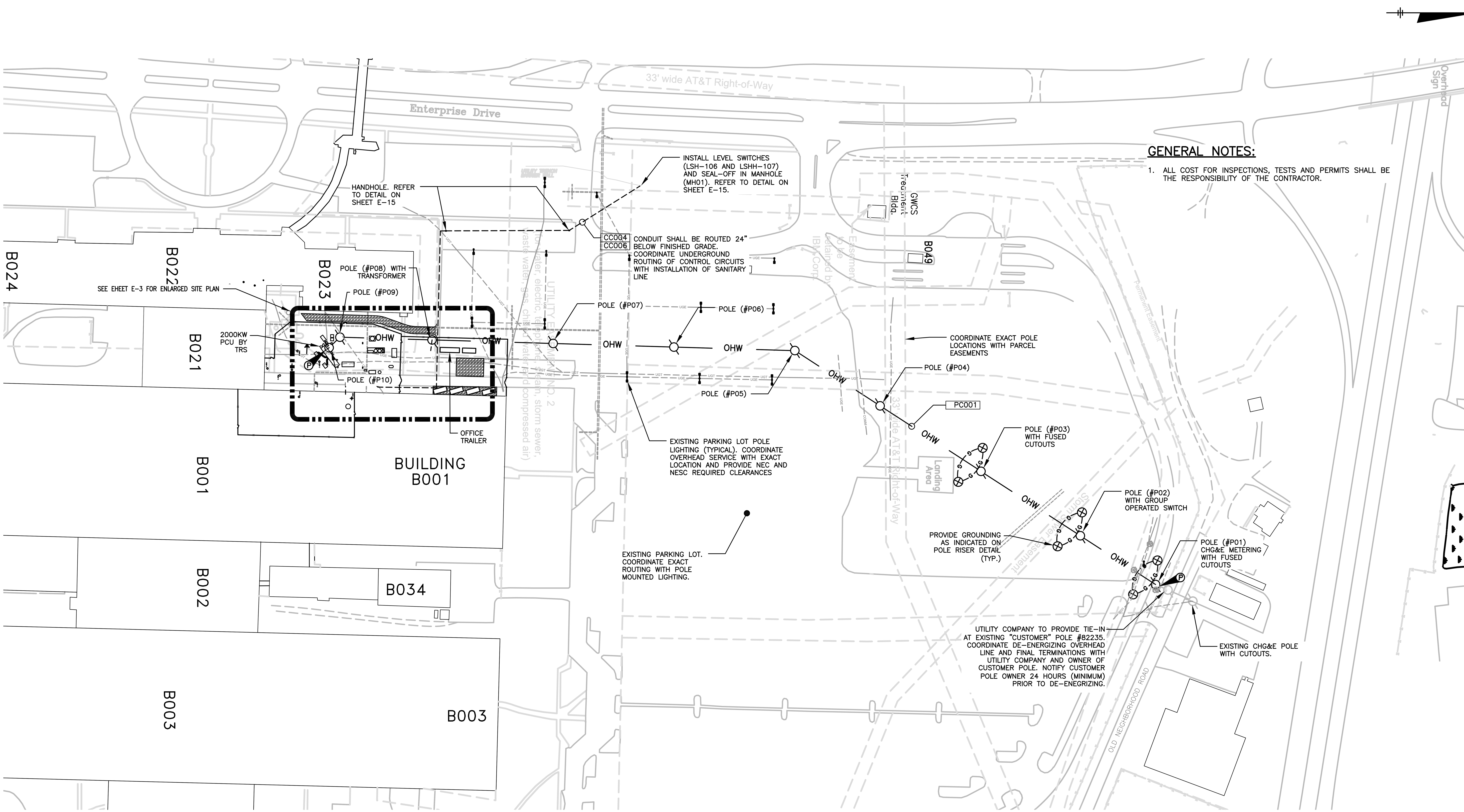
O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
SYMBOLS, NOTES, & ABBREVIATIONS

FILE NO. 2516.50682 - E-1
DATE SEPTEMBER 2014

E-1



OVERALL SITE PLAN

SCALE: 1" = 80'-0"

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

1"=80' 80 0 80 160

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR IBM CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
SITE PLAN

FILE NO. 2516.50682 - E-2

DATE SEPTEMBER 2014

E-2

NOTES:

1. 2,000KW POWER CONTROL UNIT PROVIDED BY THERMAL REMEDIATION VENDOR. COORDINATE NEW OVERHEAD SERVICE WITH EXACT LOCATION.
2. CONDUIT SHALL BE ROUTED 18" BELOW GRADE. CONTRACTOR TO BACKFILL ALL TRENCHING AND PROVIDE RESTORATION TO MATCH EXISTING CONDITIONS.
3. CONDUIT TURNS UP AND RISES UP TO PENETRATE EXTERIOR WALL IN A CONVENIENT LOCATION. PROVIDE L/B TYPE CONDUIT BODY TO FACILITATE WALL PENETRATION.
4. PROVIDE FINAL TERMINATION TO TRAILER OFFICE 120/240 1-PHASE PANEL. VERIFY EXACT LOCATION.
5. ROLL-UP RENTAL GENERATOR FURNISHED BY OBG AND INSTALLED UNDER THIS CONTRACT. ELECTRICAL CONTRACTOR SHALL PROVIDE ASSOCIATED DISTRIBUTION PANEL TO FEED ATS'S AS INDICATED ON ONE-LINE DRAWING (SHEET E-004). PROVIDE START SIGNAL CONTROL WIRING BETWEEN THE TWO ATS'S AND THE GENERATOR CONTROL PANEL.
6. COORDINATE EXACT TERMINATION LOCATION WITH THERMAL REMEDIATION VENDER EQUIPMENT.
7. CONNECT GENERATOR GROUND BAR TO GROUNDING ELECTRODE SYSTEM. DO NOT BOND GENERATOR NEUTRAL TO GROUND.
8. PROVIDE SUPPORT FOR DISTRIBUTION PANEL. COORDINATE WITH TRS SUPPLIED ELECTRICAL EQUIPMENT.
9. COORDINATE EXACT POLE LOCATION WITH 2000kW PCU CONDUIT ENTRY LOCATION.
10. PROVIDE 16"H x 14"W x 8"D NEMA 4X BOX FOR METERING CT'S, ASSOCIATED SHORTING BLOCKS, TERMINAL BLOCKS, AND FUSES. REFER TO ONE-LINE DIAGRAM.

ENLARGED SITE PLAN

SCALE: 3/32" = 1'-0"

STATE OF NEW YORK — DAREK LETKIEWICZ — 075789-1 — LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz
9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

3/32"=1'-0" 8 0 8 16 24

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
ENLARGED SITE PLAN

FILE NO. 2516.50682 - E-3
DATE SEPTEMBER 2014

E-3

9/5/2014 5:53 PM

NOTES:

1. THERMAL REMEDIATION EQUIPMENT PROVIDED BY VENDOR (TRS). PROVIDE FINAL TERMINATIONS TO EQUIPMENT AS INDICATED.
2. PROVIDE POLE FOR UTILITY METER. ELECTRICAL CONTRACTOR TO PROVIDE METER ENCLOSURE, CONNECTION LUGS AND CONDUITS FOR METERING VT'S AND PT'S.
3. CHG&E TO REMOVE EXISTING POLE CROSSARM AND HARDWARE AND INSTALL NEW CROSSARMS AND HARDWARE TO EXTEND OVERHEAD LINE AS INDICATED ON SHEET E-14.
4. SURGE PROTECTIVE DEVICE FURNISHED AND INSTALLED BY THE PANELBOARD MANUFACTURER. SURGE PROTECTIVE DEVICE SHALL BE OF TYPE 1, UL 1449 3RD EDITION, AND CONNECTED TO THE SUPPLY SIDE OF THE SERVICE DISCONNECT. REFER TO SPECIFICATION 264300 FOR MORE INFORMATION.
5. CUSTOMER WATTHOUR METERING UNIT (REVENUE GRADE) FURNISHED AND INSTALLED BY THE PANELBOARD MANUFACTURER.
6. ADD ALTERNATE #1: PROVIDE SEPARATE LINE ITEM PRICING IN THE ELECTRICAL BID TO FURNISH AND INSTALL WATTHOUR METERING UNIT (REVENUE GRADE) IN NEMA 4X ENCLOSURE. PROVIDE EQUIPMENT LABEL "CAUTION THIS EQUIPMENT IS SUPPLIED BY MORE THAN ONE POWER SOURCE". PROVIDE ADDITIONAL NEMA 4X ENCLOSURE TO MOUNT CURRENT TRANSFORMERS, ASSOCIATED SHORTING BLOCKS, TERMINAL BLOCKS, AND FUSES.
7. EQUIPMENT FURNISHED AND INSTALLED BY REMEDIATION VENDOR (TRS).
8. ROLL-UP RENTAL GENERATOR PROVIDED BY OBG AND INSTALLED UNDER THIS CONTRACT. PROVIDE ALL REQUIRED CONTROL WIRING TO ATS'S.
9. DIESEL GENERATOR AND FEEDER CABLE (PC011) PROVIDED BY OBG AS PART OF RENTAL AGREEMENT.

ONE-LINE DIAGRAM

NOT TO SCALE

STATE OF NEW YORK — DAREK LETKIEWICZ — 075789-1 — LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	0

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
ONE-LINE DIAGRAM

FILE NO. 2516.50682 - E-4

DATE SEPTEMBER 2014

E-4

PANEL SCHEDULE (1)

PANEL BOARD LP-1 LOCATION NEAR POLE 8 INSTALLATION NEMA 3R / SURFACE
RATINGS 225 AMPS 120/240 VOLTS 1 PH 3 WIRE, 60 HZ. GRD. BAR X
MAIN LUGS 225 CB. INTERRUPTING RATING 42,000 RMS. SYMM. AMPS
MAIN CIRCUIT BREAKER 175 AMPS CONNECTED LOAD – KW, PANEL SIZE 30 SPACES

DESCRIPTION	LOAD W-KW-HF	CB. AMPS	CIR	1 N 2	CIR	CB. AMPS	LOAD W-KW-HF	DESCRIPTION
HOLDING TANK CONV. RECPT.	180	20	1		2	60	9840	GAS FIRED BOILER PANEL VIA ATS-2
GENERATOR PANEL	6720	60	3		4			
			5		6	15	10	WATT HOUR MTR VOLTAGE INPUT
OFFICE TRAILER	19200	100	7		8	15	50	WATT HOUR MTR CTRL PWR
			9		10	20	180	CONV. RECPT.
SPARE		20	11		12	20		SPARE
SPARE		20	13		14	20		SPARE
SPARE		15	15		16	15		SPARE
SPACE		–	17		18	–		SPACE
SPACE		–	19		20	–		SPACE
SPACE		–	21		22	–		SPACE
SPACE		–	23		24	–		SPACE
SPACE		–	25		26	–		SPACE
SPACE		–	27		28	–		SPACE
SPACE		–	29		30	–		SPACE

(1) SERVICE ENTRANCE EQUIPMENT. PANEL SHALL BE PROVIDED WITH WATT-HOUR METER AND SURGE PROTECTION DEVICE REFER TO SPECIFICATION SECTION 26 24 16.

POWER CIRCUIT – CONDUCTOR AND CONDUIT SCHEDULE

DESIGNATION	FROM	TO	CONDUIT QTY/SIZE/TYPE	CONDUCTORS QTY/SIZE	REMARKS
PC001	EXISTING CUSTOMER POLE #82235	FUSED CUTOUT ON UTILITY POLE #P09	–	3-#4/0 ACSR & 1-#4/0 ACSR GND	13.2kV OVERHEAD LINE
PC002	FUSED CUTOUT ON UTILITY POLE P#09	REFER TO BID ALTERNATE OPTIONS	4"	3-#4/0 (15kV) & 1-#4/0 GND (600V)	13.2kV SYSTEM
PC003	TRANSFORMER ON UTILITY POLE #P08	PANELBOARD LP-1	2"	3-#3/0 (600V) & 1-#2 GND (600V)	120/240V, 1-PHASE, 3-WIRE
PC004	GAS FIRED BOILER PANEL	MS-HOLDING TANK PUMP	1"	2-#8 (600V) & 1-#10 GND (600V)	240V, 1-PHASE, 2-WIRE, COORDINATE EXACT FEEDER SIZE WITH CONTROL PANEL
PC005	PANELBOARD LP-1	HOLDING TANK PUMP RECEPTACLE	3/4"	2-#12 (600V) & 1-#12 GND (600V)	120V, 1-PHASE
PC006	PANELBOARD LP-1	TRAILER OFFICE PANEL	1-1/2"	3-#2 (600V) & 1-#8 GND (600V)	120V, 1-PHASE
PC007	PANELBOARD LP-1	CT BOX TERMINAL BLOCKS	1"	3-#6 (600V) & 1-#10 GND (600V)	120/240V, 1-PHASE, 3-WIRE
PC008	PANELBOARD LP-1	GAS FIRE BOILER WATT-HOUR METER	SEE REMARKS	3-#14 (600V)	METER VOLTAGE INPUT. ROUTE IN METER CTRL PWR CONDUIT. PROVIDE AS ADD ALTERNATE #1
PC009	PANELBOARD LP-1	GAS FIRED BOILER WATT-HOUR METER	3/4"	2-#12 (600V) & 1-#12 GND (600V)	120V, 1-PHASE FOR METER CONTROL POWER. PROVIDE AS ADD ALTERNATE #1
PC010	PANELBOARD LP-1	CONV. RECPT.	3/4"	2-#12 (600V) & 1-#12 GND (600V)	120V, 1-PHASE
PC011	STANBY GENERATOR	DISTRIBUTION PANEL HP-1	3"	3-#400kcmil (600V) & 1-#1/0 GND (600V)	480V, 3-PHASE, 3-WIRE
PC012	PANELBOARD LP-1	GENERATOR POWER PANEL	1"	3-#6 (600V) & 1-#10 GND (600V)	120/240V, 1-PHASE, 3-WIRE
PC013	PANELBOARD LP-1	HOLDING TANK WATT-HOUR METER	SEE REMARKS	3-#14 (600V)	METER VOLTAGE INPUT. ROUTE IN METER CTRL PWR CONDUIT. PROVIDE AS ADD ALTERNATE #1
PC014	PANELBOARD LP-1	HOLDING TANK WATT-HOUR METER	3/4"	2-#12 (600V) & 1-#12 GND (600V)	120V, 1-PHASE FOR METER CONTROL POWER. PROVIDE AS ADD ALTERNATE #1

CONTROL CIRCUIT – CONDUCTOR AND CONDUIT SCHEDULE

DESIGNATION	FROM	TO	CONDUIT QTY/SIZE/TYPE	CONDUCTORS QTY/SIZE	REMARKS
CC001	MS-HOLDING TANK PUMP	HOLDING TANK PUMP FLOAT SWITCH LSH-101	3/4"	2-#14AWG	120V, CONTROL CIRCUIT
CC002	MS-HOLDING TANK PUMP	HOLDING TANK PUMP FLOAT SWITCH LSL-100	SEE REMARKS	2-#14AWG	120V, CONTROL CIRCUIT ROUTE WITH CC001
CC003	WATT-HOUR METER	GAS FIRE BOILER CT ENCLOSURE	3/4"	2-#14AWG	–
CC004	MS-HOLDING TANK PUMP	MANHOLE MH01 FLOAT SWITCH LSHH-107	1"	2-#14AWG – TYPE SJO	120V, CONTROL CIRCUIT
CC005	MS-HOLDING TANK PUMP	HOLDING TANK FLOW SWITCH FSL-110	3/4"	4-#14AWG AND #14AWG GND	120V, CONTROL CIRCUIT
CC006	MS-HOLDING TANK PUMP	MANHOLE MH01 FLOAT SWITCH LSHH-107	SEE REMARKS	2-#14AWG – TYPE SJO	120V, CONTROL CIRCUIT ROUTE WITH CC004
CC007	MS-HOLDING TANK PUMP	HOLDING TANK PUMP FLOAT SWITCH LSHH-102	SEE REMARKS	2-#14AWG	120V, CONTROL CIRCUIT ROUTE WITH CC001
CC008	MS-HOLDING TANK PUMP	HOLDING TANK INPUT VALVE SV-100	3/4"	2-#14AWG	120V, CONTROL CIRCUIT
CC009	MS-HOLDING TANK PUMP	CONDENSER CONTROL PANEL	3/4"	2-#14AWG	NORMALLY CLOSED CONTACTOR
CC010	MS-HOLDING TANK PUMP	CONDENSER CONTROL PANEL	SEE REMARKS	2-#14AWG	NORMALLY CLOSED CONTACTOR ROUTE WITH CC009
CC011	ATS-1	GENERATOR CONTROL PANEL	1"	2-#14AWG	GENERATOR START SIGNAL WIRED IN PARALLEL WITH CC012
CC012	ATS-2	GENERATOR CONTROL PANEL	1"	2-#14AWG	GENERATOR START SIGNAL WIRED IN PARALLEL WITH CC011

MOTOR STARTER SCHEDULE

I.D.#	SERVICE	MOUNTING	ENCLOSURE	STARTER	PROTECTIVE DEVICE				DEVICES IN COVER		REMARKS
			(NEMA)	TYPE	TYPE	RATING (AMPS)	POLES	TRIP OR FUSE SIZE (AMPS)	ON PILOT	HAND-OFF-AUTO SWITCH	
MS-HOLDING TANK PUMP	HOLDING TANK PUMP	SURFACE	TYPE 12	COMBINATION DISCONNECT	MELTING ALLOY THERMAL OVERLOAD	SIZED PER MOTOR NAMEPLATE	3	15A	YES	YES	230V, 1-PHASE. CPT SHALL INCLUDE 100VA SPARE. CONTROL VOLTAGE SHALL BE 120V. REFER TO SHEET E-15 FOR MORE INFORMATION
–	– –	–	–	– – –	– – –	– – –	–	–	–	–	– – –

STATE OF NEW YORK
DAREK LETKIEWICZ
075789-1
LICENSED PROFESSIONAL ENGINEER
D. Letkiewicz
9/4/2014

IN CHARGE OF RGH
DESIGNED BY RGH
CHECKED BY RGH
DRAWN BY RGH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

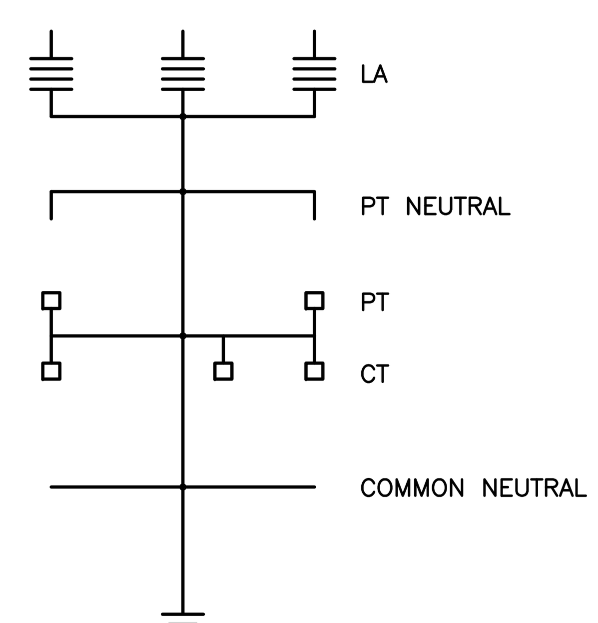
ELECTRICAL
BUILDING B001
SCHEDULES

FILE NO. 2516.50682 - E-5
DATE MAY 2014

E-5

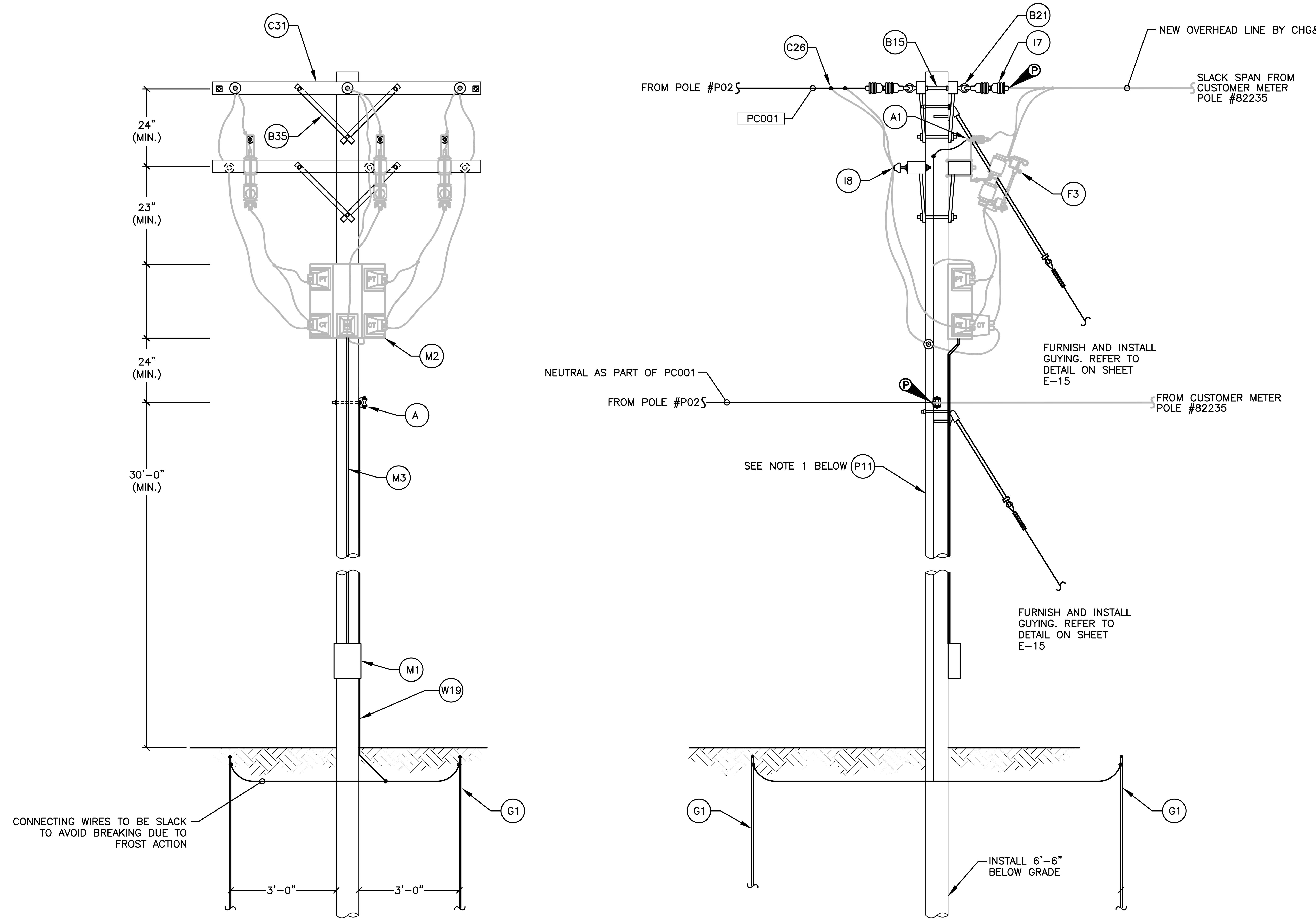
OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
A1	SURGE ARRESTOR, DISTRIBUTION CLASS 12 KV, 10.2 KV–MCOV.
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.
C26	LINE TAP CRIMPITS
C31	8' CROSS–ARM, FIR OR SPRUCE, TREATED.
F3	FUSE CUTOUT, BY CHG&E
G1	COPPER–CLAD GROUND ROD, 3/4"X10'–0".
I7	STRAIN–TYPE INSULATOR, ANSI CLASS 52–9.
I8	POST INSULATOR, 15KV, CLASS 55–5.
M1	METER PAN, NEMA 3R, MILBANK U4497–XL.
M2	POLE MOUNTED CT AND PT ENCLOSURE BY CHG&E.
M3	CONDUIT FOR METERING CT AND PT LEADS.
P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE.
W19	#4/O, COPPER, BARE, STAPLE EVERY 12" FROM GRADE TO 8' ABOVE, EVERY 24" ABOVE 8'. PROVIDE PLASTIC MOLDING TO COVER GROUND WIRE ALONG FULL RUN ON POLE.



METERING POLE GROUNDING DIAGRAM

NOT TO SCALE



1 / E–6

POLE RISER DETAIL (P#01)

NOT TO SCALE

DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. REFER TO SPECIFICAITON SECTION 26 18 00.
3. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
4. PROVIDE MIN OF 6–1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.
5. PROVIDE NEW METERING POLE AND ALL ASSOCIATED HARDWARE TO FACILITATE THE INSTALLATION OF METERING EQUIPMENT BY CHG&E.

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

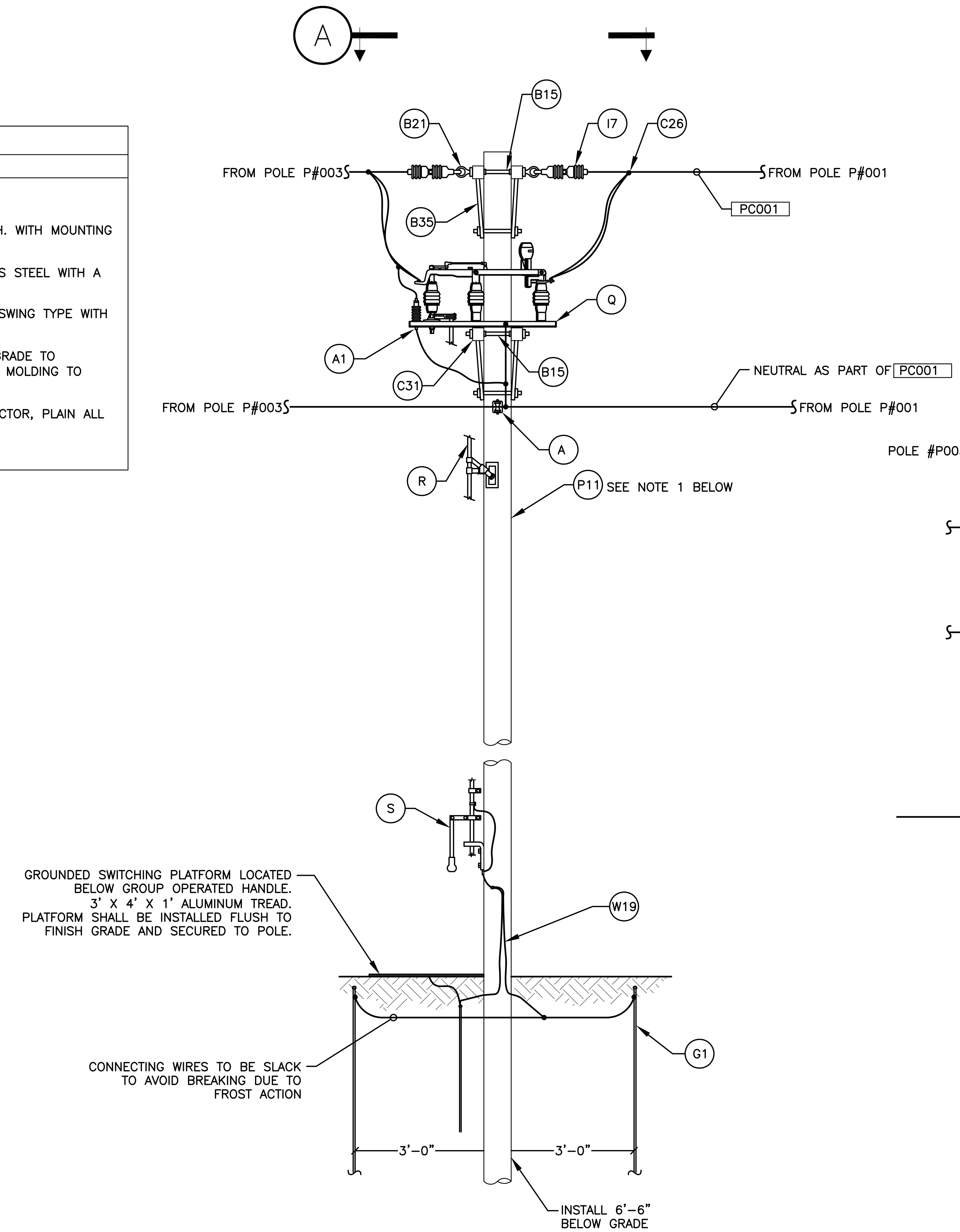
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682 - E-6
DATE SEPTEMBER 2014
E-6

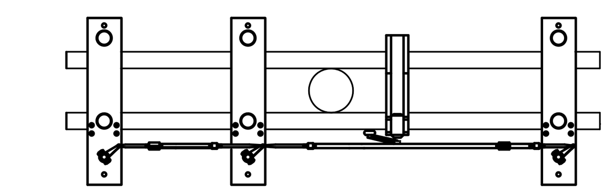
OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR	P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
A1	SURGE ARRESTOR, DISTRIBUTION CLASS 12 KV, 10.5 KV–MCOV.	Q	HORIZONTALLY MOUNTED, GROUP OPERATED SWITCH. WITH MOUNTING PROVISIONS FOR LOAD SIDE SURGE ARRESTORS.
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.	R	VERTICAL OPERATING PIPE, 1–1/2" IPS GALVANIZES STEEL WITH A FIBERGLASS ROD INSULATOR.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.	S	CONTROL HANDLE, GALVANISED STEEL, TORSIONAL SWING TYPE WITH PAD LOCK PROVISIONS.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.	W19	#4/0, COPPER, BARE, STAPLE EVERY 12" FROM GRADE TO 8' ABOVE, EVERY 24" ABOVE 8'. PROVIDE PLASTIC MOLDING TO COVER GROUND WIRE ALONG FULL RUN ON POLE.
C31	8' CROSS–ARM, FIR OR SPRUCE, TREATED.	W20	#4/0, ALUMINUM CLAD STEEL REINFORCED CONDUCTOR, PLAIN ALL ALUMINUM BEST EXCEPT IN TENSION SPAN (ACC).
G1	COPPER–CLAD GROUND ROD, 3/4"X10'–0".		
I7	STRAIN–TYPE INSULATOR, ANSI CLASS 52–9.		



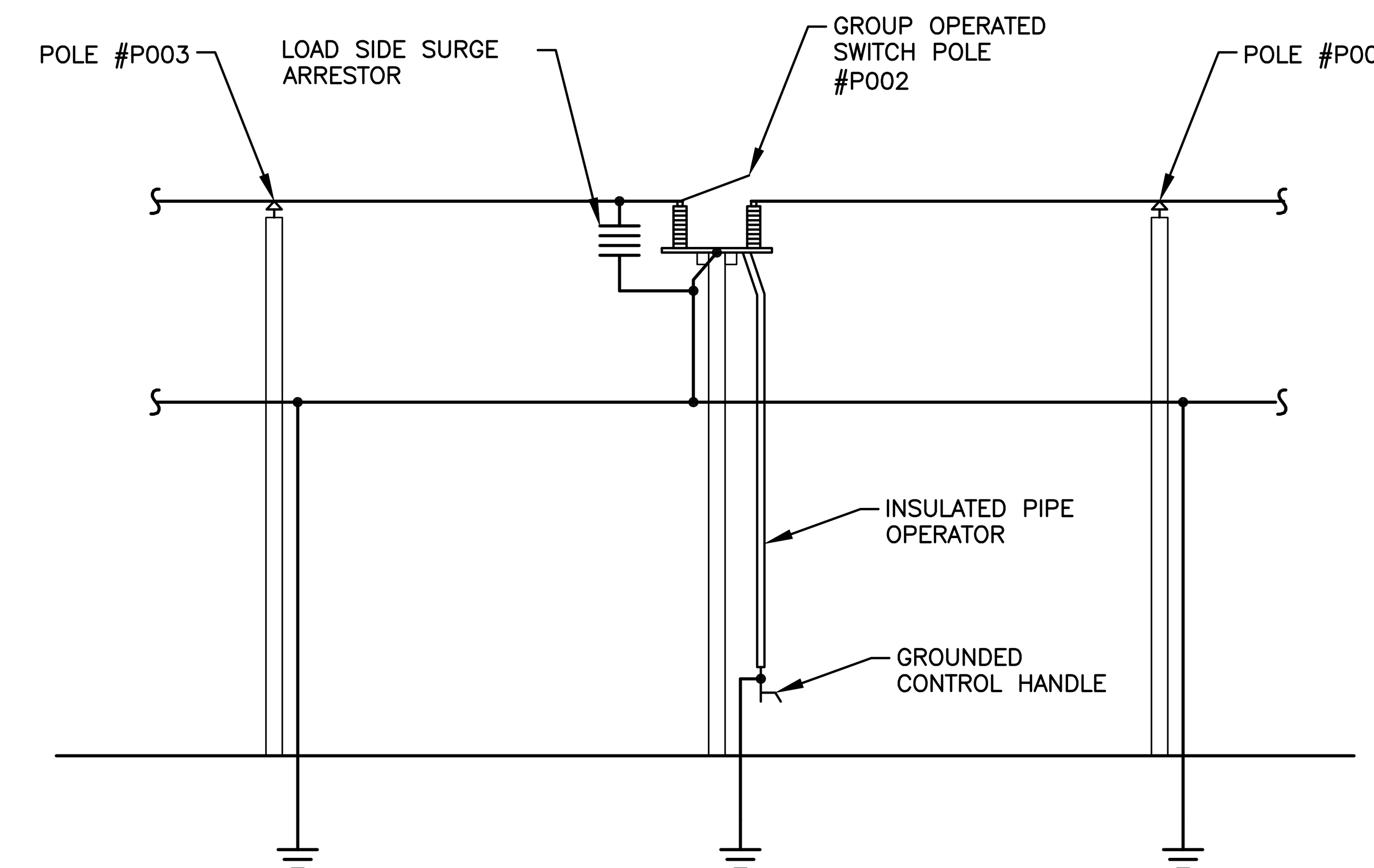
1 / E–7 POLE RISER DETAIL (P#02)

NOT TO SCALE



A POLE CROSSARM CONFIGURATION (P#02)

NOT TO SCALE



GROUP OPERATED SWITCH GROUNDING DIAGRAM

NOT TO SCALE

DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. REFER TO SPECIFICAITON SECTION 26 18 00.
3. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
4. PROVIDE MIN OF 6–1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

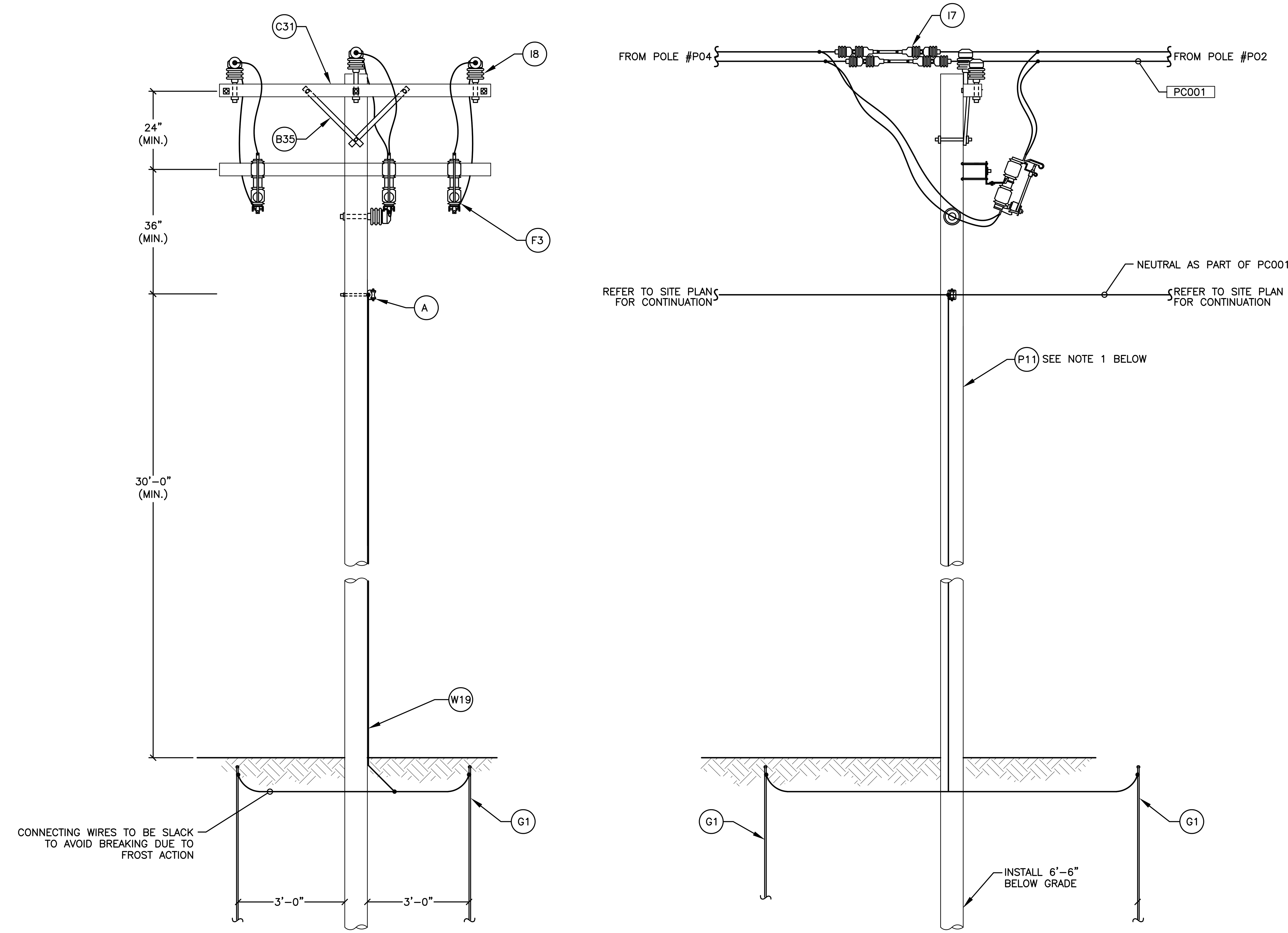
FILE NO. 2516.50682 - E-7

DATE SEPTEMBER 2014

E-7

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
C31	8' CROSS-ARM, FIR OR SPRUCE, TREATED.
F3	FUSE CUTOUT, 15KV, 150KV BIL MINIMUM, WITH 200 AMP FUSE
G1	COPPER-CLAD GROUND ROD, 3/4"X10'-0".
I7	STRAIN-TYPE INSULATOR, ANSI CLASS 52-9.
I8	POST INSULATOR, 15KV, CLASS 55-5.
P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
W19	#4/0, COPPER, BARE, STAPLE EVERY 12" FROM GRADE TO 8' ABOVE, EVERY 24" ABOVE 8'. PROVIDE PLASTIC MOLDING TO COVER GROUND WIRE ALONG FULL RUN ON POLE.



DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
3. PROVIDE MIN OF 6-1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

1 / E-8 **POLE RISER DETAIL (P#03)**

NOT TO SCALE

STATE OF NEW YORK — DAREK LETKIEWICZ — 075789-1 — LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz
9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

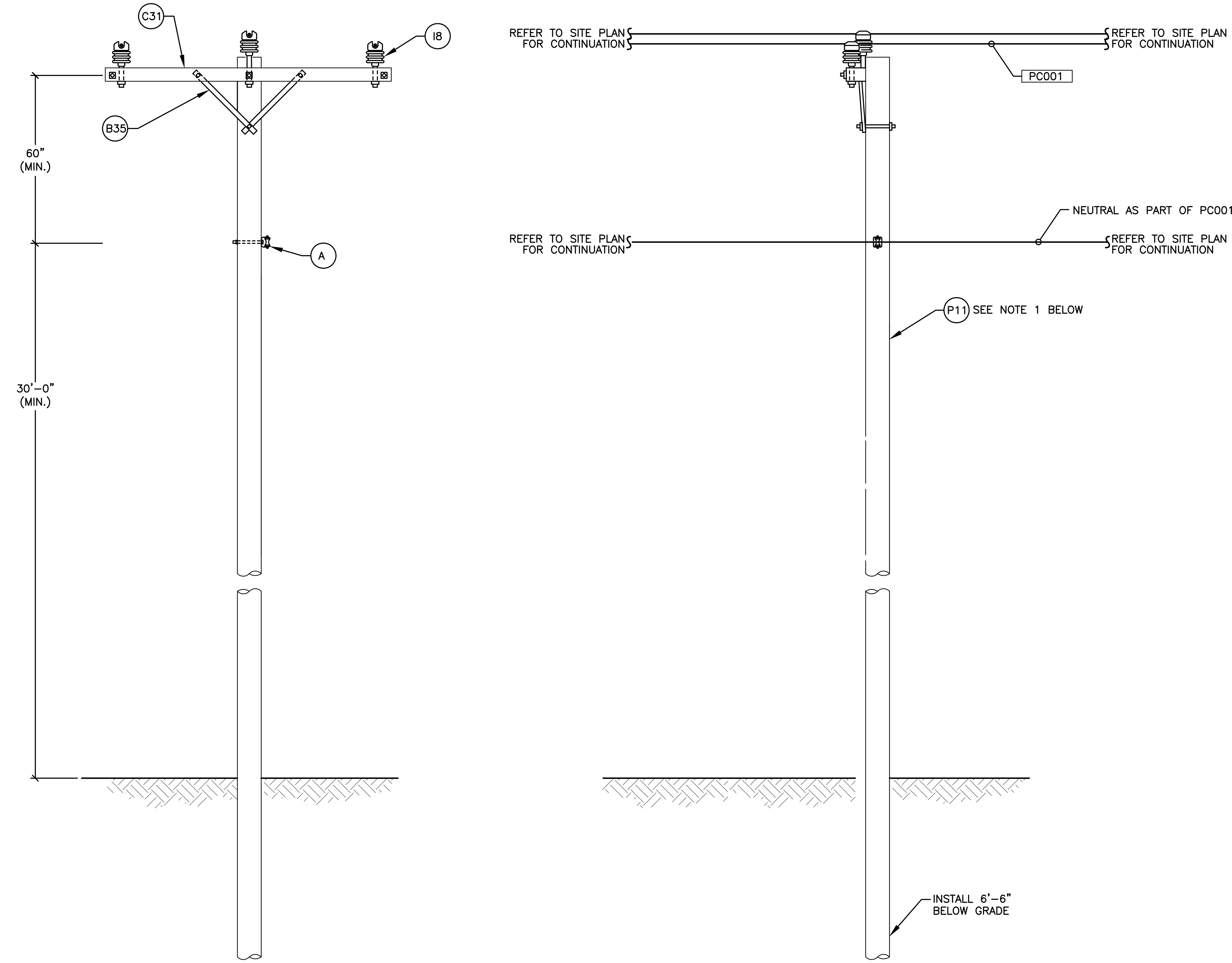
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682 - E-8
DATE SEPTEMBER 2014
E-8

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.
C31	8' CROSS-ARM, FIR OR SPRUCE, TREATED.
I8	POST INSULATOR, 15KV, CLASS 55-5.
P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE



DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
3. PROVIDE MIN OF 6-1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

1 / E-9 TYPICAL POLE RISER DETAIL (P#04, 06, AND 07)

NOT TO SCALE

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

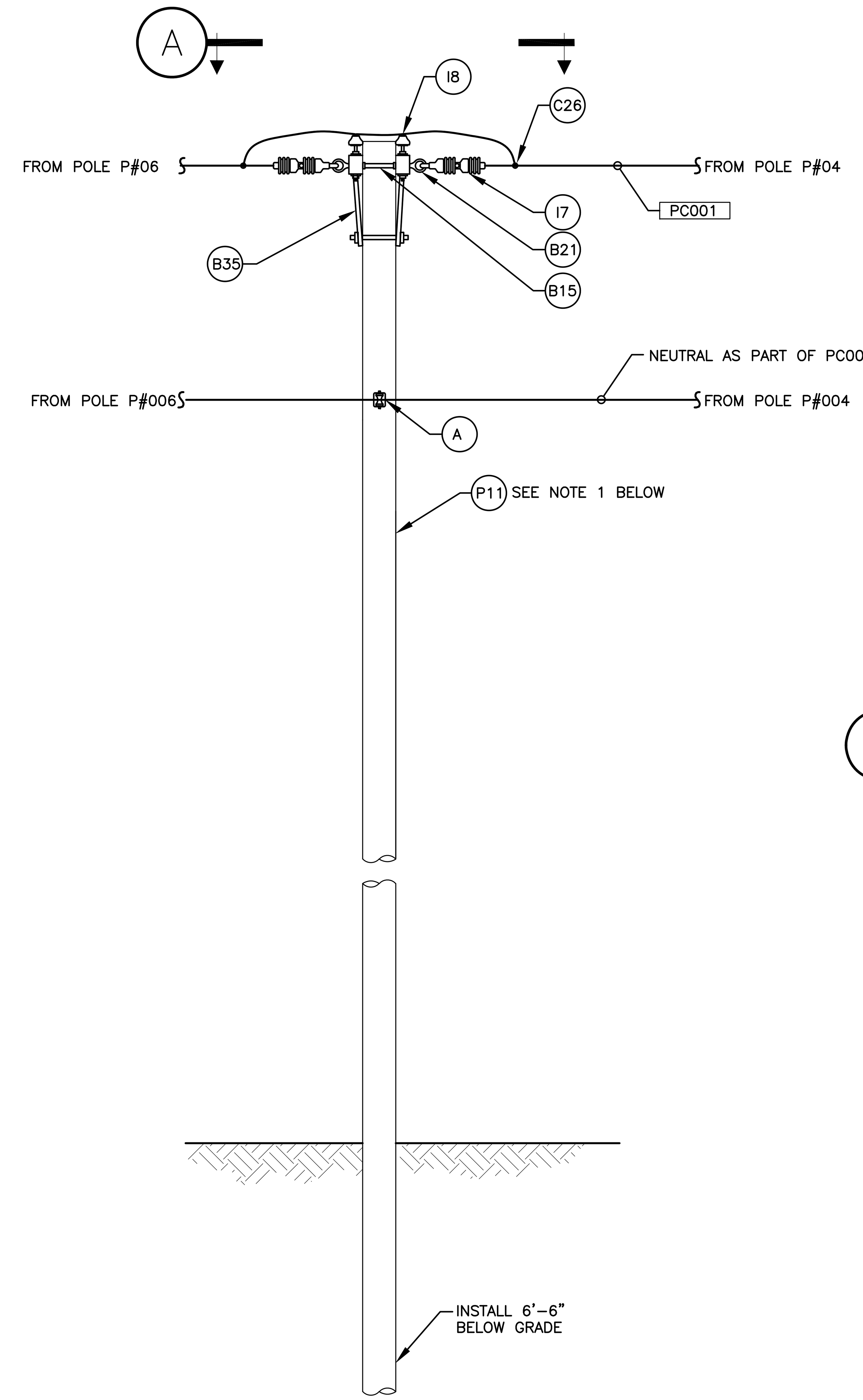
ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682-E-9
DATE SEPTEMBER 2014

E-9

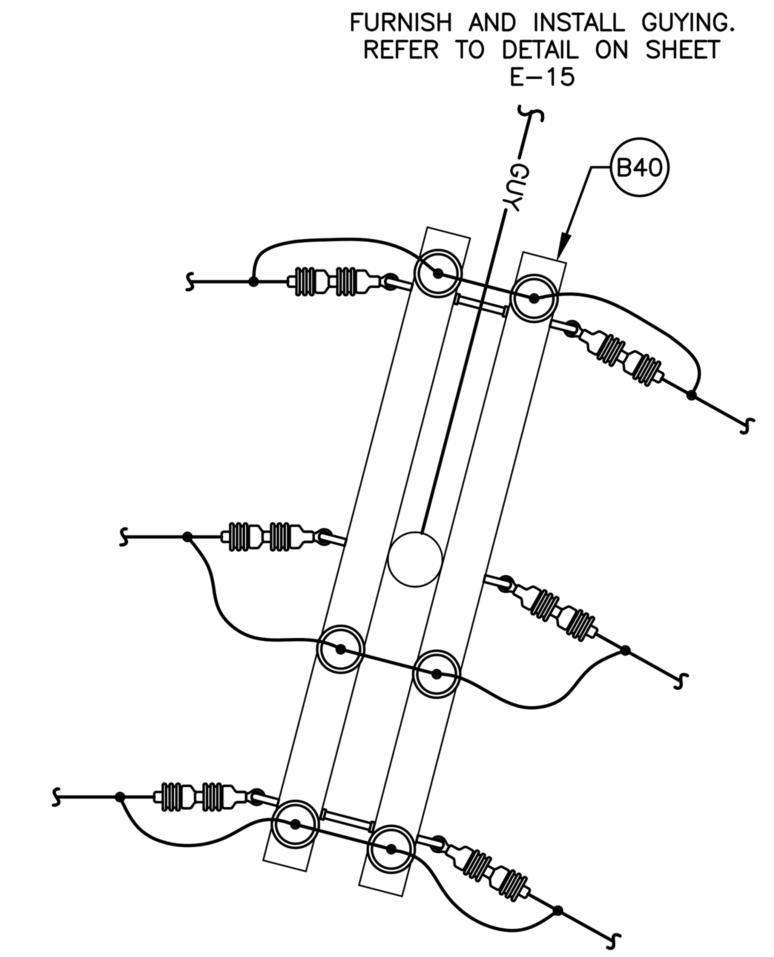
OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR	I7	STRAIN–TYPE INSULATOR, ANSI CLASS 52–9.
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.	I8	POST INSULATOR, 15KV, CLASS 55–5.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.	P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.		
B40	CROSSARM WOOD, 3 1/2" X 4 1/2" X 8'–0", 4 PIN.		
C26	LINE TAP CRIMPITS		



1 / E–10 **POLE RISER DETAIL (P#05)**

NOT TO SCALE



A **POLE CROSSARM CONFIGURATION (P#05)**

NOT TO SCALE

DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. REFER TO SPECIFICATION SECTION 26 18 00.
3. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
4. PROVIDE MIN OF 6–1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

STATE OF NEW YORK
DAREK LETKIEWICZ
075789-1
LICENSED PROFESSIONAL ENGINEER
D. Letkiewicz
9/4/2014

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

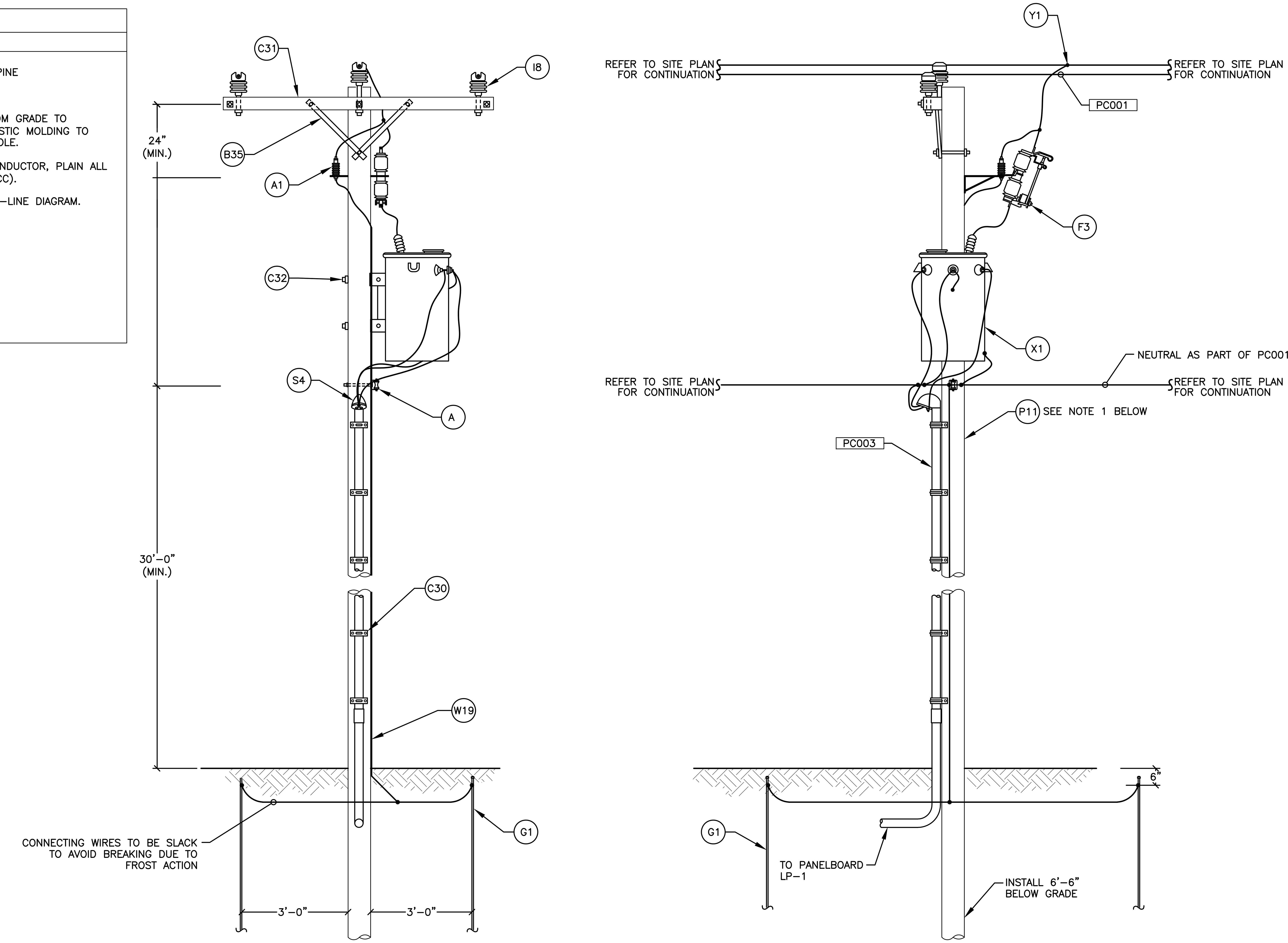
ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682 - E-10
DATE SEPTEMBER 2014

E-10

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
A1	SURGE ARRESTOR, DISTRIBUTION CLASS 12 KV, 10.2 KV-MCOV.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.
C30	STRAPS, LOCATED 2' MIN., 4' MAX.
C31	8' CROSS-ARM, FIR OR SPRUCE, TREATED.
C32	MACHINE BOLT WITH WASHER, NUT AND LOCKWASHER AS REQUIRED FOR TRANSFORMER MOUNTING.
F3	FUSE CUTOUT, 15KV, 150KV BIL MINIMUM, WITH 6A FUSE.
G1	COPPER-CLAD GROUND ROD, 3/4"X10'-0".
I8	POST INSULATOR, 15KV, CLASS 55-5.
P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
S4	WEATHER HEAD.
W19	#4/0, COPPER, BARE, STAPLE EVERY 12" FROM GRADE TO 8' ABOVE, EVERY 24" ABOVE 8'. PROVIDE PLASTIC MOLDING TO COVER GROUND WIRE ALONG FULL RUN ON POLE.
W20	#4/0, ALUMINUM CLAD STEEL REINFORCED CONDUCTOR, PLAIN ALL ALUMINUM BEST EXCEPT IN TENSION SPAN (ACC).
X1	POLE MOUNTED TRANSFORMER, REFER TO ONE-LINE DIAGRAM.
Y1	HOT LINE CLAMP.



DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
3. PROVIDE MIN OF 6-1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

1 / E-11 POLE RISER DETAIL (P#08)

NOT TO SCALE

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

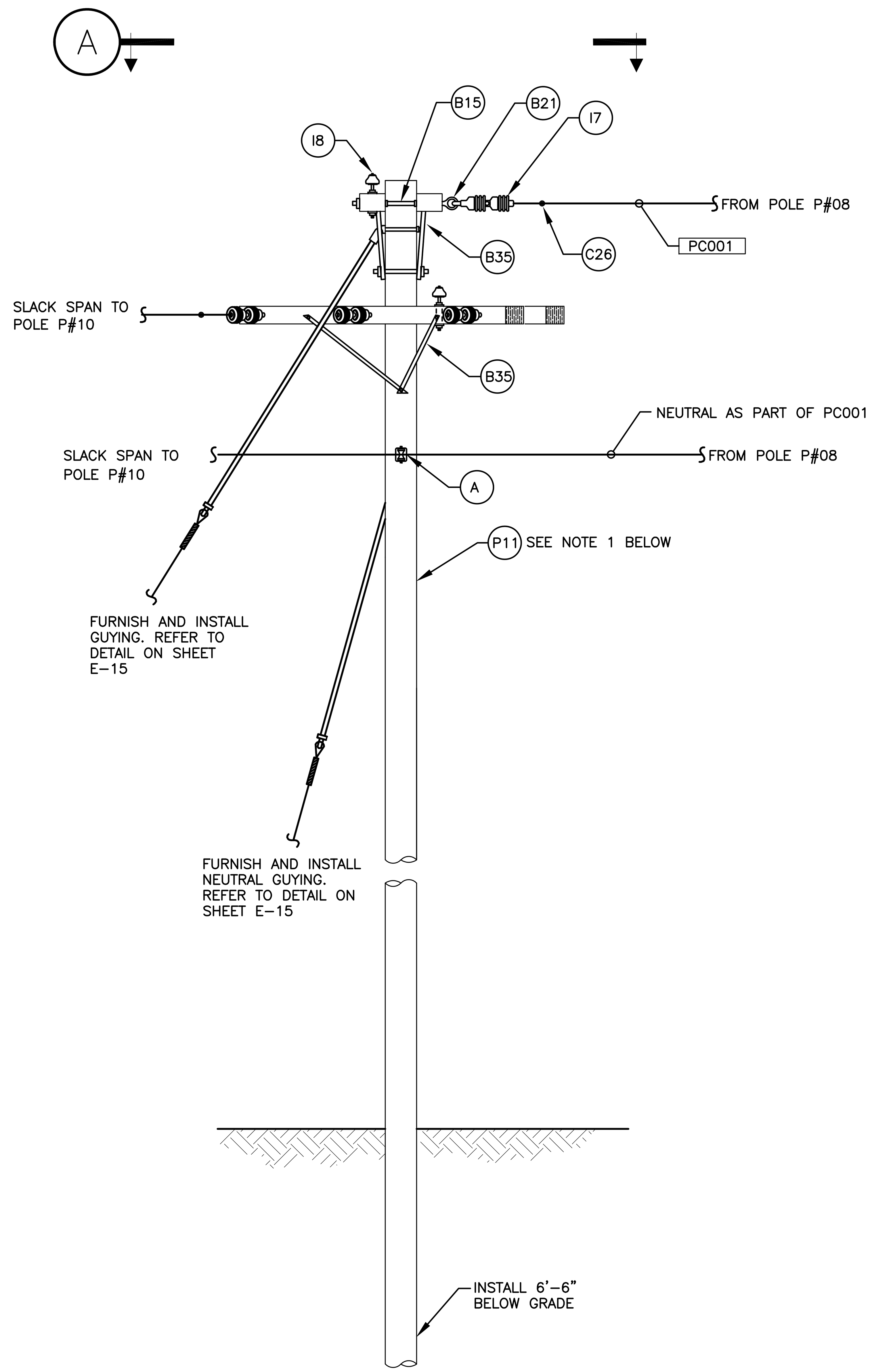
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

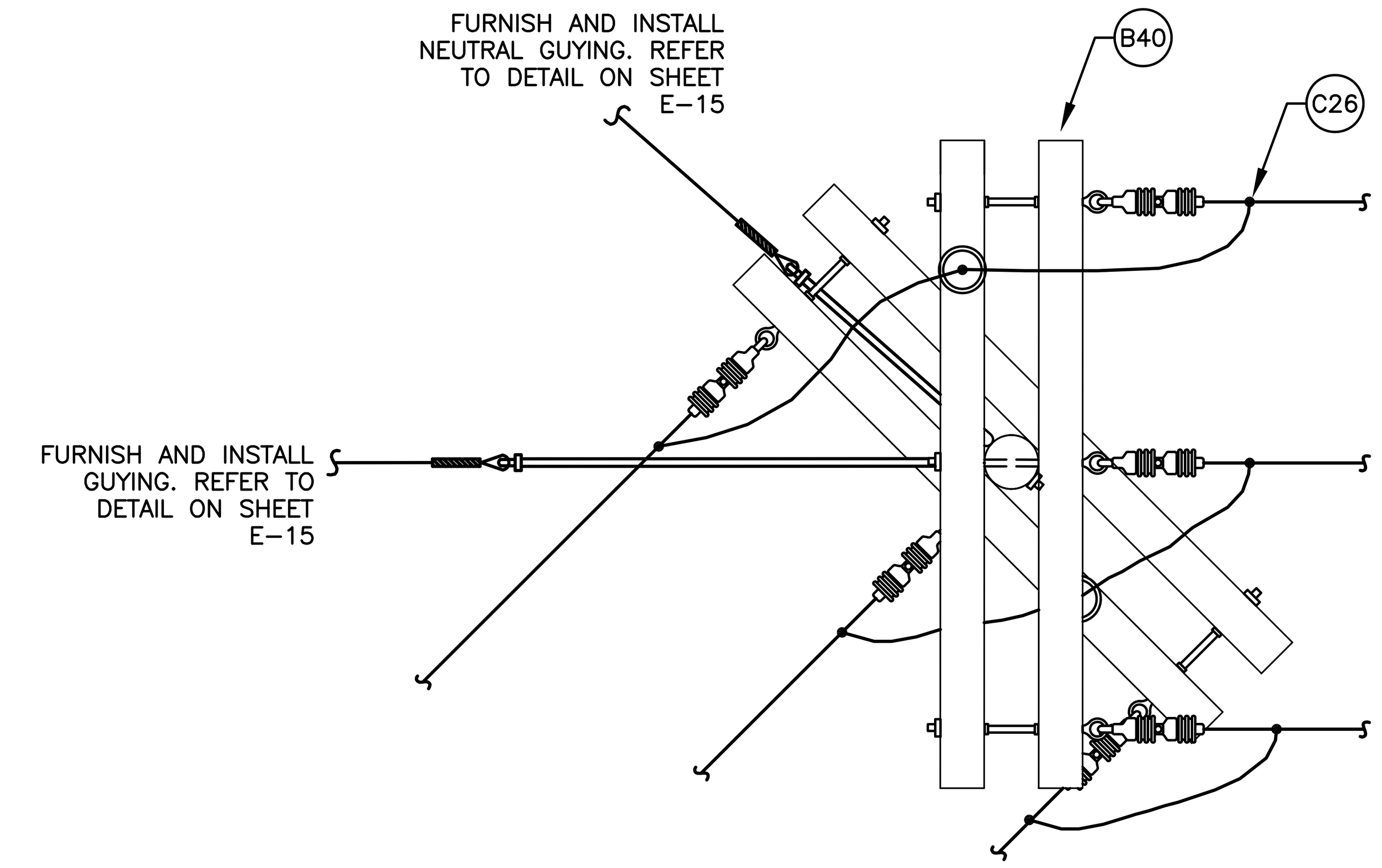
FILE NO. 2516.50682 - E-11

DATE SEPTEMBER 2014

E-11



1
E-12
POLE RISER DETAIL (P#09)
NOT TO SCALE



A
POLE CROSSARM CONFIGURATION (P#09)
NOT TO SCALE

DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. REFER TO SPECIFICATION SECTION 26 18 00.
3. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
4. PROVIDE MIN OF 6-1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION	ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR	I7	STRAIN-TYPE INSULATOR, ANSI CLASS 52-9.
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.	I8	POST INSULATOR, 15KV, CLASS 55-5.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.	P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.		
B40	CROSSARM WOOD, 3 1/2" X 4 1/2" X 8'-0", 4 PIN.		
C26	LINE TAP CRIMPITS		

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER
D. Letkiewicz
9/4/2014

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

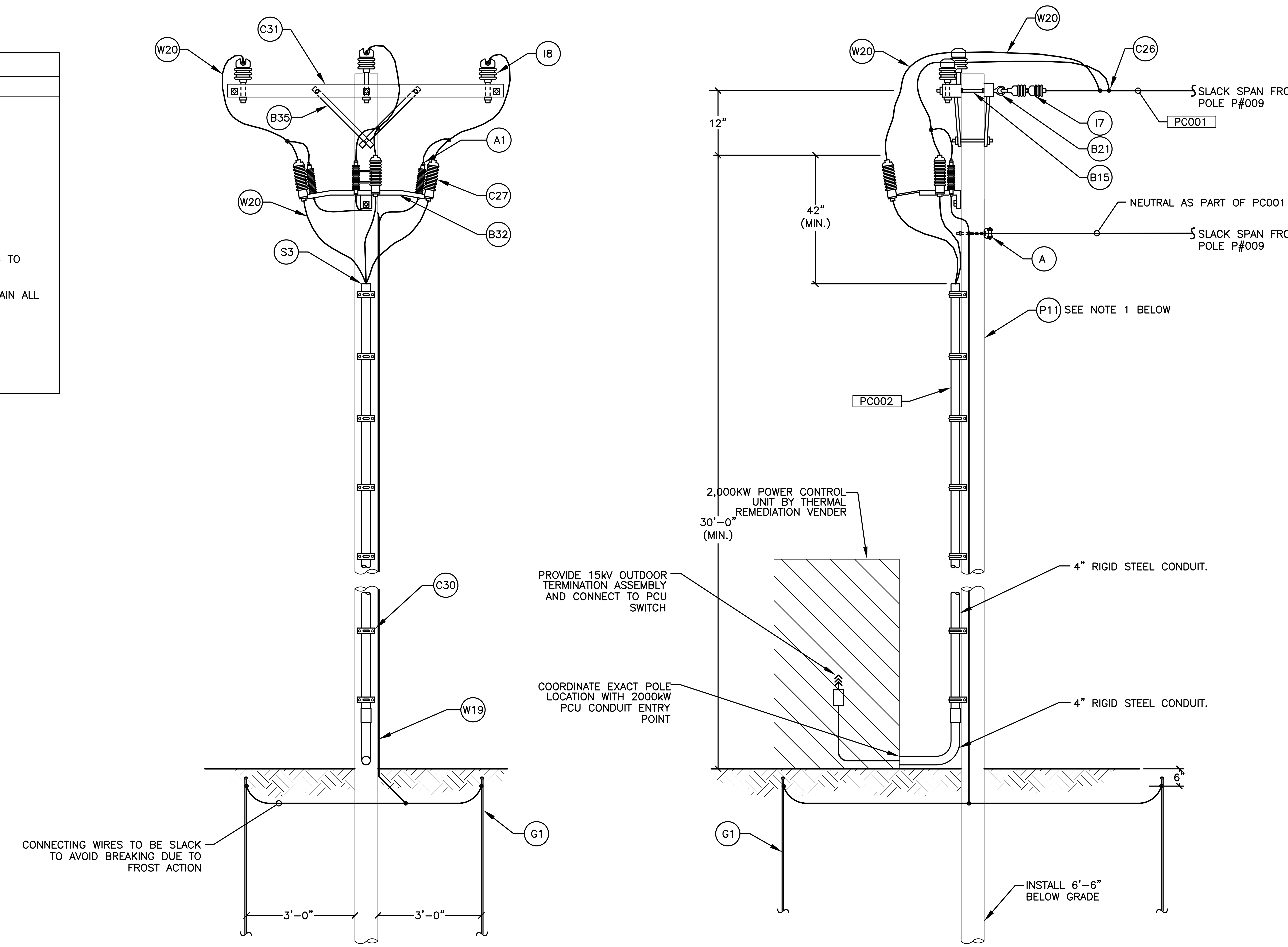
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682 - E-12
DATE SEPTEMBER 2014
E-12

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
A1	SURGE ARRESTOR, DISTRIBUTION CLASS 12 KV, 10.2 KV–MCOV.
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
B32	ALUMINUM MOUNTING BRACKET, ALUMA–FORM NO. TB–EMB–1–6PA–35.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.
C26	LINE TAP CRIMPITS
C27	BRACKET MOUNTED PORCELAIN CABLE TERMINATOR, JOSYLN NO. PSC OR EQUAL. COORDINATE LUGS WITH CABLE SIZE.
C30	STRAPS, LOCATED 2' MIN., 4' MAX.
C31	8' CROSS–ARM, FIR OR SPRUCE, TREATED.
G1	COPPER–CLAD GROUND ROD, 3/4"X10'–0".
I7	STRAIN–TYPE INSULATOR, ANSI CLASS 52–9.
I8	POST INSULATOR, 15KV, CLASS 55–4.
P11	WOOD POLE, CLASS 4 TREATED, 45' YELLOW PINE
S3	DUCT SEAL.
W19	#4/O, COPPER, BARE, STAPLE EVERY 12" FROM GRADE TO 8' ABOVE, EVERY 24" ABOVE 8'. PROVIDE PLASTIC MOLDING TO COVER GROUND WIRE ALONG FULL RUN ON POLE.
W20	#4/O, ALUMINUM CLAD STEEL REINFORCED CONDUCTOR, PLAIN ALL ALUMINUM BEST EXCEPT IN TENSION SPAN (ACC).



DETAIL NOTES:

1. REFERENCE OVERHEAD LINE LIST OF MATERIALS THIS SHEET.
2. REFER TO SPECIFICATION SECTION 26 18 00.
3. PROVIDE MIN OF 9" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO PHASE WITHOUT BARRIERS.
4. PROVIDE MIN OF 6–1/2" SPACING BETWEEN ELECTRICAL EQUIPMENT PHASE TO GROUND WITHOUT BARRIERS.

1 / E–13 **POLE RISER DETAIL (P#10)**

NOT TO SCALE

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

FILE NO. 2516.50682 - E-13
DATE SEPTEMBER 2014
E-13

OVERHEAD LINE SCHEDULE OF MATERIALS

ITEM NO.	DESCRIPTION
A	CLEVIS WITH INSULATOR
B15	BOLT, DOUBLE ARMING, HOT GALVANIZED.
B21	EYELET, BOLT EYE, 11/16"X1 1/8" SLOT, FOR 5/8" DIA. BOLT. HOT DIPPED GALVANIZED.
B35	CROSSARM BRACE, 1 1/2"X1 1/2"X3/16" STEEL ANGLE. HOT DIPPED GALVANIZED.
I7	STRAIN–TYPE INSULATOR, ANSI CLASS 52–9.
I8	POST INSULATOR, 15KV, CLASS 55–4.
W20	#4/0, ALUMINUM CLAD STEEL REINFORCED CONDUCTOR, PLAIN ALL ALUMINUM BEST EXCEPT IN TENSION SPAN (ACC).

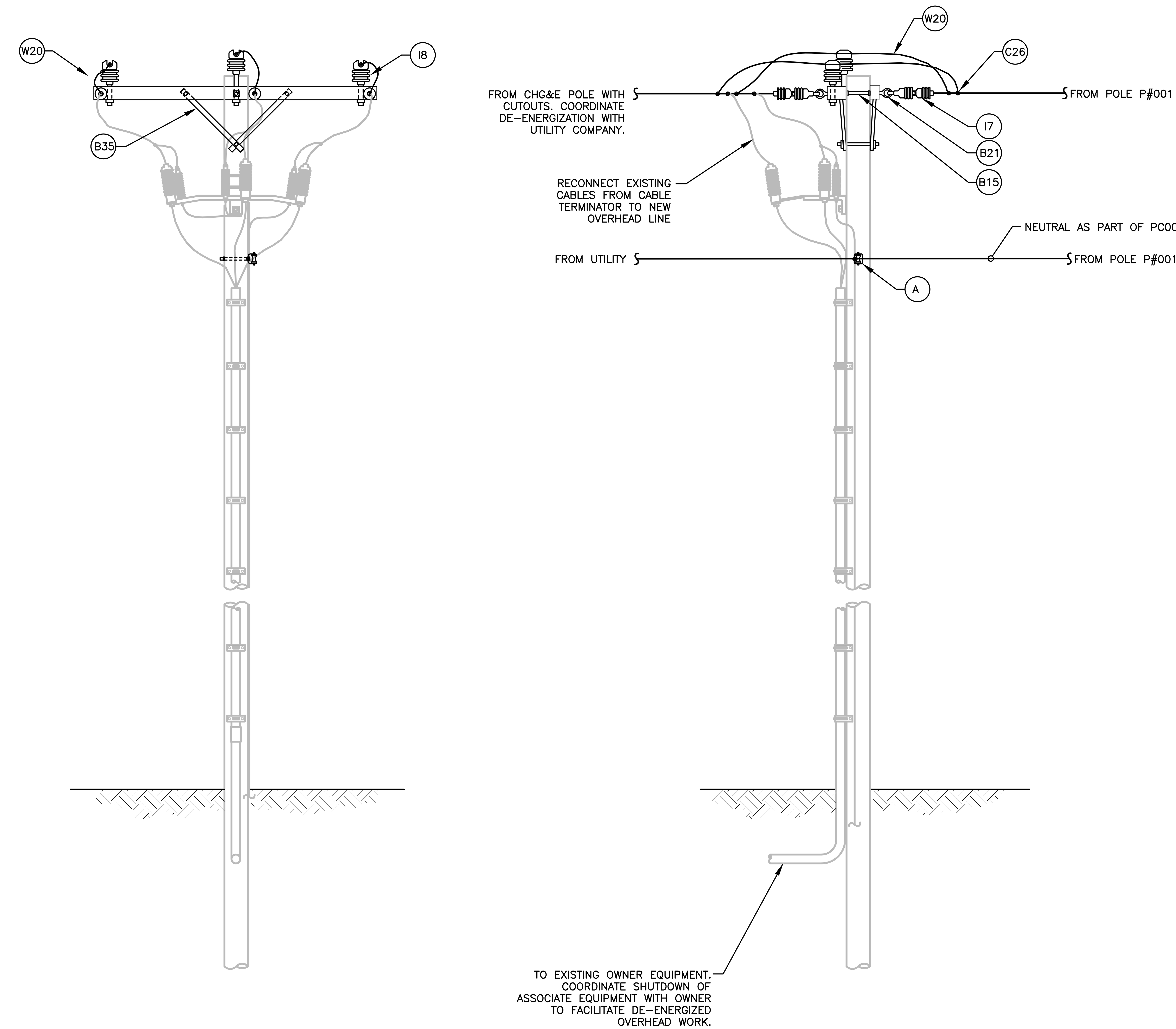
DETAIL NOTES:

1. POLE RISER DETAIL PROVIDED FOR REFERENCE ONLY. ALL WORK AND MATERIALS ON THIS SHEET TO BE PROVIDED BY CENTRAL HUDSON GAS & ELECTRIC CORPORATION.
2. COORDINATE TIE–IN WITH UTILITY COMPANY AND OWNER OF EXISTING CUSTOMER POLE.
3. PROVIDE CUSTOMER POLE OWNER 24 HOURS (MINIMUM) NOTICE PRIOR TO DE–ENERGIZING. CONTACT CUSTOMER REPRESENTATIVE (MITCHELL RUCHIN, GROUNDWATER SCIENCE CORPORATION) AT 845–896–0288 EXT. 18.

LEGEND:

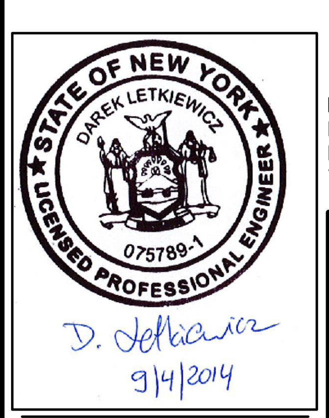
NEW WORK BY CENTRAL HUDSON GAS & ELECTRIC

EXISTING (E)



1 / E–14 POLE RISER DETAIL EXISTING CUSTOMER POLE #82235

NOT TO SCALE



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH
DESIGNED BY TMH
CHECKED BY RGH
DRAWN BY TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

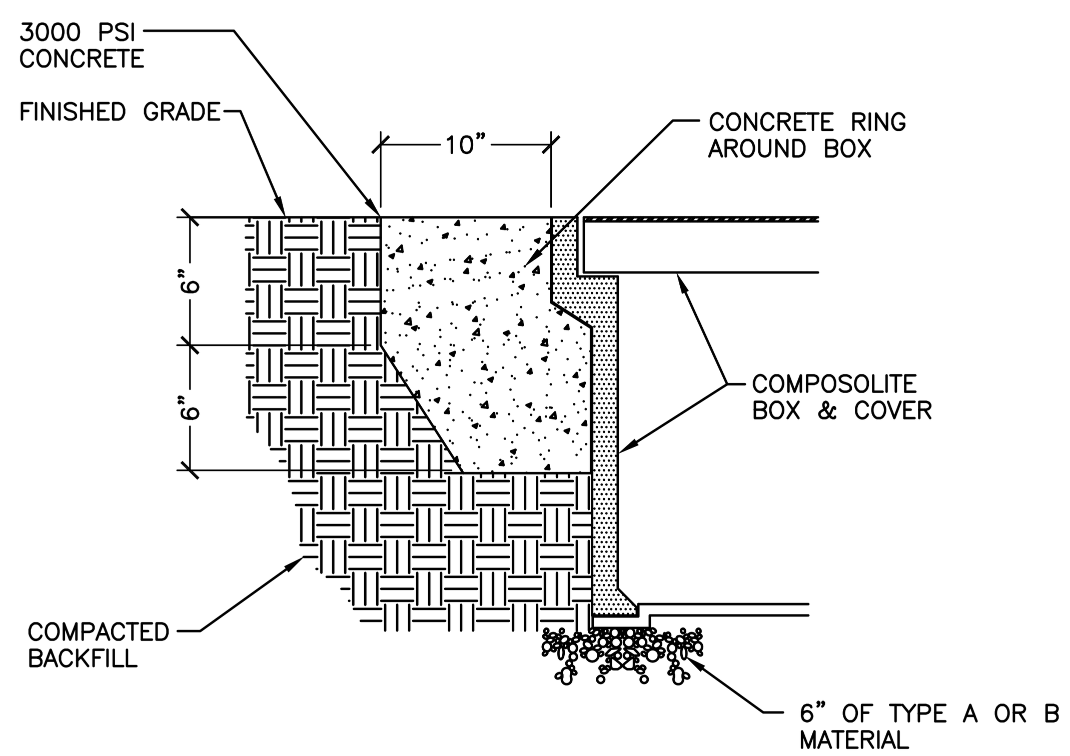
O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
POLE RISER DETAIL

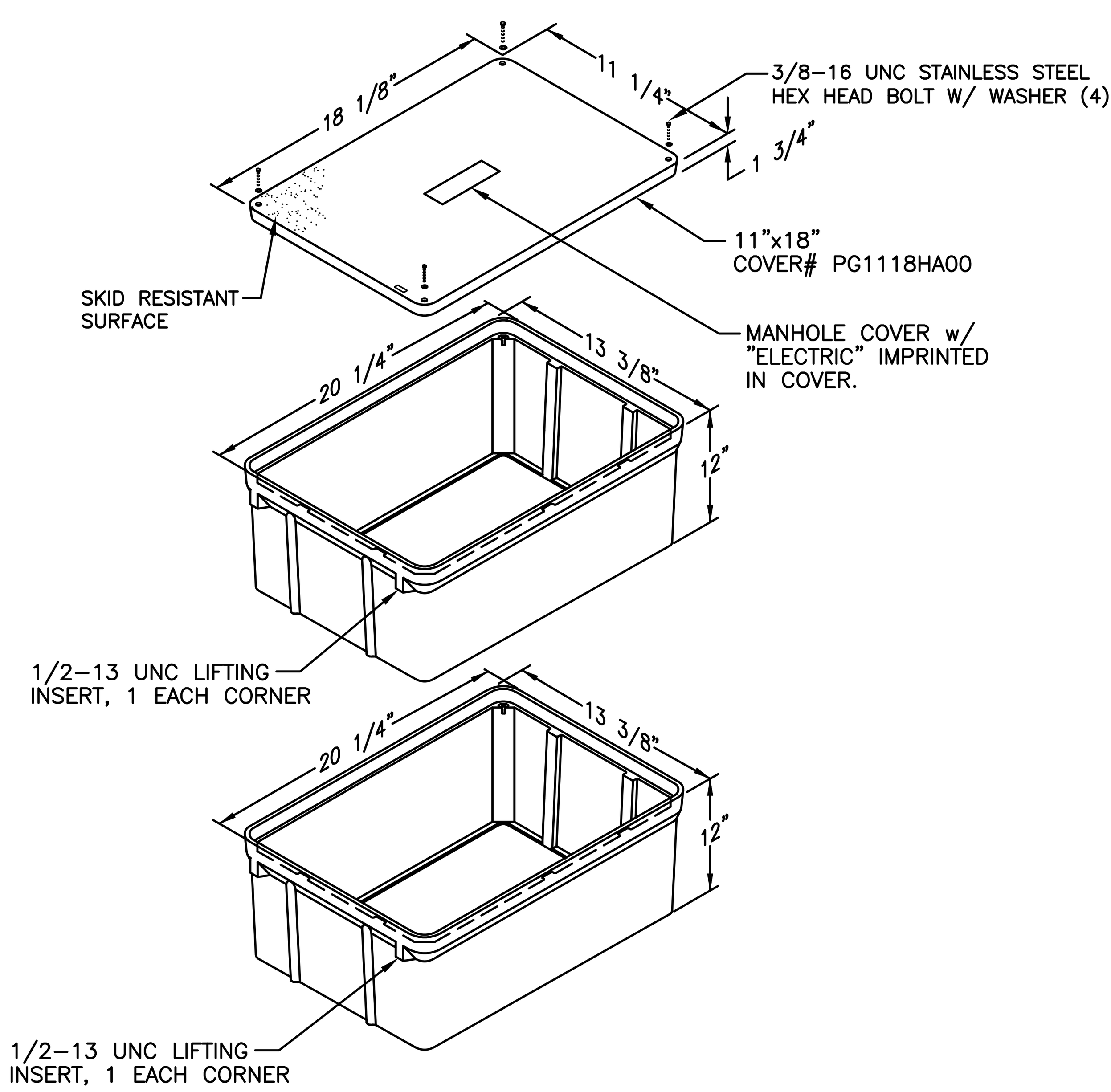
FILE NO. 2516.50682 - E-14
DATE SEPTEMBER 2014

E-14



POLYMER CONCRETE PULLBOX INSTALLATION DETAIL

NOT TO SCALE

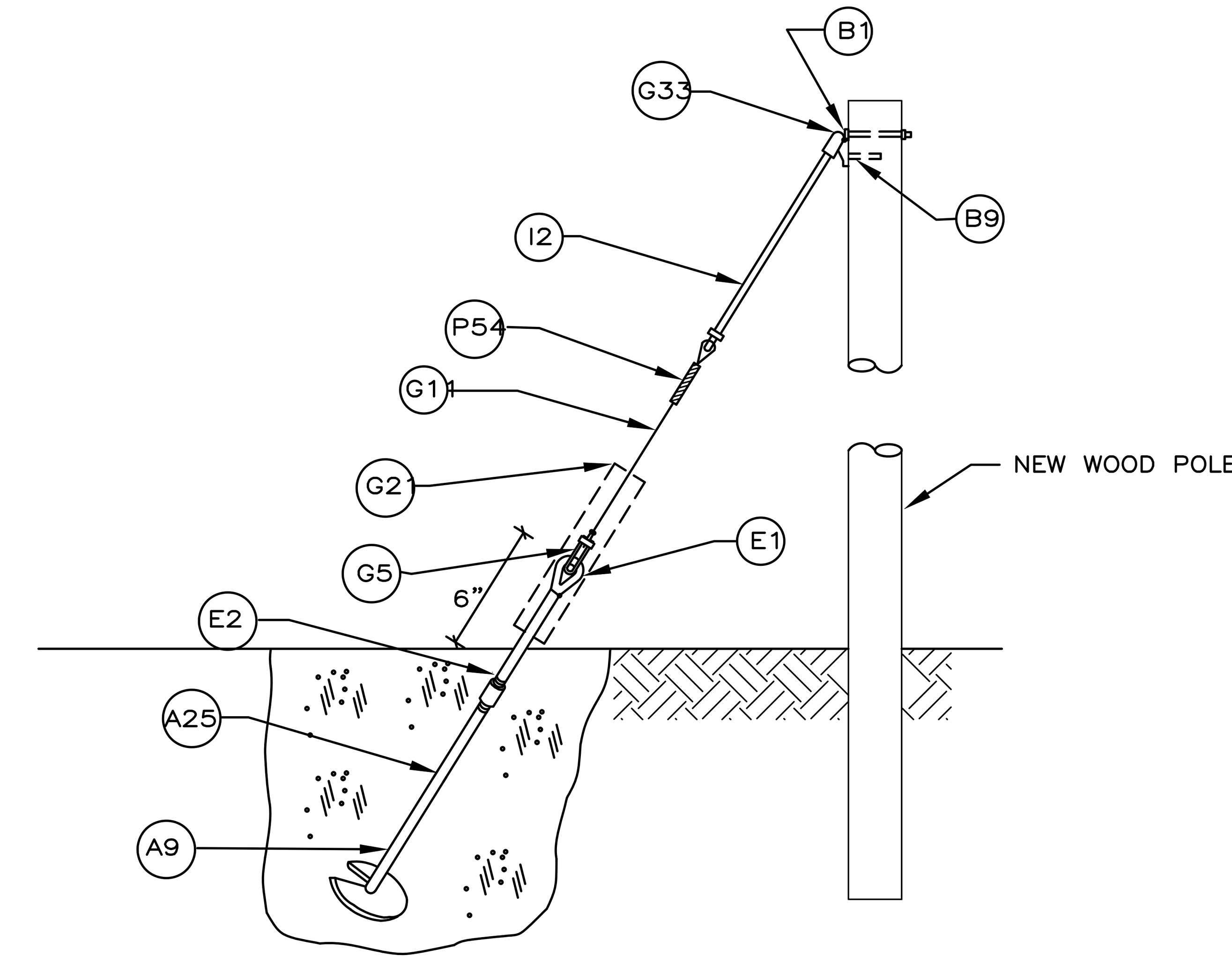


POLYMER CONCRETE

POLYMER CONCRETE PULLBOXES SHALL INCLUDE OPEN BOTTOM BASE AND SHALL BE STRONGWELL/QUAZITE BOX# PG1118BA12

TYPICAL HANDHOLE DETAIL

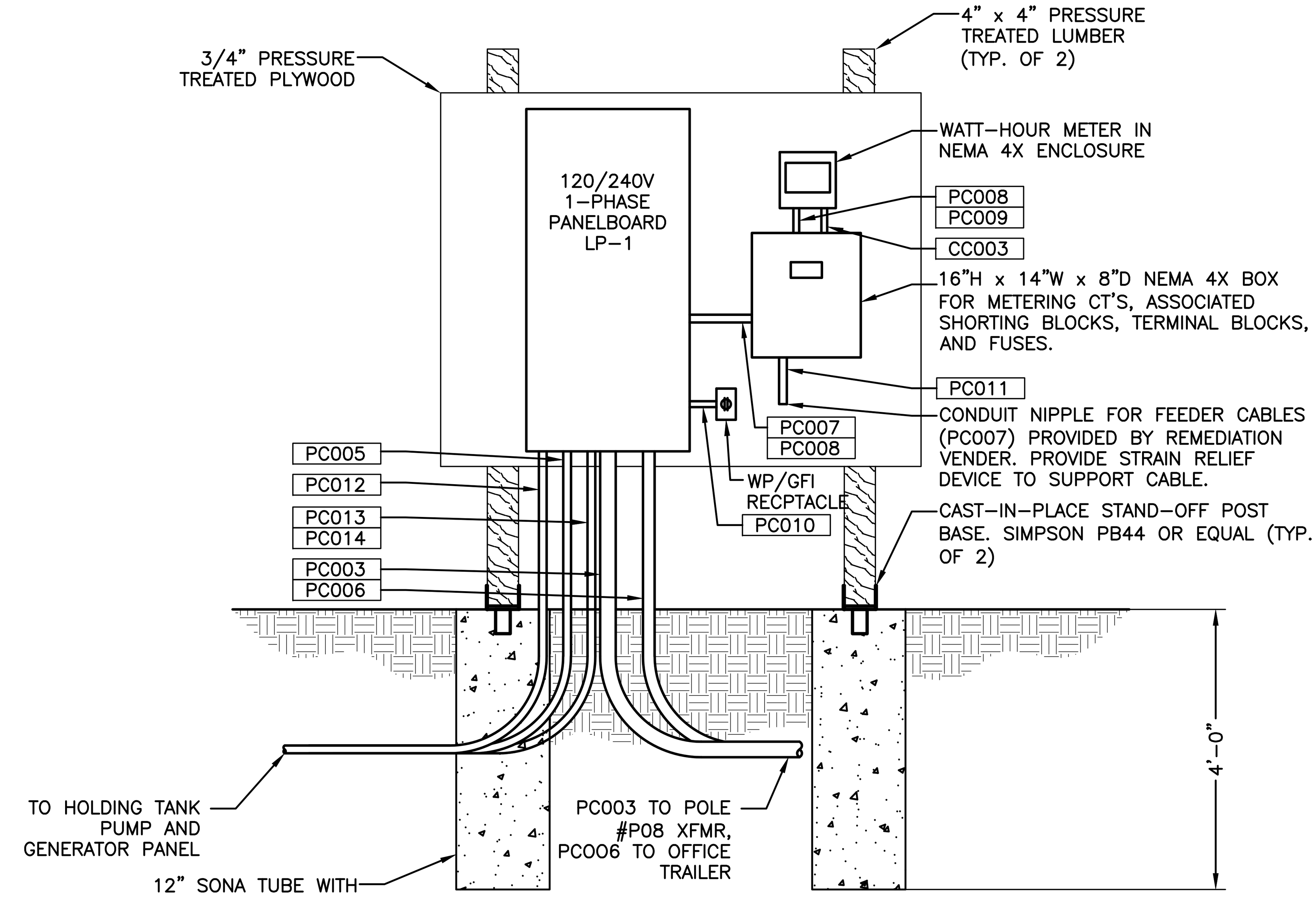
NOT TO SCALE



ANCHOR GUY DETAIL

NOT TO SCALE

MASTER LIST OF EQUIPMENT	
CODE	DESCRIPTION
A9	SCREW ANCHOR, 12" SINGLE HELIX, 4000lb. WORKING TORQUE. (SUBSTITUTE 24" CROSSPLATE ANCHOR OR EXPANDING ROCK ANCHOR WHERE NECESSARY)
A25	ANCHOR ROD, 3/4", HOT DIP GALV, 7 FT MINIMUM LENGTH. (SUBSTITUTE 1"x 10' ROD FOR USE WITH CROSSPLATE ANCHOR)
B1	BOLT, 5/8" DIA., SQUARE HEAD, STEEL
B9	LAG SCREWS FETTER DRIVE PILOT POINT 1/2"x 4"
E1	EYENUT FOR ANCHOR ROD, TWIN EYE
E2	EXTENSION RODS, 3/4", PROVIDE AS REQUIRED TO MEET REQUIRED INSTALLATION TORQUE.
G5	GUY GRIP, AUTOMATIC COMPRESSION TYPE
G11	GUY WIRE, 16M, GALVANIZED STRAND STEEL CABLE, ASTM A475 GRADE A OR B, UTILITIES.
G21	GUY GUARD, 8' YELLOW, FULL ROUND, U.V. STABILIZED POLYETHYLENE OR MPO.
G33	GUY HOOK, HOT DIP GALVANIZED, 2-HOLE, MALLEABLE.
I2	INSULATOR, FIBERGLASS, 24" FOR 15 KV, 120" FOR 34.5 KV
P54	GUY GRIP, PREFORMED

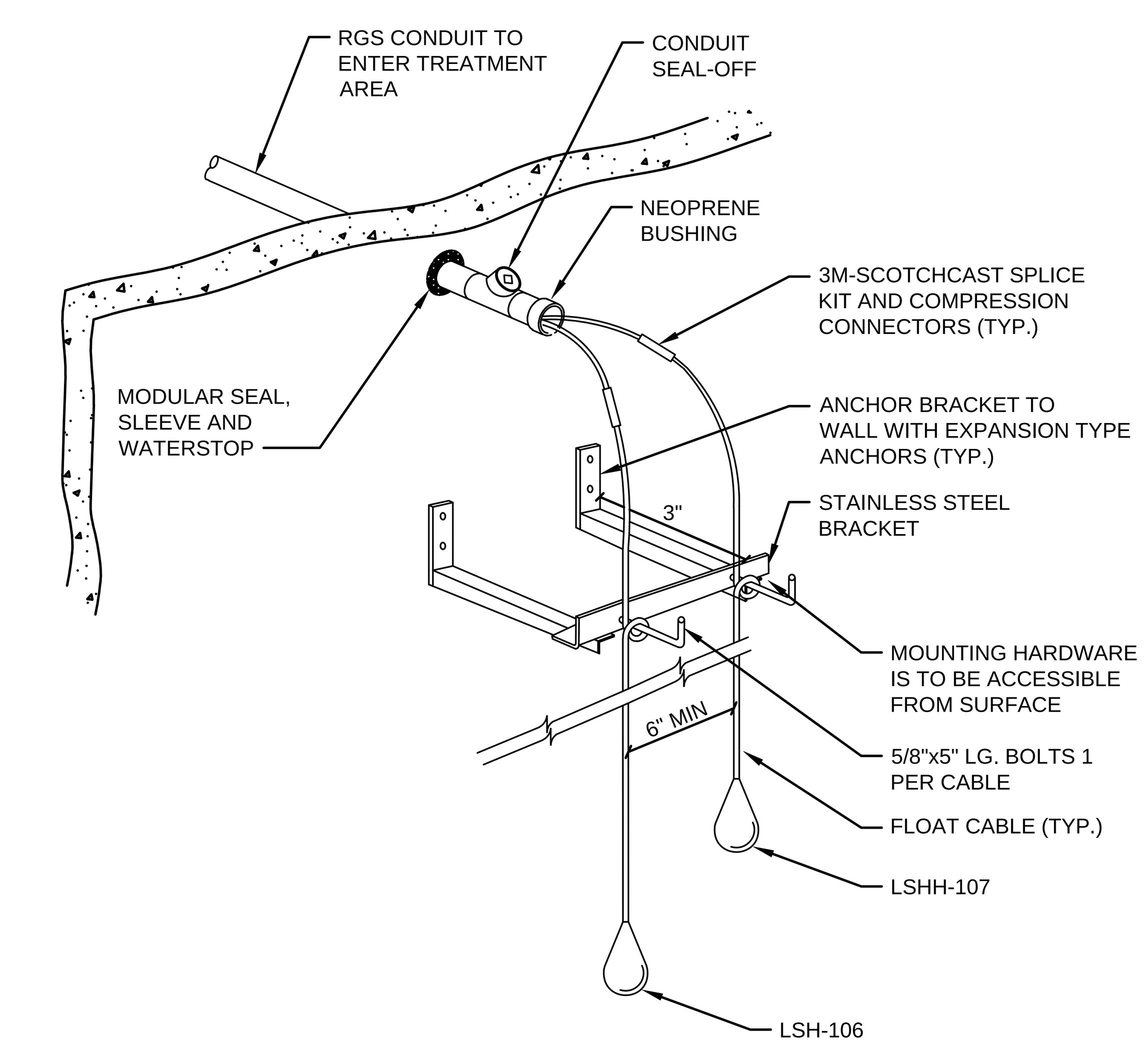


PANELBOARD MOUNTING DETAIL

NOT TO SCALE

NOTES:

1. –



NOTES:

1. ALL BRACKETS, SUPPORTS, BOLTS, ETC. SHALL BE STAINLESS STEEL.
2. BRACKET SHALL BE LOCATED ADJACENT TO HATCH SUCH THAT ELEVATIONS MAY BE ADJUSTED WITHOUT ENTERING MANHOLE.
3. REFER TO ELECTRICAL DRAWINGS FOR CONDUITS, WIRE AND TERMINATION INFORMATION.
4. FLOATS SHALL BE NON-MERCURY TYPE.
5. NO JUNCTION BOXES SHALL BE PERMITTED IN THE MANHOLE.
6. PROVIDE FLOAT WEIGHTS AS REQUIRED IF TURBULENT CONDITION IS ENCOUNTERED.

MH01 LEVEL FLOAT MOUNTING DETAIL

NOT TO SCALE

D. Letkiewicz
9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF RGH				
DESIGNED BY TMH				
CHECKED BY RGH	0	9/3/14	ISSUED FOR CONSTRUCTION	
DRAWN BY TMH	NO.	DATE	REVISION	INT.

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

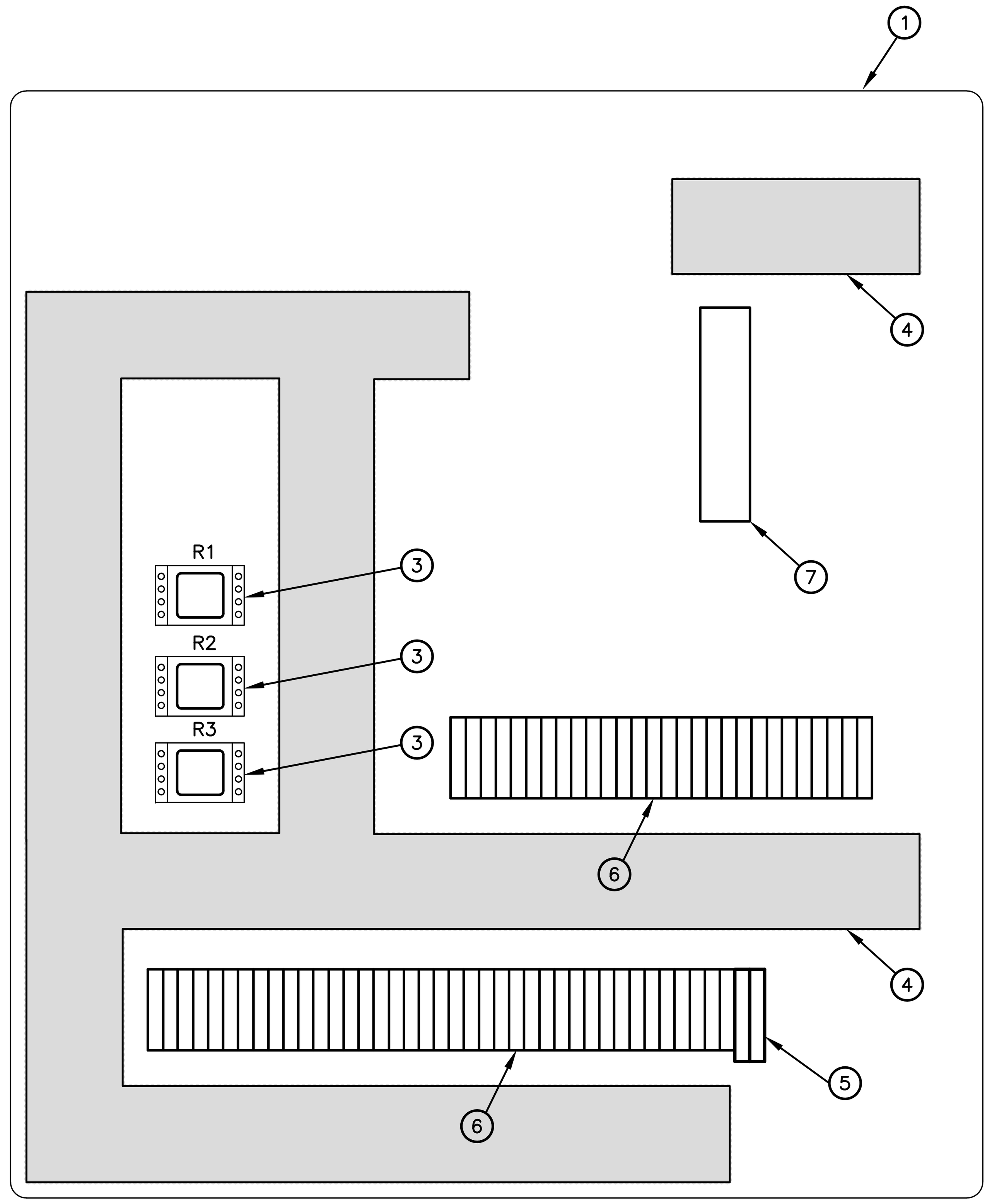
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
DETAILS

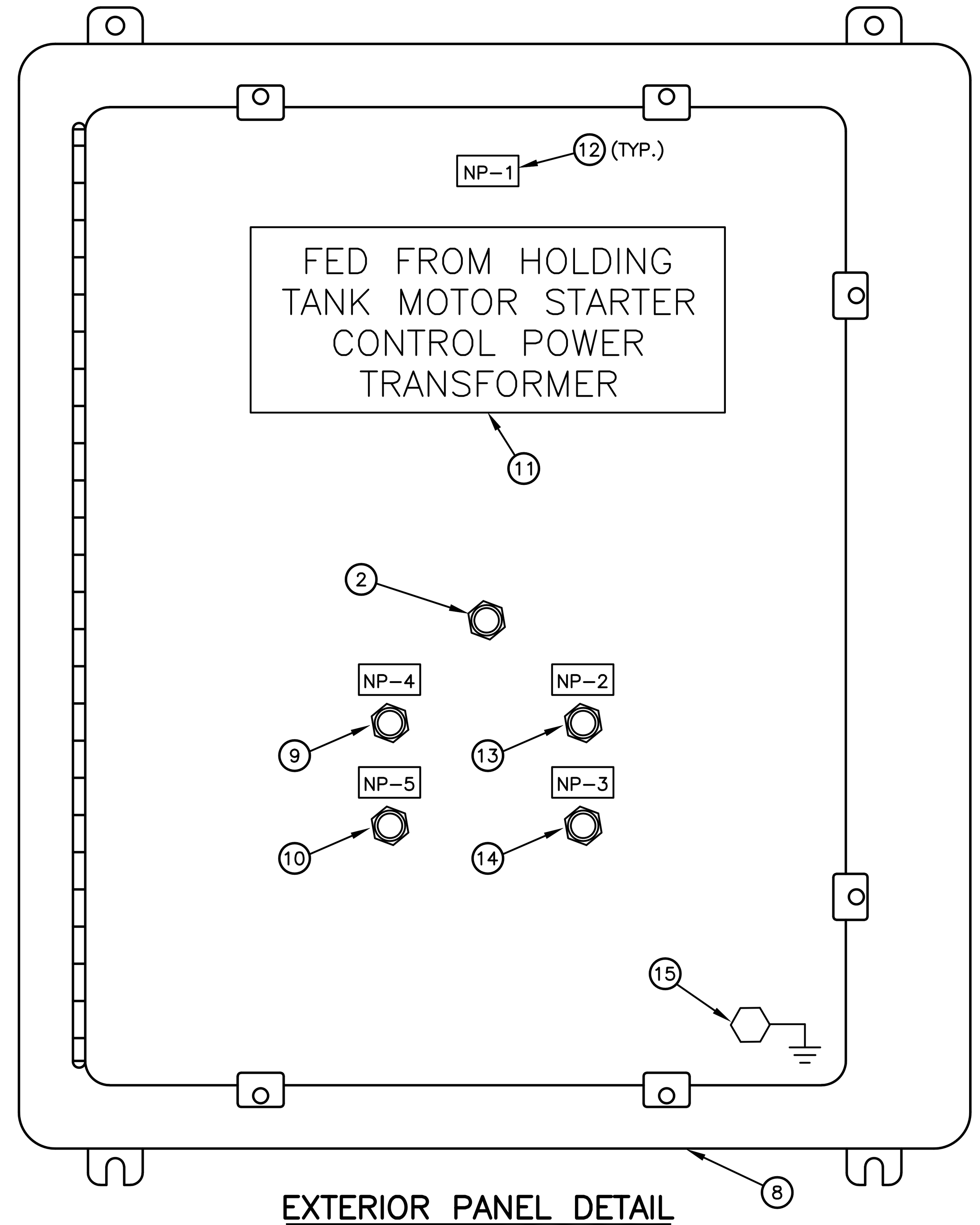
FILE NO. 2516.50682 - E-15

DATE SEPTEMBER 2014

E-15



INTERIOR PANEL DETAIL



EXTERIOR PANEL DETAIL

BILL OF MATERIALS

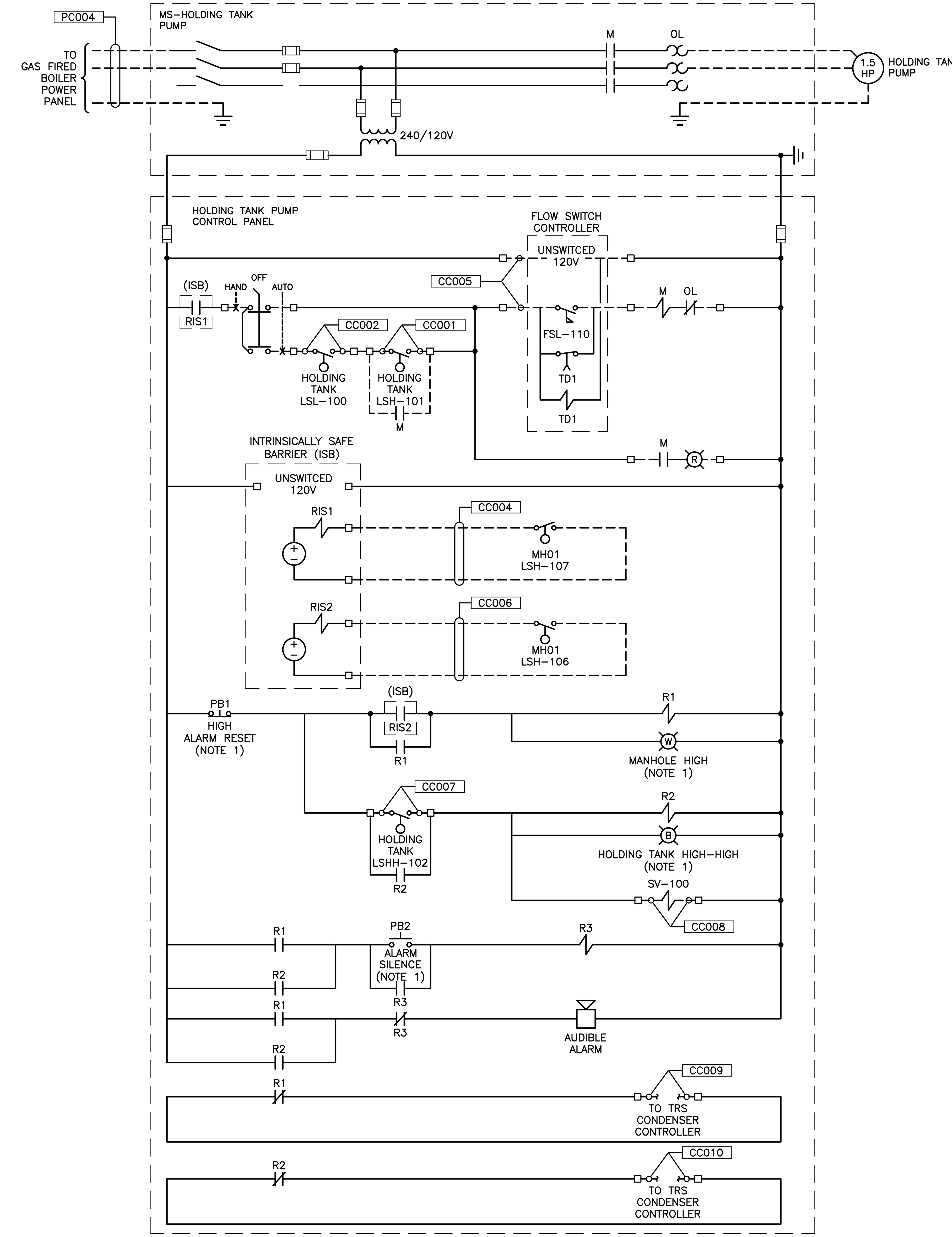
1. BACK PANEL HOFFMAN #A-36P30.
2. 120VAC ALARM HORN MALLORY SONALERT PART# ZA120MACT OR APPROVED EQUAL
3. CONTROL RELAY 120VAC ALLEN BRADLEY #700-HF34Z1 WITH MATCHING BASE.
4. CABLE TROUGH PANDUIT TYPE E 2"X 3".
5. FUSE BLOCK 30 POSITION ALLEN BRADLEY # 1492-H4
6. TERMINAL BLOCK 30 POSITION ALLEN BRADLEY #1492-W10.
7. INTRINSICALLY SAFE BARRIER PEPPERL+FUCHS #KFA5-SR2-EX2.W OR APPROVED EQUAL.
8. NEMA 4 PANEL 36" X 31" X 8" HOFFMAN #A-36HS3108LP.
9. LED CLEAR INDICATOR ALLEN BRADLEY #800L-30L10C
10. LED BLUE INDICATOR ALLEN BRADLEY #800L-30L10B
11. LAMICOID NAMEPLATE WITH 1/2" LETTERS TO READ AS SHOWN.
12. LAMICOID NAMEPLATE (LEGEND AS FOLLOWS):

NP-1	1/4" LETTERS TO READ:	HOLDING TANK CONTROL PANEL
NP-2	1/4" LETTERS TO READ:	HIGH ALARM RESET
NP-3	1/4" LETTERS TO READ:	ALARM SILENCE
NP-4	1/4" LETTERS TO READ:	MANHOLE HIGH
NP-5	1/4" LETTERS TO READ:	HOLDING TANK HIGH-HIGH

13. NEMA 4X PUSH BUTTON ALLEN BRADLEY #800H-R2D2
14. NEMA 4X PUSH BUTTON ALLEN BRADLEY #800H-R2A
15. GROUND LUG. GROUND TO POWER PANEL FEEDING CONTROL PANEL

HOLDING TANKE CONTROL PANEL DETAIL

NOT TO SCALE



HOLDING TANK PUMP COMBINATION STARTER AND CONTROL PANEL

NOT TO SCALE

NOTES:

1. PROVIDE ADHESIVE LAMACOID LABEL FOR DEVICE AS INDICATED.

STATE OF NEW YORK · DAREK LETKIEWICZ · 075789-1 · LICENSED PROFESSIONAL ENGINEER

D. Letkiewicz 9/4/2014

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	RGH
DESIGNED BY	TMH
CHECKED BY	RGH
DRAWN BY	TMH

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

ELECTRICAL
BUILDING B001
DETAILS

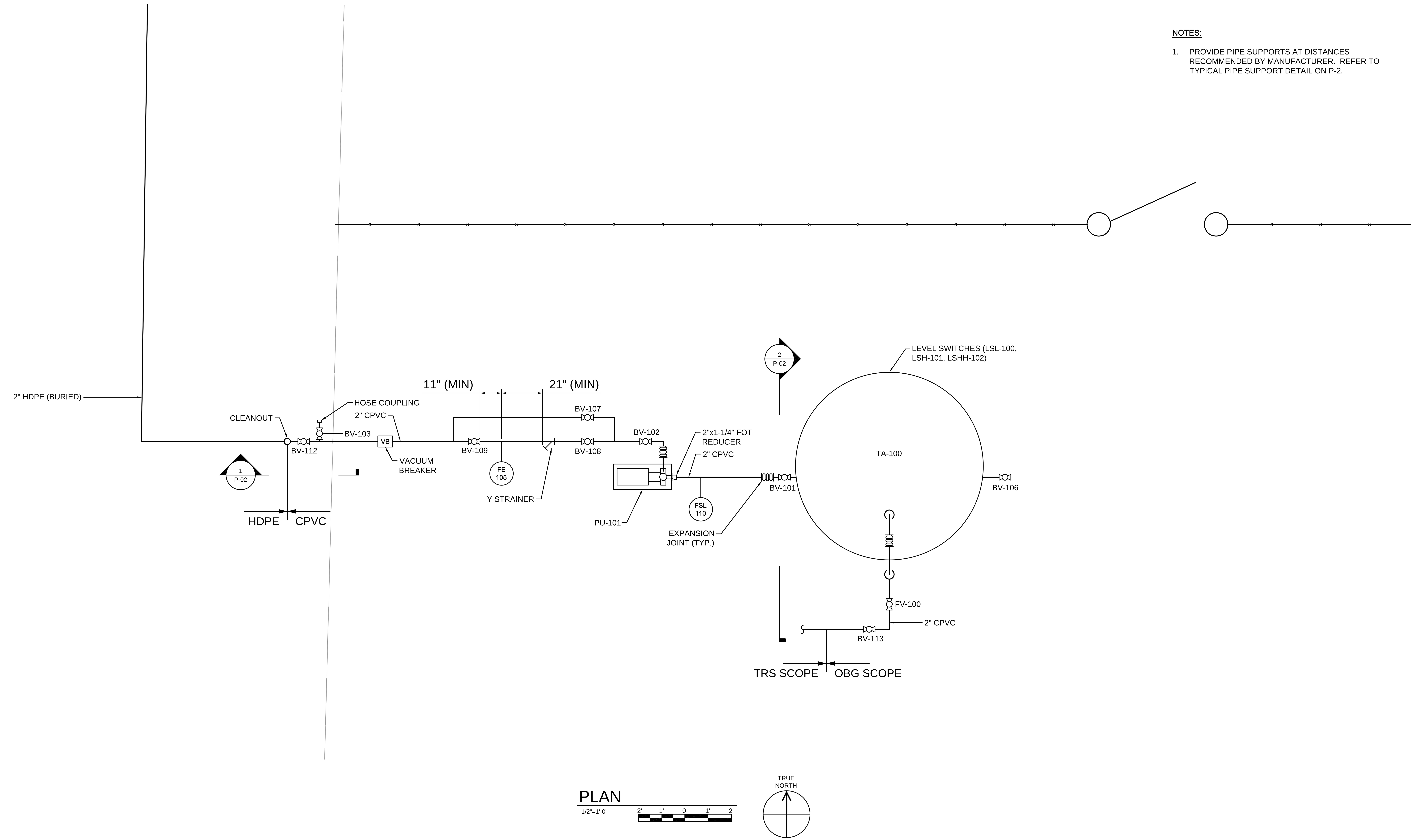
FILE NO. 2516.50682 - E-16

DATE SEPTEMBER 2014

E-16

NOTES:

1. PROVIDE PIPE SUPPORTS AT DISTANCES RECOMMENDED BY MANUFACTURER. REFER TO TYPICAL PIPE SUPPORT DETAIL ON P-2.



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

STATE OF NEW YORK · BRIAN E. WHITE · 072130 · LICENSED PROFESSIONAL ENGINEER

IN CHARGE OF	B. WHITE
DESIGNED BY	F. HENCKEN
CHECKED BY	D. SOKOLIK
DRAWN BY	F. HENCKEN

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

PROCESS MECHANICAL

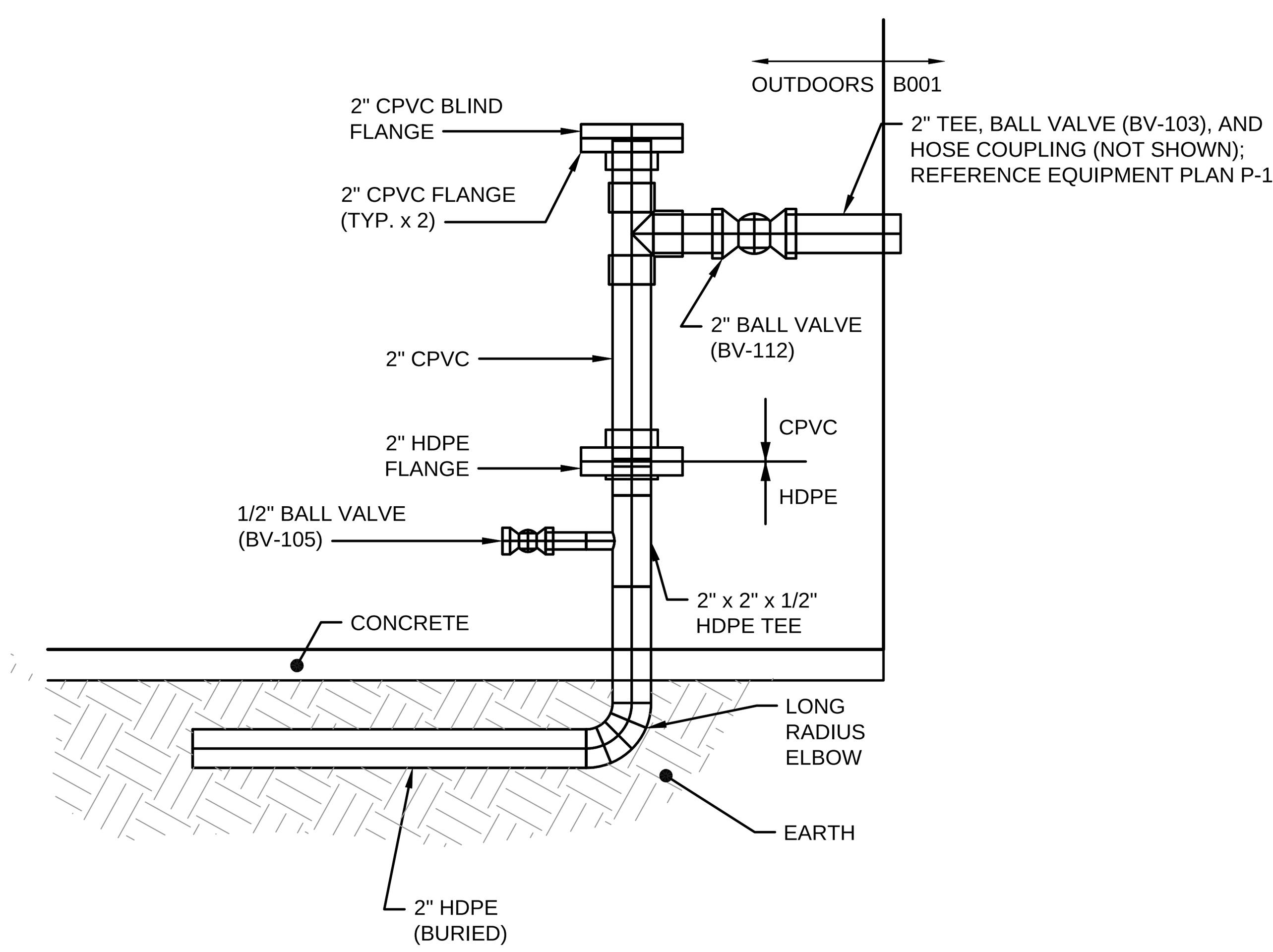
EQUIPMENT PLAN

FILE NO. 2516.50682 - P1

DATE SEPTEMBER 2014

P-1

SAVED: 9/5/14 2:29 PM

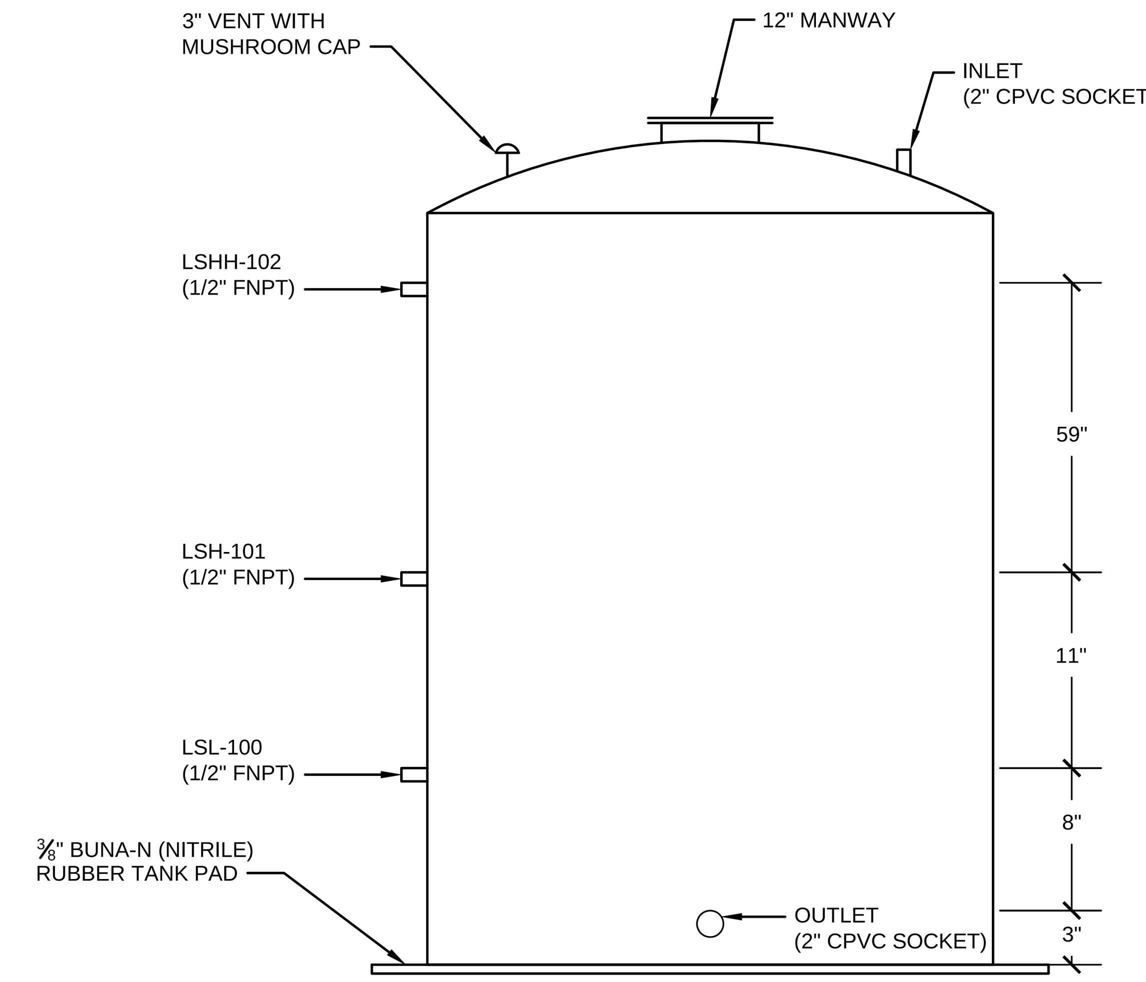


1 CLEANOUT DETAIL

NOT TO SCALE

NOTES:

1. SUPPORT PIPE FROM BUILDING AS NECESSARY.
2. INSULATE OUTDOOR, ABOVE GROUND PIPE, VALVES AND FITTINGS. INSULATION IS NOT SHOWN FOR CLARITY. REFER TO P&ID FOR INSULATION DETAILS.
3. REFER TO CIVIL DRAWINGS FOR BURIED PIPE INSTALLATION DETAILS.

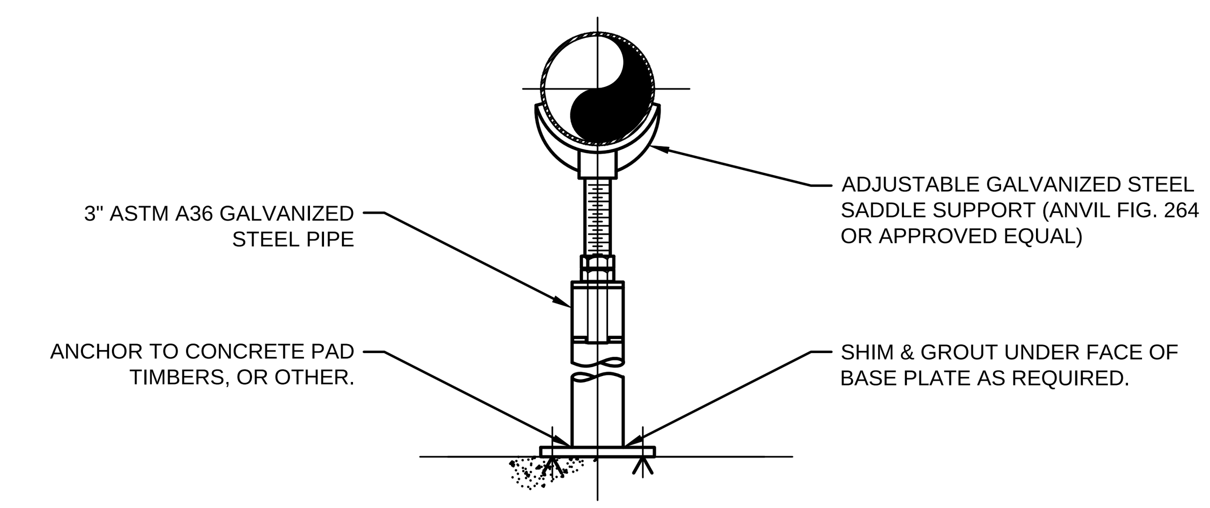


2 TA-100 NOZZLE DETAIL

NOT TO SCALE

NOTES:

1. 1/2" DRAIN IS NOT SHOWN.



FLOOR SUPPORT DETAIL

NOT TO SCALE

NOTES:

1. PROVIDE WEAR PAD BETWEEN SADDLE SUPPORT AND PLASTIC PIPE.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF B. WHITE
DESIGNED BY F.HENCKEN
CHECKED BY D. SOKOLIK
DRAWN BY M.BRUNETTI

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE

O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT

FORMER IBM KINGSTON SITE

PROCESS MECHANICAL

DETAILS

FILE NO. 2516.50682 - P2

DATE SEPTEMBER 2014

P-2

\\SYRNA01\PROJECTS\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-P2.DWG

SAVED: 9/5/14 2:30 PM

\\SYRNA01\PROJECTS\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-P3.DWG

PIPE IDENTIFICATION

2"-XXX-XXXX-XXX-XX-XX

- HEAT TRACING
- INSULATION DESIGNATION
- MATERIAL SPECIFICATION
- PIPE COUNT
- FLUID CODE DESIGNATION
- PIPE SIZE (IN INCHES)

VALVE IDENTIFICATION

XX-XXXX

- VALVE COUNT
- VALVE TYPE IDENTIFIER

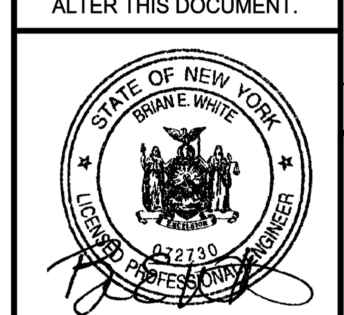
ABBREVIATIONS

BV - BALL VALVE
CPVC - CHLORINATED POLYVINYL CHLORIDE (REFER TO PIPE SPECIFICATION)
FC - FAIL CLOSED
FOT - FLAT ON TOP
FV - FLOW VALVE
HDPE - HIGH DENSITY POLYETHYLENE (REFER TO PIPE SPECIFICATION)
HP - HIGH POINT
LP - LOW POINT
MW - MANWAY
PE - POLYETHYLENE
PCV - PRESSURE CONTROL VALVE
PU - PUMP
S.S - STRAIGHT SIDE
SV - SOLENOID VALVE
TA - TANK
WW - WASTEWATER

SYMBOLS

- CENTRIFUGAL PUMP
- BASKET FILTER
- EXPANSION JOINT
- SOLENOID CONTROLLED 3-WAY VALVE (S)
- Y STRAINER
- BALL VALVE
- DIAPHRAGM PRESSURE SEAL
- TURBINE FLOWMETER
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER (FOT)
- HOSE CONNECTION
- PIPING SPEC CHANGE (SPEC 2 | SPEC 1)
- AUTOMATED ON/OFF BALL VALVE
- VENDOR PACKAGE LIMITS (— P —)
- FLANGE
- VACUUM BREAKER (VB)
- PIPE INSULATION

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.



SYMBOL DEFINITIONS & FUNCTIONS TABLE

SHARED DISPLAY, SHARED CONTROL (1)					LOCATION & ACCESSIBILITY (6)
A	B	C	D		
PRIMARY CHOICE (2)	ALTERNATE CHOICE (3)	COMPUTER SYSTEMS AND SOFTWARE (4)	DISCRETE (5)	PILOT LIGHT	
FUNCTION TAG	FUNCTION TAG	FUNCTION TAG	FUNCTION TAG	FUNCTION TAG	• LOCATED IN FIELD • NOT IN PANEL, CABINET OR CONSOLE MOUNTED • VISIBILE AT FIELD LOCATION • NORMALLY OPERATOR ACCESSIBLE
FUNC TAG FUNC TAG					• INSTRUMENTS OR FUNCTIONS SHARING A COMMON HOUSING

TABLE NOTES:

(1) - USED IN SHARED DISPLAY, SHARED CONTROL, CONFIGURABLE, MICROPROCESSOR-BASED, AND DATA-LINKED INSTRUMENTATION WHERE THE FUNCTIONS ARE ACCESSIBLE BY THE OPERATOR VIA A SHARED DISPLAY OR MONITOR.
- CONFIGURED IN CONTROL SYSTEMS THAT INCLUDE, BUT ARE NOT LIMITED TO, DISTRIBUTED CONTROL SYSTEMS (DCS), PROGRAMMABLE LOGIC CONTROLLERS (PLC), PERSONAL COMPUTERS (PC), AND INTELLIGENT TRANSMITTERS AND VALVE POSITIONERS.

(2) - PRIMARY SHARED-DISPLAY, SHARED-CONTROL SYSTEM.
- BASIC PROCESS CONTROL SYSTEM (BPCS).

(3) - ALTERNATE SHARED-DISPLAY, SHARED-CONTROL SYSTEM.
- SAFETY INSTRUMENTED SYSTEM (SIS).

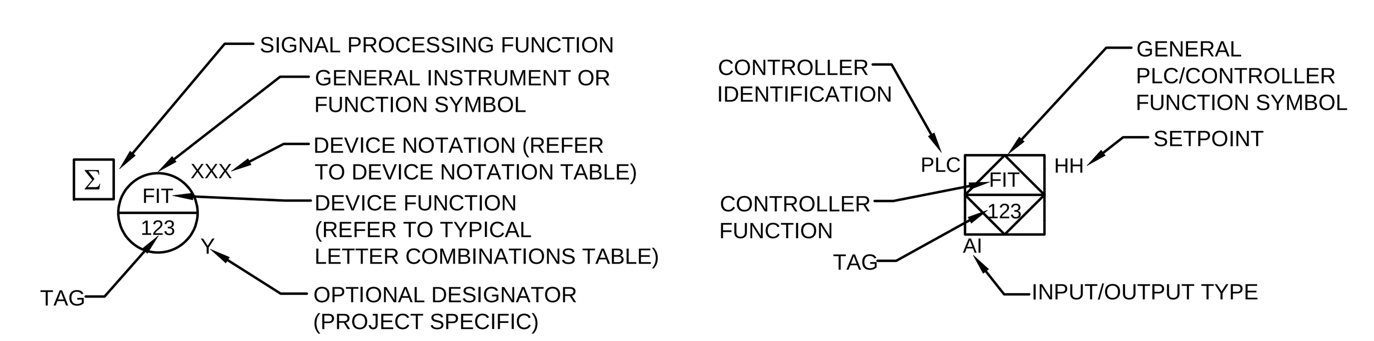
(4) - PROCESS CONTROLLERS, PROCESS OPTIMIZERS, STATISTICAL PROCESS CONTROL, MODEL-PREDICTIVE PROCESS CONTROL, ANALYZER CONTROLLERS, BUSINESS COMPUTERS, MANUFACTURING EXECUTION SYSTEMS, AND OTHER SYSTEMS THAT INTERACT WITH THE PROCESS BY MANIPULATING SETPOINTS IN THE BPCS.

(5) - DISCRETE DEVICES OR FUNCTIONS THAT ARE HARDWARE-BASED AND ARE EITHER STAND-ALONE OR ARE CONNECTED TO OTHER INSTRUMENTS, DEVICES, OR SYSTEMS THAT INCLUDE, BUT ARE NOT LIMITED TO, TRANSMITTERS, SWITCHES, RELAYS, CONTROLLERS, AND CONTROL VALVES.

(6) - ACCESSIBILITY INCLUDES VIEWING, SETPOINT ADJUSTMENT, OPERATING MODE CHANGING, AND ANY OTHER OPERATOR ACTIONS REQUIRED TO OPERATE THE INSTRUMENTATION.

(7) - A DESCRIPTION OF THE LOGIC MAY BE SHOWN NEARBY OR IN THE NOTES SECTION OF THE DRAWING.

INSTRUMENT SYMBOL IDENTIFICATION



GENERAL NOTES

1. DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE BEFORE PROCEEDING WITH ANY WORK, AND IF NECESSARY, CONTRACTOR SHALL PROVIDE PIPING OFFSETS, REROUTING, TEES, ELBOWS, ETC. WHERE REQUIRED TO DELIVER A COMPLETE AND COORDINATED INSTALLATION. WHERE CONFLICTS ARE APPARENT BETWEEN THE MECHANICAL DRAWINGS AND THE P&ID'S, THE P&ID'S SHALL GOVERN.
2. IT IS THE INTENT OF THE DRAWINGS TO CALL FOR FINISHED WORK, TESTED AND READY FOR OPERATION AND IN COMPLETE CONFORMANCE WITH ALL APPLICABLE CODES, RULES AND REGULATIONS. MINOR ITEMS NOT USUALLY SHOWN OR SPECIFIED, BUT MANIFESTLY NECESSARY FOR THE PROPER INSTALLATION AND OPERATION OF THE VARIOUS SYSTEMS, SHALL BE INCLUDED IN THE WORK. IF ANY DEPARTURES FROM THE DRAWINGS ARE DEEMED NECESSARY, DETAILS OF SUCH DEPARTURES AND THE REASONS THEREFORE SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL. NO DEPARTURES SHALL BE MADE WITHOUT PRIOR APPROVAL OF THE ENGINEER.
3. CONTRACTOR SHALL COORDINATE WORK WITH ALL OTHER TRADES.
4. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF WORK.
5. P&IDs AND VALVE INDEX DO NOT DEPICT ALL HIGH POINT VENTS, LOW POINT DRAINS, AND EQUIPMENT DRAINS. ADDITIONALLY THE DRAWINGS DO NOT DEPICT ALL ELBOWS AND FITTINGS REQUIRED TO COMPLETE THE WORK. THE CONTRACTOR SHALL PROVIDE HIGH POINT VENTS, LOW POINT AND EQUIPMENT DRAINS, ELBOWS, FITTINGS, AND CONNECTORS REQUIRED TO COMPLETE THE INSTALLATION.
6. THE CONTRACTOR SHALL DO ALL CUTTING AND PATCHING REQUIRED TO SATISFACTORILY PERFORM HIS/HER WORK. NO STRUCTURAL MEMBER SHALL BE CUT WITHOUT THE PRIOR APPROVAL OF THE ENGINEER.
7. LOCATIONS AND SIZES OF EXISTING PIPING SHOWN ARE APPROXIMATE. EXACT SIZES AND LOCATIONS FOR NEW CONNECTIONS TO EXISTING PIPING SHALL BE VERIFIED BEFORE STARTING WORK.
8. THE WORD 'PIPING' IN THIS SPECIFICATION MEANS PIPE, FITTINGS, NIPPLES, VALVES, ETC., AND SHALL BE CONSIDERED AS SUCH IN THE INSTALLATION.
9. ALL PIPING SHALL BE RUN SLOPED TO DRAIN AND FREE OF TRAPS AND UNNECESSARY BENDS, ARRANGED TO CONFORM TO THE BUILDING REQUIREMENTS AND TO SUIT THE NECESSITIES OF CLEARANCES FOR OTHER MECHANICAL WORK.
10. NO VALVE STEM SHALL BE INSTALLED BELOW THE CENTERLINE OF THE PIPING IT SERVES.
11. PIPING SHALL BE INSTALLED IN ACCORDANCE WITH THESE SPECIFICATIONS AND MANUFACTURER INSTALLATION GUIDELINES.
12. CONTRACTOR SHALL INSTALL EQUIPMENT IN ACCORDANCE WITH THE APPROVED MANUFACTURER'S INSTALLATION MANUAL AND SHALL FURNISH ALL REQUIRED VALVES, FITTINGS, VACUUM BREAKERS, TRAPS, ETC., NECESSARY FOR THE COMPLETE INSTALLATION TO PROVIDE PROPER OPERATION OF EACH PIECE OF EQUIPMENT.
13. EQUIPMENT AND PIPE HANGERS AND SUPPORTS BY CONTRACTOR AND REVIEWED BY ENGINEER PRIOR TO FABRICATION. A TYPICAL PIPE SUPPORT DETAIL IS PROVIDED ON P-2.
14. CONTRACTOR SHALL CONDUCT LEAK TEST ON PROCESS PIPING AT 50 PSIG HYDROSTATIC (WATER)
15. ALL GASKETS TO BE ANY OF THE FOLLOWING VITON TYPES: ETP, GFLT, F TYPE, B TYPE, OR TEFLON ENCAPSULATED, 1/8" THICK.
16. FLAT-FACED FLANGES SHALL BE INSTALLED AGAINST FLAT-FACED FLANGES, AND RAISED-FACED FLANGE SHALL BE INSTALLED AGAINST RAISED-FACED FLANGES.
17. CONTRACTOR RESPONSIBLE FOR ALL TRANSITIONS, FLANGES, FITTINGS AND COUPLINGS REQUIRED TO GO FROM TANK NOZZLES PROVIDED AND AT TIE-IN POINTS TO THE SIZE REQUIRED TO INSTALL PIPE, EQUIPMENT, INSTRUMENTS, AND APPURTENCES.
18. PROVIDE VALVE AND FLANGE GUARDS WHERE A SPRAY OF LIQUIDS RESULTING FROM A GASKET OR PACKING FAILURE COULD RESULT IN INJURY TO PERSONNEL OR SPRAY ONTO ELECTRICAL EQUIPMENT.
19. ALL PIPING AND VALVES TO BE INDEPENDENTLY SUPPORTED TO PREVENT TANK NOZZLES, PUMP NOZZLES, EXPANSION JOINT, OR ANY OTHER INSTRUMENT OR DEVICE FROM CARRYING ANY LOAD.

SIGNAL LINES SYMBOLS

- INSTRUMENT CONNECTION (MECH)
- ELECTRICAL OR ELECTRONIC
- PNEUMATIC

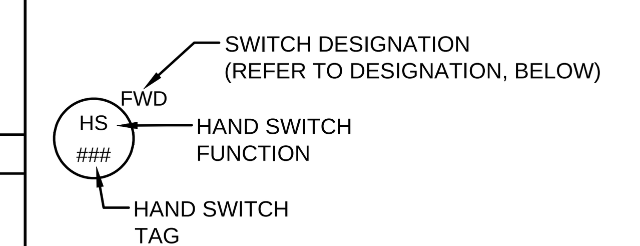
MISCELLANEOUS SYMBOLS

- IA — INSTRUMENT AIR
- P — POINT OF CONNECTION (NEW WIRING TO EXISTING)
- M ### — MOTOR

SETPOINT & I/O TYPE ABBREVIATIONS

AI - ANALOG INPUT
AO - ANALOG OUTPUT
DI - DISCRETE INPUT
DO - DISCRETE OUTPUT
DO(X) - ANALOG/DISCRETE I/O TYPE
CONTROLNET: X=C
DEVICENET: X=D
ETHERNET: X=E
FIELDBUS: X=F
MODBUS: X=M
H - HIGH
HH - HIGH HIGH
L - LOW
LL - LOW LOW

HAND SWITCH DESIGNATION



ESTOP - EMERGENCY STOP
F/R - FORWARD/REVERSE
FWD - FORWARD
HOA - HAND-OFF-AUTOMATIC
L/A - LOCAL/AUTOMATIC
L/R - LOCAL/REMOTE
LOR - LOCAL-OFF-REMOTE
OCA - OPEN-CLOSE-AUTO
OAC - OPEN-AUTO-CLOSE
O/O - ON/OFF
OSC - OPEN-STOP-CLOSE
REV - REVERSE

PIPE SPECIFICATION

CPVC

- PIPE: ASTM D1784 CPVC CELL CLASSIFICATION 23447 (TYPE IV, GRADE I CPVC), SCHEDULE 40, ASTM D1785 DIMENSIONS, PLAIN END
- FITTINGS: CPVC 23447, SCHEDULE 40, ASTM D2466, SOCKET ENDS
- FLANGES: CPVC 23447, SCHEDULE 40, ASTM D2466, ASME B16.5 CL150, FF-SOCKET FLANGE AND FF-BLIND FLANGE
- BOLTS/NUTS: ASTM A307, GR B CS HEAVY HEX MACH BOLTS, EACH WITH ASTM A563 GR A HEAVY HEX NUTS; INSTALL TYPE 304 SS FLAT WASHERS UNDER ALL NUTS AND BOLTS

HDPE

- PIPE: ASTM D2837 1600 PSI HYDROSTATIC DESIGN BASIS, PE 3408 HIGH MOLECULAR WEIGHT POLYETHYLENE PIPING HAVING A CELL CLASSIFICATION OF PE 345434C CONFORMING TO ASTM D3350, WITH STANDARD DIMENSION RATIO (SDR) OF 11 OR STRONGER
- FITTINGS: CONFORM TO REQUIREMENTS OF PIPE FOR CLASSIFICATION AND SIZE
- FLANGES: BACKUP (FOLLOWER) RINGS TO BE DUCTILE IRON OR CARBON STEEL, ASME B16.5 CL150
- BOLTS/NUTS: ASTM A307, GR B CS HEAVY HEX MACH BOLTS, EACH WITH ASTM A563 GR A HEAVY HEX NUTS; INSTALL TYPE 304 SS FLAT WASHERS UNDER ALL NUTS AND BOLTS

TYPICAL LETTER COMBINATIONS

FIRST LETTERS	INITIATING OR MEASURED VARIABLES	CONTROLLERS				READOUT DEVICES		SWITCHES AND ALARM DEVICES*			TRANSMITTERS			SOLENOIDS, RELAYS, COMPUTING DEVICES	PRIMARY ELEMENT	TEST POINT	WELL OR PROBE	VIEWING DEVICES, GLASS	SAFETY DEVICE	FINAL ELEMENT
		RECORD CONTROL	INDICATE CONTROL	CONTROL	CONTROL VALVES	RECORDING	INDICATING	HIGH**	LOW	COMB	RECORDING	INDICATING	BLIND							
A	ANALYSIS	ARC	AIC	AC		AR	AI	ASH	ASL	ASHL	ART	AIT	AT	AY	AE	AP	AW			AV
B	BURNER/COMBUSTION	BRC	BIC	BC		BR	BI	BSH	BSL	BSHL	BRT	BIT	BT	BY	BE		BW	BG		BZ
C	USER'S CHOICE																			
D	USER'S CHOICE																			
E	VOLTAGE	ERC	EIC	EC		ER	EI	ESH	ESL	ESHL	ERT	EIT	ET	EY	EE					EZ
F	FLOW, FLOW RATE	FRC	FIC	FC	FCV,FICV	FR	FI	FSH	FSL	FSHL	FRT	FIT	FT	FY	FE	FP		FG		FV
FQ	FLOW TOTAL	FQRC	FQIC	FQC	FQCV	FQR	FQI	FQSH	FQSL			FQIT	FQT	FQY	FQE					FQV
FF	FLOW RATIO	FFRC	FFIC	FFC	FFK	FFR	FFI	FPSH	FFSL						FE					FFV
G	USER'S CHOICE																			
H	HAND	HRC	HIC	HC	HCV					HS									HSS	HV
I	CURRENT	IRC	IIC	IC		IR	II	ISH	ISL	ISHL	IRT	IIT	IT	IY	IE					IZ
J	POWER	JRC	JIC	JC	JK	JR	JI	JSH	JSL	JSHL	JRT	JIT	JT	JY	JE					JV
K	TIME	KRC	KIC	KC	KCV	KR	KI	KSH	KSL	KSHL	KRT	KIT	KT	KY	KE					KV
L	LEVEL	LRC	LIC	LC	LCV	LR	LI	LSH	LSL	LSHL	LRT	LIT	LT	LY	LE		LW	LG		LV
M	USER'S CHOICE																			
N	USER'S CHOICE																			
O	USER'S CHOICE																			
P	PRESSURE/VACUUM	PRC	PIC	PC	PCV	PR	PI	PSH	PSL	PSHL	PRT	PIT	PT	PY	PE	PP			PSV, PSE	PV
PD	PRESSURE/DIFFERENTIAL	PDRC	PDIC	PDC	PDCV	PDR	PDI	PDSH	PDSL		PDRT	PDIT	PDT	PDY	PDE	PDP				PDV
Q	QUANTITY	QRC	QIC	QC		QR	QI	QSH	QSL	QSHL	QRT	QIT	QT	QY	QE					QZ
R	RADIATION	RRC	RIC	RC		RR	RI	RSH	RSL	RSHL	RRT	RIT	RT	RY	RE		RW			RZ
S	SPEED/FREQUENCY	SRC	SIC	SC	SCV	SR	SI	SSH	SSL	SSHL	SRT	SIT	ST	SY	SE					SV
T	TEMPERATURE	TRC	TIC	TC	TCV	TR	TI	TSH	TSL	TSHL	TRT	TIT	TT	TY	TE	TP	TW		TSE	TV
TD	TEMPERATURE/DIFFERENTIAL	TDRC	TDIC	TDC	TDCV	TDR	TDI	TDSH	TDSL		TDRT	TDIT	TDT	TDY	TE	TP	TW			TDV
U	MULTIVARIABLE	URC	UIC	UC		UR	UI							UY						UV
V	VIBRATION/MACHINERY ANALYSIS	VRC	VIC	VC		VR	VI	VSH	VSL	VSHL	VRT	VIT	VT	VY	VE					VZ
W	WEIGHT/FORCE	WRC	WIC	WC	WCV	WR	WI	WSH	WSL	WSHL	WRT	WIT	WT	WY	WE					WZ
WD	WEIGHT/FORCE DIFFERENTIAL	WDRC	WDIC	WDC	WDCV	WDR	WDI	WDSH	WDSL		WDRT	WDIT	WDT	WDY	WE					WDZ
X	UNCLASSIFIED	XRC	XIC	XC																
Y	EVENT/STATE/PRESENCE	YC	YIC	YC		YR	YI	YSH	YSL				YT	YY	YE					YZ
Z	POSITION/DIMENSION	ZRC	ZIC	ZC	ZCV	ZR	ZI	ZSH	ZSL	ZSHL	ZRT	ZIT	ZT	ZY	ZE					ZV
ZD	GAUGING/DEVIATION	ZDRC	ZDIC	ZDC	ZDCV	ZDR	ZDI	ZDSH	ZSL		ZDRT	ZDIT	ZDT	ZDY	ZDE					ZDV

NOTE: THIS TABLE IS NOT ALL-INCLUSIVE
*A, ALARM, THE ANNUNCIATING DEVICE, MAY BE USED IN THE SAME FASHION AS (S) SWITCH, THE ACTUATING DEVICE.
** THE LETTERS H AND L MAY BE OMITTED IN THE UNDEFINED CASE.

NOTE:
INFORMATION ON THIS DRAWING IS BASED ON THE INTERNATIONAL SOCIETY OF AUTOMATION (ISA) STANDARDS "ANSI/ISA-5.1-2009 INSTRUMENTATION SYMBOLS AND IDENTIFICATION" AND "ANSI/ISA-5.3-1983 GRAPHIC SYMBOLS FOR DISTRIBUTED CONTROL/SHARED DISPLAY INSTRUMENTATION, LOGIC AND COMPUTER SYSTEMS". REFER TO ANSI/ISA FOR FURTHER INFORMATION.

DEVICE NOTATION TABLE

ANALYSIS

AIR - EXCESS AIR
CO - CARBON DIOXIDE
CL2 - CHLORINE RESIDUAL
COMB - COMBUSTIBLES
COND - ELEC. CONDUCTIVITY
DEN - DENSITY
DO - DISSOLVED OXYGEN
H20 - WATER
H2S - HYDROGEN SULFIDE
IR - INFRARED
MOIST - MOISTURE
NH4 - AMMONIA
NO3 - NITRATE
O2 - OXYGEN
ORP - OXIDATION REDUCTION POTENTIAL
pH - HYDROGEN ION
TC - THERMAL CONDUCTIVITY
TURB - TURBIDITY
UV - ULTRAVIOLET
VISC - VISCOSITY

FLOW

CONE - CONE
COR - CORIOLIS
DOP - DOPPLER
DSON - DOPPLER SONIC
FLN - FLOW NOZZLE
FLT - FLOW TUBE
LAM - LAMINAR
MAG - MAGNETIC
OP - ORIFICE PLATE
PD - POSITIVE DISPLACEMENT
PT - PITOT TUBE
PV - PITOT VENTURI
SNR - SONAR
SON - SONIC
THER - THERMAL
TTS - TRANSIT TIME SONIC
TUR - TURBINE
US - ULTRASONIC
VENT - VENTURI
VOR - VORTEX SHEDDING
WDG - WEDGE

LEVEL

CAP - CAPACITANCE
DP - DIFFERENTIAL PRESSURE
DI - DIELECTRIC CONSTANT
GWR - GUIDED WAVE RADAR
LSR - LASER
MAG - MAGNETIC
PAD - PADDLE
RAD - RADAR
RES - RESISTANCE
SON - SONIC
US - ULTRASONIC
VIB - VIBRATION

PRESSURE

ABS - ABSOLUTE
AVG - AVERAGE
DRF - DRAFT
MAN - MANOMETER
P-V - PRESSURE-VACUUM
SG - STRAIN GAUGE
VAC - VACUUM

TEMPERATURE

BM - BI-METALLIC
IR - INFRARED
RAD - RADIATION
RTD - RES TEMP DETECTOR
TC - THERMOCOUPLE
TCK - THERMOCOUPLE TYPE K
TCT - THERMOCOUPLE TYPE T
TCE - THERMOCOUPLE TYPE E
TCJ - THERMOCOUPLE TYPE J
THERM - THERMISTOR
TRANS - TRANSISTOR

MISCELLANEOUS

BURNER, COMBUSTION

FR - FLAME ROD
IGN - IGNITER
IR - INFRARED
TV - TELEVISION

POSITION

CAP - CAPACITANCE
IR - INFRARED
LAS - LASER
MAG - MAGNETIC
MECH - MECHANICAL
OPT - OPTICAL

SPEED

ACC - ACCELERATION
PROX - PROXIMITY
VEL - VELOCITY

WEIGHT, FORCE

LC - LOAD CELL
SG - STRAIN GAUGE
WS - WEIGHT SCALE

MOTOR CONTROL

FVR - FULL VOLTAGE REVERSING
FVNR - FULL VOLTAGE NON-REV
RVS - REDUCED VOLTAGE
RVAT - REDUCED VOLTAGE AUTO-TRANSFORMER
SST - SOLID STATE (SOFT START)
VFC - VARIABLE FREQUENCY CONTROLLER (AC)
VFD - VARIABLE FREQ. DRIVE (DC)
VSD - VARIABLE SPEED DRIVE

NOTE: NOTATIONS MAY BE USED IF A GRAPHIC SYMBOL DOES NOT EXIST.

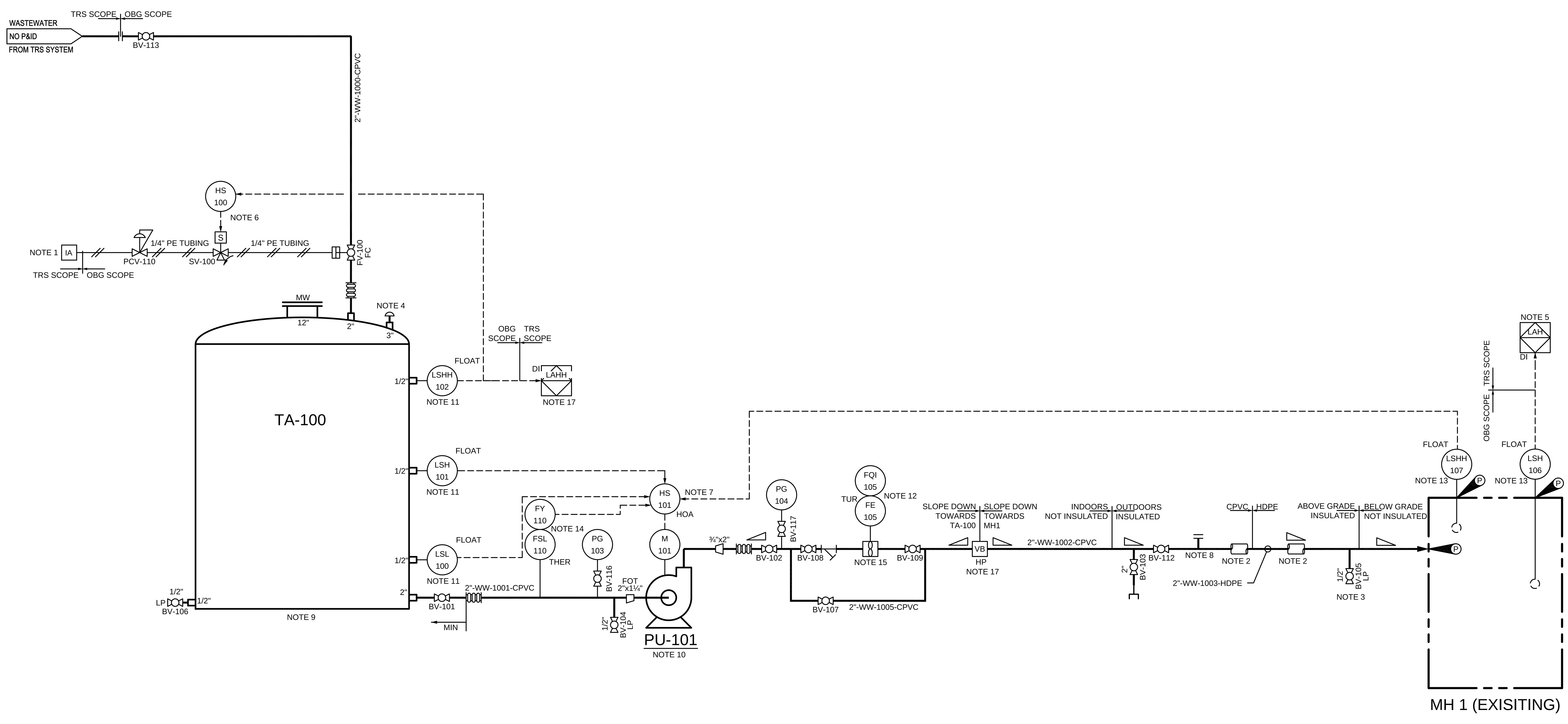
IN CHARGE OF	B. WHITE			
DESIGNED BY	F.HENCKEN			
CHECKED BY	D. SOKOLIK	0	9/3/14	ISSUED FOR CONSTRUCTION
DRAWN BY	M.BRUNETTI	NO.	DATE	REVISION	INT.

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

PROCESS MECHANICAL
PROCESS ABBREVIATIONS & SYMBOLS

FILE NO. 2516.50682 - P3
DATE SEPTEMBER 2014
P-3



DRAWING NOTES:

1. INSTRUMENT AIR SUPPLY FROM TRS COMPRESSOR.
2. INSULATE OUTDOOR, ABOVE GRADE PIPE, VALVES AND FITTINGS WITH 1" THICK POLYISOCYANURATE INSULATION, FABRICATED BOARD AND PIPE SECTIONS, WITH 0.016" THICK SMOOTH ALUMINUM JACKETING. ALL EXPOSED INSULATION TO BE SEALED LEAK TIGHT. EXTEND INSULATION A MINIMUM OF 2 FEET FROM THE WALL PENETRATION WITHIN BUILDING.
3. PROVIDE ADDITIONAL DRAIN VALVES AS NEEDED TO COMPLETELY DRAIN THE LINE.
4. ATMOSPHERIC VENT.
5. SIGNAL BACK TO THE TRS CONTROL CENTER ON HIGH LEVEL IN MH 01. TRS SYSTEM WILL SHUT DOWN ELECTRODES.
6. CLOSE FV-100 UPON ACTIVATION OF LSHH-102.
7. STOP PU-101 UPON ACTIVATION OF LSHH-107.
8. CLEANOUT.
9. INSTALL 3/8" THICK BUNA-N (NITRILE) RUBBER PAD UNDER ENTIRE BOTTOM OF TANK TO PREVENT ABRASION WITH CONCRETE DUE TO EXPANSION AND CONTRACTION OF THE TANK.
10. PU-101 SHALL BE FLOWSERVE MODEL SMP 1.25x0.75x5 WITH A 4.56" BRONZE IMPELLER (OR APPROVED EQUAL).
11. LSL-100, LSH-101, AND LSHH-102 SHALL BE OMEGA MODEL LVH-200 SINGLE STATION HORIZONTAL LEVEL SWITCHES OR APPROVED EQUAL.
12. FE-105 SHALL BE OMEGA MODEL FTB720 TURBINE FLOW METER OR APPROVED EQUAL. FQI-105 SHALL BE OMEGA MODEL FTB700-D FLOW TOTALIZER/DISPLAY OR APPROVED EQUAL.
13. LSH-106 AND LSHH-107 SHALL BE MADISON MODEL M4549 TILT FLOAT SWITCHES OR APPROVED EQUAL.
14. FSL-110 SHALL BE OMEGA MODEL FST-211-SPST THERMAL DISPERSION FLOW SWITCH OR APPROVED EQUAL. FY-110 SHALL BE OMEGA MODEL FLCN-111 RELAY FLOW CONTROLLER OR APPROVED EQUAL.
15. INSTALL FLOWMETER WITH AT LEAST 10 DIAMETERS OF STRAIGHT PIPE UPSTREAM AND 5 DIAMETERS OF STRAIGHT PIPE DOWNSTREAM.
16. VACUUM BREAKER SHALL BE WATTS SERIES 188A OR APPROVED EQUAL. INSTALL VACUUM BREAKER AT LEAST 6" ABOVE ELEVATION OF LSL-100.
17. SIGNAL BACK TO THE TRS CONTROL ON HIGH-HIGH LEVEL IN TA-100. TRS SYSTEM WILL SHUT DOWN THE AIR STRIPPER PUMP AND THE HYDRAULIC CONTROL WELLS, AND OPEN THE VAPOR TREATMENT SYSTEM BYPASS TO ATMOSPHERE.
18. PRESSURE GAUGES SHALL BE ASHCROFT MODEL 1279 OR APPROVED EQUAL, WITH 1/4" NPT CONNECTION AND 0-60 PSI RANGE.
19. BALL VALVES SHALL BE SPEARS MODEL TU-2-0205 TRUE UNION BALL VALVES OR APPROVED EQUAL.
20. EXPANSION JOINTS SHALL BE GARLOCK STYLE 204, SINGLE ARCH OR APPROVED EQUAL.

TA-100
WASTEWATER HOLDING TANK

SERVICE: WASTEWATER
SIZE: 64"Ø x 100" S.S
CAPACITY: 1200 GAL
TYPE: VERTICAL
MOC: XLPE
MANUF: POLY PROCESSING
RATING: ATMOSPHERIC

PU-101
WASTEWATER PUMP

TYPE: HORIZONTAL CENTRIFUGAL
DESIGN FLOW: 30 GPM
TDH: 75' TDH
HP: 1.5
MOC: CAST IRON

SAVED: 9/5/14 2:28 PM
\\SYRNA01\PROJECTS\IBM-MANASSAS.2516\50682.KINGSTON-SWMU-S\DOCS\DWG\SHEETS\50682-P4.DWG

IN CHARGE OF	B. WHITE
DESIGNED BY	F.HENCKEN
CHECKED BY	D. SOKOLIK
DRAWN BY	M.BRUNETTI

NO.	DATE	REVISION	INT.
0	9/3/14	ISSUED FOR CONSTRUCTION	

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC
SYRACUSE, NY

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

PROCESS MECHANICAL
WASTEWATER TANK PIPING & INSTRUMENTATION DIAGRAM

FILE NO. 2516.50682 - P4
DATE SEPTEMBER 2014
P-4

ABBREVIATIONS

"A"

&	AND
@	AT
AB	ANCHOR BOLTS ABRASIVE
ABR	ACOUSTICAL
ACT	CEILING TILE
ADD'L	ADDITIONAL
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
ALT	ALTERNATE
ALUM	ALUMINUM
APPD	APPROVED
ARRROX	APPROXIMATE
ARCH	ARCHITECTURAL
ASPH	ASPHALT

"B"

B OR BOT	BOTTOM
B/ OR BO	BOTTOM OF
BD	BOARD
BFF	BELOW FINISHED FLOOR
BIT	BITUMINOUS
BLDG	BUILDING
BLK	BLOCK / BLOCKING
BM	BEAM
BOD	BOTTOM OF DUCT
BOL	BOTTOM OF LOUVER
BOP	BOTTOM OF PIPE
BRG	BEARING

"C"

CJ	CONTROL JOINT
CANTIL	CANTILEVER
CEM	CEMENT
CHAN	CHANNEL
CHEM	CHEMICAL RESISTANT
CL	FINISH CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY
COL	UNITS COLUMN
COMBO	COMBINATION
CONC	CONCRETE
CONST	CONSTRUCTION
CONST JT	CONSTRUCTION JOINT
CONT	CONTINUE /
CONT'D	CONTINOUS CONTINUED
CONTR	CONTRACT / CONTRACTOR
COORD	COORDINATE
CORR	CORRIDOR
CORRUG	CORRUGATED
CSK	COUNTERSINK
CSKSCR	COUNTERSUNK SCREW
CTR	CENTER

"D"

DEG	DEGREE
DET	DETAIL
DEMO	DEMOLISH / DEMOLITION
DIA	DIAMETER
DIAG	DIAGONAL / DIAGRAM
DIM	DIMENSION
DIV	DIVISION
DL	DEAD LOAD
DN	DOWN
DR	DOOR
DWG	DRAWING
DWL	DOWEL

"E"

EL	EXPANSION JOINT
EA	EACH
EF	EACH FACE
EL	ELEVATION
ELEC	ELECTRIC / ELECTRICAL
ENGR	ENGINEER
EQ	EQUAL
EQUIP	EQUIPMENT
EQUIV	EQUIVALENT
ES	EXPOSED STRUCTURE
EW	EACH WAY
EXC	EXCAVATION
EXH	EXHAUST
EXP STR	EXPOSED STRUCTURE
EXIST OR EX	EXISTING
EXP	EXPANSION / EXPOSED
EXT	EXTERIOR

"F"

FAC	FACTORY
FD	FLOOR DRAIN / FOOTING DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FF	FACTORY FINISH
FFE	FINISH FLOOR ELEVATION
FIN GR	FINISHED GRADE
FIN FL	FINISHED FLOOR
FIXT	FIXTURE
FIN	FINISH
FL OR FLR	FLOOR
FR	FRAME
FT	FEET
FTG	FOOTING
FV	FIELD VERIFY

"G"

GA	GAGE / GAUGE
GALV	GALVANIZED
GB	GRADE BEAM / GRAB BAR
GL	GLASS
GR	GRADE
GRD	GROUND
GS	GALVANIZED STEEL
GVL	GRAVEL
GWB	GYPSUM WALL BOARD

"H"

HB	HOSE BIBB
HD	HEAD
HDW	HARDWARE
HGT	HEIGHT
HM	HOLLOW METAL
HMD	HOLLOW METAL DOOR
HMF	HOLLOW METAL FRAME
HORIZ	HORIZONTAL
HP	HIGH POINT
HVAC	HEATING, VENTILATING AND AIR CONDITIONING

"I"

I.F.	INSIDE FACE
INCL	INCLUDED / INCLUDING
IND	INDUSTRIAL
INFO	INFORMATION
INSUL	INSULATION / INSULATED
INT	INTERIOR
INV	INVERT

"J"

JST	JOIST
JT	JOINT

"K"

KD	KNOCK DOWN
KFS	KIPS PER SQUARE FOOT
KFT	KIP FOOT
KP	KICK PLATE

"L"

L	ANGLE
LAM	LAMINATE
LB	POUND
LBS	POUNDS
LF	LINEAR FEET
LG	LENGTH / LONG
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LP	LOW POINT
LV	LOUVER

"M"

MAN.	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MCP	METAL CLAD PANEL
MD	METAL DECK
MECH	MECHANICAL
MET	METAL
MFG	MANUFACTURING
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MOD	MODIFICATION
MP	METAL PANEL
MS	METAL STUD
MTD	MOUNTED
MTL	METAL

"N"

N	NORTH
N/A	NOT APPLICABLE
NC	NON COMBUSTIBLE
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO. OR #	NUMBER
NOM	NOMINAL
NS	NEAR SIDE
NTS	NOT TO SCALE

"O"

OC	ON CENTER
O.F.	OUTSIDE FACE
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE

"P"

PAR	PARALLEL
PART.	PARTITION
PERF	PERFORATED
PL	PLATE
PLWD	PLYWOOD
PLUMB.	PLUMBING
PNL	PANEL
PR	PAIR
PRE	POWER ROOF EXHAUSTER
PREFAB	PREFABRICATED
PREFIN	PRE FINISHED
PRI	PRIMARY
PRMLD	PRE MOLDED
P.T.	PRESSURE TREATED
PT	PAINT / PAINTED
PVC	POLYVINYL CHLORIDE
PVT	PAVEMENT
PWE	POWER WALL EXHAUSTER

"Q"

QUAL	QUALITY
QTY	QUANTITY

"R"

RAD	RADIUS
RB	ROOF BEAM
RD	ROOF DRAIN
RECT	RECTANGLE / RECTANGULAR
REF	REFERENCE
REINF	REINFORCE
REQ'D	REQUIRED
REV	REVISION / REVISED
RFG	ROOFING
RM	ROOM
RO	ROUGH OPENING

"S"

S	SOUTH
S/C	SITE/CIVIL
SCH	SCHEDULE
SEC	SECOND
SECT	SECTION
SF	SQUARE FOOT
SIM	SIMILAR
SHT	SHEET
SIM REV	SIMILAR REVERSED
SJ	STEEL JOIST
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STA	STATION
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
STOR	STORAGE
STRUCT	STRUCTURE / STRUCTURAL
SUSP	SUSPEND / SUSPENDED
SYM	SYMMETRICAL / SYMMETRICALLY

"T"

T	TOP
T/ OR T.O.	TOP OF
TBD	TO BE DETERMINED
TEMP	TEMPERATURE
TH	THICK
THRD	THREAD / THREADED
TOB	TOP OF BLOCK
TOD	TOP OF DUCT
TOF	TOP OF FOOTING
TOL	TOP OF LOUVER
TOS	TOP OF SLAB / TOP OF STEEL
TOT	TOTAL
TOW	TOP OF WALL
TYP	TYPICAL

"U"

UON	UNLESS OTHERWISE NOTED
U/S	UNDERSIDE

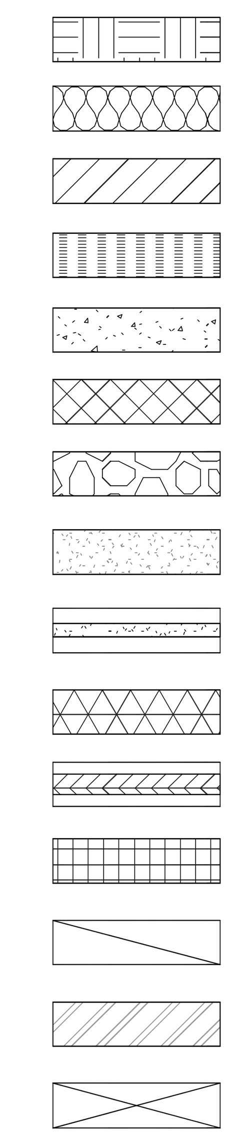
"V"

VCT	VINYL COMPOSITION TILE
VERT	VERTICAL

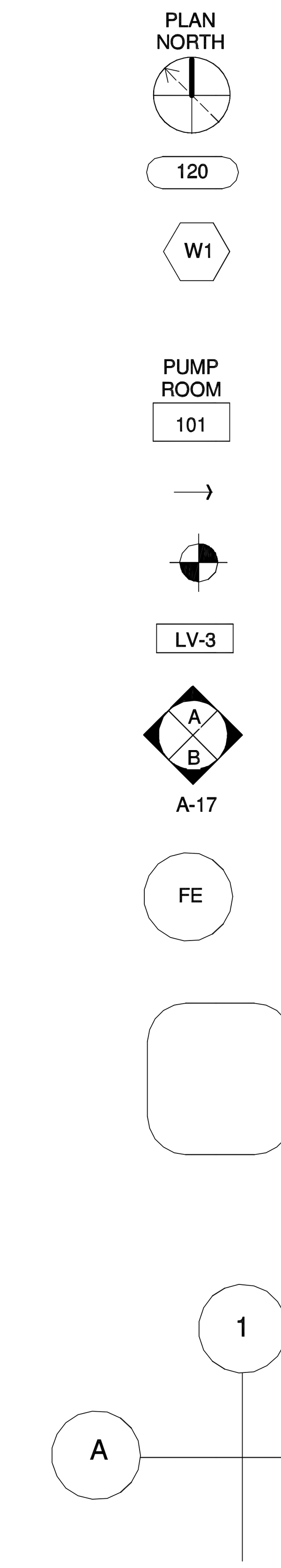
"W"

W/O	WITHOUT
W/	WITH
W	WEST
WD	WOOD
WF	WATER FOUNTAIN
WLD	WELD / WELDED
WP	WATER PROOFING
WT	WEIGHT

GRAPHIC CONVENTIONS



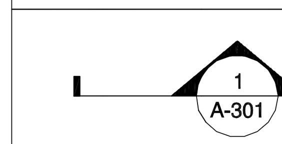
SYMBOLS



METHOD OF SECTIONING

THE DRAWING UPON WHICH A SECTION, VIEW OR DETAIL HAS BEEN TAKEN AND THE DRAWING UPON WHICH THE SECTION, VIEW OR DETAIL HAS BEEN SHOWN IS CROSS-REFERENCED WITH SYMBOLS AS FOLLOWS:

DRAWING WHERE SECTION IS TAKEN



THE NUMBER IN THE UPPER HALF OF THE CIRCLE IS THE SECTION NUMBER. THE BOTTOM NUMBER REFERS TO THE DRAWING NUMBER ON WHICH THE SECTION CAN BE FOUND.

DRAWING WHERE SECTION IS SHOWN

1 **SECTION**
SCALE SCALE BAR LOCATION

THIS IS SHOWN UNDER EACH SECTION. THE NUMBER IS THE SECTION NUMBER ON THE SHEET.

STATE OF NEW YORK · LEONARD W. WOODS · 074279 · LICENSED PROFESSIONAL ENGINEER

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	LWW
DESIGNED BY	AY / NJD
CHECKED BY	LWW / NJD
DRAWN BY	RAE / ALM

NO.	DATE	REVISION	INT.
0	9-3-14	ISSUED FOR CONSTRUCTION	LWW

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC

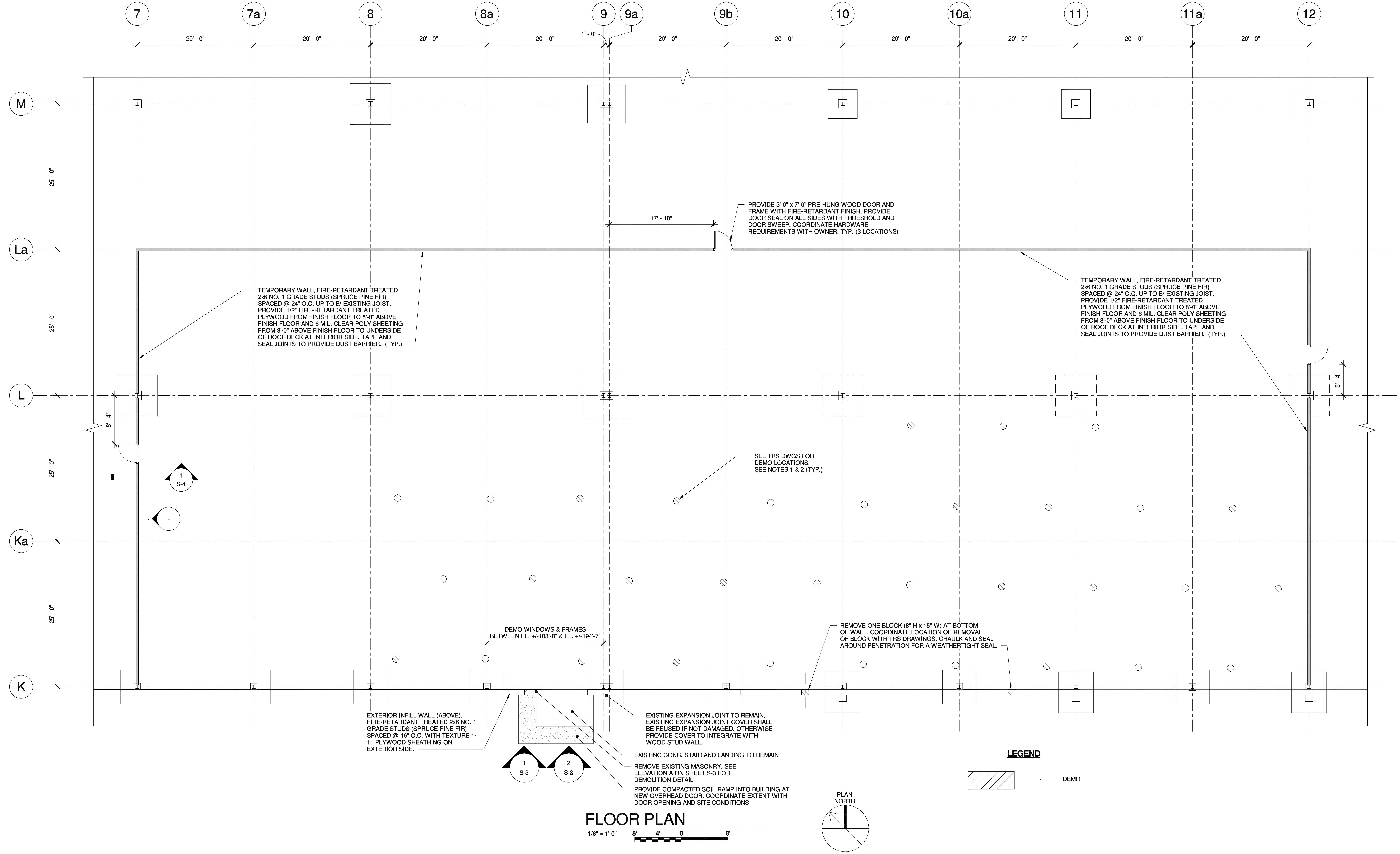
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

STRUCTURAL
BUILDING B001
ABBREVIATIONS AND SYMBOLS

FILE NO. 2516.50682- S1
DATE SEPTEMBER 2014

S-1

C:\Users\merriaal\Documents\EXIST.BUILDING B001 - STRUCTURAL_MerriaAL.rvt
9/3/2014 3:23:26 PM



FLOOR PLAN

1/8" = 1'-0"

PLAN NOTES:
1. SEE SLAB INSTALLATION DETAILS ON SHEET S-4.
2. REMOVE 1'-4" DIAMETER SLAB & EXCAVATE TO 2'-0" BELOW T/SLAB.
3. TRS DRAWINGS ARE INCLUDED WITH THE FINAL INTERIM CORRECTIVE MEASURE WORK PLAN

IN CHARGE OF	LWW
DESIGNED BY	AY / NJD
CHECKED BY	LWW / NJD
DRAWN BY	RAE / ALM

NO.	DATE	REVISION	INT.
0	9-3-14	ISSUED FOR CONSTRUCTION	LWW

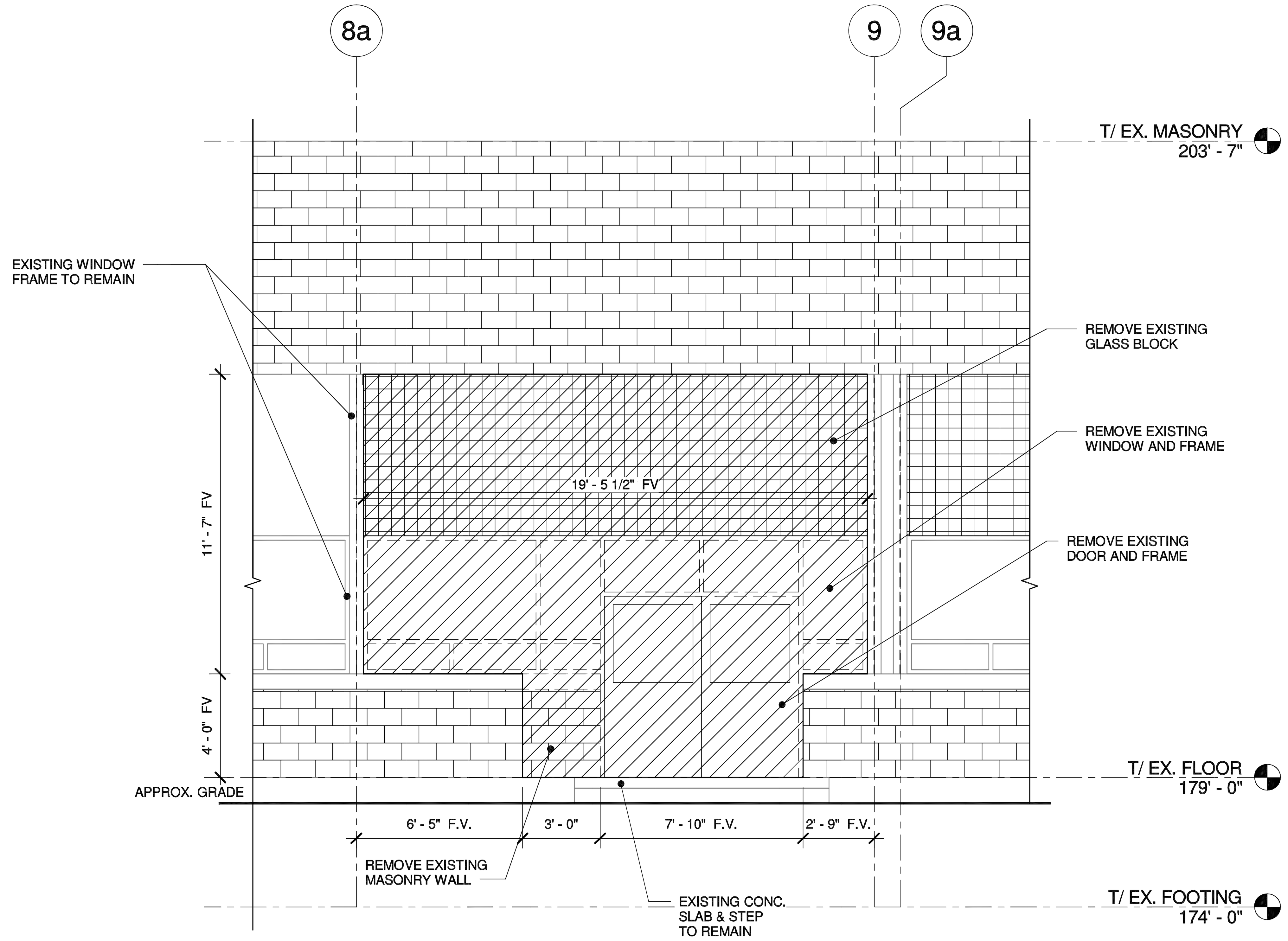
O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

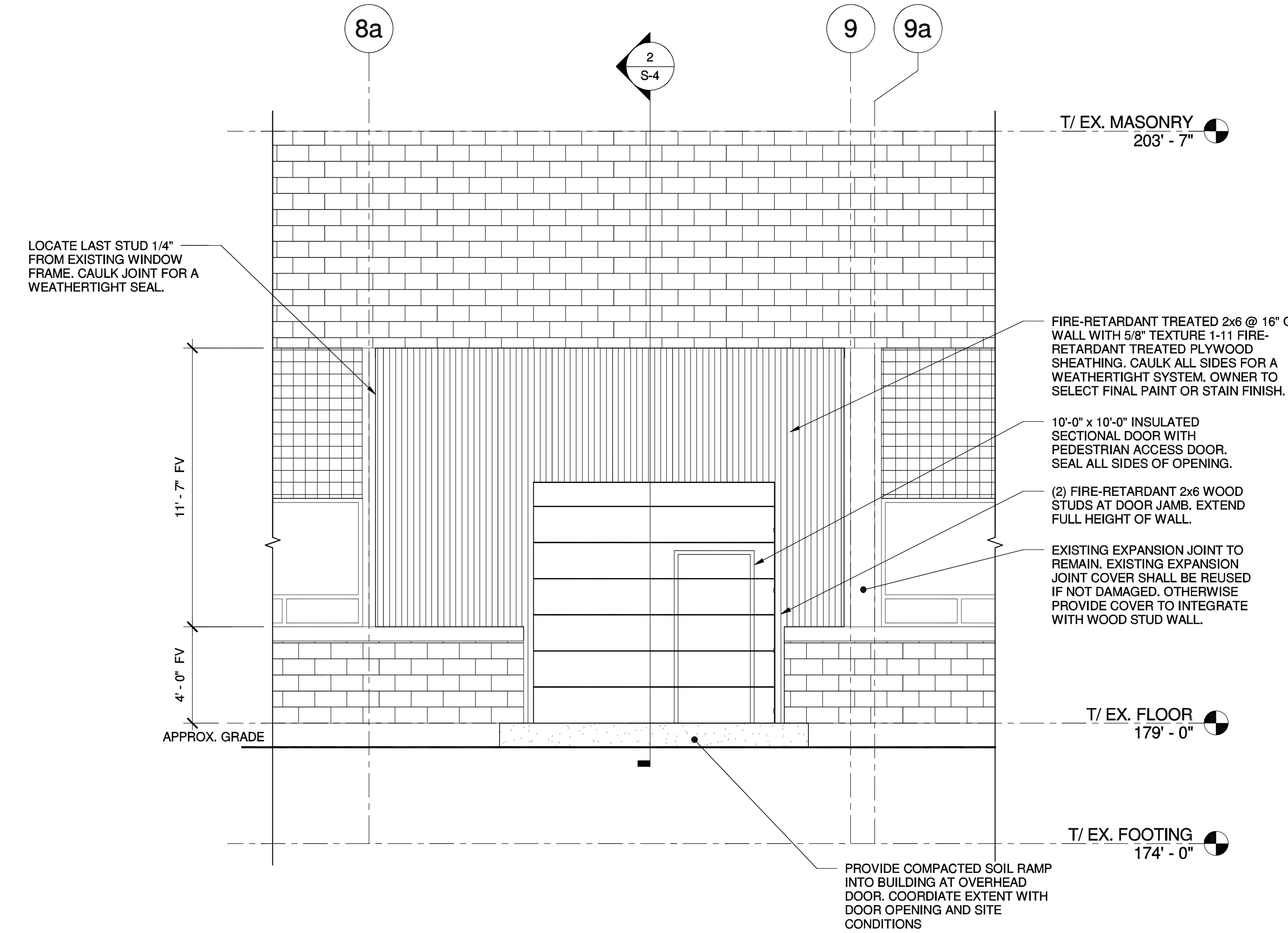
STRUCTURAL
BUILDING B001
FLOOR PLAN

FILE NO. 2516.50682- S2
DATE SEPTEMBER 2014
S-2

SAVED: 9/3/2014 3:23:27 PM

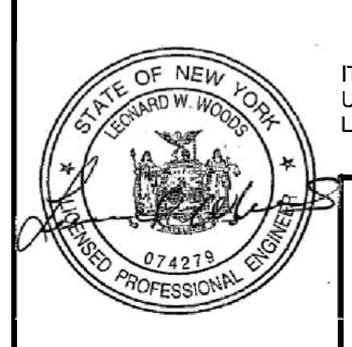


1 DEMOLITION ELEVATION
1/4" = 1'-0"



2 BUILDING ELEVATION
1/4" = 1'-0"

C:\Users\merriaal\Documents\EXIST.BUILDING B001 - STRUCTURAL_MerriaAL.rvt



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	LWW
DESIGNED BY	AY / NJD
CHECKED BY	LWW / NJD
DRAWN BY	RAE / ALM

NO.	DATE	REVISION	INT.
0	9-3-14	ISSUED FOR CONSTRUCTION	LWW

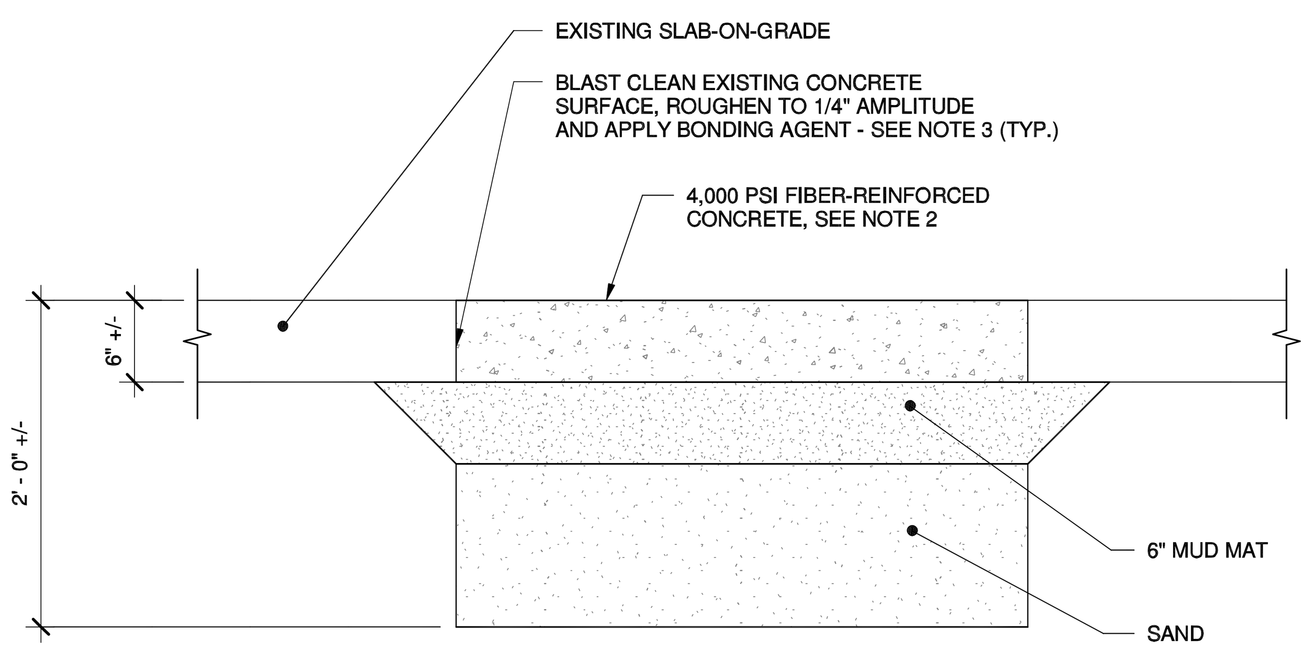
O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

STRUCTURAL
BUILDING B001
ELEVATIONS

FILE NO. 2516.50682- S3
DATE SEPTEMBER 2014
S-3

SAVED: 9/3/2014 3:23:27 PM

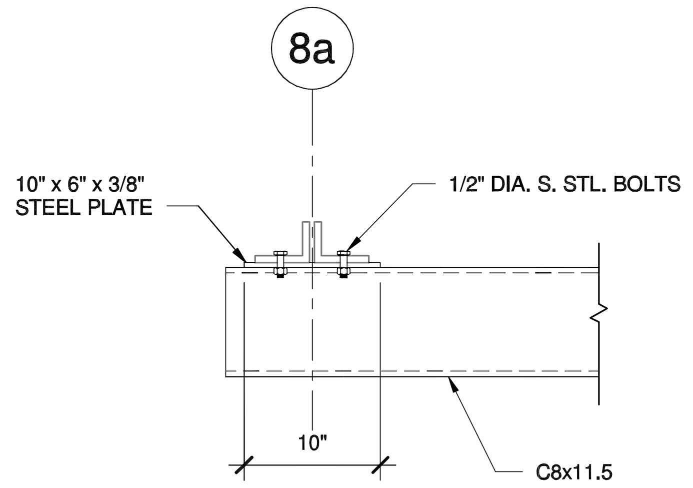


INSTALLATION SECTION

SLAB INSTALLATION DETAILS

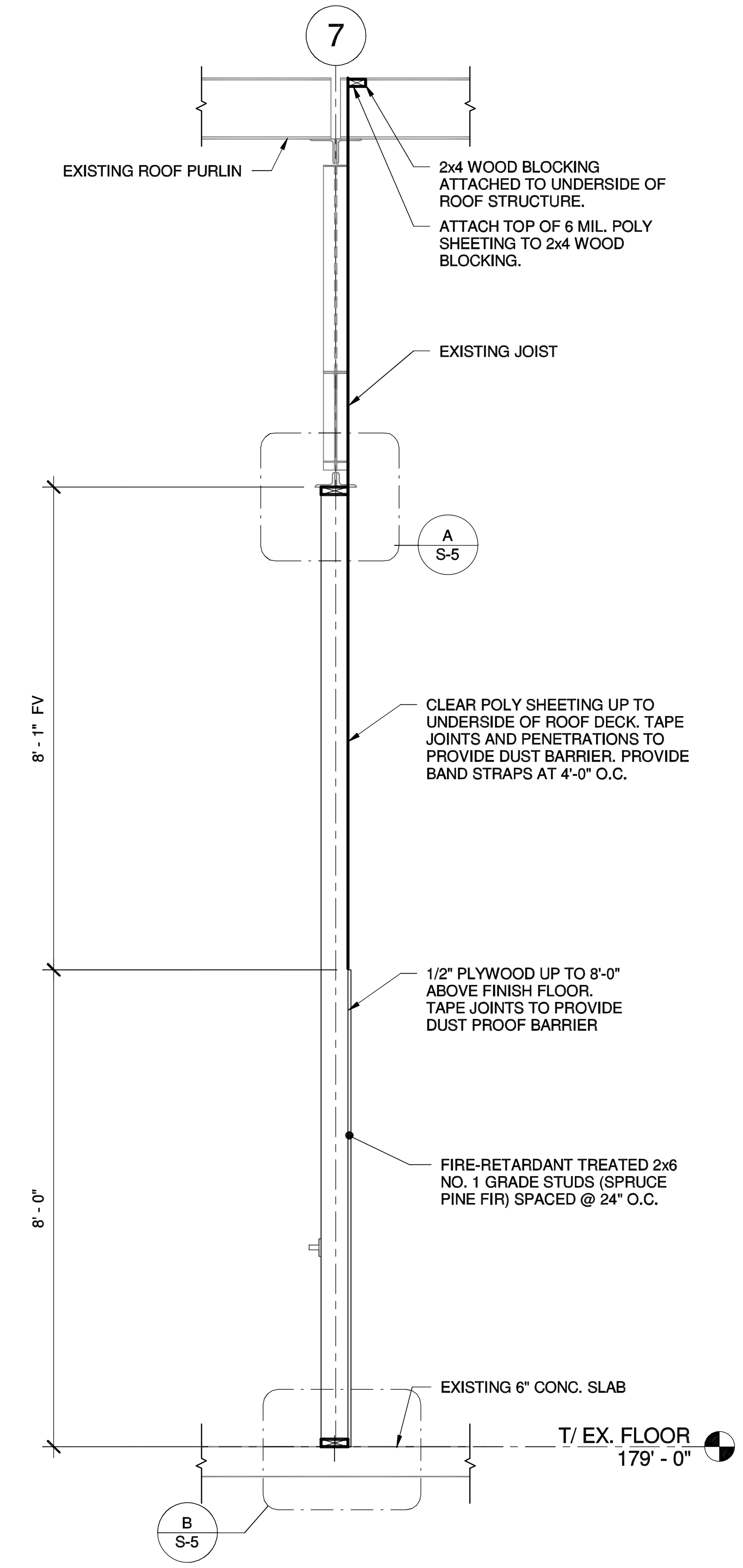
1" = 1'-0" 1' 6" 0 1'

SECTION NOTES:
1. SEE TRS DRAWING FOR BORED ELECTRODE DETAILS.
2. FIBER REINFORCEMENT SHALL BE FIBERMESH 300 APPLIED AT THE APPLICATION RATE OF 1.5 LBS PER CUBIC YARD OF CONCRETE.
3. BONDING AGENT SHALL COMPLY WITH ASTM C1059, TYPE II, NONREDISPERSIBLE, ACRYLIC EMULSION OR STYRENE BUTADIENE.



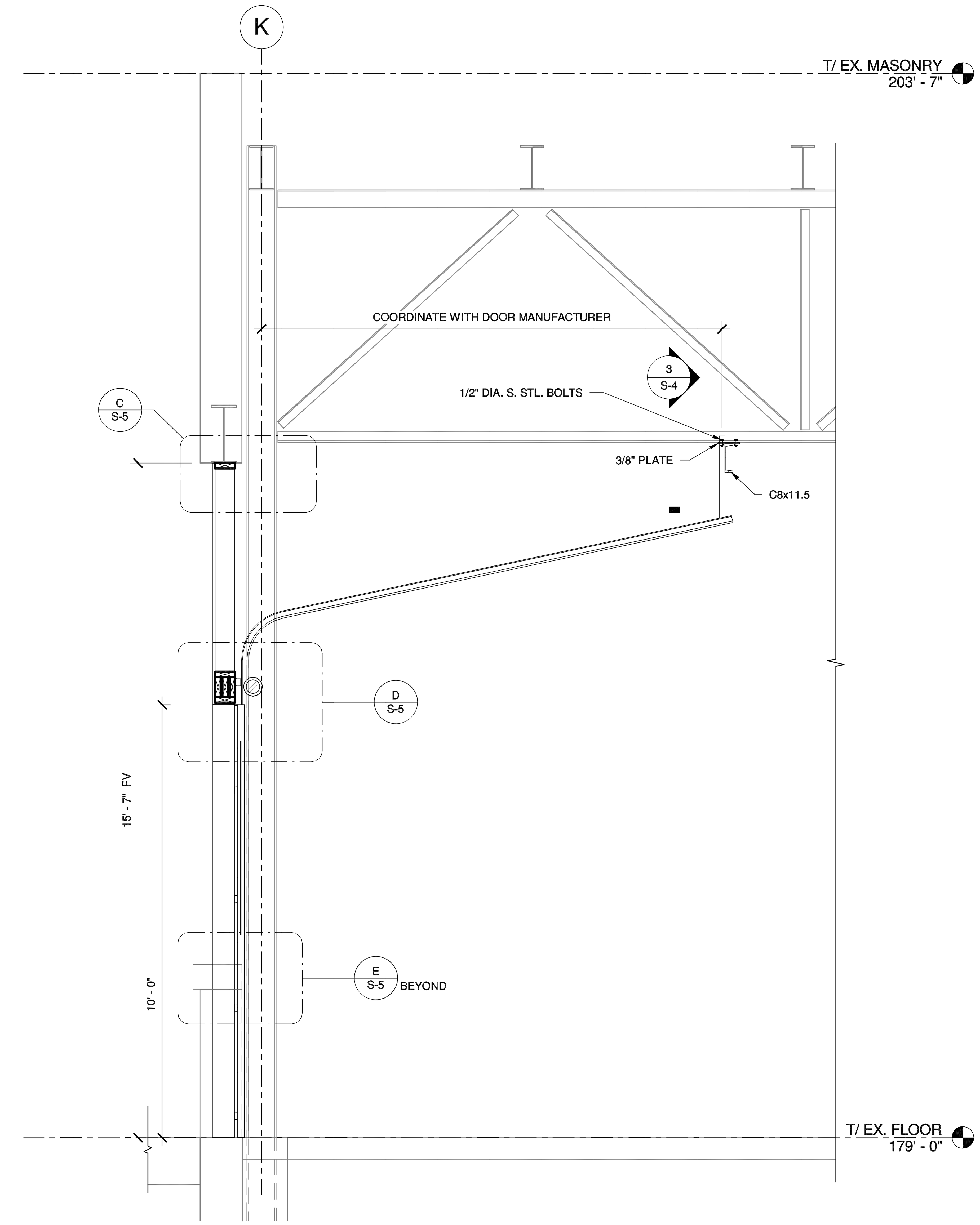
3 SECTION

1" = 1'-0" 1' 6" 0 1'



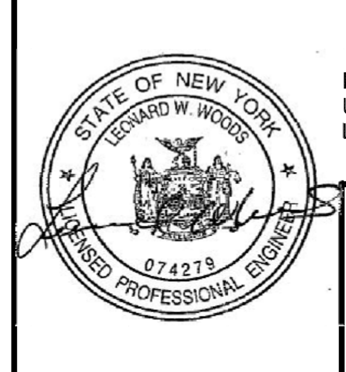
1 TEMPORARY WALL SECTION

1/2" = 1'-0" 2' 1' 0 1' 2'



2 OVERHEAD DOOR SECTION

1/2" = 1'-0" 2' 1' 0 1' 2'



IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS ACTING UNDER THE DIRECTION OF A LICENSED ENGINEER, TO ALTER THIS DOCUMENT.

THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	LWW
DESIGNED BY	AY / NJD
CHECKED BY	LWW / NJD
DRAWN BY	RAE / ALM

NO.	DATE	REVISION	INT.
0	9-3-14	ISSUED FOR CONSTRUCTION	LWW

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC

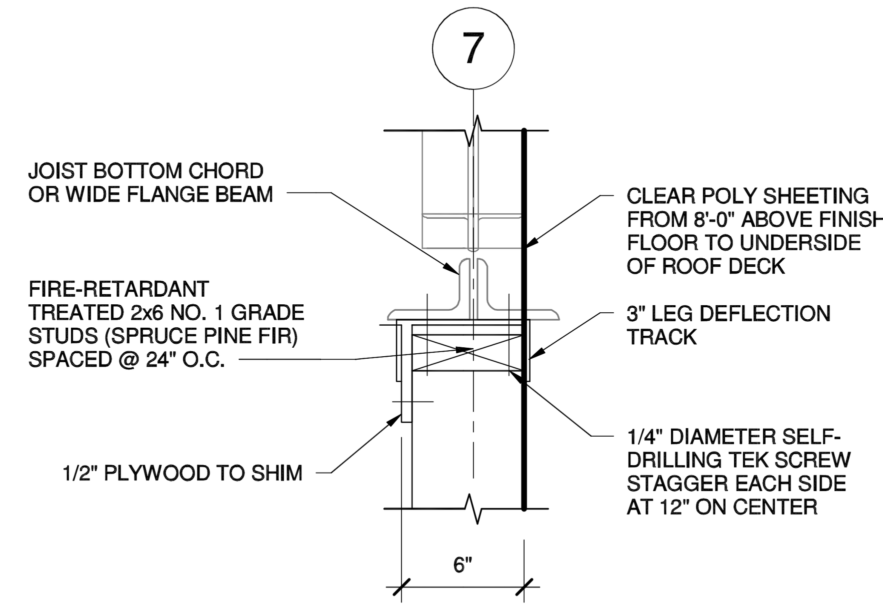
IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

STRUCTURAL
BUILDING B001
SECTIONS & DETAILS

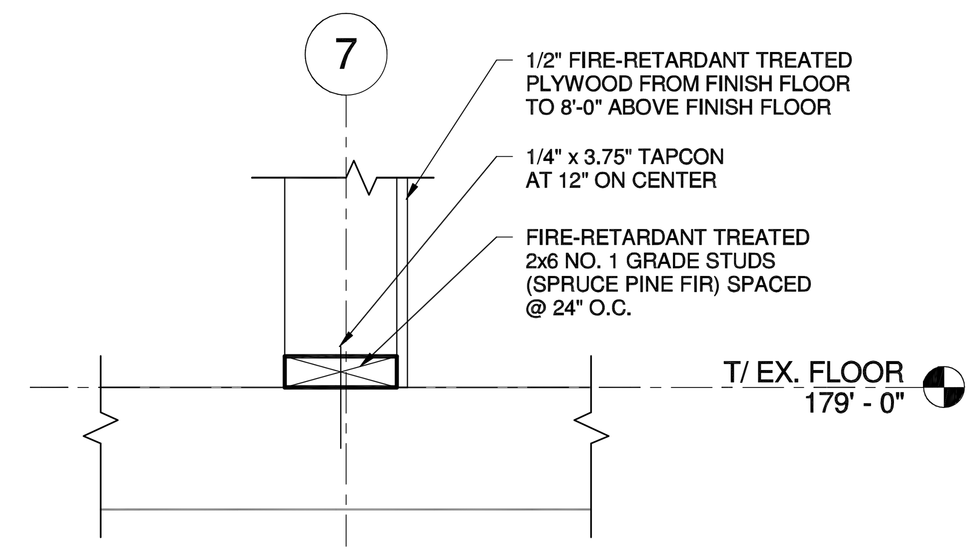
FILE NO. 2516.50682- S4
DATE SEPTEMBER 2014

S-4

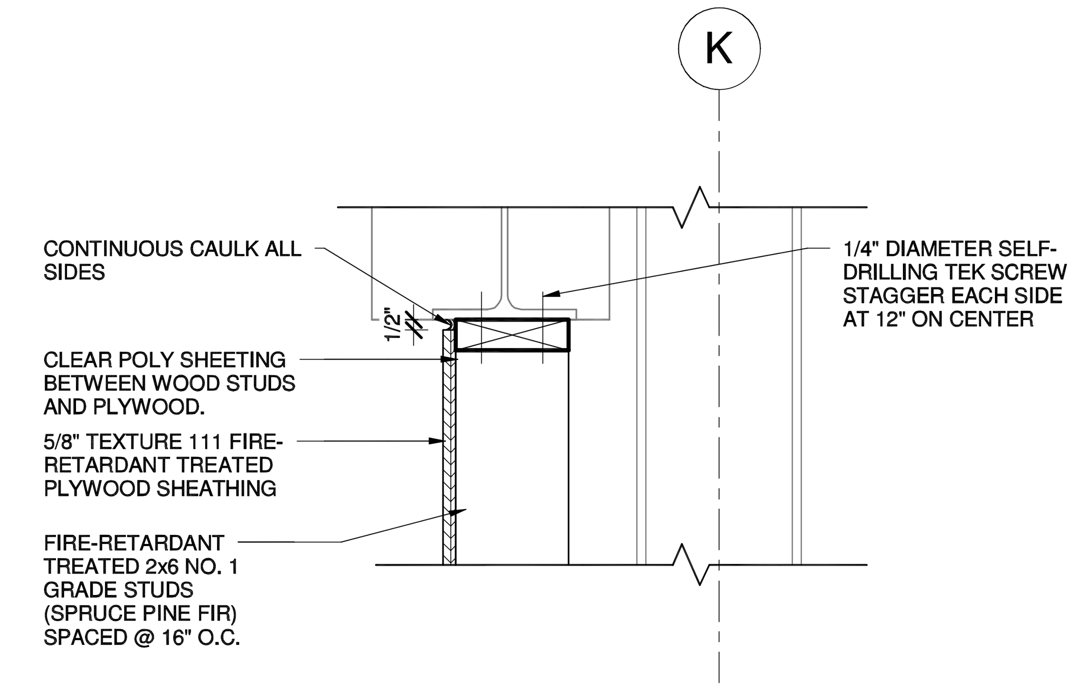
C:\Users\merriaal\Documents\EXIST.BUILDING B001 - STRUCTURAL_MerriaAL.rvt



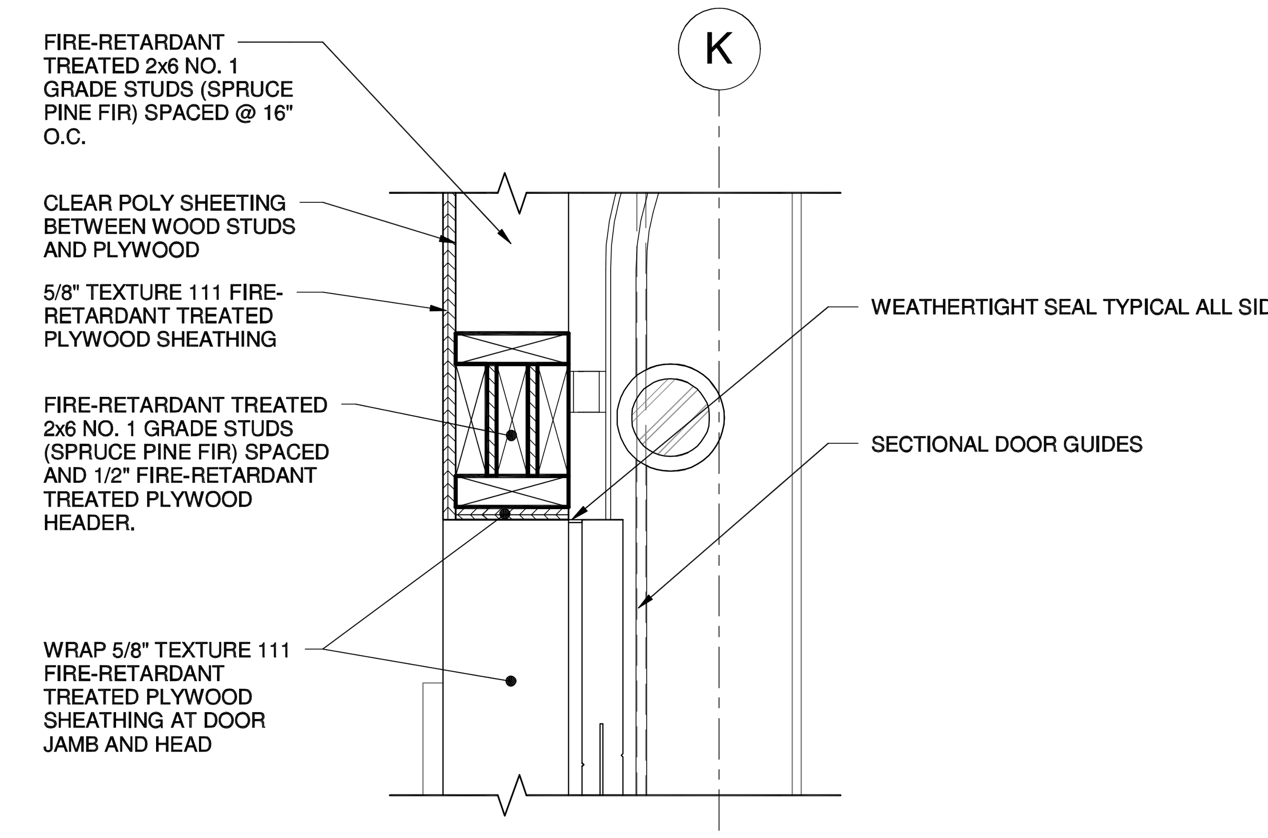
A DETAIL
1 1/2" = 1'-0"
4" 2" 0 1'



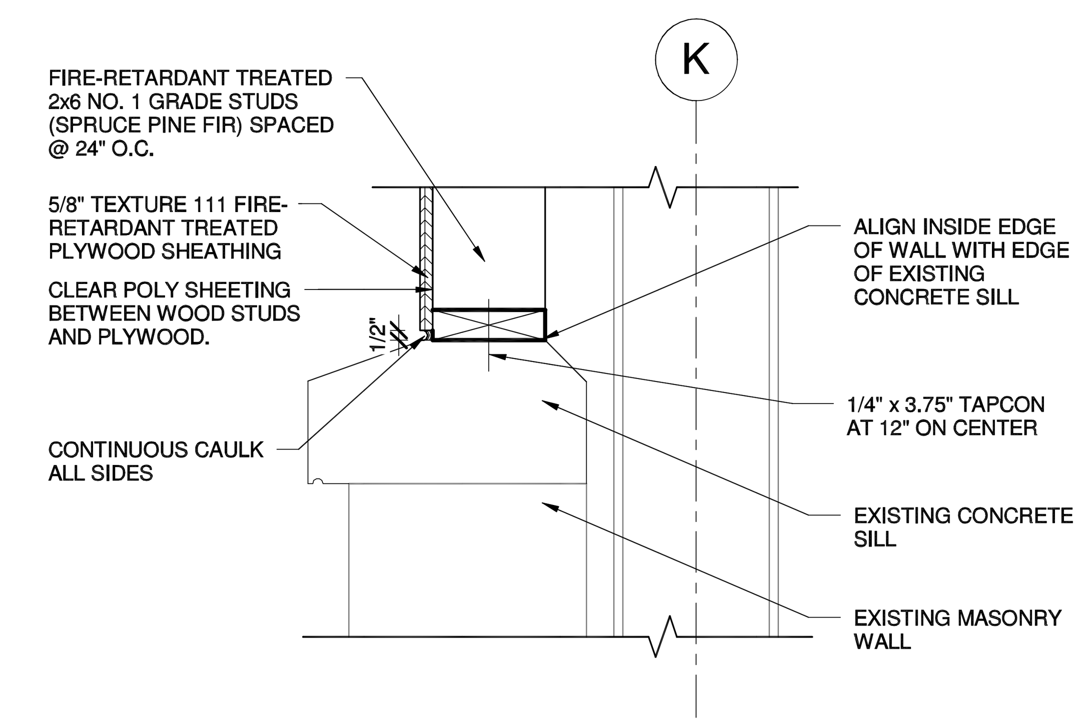
B DETAIL
1 1/2" = 1'-0"
4" 2" 0 1'



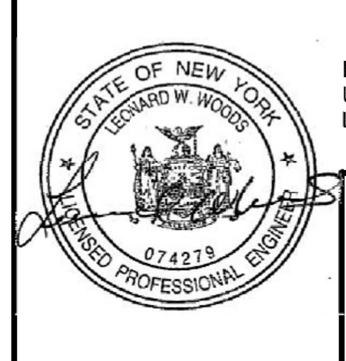
C EXTERIOR WALL HEAD DETAIL
1 1/2" = 1'-0"
4" 2" 0 1'



D OVERHEAD DOOR HEAD DETAIL
1 1/2" = 1'-0"
4" 2" 0 1'



E EXTERIOR WALL SILL DETAIL
1 1/2" = 1'-0"
4" 2" 0 1'



THIS DRAWING WAS PREPARED AT THE SCALE INDICATED. INACCURACIES IN THE STATED SCALE MAY BE INTRODUCED WHEN DRAWINGS ARE REPRODUCED BY ANY MEANS. USE THE GRAPHIC SCALE BAR TO DETERMINE THE ACTUAL SCALE.

IN CHARGE OF	LWW
DESIGNED BY	AY / NJD
CHECKED BY	LWW / NJD
DRAWN BY	RAE / ALM

NO.	DATE	REVISION	INT.
0	9-3-14	ISSUED FOR CONSTRUCTION	LWW

O'BRIEN & GERE
O'BRIEN & GERE ENGINEERS, INC

IBM
SWMU-S THERMAL REMEDIATION PROJECT
FORMER IBM KINGSTON SITE

STRUCTURAL
BUILDING B001
DETAILS

FILE NO. 2516.50682- S5
DATE SEPTEMBER 2014

S-5

O'BRIEN & GERE ELECTRICAL SPECIFICATION

SECTION 260000
ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Provide complete, tested and fully functional electrical systems as shown on the Drawings and as specified herein.

B. Electrical equipment and installed systems shall be suitable for the application, shall safe for the intended use, shall be fully rated for the available fault current, and shall conform to local building codes and statutory requirements.

1.2 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract apply to this Section.

B. Electrical requirements specified in this Section apply to electrical equipment and materials described in other Sections of Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities”.

1.3 SCOPE OF WORK

A. The work includes, but is not limited to, the work described in other Sections of Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities” and the following:
1. Underground duct banks and handholes
2. Temporary lighting and power as required for construction and as hereinafter specified
3. Field wiring for equipment provided under other Sections of the Specification
4. Thorough cleaning of all equipment prior to energization
5. Acceptance testing of all equipment installed under this Division
6. Protection of all equipment under this Division until the final acceptance of the job

B. Coordinate Division 26 requirements with work described in other Divisions of the Specification.

C. Submit pre-construction submittals, shop drawings, product data, samples, design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, operation and maintenance data, closeout submittals and other specified documents to the Engineer for review and approval as described in the General Provisions, Special Provisions, this Section, and in other Sections of Division 26”.

D. Perform electrical acceptance tests described in Part 3.

E. The following principal items of work will be performed under other Sections unless otherwise noted:

1. Motors for mechanical equipment will be furnished under other Divisions of this Specification.

1.4 PROJECT CONDITIONS

A. Ambient temperature, humidity, and elevation ranges:

1. Ambient Temperature: 0 to 40 deg C.
2. Humidity: Less than 90 percent (non-condensing).
3. Altitude: Not exceeding 3300 feet (1000 m).

B. Transformer output ratings shall be as specified in Division “Electrical” Sections "Medium Voltage Transformers".

C. Unusual service conditions:

1. Exposure to hot and humid climate or to excessive moisture and dripping water.
2. Exposure to excessively high or low temperatures.

D. Product Selection for Restricted Space: Drawings show allowable space to scale for anticipated equipment sizes. Comply with NEC requirements for working clearances and with manufacturer's recommendations for access for maintenance. Notify the Engineer if insufficient space is available for available products.

1.5 DEFINITIONS

A. In addition to the Definitions in the General Provisions, the following definitions apply to Division “Electrical”.

1. Acceptance Tests: power distribution and control equipment testing performed in conformance with NETA Acceptance Testing Specification
2. AHJ: The statutory Authority Having Jurisdiction as defined in NEC Article 100 for enforcement of legally required compliance to local codes, standards, and ordinances.
3. ANSI: American National Standards Institute
4. AEIC: Association of Edison Illuminating Companies
5. ASQ: American Society for Quality
6. AWG: American Wire Gauge
7. CFR: Code of Federal Regulations
8. Cable: an assembly of insulated conductors
9. Control panel: an electrical enclosure housing control logic devices and an operator control interface

10. Commissioning: the process of testing system performance after the sequential steps of installation, testing, energization, startup (including initial adjustment and de-bugging) and functional testing of individual pieces of equipment have all been completed
11. Contract: as used in the Electrical Specification, includes all Contract documents including Specifications and Appendices, Drawings, Addenda, and Change Orders
12. ICEA: Insulated Cable Engineers Association
13. Equipment: a general term including materials, fittings, devices, appliances, fixtures, apparatus, and the like, used as part of, or in connection with, an electrical installation (OSHA Section 29 CFR 1910.399(46) definition)
14. FM: Factory Mutual, Inc.
15. Field wiring: on-site installation of raceways & conductors to connect equipment in accordance with approved drawings
16. Field test: electrical test carried out on-site
17. Fail-safe: selection of control devices and contacts in a manner which results in safe shutdown of the equipment whenever one of the following events occurs:
    a. Power supply failure
    b. Loss of remote control RUN command (normal configuration: contacts close to run equipment)
    c. Intentional and unintentional disconnection of device (normal configuration: contacts open to shut down equipment)
    d. High contact resistance or high resistance connection
    e. Loss of 4-20mADC signal
    f. Definite-time sequence takes too long, e.g., reduced voltage motor starter fails to make transition from START mode to RUN mode after a reasonable time
    g. Defined sequence does not occur, e.g., there is no flow from a motor driven pump within a reasonable time after the motor starter contactor is energized.
18. Furnish and install: same as "Provide" below.
19. Functional testing: verification of the satisfactory performance of control logic, with due attention to the functionality of equipment protective devices, for example, overload relays, temperature switches, pressure switches, flow switches, and similar devices, under actual operating conditions
20. HV: high voltage, operating voltage over 600V (NEC definition)
21. IEEE: Institute of Electrical and Electronics Engineers, Inc.
22. ISO: International Standards Organization
23. Lineup: with respect to switchgear, switchboards, and motor control centers, a contiguous group of vertical sections with common main busbars, and including bus tie breaker sections and control sections
24. LV: low voltage, operating voltage under 600V (NEC definition)

25. Megger: insulation tester with megohm scale
26. NEC: NFPA 70, the National Electrical Code
27. NETA: InterNational Electrical Testing Association, Inc.
28. NICET: National Institute for Certification in Engineering Technologies
29. NFPA: National Fire Protection Association
30. NRTL: Nationally recognized testing laboratory as defined in 29 CFR 1910.7 as it applies to testing and inspecting for safety in the workplace (OSHA definition)
31. Nonconformity: The nonfulfillment of a specified requirement (ASQ definition)
32. "Or approved equal": proposed "equal" product shall be in conformance with all specified requirements, shall be equivalent in materials of construction to specified manufacturers' products, shall have equal or superior performance in the conditions anticipated for use of the product in this project, and shall be approved by the Engineer
33. OSHA: Occupational Safety and Health Act
34. Panel: with respect to circuit breaker and fuse power distribution centers, panel is equivalent to "distribution board", e.g., lighting panel; with respect to control panels, refers either to the entire control panel itself or to a steel plate used for mounting devices inside the control panel
35. Provide: Throughout the Specification, use of this term includes project administration, quality assurance, human resources, tools & equipment, logistics and scheduling, submittals of shop drawings & samples for approval, managing suppliers, purchasing, manufacturing, factory testing, release for shipment, packing, delivery, storage, submittal of coordinated & dimensioned installation drawings for approval, installation, surface preparation & finishes, site testing, startup & commissioning, on-site supervision by equipment manufacturers' representatives, spare parts & tools, Operations and Maintenance (O&M) Manuals, training, guarantees and warrantees, other work described in individual Sections of the Specification, and the Contractor's duties, responsibilities, risks, and liabilities under the Contract.
36. Punch list: document containing detailed descriptions of non-conformities
37. Quality: conformance to specified requirements.
38. RMS: root mean square
39. Raceways: cable ladder and tray, conduit, duct, wireway, and associated boxes and fittings which enclose, support, and protect wires and cables
40. Shop drawings: a complete package of manufacturer's equipment drawings, bill of materials, catalog data sheets, performance curves, calculations, and other data provided to demonstrate conformance to the equipment specification
41. Substitution: an alternative, nonconforming product proposed by the Contractor in lieu of a specified, conforming product
42. Substantial Completion: an electrical system may be considered substantially complete when the equipment has passed the specified tests

required prior to energization, has been energized, has passed the Electrical Acceptance Tests, and all related Specification requirements have been met except for well-defined minor items which, in the opinion of the Engineer, may be repaired or replaced prior to Final Acceptance without adversely affecting process performance.

43. Terminal box: an electrical enclosure containing labeled terminal blocks for connection of wiring
44. UL: Underwriters Laboratories, Inc.
45. VFC: variable frequency controller
46. VFD: variable frequency drive, the combination of VFC and inverter-duty motor that drive mechanical loads using the principle of variable frequency motor control
47. Wiring: conductors and connections to equipment terminals. 'Wiring' and 'cabling' shall be considered equivalent terms. Fiber optic cables shall be included in the scope of electrical wiring.

1.6 REFERENCE STANDARDS IN EFFECT

A. Notwithstanding revision dates shown in this and other Sections of Division 26 the codes and standards applicable to this project shall be those in effect when bids are submitted.

1.7 QUALITY ASSURANCE

A. In consultation with the equipment and materials Suppliers, the Contractor shall prepare and submit a Compliance Statement as described in "SUBMITTALS" with each submittal requiring approval.

B. The Engineer's review of a submittal shall not relieve the Contractor of any Contractor responsibilities under the Contract. Review of a submittal that is incomplete, or one that has nonconformities that are not described in the Compliance Statement, followed by the discovery of unapproved nonconformities, will result in replacement of the non-conforming items at no additional cost to the Owner. Substitutions require the approval of the Engineer as described in the General Provisions.

C. Manufacturers of electrical equipment shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer.

D. Equipment, materials, and installation shall conform to NEC requirements and shall be NRTL-listed and labeled.

E. On-site electrical acceptance testing shall be performed as specified in Part 3 of other Sections of the Specification.

F. Manufacturers, manufacturer's representatives, subcontractors, supervisors, installers, and testing agencies shall have qualifications and experience as described in other Sections of the Specification. Qualifications and experience submittals for firms and individuals shall be submitted, re-submitted, or updated whenever requested by the Owner's Representative.

1.8 SAFETY IN THE WORKPLACE

A. Electrical equipment and materials, and the Contractor's installation practices, shall conform to the following:

1. Current edition of OSHA sections of the Code of Federal Regulations (CFR): Part 29 CFR 1910 for General Industry and Part 19 CFR 1926 for Construction Activities
2. NFPA 70, the National Electrical Code
3. Current edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces

B. These regulations and standards impose obligations on equipment manufacturers to obtain NRTL certification, listing, and labeling to comply with OSHA (Occupational Safety and Health Act) and Department of Labor regulations.

C. All electrical equipment for which NRTL test procedures have been established shall be certified, listed, and labeled, or otherwise determined to be safe for its intended use, by a NRTL. The absence of a specific reference to NRTL-listing in other Sections shall not relieve the Contractor of the requirement to provide NRTL-listed equipment, and to obtain certification as required by the AHJ in cases where NRTL listing and labeling is not a manufacturer's standard offering for a particular product.

D. Equipment shall not be modified in any manner adversely affecting safety for the intended use, nor shall any equipment be modified on-site without the approval of the manufacturer.

E. Equipment sound levels shall not exceed limits established by reference standards and local regulations. In the absence of reference standards and local regulatory requirements, sound pressure levels shall not exceed 85 dB (A) measured three feet from the equipment.

F. Equipment with moving parts shall be fully guarded in compliance with OSHA rules and regulations.

1.9 INSPECTIONS BY THE AHJ

A. The Contractor shall make arrangements for electrical inspection of the project by the AHJ. Upon completion of the work, final certificate of approval documents shall be submitted to the Engineer for forwarding to the Owner. This certificate shall be submitted prior to request for final payment. The Contractor shall pay all fees required for inspection.

1.10 WORKMANSHIP AND MATERIALS

A. Materials and equipment shall be new and undamaged, shall be marked by the manufacturer, and shall be delivered to the construction site in the original factory packaging.

B. Materials and equipment shall be installed in accordance with the Drawings, the Specification, the manufacturer's installation, operation, and maintenance instructions, and NECA installation standards that have been adopted by ANSI. In the event of apparent conflicts or discrepancies, the Engineer shall be informed of the apparent conflict or discrepancy in writing, and will instruct the Contractor how to proceed.

1.11 RESOURCES AND CONSTRUCTION SCHEDULE

A. The Contractor shall provide sufficient resources, including qualified and experienced project managers, electrical engineers, superintendents, technicians, supervisors, electricians, tools and construction equipment to complete the electrical work in accordance with the activity durations and sequences shown on the Construction Schedule for this project.

B. The construction schedule shall include the following activities and milestones, in realistic sequence, for each major item of electrical equipment in each building:

1. Review of shop drawings
2. Approval of shop drawings (milestone)
3. Factory testing
4. Shipping
5. Delivery to site (milestone)
6. Equipment installation (including "remote" sites)
7. Tests on completion of installation (prior to energization)
8. Energization (milestone)
9. Acceptance testing
10. Functional testing
11. Installation, acceptance testing, and functional testing and commissioning complete (milestone)

C. The construction schedule shall include the following activities and milestones, in the following sequence, for electrical raceways and wiring in each building and structure:

1. Materials delivery to site (milestone)
2. Wire & cable installation
3. Acceptance testing complete (milestone)

1.12 CONTRACT DRAWINGS

A. The Electrical Drawings show scaled layouts of “basis of design” equipment but do not include "approved for construction" dimensions for equipment, which shall be based on approved equipment shop drawings.

1.13 COORDINATION OF ELECTRICAL WORK WITH OTHER TRADES

A. Work under this Division shall be performed in conjunction with the work of other trades. Coordinate electrical installation work with the overall construction schedule. Examine the plans and specifications prior to commencement of work and become familiar with all phases of work involved prior to commencing installation work.

B. The Contractor shall be responsible for coordinating dimensions of equipment and working clearances in accordance with the NEC, and in all cases shall bring to the attention of the Engineer any discrepancies on the plans and in the specifications prior to installation. Any work that installed without conformance to NEC requirements shall be removed and reinstalled at the Contractor's expense. The layout for sleeves, chases, openings, etc., must be arranged prior to construction in order to prevent unnecessary cutting. Examine Architectural drawings for doors swings, countertop heights, built-in furniture and casework, and other factors affecting electrical outlet locations prior to roughing-in raceways, boxes, fittings, and outlets.

1.14 CODES AND STANDARDS

A. All equipment and materials shall be manufactured, tested, and installed in accordance with the National Electrical Code (NEC) and local codes and standards, in accordance with the requirements of the AHJ.

B. In addition, work shall be in accordance with the versions of the following referenced standards in effect at the time of bid opening:

1. American Association for Laboratory Accreditation (A2LA) (establishes NRTL accreditation)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Americans with Disabilities Act (ADA)
5. Code of Federal Regulations (29 CFR 1903, 1910, and 1926)
6. Factory Mutual Engineering & Research (FME&R)
7. Illuminating Engineering Society of North America (IESNA)
8. Institute of Electrical and Electronic Engineers (IEEE)
9. Insulated Cable Engineers Association (ICEA)
10. International Building Code
11. International Organization for Standardization (ISO)
12. National Electrical Contractors Association (NECA)

13. National Electrical Manufacturers Associates (NEMA)
14. National Fire Protection Association (NFPA)
15. Occupational Safety and Health Act (OSHA)
16. Underwriters Laboratory, Inc. (UL) and other NRTL standards and test procedures

1.15 SUBMITTALS

A. In addition to conforming to the requirements described in the General Provisions, submittals shall conform to the following requirements.

B. One complete shop drawing submittal is required for all of the electrical equipment described in single Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities” Sections of the Specification. Prerequisites for equipment shop drawing submittals, for example, Harmonics Analysis submittals associated with Variable Frequency Controllers and Coordination Studies associated with Switchgear, are described in each Section. Incomplete shop drawing submittals, and out-of-sequence shop drawing submittals, will be reviewed to the extent needed to determine incompleteness and out-of-sequence, and returned to the Contractor for re-submission.

C. Compliance Statement: with each Shop Drawing submittal, include a Compliance Statement listing each Specification Section, and Part 1, 2, and 3 Sub-Sections, stating, paragraph-by-paragraph, compliance with the Specification, each minor nonconformity that is within the intent of the Specification, and proposed nonconformities. Provide short description of minor nonconformities, and detailed explanation of other nonconformities.

D. Submittal Format
1. Each submittal shall be accompanied by a transmittal letter showing the submittal category and Specification Section reference number(s). Submittals shall be 3-hole punched and neatly bound in a 3-pin or 3-ring binder. Stapled bindings are not acceptable.
2. Submittals shall have a complete Table of Contents with tabs corresponding to the Table of Contents headings.
3. Submittal transmittal letters shall clearly identify the reason for submittal, e.g., for approval, as manufactured, or as-built / record.
4. Each page of each submittal shall be numbered. Page numbers shall be listed on the Table of Contents. Content shall be printed on 8-1/2 x 11 inch paper, or 11 x 17 paper (folded). Larger size drawings shall be folded and placed in labeled individual clear plastic pockets.
5. Product Data shall be clearly marked to show which items are proposed for this project. Information that does not apply to this project shall be crossed out.

E. Submittal Categories

1. Preconstruction Submittals, including proposed substitutions, supplier and manufacturer qualifications and experience, construction scheduling
2. Shop Drawings, including equipment drawings with a complete bill of materials and supporting manufacturer's catalog data. One separate and complete shop drawing submittal for all of the equipment specified in each Section is required.
3. Product Data, marked to indicate precisely which items are proposed for this project. One complete and separate Product Data submittal for all of the equipment and materials described in each Section requiring a product data submittal, is required. See Submittals requirements in other Sections in Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities” to determine if Product Data is to be included in Shop Drawing submittals.
4. Samples, labeled by name, Specification Section and sub-clause, and mounted on sample boards
5. Design Data, including manufacturer's design calculations, where specified
6. Test Reports, including prototype tests, factory tests, field tests, acceptance tests, and functional tests. A test report is required for each specified test.
7. Certificates, including seismic qualification certification, welding certificates, factory training certificates for manufacturer's representatives
8. Manufacturer's Installation Instructions, including unloading, hoisting, rigging, short term storage, long term storage, method of field assembly, and other installation instructions
9. Manufacturer's Field Reports, including inspections and training records
10. Operation and Maintenance Manuals, including manufacturer's standard published literature and specially prepared descriptions of operation
11. Closeout Submittals, including black line paper copy of Record Drawings marked in red illustrating changes during construction
12. Spare Parts and Special Tools List

F. In the absence of contradictory instructions in the General Provisions, Shop Drawings shall be marked with revision blocks to indicate status as follows:

1. FOR APPROVAL
2. AS MANUFACTURED (incorporates Engineer's comments)
3. AS BUILT / RECORD (incorporates on-site modifications)

G. Record Drawings: Maintain a full size paper set of "black-line" working drawings throughout the project, and carefully record in red ink the locations and sizes of each major piece of electrical equipment, as well as manholes, handholes, and duct bank routing, to scale. Upon Substantial Completion of the work, deliver the marked-up set of prints to the Engineer. The Engineer reserves the right to withhold final payment until "As-Built" drawings are received.

H. Operation and Maintenance Manuals: Provide copies of electrical Operation and Maintenance Manuals in conformance with the General Provisions. O&M Manuals shall be organized according to Divisions "Electrical", "Communications", "Electronic Safety and Security" and "Utilities" Section numbers. Each copy shall be bound in a durable, 3-ring hardback binder, with data sheets individually punched and reinforced to prevent tearout. Data sheets shall be grouped, and binder dividers shall be provided to match the Table of Contents. Each Manual shall have an identifying label on the spine and front cover and shall include the following:

1. List of all O&M Manuals in the front of each manual.
2. Table of Contents for each manual and each binder
3. Copy of each of the following:
   a. Preconstruction Submittals
   b. Shop Drawings
   c. Product Data
   d. Design Data
   e. Test Reports
   f. Certificates
   g. Manufacturer's Instructions
   h. Manufacturer's Field Reports
   i. Operation and Maintenance Data
   j. Closeout Submittals

I. Spare Parts and Special Tools List: 90 days prior to the scheduled Substantial Completion date, submit a complete list of Spare Parts and Special Tools included in other Sections of Division 26 to the Owner, and request a time and location for delivery of the Spare Parts and Special Tools to the Owner.

1.16 OUTAGES

A. Electrical outages: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service if required by the Specification.

1. Submit written requests to the Owner for approval of proposed electrical outages a minimum of 30 days in advance of proposed interruption of electrical circuits, with step-by-step sequence and schedule for proposed outage. If required to maintain critical processes in operation during an outage, submit proposed method of providing temporary electrical circuits and power supplies.
2. Confirm approved interruption of electrical service one week in advance of Owner-approved date.
3. Do not proceed with interruption of electrical service without written approval from the Owner.

1.17 TEMPORARY LIGHTING AND POWER

A. Refer to the General Provisions.

B. The Contractor shall provide all temporary electric services for power and lighting including panels, feeders, lighting, outlets, branch circuits, etc.

C. The Owner's electrical power shall not be used without permission of the Owner.

D. All temporary work shall be in accordance with the NEC, OSHA, and NFPA safety requirements and shall be completely removed upon completion of the project.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide equipment and materials in compliance with other Sections of Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities”. The requirements in this Section apply to all Sections in Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities”.

2.2 WITNESSED FACTORY TESTS:

A. Witnessing factory tests are required for the following equipment:

1. Medium Voltage Transformers

B. Notify the Owner's Representative 60 days in advance of the scheduled date for factory tests listed above, and confirm the date 30 days in advance. The Owner's Representative will notify the Contractor which factory tests will be attended by the Owner's Representative.

2.3 ELECTRICAL IDENTIFICATION

A. Electrical equipment, raceways, boxes, fittings, wires and cables shall be marked in the field in accordance with Division “Electrical” Section "Identification for Electrical Systems".

2.4 ELECTRICAL ENCLOSURES

A. In the absence of other specified NEMA enclosure ratings in other Sections of the Specification, and where cross-referenced in other Sections of Divisions “Electrical”, “Communications”, “Electronic Safety and Security” and “Utilities” electrical enclosures shall have degree of protection ratings suitable for the intended application (e.g., watertight, dust-tight, explosion-proof) and environmental conditions.

B. Electrical equipment enclosures shall have the following NEMA 250 ratings for the following specified non-hazardous locations unless otherwise indicated:

1. NEMA 1 or 1A painted steel:
    a. Electrical Rooms
    b. Clean, dry, indoor rooms in administrative office building areas
2. NEMA 3R painted steel: Electrical enclosures located outdoors.
3. NEMA 12: Clean, dry non-process areas, attics, and HVAC equipment rooms

C. Where different enclosure ratings and enclosure materials are specified in other Sections of the Specification, the Contractor shall submit a written request for clarification of the intent of the Specification to the Engineer.

2.5 ELECTROMAGNETIC INTERFERENCE

A. Power conversion equipment, including variable frequency controllers, battery-powered inverters, computer power supplies, frequency converters, and Uninterruptible Power Supplies, shall be fitted with EMI (electromagnetic interference), RFI (radio frequency interference) and telephone interference filters to limit interference effects on other equipment in the area in accordance with IEEE standards and recommendations applicable to the equipment.

2.6 DISSIMILAR METALS

A. Dissimilar metals shall not be connected, spliced, or joined except where specifically approved in writing by the Engineer. Copper busbars, aluminum busbars, and copper-to-aluminum busbar connections shall be tin-plated at joints and at cable lugs. Bolted electrical conductor connections shall be made with silicone-bronze bolts, nuts, and washers. Belleville washers & tin-plated flat washers shall be used at aluminum-to-copper and aluminum-to-aluminum busbar joints.

2.7 WARRANTIES

A. Warranties for equipment and materials shall conform to the General Provisions.

B. Provide an on-site parts and labor warranty for a minimum period of one year after Substantial Completion for all equipment and materials. In cases where the manufacturer offers a longer warranty period, the longer warranty period shall apply as described by the manufacturer.

C. All components of electrical systems that are not fully functional at the time of Substantial Completion shall have warranties extended to provide minimum one year coverage of fully operational equipment unless otherwise approved by the Owner's Representative.

PART 3 - EXECUTION

3.1 DELIVERY AND HANDLING

A. Equipment delivered to site shall be handled in accordance with manufacturer's recommendations by experienced riggers, crane operators, and fork lift truck operators.

3.2 STORAGE AND PROTECTION OF EQUIPMENT

A. All electrical equipment to be used in construction shall be properly stored and protected against the elements. General construction materials shall be stored in covered trailers. Switchgear, unit substations, motor controllers, panelboards, emergency lighting, solid state equipment, engine generator shall be stored in a clean, dry, indoor location, under cover, until the building is weathertight and the area where the equipment is to be installed has been completed to the satisfaction of the Engineer, including completion of overhead work by other trades.

B. Long term storage instructions of the manufacturer shall be followed.

C. Equipment with anti-condensation heaters shall have the 120VAC anti-condensation heaters energized from temporary 120VAC supplies as soon the factory packaging has been opened.

D. Equipment enclosures exposed to construction damage such as paint spots, spackling, waterproofing, insulation etc. shall be covered and protected against damage.

3.3 INSPECTIONS PRIOR TO COVERING-UP

A. Raceways embedded in concrete or otherwise concealed shall be inspected in the presence of the Engineer's Representative prior to placement of concrete. Sufficient time shall be allowed to make corrections if required.

3.4 ON-SITE INSPECTIONS AND NONCONFORMITIES

A. Equipment shall be inspected on delivery to site for physical damage and for compliance with the Specification and approved equipment shop drawings.

B. Installed equipment, raceways, and wiring shall be inspected on completion of installation for compliance with the Specification and approved installation drawings.

C. A Punch List will be prepared by the Owner's Representative during inspections and testing, and issued to the Contractor for corrective action.

D. Repairs, replacement, and other corrective action that requires de-energizing any part of the Electrical Power Distribution and Control System shall be completed prior to the scheduled date for Substantial Completion of the project.

3.5 PENETRATIONS AND SEALING

A. Sleeves and rectangular openings shall be provided for raceways provided under this Contract, and for raceways for future equipment where future equipment is shown on the Drawings. Sleeves and rectangular openings for the passage of raceways and conductors shall be sealed after the raceways and conductors have been installed. Spare sleeves and rectangular openings shall also be sealed.

B. Penetration of Waterproof Construction: Coordinate the work to minimize penetration of waterproof construction, including roofs and exterior walls. Where penetrations are necessary, provide sleeves and sealing fittings to make each penetration watertight. Conduit sleeves and openings shall be sealed watertight with mechanical seals. Watertightness shall not rely on caulking.

C. Penetration of Fire-Rated Construction: Sleeves and openings in fire-resistant walls and floors for electrical raceways, wires, and cables shall be sealed after installation of the raceways, wires, and cables with NRTL-certified fire penetration seals, sealant, and fire-rated foam filler products to the same degree of fire resistance (e.g., 1, 2, or 4 hours) as the adjacent walls and floors, and to the satisfaction of the AHJ. Where both fire sealing and water sealing is required, mechanical seals with NRTL-listed fire-resistant properties shall be used. Fire sealants shall be compatible with the cable jacket and wire insulation materials. Manufacturer's certification of compatibility shall be provided at the request of the Engineer. For additional requirements, refer to Division “Electrical” Section "Raceways and Boxes for Electrical Systems".

3.6 ALTERATIONS AND REMOVAL OF EXISTING WORK

A. Conform to the General Provisions.

B. Where the work specified under this Division connects to the existing electrical systems, the Contractor shall perform all necessary alterations to the existing work as required.

C. All work performed on the existing electrical systems shall be in accordance with the applicable provisions of the Specification. Visit the project site prior to submitting bids and examine the conditions in which work will be performed. Carefully document all existing conditions pertaining to removal and demolition work.

D. Contractor shall make connections to existing equipment where indicated on the Drawings.

E. All existing electrical materials not reused under this Division, and not indicated for handover to the Owner, shall become the property of the Contractor and shall be expeditiously removed from the project site.

F. While performing connections and alterations to existing electrical work, the Contractor shall take special care to protect all existing equipment from dirt, debris and damage. Damaged equipment shall be replaced at no additional cost to the Owner.

G. All removal work shall be performed in a neat and workmanlike manner and shall be executed with the least possible disturbance to the building and tenants. The scheduling of all removal work shall be coordinated with other trades and with the Owner's schedule and operation of the building.

H. Where removal work is performed, the Contractor shall repair all building surfaces damaged by such work. Cut back embedded conduits to 2 inches minimum below finished face of walls, floor, and ceilings, and fill in holes with appropriate patching material. Repair, re-tile, replace (in the case of ceiling panels) or re-paint to match existing adjacent surfaces.

3.7 ELECTRICAL SAFETY AND TEST EQUIPMENT

A. Maintain the following test instruments and calibration certificates less than 12 months old on-site as a minimum:

1. True RMS digital volt-ohm meter with resistance scale
2. Clip-on ammeter with range from 1 to 1000 amps
3. 1000V DC battery-powered megger insulation tester

B. Provide electrical safety equipment, including personal protective equipment, hot sticks, HV gloves, electrical blankets, test instruments, lighting, ventilation, and instructions in the use of safety equipment, and perform the work under this Contract in accordance with applicable safety rules and regulations. The Contractor's attention is directed to safety issues related to confined spaces as defined in OSHA regulations.

C. One numbered safety lockout padlock with an 'unlawful-to-duplicate' unique key shall be provided for each motor controller. Safety lockouts shall be used during testing and commissioning, and shall subsequently be handed over to the Owner in a lockable sheet metal key cabinet. The safety lockout padlock supplier shall be a specialist supplier with a registered key program.

3.8 CLEANING AND PAINTING

A. Conform to the General and Special Provisions.

B. After installation and wiring work is completed, all dust and debris shall be removed from the interior and exterior of each electrical equipment enclosure and motor by vacuum-cleaning with circuits de-energized. Do not use compressed air for cleaning. Vacuum cleaner wands and brushes shall be non-conducting. Anti-static protection shall be provided for static-sensitive devices.

C. Clean and remove all rust, scale, oil, grease, and dirt from panelboard enclosures, conduits, pull, junction and terminal boxes, fittings and hangers, leaving surfaces in condition for final surface preparation and painting under Division “Finishes”.

D. All ferrous materials that are concealed, or exposed in unfinished areas, including fittings, hangers, junction, pull and terminal boxes, that are not plated or painted with a factory-applied finish, shall be painted under this Section with one coat of zinc-chromate primer and one finish coat of paint approved by the Engineer. Nonferrous materials shall be cleaned only and left unpainted.

E. Equipment furnished with a factory finish coat shall have finish carefully touched-up where it is scratched or otherwise damaged. Touch-up work shall be match the color and type of the original finish.

3.9 INSPECTION AND TESTING ON-SITE

A. The Contractor shall hire a NETA-certified or NICET-certified specialist electrical testing firm to perform on-site inspection and electrical testing.

B. Perform Electrical Acceptance Tests in accordance with NETA Acceptance Testing Specifications as described in Part 3 of each Section of Division “Electrical”.

C. Submit manufacturer-endorsed field test data sheets & procedures for approval, test equipment and materials on-site prior to site visit by manufacturer's factory-trained representative, test equipment on-site under the supervision of the Owner's Representative and the equipment manufacturer's factory-trained representative(s), and submit manufacturer's statement of acceptance of installation prior to energization of equipment. Invite the Engineer and Owner's Representatives to witness field testing.

D. Electrical equipment shall not be energized without the approval of the Engineer.

E. A complete certified electrical test report shall be compiled by the electrical testing firm, checked for completeness, and submitted for the record.

F. The Contractor shall notify all parties whose presence is necessary for the test; and in all cases, the Engineer shall be notified at least one week prior to the actual test.

3.10 ELECTRICAL POWER DISTRIBUTION SYSTEM FUNCTIONAL TESTS

A. Conform to the General Provisions.

B. After testing and commissioning for equipment has been completed, the following functional tests of the electrical power distribution and control system shall be carried out by the Contractor's specialist electrical testing firm in the presence of the Engineer or Owner's representative:

1. Using a precision laboratory voltmeter with certified 0.1 % accuracy, record incoming supply voltages for each switchgear lineup, switchboard, and motor control center in the presence of the Engineer's Representative. Measurements shall be taken under no-load and normal load conditions. Readings which indicate more than 1% voltage difference between phases will require corrective action.
2. Using a precision harmonic voltage and current measuring and recording instrument, measure the total harmonic voltage distortion at each motor control center and switchboard main busbars (through the normal metering test blocks). Measurements shall be taken at two or three different operating load conditions determined by the Engineer.

C. Additional testing shall be carried out where recommended by equipment suppliers or requested by the Engineer.

3.11 DISTURBING EXISTING PAVEMENT AND LANDSCAPING

A. Where cutting existing pavement and disturbing existing landscaping is necessary to perform work included in this Contract, the Contractor shall employ professional subcontractors to restore the appearance of disturbed areas to their original condition.

END OF SECTION 260000

SECTION 260513
MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide single or multiple conductor shielded medium voltage power cable suitable for use in wet and dry locations in conduit, underground duct systems, and direct buried, as shown on the Drawings and in conformance with the requirements in this Section.

B. Include related cable splices, terminations, fireproofing and accessories required for a complete medium voltage electrical power cable system.

C. This Section describes 5 through 35 kV (nominal voltage) solid dielectric insulated cable requirements.

1.2 RELATED DOCUMENTS

A. Medium Voltage Cable components and related requirements are also specified in the following Sections:

1. Division “Electrical” Section “Grounding and Bonding for Electrical Systems” for equipment grounding conductor and bonding jumper requirements

1.3 DEFINITIONS

A. In addition to the definitions in Division “Electrical” Section “Electrical”, the following definitions apply to this Section:

1. Corona: with regard to cables, an electrical discharge across a void in the insulation
2. Discharge-free: cable corona properties in compliance with NEC Article 310.6
3. Ozone-resistant: cable ozone resistance properties in compliance with NEC Article 310.6
4. Pothead: a liquid dielectric-filled cable conductor and insulation termination device
5. Stress Relief: application of semiconducting and insulating materials where shields are cut for splicing and terminations, to reduce the voltage gradient in the cable insulation system
6. Stress Cone: a cable termination devise for shielded medium voltage cable that reduces the voltage gradient across the insulation where the cable shield is cut to make the cable termination

1.4 QUALIFICATIONS

A. The cable manufacturer shall have AEIC Qualification Test Reports available for the specified cable type as evidence of proven ability to meet or exceed the requirements of AEIC CS8-2000.

B. The cable manufacturer, splice and termination kit manufacturer, and other component manufacturers shall have quality certification to ISO 9000:2000 or equivalent.

1.5 REFERENCE STANDARDS

A. Comply with the following standards in effect at the time of bid submittal:

1. AEIC CS8-00 (1st Edition) Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV
2. ANSI/ICEA S-97-682-2000 Utility Shielded Power Cables Rated 5 Through 46 kV
3. ASTM B3-01 Standard Specification for Soft or Annealed Copper Wire
4. ASTM B496-01 Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
5. ICEA / NEMA S-93-639 Shielded Power Cables
6. ICEA P-32-382-1999 Short-Circuit Characteristics of Insulated Cable
7. ICEA P-34-359-1973 AC/DC Resistance Ratios @ 60Hz - 1973 Reprint
8. ICEA P-45-482-1999 Short-Circuit Performance of Metallic Shields & Sheaths
9. ICEA P-46-426 Power Cable Ampacities - Out of Print (See IEEE 835)
10. ICEA P-57-653-1995 Guide for the Implementation of Metric Units in ICEA Publications
11. ICEA P-60-573 Guide for Tapes, Braids, Wraps & Serving Specifications (Draft)
12. ICEA T-22-294-1983 Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations
13. ICEA T-24-380-1994 Guide for Partial-Discharge Test Procedure
14. ICEA T-31-610-1994 Guide for Conducting a Longitudinal Water Penetration Resistance Test for Sealed Conductor
15. ICEA T-32-645-1993 Guide for Establishing Compatibility of Sealed Conductor Filler Compounds with Conductor Stress Control Materials
16. ICEA T-33-655-1994 Low Smoke, Halogen-Free Polymeric Jackets
17. ICEA T-34-664-1996 Conducting Longitudinal Water Penetration Resistance Tests on Cable
18. IEEE 48 -1996 Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV Through 765 kV
19. IEEE 82 -1994 IEEE Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors

20. IEEE 400 -2001 IEEE Guide Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
21. IEEE 404 -2000 IEEE Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500 000 V
22. IEEE 576-2000 Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
23. IEEE 592 -1990 (R1996) IEEE Standard for Exposed Semiconducting Shields on High-Voltage Cable Joints and Separable Insulated Connectors
24. IEEE 835-1994 (R2000), IEEE Standard Power Cable Ampacity Tables
25. IEEE 1026-1995 IEEE Recommended Practice for Test Methods for Determination of Compatibility of Materials with Conductive Polymeric Insulation Shields and Jackets
26. IEEE 1142-1995 IEEE Guide for the Design, Testing, and Application of Moisture-Impervious, Solid Dielectric, 5-35 kV Power Cable Using Metal-Plastic Laminates
27. IEEE 1143-1994 IEEE Guide on Shielding Practice for Low Voltage Cables
28. IEEE 1210-1996 IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable (CSA)
29. IEEE 1299/C62.22.1-1996 IEEE Guide for the Connection of Surge Arresters to Protect Insulated, Shielded Electric Power Cable Systems

1.6 ENVIRONMENTAL CONDITIONS

A. Environmental Conditions: Temperature range, humidity range, and elevation are specified in Division “Electrical” Section “Electrical”.

B. Cable installed underground shall be suitable for continuous submersion in groundwater.

1.7 SUBMITTALS

A. Product Data: For each type of cable indicated on the Drawings, showing cable cross-section, materials of construction, and descriptions with applicable standards. Submit splices and terminations for cables and cable accessories together with cable submittal. Data sheets shall have sufficient level of detail to indicate compliance with the requirements described in this Section.

B. Qualification Data: For cable manufacturer, for splice and termination kit manufacturer, and for testing agency.

C. Material Certificates: For each cable and accessory type, signed by manufacturers, certifying that cables comply with requirements specified in Part 2 Article "Quality Assurance".

D. Operation and Maintenance Data: For cables, splices, terminations, and accessories.

1.8 QUALITY ASSURANCE

A. The cable manufacturer shall supply a copy of the manufacturer's latest AEIC Qualification Test Report with the product data sheet submittal to the Engineer. The results of the tests performed shall meet or exceed the requirements of AEIC CS8.

B. Installer: Engage a licensed electrician, trained in the installation of high voltage cables and with a training certificate from an authorized representative of the splice and termination manufacturer, to install, splice, and terminate medium-voltage cable.

C. Source Limitations: Obtain all medium voltage cables through one source from a single qualified manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with IEEE C2 and NFPA 70.

1.9 WARRANTY

A. To demonstrate long term reliability and performance of the cable, the manufacturer shall issue a forty-year warranty with replacement cost provisions on the product. The warranty shall be signed by an officer of the company and submitted with the product data sheet submittal to the Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements described elsewhere in the Section, provide products by one of the following:

1. Cables:
    a. Pirelli Cables & Systems NA.
    b. The Kerite Co., Hubbell Incorporated
    c. The Okonite Company
2. Cable Splicing and Termination Products and Accessories:
    a. G&W Electric Co.
    b. Pirelli Cables & Systems NA
    c. Raychem Corp., Telephone Energy and Industrial Division.
    d. RTE Components, Cooper Power Systems, Inc.

e. The Scott Fetzer Co., Adalet, Inc.
f. Thomas & Betts Corporation.
g. Thomas & Betts / Elastimold.
h. 3M Company, Electrical Products Division.

2.2 CABLES

A. Cable Type: UL MV-105.

B. Voltage Rating: 15 kV.

C. Insulation Thickness: 133 percent insulation level.

D. The cable shall be rated 130 deg. C minimum for emergency overload operation, and 250 deg. C for short circuit conditions.

E. Conductor: The conductor shall be uncoated soft copper, compact round, Class B stranded, in accordance with ASTM B 496.

F. Conductor Screen: An extruded layer of thermosetting semiconducting compound shall be applied over the conductor. The thickness of the conductor screen shall be per AEIC CS8.

G. Insulation: The insulation shall be a thermosetting ethylene propylene based elastomer that meets or exceeds the electrical and physical characteristics of ICEA S93-639, Class III type insulation, and AEIC CS8. The thickness shall be per Table I. The insulation shall be triple tandem extruded with the conductor and insulation screens, and be applied in accordance with the above referenced industry standards.

H. Insulation Screen: The insulation screen shall be an extruded semiconducting compound. The screen shall be applied in complete accordance with AEIC CS8.

I. Metallic Shield: The outer semiconducting screen shall be covered with a shield consisting of 5-mil bare copper tape applied helically with a minimum 12.5% overlap.

J. Separator Tape (Optional): Jacket shall be easily removable for splicing and terminations. Moisture-resistant helically applied separator tape may be provided for easy removal of jacket at the discretion of the cable manufacturer.

K. Jacket: The overall jacket shall be sunlight and oil resistant black polyvinylchloride or polyethylene and shall meet the requirements of ICEA S93-639. The thickness shall not be less than 80% of the specified minimum average.

L. Circuit Identification: Color-coded imprinted tape (black, red, blue) under the metallic shielding.

M. Jacket Identification: An identifying legend shall be printed on the jacket with contrasting ink or by indent printing and be repeated at two-foot intervals. The minimum information shall include: Manufacturer's Name, Conductor Size, Conductor Material (copper or aluminum), Insulation Type & Thickness, Voltage Rating, and UL Ratings.

2.3 SOLID TERMINATION

A. Multi-conductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.

1. Compound-filled, cast-metal body, metal-clad cable terminator for metal-clad cable with external plastic jacket.
2. Heat-shrink sheath seal kit with phase- and ground-conductor re-jacketing tubes, cable-end sealing boot, and sealing plugs for unused ground-wire openings in boot.

B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Minimum insulation class shall be same as cable. Include shield ground strap for shielded cable terminations.

1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone rubber, insulator modules; shield ground strap; and compression-type connector.
2. Class 1 Terminations: Heat-shrink type with heat-shrink inner stress control and outer non-tracking tubes; multiple, molded, non-tracking skirt modules; and compression-type connector.
3. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief shield terminator; multiple-wet-process, porcelain, insulator modules; shield ground strap; and compression-type connector.
4. Class 3 Terminations: Not acceptable.

2.4 QUALITY ASSURANCE

A. Production Tests: The conductor shall meet the electrical resistance requirements of ICEA S-93-639 for shielded cable or ICEA S-94-649 for concentric neutral cable. The insulation resistance test shall be performed in accordance with the relevant ICEA standard, and shall have an insulation resistance constant of at least 50,000-megohms at 1000 ft. at 15.6 deg. C.

B. High voltage AC high potential test: In accordance with the relevant ICEA standard, AC test voltages shall be as specified in Table I below.

TABLE I		
Voltage(kV)	Insulation Wall (mils)	AC Test Voltage (kV)

15	220	44

C. The shield resistance shall be measured and recorded from end to end on the completed cable.

D. The cable shall be corona discharge tested in accordance with the relevant ICEA standard. The maximum allowable discharge in picocoulombs is 5 pc throughout the entire specified test voltage range.

E. Certified factory test reports shall be furnished for all cables.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that conduits, duct banks, manholes, handholes, and pullboxes are clean and clear of construction debris prior to cable installation.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver cables to construction site just prior to installation.

B. Store cables on reels and transport reels in compliance with manufacturer’s printed instructions.

C. Cable ends shall be capped and taped watertight until terminations and splices are installed.

3.3 CABLE LAYING AND PULLING

A. Install cables in accordance with IEEE 576 and AEIC CG5-90

B. Pulling cables: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
   1. Lubricate cables with pulling compound or lubricant that is approved by the cable manufacturer and will not deteriorate conductor or insulation materials of construction.
   2. Follow cable manufacturer’s recommendations for attaching pulling means to cables, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to cable jacket alone for pulling.

C. Install cables in conduit as shown on the Drawings.

D. Support cables in accordance with manufacturer’s recommendations.

3.4 CABLE TERMINATIONS

A. Install terminations at ends of conductors and seal multi-conductor cable ends with standard kits.

B. Cable terminations shall be performed by experienced high voltage electricians, using kits with components that are selected specifically for the size and type of cable being terminated. Termination kit manufacturer's instructions shall be carefully followed.

3.5 SEALING

A. Seal around cables passing through fire-rated walls and floors to maintain the integrity of the fire resistance rating of the walls and floors. Use manufacturer's standard UL-Listed products installed in conformance with the manufacturer's instructions.

3.6 GROUNDING

A. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.

3.7 IDENTIFICATION

A. Identify each phase of each cable with embossed rectangular nylon cable tags at each termination. Nylon cable tags shall be fastened to cables just below the stress cones with nylon ties, and shall be oriented for easy visibility.

B. Identify each cable with engraved or stamped round stainless steel cable tags in each manhole, handhole, and pull box.

C. Tags shall have the legend 13.2 KV FEEDER NO. ___ PHASE A" (or B or C as appropriate). Use FEEDER NO. shown on the Drawings. Phase identification is not necessary for triplex cables where triplex cable jackets are unbroken at pull points.

3.8 ACCEPTANCE TESTING

A. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification Inspection and Test Procedure 7.3.3 "Cables, Medium- and High-Voltage".
2. Certify compliance with test parameters.

B. Remove malfunctioning cable, splices and terminations, and replace with new cable, splices and terminations, and retest as specified above.

C. Acceptance Test reports: Prepare written reports to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

END OF SECTION 260513

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of wiring and cabling, including wire and cable pulling, splicing, and termination accessories, as shown on the Drawings and in conformance with the requirements in this Section and Division “Electrical” Section “Electrical”.

1.2 RELATED DOCUMENTS

A. Related requirements are also specified in the following Division “Electrical” Sections:

1. "Identification for Electrical Systems" for identification and color coding requirements.
2. “Grounding and Bonding for Electrical Systems”
3. “Medium-Voltage Cables" for single conductor and multi-conductor cables, cable splices, and terminations for electrical distribution systems over 600 V.

1.3 DEFINITIONS

A. In addition to the definitions in Division “Electrical” Section “Electrical”, the following definitions apply to this Section:

1. MI: Mineral Insulated
2. MTW: machine tool wire, 90 deg. C max in dry locations, 60 deg. C max in wet locations
3. NMC: non-metallic jacketed cable
4. RTD: resistance temperature detector
5. SE: service entrance cable
6. THHN: NEC and UL designation for flame-retardant and heat resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry locations only, 90 deg. C. max in dry locations
7. THW: NEC and UL designation for flame-retardant, moisture resistant thermoplastic insulation suitable for dry and wet locations, 75 deg. C. max
8. THWN: NEC and UL designation for flame retardant and moisture-resistant thermoplastic insulation, gas and oil resistant nylon jacketed, suitable for dry and wet locations, 75 deg. C. max in wet locations
9. TSP: twisted shielded pair
10. UF: underground feeder
11. USE: underground service entrance cable

12. XHHW: NEC and UL designation for (thermoset) cross-linked synthetic polymer insulation suitable for dry and wet locations, 90 deg. C. max in dry locations, 75 deg. C max in wet locations
13. XHHW-2: NEC designation for (thermoset) cross-linked synthetic polymer insulation suitable for dry and wet locations, 90 deg. C. max in wet and dry locations.

1.4 REFERENCE STANDARDS

A. Conform to the following standards in effect at the time of bid submittal:

1. AEIC CG5-90 Underground Extruded Power Cable Pulling Guide
2. ICEA P-51-432-1970 Copper Conductors, Bare & Weather Resistant
3. ICEA P-56-520-1984 Cable Tray Fire Test Report (Round Robin Project)
4. ICEA S-58-679-1996 Standard for Control Cable Conductor Identification
5. ICEA S-95-658 / NEMA WC70 Non-Shielded Power Cables Rated 2000 V or Less
6. ICEA T-22-294-1983 Test Procedures for Extended Time-Testing of Wire and Cable Insulations for Service in Wet Locations
7. ICEA T-29-520-1986 Vertical Cable Tray Flame Tests @ 210,000 Btu
8. ICEA T-30-520-1986 Vertical Cable Tray Flame Tests @ 70,000 Btu
9. ICEA T-33-655-1994 Low Smoke, Halogen-Free Polymeric Jackets
10. IEEE 576-2000 Recommended Practice for Installation, Termination, and Testing of Insulated Power Cable as Used in Industrial and Commercial Applications
11. UL 4 Armored Cable
12. UL 44 Thermoset–insulated Wires and Cables
13. UL 62 Flexible Cord and Fixture Wire
14. UL 83 Thermoplastic Insulated Wires and Cable
15. UL 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors
16. UL 486B Wire Connectors for Use with Aluminum Conductors
17. UL 486C Splicing Wire Connectors
18. UL 486D Insulated Wire Connector Systems for Underground Use in Damp or Wet Locations
19. UL 493 Thermoplastic Insulated Underground Feeder and Branch Circuit Cables
20. UL 1569 Metal-Clad Cable

1.5 SUBMITTALS

A. Product Data: For each type of product specified herein, including catalog data, technical specifications, evidence of UL listing, and evidence of manufacturer’s certification to ISO 9000:2000 or an equivalent quality management system certification acceptable to the Engineer.

B. Qualifications and experience proposal for the electrical testing firm.

C. Electrical Acceptance Test reports.

D. Operation and maintenance data is not required, however, approved shop drawing submittals are required to be included for the record in the Operation and Maintenance Manuals, as described in Division “Electrical” Section “Electrical”.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain all wire and cable of a particular type through one source from a single qualified manufacturer.

B. To be a qualified manufacturer, wire, cable, splice and termination components manufacturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer, and shall offer NRTL-listed and labeled products.

C. Testing firm shall be qualified as defined by OSHA in 29 CFR 1910.7, shall be a member of the InterNational Electrical Testing Association, shall be acceptable to the AHJ, and shall have supervision as follows:

1. Testing Firm's Field Supervisor: Qualifications and experience for the person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Wire and cable and accessories: Listed and labeled as defined in NEC Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 APPLICATIONS

A. Refer to Part 3 for wire and cable applications.

2.2 BUILDING WIRE AND MULTI-CONDUCTOR POWER CABLES

A. Manufacturers:

1. Alcan Cable, Div. of Alcan Aluminum Corp.
2. American Insulated Wire Corp.
3. Belden Wire and Cable Co.
4. Cerro Wire and Cable Co., Inc.
5. General Cable Industries Inc.
6. Okonite Co.
7. Pirelli Cable Corp.
8. Rome Cable Corp.
9. Southwire Co.

B. Conductor Material: Copper, stranded conductor.

C. Building Wire and Multi-conductor Cable Insulation Types: Type THHN-THWN.

2.3 CONTROL AND INSTRUMENTATION WIRE AND CABLE

A. Manufacturers:

1. Belden Wire and Cable Co.
2. Clifford of Vermont / TVC
3. General Cable Co., Inc.
4. Okonite Co.
5. Rome Cable Corp.
6. Southwire Co.

B. Control wire: 600V type THWN insulated stranded copper conductors in conduit, minimum size #14 AWG, UL listed and suitable for installation in conduit.

C. Power-limited tray cable, in cable tray: Multi-conductor type THHN/THWN, minimum size #14 AWG, with overall galvanized steel armor and PVC outer sheath. UL listed and suitable for installation in conduit and cable tray.

D. Instrumentation cable, TSP for 4-20 mA DC circuits:

1. For installation in the same handholes, manholes, and pullboxes with power cables: 600 V TFFN insulated #16 AWG stranded tinned copper twisted pair, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield (100% coverage), with chrome PVC outer jacket, maximum outside diameter 0.30 inches. NRTL listed and suitable for installation in conduit, cable tray, and direct burial.
2. For installation in dedicated shielded signal cable raceways: 300 V TFFN insulated #16 AWG stranded tinned copper twisted pair, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield (100% coverage), with chrome PVC outer jacket, maximum outside diameter 0.25 inches. NRTL listed and suitable for installation in conduit, cable tray, and direct burial.
3. Cables installed in cable tray shall be multiple TSP type with additional shield overall.

E. Instrumentation cable, twisted shielded triple for RTDs: 600 V TFFN insulated #16 AWG stranded tinned copper twisted triple, with #18 AWG or larger stranded tinned copper drain wire, overall aluminum-on-mylar shield, with chrome PVC outer jacket. NRTL listed and suitable for installation in conduit and cable tray.

2.4 WIRE AND CABLE CONNECTORS AND SPLICES

A. Manufacturers:

1. 3M Company, Electrical Products Division
2. AMP Incorporated / Tyco International
3. Burndy

4. Square D
5. Thomas and Betts
6. Or approved equal.

B. Description: Factory fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

C. Wirenuts: Spring type rated for copper wire, sized for the actual number of wires connected.

D. Splices: Tin-plated copper compression type. Pre-insulated crimp-on connectors may be used for #14 AWG control wires. Long barrel splices shall be used for #1/0 AWG and larger.

E. Connection lugs: Tin-plated copper compression type with NEMA drilling. Long-barrel lugs shall be used for #1/0 AWG and larger wire, and for ground wires as specified in Division “Electrical” Section "Grounding and Bonding for Electrical Systems".

F. Connections at molded case circuit breakers, disconnect switches, and other equipment provided with wire termination lugs: NRTL-listed, suitable for use with the copper wire size to be connected.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that conduits, duct banks, manholes, handholes, and pullboxes are clean and clear of construction debris prior to installation of wire and cable.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cables to construction site and unload in accordance with manufacturer’s recommendations.

B. Store and transport reels in conformance with the manufacturer’s printed instructions.

C. Wire and cable ends shall be taped watertight until terminations and splices are completed.

3.3 WIRE AND CABLE APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Feeders: Type THHN-THWN, single conductors in raceway.

C. Branch Circuits: Type THHN-THWN, single conductors in raceway.

3.4 CABLE LAYING AND PULLING

A. Install cables in accordance with manufacturer's installation instructions, IEEE 576 and AEIC CG5-90.

B. Run wires and cables in raceways as shown on the Drawings and as specified in Division "Electrical" Section "Raceways and Boxes for Electrical Systems".

C. Use cable manufacturer approved water-based wire pulling lubricant for pulling in wire and cables in conduit. Lubricant shall be UL-listed and shall be suitable for the conductor insulation.

D. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

E. Pull wire and cables in accordance with the manufacturer's installation recommendations and requirements, with emphasis on the following:

1. Do not exceed manufacturer's recommended maximum pulling tensions and side-wall pressure values
2. Lubricate cables with pulling compound or lubricant that is approved by the cable manufacturer and will not deteriorate conductor or insulation materials of construction.
3. Follow cable manufacturer's recommendations for attaching pulling means to cables, including fish tape, cable, rope, and basket-weave cable grips. Do not attach to cable jacket alone for pulling.
4. Rig pulleys and use pull ropes for pulling cables into raceways.
5. Use tension indicators and electric-motor driven capstan rollers for pulling cables that are too large for pulling by hand.
6. Observe manufacturer's recommendations for the minimum wire and cable bending radius for each type and size of wire and cable provided for this project.

F. Install "buried-cable" warning tape in the backfill above the cables as shown on the Drawings.

G. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around perimeter from entry to exit, and support cables at intervals adequate to prevent sagging.

H. Emergency circuit wires and cables shall be routed and protected from fire and other hazards in accordance with locals codes, in a manner acceptable to the AHJ.

I. Identify and color-code conductors and cables according to Division "Electrical" Section "Identification for Electrical Systems".

3.5 WIRE AND CABLE CONNECTIONS AND TERMINATIONS

A. Tighten electrical connectors and terminals according to the manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. For compression lugs and splices, use the lug manufacturer’s compression tools and conform to the manufacturer’s written instructions.

C. Control wires shall be run from terminal to terminal without splices, and no more than two wires under a terminal screw.

D. Splices and terminations shall be insulated with boots, heat shrink tubing, or tape to 600 volts in accordance with the insulation product manufacturer’s written instructions.

E. Feeder taps shall be made with cast bronze 2-bolt or 4-bolt connectors with built-in conductor spacer, suitable for the run and tap conductor sizes. Split bolt connectors shall not be used unless approved by the Engineer.

F. Wiring at Device Outlets: Install conductor at each outlet, leaving 8 inches (200 mm) of wire coiled in the box for connection to wiring devices. Wiring devices that are suitable for solid wire only shall be pigtailed to stranded wire with solid wire 6 inches long using wirenuts.

G. Install a green insulated NEC-sized grounding jumper from a green ground screw in the outlet box to the receptacle or switch green ground screw.

H. Wiring to terminals at transformers and busbars shall be connected with tin-plated copper compression connectors and insulated for 600 volts with tape, boots, or heat-shrink tubing rated for the temperature specified by the equipment manufacturer. Two hole lugs shall be used for power cable terminations # 1/0 AWG and larger.

I. Building wire connections to flexible motor leads shall be made with compression connectors bolted back-to-back with silicone-bronze bolts and insulated for 600 volts. For motors with busbar connections, connections shall be made with long-barrel two-hole tin plated copper lugs, copper-plated belleville washers, and silicone bronze bolts.

J. Multi-conductor cables shall be installed and terminated in accordance with the cable manufacturer’s installation instructions. Armored and metal clad cables shall be terminated with fittings suitable for grounding.

K. Shielded cable conductors shall be terminated with insulated crimp-on connectors suitable for the terminals provided with the equipment, or tinned for connection to terminals which are not suitable for crimp-on connectors. A minimum two inch length of heat shrink tubing shall be applied over each insulated conductor and the insulated portion of the crimp-on connector, and a separate piece of larger diameter heat shrink tubing shall cover the end of the cable jacket and cut shield, and overlap the individual conductor heat shrink tubing. Connect drain wire to the ground bus at the transmitter end only except where otherwise indicated on the Contract Drawings and approved shop drawings.

L. MI cable terminations shall be watertight mechanical compression type, and shall be as recommended by the MI cable manufacturer for the application.

3.6 ELECTRICAL ACCEPTANCE TESTING

A. Testing: Perform the following field quality control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for conformance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.3.2 "Cables, Low Voltage, 600 Volt Maximum". Certify conformance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that conform to requirements.
3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, and bonding in accordance with NEC requirements, in conformance with this Section and as shown on the Drawings.

B. This Section includes requirements for grounding electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.2 RELATED DOCUMENTS

A. Related Documents include the following Division “Electrical” Sections:
   1. "Underground Ducts and Raceways for Electrical Systems" for additional grounding and bonding requirements
   2. “Low-Voltage Electrical Power Conductors and Cable” for wire connector and equipment grounding conductor requirements
   3. “Raceway and Boxes for Electrical Systems” for grounding bushing requirements
   4. “Electrical Distribution, Aerail” for additional grounding and bonding requirements

1.3 DEFINITIONS

A. Refer to NEC for definitions of grounding terms used in this Section.

1.4 QUALIFICATIONS

A. Manufacturer’s Factory Qualifications: Manufacturing facilities shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer. The manufacturing company shall be listed in a published NRTL directory of companies offering NRTL-listed and labeled products.

B. Testing Firm Qualifications: An independent firm, with experience and capability to conduct specified tests, and is a member company of NETA or is an NRTL as defined by OSHA in 19 CFR 1910.7, acceptable to the AHJ.

C. Testing Firm’s Field Supervisor Qualifications: person currently certified by NETA or NICET to supervise on-site testing specified in Part 3.

1.5 REFERENCE STANDARDS

A. Comply with the following standards:
1. IEEE 80-1986 Interpretation: Guide for Safety in AC Substation Grounding
2. IEEE 80-2000 Guide for Safety in AC Substation Grounding
3. IEEE 81.2-1991 Guide for Measurement of Impedance and Safety Characteristics of Large Extended or Interconnected Grounding Systems (Part 2)
4. IEEE 81-1983 Guide for Measuring Earth Resistively, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
5. IEEE 118-1978 (R1992) Standard Test Code for Resistance Measurements
6. IEEE 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power Systems (IEEE Green Book)
7. IEEE 665-1995 (R2001) Guide for Generating Station Grounding
8. IEEE 837-1989(R1996) Standard for Qualifying Permanent Connections Used in Substation Grounding
9. IEEE 1050-1996 Guide for Instrumentation and Control Grounding in Generating Stations
10. IEEE 1100-1999 IEEE Recommended Practice for Powering and Grounding Electronic Equipment. (IEEE Emerald Book)
11. IEEE 1246-1997 Guide for Temporary Protective Grounding Systems Used in Substations
12. IEEE C57.13.3-1983 (R1990) Guide for the Grounding of Instrument Transformer Secondary Circuits and Cases
13. IEEE C57.13.3-1983 (R1991) Guide for the Grounding of Instrument Transformer Secondary Circuits and Cases
14. NFPA 70 The National Electrical Code

1.6 SUBMITTALS

A. Conform to the General Provisions.

B. Product Data: Submit manufacturer's catalog data and specification sheets for each manufacturer's product described in Part 2 of this Section, marked to show which products are proposed for this project.

C. Qualification Data: For firms and persons specified in "Qualifications" in Part 1 of this Section.

D. Acceptance Test Reports: Submit written test reports to include the following:
1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements described in this Section, provide products by one of the listed manufacturers in the Sub-Sections below.

1. Ground Rods:
    a. Copperweld Corp.
    b. Eritech / Erico International Corporation
    c. Galvan Industries, Inc.
    d. Harger Lightning and Grounding, Inc.
    e. Robbins Lightning, Inc.
2. Grounding electrode connectors:
    a. Exothermic type:
        1) Cadweld / Erico International Corporation
        2) Furseweld
        3) Harger Lightning and Grounding, Inc. (Ultraweld)
        4) ThermOweld, a division of Continental Industries
    b. Copper compression type:
        1) Dossert Corp.
        2) Framatome Connectors / Burndy
        3) Harger Lightning and Grounding, Inc.
        4) ILSCO
        5) O. Z. Gedney / EGS Electrical Group
        6) Panduit Corp.
        7) Robbins Lightning, Inc.
3. Ground test (access) wells
    a. Eritech / Erico International Corporation
    b. Harger Lightning and Grounding
    c. Robbins Lightning, Inc.

2.2 GROUNDING ELECTRODES

A. Ground Rods: 3/4 in. x 10 ft. copper-clad steel, sectional type, with silicone bronze threaded connectors.

B. Ground Ring: #4/0 AWG Class A stranded copper conductor (7-strand). 17 strand ground wire is not acceptable in contact with earth.

C. Test (Access) Wells: Provide PVC or concrete test wells approximately 12 inches in diameter x 2 ft. deep for access to grounding electrode conductor connections to grounding electrodes as shown on the Drawings. Covers shall be cast iron, engraved “Ground Test Well”.

2.3 GROUNDING ELECTRODE CONDUCTORS

A. Grounding Electrode Conductors: Solid for #6 AWG and smaller, Class A stranded for #4 AWG and larger bare copper conductor, size(s) as indicated on the Drawings. Class B stranding is not acceptable for conductors in contact with earth.

B. Comply with the following:
   1. Solid Conductors: ASTM B 3.
   2. Assembly of Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.

2.4 BONDING JUMPERS

A. Main Bonding Jumpers: copper, furnished with the service equipment by the equipment manufacturer. Panelboards up to 225 amps may use a bonding screw.

B. Equipment Bonding Jumpers: insulated copper building wire, sized to match the largest equipment grounding conductor in the associated conduits.

C. Bonding Jumper: insulated copper wire, protected by conduit where exposed to physical damage

D. Electrical and telephone room ground bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.5 EQUIPMENT GROUNDING CONDUCTORS

A. Equipment Grounding Conductors: Insulated building wire in accordance with Division “Electrical” Section “Low-Voltage Electrical Power Conductors and Cable”. #6 AWG and smaller shall have green insulation, #4 AWG and larger shall have green insulation or shall be marked with green tape at each end.

2.6 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467. Products shall be NRTL-listed and shall be suitable for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure type silicone bronze connectors for test joints at ground rods with test (access) wells, and two-hole long barrel tin-plated copper compression type at equipment busbars and bonding connections to structural steel.

C. Grounding clamps for metal water pipe connections: all cast bronze parts with silicone bronze bolts.

D. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

E. Wirenuts: Use only for branch circuit wiring in switch and receptacle outlet and junction boxes containing #10 AWG and smaller wires.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Install grounding electrodes, grounding electrode conductors, main bonding jumpers, equipment grounding conductors, equipment bonding jumpers, and bonding, in accordance with NEC requirements and as shown on the Drawings.

B. Provide only copper and bronze grounding materials in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

C. Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

D. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

3.2 INSTALLATION: GROUNDING ELECTRODES

A. Install one ground test (access) well for each service at a convenient location outside the building as shown on the Drawings. Set top of well flush with finished grade. Tag the mechanical connection to the ground rod “Grounding Connection – De-Energize Service Prior to Disconnecting for Ground Resistance Tests”.

B. Remove paint and surface corrosion from structural steel and metal water pipes at grounding connection points down to bright metal, and coat dissimilar metals with anti-corrosion compound after making grounding connections wrench-tight.

C. Ground ring: Use bare Class A stranded (7-strand) copper conductor, #250 kcmil. Bury at least 30 inches below grade

D. Ground Rod Clamps at Test Wells: Use bolted-pressure clamps of same material as ground rod (or silicone bronze with copper-clad rods) with at least two silicone bronze bolts.

3.3 INSTALLATION: GROUNDING ELECTRODE CONDUCTORS

A. Grounding Electrode Conductors: Route along shortest and straightest paths possible, unless otherwise indicated on the Drawings. Avoid obstructing access or placing conductors where subject to strain, impact, or damage.

B. Connect grounding electrode conductor(s) to the service transformer enclosure ground equipment as shown on the Drawings.

C. Bond grounding electrode conductors in metal conduits to each end of each conduit run using a bronze conduit-to-wire grounding fitting.

3.4 INSTALLATION: EQUIPMENT GROUNDING CONDUCTORS

A. Provide separate insulated equipment grounding conductors in raceways, boxes, and fittings, as shown on the Drawings and specified herein.

B. Equipment Grounding Conductor Terminations:
1. At oil-filled transformers, connect to tank studs provided by transformer manufacturer.
2. At dry-type transformers, provide two-hole long-barrel tin-plated compression connector bolted to ground busbars with tin-plated or silicone bronze bolts.
3. At switchgear, switchboards, distribution boards, panelboards, and motor control centers, provide two-hole long-barrel tin-plated compression connector bolted to ground busbar(s) with tin-plated or silicone bronze bolts.
4. At generators, provide separate two-hole long-barrel tin-plated compression connector bolted to ground connection point in generator terminal box, and to generator structural steel frame, with tin-plated or silicone bronze bolts.

3.5 INSTALLATION: EQUIPMENT BONDING JUMPERS

A. At sheet metal junction, pull and outlet boxes, and electrical enclosures, use conduit hubs bolted to enclosure or double locknuts to bond enclosure to conduit, and connect grounding bushings to equipment grounding conductors. Install equipment bonding jumpers between conduit bushings entering and leaving boxes, using the lugs provided with the grounding bushings.

B. At cast enclosures, connect equipment grounding conductors together with a mechanical connector. Use mechanical connectors in conformance with Division “Electrical” Section “Low-Voltage Electrical Power Conductors and Cable”.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

3.6 INSTALLATION: BONDING JUMPERS

A. Bonding Straps and Jumpers: Install so equipment vibration is not transmitted to rigidly mounted equipment support structure. Use long-barrel tin-plated compression connectors and galvanized steel or silicone bronze hex head cap screws in drilled and tapped holes to bond miscellaneous equipment to equipment grounding conductors.

3.7 CONNECTIONS

A. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.8 OVERHEAD-LINE GROUNDING

A. Comply with IEEE C2 requirements. Add a section to driven ground rod if single ground rod electrode resistance to ground exceeds 25 ohms.

B. Drive ground rods to a depth of 12 inches below finished grade in undisturbed earth.

C. Ground Rod Connections: Use clamp-type connectors listed for the purpose for underground connections and connections to rods.

D. Lightning Arresters: Separate arrester grounds from other grounding conductors.

E. Secondary Neutral and Tank of Transformer: Interconnect and connect to grounding conductor.

F. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

3.9 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Pad-Mounted Transformers and Switches: Install minimum two ground rods and ground ring encircling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting to ground ring. Use tinned-copper conductor not less than #4/0 AWG for connections to equipment ground pad. Bury ground ring not less than 18 inches below grade and 6 inches from the foundation.

3.10 ACCEPTANCE TESTING

A. Testing: Perform the following field quality-control testing:
   1. After installing grounding system and before electrical circuitry has been energized, test for conformance with requirements.
   2. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification, Section 7.13 "Grounding Systems". Certify conformance with test parameters.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that conform to requirements.
   3. Test results that do not conform to requirements and corrective action taken to achieve conformance with requirements.

END OF SECTION 260526

SECTION 260533
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete system of raceways, including conduit, fittings, terminal boxes, hangers, supports, and accessories, as shown on the Drawings and specified herein.

1.2 RELATED DOCUMENTS

A. Related requirements are also included in the following Division “Electrical” Sections:

1. "Grounding and Bonding for Electrical Systems" for equipment grounding requirements.

1.3 DEFINITIONS

A. In addition to the definitions in Division “Electrical” Section “Electrical”, the following definitions apply to this Section:

1. Clamp-back: spacer used with conduit one-hole strap to provide air gap between surface and conduit
2. EMT: Electrical metallic tubing (NEC definition)
3. Equipment bonding jumper: suitable for connecting sections of conduit used for equipment grounding conductor (see NEC definition)
4. ID: inside diameter
5. LFMC: Liquidtight flexible metal conduit (NEC definition)
6. NPT: National pipe thread
7. OD: outside diameter
8. PVC: Polyvinyl chloride
9. RNC: Rigid nonmetallic conduit (NEC definition) includes PVC and RTRC

1.4 REFERENCE STANDARDS

A. Comply with the following standards:

1. NEMA Standards applicable to raceways, boxes, and fittings.
2. UL Standards applicable to raceways, boxes, and fittings. Each raceway, box, and fitting shall be NRTL-listed and labeled.
3. ANSI and ASTM standards mentioned in this Section and included in the UL and NEMA Standards applicable to raceways, boxes, and fittings.

1.5 ENVIRONMENTAL CONDITIONS

A. Provide raceways, boxes, and fittings fabricated from materials resistant to corrosion and suitable for the application in the locations where installed, in conformance with NEC requirements for installation in "damp", "wet", and hazardous (classified) areas.

1.6 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

C. Source quality-control test reports.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 and NEMA standards.

C. PVC-coated conduit, boxes, and fittings that are connected together shall be from the same manufacturer.

PART 2 - PRODUCTS

2.1 CONDUIT, BOX, AND FITTING MANUFACTURERS

A. Provide products by the following manufacturers:

1. Adalet / A Scott Fetzer Company
2. AFC Cable Systems, Inc.
3. Alflex Inc.
4. Allied Tube & Conduit Corporation
5. Allied Tube and Conduit Div. / A TYCO International Ltd. Company
6. Anamet Electrical, Inc.; Anaconda Metal Hose.
7. Appleton
8. Bell
9. Carlon
10. Cooper / B-Line
11. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
12. Electri-Flex Co.
13. Emerson/General Signal; Appleton Electric Company.
14. Erickson Electrical Equipment Co.
15. Hoffman.
16. Hubbell, Inc. / RACO

17. Hubbell, Inc./ Killark Electric Manufacturing Co.
18. Lew Electric Fittings Co.
19. LTV Steel Tubular Products Company
20. Myers
21. O-Z Gedney
22. Perma-Cote
23. Pittsburgh Standard Conduit Co.,
24. RACO; Division of Hubbell, Inc.
25. Robroy Industries
26. Robroy Industries, Inc.; Enclosure Division.
27. Scott Fetzer Co.; Adalet-PLM Division.
28. Spring City Electrical Manufacturing Co.
29. Thomas & Betts Corporation.
30. Triangle PWC Co.
31. Wheatland Tube Co.
32. Or approved equal.

2.2 ELECTRICAL METALLIC TUBING (EMT)

A. Electrical Metallic Tubing (EMT): hot-dip galvanized steel tubing to ANSI C80.3 with fittings be for use in accordance with NEC Article 358 "Electrical Metallic Tubing: Type EMT", NRTL-listed and labeled under UL 797.

B. Provide locknuts, bushings, fittings, conduit bodies, junction boxes, pull boxes, and outlet boxes as follows:

1. NEMA enclosure type in accordance with Part 3 of this Section
2. Locknuts: galvanized steel
3. Bushings: thermoplastic
4. Fittings;
    a. Indoor and two (2") inches in size and smaller, shall be steel compression type fittings.
    b. 2-1/2 inch size and larger must employ steel compression gland fittings.
    c. Outdoor shall be rain-tight steel compression gland fittings.
    d. Indent type fittings shall not be used.
    e. Where installed in slab or concrete work, provide approved concrete tight fittings.
5. Conduit bodies: cast metal
6. Junction and outlet boxes: stamped steel in dry indoor areas, cast metal in wet and outdoor areas
7. Pull boxes: painted sheet metal with hinged screw cover

2.3 RIGID NON-METALLIC CONDUIT

A. Rigid non-metallic conduit: Schedule 40 polyvinyl chloride conduit to NEMA TC-2, for use in accordance with NEC Article “Rigid Nonmetallic Conduit: Type RNC”, NRTL-listed and labeled under UL 651.

B. RNC Fittings: solvent-welded PVC, NRTL listed and labeled, by same manufacturer as the conduit.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Liquidtight flexible metal conduit (LFMC): Flexible steel type UA conduit with PVC jacket, for use in accordance with NEC Article “Liquidtight Flexible Metal Conduit: Type LFMC”, NRTL-listed and labeled under UL 360. Non-UL listed LFMC is not acceptable.

B. Fittings: Insulated-throat screw-in connectors, NEMA FB 1, UL 514B, galvanized malleable iron or steel. Connectors shall be suitable for use as grounding fittings. Provide fittings with bonding jumper connections for exterior bonding jumpers at motors. Non-stainless steel parts shall be PVC-coated when used with PVC-coated RGS conduit.

2.5 SINGLE CONDUIT HANGERS

A. Manufacturers:

1. Appleton
2. Crouse-Hinds
3. Erico International Corporation (Caddy)
4. Killark
5. Thomas and Betts (Kindorf, Steel City)
6. Unistrut
7. Or approved equal

B. Single EMT attachment to structural steel: galvanized malleable iron beam clamp with hardened set screw and threaded hole for galvanized steel single-bolt conduit hanger or threaded rod and clevis hanger. Bolts shall be plated steel.

C. Single EMT attachment to concrete and masonry surfaces: galvanized steel one-hole clamp and galvanized steel clamp-back, or plated steel single-bolt hangers on plated steel threaded rods attached to galvanized steel rod hanger fitting bolted to concrete with expansion bolts. Single piece combination one-hole clamp and clamp-back hangers are also acceptable. Bolts shall be plated steel.

2.6 CONDUIT SLEEVES AND SEALING FITTINGS

A. Manufacturers:

1. Appleton
2. Crouse-Hinds
3. Spring City Electric
4. Thomas & Betts
5. O.Z. Gedney
6. Or approved equal

B. Wall and Floor Sleeves:

1. Hot-dip galvanized steel or stainless steel pre-fabricated conduit sleeves with welded water-stop ring.
2. Galvanized steel, PVC, and polyethylene sleeves that are part of a manufacturer's standard wall seal assembly are also acceptable, subject to compliance with the fire resistant rating of the related walls and floors.

C. Conduit-to-Sleeve Sealing Fittings:

1. Synthetic elastomeric gland with galvanized steel or stainless steel compression plates sized for the conduit OD and sleeve ID, or a manufactured assembly of hot-dip galvanized or stainless steel pressure plates, neoprene sealing grommets, and cast or malleable iron sealing bodies with zinc-rich epoxy coating, with factory-assembled galvanized steel, PVC, or polyethylene pipe sleeve. Segmented seals are also acceptable for conduit 4-inch trade size and larger.
2. Sealing fittings for wall penetrations with water or soil on one side shall have seals installed at both ends of the conduit sleeve or core-drilled hole.
3. Where single conductors pass through a single sleeve, select materials to mitigate the effects of inductive heating.
4. Provide ground wire attachment bolts for manufactured sleeve assemblies.
5. Seals shall have fire ratings equal to the fire-resistant rating of the wall.

2.7 CONDUIT INTERIOR SEALING FITTINGS

A. Manufacturers:

1. Crouse-Hinds
2. O.Z. Gedney
3. Thomas & Betts

B. Conduit-to-Cable Sealing Fittings:

1. For exposed conduit ends without pull and junction boxes: Conduit fitting with synthetic elastomeric sealing gland with galvanized stainless steel compression plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
2. For exposed conduit ends entering pull or junction box: Conduit fitting suitable for installation of locknuts at conduit entry to sheet metal box, and bushing with synthetic elastomeric sealing gland with galvanized stainless steel compression plates drilled for the conduit ID and cable(s) OD, retained by threaded collar at the end of the conduit.
3. Seal shall be watertight at 20 feet of water pressure value.
4. Where single conductors pass through a seal, select materials to mitigate the effects of inductive heating.
5. Where bare stranded copper conductors pass through sealing fittings, place an exothermic weld in the stranded cable to prevent water from leaking through the strands.

2.8 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

2.9 FACTORY FINISHES

A. Finish: For painted steel enclosures, provide manufacturer's standard commercial and industrial coating in ANSI 49 or 61 light gray color, or different color when required by the NEC.

B. Field painting will be required for uncoated cast iron, steel, galvanized, zinc-coated, and factory primed surfaces. Products shall be degreased and made suitable for field painting prior to packaging for shipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATIONS

A. Outdoor raceways, boxes, and fittings:

1. Exposed: EMT.
2. Underground, Individual Conduit Runs: Schedule 40 PVC.

3. Connections to transformers, motor-driven equipment, vibrating equipment, and equipment requiring position adjustment, e.g., rail-mounted motors: liquidtight flexible metal conduit in non-hazardous areas, explosion-proof flexible couplings in hazardous areas.
4. Conduit Support Channels: hot dip galvanized.
5. Boxes and fittings: as described in each raceway sub-section, and recommended as suitable for the particular application by the manufacturer.
6. Enclosures: refer to Division “Electrical” Section “Electrical”

B. Indoor raceways, boxes, and fittings:

1. Exposed: EMT in above-grade, exposed locations.
2. NEC Damp and Wet Locations: EMT
3. Conduit Support Channels: hot dip galvanized.
4. Boxes and fittings: as described in each raceway sub-section, and recommended as suitable for the particular application by the manufacturer.
5. Enclosures: as specified in Division “Electrical” Section “Electrical”.

C. Minimum Raceway Size: 3/4-inch trade size.

3.2 INSTALLATION – GENERAL

A. Deliver raceways, boxes, and fittings to job site in factory packaging. Store in clean, dry, weatherproof locations. Handle in accordance with manufacturer’s recommendations.

B. Install raceways, boxes, and fittings in accordance with manufacturer’s installation instructions and NEC requirements as a minimum, and comply with the additional requirements described in this Section.

C. Conduits shall be electrically and mechanically continuous, and suitable for use as an equipment-grounding conductor. Make up threaded joints wrench tight.

D. Fasten boxes in wet and damp areas using external mounting feet. Do not drill through boxes.

E. Comply with NEC requirements for sizing outlet and junction boxes to accommodate wires, splices, and devices.

F. Bends and offsets between pull points shall not exceed a cumulative total of 270 degrees unless otherwise approved by the Engineer. Maximum distance between pull points in conduit systems inside buildings shall be 100 feet unless otherwise approved by the Engineer.

G. Raceways shall be routed in conformance with the following guidelines:

1. Run conduits exposed, concealed, and underground as indicated on the Drawings.
2. The preferred location for horizontal conduit runs is just below the ceiling structural supports.

3. Do not obstruct access to equipment for operation and maintenance. Coordinate conduit runs with the work of other trades. Plan conduit runs to avoid lighting fixtures, and leave space for easy access to HVAC equipment, motors, and duct access hatches and doors.
4. Route conduits around doors, windows, hatches, louvers, and other building openings, and around range and fume hoods.
5. Group conduits on horizontal trapeze hangers or on wall-mounted steel channel where long horizontal runs are required.
6. Do not run conduits through stairwells unless required for connection to equipment located in the stairwell.
7. Maintain eight feet minimum clearance above finished floor wherever it is physically possible to do so. Comply with OSHA requirements for minimum headroom.
8. Comply with raceway, boxes, and fitting details shown on the Drawings.
9. Provide seals and flashings at roof penetrations in accordance with the recommendations of the roofing system supplier, or as shown on the Drawings.
10. Where conduits enter the top of electrical equipment enclosures and control panels, install conduit interior sealing fittings to prevent entry of water and condensation from conduit.
11. Concealed conduits shall not be run below floor slabs in basements unless otherwise indicated on the Drawings. Run concealed conduits embedded in basement floor slab.

H. Cut conduits square with roller-wheel pipe cutter. Hacksaw cuts are acceptable only if the entire conduit is swabbed clean after cutting and threading is completed. Conduits cut in the field shall be threaded with sharp, standard NPT dies to achieve a fully cut tapered thread with a minimum of five full tapered threads at the end of the conduit. Running threads are not acceptable. Over- and under-threading are not acceptable. After threading, ream conduit ends, remove cuttings and debris from inside and outside of conduit, degrease, and apply cold spray-on zinc-rich paint.

I. Conduit bends shall be made with conduit bending tools manufactured for the purpose. Comply with conduit and bending tool manufacturers' instructions. Use specially sized shoes in bending tools for PVC-coated rigid galvanized steel conduits.

J. Do not cut or drill holes in structural beams and columns, or other structural members. Do not weld raceway supports to structural steel.

K. Join raceways with fittings designed and approved for that purpose and make joints wrench tight. Comply with NEC requirements for minimum thread engagement in Hazardous Classified areas.

L. Provide expansion, deflection, or expansion & deflection couplings at building expansion joints. Expansion and deflection fittings shall comply with UL 467 and UL 514B, and shall be suitable for the anticipated amount of movement and direction(s) of movement.

M. Provide drain fittings at the first junction or pull box where conduits enter the building from outdoor and underground locations. Locate drains to permit observation of leakage without damage to electrical and mechanical equipment.

N. Three-piece (Erickson) couplings shall be used where it is not possible to turn conduits to make up threaded joints. Threadless fittings are not generally acceptable. Application for permission to use threadless fittings at particular locations shall be made in writing to the Engineer, and threadless fittings shall not be used unless approved.

O. Complete raceway installation before starting conductor installation.

P. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division “Thermal and Moisture Protection” Section "Penetration Firestopping".

Q. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

R. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box. Install bushings wrench-tight.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
3. Install temporary closures to prevent foreign matter from entering raceways.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

T. Flexible Connections:

1. Recessed and semi-recessed lighting fixtures: maximum of 72 inches of flexible metal conduit with UL-listed grounding fittings
2. Motors and equipment subject to vibration or movement: maximum 36 inches of LFMC up to 2 inch trade size, up to 72 inches in larger sizes, and explosion-proof couplings of adequate length for the installed conditions in hazardous (classified) locations.
3. Install separate equipment bonding jumper across flexible connections where required by the NEC.

3.3 INSTALLATION – EXPOSED RACEWAYS, BOXES AND FITTINGS

A. Install raceways, boxes, and fittings exposed as indicated on the Drawings.

B. Install exposed raceways parallel or at right angles to nearby surfaces or structural members.

1. Run raceways together in-groups on common supports wherever possible.
2. Do not use mechanical piping or ceiling supports to support conduit runs.

C. Surface-mounted channel supports shall be 1-1/2 inch x 1-1/2 inch channel bolted to wall or ceiling with expansion anchors.

D. Keep raceways at least 6 inches away from parallel runs of flues and mechanical piping (including insulation). Install horizontal raceway runs above water and steam piping.

E. Install electrical enclosures and cabinets plumb. Support at each corner.

3.4 INSTALLATION – UNDERGROUND CONDUIT

A. Install raceways, handholes, and fittings underground as indicated on the Drawings.

B. Comply with the requirements in Division “Electrical” Section “Underground Ducts and Raceways for Electrical Systems”.

3.5 PROTECTION DURING CONSTRUCTION

A. Provide final protection and maintain conditions that ensure coatings and finishes without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanize finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CLEANING & PAINTING

A. Swab conduits clean after installation and plug ends until conductors are installed.

B. Remove dust, construction debris, plaster and paint spatters from raceways, boxes, and fittings after all trades have completed their work, and prior to painting.

C. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes, touch up damage, and prepare for finish painting in accordance with Division “Finishes” Section “Exterior Painting”.

3.7 IDENTIFICATION

A. Identify raceways, boxes, and fittings as described in Division “Electrical” Section “Electrical Identification for Electrical Systems”.

END OF SECTION 260533

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide electrical equipment nameplates, junction, pull and outlet box labels, raceway identification, wiremarkers, circuit identification, and warning signs for electrical equipment included in this Contract, as specified herein.

B. This Section includes product and installation requirements for identification of electrical equipment, raceways, conductors, circuits, and outlets, and warning signs.

1.2 CODES AND STANDARDS

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
   1. National Electrical Safety Code (NESC)
   2. Nationally Recognized Testing Laboratory (NRTL)
   3. NFPA 70E Standard for Electrical Safety in the Workplace®
   4. NFPA 79 Electrical Standard for Industrial Machinery

1.3 QUALITY ASSURANCE

A. Manufacturers: Manufacturers shall have accreditation to ISO 9000:2000 or an equivalent quality management system acceptable to the Engineer, and shall offer NRTL-listed and labeled products.

B. Comply with NFPA and OSHA standards.

1.4 SUBMITTALS

A. Make submittals in accordance with the General Provisions.

B. Submittals shall include the following:
   1. Product data
   2. Complete list of all engraved nameplates.
   3. Sample of each of the following:
      a. engraved equipment nameplate
      b. computer-generated label
      c. wiremarkers

d. safety signs
e. laminated instrument tags

PART 2 - PRODUCTS

2.1 EQUIPMENT NAMEPLATES

A. Provide custom nameplates for all equipment listed in Part 3 of this Section.

B. Nameplates shall have white letters engraved on black field, and shall be fabricated from 3-layer (black-white-black) thermoset plastic.

C. Drill holes in nameplates to be fastened with tie-wraps as described in Part 3 of this Section.

D. Nameplate lettering to be uppercase Roman block letters, minimum height as follows:

1. MCCs, VFCs, panelboards, and transformers: 1/2 inch.
2. Process Control Panels (unless factory-labeled): 1/2 inch.
3. Valve actuators: 3/8 inch.
4. Other equipment: 1/4-inch minimum.

2.2 PUNCHED TAPE LABELS (RECEPTACLE IDENTIFICATION)

A. Punched Tape Labels for identification of receptacle circuits shall be 1/2 -inch black tape with white raised lettering.

B. Manufacturer: Dymo or approved equal

2.3 WIREMARKERS

A. Wiremarkers shall be computer-printed on white wrap-around paper with clear plastic protective "tail" and pressure-sensitive adhesive.

B. Manufacturer: Brady, T&B, Panduit, or approved equal.

2.4 WIRE COLOR CODING

A. Comply with NEC requirements for applying color-coding.

B. Color Coding for service, feeder, and branch circuit wiring shall be as follows:

1. 240 / 120 VOLTS A-B-N-G Black - Red - White - Green

C. Color coding for 120 VAC control wiring shall be as follows:

1. Line - Black
2. Neutral - White
3. Ground - Green
4. Switched - any color except black, white, and green.

2.5 CONDUIT IDENTIFICATION

A. Identify exposed unpainted conduits with a black indelible felt-tip marker.

2.6 WARNING SIGNS

A. Provide warning signs on electrical equipment, electrical room doors, and automatically started mechanical equipment in accordance with NEC and OSHA requirements.

B. Automatically started motor-driven equipment shall have warning signs with the legend: "Warning - This Equipment Starts and Stops Automatically".

PART 3 - INSTALLATION

3.1 NAMEPLATES

A. Fabricate equipment nameplates using the description and tag number nomenclature shown on the Drawings.

B. Provide equipment nameplates for circuit breakers, panelboards, enclosed motor controllers and contactors, transformers, and disconnect switches.

C. Fasten nameplates to clean flat metal surfaces with pressure-sensitive two-sided adhesive tape and stainless steel screws.

3.2 RECEPTACLES

A. Label all receptacle circuits on device faceplates with punched (Dymo) tape.

B. Provide the following information:

1. Panel Designations (as shown on the Panelboard Schedules)
2. Branch Circuit Breaker Number

3.3 WIRE COLOR CODING AND MARKING

A. Color code each phase, neutral, and ground wire for service conductors, feeders, and branch circuits, at points of origin and termination of wires.

B. Provide wiremarkers on all control and signal wires, as shown on the approved Loop Diagrams, Motor Control Wiring diagrams, and Control Panel field wiring diagrams.

3.4 CONDUIT IDENTIFICATION

A. Clean unpainted conduit surfaces with mineral spirits. Write conduit number shown on the Conduit & Wire Schedules on each conduit at each exposed conduit termination point.

3.5 WARNING SIGNS

A. Suspend automatically started equipment warning signs above motors with chain hangers.

B. Install warning signs required by OSHA in accordance with OSHA recommendations.

3.6 PANELBOARD DIRECTORIES

A. During construction, provide handwritten panelboard schedules. Provide complete typewritten directory with protective clear plastic cover for each panelboard, with name of load as shown on the Panelboard Schedules on the Drawings for each individual branch circuit.

B. When branch circuits are relocated, the panel directory shall be updated to indicate functions and locations.

C. When branch circuits are removed the panel directory shall be updated to indicate a spare.

D. Handwritten directory shall be provided until all circuits are connected. After panelboard acceptance testing and load balancing, install the permanent directory.

END OF SECTION 260553

SECTION 261800
ELECTRICAL DISTRIBUTION SYSTEM, AERIALGENERAL

1.1 SUMMARY

A. Provide the aerial electrical distribution system as shown on the Drawings and specified herein.

1.2 RELATED DOCUMENTS

A. Aerial electrical distribution system components and related requirements are also specified in the following Sections:

1. Division 26 Section "Grounding and Bonding" for equipment grounding requirements.

1.3 GENERAL

A. This Section includes the following system components:

1. Conductors, connectors, and splices
2. Lines
3. Poles, crossarms and related hardware
4. Fused overhead disconnect (cutout)
5. Group operated switch
6. Insulators
7. Overhead type distribution transformers.

1.4 DEFINITIONS

A. In addition to the definitions in Division 26 Section “Electrical - General”, the terminology used in this specification is as defined in IEEE Standard 100.

1.5 QUALIFICATIONS

A. Manufacturer shall have quality certification to ISO 9000:2000 or equivalent.

1.6 REFERENCE STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only

1. 10 CFR Part 431 – Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule
2. ANSI C29.1 (1988; R 1996) Electrical Power Insulators - Test Methods
3. ANSI C29.2 (1992) Insulators - Wet-Process Porcelain and Toughened Glass - Suspension Type
4. ANSI C29.3 (1986; R 1995) Wet Process Porcelain Insulators - Spool Type
5. ANSI C29.4 (1989; R 1995) Wet-Process Porcelain Insulators - Strain Type

6. ANSI C29.5 (1984; R 1995) Wet-Process Porcelain Insulators - Low- and Medium-Voltage Types
7. ANSI C29.6 (1996) Wet-Process Porcelain Insulators - High-Voltage Pin Type
8. ANSI C29.8 (1985; R 1995) Wet-Process Porcelain Insulators - Apparatus, Cap and Pin Type
9. ANSI C29.9 (1983; R 1996) Wet-Process Porcelain Insulators - Apparatus, Post-Type
10. ANSI C135.1 (1979) Galvanized Steel Bolts and Nuts for Overhead Line Construction
11. ANSI C135.2 (1987) Threaded Zinc-Coated Ferrous Strand-Eye Anchor Rods and Nuts for Overhead Line Construction
12. ANSI C135.4 (1987) Zinc-Coated Ferrous Eyebolts and Nuts for Overhead Line Construction
13. ANSI C135.14 (1979) Staples with Rolled or Slash Points for Overhead Line Construction
14. ANSI C135.22 (1988) Zinc-Coated Ferrous Pole-Top Insulator Pins with Lead Threads for Overhead Line Construction
15. ANSI C135.30 (1988) Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction
16. ANSI O5.1 (1992) Specifications and Dimensions for Wood Poles
17. ASTM A 36/A 36M (1997a) Carbon Structural Steel
18. ASTM A 123/A 123M (1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
19. ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
20. ASTM A 475 (1998) Zinc-Coated Steel Wire Strand
21. ASTM A 575 (1996) Steel Bars, Carbon, Merchant Quality, M-Grades
22. ASTM A 576 (1990b; R 1995) Steel Bars, Carbon, Hot-Wrought, Special Quality
23. ASTM B 1 (1995) Hard-Drawn Copper Wire
24. ASTM B 8 (1999) Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
25. ASTM B 117 (1997) Operating Salt Spray (Fog) Apparatus
26. ASTM B 228 (1998) Concentric-Lay-Stranded Copper-Clad Steel Conductors
27. ASTM B 232 (1997) Concentric-Lay-Stranded Aluminum Conductors, Coated-Steel Reinforced (ACSR)
28. ASTM D 1654 (1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
29. AWPA C4 (1995) Poles - Preservative Treatment by Pressure Processes
30. AWPA C25 (1995) Sawn Crossarms - Preservative Treatment by Pressure Processes
31. AWPA P1/P13 (1995) Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water Use)
32. AWPA P5 (1997) Standards for Waterborne Preservatives
33. AWPA P8 (1997) Standards for Oil-Borne Preservatives
34. AWPA P9 (1997) Standards for Solvents for Organic Preservative Systems

35. IEEE C2 (2007) National Electrical Safety Code
36. IEEE Std C57.12.00 (2000) – IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
37. IEEE Std C57.12.20 (2005) – IEEE Standard for Overhead-Type Distribution Transformers, 500kVA and Smaller: High Voltage, 34500V and Below; Low Voltage, 7970/13800Y V and below
38. IEEE Std C57.12.31 (2010) – IEEE Standard for Pole Mounted Equipment – Enclosure Integrity
39. IEEE Std C57.12.35 (1996) – IEEE Standard for Bar Coding for Distribution Transformers
40. IEEE Std C57.12.90 (2006) – IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
41. IEEE Std C57.12.91 (2001) – IEEE Guide for Loading Mineral-Oil-Immersed Transformers
42. IEEE Std C57.154™-2012 standard (Pending Approval)– IEEE Standard for the Design, Testing and Application of Liquid-Immersed Distribution, Power and Regulated Transformers using High-Temperature Insulation Systems and Operating at Elevated Temperatures
43. IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System (Part 1)
44. IEEE Std 100 (1996) IEEE Standard Dictionary of Electrical and Electronics Terms
45. IEEE Std 404 (1993; errata) Cable Joints for Use with Extruded Dielectric Cable Rated 5000 V Through 138 000 V and Cable Joints for Use with Laminated Dielectric Cable Rated 2500 V Through 500 000 V
46. NEMA HV 2 (1991) Application Guide for Ceramic Suspension Insulators
47. NEMA TR 1-1993 (R2000) – Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels
48. NFPA 70 (1999) National Electrical Code
49. REA Bulletin 1728H-701 (1993) Crossarms (Solid and Laminated), Transmission Timbers and Pole Keys
50. UL 467 (1993; Rev thru Aug 1996) Grounding and Bonding Equipment
51. UL 486A (1997; Rev thru Dec 1998) Wire Connectors and Soldering Lugs for Use with Copper Conductors
52. UL 486B (1997; Rev Jun 1997) Wire Connectors for Use with Aluminum Conductors

1.7 ENVIRONMENTAL CONDITIONS

A. Environmental conditions:

1. Temperature range, humidity range, and elevation are specified in Division 26 Section “Electrical – General”.

1.8 SUBMITTALS

A. Product Data

1. Catalog cuts, brochures, circulars, specifications, product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.
2. Material, Equipment, and Fixture List
3. A complete itemized listing of equipment and materials proposed for incorporation into the work. Each entry shall include the item number, the quantity of items proposed, and the name of the manufacturer of the item.

B. As-Built Drawings

1. The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be kept at the job site and updated daily. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. The as-built drawings shall be complete and show the location, dimensions, part identification, and other information. Additional sheets may be added. Upon completion of the work, the Contractor shall submit three full sized sets of the marked prints to the Construction Manager for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Construction Manager for approval within ten calendar days from the time the drawings are returned to the Contractor.

C. Field Testing

1. Prepare written reports to record the following:
    a. A list of equipment used, with calibration certifications
    b. A copy of measurements taken
    c. The dates of testing
    d. The equipment and values to be verified
    e. The condition specified for the test
    f. The test results; signed and dated.
    g. A description of adjustments made
    h. Materials and Equipment

D. Where materials or equipment are specified to conform to the standards of the Underwriters Laboratories (UL) or to be constructed or tested, or both, in accordance with the standards of the American National Standards Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), or the National Electrical Manufacturers Association (NEMA), the Contractor shall submit proof that the items provided under this section of the specifications conform to such requirements. The label of, or listing by, UL will be acceptable as evidence that the items conform thereto. Either a certification or a published catalog specification data statement, to the effect that the item is in accordance with the referenced ANSI or IEEE standard, will be acceptable as evidence that the item conforms thereto. A similar certification or published catalog specification data statement to the effect that the item is in accordance with the referenced NEMA standard, by a company listed as a member company of NEMA, will be acceptable as evidence that the item conforms thereto. In lieu of such certification or published data, the Contractor may submit a certificate from a recognized testing agency equipped and competent to perform such services, stating that the items have been tested and that they conform to the requirements listed, including methods of testing of the specified agencies.

1.9 QUALITY ASSURANCE

A. Quality Certification: The manufacturers of components shall have quality certification to ISO 9000:2000 or an equivalent Quality Management System acceptable to the Engineer. Evidence of certification shall be submitted with product data.

B. Comply with NFPA 70 National Electrical Code requirements, and Reference Standards listed herein.

C. Comply with IEEE C2 National Electrical Safety Code, NEC requirements, and Reference Standards listed herein.

1.10 COORDINATION

A. Coordinate cable quantities, sizes, and connection requirements specified in other Sections of Division 26 with components to be provided under this Section.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Products shall conform to the following requirements. Items of the same classification shall be identical including equipment, assemblies, parts, and components.

2.2 STANDARD PRODUCT

A. Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

2.3 CORROSION PROTECTION

A. Aluminum materials

1. Aluminum shall not be used in contact with earth or concrete. Where aluminum conductors are connected to dissimilar metal, fittings conforming to UL 486B shall be used.

B. Ferrous Metal Materials

1. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M and ASTM A 123/A 123M.

C. Equipment and component items, which are not hot-dip galvanized or porcelain enamel finished, shall be provided with corrosion-resistant finishes which shall withstand 120 hours of exposure to the salt spray test specified in ASTM B 117 without loss of paint or release of adhesion of the paint primer coat to the metal surface in excess of 1/16 inch from the test mark. The described test mark and test evaluation shall be in accordance with ASTM D 1654 with a rating of not less than 7 in accordance with TABLE 1, (procedure A). Cut edges or otherwise damaged surfaces of hot-dip galvanized sheet steel or mill galvanized sheet steel shall be coated with a zinc rich paint conforming to the manufacturer's standard.

2.4 CONDUCTORS, CONNECTORS, AND SPLICES

A. Conductors shall be of ACSR type and comply with ASTM B 232.

B. Connectors and Splices shall be of copper alloys for copper conductors, aluminum alloys for aluminum-composition conductors, and a type designed to minimize galvanic corrosion for copper to aluminum-composition conductors. Aluminum-composition and aluminum-composition to copper shall comply with UL 486B, and copper-to-copper shall comply with UL 486A.

2.5 MEDIUM-VOLTAGE LINES

A. Bare medium-voltage line conductors shall be aluminum-conductor-steel-reinforced, ACSR. Conductor types shall not be mixed on any project, unless specifically indicated. Conductors larger than No. 2 AWG shall be stranded.

2.6 POLES AND HARDWARE

A. Wood poles shall comply with ANSI O5.1, and shall be pressure treated in accordance with AWPA C4, with creosote conforming to AWPA P1/P13or with oil-borne preservatives and petroleum conforming to AWPA P8 and AWPA P9, respectively, and waterborne preservatives conforming to AWPA P5. Waterborne preservatives shall be either chromated or ammoniacal copper arsenate. Any species listed in ANSI O5.1 for which a preservative treatment is not specified in AWPA C4, shall not be used; northern white cedar, if treated as specified for western red cedar, and western fir, if treated as specified for Douglas fir, may be used. Wood poles shall have pole markings located approximately 10 feet from pole butts for poles 50 feet or less in length, and 14 feet from the pole butts for poles longer than 55 feet in length. Poles shall be machine trimmed by turning smooth full length, and shall be roofed, gained, and bored prior to pressure treatment. Where poles are not provided with factory-cut gains, metal gain plates shall be provided

B. Pole-Line Hardware shall be Zinc-coated and comply with ANSI C135.1, ANSI C135.2, ANSI C135.4, ANSI C135.14 ANSI C135.22. Steel hardware shall comply with ASTM A 575 and ASTM A 576. Hardware shall be hot-dip galvanized in accordance with ASTM A 153/A 153M. Pole-line hardware shall be hot-dip galvanized steel. Washers shall be installed under boltheads and nuts on wood surfaces and elsewhere as required. Washers used on through-bolts and double-arming bolts shall be approximately 2-1/4 inches square and 3/16 inch thick. The diameter of holes in washers shall be the correct standard size for the bolt on which a washer is used. Washers for use under heads of carriage-bolts shall be of the proper size to fit over square shanks of bolts. Eye bolts, bolt eyes, eyenuts, strain-load plates, lag screws, guy clamps, fasteners, hooks, shims, and clevises shall be used wherever required to support and to protect poles, brackets, crossarms, guy wires, and insulators

C. Guy assemblies shall be aluminum-clad steel in accordance with ASTM B 416. Guy assemblies, including insulators and attachments, shall provide a strength exceeding the required guy strength. Three-eye thimbles shall be provided on anchor rods to permit attachment of individual primary, secondary, and communication down guys. Anchors shall provide adequate strength to support all loads. Guy strand shall be 7 strand. Guy material shall be aluminum-clad-steel-strand, with a minimum breaking strength as shown, except where two or more guys are used to provide the required strength. Guy rods shall be not less than 8 feet in length by 3/4 inch in diameter.

2.7 GROUP OPERATED POLE MOUNTED SWITCH

A. The group operated switches shall be pre-assembled and comply with IEEE C37 standards and installed in accordance with the latest edition of the NESC.

1. All grounding and bonding comply with Division 26 Section "Grounding and Bonding" and all applicable codes and standards.

B. The switch shall be horizontally mounted, group operated type that meets the following requirements:

1. Maximum voltage: 17kV
2. Minimum BIL: 110kV
3. Capable of carrying a continuous load current of 600 amps and equipped with arcing horns
4. Designed with 900 amp overload capability with 40kA momentary rating and 25kA three second rating.
5. Mounting provisions for load side surge arrestors.

C. Phase operator shall be galvanized steel pipe.

D. Vertical operating pipe shall be an 1 ½ inch IPS galvanized steel with a fiberglass rod insulator.

E. Control handle shall be a galvanized steel, torsional swing type with pad locking provisions.

F. A ground mat operator’s platform shall be provided that is a minimum of 3’ x 4’ and constructed from 6061-T6 aluminum.

2.8 FUSED OVERHEAD DISCONNECT (CUTOUT)

A. Provide pole-top style fused overhead disconnects, one per phase, and mounting hardware. All components shall be supplied from the same manufacturer.

B. Each fused overhead disconnect shall meet the following requirements:

1. Maximum voltage: 17kV

2. Minimum BIL: 110kV
3. Maximum 200 amps

C. Install in each a standard speed, E-Rated fuses, which is rated for 120 amps at 14.4kV.

2.9 INSULATORS

A. Insulators shall comply with NEMA HV 2 for general requirements. Suspension insulators shall be used at corners, angles, dead-ends, other areas where line insulators do not provide adequate strength, and as indicated. Mechanical strength of suspension insulators and hardware shall exceed the rated breaking strength of the attached conductors.

B. Medium-voltage line insulators shall comply with ANSI C29.2, ANSI C29.5, and ANSI C29.6, and as applicable. Ratings shall not be lower than the ANSI classes indicated in Table I below. Where line-post insulators are used for angles greater than 15 degrees, clamp-top fittings shall be provided as well as for other locations shown. Conductor clamps for use with clamp-top, line-post insulators shall be hot-dip galvanized malleable iron for copper conductors and aluminum alloy for aluminum-composition conductors. Either line-post or pin insulators may be used for crossarm construction. Pin insulators for use on voltages in excess of 6 kV phase-to-phase shall be radio-interference-freed or else line-post insulators shall be used.

TABLE I MINIMUM ANSI RATING OF MEDIUM-VOLTAGE INSULATORS BY CLASS			
Voltage Level (kV)	Line-Post	Pin	Number of Insulators
15	57-1	55-6	1

C. Strain insulators for use in insulated guy assemblies shall comply with ANSI C29.4 for porcelain or equivalent fiberglass, and shall have a mechanical strength exceeding the rated breaking strength of the attached guy wire. Insulators shall be not smaller than Class 54-4 with two in tandem

2.10 CROSSARM ASSEMBLIES

A. Crossarms shall comply with REA Bulletin 1728H-701 and shall be solid wood, distribution type, except cross-sectional area with pressure treatment conforming to AWPA C25, and a 1/4 inch, 45 degree chamfer on all top edges. Cross-sectional area minimum dimensions shall be 4-1/4 inches in height by 3-l/4 inches in depth in accordance with IEEE C2 for Grade B construction. Crossarms shall be 8 feet in length. Crossarms shall be machined, chamfered, trimmed, and bored for stud and bolt holes before pressure treatment. Factory drilling shall be provided for pole and brace mounting, for four pin or four vertical line-post insulators, and for four suspension insulators, except where otherwise indicated or required. Drilling shall provide required climbing space and wire clearances. Crossarms shall be straight and free of twists to within 1/10 inch per foot of length. Bend or twist shall be in one direction only.

2.11 GROUNDING AND BONDING

A. All grounding and bonding of the electrical system shall comply with Division 26 Section "Grounding and Bonding" and all applicable codes and standards.

B. Driven ground rods shall be of copper-clad steel conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length of the sectional type driven full length into the earth

C. Grounding conductors shall be bare, except where installed in conduit with associated phase conductors. Insulated conductors shall be of the same material as the phase conductors and green color-coded, except that conductors shall be rated no more than 600 volts. Bare conductors shall be ASTM B 8 soft-drawn unless otherwise indicated. Aluminum is not acceptable.

2.12 SURGE ARRESTORS

A. Arrestors shall be metal oxide surge arrester without spark gaps

B. Distribution heavy-duty class for use outdoor with ratings as indicated on the Contract Drawings.

2.13 OVERHEAD TYPE DISTRIBUTION TRANSFORMERS

A. The overhead type distribution transformer shall have the following ratings:
   1. 37.5kVA single phase, 60Hz, capable of continuous operation without exceeding an Average Winding Rise (AWR) of 65 °C or an 80 °C hot spot temperature rise.
   2. Primary voltage rating shall be 7620V (single bushing) and have a basic insulation level (BIL) of 95kV
   3. Secondary voltage 120/240V (three bushing) single phase center tapped 30kV BIL.

B. Full-Capacity Voltage Taps: four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage, with label reflecting that tap changer is for de-energized use.

C. Dielectric coolant: Less flammable, edible-seed-oil based, and UL listed as complying with NFPA 70 requirements for fire point of not less than 300 deg C when tested according to ASTM D 92. Liquid shall be biodegradable and nontoxic.

D. Transformer coils shall be aluminum wound on a core of electrical grade steel with high magnetic permeability and insulated laminations.

E. The tank shall include a self sealing pressure relief valve.

F. The tank shall include grounding provisions.

G. ANSI support lugs (hanger brackets) and lift lugs.

H. Accessories:

1. Tank ground connector
2. Ground strap
3. bird guard
4. Primary Voltage Decal
5. Secondary Voltage Decal
6. Non-PCB Decal

I. Factory Tests: Perform the following factory-certified tests on each transformer:

1. No-Load losses at rated current
2. Total losses at rated current
3. Percent Impedance at rated current
4. Excitation current (100% voltage) test
5. Winding resistance measurement tests
6. Ratio tests using all tap settings
7. Polarity and phase relation tests
8. Induced potential tests
9. Full wave and reduced wave impulse test

J. The high-voltage bushings shall have the following ratings:

1. 95kV BIL
2. minimum creepage distance of of 16½" ± 1½"
3. 35kV 60Hz dry 1 minute withstand
4. 30kV 60Hz wet 10 second withstand

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Equipment, devices and components shall be installed and energized in accordance with the manufacturer's published instructions.

B. The installation shall be in compliance with the requirements and recommendations of IEEE C2 for heavy loading districts, Grade B construction. No reduction in clearance shall be made. The installation shall also comply with the applicable parts of NESC and NFPA 70.

C. The Contractor shall become familiar with details of the work, shall verify dimensions in the field, and shall notify the Construction Manager of any discrepancy before performing any work.

3.2 DELIVERY, STORAGE, AND HANDLING

A. Devices and equipment shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced. Wood poles held in storage for more than 2 weeks shall be stored in accordance with ANSI O5.1. Handling of wood poles shall be in accordance with ANSI O5.1, except that pointed tools capable of producing indentations more than inch in depth shall not be used.

3.3 POLE INSTALLATION

A. Wood poles shall be set straight and firm. In normal firm ground, minimum pole-setting depths shall be as listed in Table II. In swampy or soft ground, a bog shoe shall be used where support for a pole is required. Poles in straight runs shall be in a straight line. Curved poles shall be placed with curvatures in the direction of the pole line. Poles shall be set to maintain as even a grade as practicable. When the average ground run is level, consecutive poles shall not vary more than 2 feet in height. When the ground is uneven, poles differing in length shall be kept to a minimum by locating poles to avoid the highest and lowest ground points. If it becomes necessary to shorten a pole, a piece shall be sawed off the top end and roofed. If any pole is shortened after treatment, the shortened end of the pole shall be given an application of hot preservative. Where poles are set on hilly terrain, along edges of cuts or embankments, or where soil may be washed out, special precautions shall be taken to ensure durable pole foundations, and the setting depth shall be measured from the lower side of the pole. Holes shall be dug large enough to permit proper use of tampers to the full depth of a hole. Earth shall be placed into the hole in 6 inch maximum layers, then thoroughly tamped before the next layer is placed. Surplus earth shall be placed around each pole in a conical shape and packed tightly to drain water away from poles.

Table II MINIMUM POLE-SETTING DEPTH (FEET)		
Pole Length Overall (Feet)	Straight Lines	Curves, Corners, and Points of Extra Strain
20	5.0	5.0
25	5.5	5.5
30	5.5	5.5
35	6.0	6.0
40	6.5	6.5
45	6.5	7.0
50	7.0	7.5
55	7.5	8.0
60	8.0	8.5
65	8.5	9.0
70	9.0	9.5
75	9.5	10.0
80	10.0	10.5
85	10.5	11.0
90	11.0	11.5
95	11.5	12.0
100	12.5	12.5

3.4 CROSSARM MOUNTING

A. Crossarms shall be bolted to poles with 5/8 inch through-bolts with square washers at each end. Bolts shall extend not less than 1/8 inch nor more than 2 inches beyond nuts. On single crossarm construction, the bolt head shall be installed on the crossarm side of the pole. Metal crossarm braces shall be provided on crossarms. Flat braces may be provided for 8 foot crossarms and shall be 1/4 by 1-1/4 inches, not less than 28 inches in length. Flat braces shall be bolted to arms with 3/8 inch carriage bolts with round or square washers between boltheads and crossarms, and secured to poles with 1/2 by 4 inch lag screws after crossarms are leveled and aligned. Double crossarms shall be securely held in position by means of 5/8 inch double-arming bolts. Each double-arming bolt shall be equipped with four nuts and four square washers.

3.5 GUY INSTALLATION

A. Guys shall be provided where shown, with loads and strengths as indicated, and wherever conductor tensions are not balanced, such as at angles, corners, and dead-ends. Where a single guy will not provide the required strength, two or more guys shall be provided. Where guys are wrapped around poles, at least two guy hooks shall be provided and pole shims shall be provided where guy tension exceeds 6000 pounds. Guy clamps 6 inches in length with three 5/8 inch bolts, or offset-type guy clamps, or approved guy grips shall be provided at each guy terminal. Guy-strain insulators shall be provided in each guy for wood poles. Multiple-helix screw anchors shall be provided in marshy ground; rock anchors shall be installed in rock at right angles to guys, elsewhere anchors shall be of an expanding type, except that power installed screw anchors of equivalent holding power are acceptable. A half-round yellow fiberglass or other suitable plastic guy marker, not less than 8 feet in length, shall be provided at the anchor end of each guy shown, securely clamped to the guy or anchor at the bottom and top of the marker. Holding capacities for down guys shall be based on a lead angle of 45 degrees.

3.6 CONDUCTOR INSTALLATION

A. Line Conductors: Unless otherwise indicated, conductors shall be installed in accordance with manufacturer's approved tables of sags and tensions. Proper care shall be taken in handling and stringing conductors to avoid abrasions, sharp bends, cuts, kinks, or any possibility of damage to insulation or conductors. Conductors shall be paid out with the free end of conductors fixed and cable reels portable, except where terrain or obstructions make this method unfeasible. Bend radius for any insulated conductor shall not be less than the applicable NEMA specification recommendation. Conductors shall not be drawn over rough or rocky ground, nor around sharp bends. When installed by machine power, conductors shall be drawn from a mounted reel through stringing sheaves in straight lines clear of obstructions. Initial sag and tension shall be checked by the Contractor, in accordance with the manufacturer's approved sag and tension charts, within an elapsed time after installation as recommended by the manufacturer

B. Connectors and Splices: Connectors and Splices shall be mechanically and electrically secure under tension and shall be of the nonbolted compression type. The tensile strength of any splice shall be not less than the rated breaking strength of the conductor. Splice materials, sleeves, fittings, and connectors shall be noncorrosive and shall not adversely affect conductors. Aluminum-composition conductors shall be wire brushed and an oxide inhibitor applied before making a compression connection. Connectors which are factory-filled with an inhibitor are acceptable. Inhibitors and compression tools shall be of types recommended by the connector manufacturer. Primary line apparatus taps shall be by means of hot line clamps attached to compression type bail clamps (stirrups). Low-voltage connectors for copper conductors shall be of the solderless pressure type. Noninsulated connectors shall be smoothly taped to provide a waterproof insulation equivalent to the original insulation, when installed on insulated conductors. On overhead connections of aluminum and copper, the aluminum shall be installed above the copper.

C. Conductor-To-Insulator Attachments: Conductors shall be attached to insulators by means of clamps, shoes or tie wires, in accordance with the type of insulator. For insulators requiring conductor tie-wire attachments, tie-wire sizes shall be as indicated in TABLE III.

TABLE III TIE-WIRE REQUIREMENTS	
CONDUCTOR AAC, AAAC, or ACSR (AWG)	TIE WIRE AAAC OR AAC (AWG)
Any Size	6 or 4

D. Armor rods shall be provided for AAC, AAAC, and ACSR conductors. Armor rods shall be installed at supports, except armor rods will not be required at primary dead-end assemblies if aluminum or aluminum-lined zinc-coated steel clamps are used. Lengths and methods of fastening armor rods shall be in accordance with the manufacturer's recommendations. Flat armor rods shall be not less than 0.05 by 0.30 inches. For span lengths of 200 feet or more, preformed round armor rods shall be used

3.7 CONNECTIONS BETWEEN AERIAL AND UNDERGROUND SYSTEMS

A. Connections between aerial and underground systems shall be made as shown. Underground cables shall be extended up poles in conduit to cable terminations. Conduits shall be secured to poles by conduit supports spaced not more than 10 feet apart and with one support not more than 12 inches from any bend or termination. Cables shall be supported by devices separate from the conduit or guard, near their point of exit from the riser conduit or guard. Cables guards shall be secured in accordance with the manufacturers published procedure. Risers shall be equipped with bushings to protect cables.

3.8 GROUNDING

A. Noncurrent-carrying metal parts of equipment and conductor assemblies, such as luminaires, medium-voltage cable terminations and messengers, metal poles, operating mechanisms of pole top switches and other noncurrent-carrying metal items shall be grounded. Additional grounding of equipment, neutral, and surge arrester grounding systems shall be installed at poles where indicated.

B. Grounding electrodes shall be installed as follows:

1. Driven rod electrodes - Unless otherwise indicated, ground rods shall be located approximately 3 feet out from base of the pole and shall be driven into the earth until the tops of the rods are approximately 1 foot below finished grade. Multiple rods shall be evenly spaced at least 10 feet apart and connected together 2 feet below grade with a minimum No. 6 bare copper conductor.
2. Ground Resistance - The maximum resistance of a driven ground rod shall not exceed 5 ohms under normally dry conditions. Whenever the required ground resistance is not met, provide additional electrodes interconnected with grounding conductors to achieve the specified ground resistance. The additional electrodes will be up to three 10 feet rods spaced a minimum of 10 feet apart. In high ground resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 5 ohms measured not less than 48 hours after rainfall, the Construction Manager shall be notifies immediately. Connections below grade shall be fusion welded. Connections above grade shall be fusion welded or shall use UL 467 approved connectors

C. Grounding and Bonding connections above grade shall be made by the fusion-welding process or with bolted solderless connectors in compliance with UL 467, and those below grade shall be made by a fusion-welding process. Where grounding conductors are connected to aluminum-composition conductors, specially treated or lined copper-to-aluminum connectors suitable for this purpose shall be used.

D. Grounding Electrode Conductors: On multi-grounded circuits, as defined in IEEE C2, provide a single continuous vertical grounding electrode conductor. Neutrals, surge arresters, and equipment grounding conductors shall be bonded to this conductor. For single grounded or ungrounded systems, provide a grounding conductor for the surge arrester and equipment grounding conductors and a separate grounding conductor for the secondary neutrals. Grounding electrode conductors shall be sized as shown. Grounding electrode conductors shall be stapled to wood poles at intervals not exceeding 2 feet. Bends greater than 45 degrees in grounding electrode conductor are not permitted.

3.9 FIELD TESTING

A. Field testing shall be performed in the presence of the Construction Manager. The Contractor shall notify the Construction Manager 10 days prior to conducting tests. The Contractor shall furnish materials, labor, and equipment necessary to conduct field tests. The Contractor shall perform tests and inspections recommended by the manufacturer unless specifically waived by the Construction Manager. The Contractor shall maintain a written record of tests which includes date, test performed, personnel involved, devices tested, serial number and name of test equipment, and test results. Field reports will be signed and dated by the Contractor.

B. Safety: The Contractor shall provide and use safety devices such as rubber gloves, protective barriers, and danger signs to protect and warn personnel in the test vicinity. The Contractor shall replace any devices or equipment which are damaged due to improper test procedures or handling.

C. Ground Resistance Testing: The resistance of each pole ground of 5 ohms shall be measured using the fall-of-potential method defined in IEEE Std 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes shall be provided.

D. Sag and Tension Test: The Construction Manager shall be given prior notice of the time schedule for stringing conductors or cables serving overhead medium-voltage circuits and reserves the right to witness the procedures used for ascertaining that initial stringing sags and tensions are in compliance with requirements for the applicable loading district and cable weight.

3.10 MANUFACTURER’S FIELD SERVICE

A. After delivery of the equipment, the Contractor shall furnish one or more field engineers, regularly employed by the equipment manufacturer to supervise the installation of the equipment, assist in the performance of the onsite tests and initial operation

3.11 ACCEPTANCE

A. Final acceptance of the facility will not be given until the Contractor has successfully completed all tests and after all defects in installation, material or operation have been corrected

END OF SECTION 261800

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a service entrance panelboard as shown on the Drawings and specified herein.

1.2 REFERENCES

A. Materials and installation shall be in conformance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. Underwriters Laboratories, Inc. (UL) 508 – Industrial Control Equipment
2. American National Standards Institute, Inc. (ANSI) C12.20 – American National Standard for Electricity Meters – 0.2 and 0.5 Accuracy Classes.
3. National Electrical Code (NEC).

1.3 RELATED DOCUMENTS

A. Additional requirements are described in the following Division “Electrical” Sections:

1. “Grounding and Bonding for Electrical Systems” for grounding requirements.
2. “Surge Protective Devices” for units mounted integral to the panelboard.

1.4 DEFINITIONS

A. In addition to the definitions in Division “Electrical” Section “Electrical”, the following definitions apply to this Section:

1. GFCI: Ground-fault circuit interrupter
2. RMS: Root mean square
3. SPDT: Single pole, double throw

1.5 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, transient voltage surge suppression device, metering device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment, submit the following:

1. Specially prepared drawing for each panelboard showing dimensions, busbars, circuit breakers, doors and trim, latches and locking devices, and complete bill of materials listing all components. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    a. Enclosure types and details for types other than NEMA 250, Type 1.
    b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of panelboard and overcurrent protective devices
d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power (for all panelboards) and control wiring (for panelboards with control devices).
3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Qualification Data: For testing agency.

D. Field quality-control test reports including the following:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of adjustable overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, metering device, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70

F. Comply with UL 67 and UL 50

G. When used as service equipment the panelboard shall be UL label for Service Equipment.

1.7 PROJECT CONDITIONS

A. Ambient temperature, humidity, and elevation ranges:

1. Ambient Temperature: 0 to 40 deg C.
2. Humidity: Less than 90 percent (non-condensing).
3. Altitude: Not exceeding 3300 feet (1000 m).

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Arc flash warning label as specified in latest edition of NFPA 70

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
   a. Eaton Corporation; Cutler-Hammer Products.
   b. General Electric Co.; Electrical Distribution & Protection Div.
   c. Siemens Energy & Automation, Inc.
   d. Square D.
2. Transient Voltage Suppression Suppression Panelboards:
   a. Advanced Protection Technologies.
   b. Current Technology.
   c. Liebert Corporation
   d. Eaton/Cutler Hammer.
   e. United Power.

2.2 MANUFACTURED UNITS

A. All panelboards shall be dead front design

B. Enclosures: Surface-mounted cabinets in conformance with NEMA PB 1.

1. Rated for environmental conditions at installed locations, and in conformance with Division “Electrical” Section “Electrical” enclosure requirements.
2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions.
3. Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
6. The manufacturer's nameplate shall be of corrosion resistant metal such as stainless steel and have the pertinent ratings embossed in raised letters and numerals. The pertinent ratings shall include at least the following; amperage, voltage, phase, wires, AIC, manufacturer and model number.

C. Phase and Neutral Buses: Tin-plated Hard-drawn copper, 98 percent conductivity.

D. Equipment Ground Bus: Hard-drawn copper, adequate connections for feeder and branch-circuit equipment ground conductors; bonded to box.

E. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs: Mechanical type.

F. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switch.

G. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Metering Device: Revenue Grade, ANSI C12.20 0.5% accuracy, IEC 62053-22 Class 0.5S. Operating temperature for the meter shall be (-30 to +70) degrees C.

B. Main Overcurrent Devices: Thermal-magnetic circuit breaker.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

E. Transient Voltage Surge Suppression Device: IEEE C62.41, integrally mounted, plug-in-style, solid-state, parallel-connected. Refer to specification Division “Electrical” Section “Surge Protective Devices”.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box.

D. Install overcurrent protective devices and controllers.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division “Electrical” Section "Identification for Electrical Systems".

B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division “Electrical” Section "Grounding and Bonding for Electrical Systems".

B. Connect wiring according to Division “Electrical” Section "Low-Voltage Electrical Power Conductors and Cable".

3.4 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:
   1. Perform electrical test and visual and mechanical inspections described in the following NETA Acceptance Testing Specification Inspection and Test Procedures that are applicable to the products furnished for this project:
      a. 7.1 “Switchgear and Switchboard Assemblies”
      b. 7.6.1.1 “Circuit Breakers, Air, Insulated-Case, Molded-Case”
      c. 7.19.1 “Surge Arresters, Low-Voltage”
      d. 7.16.1.1 “Motor Control, Motor Starters, Low-Voltage”
   2. Certify compliance with test parameters.
   3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.6 FOLLOWUP SERVICE

A. Infrared Scanning: One month after Substantial Completion, perform an infrared scanning of each panelboard in conformance with NETA Acceptance Testing Specification 9. “Thermographic Survey”. Remove panel fronts so joints and connections are accessible to portable scanner.

B. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

C. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. Provide a color photo along side an infrared photo of each panelboard in the report.

END OF SECTION

SECTION 264300
SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide surge protection device unit for protection of low-voltage service equipment as indicated on the contract documents to protect electric, electronic systems, and control equipment from the effects of line and induced transient voltage surges and coupled lightning discharged transients.

1.2 REFERENCES

A. Materials and installation shall be in conformance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:

1. Underwriters Laboratories, Inc. (UL) 1449 3rd Edition – Surge Protective Devices.
2. National Electrical Code (NEC)
3. The Institute of Electrical and Electronic Engineers (IEEE) ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.

1.3 RELATED DOCUMENTS

A. Additional requirements are described in the following Division “Electrical” Sections:

1. “Panelboards” for surge protection device requirements internally mounted in the panelboard.

1.4 SUBMITTALS

A. Submittals shall conform to the General Provisions.

B. Submit manufacturer's catalog data for each product, clearly marked to show which items are proposed for this project. Cross out non-applicable information.

C. Operation and Maintenance Manuals: Provide copies of electrical Operation and Maintenance Manuals in conformance with the General Provisions.

1.5 QUALITY ASSURANCE

A. Uniformity: Unless otherwise specified, equipment or material of same type of classification shall be products of same manufacturer. All material shall be new and of the latest design of manufacturer providing equipment or material.

B. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog numbers shall be designed in conformity with all applicable technical standards and shall have neat and finished appearance.

C. The surge protective device shall have a minimum of 10 years warranty.

PART 2 - PRODUCTS

2.1 GENERAL

A. MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Innovative Technology Inc.
    b. Advanced Protection Technologies, Inc.
    c. Cutler-Hammer, Inc.
    d. Leviton Manufacturing Co. Inc.
    e. Intermatic Incorporated
    f. Liebert Corp.
    g. Siemens Energy & Automation.
    h. Square D Co.
    i. Or approved equal.

2. The surge protective device shall be of the fast acting Metal Oxide Varistor (MOV) design.

B. SERVICE ENTRANCE SURGE PROTECTIVE DEVICES

1. Modular design with field-replaceable modules for the purpose of in-service replacement for each phase. The SPD shall provide redundancy in the event of primary phase-module failure.

2. The Surge Protective Device shall be furnished and installed by the panelboard manufacturer. The devise shall be Type 1 as defined by UL 1449 and internally mounted into the panelboard.

3. Provide the following features and accessories:

    j. Fuses rated at 200-kA interrupting capacity (or at a minimum the available fault current at the utility connection).
    k. Fabrication using bolted compression lugs for internal wiring.
    l. Integral disconnect switch.
    m. Connection Means: Permanently wired.
    n. Redundant suppression circuits.
    o. Redundant replaceable modules.
    p. Arrangement with copper busbars and for bolted connections to phase buses, neutral bus, and ground bus.

q. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
r. Red and green LED indicator lights for power and protection status.
s. Audible alarm, with silencing switch, to indicate when protection has failed.
t. One set of dry contacts rated at 5 a and 250-V ac, for remote monitoring of protection status.
u. Surge-event operations counter.
v. Peak Single-Impulse Surge Current Rating: 240 kA per phase.
w. Protection modes and UL 1449 clamping voltage for 240/120 V, single-phase, 3-wire circuits, shall be as follows:
    1) Line to Neutral: 400 V
    2) Line to Ground: 400 V
    3) Neutral to Ground: 400 V

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Surge Protective Devices shall be installed as an integral part of the panelboard by the panelboard manufacturer. Surge Protective Devices shall be directly connected to panelboard bussing.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including conduit and electrical connections.

1. Verify that electrical wiring installation complies with manufacturer's installation requirements.

3.3 ACCEPTANCE TESTS

A. Testing: Perform the following acceptance tests:
1. Complete startup checks according to manufacturer's written instructions.
2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification Inspection and Test Procedure 7.19.1 "Surge Arrestors, Low Voltage".
3. Certify compliance with test parameters.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made. Submit test report.

END OF SECTION

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH & SAFETY PLAN

IN SITU THERMAL REMEDIATION PROJECT
SWMU-S
Site # 356002
Order on Consent Index No. D3-10023-6-11
Former IBM Kingston Facility

May 22, 2014

REVISION SUMMARY

Revision Date	Description of Changes	Reason For Change
	(Section title or number – description)	(individual name or title, company / agency name, document reference and date)
May 22, 2014	NA	Original Document

PREFACE

This document describes the minimum anticipated protective measures necessary for worker health and safety during the activities associated with this project. O'Brien & Gere employees and subcontractors must read and understand the contents of this document. We do not intend the contents of this document to cover all situations that may arise nor to waive any provisions specified in Federal, State, and local regulations or site owner / contractor health and safety requirements. During this project, if any task occurs that is not covered in this Project Safety Plan, the individual responsible for that task will inform O'Brien & Gere's Project Manager. Site personnel affected by the new activity and its associated hazards must ensure that they follow necessary safety procedures and use appropriate protective equipment.

Subcontractors are accountable for the health and safety of employees. No requirements or provisions within this plan shall be construed by subcontractors as an assumption by O'Brien & Gere or IBM of the subcontractor's legal responsibilities as an employer.

TABLE OF CONTENTS

TABLES

ATTACHMENTS

APPENDICES

1 INTRODUCTION

This Health & Safety Plan (HASP) has been developed to outline the requirements to be met by O'Brien & Gere employees, subcontractors, and visitors while performing activities outlined herein and at the Thermal Remediation Project at the Former IBM Facility (Site) in Kingston, NY. This HASP describes the responsibilities, training requirements, protective equipment, and safety procedures necessary to minimize the risk of injury, fires, explosion, chemical spills, and material damage incidents related to construction activities. This HASP incorporates by reference the Occupational Safety and Health Administration (OSHA) regulations contained in 29CFR1910 and 29CFR1926.

The requirements and guidelines in this HASP are based on a review of available information and data, and an evaluation of identified on-site hazards. This HASP will be reviewed with site personnel and will be available on-site. O'Brien & Gere employees, subcontractors, and visitors will report to the on-site O'Brien & Gere Site Safety & Health Coordinator (SSHC) in matters of health and safety. While the SSHC is responsible for overseeing compliance with this HASP and stopping work when necessary, the Project Field Supervisor (or equivalent) is responsible for implementation of this HASP into daily site activities. The SSHC may also serve as the Project Field Supervisor or Foreman depending on project size and work activities.

O'Brien & Gere employees and subcontractors must review this safety plan prior to beginning work and sign the Pre-Work Briefing / Safety Compliance form (*Attachment 1*).

1.1. COVERED PERSONNEL

This HASP is specifically intended for O'Brien & Gere employees, subcontractors, and visitors who will be conducting activities within the defined scope of work in specified areas of the site. O'Brien & Gere will inform site personnel of identified safety and health hazards as outlined in this HASP. O'Brien & Gere employees, subcontractors, and visitors are responsible for complying with government regulations, site owner policies, and this HASP as it relates to their scope of work. This HASP may be provided to interested third parties for informational purposes.

1.2. HASP REVIEW & MODIFICATION

Future actions may be conducted at this site and unexpected conditions may be encountered that may require modification of this HASP. The SSHC will recommend modifications to this HASP, and the O'Brien & Gere Project Manager will have the responsibility of approving them. The Project Manager should consult with O'Brien & Gere Corporate H&S for modifications that involve new high-risk activities. Modifications to this HASP shall be outlined on the ***Revision Summary*** page.

This HASP may be modified for new or additional scopes of work by directly revising this HASP and saving a revised copy or by developing supplemental Job Safety Analyses (JSAs) based on a template in ***Appendix A***. JSAs may modify air sampling, personal protective equipment, and other safety precautions in this HASP as necessary to safely perform new work activities.

1.3. SITE DESCRIPTION

The 258-acre property was developed by IBM in 1954, with manufacturing operations beginning in 1955. Operations included, but were not limited to: computer manufacturing, metal plating, circuit board production and typewriter production. IBM ceased operations at the Site during the mid-1990's. In 1998, IBM sold the site to AG Properties of Kingston, LLC and Ulster Business Complex, LLC, who renamed the Site, TechCity, and subdivided the property into multiple parcels. The site is currently owned and managed by Tech City Properties (TechCity).

The site is located within the boundaries of the former IBM facility at 300 Enterprise Drive, Kingston, NY. The project occurs with Solid Waste Management Unit (SWMU) S, in and around building B001, which is unoccupied, with much of the scope of work being conducted in the adjacent courtyard. The courtyard is bordered on the south and west by buildings 21 and 23, respectively, with building 23 being unoccupied at this time with plans for use in the future. In the southwest corner of the courtyard is building 22, which is occupied by an active food packaging company whom will need access to the western edge of the courtyard during scheduled work activities. Building B001 is located on the eastern most edge of the courtyard.

Primary site access will be the Enterprise Drive entrance, through the large parking lot to the north of the site, where the crews will have access through the gates. Building B001 and the courtyard will be secured from occupied portions of the site by a perimeter fence through which access will be controlled by O'Brien & Gere during this project. Strict traffic patterns including speed postings and traffic flow directions must be observed at all times. A temporary field office, waste storage and laydown area will be established inside of the secured courtyard, where internet service will be acquired through an air card and the main point of phone contact will be through cell phones.

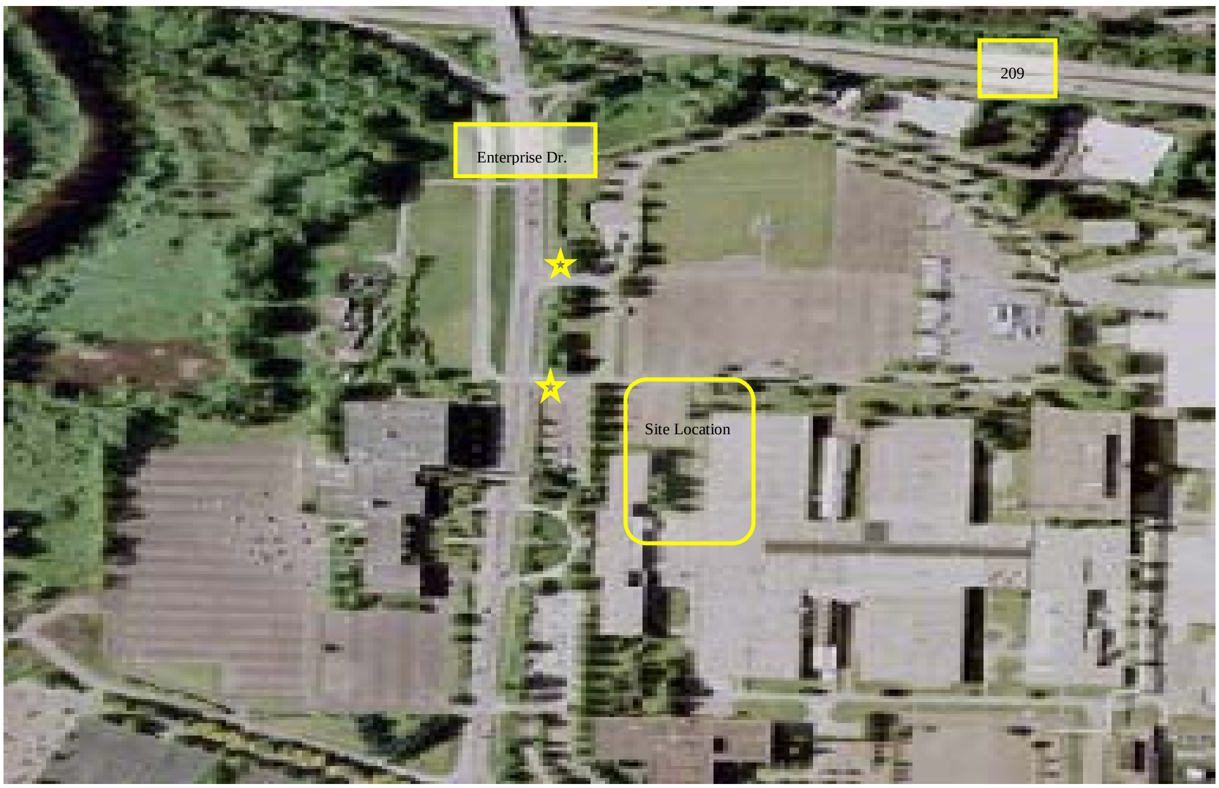


Photo 1: Showing aerial view of former IBM, Kingston, NY site. Stars denote site entrance and egress.

1.4. SCOPE OF WORK

O'Brien & Gere is managing and supporting TRS GROUP INC. in the installation of an insitu thermal remediation technology called electrical resistance heating (ERH). The ERH design, installation and operations will be performed by TRS GROUP INC. The ERH heating process utilizes electrical current and vapor extraction to vaporize contaminants and extract them from the soil and groundwater. The total remediation will require installation of a specifically designed pattern of electrodes. Each electrode is connected to an electrical power source and a current is generated in the ground between the electrodes. The groundwater will be heated to its boiling point which should destroy or volatilize solvents, ***which in this case is primarily 1,1,1-trichloroethane (TCA)***. A key hazard is electrical safety where everything must be electrically grounded and bonded including the building structures and perimeter fence posts. Solvent vapors will be captured by a vapor collection system and removed with a steam regenerative granular activated carbon (SRGAC). Hydraulic control will be established and maintained through a series of temporary groundwater extraction wells. Extracted groundwater and ERH condensate will be treated with an air-stripper and GAC. Additional chemicals of concern in the immediate vicinity are trichloroethene (TCE) and tetrachloroethene (PCE) and related degradation products (i.e., 1,1-dichloroethene [1,1-DCE], 1,1-dichloroethane [1,1-DCA], and 1,2-dichloroethene [1,2-DCE]). Other volatile organic compounds (VOCs) have been detected in groundwater, including carbontetrachloride, Freon and petroleum (BTEX) hydrocarbons; however, the concentrations of these VOCs are generally lower and less extensive than the chlorinated compounds that are present. O'Brien & Gere will both self-perform and subcontract (as appropriate) the following scope of work:

- Mobilization/Demobilization
  - Install / locate trailer and roll-offs
  - Install overhead power line (hook-up located at north end of parking area)
  - Installation of GAC's, cooling towers, power control units, generator, etc.
  - Installation of false wall within building 1 (non-combustibles)
- Site Preparation
  - Clearing brush & small trees (If necessary)
  - New fence installation
- Electrode Installation
  - Drill installation site (12"x35', approximately 70 borings)
  - Installation of electrodes (as part of thermal treatment system)
- Installation of Thermal Treatment System
  - Installation of vapor collection system and carbon units
  - Placement of power control units (rigging & crane use)
  - Connection of electrodes to power control units
  - Connection of power control units to the NYSEG utility pole
- Excavations
  - Removal and decommissioning of fire line feed
- Concrete and Masonry Construction
  - Drill through existing foundation of building 1

  Install overhead door with an integrated man door on the west side of building 001
- Installation of Hydraulic Vapor Capturing Wells (4)

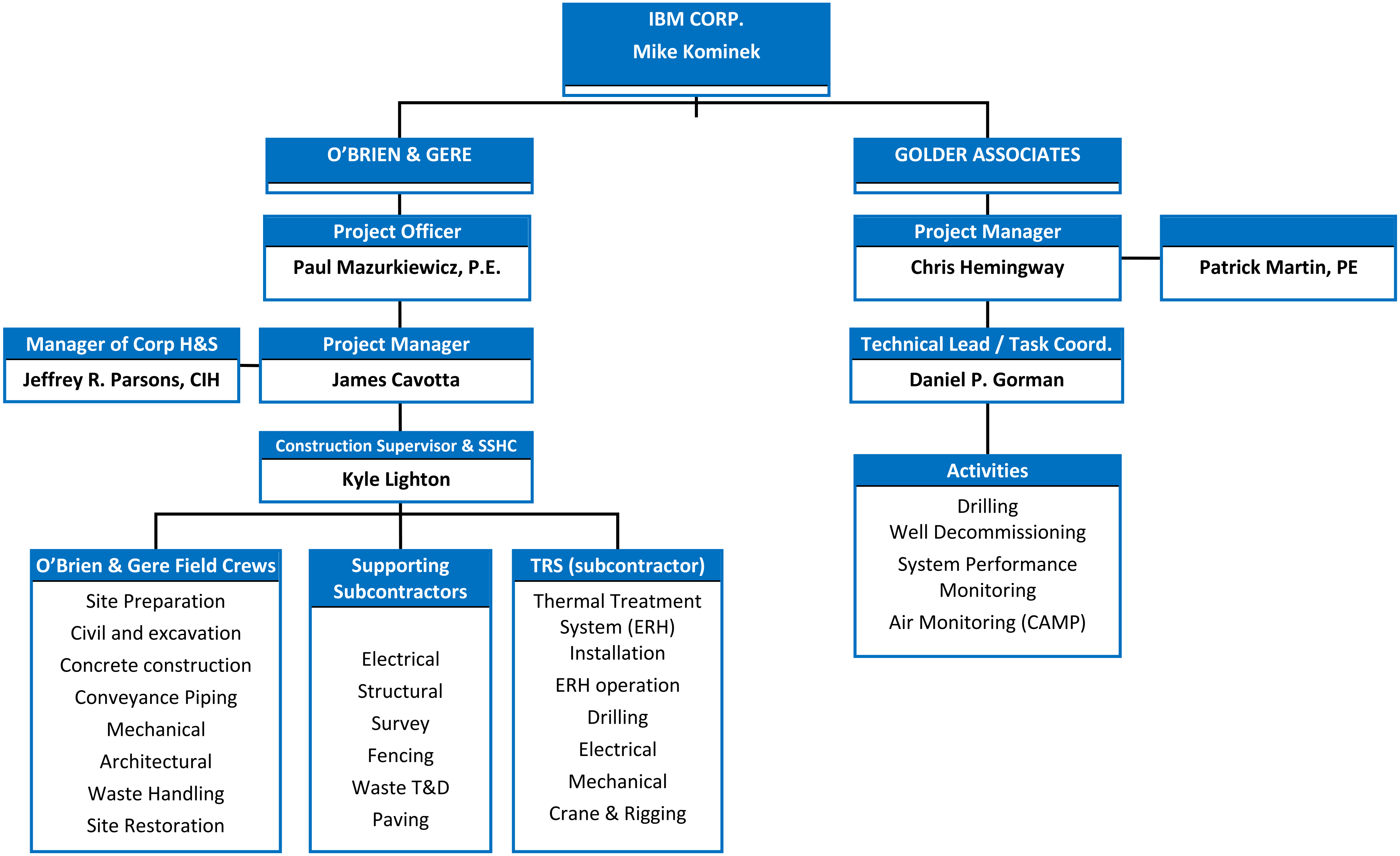
1.5. PROJECT PERSONNEL & ORGANIZATION

The following are key project personnel for the project

COMPANY	NAME	TITLE
IBM	Michael J. Kominek	Program Manager
O'BRIEN & GERE	Paul Mazurkiewicz, P.E. James Cavotta Kyle Lighton Jeffery R. Parsons, CIH Michael Kozar, P.G., LSRP	Project Officer Project Manager Construction Manager Manager of Corporate Health and Safety Technical QA/QC
GOLDER Associates	Christopher H Hemingway, PG, LSRP Daniel P Gorman	Project Geologist Hydro-geologist
TRS GROUP INC.	Tim Warner Chris Blundy Bob Poulin Michelle Nanista	VP of operations Sr. Project Manager Project Manager Project Engineer

1.6. PROJECT ORGANIZATION CHART

The following organization chart outlines the anticipated project organization.



1.7. RESPONSIBILITIES

As directed in the HASP, general compliance and HASP implementation will generally be addressed first by the O'Brien & Gere Site Safety & Health Coordinator (SSHC) with support from Project Officers. Subcontractors must identify qualified Safety Competent Persons who must be on site for all field activities. All project personnel have the authority to stop work if a life-threatening condition or behavior is observed.

1.7.1. O'Brien & Gere Project Officers – *Paul D. Mazurkiewicz, P.E. – 315-956-6826*

The Project Officer is responsible for providing upper level management support for health and safety. He or she will provide sufficient authority and resources to the Construction Supervisor and SSHC to fully implement health and safety requirements as outlined in this HASP, contract documents, and regulatory requirements. The Project Officer will provide this support to the entire project while the Construction Project Officer will provide additional attention and support to site remediation activities.

1.7.2. O'Brien & Gere Project Manager – *James Cavotta – 315-956-6836*

The Project Coordinator will have overall responsibility for implementing HASP requirements through the project. The Project Coordinator will be the primary liaison to and from the Client for health and safety.

1.7.3. O'Brien & Gere Construction Supervisor – *Kyle Lighton – 315-956-6551*

The Construction Supervisor shall be qualified to serve as the O'Brien & Gere Safety & Health Coordinator (SSHC) when less than 25 tradespersons are on site and during temporary absences of a full-time SSHC when more than 25 tradespersons are on site. Construction management staff, construction inspectors, quality inspectors, scientists, engineers, and other professionals are not considered to be tradespersons.

The Project Supervisor is responsible for coordinating project requirements in the field. The Construction Supervisor oversees daily activities and is, therefore, responsible for implementing health and safety requirements on a daily basis in the field. The Project Supervisor is also responsible for conducting daily safety inspections and coordinating timely correction of observed deficiencies with any sub-contractor. The Project Supervisor shall be qualified to also serve as the O'Brien & Gere Site SSHC with respect to O'Brien & Gere's scope of work.

1.7.4. O'Brien & Gere Site Safety & Health Coordinator (SSHC) – *Kyle Lighton (same as above)*

The SSHC advises project personnel on matters of health and safety on the site. The SSHC has the authority to stop work if any operation threatens site workers, the public, or environment.

In general, responsibilities of the SSHC include, but are not limited to, the following:

- Conducting and documenting safety inspections on a weekly basis and conducting daily safety walkthroughs
- Conducting daily safety pre-work safety meetings and documenting meetings on a daily Pre-Task Planner (or equivalent)
- Selection and inspection of PPE
- Conducting periodic surveillance to evaluate effectiveness of the HASP
- Monitoring on-site hazards and conditions and recommending modifications to the HASP when new hazards are observed
- Informing the Construction Supervisor of observed safety deficiencies requiring corrective action
- Having knowledge of emergency procedures, evacuation routes, and telephone numbers for emergency services

- Posting directions to the hospital and telephone numbers for emergency services
- Coordinating emergency medical care as necessary
- Immediately notify followed by submittal of written accident/emergency reports to a client representative within 48 hours
- Review JSAs for all high-risk construction activities
- Reviewing and maintaining safety documentation and reports

1.7.5. O'Brien & Gere Manager of Corporate Health & Safety – *Jeffery Parsons, CIH – 315-956-6070*

The O'Brien & Gere Manager of Corporate Health & Safety will make safety-related recommendations regarding the work area to the SSHC and engage ongoing support from O'Brien & Gere Corporate Safety Department as necessary. Inspections will periodically be conducted to monitor worker health and safety and will address issues such as subcontractor pre-qualification, site safety orientation programs and documentation, implementation of permit programs (confined space, hot work, etc.) safety planning, accident investigations, meetings with client, adequacy of personal protective equipment (PPE), air monitoring needs, and general construction safety issues. The O'Brien & Gere Manager of Corporate Health & Safety will approve modifications to this HASP and will prepare a Monthly Safety Report.

1.7.6. O'Brien & Gere Corporate Health & Safety Specialist – *Sean Benz, CHST – 315-396-9120*

The O'Brien & Gere Corporate Health & Safety Specialist (HSS) will assist the O'Brien & Gere Manager of Corporate Health & Safety in the implementation of the Corporate Health & Safety program. General support tasks related to the implementation of the O'Brien & Gere Corporate Health & Safety Program include safety audits, air monitoring, training, accident investigations, etc.

1.7.7. Subcontractor Safety Competent Person – *Bob Poulin*

All subcontractors under contract to O'Brien & Gere are covered by this HASP and will be required to designate a Safety Competent Person. The Safety Competent Person must be the Superintendent/Foreman unless the project is sufficiently large to require a full-time Safety Competent Person. A Safety Competent Person will have the same responsibilities as the O'Brien & Gere SSHC within the subcontractor's scope of work. This individual must possess a sound working knowledge of pertinent OSHA regulations, this HASP, and other applicable safety requirements related to scope of work. The competent person will ensure timely correction of safety deficiencies identified by O'Brien & Gere. Subcontractors may request assistance from the O'Brien & Gere Corporate Health & Safety Department. An Alternate Safety Competent Person may also be designated as a backup.

2 SITE SAFETY & CONTROL PROCEDURES

This Health & Safety Plan (HASP) incorporates by reference the Occupational Safety and Health Administration (OSHA) requirements in 29 CFR Part 1910, 29 CFR Part 1926, and the O'Brien & Gere Corporate Health & Safety Manual (CHS Manual). A copy of the O'Brien & Gere CHS Manual will be maintained on site for reference. Subcontractors must review the O'Brien & Gere CHS Manual and/or site HASP to ensure they meet or exceed O'Brien & Gere corporate requirements as well as all regulations applicable to their scope of work. Key site safety procedures applicable to O'Brien & Gere employees and subcontractors are described in more detail in this section.

2.1. SITE SECURITY & CONTROL

NOTE –During Operation, TRS will control access to areas affected by this project to minimize the potential for electric shock to individuals who may otherwise enter the site and are unfamiliar with the treatment method being used and the associated electrical hazards.

The elements of site control include restricting access to the site to persons who have the proper safety training and have received a site safety orientation that reviews the information in this HASP at a minimum. O'Brien & Gere will oversee site security and control with specific site-entry requirements. A motion detector system will be establish on the perimeter of the ERH zone which will de-energize the electrode field upon an alarm situation.

2.1.1. Subcontractor Prequalification

Subcontractors must be prequalified annually and using the O'Brien & Gere Subcontractor Safety Prequalification Form (or approved alternate). Subcontractors must achieve a Pass (A, B, or C) rating or a "Conditional" rating. Subcontractors with a conditional rating must implement additional safety requirements outlined by the conditions specified by O'Brien & Gere Corporate Health & Safety Department.

2.1.2. Citizenship

All project personnel must be U.S. citizens or legally be authorized to work in the U.S. with the proper work visas.

2.1.3. Language

All project personnel must understand and speak English at a "conversational" level. Subcontractors are responsible for all costs or delays incurred if non-English speaking employees are banned from the site. O'Brien & Gere will make the final determination if a person is sufficiently fluent in English. Interpreters may be used if authorized by O'Brien & Gere. When authorized, a minimum of one interpreter will be required for every 10 non-English speaking personnel at all times while work is on site.

2.1.4. Drug & Alcohol Testing

All project personnel are required to work in accordance with O'Brien & Gere's policy for a Drug Free Workplace, as appropriate. Testing allowed under both policies is summarized below:

- **Pre-Access** – No pre-access drug or alcohol testing is required for this project.
- **Reasonable Cause** – Two supervisors must concur that the person is exhibits symptoms and behavior that "more probably than not" be the result of a controlled substance.
- **Post Accident** – Similar to Reasonable Cause, testing may be performed following an accident if the accident may have been avoided by a "reasonably alert" action and substance abuse cannot be discounted as a contributing factor.

- **Random Testing** – O'Brien & Gere may start and stop random testing at any time. Such testing will be non-discriminatory and be conducted at a rate up to 50% of employees on an annualized basis. O'Brien & Gere will coordinate random testing through Industrial Medical Associates (IMA) as a third party administrator.

2.1.5. Safety Training & Competent Persons

Project personnel must be properly trained for the type of work being performed and consistent with OSHA Standards 29CFR1910 and 29CFR1926. Specialized training is required for (but not limited to) work with asbestos, lead, hazardous waste, confined space entry, fire prevention and control, lockout / tagout, hazard communication, fall protection, NFPA 70E (energized electrical), etc.

HAZWOPER TRAINING - Project personnel will be trained as required by the OSHA Hazwoper Standard 29CFR1926.65 and 1910.120 as outlined below:

- **Non-Contact Visitors & Workers** –OSHA 24/40 Hour training is not required for Non-Contact Visitors, including delivery personnel, utility workers, vendor reps, inspectors, surveyors, site preparation personnel and others who will not enter exclusion or contamination reduction zones.

NOTE – Subcontractors performing work that does not involve contact with contaminated soil, groundwater, or vapors released from soil or ground water do not require Hazwoper training.

- **Contact/Remediation Workers** – OSHA 40 hour training with current 8-hour refresher. Required for all site personnel who may contact contaminated soil, sediment, groundwater, or materials or must otherwise enter an Exclusion or Contamination Reduction Zone. Site personnel with limited potential for contact with contaminated soil, sediment, or water may enter Exclusion Zones with OSHA 24 hour training with a current 8-hour refresher. An example of a trade in this category is surveyors.

- **Hazwoper Supervisors, Superintendents, and Foreman** – Field management personnel who are overseeing work performed by "Contact/Remediation Workers" must have OSHA 8-hour Hazwoper Supervisor training.

HEAVY EQUIPMENT QUALIFICATIONS - In addition to have appropriate Hazwoper training, only qualified persons may operate heavy equipment including (but not limited to) the following:

- **Forklift License** – Required for operation of forklifts and lulls but NOT required for front loaders equipped with forks

- **Crane Operation** – Crane operator license (state-issued) or Certified Crane Operator (CCO) designation

- **General Heavy Equipment** – Subcontractors will designate in writing to O'Brien & Gere their employees who are trained and authorized to operate heavy equipment including manlifts, excavators, front loader, dozers, demolition hammers, shears, grapples, dump trucks, pulverizers, skid steer, and drill rigs.

COMPETENT PERSONS - Although O'Brien & Gere and subcontractors must designate a general Safety Competent Person, other competent persons must also be designated in subcontractor safety plans or JSAs for the following activities and be on site as necessary to support activities performed under their oversight. In addition to written designation, the subcontractor must submit evidence of competency when requested by O'Brien & Gere. The general Safety Competent Person may also assume responsibility for other competent person roles if qualified and authorized.

- **Excavation Competent Persons** – When excavations are being performed

- **Demolition Competent Persons** – Perform pre-demolition "engineering survey" in support of a demolition plan. During demolition, the competent person must perform regular inspections to detect hazards resulting from weakened or deteriorated floors, or walls, or loosened material

- **Scaffolding Competent Persons** – Supervise the erection and dismantling of scaffolds and perform daily inspections while scaffolds are in use
- **Fall Protection Competent Persons** – Oversee implementation of fall protection systems including anchoring personal arrest equipment
- **Welding & Cutting Competent Persons** – Must determine if coated surfaces are flammable. For this project, they must also assess combustibility of underlying surfaces and residual dust (especially grain or similar organic dusts)
- **Crane & Hoist Competent Persons** – Must inspect cranes and hoists prior to use
- **Rigging Equipment Competent Persons –** Must inspect rigging equipment prior to use
- **Ladder Competent Persons** – Periodically inspect ladders
- **Powder Actuated Tools** – Training certification to safely use Hilti Guns, Ramset Guns, and similar powder actuated tools

2.1.6. Project Safety Orientation

All project personnel must complete a Project Safety Orientation to ensure understanding of O'Brien & Gere, ***TRS and IBM*** safety requirements. Upon completing a Project Safety Orientation, project personnel will sign a **Pre-Work Briefing form** ***(Attachment 1 or equivalent).*** The Project Safety Orientation will focus on hazards and the required hazard controls as outline in the HASP and/or Pre-Work JSA and will at a minimum include:

- Applicable Sections of the Project Safety Plan (HASP)
- Pre-Work JSAs (if any)
- Associated Exhibits, Permits, and Attachments identified on (and attached to) the Pre-Work JSA

2.1.7. Entry/Exit Log

The SSHC shall require that all employees, subcontractors, and visitors to sign in and out on an **Entry / Exit Log** ***(Attachment 2 or equivalent).***

2.1.8. Authorized Project Personnel

At a minimum, authorized personnel who will be granted unescorted access to the project include employees from O'Brien & Gere and appropriately prequalified subcontractors that have successfully completed the following:

- Submitted Safety Training and Competent Person documentation to the O'Brien & Gere SSHC
- Submitted medical surveillance documentation (for persons entering Exclusion and Decontamination Areas)
- Submitted respirator medical clearance (for persons who may use respirators)
- Attend an O'Brien & Gere Project Safety Orientation (applicable sections of this HASP as outlined above)

2.1.9. Visitors

Visitors must be escorted by an Authorized Project Person.

2.1.10. Pre-Work Safety Planning

NOTE - Subcontractors may develop an alternate safety planning document in lieu of using the Pre-Work JSA Template (APPENDIX A) if approved in advance by the O'Brien & Gere SSHC. Submittal of general safety policies and procedures will not (by themselves) be acceptable.

Subcontractors are required to complete the O'Brien & Gere Pre-Work JSA Template ***(Appendix A)*** prior to mobilization and may complete additional Pre-Work JSAs as required for high-hazard tasks. The Pre-Work JSA should be completed in a collaborative effort between O'Brien & Gere and subcontractors and will help identify appropriate permits and notifications based on the specific means, methods, tools, and equipment used by subcontractors.

O'Brien & Gere may also use the Pre-Work JSA Template to identify hazards and controls associated with changes to O'Brien & Gere's scope of work. JSAs will supplement information in this HASP.

2.1.11. Site Layout & Work Zones

NOTE – Signs, sign posts, and barricade stanchions should be made from a non-conductive material in all areas where shock hazards could potentially exist from stray electrical currents associated with the electrical resistance thermal heating equipment. TRS shall advise O'Brien & Gere where such areas exist.

The visible delineation of the Construction Area is required to prevent unauthorized persons from entering. Physical markings of the perimeter of the Construction Areas can be accomplished through the use of fencing, wood barricades, rope, barricade tape, etc. Existing structures or land features may also be utilized where appropriate.

The use of barricade tape for outdoor exclusion zones or work zones that will be setup for greater than 24 hours is not permitted.

Warning signs will be posted on at the perimeter of site as well as any Exclusion and Contamination Reduction (Decontamination) Zones to alert site personnel and the public. Signs shall be approximately 10 inches by 14 inches in size and of aluminum or steel construction for outdoor use. The site perimeter must be posted but with a sign that is different from that used for any Exclusion Zones and states "DANGER – CONSTRUCTION AREA – UNAUTHORIZED PERSONNEL KEEP OUT" (Emedco # 42525) or acceptable alternate. Signs marking the perimeter of Exclusion Zones must state the following or an acceptable alternate: "RESTRICTED AREA – AUTHORIZED PERSONNEL ONLY" (Emedco # 33989).

The following work zones will be established as required by the OSHA Hazwoper standard (29CFR1926.65 / 1910.120) where intrusive excavation activities may be required.

- **Exclusion Zones** – Include "hot spot" remedial excavations, and trenches impacted by contaminated soil or groundwater, electrode installations, drilling operations, excavation 2' below concrete floor slabs removed to support installation of electrodes, inside containers used to store contaminated soil or or any areas where contaminated soils are handled.
- **Contamination Reduction Zones** – Areas setup to decontaminate tools, equipment, and personnel.
- **Support Zone** – All areas not otherwise classified as above.

2.1.12. Contamination Control & Decontamination

Basic precautions that will be implemented to remove and manage contaminated soils and groundwater during intrusive work without spreading contamination beyond the boundaries of the site or into support areas.

- Exclusion zones and decontamination areas will be clearly marked and protected against unintentional entry by unauthorized persons as outlined above.
- Staging Area(s) will be lined and equipped with a sump and water management equipment (pumps, piping/hose, frac tank, etc.) to control water seepage if saturated soils must be staged prior to disposal .
- All heavy equipment will be cleaned using shovels and brooms to remove gross contamination prior to being moved between intrusive work areas to minimize cross contamination.
- Wet soil or waste will be de-watered or will be blended with dry soil, cement, sawdust or equivalent material to prevent "dripping" during transportation.
- Haul trucks will be kept on clean haul roads/surfaces to prevent contamination of tires.
- Haul truck loading areas located adjacent to staged soil will be kept clean from spillage during loading operations. If necessary, plastic will be placed under haul vehicles while loading and periodically swept clean to prevent contamination of haul vehicle tires. Plastic will be replaced as necessary.
- Heavy equipment will be decontaminated with pressurized water at a decontamination pad prior to leaving the site and/or working in areas deemed “clean”. The decontamination pad will consist of a plastic liner on grade and/or stone sub base with water management equipment (sump, pump, holding tanks, etc.).
- Hand washing facilities will be located on site for daily use by field personnel.

2.1.13. Vapor & Odor Control

Vapors released during site activities represent a potential health hazard and odor problem. The following controls will be implemented to mitigate these issues:

- Controlling the amount of soils/sediments disturbed concurrently.
- Open excavations and exposed stockpiled contaminated soil will be covered with polyethylene sheeting at the end of each work day.
- If sheeting does not adequately control odors, a water-based foaming agent (or equivalent) will be applied as necessary for short-term (18-hour/overnight) control.
- Air monitoring will be conducted per the Employee & Community Air Monitoring Program (ECAMP).

2.1.14. Dust Control

Dust released during remedial activities represents a nuisance and a potential health hazard.

The following controls will be implemented to mitigate dust issues:

- Water will be used to suppress dust during demolition and excavation activities as required by dust monitoring and visual observations.
- A water source will be available at the site to support dust control activities if dry, dusty conditions are encountered.
- The site speed limit of 10 mph (or as otherwise posted) will be enforced. Slower vehicle speeds reduce road dust and minimize the potential for accidents and spills. Dust monitoring will be conducted per the Employee & Community Air Monitoring Program (ECAMP).

2.2. DAILY SAFETY MEETINGS

Safety meetings must be held daily and documented using a **Daily Pre-Task Planner** (***Attachment 3***) or equivalent document approved by the O'Brien & Gere SSHC.

> ***NOTE - The intent of daily safety meetings is to encourage daily safety planning (top portion of the Daily Pre-Task Planner)by Supervisors and support communication between Supervisors and their respective field crews (bottom portion of the Daily Pre-Task Planner).***

The use of Pre-Task Planners during daily safety meetings provides documentation about what "safety messages" site personnel are receiving on a daily basis. Pre-Task Planners also provide a checklist to monitor changes to site personnel, equipment, work methods, or conditions that may affect hazards and require different safety precautions. Pre-Tasks Planners are intended to supplement, but not replace, Pre-Work JSAs and safety plans. Pre-Task Planners will be retained on site for inspection during periodic safety audits.

The form will be completed as follows:

- Subcontractor Crew Foremen will prepare a Daily Pre-Task Planner for that day's activities or the next day's activities if the Daily Pre-Task Planner is prepared the prior afternoon
- The Supervisor/Superintendent/or Foreman will review the Pre-Task Planner with his respective crew
- Each site worker will then sign the Pre-Task Planner
- All Pre-Task Planners will be returned to O'Brien & Gere after the day's activities are complete
- Any significant changes to the scope of work or work methods during the work shift will require revising the Pre-Task Planner. Recognition of previously unidentified hazards will also require revising their safety plan or Pre-Work JSAs.

2.3. WEEKLY TOOLBOX SAFTEY MEETINGS

> ***NOTE – A separate Weekly Toolbox Safety meeting (or "All-Hands" Safety meeting) is required on projects where separate Daily Safety meetings are held for different work crews. When all site personnel attend the same Daily Safety meeting, a separate Weekly Toolbox Safety meeting is not necessary. Pre-task safety planning is completed by each foreman for each crew under his direction as outlined in the previous section.***

Toolbox Safety meetings are held at a minimum of once per week. The SSHC on smaller projects with fewer site personnel may choose to assemble all site personnel during Daily Safety meetings and in so doing, may not hold separate Weekly Toolbox Safety Meeting. On projects where separate Daily Safety meetings are held for different field crews, the SSHC will assemble all site personnel at a Weekly Toolbox Safety meeting ("All-Hands" Safety meeting). The intent of the weekly toolbox meeting is to provide additional field safety training and review relevant safety topics for approximately 15 minutes, and ensure that a consistent safety message is delivered to all site personnel on larger projects. Attendance will be documented on the **Safety Toolbox Meeting forms** ***(Attachment 4 or equivalent).***

2.4. SAFETY AUDITS & INSPECTIONS

Although the O'Brien & Gere representatives and subcontractor Foremen/Superintendents must review work areas and work practices on a daily basis, O'Brien & Gere will conduct formal weekly safety audits that are documented using a safety audit checklist. Subcontractors may also participate in safety audits. A variety of checklists are available with one being the **Safety Audit Checklist** (***Attachment 5***).

2.5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Specific PPE requirements are outlined below but a general dress code for any work areas includes long pants that must cover top of ANSI-approved protective toe leather work shoe, hard hat, and safety glasses with rigid side shields. Shirts must have at least 4 inches of sleeve. Long-sleeve shirts may be required at specific locations or for certain tasks. **Gloves are required for all tasks unless glove use is exempted on an approved O'Brien & Gere Job Safety Analysis (JSA) or Daily Pre-Task Planner.** Subcontractors must specify additional PPE as appropriate for specific work methods, tools, and equipment covered by their safety plans. Additional PPE that may be necessary is summarized in the following paragraphs.

2.5.1. High Visibility Clothing

All project personnel are required to wear high visibility clothing including a vest, shirt, or jacket. High visibility clothing must be predominantly safety yellow in color.

2.5.2. Head Protection

All project personnel are required to wear approved hard hats that meet ANSI Z89.1-2003. Hard hats must be in good condition and be worn with brim to the front unless the manufacturer certifies the hard hat to be worn reverse when the harness is oriented properly. Subcontractors will be required to submit manufacturer's certification upon request from O'Brien & Gere.

2.5.3. Eye & Face Protection

Project personnel are required to wear approved ANSI Z87.1-2003 safety glasses with rigid side shields. **Chemical goggles** are required during equipment decontamination work or other activities with a potential for chemical splashes to the face. **Face shields** will be required when performing certain tasks (e.g. chipping, sawing, and handling chemicals or corrosive liquids) **Face shield must be worn over safety glasses or chemical goggles.**

2.5.4. Hearing Protection

Approved hearing protection must be worn as specified in all posted areas and while working with or around high noise level producing tools, machines or equipment.

2.5.5. Fingers, Hand & Wrist

Gloves suitable for the job being performed shall be worn unless the job cannot be done with gloves or wearing gloves increases the hazard. **Exceptions to mandatory glove use must be identified in approved safety plans or JSAs.** Tool holders should be used when driving stakes and wedges or when holding star drills, bull pins or similar tools. **Fixed blade knives (pocket knives, razor knives, and box cutters) are prohibited and safety knives or scissors must be substituted in their place.** Exceptions must be approved by O'Brien & Gere.

2.5.6. Foot Protection

All project personnel are required to wear safety footwear that is in accordance with ANSI Z41-1991. Rubber boots with safety toe protection are required on jobs subject to chemically hazardous conditions. Metatarsal protection should be worn when using jack hammers, tamps and similar equipment which has the potential for foot injury above the toes.

2.5.7. Respiratory Protection

Respirators (including SCBAs and airlines) used by project personnel must meet NIOSH/MSHA standards. Respirators must be inspected regularly and stored in a dust-free container. Employees required to wear a respirator must have a physician's approval and be fit tested within the last year. Employees must be clean shaven in the facial area to obtain an acceptable seal. Subcontractors must keep respirator training, fit testing, and medical clearance documentation on site for the duration of the project and available for O'Brien & Gere inspection. The following table summarizes common respiratory hazards that may be encountered during remediation and demolition activities. Those that are present or are potentially present are marked (✓). Additional (usually less common) respiratory hazards that may be present will be added to the table and also marked (✓).

Respiratory Protection by Contaminant

Present (✓)	Contaminant	Minimum Respirator Type*	Source of Exposure
	PCBs	Respirator with N95 or P95 filters combined with an Organic Vapor Cartridge	During excavation, handling, and sampling of PCB-contaminated soil, water, drums, and debris
✓	Silica	Respirator with N100 or P100 filter	During cutting or pulverizing concrete
	Lead dust or fume	Respirator with N100 or P100 filter	During hand scraping, chipping, wire brushing, torch cutting, and grinding surfaces with lead paint
	Asbestos	Respirator with N100 or P100 filter	Friable asbestos-containing materials (ACM)
	Carbon monoxide	Supplied Air (SCBA or Airline)	Engine combustion byproduct in enclosed or confined spaces
✓	Volatile Organic Compounds (VOCs)	Respirator with activated carbon cartridges	Vapors from subsurface soil or groundwater contamination or spilled fuel
	Metal dust	Respirator with N95 or P95 filters	Settled dusts getting airborne, grinding metals or painted surfaces, Welding, or torch cutting
	Metal fumes	Respirator with N100 or P100 filters	Welding or torch cutting

* Respirator types have Assigned Protection Factors (APFs) that limit the maximum airborne concentration in which they may be used. Also, the APF for a full-face air purifying respirator is limited to 10x the exposure limit when qualitative (smoke) fit testing is used. Subcontractors must select respiratory protection requirements in accordance APFs and fit testing methods.

2.5.8. Skin

If the possibility of skin contact with chemicals, lead, asbestos or other hazardous material exists, then protective clothing will be worn.

- **Tyvek®** (or equivalent) – asbestos, lead, or other dust exposures
- **Tychem QC®** (poly-coated Tyvek®) or **Tychem SL®** (Saranex®) or equivalent – for liquid chemical exposures including liquids contaminated with PCBs
- **Tychem SL®** (Saranex®) **with hood and boots** (or equivalent) – for use with SCBAs during emergency response involving chemical releases

2.5.9. PPE Summary

In general, PPE is divided into four broad categories as outlined below.

- **Level D PPE** – Minimum PPE for Level D includes hard Hat, safety glasses with side shield, safety shoes/boots, cut-resistant gloves, and high visibility vest. Additional PPE that may be required includes hearing protection, face shield, fall protection harness and lanyard, and Kevlar Chaps and Jacket (if using a chainsaw).

- **Modified Level D PPE** – Level D PPE plus protective clothing to prevent skin contact or contamination of support zone areas. Additional information on chemical protective clothing, chemical resistant gloves, and face shields is described in previous paragraphs of the PPE section of this HASP.
  - **Full Modified Level D PPE** consists of Level D PPE plus coveralls, nitrile gloves (or equivalent), and boots or shoe covers. Full Modified Level D PPE is necessary when extensive contact with contaminated materials is anticipated, such as the manual-excavation of contaminated soils. Full Modified Level D PPE is also required when handling corrosive chemicals.
  - **Lightweight Modified Level D PPE** consists of nitrile gloves (or equivalent) and boots or boot covers. Lightweight Modified level D is necessary when minimal contact with contaminated materials in anticipated and contamination control must be maintained. Appropriate tasks for Lightweight Modified Level D PPE include equipment operators with minimal direct contact, surveyors, sampling technicians, inspectors, etc. The SSHC shall determine which is appropriate based on site conditions.
- **Level C PPE** – Modified Level D PPE plus air purifying respiratory protection. Additional information on respiratory protection is described in previous paragraphs of the PPE section of this HASP.
- **Level B PPE** – Modified Level D PPE plus supplied air respiratory protection. **Level B PPE is not anticipated for this project.**

The following table provides more specific initial PPE requirements for different tasks anticipated on this project based on HASP requirements. **When work assignments involved mixed tasks, choose the most conservative PPE or change PPE as required between different tasks.**

PPE by Task									
PPE level	Level D						Mod Level D		C
TASK	High Vis[1]	Head	Eye & Face	Foot	Hearing	Hand[2]	Hand[2]	Skin[3]	Resp
All site work not otherwise specified below	X	X	Glasses	X		CR			
Welding & Torch Cutting (carbon steel)	X	X	Glasses with welding face shield	X	X	CR/HR			N95 or N100 (option)
Welding & Torch Cutting (stainless or galvanizedl)	X	X	Glasses with welding face shield	X	X	CR/HR			N95 or N100
Clearing & Grubbing	X (and Kevlar chaps)	X	Glasses with face shield if chainsaw or weed trimmer is used	X	During operation chainsaws and weed trimmers	CR			
Work Inside Contaminated Excavations	X	X	Glasses	X	X	CR	CR and nDex	Tyvek	

PPE by Task									
PPE level	——————————— Level D ———————————						Mod Level D		C
TASK	High Vis[1]	Head	Eye & Face	Foot	Hearing	Hand[2]	Hand[2]	Skin[3]	Resp
Chop saw, demo saw, or Walk-Behind Saw to cut Concrete (or other masonry material) or steel	X	X	Glasses & Face Shield	X	X	CR			N95 or N100 (option if wet cutting doesn't control dust)
Drilling Operations	X	X	Glasses	X	Plugs or Muffs	CR			
Energized[4] Electrical Installations	X	X	Glasses with arc flash face shield	X		CR and electric			
Heavy Equipment Operators (when outside cab)	X	X	Glasses	X	X	CR			
Heavy Equipment Operators (when inside cab)			Glasses	X					
Hot Soil sampling									
Decon with pressure washers		X	Glasses	X	Operation of heavy equipment		CR and nDex	Poly-coated Tyvek	

NOTES

1. High visibility vests will not be required where persons are wearing Tyvek or Poly-Coated Tyvek
2. **CR** = cut resistant gloves, **HR** = heat resistant, **nitrile** = 3-5 mil nitrile gloves, **nDex®** = surgical nitrile
3. Tyvek and Poly Coat Tyvek include the use of boot covers or a boot wash to prevent the spread of contaminated materials to support zone areas and includes the use of nitrile surgical gloves (usually underneath cut-resistant gloves)
4. Energized electrical work required all PPE as required by NFPA 70E

2.6. TEMPORARY CORDS & HOSES

Proper management of temporary cords and hoses is required to minimize the potential for slips and trips.

The following guidelines should be implemented to the extent feasible:

- Cords and hoses must be run out of aisles and sidewalks (e.g., within six inches of a wall or toe board)
- Cords and hoses must be buried or run overhead (7.5 feet) when crossing aisles or sidewalks whenever feasible unless doing so creates a potentially greater hazard
- Cords and small diameter hoses that cannot be run overhead or buried must be marked with cones, protected by hose ramps, or equivalent whenever the cross aisles or sidewalks
- Cords and hoses that cross roads must be protected from damage
- All temporary cords and hoses must be removed to equipment laydown areas when not in use

Cords also pose an electrical hazard if they are not protected from damage and inspected before each use. Cords may not be run through doors or windows without being protected. Cords must not be run across walkways and stairs. Cords may not be run through standing water. Ground Fault Circuit Interrupters (GFCIs) are required on all extension cords and 120v hand tools and equipment.

2.7. EXCAVATIONS

NOTE – Subcontractor performing excavation work will designate qualified Excavation Competent Person(s) who must be on site during all excavation work. Soil is designated as OSHA Type C on this site for purposes of sloping and shoring. Site personnel are considered "exposed" to a cave-in hazard that must be evaluated by an Excavation Competent Person if they are standing within a distance equal to 1.5 times the depth to an excavation wall that is not shored or sloped.

All excavations greater than five feet deep require sloping or shoring whenever persons enter excavations or adjacent structures may be affected by a cave-in. Subcontractors will identify in safety plans or JSAs specific shoring systems or sloping/benching that will be used in specific areas. Excavations greater than four feet in depth are classified as a non-permit confined space unless contamination is encountered. Refer to the "Confined Space" section of this HASP for more guidance on how excavations will be handled with respect to confined space entry requirements.

- Assume soil is Type C unless soil testing indicates otherwise and such testing is documented on an O'Brien & Gere Soil Analysis Checklist ***(Attachment 6)*** or approved alternate. Standard sloping and benching (per OSHA) will follow a 1:1.5 (V:H) cut-back associated with Type C soil.
- Shore excavations greater than five feet depth where personnel must enter and sloping is not feasible. Equipment used to shore excavations MUST follow OSHA shoring tables, or the subcontractor must have **tabulated data from the manufacturer on site.**
- If sections of trench are less than five feet and no cave-in hazard exists, then shoring is not required
- No workers may enter excavations until the designated Excavation Competent Person has inspected the excavations using the Daily Excavation Checklist ***(Attachment 7).*** Excavation inspections must be documented with documentation remaining on site for the full project duration and made available for O'Brien & Gere review.
- Qualified engineers will evaluate excavations that could affect the stability of adjacent structures
- A ladder or egress ramp will be provided within 25 feet of workers who must enter excavations

- Water will not be allowed to accumulate in trenches in a manner that will affect the integrity of excavation walls and shoring systems
- All spoils will be kept a minimum of two feet from the edge of the excavation
- Fall Protection will be provided around excavations left open during off-hours. Fall protection will consist of solid barricades (saw horses or portable chain link) or soft barricades (safety fence) off-set 6' from the edge.
- Pedestrian Barricades
  - Portable chain link fence (48 inches) or equivalent will be used to protect pedestrians. If pedestrian traffic is re-routed to avoid excavations, pedestrian detours must be accessible to bicyclists, handicapped persons, and other pedestrian in the area who may have special needs.
- Traffic Barricades
  - Any excavation activities that affect public or plant roads must be equipped with traffic safety devices as required by the Manual on Uniform Traffic Control Devices. If flaggers are used on public roads, they must receive DOT Flagger Training.

2.8. CONFINED SPACE ENTRY

NOTE – Permit-required confined space entry is not anticipated for this project. If confined space entry is required, O'Brien & Gere will issue a confined space entry permit or authorize a subcontractor to use their permit. The Kingston Fire Department must be notified in advance of permit-required entries to ensure the availability of rescue team support.

A **Confined Space Entry Permit** ***(Attachment 8)*** must be fully completed prior to entry of all permit-required confined spaces. Confined spaces may be classified as non permit spaces if serious hazards have been eliminated and the classification process is documented in accordance with O'Brien & Gere's Confined Space Entry Program. Documentation must remain on site for the full project duration and available for review.

Excavations (which are accessed by roads or ramps of sufficient grade to allow vehicles and personnel unrestricted access) are **not confined spaces** and are therefore not covered by confined space requirements. Excavations that lack access ramps or stairs will be considered **non-permit** confined spaces unless there is a chemical spill. If there is a chemical spill or contaminated soil or groundwater is encountered then the excavation will be treated as a **permit-required** confined space until air monitoring supports reclassifying to a non-permit confined space as outlined in O'Brien & Gere's confined space procedure and this HASP.

2.8.1. General Permit-Required Confined Space Entry Precautions

All persons entering manholes, tanks or similar permit-required confined spaces must have a body harness and lifeline attached. When vertical entry /exit is required at greater than four feet, a tripod and man-winch (or equivalent means of rescue) must be setup prior to entry. The standby person must be familiar with its operation. Rescue services (i.e., fire department) MUST also be available and notified of the entry. Standby persons shall NOT enter permit-required confined spaces to conduct rescue or first aid activities.

Respiratory protection and/or mechanical ventilation must be provided where hazardous atmospheres are identified or may develop during work activities. Action levels for oxygen, combustible vapors, hydrogen sulfide and carbon monoxide are outlined below and on the Confined Space Entry Permit.

- Oxygen – 19.5% to 23.5%
- LEL – 10%
- Carbon Monoxide – 35 ppm

- Hydrogen Sulfide – 10 ppm

2.8.2. Removal of Permit-Required Confined Space Entry Requirements

If confined spaces are reconfigured so that they are no longer confined, then **permit-required confined space entry procedure does not apply.** Examples include installing stairs or a ramp into pits and excavations and installing a man-door size opening in tanks.

2.8.3. Downgrade to a Non-Permit Confined Space

If all serious hazards can be eliminated, then a permit-required confined space can be reclassified as a non-permit confined space. As long as hazards are eliminated, a non-permit space is essentially treated like a normal work area subject to all other safety requirements. This must be done in accordance with the Confined Space Entry Program and requires at least initial air tests, documented on a permit before a confined space can be considered a non-permit space.

2.8.4. Alternate Entry Approach

If the only actual or potential hazards in a confined space are atmospheric (oxygen, flammable vapors, toxic vapors, etc.) and a mechanical blower is sufficient to control them, then entry may be conducted under an **Alternate Entry** approach. Under this approach, no permit is required, no rescue equipment is necessary, no standby person is needed, and a rescue team is not required. However, the following confined space requirements remain in effect: Entrants must be trained; initial air tests must be taken; and the blower must remain operating throughout entry. Refer to the ***O'Brien & Gere Confined Space Entry Procedure*** for more information.

2.9. HOT WORK

NOTE – Hot work may be necessary when installing doors and sheet piles. O'Brien & Gere will issue Hot Work Permits in accordance with requirements in this section prior to all hot work on this project.

Hot work includes any activities that generate an open flame, arc, **or sparks** and includes the use of **temporary heaters (salamanders).** Hot work is anticipated and will typically include welding, cutting, soldering, and grinding.

Specific hot work requirements will be identified on the Hot Work Permit but will generally include the following:

- Print the names of all persons performing hot work on the permit. Only persons listed may perform hot work as authorized by the permit.
- Print the name of the fire watch on the permit. Changes in fire watch persons must immediately be noted on the permit if authorized by O'Brien & Gere. Fire watches are responsible for inspecting the site for evidence of fire or fire hazards associated with hot work activities.
- Continue fire watch activities for **30 minutes** after hot work activities have stopped if required on the **O'Brien & Gere Hot Work Permit** ***(Attachment 9).***
- All combustible material must be removed from the hot work area when possible or protected from sparks and slag when located within **35 feet** of hot work.
- At least one **20lb Type ABC fire extinguisher** must be in possession of each individual identified as a fire watch.

- All heavy equipment must be equipped with at least a **5 lb fire extinguisher** that is secured to prevent movement while equipment is in operation.
- All hot work areas shall be specified on the Hot Work Permit. Hot work shall NOT be conducted in additional areas without first notifying O'Brien & Gere and the Hot Work Permit is modified or a new permit is issued.
- Additional fire safety precautions may be specified on the permit and must also be implemented by site personnel.

2.10. FIRE PROTECTION & PREVENTION

Hot Work Permits, subcontractor safety plans, and JSAs may supplement basic fire safety requirements outlined below by establishing specific requirements throughout the course of the project as needed to ensure that personnel and property are adequately protected from potential fires. Emergency response associated with fires is covered in the Emergency Response section of this HASP.

Basic fire protection requirements include:

- Construction heaters or other forms of heat generating equipment may only be used by subcontractors with prior approval from O'Brien & Gere and a Hot Work Permit is obtained.
- Fire protection water, pull stations, alarms, and strobes should be the last utilities and services to be shut down when complete isolation from utilities is necessary to support demolition, construction, or remediation activities.
- Where applicable, fire protection systems must not be obstructed, shut-off nor left inactive at the end of a working day or shift without notification of and authorization from O'Brien & Gere or the site owner.
- Where applicable, sprinkler systems must be kept at **41˚F** or higher.
- Fire hydrants and standpipes may only be used for firefighting purposes unless other use is authorized by O'Brien & Gere or the site owner.
- Fire hydrants and valves must not be obstructed or blocked. At least a **6-foot** clearance must be maintained on all sides for emergency access.
- Subcontractors **must inspect extinguishers monthly** in addition to annual service provided by an extinguisher service company. Inspections and testing must be documented on **weather-resistant tags or labels** attached to each fire extinguisher.

2.11. LOCK OUT/TAG OUT

NOTE - Lockout/Tagout is not anticipated until thermal treatment equipment tie-ins are completed. TRS will specify energy control procedures but in general the control units must be locked and tagged following tie-in to the utility power pole. All persons performing electrical work on the thermal treatment system or are otherwise exposed to shock hazards from thermal treatment equipment must work under their own locks & tags. O'Brien & Gere may place a "control" lock on the main disconnect(s).

All persons exposed to potential injury from the unexpected energizing of system components must perform work under a lockout/tagout (LOTO) program with his or her own lock(s) in place. **No individuals may work under another individual's lock.** Lockout/Tagout must be conducted in accordance with the O'Brien & Gere LOTO Procedure in the Corporate Health & Safety Manual. When required, O'Brien & Gere will follow the site owner's LOTO program for equipment and systems under the site owner's control.

General LOTO requirements include the following:

- O'Brien & Gere SSHC (with support from site owner if necessary) will identify lockout boundaries and operate necessary valves, breakers, etc. necessary to install injection tubing.
- Ensure pumps, fans, and other equipment are in a safe condition and piping is purged and blanked when necessary.
- O'Brien & Gere (or designated subcontractor) shall keep a list of locks and tags placed on each equipment or system that is locked out. An **Equipment-Specific LOTO form** ***(Attachment 10)*** or equivalent.
- O'Brien & Gere LOTO tags must show diagonal red and white stripes unless the site owner requires a different tag.
- Keys to all locks will be placed in a lock box.
- **Each person working on a system or equipment that is locked out must place his or her lock and tag on the lock box.**
- Locks and tags must be removed from lock boxes at the end of each shift.

2.12. ENERGIZED ELECTRICAL WORK

CAUTION – Qualified Electrical Workers who are performing authorized energized electrical work are prohibited from opening equipment enclosures that may expose oversight personnel and other unqualified personnel to potentially energized and exposed conductors > 50 volts or allowing unqualified personnel to approach closer than 4' to such conductors.

All work that can be conducted in a de-energized electrically safe condition must be performed under LOTO. Electrical work that cannot be performed in a de-energized state and involves exposure to unprotected conductors >50 volts, must be performed in accordance with NFPA 70E standard on arc flash using an **"Energized Electrical Work Permit"** ***(Attachment 11 or equivalent)*** and program. Subcontractors will complete permits and keep expired permits on site for review by O'Brien & Gere at any time during the project. Energized electrical work must be identified in subcontractor safety plans or JSAs, and O'Brien & Gere must be notified prior to all energized electrical work. **Energized electrical work may only be conducted by qualified persons who have submitted evidence of NFPA 70E training and FA/CPR training to O'Brien & Gere.**

2.13. OVERHEARD POWER LINES

All overhead power lines must be assumed energized. O'Brien & Gere has a **20-foot** clearance policy to overhead power lines whenever feasible. If work must be conducted at less than 20 feet but NOT less than the OSHA minimum clearance of 10 feet, then additional safety requirements apply and will be identified in the Pre-Work JSA or BMS Safe Work Permit for that work. Additional precautions may include one or more of the following:

- Call the local utility to get the voltage and ask if lines can be de-energized or insulated/sleeved.
- Dedicated spotter.
- Non-conductive distance markers or devices to delineate the necessary clearances.

2.14. FALL PROTECTION

OSHA-approved methods of fall protection are required under the following conditions:

- An employee is working **6 six feet** or more above the ground.
- An employee is working on scaffolding without a **42-inch** railing protection.

- An employee is working in a manlift or scissors lift more than **six feet** above the ground.
- An employee is involved in assembly/disassembly of scaffolds, work platforms or temporary surfaces working **6 feet** or more above the ground.
- An employee is working over dangerous equipment/conditions (at any height).
- An employee is working on a walking/working surface or roof and is **within 15 feet unprotected edge or floor opening/hole** that will expose the employee to a fall greater than six feet.

Fall protection that uses a harness and lanyard must be a Class III safety harness and be secured to an anchor point that can withstand 5,000 lbs of force. Other methods to prevent falls include temporary guardrails, installation of hole covers, warning lines (15' from the edge), fall restraint lines, safe use of ladders, and safe use of manlifts.

2.15. SCAFFOLDS

NOTE – O'Brien & Gere employees will not be involved in the design, installation, or dismantling of scaffolds on this project. If subcontractors build and use scaffolds, then requirements in this section apply.

All scaffolding used on this project will meet the requirements established in OSHA 29 CFR 1926.451. Each contractor using scaffolds must designate a scaffolding competent person to direct and supervise the erection and dismantling of all scaffolding on this project. The competent person will sign and attach one of the following color-coded scaffold tags to each scaffold:

- **Green Tag:** Scaffolding complete and ready for use
- **Red Tag:** Scaffolding incomplete and not for use
- **Yellow Tag:** Scaffolding usable but personal fall protection or other restrictions will be required

Scaffolding will be inspected daily by the Scaffolding Competent Person designated in writing by the subcontractor prior to use and sign the tag at the time of inspection. When scaffolds are removed from service (i.e., not being used) the scaffold competent person shall remove old/expired green tags. Users shall not use any red-tagged scaffold or any scaffold without a green or yellow inspection tag.

2.16. HEAVY EQUIPMENT & TEMPORARY FUEL AREAS

CAUTION – Site Personnel working near heavy equipment will be exposed to "struck-by" injuries and "crush" injuries if caught between heavy equipment (or counterweights) and a fixed object.

All equipment must be secured after hours. Keys must be removed from equipment and secured away from the equipment. Mobile equipment that does not require an ignition key shall be disabled. All vehicles and heavy equipment must be turned off when left unattended.

Subcontractors shall submit a letter on company letterhead that designates which of their employees is competent and authorized to operate each type of equipment present on this project. Forklift and lull operators must have a license or certificate that indicates they have passed a written test and "road" test for the type of forklift they will be operating.

INSPECTIONS - Operators will **inspect equipment daily** for leaks, damage, and other necessary repairs.

SAFETY DEVICES - Operators will use seatbelts if so equipped. Heavy equipment will be equipped with **overhead and rollover protection** whenever feasible. Heavy equipment must be equipped with **backup alarms, horns, and other safety devices** installed by the manufacturer. Vehicles operated at night must have headlights, tail lamps, and reflectors. Safety devices must not be disabled.

TEMPORARY FUEL STORAGE AND SPILLS - Temporary fuel storage tanks will be labeled as to their content and be protected from collision by site vehicles using solid barricades including balusters, chain link fence, or equivalent. **Spill kit** (55 gallon sorbent capacity contained in an overpack) and one **20lb Type ABC fire extinguisher** will be located within **45 feet** of fueling areas. Tanks will be rated for above ground use and provided with secondary containment. Tanks and dispensing hose will be bonded and grounded. **Temporary secondary containment must be provided in the refueling area that includes the storage tank and dispensing hoses.**

2.17. LIFTING & RIGGING

NOTE –Crane use is anticipated for this project. Crane use and associated rigging is anticipated for placement of thermal treatment power control units. Subcontractors that use cranes, hoists, or rigging will comply with requirements in this section. Any circumstances not directly addressed in this HASP or associated JSAs will ultimately defer to the updated (Nov.2010) OSHA cfr1926.1400 regulations or Cranes and Derricks.

The following equipment is covered by requirements in this section of the HASP and O'Brien & Gere's Cranes and Rigging Safety Procedure in the Corporate Health & Safety Manual: cranes, hoists, lulls, and forklifts. Lulls and forklifts are only covered when they are used to lift materials using rigging equipment (chains, slings, wire rope, etc.) as opposed to lifting materials that are properly placed on the forks.

Critical Lifts

All critical lifts require a **Lifting & Rigging Plan** ***(Appendix B)***. However, O'Brien & Gere may request a Lifting & Rigging Plan for any lift when deemed necessary.

Critical lifts include the following:

- Any lift that exceeds (or potentially exceed) 80% of the rated capacity of the equipment
- Any lifts near overhead power lines
- Any lifts over production/process equipment that could result in chemical spills, product contamination, or other major loss
- Any lifts over buildings that will be occupied or partially occupied
- Any lifts of custom or long-lead time equipment

Rigging Safety

All rigging must meet the following requirements:

- Be inspected prior to each use by a competent, qualified, and designated employee.
- All rigging must have tags that are legible with the allowable load ratings listed.
- Rigging must be of the proper type and size for the load being moved.
- Straps etc. may not be attached directly to forks of a loader/forklift/ or Lull.

2.18. DEMOLITION SAFETY REQUIREMENTS

NOTE – Minimal demolition is required for current scope of work and is associated primarily with installation of an overhead door through the eastern wall of building 1. Most requirements in this section will not apply to such limited demolition but the wall will require installation of temporary supports and the presence of lead and asbestos materials will also be considered.

This section outlines general demolition safety requirements and precautions for demolition work but is not intended to replace a demolition safety plan that must be developed by the demolition subcontractor.

2.18.1. Utilities

All natural gas, plant/process air, nitrogen, electric, water, sewer, and steam utilities will be disconnected as part of demolition activities. The subcontractor Demolition Competent Person will verify the disconnection of utilities prior to demolition during a pre-demolition inspection. The verification will be witnessed by O'Brien & Gere. The subcontractor demolition plan must include a marking scheme for the exterior of structures to be demolished that indicates when utility disconnections have been verified by the Demolition Competent Person and witnessed by O'Brien & Gere.

2.18.2. Pre-weakening of Structures or Temporary Supporting Structures

The demolition subcontractor must indicate if pre-weakening of structures is necessary and will describe how structures will be pre-weakened in the Demolition Work/Safety Plan in a manner that will prevent **unplanned** collapse.

2.18.3. Demolition Safeguards to Site Personnel and the Public

- **Barricades** – All buildings to be demolished will be surrounded by a barricade or other markings that encompasses sufficient "buffer zone" to prevent site personnel from being struck by collapsing structures or flying debris. If necessary, solid barriers (such as plywood or tarps) will be used to contain flying debris. Barricades will be sufficiently sturdy and meet at least the stanchion requirements specified by OSHA for warning lines used in fall protection. These requirements include withstanding 16 pounds of lateral force and spaced so that warning lines are between 34" and 39" in height. Barricades that are left in vehicle or pedestrian traffic areas overnight must be equipped with flashers or reflective surfaces.

- **Signs** – Warning signs will be posted on all sides of the demolition to alert site personnel and the public of the demolition hazards. Signs shall be OSHA-type "danger" signs of steel or aluminum and approximately 10"x14" in size. Demolition area signs shall state the following or an acceptable alternate:

- **Restricted access** – Only essential personnel necessary to operate heavy equipment remove debris, and other necessary demolition activities will be allowed to enter demolition areas during demolition activities. Other ("non-essential") personnel will be required to observe from outside barricaded areas. If inspections or other activities are required by "non-essential" personnel during demolition, then demolition activities will temporarily cease and such personnel may enter demolition areas ONLY when the subcontractor Demolition Competent Person has determined that there is no danger of an unplanned collapse.

- **Heavy equipment safety** – All operators will be competent in the operation of heavy equipment. The operator's employer will identify heavy equipment operators who are authorized to operate heavy equipment on this project in writing on company letterhead and submit to O'Brien & Gere prior to work. All heavy equipment shall be equipped with overhead protection, backup alarms, seatbelts and an enclosed cab.

2.18.4. Asbestos

ACM should be anticipated in structures including exterior thermal systems insulation, interior thermal system insulation, VAT and mastic, roofing, and caulking. ACM will be abated prior to demolition, but O'Brien & Gere must be notified if potential ACM material is encountered during demolition. Any work that may disturb the potential ACM must be immediately stopped pending further direction from O'Brien & Gere. Only NYS certified asbestos workers will be permitted to enter the area to sample, inspect, or otherwise handle possible ACM. All asbestos work areas will be identified by a sign that states the following (or acceptable alternate) and is of similar construction to that specified above for demolition.

2.18.5. Lead

Most buildings, structures and equipment are surfaced with pre-1985 coatings and should be assumed to contain lead unless testing by the subcontractor indicates otherwise and test results are forwarded to O'Brien & Gere. Subcontractors who may disturb pre-1985 coatings by scraping, sanding, cutting, grinding, pulverizing, or similar activities that could create airborne lead must submit a Lead Work Plan to O'Brien & Gere that is in accordance with OSHA 29CFR1926.62. Loose, peeling lead paint must be removed by hand scraping prior to demolition but complete removal of lead paint is not required. As required by OSHA's lead regulation, a lead work area must be established around paint removal activities. Paint chips on the ground will be cleaned and all lead paint waste will be containerized for off-site disposal at a location approved by MLC. All lead work areas will be identified by a sign that states the following (or acceptable alternate) and is of similar construction to that specified above for demolition:

2.18.6. Crystalline Silica

Grinding, cutting, pulverizing and drilling into concrete and masonry material will generate airborne concentrations of crystalline silica. A hazard assessment must be completed on workers performing these activities. Appropriate engineering controls (e.g., wet methods, and local exhaust ventilation) must be implemented to reduce airborne exposures. Appropriate respiratory protection must be selected by the employer based on workers airborne exposure performing these activities. Subcontractor safety plans or JSAs must outline the combination of dust control (water mist), ventilation, respirators, and other safety controls to mitigate exposure to silica.

2.18.7. Hexavalent Chromium

The potential for exposure to CrVI exists when cutting or welding on stainless steel that may be associated with process piping or equipment. Exposure monitoring and respiratory protection may be required as outlined in OSHA 29CFR 1926.1126. Subcontractor safety plans or JSAs should outline exposure monitoring requirements when welding or torch-cutting stainless steel (at a minimum) and other dust or fume producing activities.

2.18.8. Mercury-Containing Materials

Mercury switches, thermometers and thermostats must be identified and removed from the area prior to demolition. Mercury-containing components must be removed from equipment and placed in a separate, suitable container for disposal. When handling items known to or thought to possibly contain mercury, impervious hand protection must be worn to prevent direct contact with mercury. Mercury-containing lamps can either be managed as Universal Waste (if shipped intact to a reclaim facility) or as Hazardous Waste.

2.18.9. Traffic Control

Subcontractors will be responsible for closing appropriate roads when necessary. Detour signs will be placed to direct traffic around the area. Notification to close roads will need to be made to O'Brien & Gere with at least 3 days prior notice. Barricades with adequate flashers or reflective surfaces are required for normal pedestrian and road traffic areas that are barricaded overnight.

2.18.10. Debris/Material Staging

Subcontractors will be responsible for storing their materials and debris in a safe and secure area. O'Brien & Gere must approve all laydown areas prior to dumping debris or staging materials.

2.18.11. Building Egress

Subcontractors must consider the impact on life safety for any work that will interfere with building egress such as blocking stairways or exterior building exits. Subcontractors must inform project personnel of potential life safety hazards and mark safe means of emergency egress.

2.18.12. Lighting

As utilities are disconnected, building lighting may become an issue. Daylight may be adequate in some areas but subcontractors will have to **provide adequate work lighting when daylight is not sufficient.** All individuals must be provided battery-operated emergency lighting such as flash lights or hard hat-mounted "miners' lamps." All temporary lighting must have intact protective guards to prevent damage or accidental contact which could lead to burns, fire, or electrocution. **Light bulbs must be replaced immediately upon burnout.** All project work areas must comply with the following lighting standards:

2.18.13. Hauler Loading

Subcontractors will be responsible for loading and unloading of their heavy equipment in a safe and secure area. O'Brien & Gere must approve the location to load/unload heavy equipment.

2.19. HOUSEKEEPING & MATERIAL STORAGE

The site shall be maintained in a clean and orderly condition at all times. Construction areas shall be free of waste materials, debris, and rubbish that will be **removed on a DAILY basis.** Waste materials shall be placed in appropriate waste receptacles for off-site disposal or recycling. All recycling bins must be covered with a tarp covering or roofing to prevent anything from getting to pavement and into storm drains. Items with any kind of chemical or contaminant must be removed from the property **immediately** following job completion. Materials and equipment shall not obstruct traffic or emergency response activities. Each sub-contractor will have a **designated lay-down area** for the storage of their project materials. O'Brien & Gere must approve all areas. It is the responsible of the sub-contractor to maintain cleanliness of their area. **Unused tools and materials shall be returned to lay-down areas on a DAILY basis.**

2.20. HAZARD COMMUNICATION & MSDS

NOTE – O'Brien & Gere does not anticipate the mobilization of chemicals to the site beyond typical office and cleaning supplies in small, consumer-type containers and limited quantities of "Bulk" chemicals that will primarily include oil, hydraulic fluid, lubricants and similar products necessary to maintain equipment. Bulk chemicals also include fuels stored within heavy equipment and (potentially) within a temporary fuel tank. MSDS will be retained in O'Brien & Gere's field office.

Each subcontractor is responsible for having and administering a Hazard Communication Program that requires all employees to be informed about the hazards associated with chemicals used on the job and the location of the material safety data sheets (MSDSs) for all materials brought on site.

MSDSs shall be obtained from all suppliers of paints, coatings, adhesives, grout, caulk, lubricants, welding products, solvents, insulation, and similar products prior to being brought on-site. Subcontractors will submit MSDSs to O'Brien & Gere for review and upon request. O'Brien & Gere will provide the site owner with MSDSs for each chemical and (if required) sign an approval form prior to any chemicals being brought on site.

2.21. GENERAL WORKER SAFETY RULES

Workers follow the established safety practices for their respective tasks. The need to exercise caution in the performance of work is made more acute due to weather conditions and restrictions in mobility, peripheral vision, and communication caused by the personal protective equipment.

To enhance site safety, the following General Worker Safety procedures have been established:

- **Smoking is not permitted on the TechCity Campus or in work areas, smoking is otherwise allowed in designated areas only**
- **Eating, drinking, chewing gum, chewing tobacco and application of cosmetics in exclusion and contamination reduction zones are prohibited**
- **No firearms may be brought on site**
- Employ the buddy system when appropriate. Be alert.
- Minimize contact with contaminated materials
- Avoid breathing chemical odors
- Do not expose skin to water, chemicals, or soil. If one becomes dirty or wet with contaminated fluids, clean up immediately using plenty of water.
- Hands must be washed before eating or drinking and after using toilets
- Consumption of alcohol or intoxication (under the influence or impaired) during work hours or while on site is prohibited
- Working when ill is prohibited

2.22. DRUM HANDLING & SAFETY

NOTE – Drum Handling is not anticipated in the scope of work.

Accidents may occur during handling of drums and other hazardous waste containers. Hazards include detonations, fires, explosions, vapor generation, and physical injury. The most significant ways to improve the safety of drum handling activities at a site are to keep the operation as remote from workers as possible and to assign the minimum number of people necessary to safely handle or sample drums.

2.22.1. Drum Inspection

Prior to handling, drums should be inspected visually to identify their contents. Air monitoring instrumentation will be used to monitor the work area as drums are uncovered and approached for inspection.

Information that may be helpful includes:

- Symbols, words, or other marks on the drum indicating that its contents are hazardous
- Symbols, words, or other marks indicating that the drum contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers
- Signs of deterioration such as corrosion, rust, and leaks
- Signs that the drum is under pressure

> ***CAUTION – Bulging drums that may be under pressure will not be approached but will be handled remotely using heavy equipment and the pressure relieved. The location and depth of bulging drums will be estimated from a safe distance before they are located to a remote location for pressure relief.***

- Configuration of the drumhead
- For example, if the **whole lid** of the drum can be removed, then it was designed to contain solid material. If the lid has a **bung**, then the drum was intended for liquids. If the drumhead contains a **liner**, the drum may likely contain highly corrosive or otherwise hazardous materials.
- Type of drum
- **Polyethylene** or **PVC-lined** drums often contain strong acids or bases. If the lining is punctured, the substance usually quickly corrodes the steel, and may cause a significant leak or spill. **Exotic metal** drums (e.g., aluminum, nickel, stainless steel) are very strong and expensive, and are often used to store extremely dangerous materials. **Single-walled drums used as a pressure vessel** have fittings for both the storage product and for an inert gas. These drums may contain reactive, flammable, or explosive substances. **Paperboard or fiberboard** drums may contain nitrocellulose.

2.22.2. Drum Excavation & Removal

Drum excavation and removal equipment will be used as necessary to perform the following activities:

- Excavating to the depth of up to 6-foot bgs and removing surface cover over subsurface drums
- Excavating around subsurface drums to free them for removal
- Removing (lifting) drums from exposed pits and trenches
- Loading and transporting drums to onsite storage areas
- Sampling, segregating, bulking, storing, and recontainerizing (e.g., overpacking) drums
- Transporting offsite for appropriate storage, treatment, or disposal
- **Heavy equipment operators must be shielded from potential drum explosions. Site personnel will not enter excavation areas while drums are being uncovered**
- **Per the above drum inspection requirements, bulging drums and intact metal drums with unknown contents will be removed remotely using heavy equipment and assumed to be potentially explosive until subsequent testing or inspection indicates otherwise**
- **Designated persons will approach uncovered drums only when excavation work has stopped so that further vibration is minimized and visual inspection indicates that drums are not bulging**
- Drums must not be moved or impacted while measuring their GPS location and depth and marking with a unique ID number

2.22.3. Drum Handling

The purpose of drum handling is to:

1) Respond to obvious problems that might impair worker safety
2) Unstack and orient drums for sampling
3) If necessary, organize drums into different areas on-site to facilitate characterization and remedial action. Drums will only be handled to the extent necessary

- Empty overpack drums will be staged prior to handling waste drums
- Spill cleanup and containment supplies will be staged near drum excavation areas and staging areas.
- Containment berms will be constructed if major spills (>55 gallons) are anticipated and to prevent any spills from reaching to sewers or surface waters
- If a drum containing a liquid cannot be moved without rupture, its contents will be immediately transferred to a sound drum
- **Leaking drums** that contain sludge or semisolids, open drums that contain liquid or solid waste, and deteriorated drums that can be moved without rupture will be placed in overpack containers. Review additional precautions in the "Nitrocellulose Drums & Waste" section below if spills may involve nitrocellulose waste.

2.22.4. Drum Opening

Drums will be opened and sampled in a separate drum opening area.

To maximize worker safety during drum opening, the following procedures should be instituted:

- If a supplied-air respiratory protection system is used, place a bank of air cylinders outside the work area and supply air to the operators via airlines and escape SCBAs
- The drum opening area will be located as remote from drum excavation and staging activities as possible to expose fewer site personnel to drum opening hazards
- **Explosion-resistant shields will be placed between personnel and the drums for protection in case of detonation or sudden discharge of drum contents via a pressure release or chemical reaction**
- Air monitoring will be conducted during drum-opening activities
- **Non-sparking bronze-beryllium tools (or equivalent) will be used when possible**
- Remote-controlled devices for opening drums will be used when feasible
- Drum opening equipment will be setup to minimize worker exertion
- **If the drum shows signs of swelling or bulging, all steps will be performed slowly and excess pressure will be relieved prior to opening**
- Exotic metal drums and polyethylene or polyvinyl chloride-lined drums will be opened through the bung by removal or drilling
- Individual containers within laboratory packs will not be opened or sampled
- Opened bungs and drilled openings will be resealed as soon as possible
- Equipment will be decontaminated after each use to avoid mixing incompatible wastes

2.22.5. Drum Sampling

Drum sampling can be hazardous to worker health and safety because it can involve direct contact with unidentified wastes.

To maximize worker safety during manual sampling from a drum, the following techniques should be used:

- Sampling personnel will remain at a safe distance while drums are opened and sample only after opening operations are complete
- DO NOT lean over other drums to reach the drum being sampled, unless absolutely necessary
- Drum tops will be covered with plastic sheeting or other suitable uncontaminated materials
- Never stand on drums – use mobile steps or another platform to achieve the height necessary to safely sample from the drums
- Samples with glass rods or vacuum (or equivalent method)

2.23. HOT SOIL SAMPLING

- Project Specific Hot Soil Sampling procedures will be developed by Golder Associates, TRS and Obrien & Gere.
- The ERH PCU system must be turned off and LOTO applied by all effected personnel
- High Temperatures and Steam may be encountered , so proper PPE is mandatory, including heat resistant gloves

2.24. DRILLING OPERATIONS

TRS personnel will be on site during drilling activities. The following list provides guidance to TRS personnel:

- Level D PPE will be worn by all employees involved in drilling activities, and by employees required to work in the immediate vicinity of drilling activities.
- Only trained and authorized personnel will operate the drill rig.
- At no time will employees be allowed to climb the mast of a drill rig while it is in the upright position without appropriate fall protection and fall protection equipment training.
- Care will be taken to avoid slips/trips while working on uneven, wet, or plastic covered surfaces.
- There will be no walking, standing, or crawling under a suspended load.
- All personnel will be trained on the location and function of the “kill switch” on the drill rig prior to beginning drilling operations.
- Clear exit routes away from the drill rig will be established and maintained while the drill rig is in operation.
- Site personnel will not approach an operating drill rig without establishing communications with the drill rig operator.
- When working around overhead power lines, heavy equipment and personnel will maintain the minimum distances specified in **Table 4**.

Table 4. Safe Distance from Overhead Power Lines

Voltage of Power Line	Minimum Distance to be Maintained from Power Line
≤ 50kV	10 feet
200 kV	15 feet
350 kV	20 feet
500 kV	25 feet
650 kV	30 feet
800 kV	35 feet

3 CHEMICAL PARAMETERS OF CONCERN

The OSHA HAZWOPER standards (29CFR1910.120 and 1926.65) and OSHA Hazard Communication Standard require that site personnel, subcontractors, and visitors must be informed of chemical hazards associated with their work area. Health hazard information for site chemical hazards is summarized below and in ***Table 3.1*** of this HASP. Health and safety information in this HASP is intended to supplement Hazard Com training previously provided to site workers by his or her employers.

3.1. EXPOSURE PATHWAYS

Possible exposure pathways are:

- Inhalation of vapors released from contaminated soil or groundwater
- Inhalation of contaminated dusts
- Accidental ingestion of contaminants
- Skin contact/absorption with contaminated soils and/or water
- Injection through punctures and lacerations

Based upon anticipated site activities and prudent safety and hygiene practices during site work, ingestion of site contaminants is unlikely. Hazardous skin contact or absorption by the various contaminants is also unlikely because of the low concentrations that are anticipated and/or the use of personal protective equipment (PPE). The primary route of exposure is inhalation of airborne contaminants and contaminated dusts. However, inhalation of airborne contaminants approaching the OSHA PELs is unlikely because of natural ventilation of the work area, safe work practices, PPE, and/or air monitoring.

3.2. CHEMICAL HAZARDS SUMMARY

CAUTION - Previous site investigations indicate that soil and groundwater contains solvents (primarily trichloroethylene) which could contribute to airborne Volatile Organic Compounds (VOCs).

The following paragraphs summarize the health effects of site contaminants that are frequently of concern and other site chemicals (if any). Site chemicals are usually those chemicals used during water or wastewater treatment, petroleum products (fuel), and potentially lubricants such as hydraulic fluids. This HASP focuses on those which are believed to have the potential to pose a significant health hazard to site personnel based on their potential to become airborne, concentrations in soil and groundwater, and their toxicity and other hazardous characteristics. ***Table 3.1*** – "Summary of Potential Health Effects" also includes information on exposure limits and key physical characteristics such as flammability. *Several chemical hazards that are routinely encountered are listed below but those which are not present on the current project are identified by "Not Applicable" or "NA."*

- ☐ **APPLICABLE** | ☒ **NOT APPLICABLE**
  - **Polychlorinated Biphenyls (PCBs)** – PCBs are considered a potential human carcinogen, especially with respect to the liver. PCBs can be inhaled or absorbed through the skin. Skin effects include lesions, rashes, and severe acne-like conditions for those who may be especially sensitive to contact with PCBs. PCBs are not volatile and potential exposure will consist of contaminated dust and contact with contaminated soil and groundwater.

- ☐ **APPLICABLE |** ☒ **NOT APPLICABLE**
  - **Lead** – Lead is a hazardous metal that was once common in paint, gasoline, and a variety of other uses. Lead is a solid material and may be inhaled as airborne dust or ingested if personal hygiene is poor. Lead can gradually accumulate in the body with frequent small exposures adding to a growing body burden. Lead is especially hazardous to young children and infants and every effort must be made to prevent site personnel from carrying lead home on contaminated clothing, tools, and equipment.
- ☒ **APPLICABLE |** ☐ **NOT APPLICABLE**
  - **Asbestos** – Asbestos is a material often used in insulation, transite panels, and roofing materials and the potential exists to encounter this material in buildings on the site. Asbestos is a naturally occurring mineral and is considered a potential occupational carcinogen by OSHA. Asbestos-related diseases such as lung cancer, mesothelioma and digestive system cancer may occur if over exposed to asbestos fibers. Asbestos and cigarette smoking interact with each other and will have an effect much greater than either one individually.
- ☒ **APPLICABLE |** ☐ **NOT APPLICABLE**
  - **Silica** – Crystalline silica has been classified as a human lung carcinogen. Additionally, breathing crystalline silica dust can cause silicosis, which in severe cases can be disabling, or even fatal. The respirable silica dust enters the lungs and causes the formation of scar tissue, thus reducing the lungs' ability to take in oxygen. There is no cure for silicosis. Since silicosis affects lung function, it makes one more susceptible to lung infections like tuberculosis. In addition, smoking causes lung damage and adds to the damage caused by breathing silica dust. Exposure occurs during many different construction activities. The most severe exposures generally occur during abrasive blasting with sand to remove paint and rust from bridges, tanks, concrete structures, and other surfaces. Other construction activities that may result in severe exposure include: jack hammering, rock/well drilling, concrete mixing, concrete drilling, brick and concrete block cutting and sawing, tuck pointing, and tunneling operations.
- ☐ **APPLICABLE |** ☒ **NOT APPLICABLE**
  - **Chromium & Hexavalent Chromium** – Chromium metal and chromium salts (Cr II/III) are naturally occurring and generally less hazardous than hexavalent chromium (Cr VI). The risk is further reduced with exposure to chromium dust as opposed to chromium fume. All chromium can affect the liver, kidneys, respiratory system and many forms can cause skin sensitization. CrVI is clearly the more hazardous form of chromium. Workplace exposure to Chromium (Cr(VI)) may cause the following health effects: lung cancer in workers who breathe airborne Cr(VI); irritation or damage to the nose, throat and lungs (respiratory tract) if Cr(VI) is inhaled; and irritation or damage to the eyes and skin if Cr(VI) contacts these organs. Workers can inhale airborne Cr(VI) as a dust, fume or mist while, among other things, producing chromate pigments, dyes and powders (such as chromic acid and chromium catalysts); working near chrome electroplating; performing hot work and welding on stainless steel, high chrome alloys and chrome-coated metal; and applying and removing chromate-containing paints and other surface coatings. Skin exposure can occur while handling solutions, coatings and cements containing Cr(VI).
- ☐ **APPLICABLE |** ☒ **NOT APPLICABLE**
  - **Mercury** – The nervous system is very sensitive to all forms of mercury. Methyl mercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems. Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation. Mercury is a naturally occurring metal which has several forms. Metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas and small amounts (several milligrams) may be contained in fluorescent bulbs. Mercury may also be in switches and thermostats.

- ☒ **APPLICABLE |** ☐ **NOT APPLICABLE**
  - » **Volatile Organic Compounds** (VOCs) – Several organic solvents may be encountered and are collectively referred to as VOCs. Residual quantities may be present in process piping and subsurface soils and groundwater and could be encountered during excavation work. Although the precise mixture is unknown, VOCs may include (but not necessarily be limited to) trichloroethylene, 1,2-dichloroethylene, vinyl chloride, and phenol (semi-volatile) from process operations and petroleum products such as gasoline and heating oil that may be associated with site vehicles or combustion equipment. ***The main chemical of concern on site will be trichloroethane.***
- ☐ **APPLICABLE |** ☒ **NOT APPLICABLE**
  - » **Polycyclic Aromatic Hydrocarbons** (PAHs) –PAHs are semi-volatile organic compounds that do not readily evaporate. As a result of their low volatility, exposure to these compounds will result from airborne dusts contaminated with PAHs. Short-term (acute) effects of exposure to these compounds are the same as those associated with exposure to dusts in general and may include eye and upper respiratory tract irritation at high dust levels. High dust levels are characterized by dust levels where visible dust emissions are observed that typically obscure vision. The primary health effect associated with PAHs is cancer as a result of long-term (chronic) exposure. Several PAHs are suspected as being potential human carcinogens.

Table 3.1 – Summary of Potential Health Effects

Chemical	Location	PEL	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure & Health Effects
SEMI-VOLATILES – may include a mixture of the following						
☒ **NA** **Polychlorinated Biphenyls (PCBs)**	Soil and sediment	1 mg/m^3 1242 0.5 mg/m^3 1254/1260	5 $mg/\ m^3$	Oil liquids or solids that are colorless to light yellow	Inhalation Contact	PCBs are classified as probable human carcinogen by the EPA More common symptoms and health effects include skin lesions and rashes Although PCBs may create vapor, they do not evaporate easily and the most likely inhalation exposure is by dust contaminated with PCBs
☒ **NA** **Phenol**	Soil and sediment	5 ppm TWA (skin)	250 ppm	Colorless to light pink liquid with a sharp, medicinal, sweet, tarry odor Ionization potential = 8.5	Inhalation Absorption	Inhalation of vapors, dust, or mist contaminated with phenol may result in vomiting, difficulty in swallowing, diarrhea, loss of appetite High concentrations or chronic exposure may also cause burning in the eyes, nose and throat, dizziness, irregular breathing and abdominal pain Phenol is readily absorbed through the skin causing discoloration and ulcerations Skin contact must be avoided
☒ **NA** **Polycyclic Aromatic Hydrocarbons (PAH)** **Also known as:** PNAH Polynuclear aromatic hydrocarbons	Excavations	0.2 mg/m^3 (Coal tar pitch volatiles - benzene soluble fraction) 0.15 mg/m^3 (Coke Oven Emissions - benzene soluble fraction)	Not determined	PAHs do not readily evaporate. Exposure from contaminated soil/dust created during remediation activities Pure material is a brown/black tar-like substance	Inhalation Contact	High exposures (>PEL) may cause irritation of the respiratory system The skin and eyes are especially prone to irritation from contact with PAHs May cause photosensitization of the skin and eyes increasing the potential for sunburn and irritation Long-term exposure may cause skin, lung, and kidney cancer

Table 3.1 – Summary of Potential Health Effects

Chemical	Location	PEL	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure & Health Effects
METALS & MINERALS						
☒ NA **Lead**	Lead in soil or ground water	0.05 mg/m^3 TWA 0.035 mg/m^3 Action Level	100 mg/m^3	Pure material is a heavy, ductile, soft, gray, solid Lead is present on site as a component of soil from paint chips that have flaked off painted structures and will not resemble its pure form Lead is also a component of paint	Inhalation Ingestion	Lassitude (weakness, exhaustion), insomnia Facial pallor Anorexia, weight loss, malnutrition; constipation, abdominal pain, colic Anemia Gingival lead line Tremor Paralysis of the wrist, ankles Encephalopathy Kidney disease Irritation eyes Hypotension
☐ NA **Asbestos**	Existing building: floor tiles, window caulk, roofing mastic	0.1 fibers/cc	NA	Commonly found in insulation, felt, mastic, transite panels, and a variety of other structural applications	Inhalation Ingestion Contact	Asbestosis, Mesothelioma cancer Restricted pulmonary function
☐ NA **Silica**	Cutting or pulverizing concrete	0.05 mg/m^3 (NIOSH)	50 mg/m^3 (quartz)	Colorless, odorless solid A component of sand, concrete and other masonry materials	Inhalation	Cough, dyspnea (breathing difficulty), wheezing Decreased pulmonary function, progressive resp symptoms (silicosis) Irritation to the eyes Potential occupational carcinogen
☒ NA **Hexavalent Chromium**	Chromium in soil or groundwater	0.005 mg/m^3 [skin]	15 mg/m^3	Dark-red, odorless flakes or powder (pure form)	Inhalation Contact	Irritation to the respiratory system Nasal septum perforation Liver, kidney damage Leukocytosis (increased blood leukocytes), leukopenia (reduced blood leukocytes), eosinophilia Eye injury, conjunctivitis Skin ulcer, sensitization dermatitis Potential occupational carcinogen
☒ NA **Mercury**	Fluorescent light bulbs and mercury switches and thermostats	0.1 mg/m^3 [skin]	10 mg/m^3	Metal: Silver-white, heavy, odorless liquid	Inhalation Contact	Irritation to the eyes and skin Cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis Tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion) Stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss;
VOLATILE ORGANIC COMPOUNDS (VOCs) – may include a mixture of the following – Constituents in DNAPL						
1,1,1-Trichloroethane (TCA)	**Soil, groundwater**	350 ppm (1900 mg/m^3)	700 ppm	Colorless Liquid with a mild, Chloroform-like odor	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmia; liver

Table 3.1 – Summary of Potential Health Effects

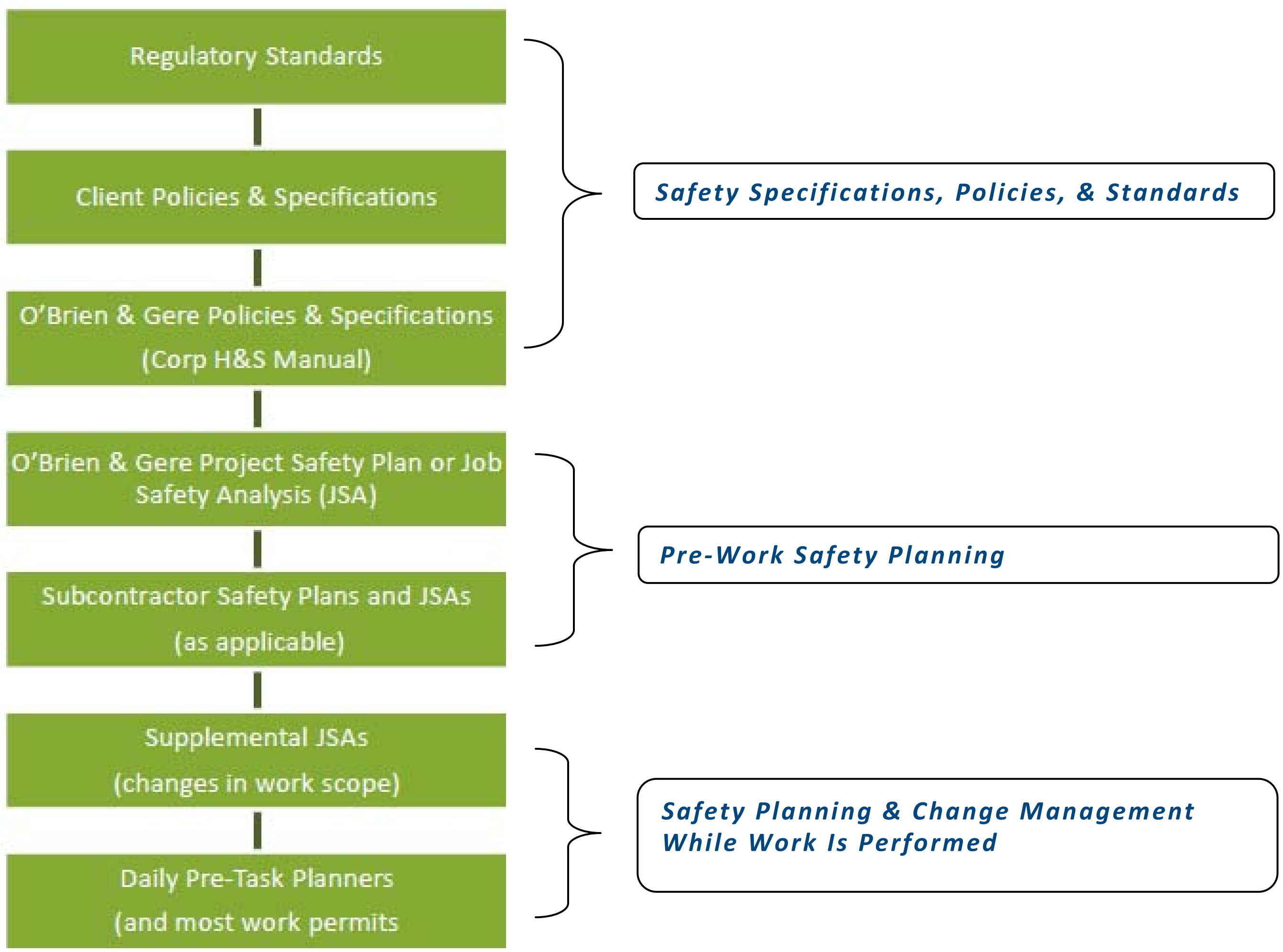
Chemical	Location	PEL	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure & Health Effects
						damage
☐ NA **Trichloro-ethylene (TCE)**	Soil, groundwater ,	100 ppm TWA	1000 ppm	Colorless liquid with a chloroform odor UEL=10.5%, LEL=8.0% Combustible Liquid Ionization Potential = 9.45 eV	Inhalation Absorption Contact	Causes headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating Large amounts of may cause impaired heart function, unconsciousness, and death Breathing for long periods may cause nerve, kidney, and liver damage
☒ NA **Vinyl Chloride**	soil, groundwater , residual in drums	1 ppm carcinogen	NA	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations UEL=33%, LEL=3.6% Flammable Liquid Ionization Potential = 9.99 eV	Inhalation Contact	Lassitude (weakness, exhaustion) Abdominal pain Gastrointestinal bleeding Enlarged liver Pallor or cyanosis of extremities; liquid Frostbite Potential occupational carcinogen
☐ NA **1,2,-Dichloro ethylene**	Soil, groundwater , residual in drums	200 ppm	1,000 ppm	Colorless liquid (usually a mixture of the cis and trans isomers) with a slightly acrid, chloroform-like odor. UEL=12.8%, LEL=5.6% Flammable Liquid Ionization Potential = 9.65 eV	Inhalation Contact	Irritation to the eyes and respiratory system Central nervous system depression
☐ NA **Benzene**	Soils, groundwater , residual in drums	1 ppm TWA 5 ppm STEL	500 ppm	Colorless vapor released from contaminated soil or water that may have a strong, irritating, or otherwise characteristic odor generally detectable at 4-5 ppm Ionization Potential = 9.24 eV	Inhalation Absorption Contact	Irritation to the eyes, nose, and throat Dizziness Dermatitis Prolonged exposure to hazardous levels may damage blood-forming systems Benzene is also a suspected human carcinogen (ACGIH 1996 Class A2)
☐ NA **Toluene**	Soils, groundwater , residuals in drums	200 ppm 300 ppm Ceiling	500 ppm	Colorless liquid with a sweet benzene-like odor UEL=7.1% and LEL=1.1% Class IB Flammable Liquid Ionization Potential=8.82 eV	Inhalation Contact (dermatitis)	Irritation to eyes and nose May cause skin irritation/dermatitis and headaches Exposures at or above the OSHA PEL may cause fatigue, confusion, dizziness and overall depression of central nervous system Chronic exposure or high exposures approaching IDLH levels may cause liver and kidney damage

Table 3.1 – Summary of Potential Health Effects

Chemical	Location	PEL	IDLH	Characteristics	Routes of Exposure	Symptoms of Exposure & Health Effects
☐ **NA** **Xylene (o,m,p)**	Soils, groundwater, residuals in drums	100 ppm	900 ppm	Colorless liquid with an aromatic odor UEL=6.7%-7.0% and LEL=0.9%-1.1% Class IC Flammable Liquid Ionization Potential = 8.56 eV	Inhalation Contact (dermatitis)	Irritation to eyes, nose, and throat May cause skin irritation/dermatitis and headaches Exposures at or above the OSHA PEL may cause fatigue, confusion, dizziness, nausea, vomiting, cornea (eye) damage, and overall depression of central nervous system Chronic exposure or high exposures approaching IDLH levels may cause liver and kidney damage
Footnotes	All values are 8-hour time-weighted averages (TWAs) unless otherwise indicated **PEL**: Permissible Exposure Limit, the concentration an employee may be exposed to for an 8-hour work day for a 40 hour work week for which nearly all employees may be repeatedly exposed without adverse health effects **REL**: NIOSH recommended exposure limit for full-shift exposures **STEL**: Short-Term Exposure Limit as a 15 minute average **CEILING:** maximum concentration **IDLH**: IMMEDIATELY Dangerous to Life and Health, contaminant concentration which present the possibility for severe health consequences if exposed to the IDLH concentration without the appropriate personal protective equipment (PPE) **LEL**: Lower Explosive Limit **Units: mg / m^3** = milligrams per cubic meter of air | **f / cc** = fibers per cubic centimeter of air					

4 HAZARD EVALUATION

The OSHA safety regulations (29CFR1910 and 29CFR1926) require that site personnel, subcontractors, and visitors must be informed of the hazards associated with their work activities. Hazard Identification and control begins during safety planning. Safety planning is required for work on this project and occurs at different times during the project. Each "level" of safety planning typically has differing degrees of detail and focus. However, the ultimate objective is that site management and crafts methodically evaluate hazards and implement safety controls to prevent the occurrence of an injury, fire, explosion, spill, or property damage incident and are able to manage changes as they occur. **The following flow chart shows hierarchy of safety requirements and safety planning documents referenced in this HASP.**



Safety Plans, JSAs, and Safe Work Permits developed subsequent to this HASP by O'Brien & Gere or subcontractors (if any) will identify hazard controls that are consistent with this Health & Safety Plan. Subcontractors may use an O'Brien & Gere Pre-Work JSA template ***(Appendix A)*** or request approval from O'Brien & Gere to use an alternate JSA template. **Submitting standard company policies or programs is not acceptable.** Preliminary identification of hazards and their respective controls for major work tasks or phases are outlined in ***Table 4.1.***

Table 4.1 – Hazard Identification & Control

<table>
<tr><th>Activities & Tasks</th><th>Affected Personnel</th><th>Safety Hazards</th><th>Safety Hazard Controls</th></tr>
<tr><td rowspan="5">GENERAL SAFETY HAZARDS

Mandatory PPE:
Level D PPE
(Refer to PPE section of HASP for specific components of Level D PPE based on the task being performed)

As needed PPE:
Face shield for all grinding, torch cutting, pressure washing

Covered tasks:
This section covers safety hazards and their associated controls that are applicable to a variety of crafts/trades.

These will only be repeated in subsequent sections when specific tasks or site conditions require changing or modifying safety hazard controls.</td><td rowspan="5">Generally applicable to all trades/crafts</td><td>Slip, trips, and falls</td><td>Safety controls for slips, trips, and falls include:
▪ Daily cleanup
▪ Unused materials must be stored in a designated area
▪ Unused tools must be picked up daily
▪ All trash, scrap metal, and construction debris must be placed in the appropriate dumpsters
▪ Icy walkways, stairs, work platforms, and scaffolding must be salted prior to use. Slip-on traction devices (YakTrax®) should also be considered.</td></tr>
<tr><td>Manual lifting</td><td>Follow proper manual lifting technique.
Review primary precautions below:
▪ Keep load in close to the body
▪ Keep hips and shoulders aligned (no twisting)
▪ Maintain stability (keep a balanced position)
▪ Think and plan difficult lifts
(use two people when weight is >55-75 lbs)</td></tr>
<tr><td>Noise- during operation of heavy equipment and power tools or working adjacent to such equipment</td><td>Safety controls to prevent hearing loss associated with excessive noise exposure include:
▪ Wear hearing protection while operating heavy equipment (unless with enclosed cab) or noisy power tools.
▪ Wear hearing protection if you have to raise your voice talking to someone five feet away.</td></tr>
<tr><td>Electrical, Fire, and Explosion when working near power lines or performing sub-surface work when underground utilities may exist.
▪ Contact with damaged cord
▪ Overhead power lines
▪ Contact with sub-surface utilities</td><td>Safety controls when working near overhead power lines or performing sub-surface work (including excavating, trenching, test pits, post holes, and any stakes >18”:
▪ Locate and verify all building utilities with owner representative
▪ Inform all site personnel that overhead power lines are energized and a 20-foot clearance must be maintained
» A 10-foot clearance may be used for insulated secondary lines that distribute power within the site
» If the lines are <300 volts and a safety spotter observes equipment while it's moved, then a 3-foot clearance may be used
▪ Subsurface utilities must be located and marked prior to driving stakes, fence posts, or earthwork. Temporary utilities for construction may be shallower than expected.</td></tr>
<tr><td>Shock and injury associated with use hand tools, power tools and extension cords
▪ Shock
▪ Flying dust, cuttings, debris
▪ Hand injuries from cutting blades/bits</td><td>Perform the following to ensure that tools are in good working order
▪ Inspect tools for visible damage prior to each use.
▪ Inspect all flexible extension cords and power tool cords. Discard all flexible cords without a ground plug or outer insulation that is cut through. Tool cords must be in similarly good condition. Electrical tape is NOT considered an acceptable repair.
▪ Do not operate tools without guards and use only in accordance with manufacturer’s operating instructions
▪ Use GFIs on all extension cords and power tools
▪ Inspect tools for visible damage on a daily basis
▪ Inspect all flexible extension cords and power tool cords daily prior to use</td></tr>
</table>

Table 4.1 – Hazard Identification & Control			
Activities & Tasks	**Affected Personnel**	**Safety Hazards**	**Safety Hazard Controls**
			▪ Discard all flexible cords without a ground plug or outer insulation this is cut through. Tool cords must be in similarly good condition. ▪ Do not repair flexible cords smaller than 12 gauge ▪ All extension cords must be ran overhead (>7-foot) when crossing walkways or other areas of high travel or protected when run across the floor (in a manner that does not create an excessive trip hazard) ▪ All extension cords must be protected when run across roadways
		Ladder hazards ▪ Ladders kicking out or tipping over during use ▪ Users fall from a ladder ▪ Falling objects strike workers or pedestrians on lower work surfaces	**Ladders must be used in accordance with OSHA guidelines or fall protection must be implemented above six feet. Ladder safe guidelines include, but are not limited to:** ▪ Ensure all ladders are inspected and properly labeled ▪ Maintain 3-point contact while working on step ladders and extension ladders (work requiring the use of both hands when on a ladder will require the worker to tie-off) ▪ Keep your torso between the rails of the ladder ▪ Do not use a step ladder as a straight ladder ▪ Do not stand on the top two steps of a step ladder ▪ Extend extension ladders three feet above the upper level ▪ Secure the top and base of extension ladders ▪ Extension ladders should have a 4:1 height to base ratio ▪ Do not use metal ladders within 20 feet of exposed conductors or overhead power lines ▪ **Ladders must be inspected prior to each use**
		Heat Stress during summer construction season ▪ All construction and remediation work performed at a HIS >80. ▪ Work in Tyvek. ▪ Work in Respirators.	**Implement basic heat stress precautions for all summer work, especially work performed with a Heat Stress Index (HIS) > 80.** ▪ All workers must start the work day rested and well-hydrated. Lack of sleep, excessive alcohol consumption, and heavy exercise (without adequate hydration) the evening or morning before work can contribute to dehydration and heat stress and should be avoided. ▪ Take regular drink breaks which are more frequent with higher HSI. Workers should not wait until they feel thirsty. Drinks may be provided in Exclusion Zones as long as coolers are sealed and single-use cups are used. ▪ Highly laborious tasks or tasks performed in Tyvek or respirators should be monitored closely and rotated between employees so one worker can recover while the other is working. ▪ Employees must know symptoms of heat stress and be instructed to notify site management when symptoms are observed in themselves or others.
		Heavy equipment hazards – Working near heavy equipment requires that general safety precautions be considered. When tasks require the use of certain types of heavy equipment (e.g., manlifts, forklifts, and cranes), they will be covered in more detail with respect	**Heavy equipment safety precautions include:** ▪ Ensure **slopes** in designated work areas do not exceed slopes allowed by manufacturer's safe operating guidelines ▪ Keep **non-essential personnel** out of areas in which heavy equipment will be operating. Portable chain link (or equivalent) will be used to secure the construction area ▪ Ensure all operators are qualified and familiar with the **manufacturer's safe operating guidelines** for the

Table 4.1 – Hazard Identification & Control

Activities & Tasks	Affected Personnel	Safety Hazards	Safety Hazard Controls
		to those tasks. ▪ Turnover due to the slope angle and/or stability ▪ Struck by injuries (counterweight swing or run-over) ▪ Dropped loads ▪ Hydraulic fluid leaks ▪ Equipment fire	equipment they are operating. Subcontractors must submit the following for specific types of equipment: ▪ Forklift – Operators license ▪ Manlift – Training certificate. Letter of Authorization and Training on company letterhead, or equivalent. ▪ Crane – State License and/or CCO ▪ **Inspect heavy equipment daily** prior to use Immediately repair any leaks ▪ Operators must wear **seatbelts** at all times unless the manufacturer does not provide seat belts ▪ Equipment operators must ensure workers are kept clear from **crush points** created by counterweight swings and for boom movement ▪ Never lift or suspend a load over people ▪ Inspect all rigging materials prior to use ▪ Ensure that a **fire extinguisher** is mounted to the equipment ▪ Ensure spill materials for oil/hydraulic fluid are located near the construction area
SITE PREPARATION, MOBILIZATION, & DEMOBILIZATION **Minimum PPE:** Level D PPE (Refer to PPE section of HASP for specific components of Level D PPE based on the task being performed.) **Additional PPE:** Hearing protection during operation of heavy equipment or other loud equipment **Kevlar Chaps & Jacket**: During operation of chainsaw that may be required to clear small trees and large shrugs **Covered Tasks:** Mobilization of equipment Site Survey Site security – perimeter safety fence installation Setup of temporary drum storage areas Installation of silt fence, drainage swales, and other erosion controls	Laborers Equipment Operators Surveyors Delivery Personnel Utility Installation Crews Fence removal and installation	**General Hazards previously listed in the "General Safety Hazards" section of this table** **Vegetative Clearing** ▪ Biological hazards - Poison Ivy and poisonous snakes and insects ▪ Cuts/lacerations from chainsaws (if used)	**General Hazards previously listed in the "General Safety Hazards" section of this table (liner may be installed and used on site and is extremely slippery when wet)** **Safety controls for clearing and grubbing include:** ▪ Know how to recognize poison ivy. Maintain alcohol wipes or rubbing alcohol to wipe down exposed skin following contact with allergy-causing oils from poison ivy. ▪ Newburgh is in a high Lyme disease area. Use 25%+ DEET on skin and permethrin on clothes when walking into overgrown areas. ▪ All personnel using chainsaws and fixed blade weed wackers for clearing activities must wear **Kevlar Chaps and Jacket** and hard hat mounted face shield in addition to other safety gear ▪ Use heavy equipment to do as much of the vegetative clearing as possible. ▪ Roots and stumps will be removed during excavation work. Removing surface vegetation without disrupting contaminated soil is not considered "intrusive."
EQUIPMENT RELOCATION,	Field Techs Rack Storage removal and	General Hazards previously listed in the "General Safety Hazards" section of this table	**General Hazards previously listed in the "General Safety Hazards" section of this table:**

Table 4.1 – Hazard Identification & Control

Activities & Tasks	Affected Personnel	Safety Hazards	Safety Hazard Controls
REMOVAL, and/or REINSTALLATION **Minimum PPE:** Level D PPE (refer to PPE section of HASP for specific components of Level D PPE based on the task being performed) **Additional PPE:** Hearing protection during operation of heavy equipment or other loud equipment **Covered Tasks:** Relocate existing trash compactor Remove 20' high rack storage equipment in B57 that impedes installation of remedial measures. Re-install 20' high rack system following completion of remedial measure. Remove or disconnect sections of fire sprinkler piping installed within storage racks for building structure.	installation subcontractor	**Use of forklifts, lulls, and similar material handling equipment** - Dropped loads - Struck-by forklift - Overturned forklift **Rigging Failure leading to accidental release of load** **Falls from height removing racks or sprinklers** **Use of Manlifts to access racks and sprinklers** **Injuries to hands while working with aluminum siding and roofing** **Hot work (fire) from cutting or grinding activities that may be necessary during removal of racks and sprinklers.**	**Forklift safety controls include:** - Operators must by licensed by their employer per OSHA regulations including a written and "road" test - Loads will not exceed manufacturer's limitations. - Do not tip-load forks. - Maintain the center of balance of the forklift to ensure stability while transporting loads. - Raise load the minimum height to clear floor obstructions but never more than the maximum recommended by the forklift manufacturer. - Do not rig directly to the forks. Use a crane-hook attachment that is compatible with the forklift. - Ensure all personnel are clear of the travel path and any potential pinch points between the forklift and fixed objects (like building columns). **Rigging failure leading to accidental release of load:** - Inspect all rigging prior to use - Use proper type of rigging for the load - Do not overload rigging - Make certain all loads are stabilized prior to lifting **Falls from height while aligning steel beams:** - Fall protection as required by OSHA in regards to steel erection **Use of boom lifts / scissor lifts to access beams and assemble siding sections:** - Use fall protection when in a boom lift at all times - Protect swing radius of counterweight with a cone - Use lifts only of firm level surface - Only trained individuals may use man lifts **Injuries to hands while working with aluminum siding and roofing:** - Always wear gloves when working with aluminum sheets **Injuries to hands while working with aluminum siding and roofing:** - Obtain a hot work permit each day prior to performing any tasks that cause an open flame, arc, or sparks. - Refer to the "Hot Work" section of this HASP.
CONCRETE WORK (Concrete Cutting and Capping Electrodes with Concrete) **Minimum PPE:** LEVEL D PPE	Field Techs Equipment Operators TRS (thermal treatment system install crew)	**General Hazards previously listed in the "General Safety Hazards" section of this table** **Contact with potentially contaminated soils that may remain on the excavation floor**	**General Hazards previously listed in the "General Safety Hazards" section of this table:** **Hazard controls to prevent contact with contaminated materials include:** - Maintain Modified Level D PPE with boot covers or boot wash stations while potential exposure to subsurface soil remains a possibility

Table 4.1 – Hazard Identification & Control			
Activities & Tasks	**Affected Personnel**	**Safety Hazards**	**Safety Hazard Controls**
(refer to PPE section of HASP for specific components of MODIFIED LEVEL D PPE if contact is anticipated while handling contaminated concrete slabs. LEVEL C PPE if concrete dust is not controlled by wet cutting or if air monitoring action levels for VOCs are exceeded from VOCs released from underlying soil. **Additional PPE:** Hearing protection during operation of heavy equipment or other loud equipment **Covered Tasks:** Cut 5'x5' holes through concrete floor Cut masonry material for wall opening to install 10'x10' door Pouring "soft" concrete to enclose the top of electrodes Any rebar installation or construction of concrete forms Cutting rebar /wire reinforcement to size		**Hand injuries due to rebar and wire reinforcement** **Property damage or personal Injury while bringing trucks into place to dump** **Pinch points leading to hand injury while assembling chutes** **Chemical burns from contact with concrete** **Cutting Concrete** - Airborne silica dust - Noise **Contact with contaminated concrete surfaces when the underside of the concrete is in direct contact with contaminated soil.**	- Place fabric and clean stone bed over excavated soil as soon as possible to reduce any possible VOCs **Hand injuries due to rebar and wire reinforcement:** - Gloves are required to protect hands - Exposed rebar will have Rebar Caps on them **Property damage or personal Injury while bringing trucks into place to dump:** - Use a spotter in order to guide concrete trucks into place to unload **Pinch points leading to hand injury while assembling chutes:** - Always wear gloves to protect hands from potential injury - Be aware of your hand placement and body position while setting chutes into place **Chemical burns from contact with concrete:** - Wear gloves to protect hands from contact with concrete - If concrete comes in contact with skin, wash and use hand lotion as necessary to minimize irritation. **Safety controls related to concrete cutting include:** - Use wet cutting to control silica dust - Wear N95 (or better) respirators if wet cutting is not effective to control dust. - Increase general/dilution ventilation to the work area. **Safety controls related to concrete cutting include:** - Minimize contact with concrete by using heavy equipment to place cut sections of concrete directly into roll-off containers or other designated staging area. - Wear Lightweight Modified Level D PPE to prevent hand contact if manual handling cannot otherwise be avoided. - Wear full Modified Level D to prevent body contact which would be necessary if concrete slabs are pulverized and gross contact is possible.
DOOR INSTALLATION **Minimum PPE:** LEVEL D PPE (refer to PPE section of HASP for specific components of **Additional PPE:** Hearing protection during operation of heavy equipment or other loud equipment **Covered Tasks:** Refer to "Concrete Work" for tasks related to cutting or	Field Techs Equipment Operators	**General Hazards previously listed in the "General Safety Hazards" section of this table** **Contact with potentially contaminated soils that may remain on the excavation floor** **Hand injuries due to rebar and wire reinforcement**	**General Hazards previously listed in the "General Safety Hazards" section of this table:** **Hazard controls to prevent contact with contaminated materials include:** - Maintain Modified Level D PPE with boot covers or boot wash stations while potential exposure to subsurface soil remains a possibility - Place fabric and clean stone bed over excavated soil as soon as possible to reduce any possible VOCs **Hand injuries due to rebar and wire reinforcement:** - Gloves are required to protect hands - Exposed rebar will have Rebar Caps on them

Table 4.1 – Hazard Identification & Control

Activities & Tasks	Affected Personnel	Safety Hazards	Safety Hazard Controls
pulverizing concrete to enlarge door opening in masonry wall. Install new lintel and block. Install new door, frame, and supporting equipment for new 10x10 door on the east side of building 1		**Sharp edges (hand cuts) associated with metal sheeting, tools, and reinforcing steel or rebar** **"Struck by" falling tools or materials**	**Safety controls to prevent hand injuries include:** ▪ Wear cut resistant gloves (leather, Kevlar, or aramid fiber) ▪ When left unattended, cover or barricade exposed sheet metal edges, rebar, or similar sharp edges to prevent accidental contact by others working in the area. **Safety controls to prevent "struck by" injuries include:** ▪ Maintain housekeeping in elevated work areas and minimize the amount of loose materials or tools that may fall off the ladder, scaffold, manlift, or other elevated work platform. ▪ Prevent unauthorized persons from walking or working under elevated work areas.
ELECTRODE INSTALLATION **Mandatory PPE:** Refer to PPE section of HASP for specific components of Level D and Modified Level D PPE based on the task being performed LEVEL D (Electrode Installation) MODIFIED LEVEL D (Electrode Removal) LEVEL D (Operators) **As needed PPE:** Hearing protection Hearing protection during electrode driving operations Level C PPE - based on air monitoring results **Covered Tasks:** Drilling operations	Loader Operators Drill Rig Operators Drilling Crew associates	**General Hazards previously listed in the "General Safety Hazards" section of this table** **Caught between struck by drilling equipment** **Hearing damage due to impact type noise created during drilling** **Inhalation of vapors released drilling operations** **Contact with overhead lines leading to damage to equipment or injury**	**General Hazards previously listed in the "General Safety Hazards" section of this table:** **Caught between struck by drilling equipment** ▪ One person should be designated to control any lift ▪ Qualified signal person only ▪ Use tag lines to control loads ▪ Never place yourself between a movable and stationary object ▪ Never lift drilling equipment over associates **Hearing damage due to drilling activities** ▪ Wear approved hearing protection (ear buds, ear cuffs, etc.). ▪ If you have to raise your voice to be heard at 5 feet away… you need hearing protection **Inhalation of vapors released during drilling operations** ▪ Air monitoring **Contact with overhead lines leading to damage to equipment or injury:** ▪ Maintain 20-foot clearance from any overhead lines. ▪ Assume all lines to be live unless grounded and visually isolated
EXCAVATIONS **Minimum PPE:** LEVEL D PPE – (Refer to PPE section of HASP for specific	Field Techs Equipment Operators	**General Hazards previously listed in the "General Safety Hazards" section of this table** **Excavation Hazards:** ▪ Cave In	**General Hazards previously listed in the "General Safety Hazards" section of this table:** **Excavation Safety Controls:** ▪ Implement safety precautions outlined in Section 2.8, "Excavations" of this HASP

Table 4.1 – Hazard Identification & Control			
Activities & Tasks	**Affected Personnel**	**Safety Hazards**	**Safety Hazard Controls**
components of Modified Level D PPE based on the task being performed) MODIFIED LEVEL D PPE - Work within excavations where contact with contaminated soil is anticipated. (Refer to PPE section of HASP for specific components of Modified Level D PPE based on the task being performed) **Additional PPE:** Hearing protection during operation of heavy equipment or other loud equipment LEVEL C PPE based on air monitoring results **Covered tasks:** Removal of fire line feed Removal of 2' of soil following removal of concrete slabs and at outdoor electrode locations to bury the top of electrodes Staging potentially contaminated soil for removal. Staging contaminated soil for disposal. Decontamination of tools and equipment.		- Falls into excavations - Struck by vehicles - Struck by heavy equipment - Stability of adjacent structures - Buried utilities **Inhalation of VOCs released by intrusive work, disruption of soil and or exposure to groundwater**	- Complete work from outside the trench as much as possible - **Shallow excavations <5 feet deep** could pose a cave in hazard if site persons must work in trenches and excavations such that their head or chest is located below ground level. In these situations, Excavation Competent Person will ensure the trench/excavation is safe for entry as outlined for "Shallow Excavations" in Section 2.8 of this HASP. - **Deep Excavations ≥5 feet deep** must be sloped or shored. There is sufficient room to slope or bench these areas at 1.5H:1V which is appropriate for Type C soil - Ensure workers, pedestrians, and vehicles are protected from movements by heavy equipment. Movements include relocation of equipment, counterweight swing, and bucket / arm movement. - All workers in excavation areas located in high traffic areas will wear high visibility vests - Implement excavation safety requirements in this HASP **Safety controls to mitigate inhalation of vapors and dust are outlined below and explained more thoroughly in this safety plan.** - Implementation of an Employee and Community Air Monitoring Plan (ECAMP) to verify that Modified Level D PPE is adequate and determine if, or when, Level C PPE is necessary - Use of Level C PPE if ECAMP action levels are exceeded. - Dust and odor controls as outlined in the Employee and Community Protection Plan (ECPP)
THERMAL TREATMENT SYSTEM INSTALLATION **Minimum PPE:** LEVEL D PPE (refer to PPE section of HASP for specific components of Level D PPE based on the task being performed) **Additional PPE:** Electrical safety equipment as required by NFPA 70E if work with exposed energized conductors is required. **Covered Tasks:** Lifting and placing control units	Electricians Crane operator Riggers	**General Hazards previously listed in the "General Safety Hazards" section of this table** - Electrical Shock	**General Hazards previously listed in the "General Safety Hazards" section of this table:** **Safety controls to prevent electrical shock include:** - Licensed electricians will connect control units to the power pool and install bonding and grounding cables as necessary and verify the effectiveness of existing bonding and grounding systems. - Only persons approved by TRS and others qualified to perform electrical work will connect electrodes to the power control units. - Cables will be run in a manner that prevents damage from pedestrian and vehicle traffic, minimizes slips and trips, and minimized runs through standing water in outdoor areas. - Lockout/Tagout procedures developed by TRS and in accordance with OSHA requirements will be implemented following tie-in of the control units to the electrical pole and during subsequent operations and maintenance work. - The system to be installed, operated, and maintained in accordance with TRS procedures.

Table 4.1 – Hazard Identification & Control			
Activities & Tasks	**Affected Personnel**	**Safety Hazards**	**Safety Hazard Controls**
Electrical wiring of control units to electrodes Connecting control units to utility pole Bonding and grounding of building structure, equipment, poles, etc.		▪ Crane hazards associated with placing power control units.	**Safety controls associated with cranes and rigging are summarized below:** ▪ Refer to "Lifting & Rigging" and "Overhead Power Lin" sections of this HASP ▪ Power lines are near perimeter of the site but work should is not anticipated within 20'
		▪ Contact with contaminated soil when excavating electrode pits. ▪ Electrode (Sheet Pile) Installation ▪ Installing concrete cap over electrodes.	Refer to "Excavations". Refer to "Concrete Work"

5 EMPLOYEE AND COMMUNITY AIR MONITORING (ECAMP)

Work Area air monitoring is to be performed in accordance with Program 2.1 of the O'Brien & Gere Corporate Health & Safety Manual, *Airborne Materials Exposure*, and Program 2.22 of the O'Brien & Gere CHS Manual, *Hazardous Waste Operations*. Presented below is the site-specific information. The purpose of air monitoring is to verify the adequacy of PPE being used and to evaluate new hazards or changing site conditions.

NOTE – Community air monitoring program has been designed by Golder Associates, O'Brien & Gere personnel will assist Golder in the implementation of the CAMP O'Brien & Gere and subcontractors will implement any work area monitoring that may be necessary to ensure the safety of site personnel.

The **"site"** refers to the work area(s) designated for this project. The **"fence line"** refers to the site perimeter or 200' downwind, whichever is closer, and includes areas where the general public may be present. **Community action levels** generally apply at the fence line or site perimeter. The **"work area or zone"** is the area immediately surrounding activities that disturb contaminated materials and is the area within which "work area action levels" apply. Exclusion Zones may be setup to coincide with the perimeter of individual work areas or encompass several work areas. Where Exclusion Zones are adjacent to the fence line, the most stringent of work area and community action levels shall apply.

5.1. MONITORING EQUIPMENT

Monitoring Instruments will be calibrated in accordance with manufacturers' recommendations. Air monitoring information from perimeter dust meters will be downloaded at the end day. Air monitoring results will be submitted to DEC.

Monitoring Equipment				
Required?	**Contaminant**	**Location**	**Equipment**	**Comments**
YES	Volatile Organic Compounds (VOCs)	1 PID or 5 gas meter in each active excavation, drilling location , confined spaces	Photoionization Detector (PID) with 10.6 eV lamp	Available from Pine Environmental 800-301-9663 (approx $200 a week)
NO	Oxygen and flammable vapors	Confined spaces	Gas Meter – Neotronics Minigas or equivalent	Available from Pine Environmental 800-301-9663 (approx $150 a week) For use if confined space entry Not to be used for ambient monitoring
NO	Dust / Particulate (PM-10)	1 upwind 2 downwind 1 "roving" meter for use in work areas and backup for perimeter monitors	Dust Meter - TSI DustTrak Model 8520 (w/ PM-10)	Available from Pine Environmental 800-301-9663 (approx $300 a week) Rent the optional TSI Environmental Enclosure for stationary locations subject to rain and prolonged sun
NO	Hydrogen cyanide		ToxiRAE Plus or Industrial Scientific T82 single gas monitors with HCN sensor	Available from Pine Environmental 800-301-9663 (approx $75 a week)
NO	VOC -benzene (Drager tube)	At the discretion of the SSHC to supplement PID Readings	Drager Tube - Benzene 0.5/c (tube # 81 01841) 20 strokes, approx 20 minutes per test, uses scrubber tube to decrease interference from other VOCs	Benzene colorimetric tubes are subject to cross-sensitivity to a variety of aromatic compounds and will therefore be used only at the discretion of the SSHC or Manager of Corporate Health & Safety
NO	VOC - benzene	Intrusive Work	3M 3520 Organic Vapor Badge	Supplied by Galson Labs

Monitoring Equipment				
Required?	**Contaminant**	**Location**	**Equipment**	**Comments**
	(exposure sampling badge)	Activities at the discretion of the SSHC	for analysis by NIOSH 1500 (benzene)	888-432-5227 ($5.00 when analysis performed by Galson)

5.2. WIND DIRECTION

NOTE – Wind direction is part of community air monitoring not performed by O'Brien & Gere.

Wind direction will be monitored daily using visual observations with wind direction and velocity recorded in a field log.

5.3. WORK AREA (EMPLOYEE) MONITORING

The Work Area Monitoring approach will use "roving" (hand-held) equipment to periodically check breathing zone exposures in active work areas. One PID and one dust meter will be used to assess potential contamination hot spots, investigate odors, and monitor effectiveness of dust and vapor controls in the work area. Hand held meters may be used as backups to perimeter CAMP instruments if equipment fails.

Work area monitoring includes one or more of the following depending on site activities:

- **Periodic / Roving Monitoring** – The SSHC or designated alternates will conduct air monitoring using hand-held instruments within each intrusive work area when intrusive work is being conducted
- **Confined Space Entry** – A combustible gas / oxygen meter will be required for entry into confined spaces, including excavations greater than four feet deep that are classified as a confined space. Refer to the "Confined Space Entry" section of this HASP.
- **Hot Work** – A combustible gas / oxygen meter will be required to monitor areas where flammable vapors may accumulate prior to conducting hot work

Work Area (Employee) Air Monitoring Action Levels			
Contaminant (equipment / method)	**Frequency**	**Action Level**	**SSHC Action/Response**
Volatile Organic Vapors (VOCs) (PID)	▪ Periodically in work areas during intrusive activities (excavation work). ▪ When odors are encountered or changing site conditions affect hazards. ▪ Prior to and continuous during confined space entry (i.e., excavations >4 feet and tanks). NOTE: a trench or pit with limited access over 4 feet may be considered a confined	*5 ppm *50 ppm *250 ppm	▪ Increase to Level C PPE (half or full-face respirator) ▪ Increase to Level B (supplied air) PPE or implement additional vapor controls outlined in this HASP to keep VOC levels below 50 ppm. ▪ Notify personnel responsible for the Community Air monitoring program. ▪ Notify the O'Brien & Gere Manager of Corporate Health & Safety and the Project Manager. ▪ STOP work and use ventilation, covers, vapor suppressants or other controls to reduce VOC levels below 250 ppm. ▪ Notify personnel responsible for the Community Air monitoring program. ▪ Immediately notify the O'Brien & Gere Manager of Corporate Health & Safety, O'Brien & Gere Project

Work Area (Employee) Air Monitoring Action Levels			
	space if it is sloped steeper than 1.5H:1V and/or does not have access "ramps" or stairs.		Manager and IBM Representative.

* VOCs - Sustained readings for 5 minutes above background. Background readings are taken at upwind locations relative to Work Areas.
** DUST/PARTICULATE - 15 minute time-weighted average above upwind background readings.

5.4. COMMUNITY AIR MONITORING – VAPOR & PARTICULATE EMISSION RESPONSE PLAN

The Community Air Monitoring (CAMP) has been developed by Golder Associates as a separate document. The implementation and tracking of data from the CAMP is primarily the responsibility of Golder Associates. At times when Golder Associates are not on site O'Brien & Gere will assist Golder with the implementation of the CAMP.

6 MEDICAL MONITORING

Medical surveillance requirements are required by OSHA for persons who are exposed to lead (above OSHA action levels), perform asbestos abatement, wear respirators, perform hazardous waste work, and other activities. Subcontractors are required to have medical surveillance that complies with OSHA regulations.

6.1. FITNESS FOR RESPIRATOR USE

Persons who may wear respiratory protection must be provided respirators as regulated by 29 CFR 1926.103 and 29 CFR 1910.134. This Standard requires that an individual's ability to wear respiratory protection be medically certified before he / she performs designated duties. Where medical requirements of 29 CFR 1926.65 overlap those of 29 CFR 1910.134, the more stringent of the two will be enforced.

6.2. EXPOSURE MEDICAL EXAMINATIONS

Medical examinations for persons conducting hazardous waste work, asbestos abatement, and lead work are administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. Medical exams must be administered by a board-certified (or one who is eligible for board certification) physician in Occupational Medicine. The examining physician is required to make a report to the employer of any medical condition which would place employees at risk when wearing a respirator, wearing other personnel protective equipment, or working with hazardous materials. Subcontractors must maintain medical records in accordance with OSHA regulations.

6.3. HEAT & COLD STRESS

The timing and location of this project may be such that heat / cold stress could pose a threat to the health and safety of site personnel. Work / rest regimens will be employed as deemed necessary by the HB Safety Manager (Field Operations). However, subcontractor Safety Competent Persons may initiate heat/cold stress monitoring at any time as necessary to protect their employees. Special clothing and an appropriate diet and fluid intake will be recommended to all on-site personnel to further reduce these temperature-related hazards. Site workers should stop work, and notify the HB Safety Manager (Field Operations) when they observe symptoms of heat / cold stress in themselves or co-workers.

6.3.1. Heat Stress Monitoring

Heat stress monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70°F or above. To monitor the worker, one of the following methods should be employed:

- Heart rate should be measured by the radial pulse for a 30 second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following cycle by one-third.

- Oral temperature should be measured at the end of the work period (before drinking). If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. If the oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the next work cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when his / her oral temperature exceeds 100.6°F.

6.3.2. Cold Stress Monitoring

Work / rest schedules must be altered to minimize the potential for cold stress. Cold stress is defined as a decrease in core body temperature to 96.8°F and / or cold injury to body extremities. Decreases in core body temperature are associated with reduced mental alertness, reduction in rational decision making, or loss of consciousness in severe cases. Symptoms of cold stress include pain in extremities (i.e. hands and feet) and severe shivering. If workers experience these symptoms, then stop work and implement the following controls.

- Workers must don adequate dry insulating clothing; and
- Adjust the work / rest schedule to increase the amount of rest / rewarming time.
- Toolbox safety meetings discussing symptoms of cold stress, clothing requirements, and work breaks must be held when the wind chill temperature (see Appendix A) drops below 0°F and EACH DAY the wind chill temperature is below 25°F.

The wind chill index provided below shows the effective cooling on exposed skin. When the wind blows across the skin, it removes the insulating layer of warm air adjacent to the skin. When all factors are the same, the faster the wind blows the greater the heat loss which results in a colder feeling. Wind chill temperatures that are **25°F** below zero or are extremely dangerous. Workers must protect any exposed skin, especially the face, ears, and fingers.

Wind Chill Chart (Temperature vs Wind Speed)

Wind Speed-mph							
Calm	**5**	**10**	**15**	**20**	**25**	**30**	**35**
Temperature (Degrees F)				**Wind Chill**			
45	43	34	29	26	23	21	20
40	37	28	23	19	16	13	12
35	32	22	16	12	8	6	4
30	27	16	9	4	1	-2	-4
25	22	10	2	-3	-7	-10	-12
20	16	3	-5	-10	-15	-18	-20
15	11	-3	-11	-17	-22	-25	-27
10	6	-9	-18	-24	-29	-33	-35
5	0	-15	-25	-31	-36	-41	-43
0	-5	-22	-31	-39	-44	-49	-52
-5	-10	-27	-38	-46	-51	-59	-64
-10	-15	-34	-45	-51	-59	-64	-67
-15	-21	-40	-51	-60	-66	-71	-74
-20	-26	-46	-58	-67	-74	-79	-82
-25	-31	-52	-65	-74	-81	-86	-89

If you would like to calculate the wind chill index for combinations of temperature and wind other than those given in the table above, you can use the formula:

WC = 91.4 - (0.474677 - 0.020425 * V + 0.303107 * SQRT (V)) * (91.4 - T)

Where: WC = wind chill index; V = wind speed (mph); T = temperature (° F)

7 EMERGENCY RESPONSE PLAN

This emergency response section details actions to be taken in the event of site emergencies. The SSHC is responsible for implementation of emergency response procedures and will ensure that a **First Aid/CPR trained person is on site at all times when work activities are in progress.**

7.1. EMERGENCY PHONE NUMBERS

To be posted or provided on site. Emergencies encountered on this site will be responded to by a combination of off-site emergency services and site personnel.

EMERGENCY NUMBER Fire, Explosion, Emergency Medical, and Spills that may reach surface waters	
Site Address	**Phone Number**
Former IBM Kingston, NY (TechCity)	911

EMERGENCY NOTIFICATIONS		
Fire, Explosion, Emergency Medical, OSHA-Recordable Injuries, Petroleum Spills		
IBM		
Program Manager	**Michael Kominek**	**Phone: (703) 257-2586** **Cell: (703) 300-4341**
O'BRIEN & GERE **All emergencies immediately (and first aid injuries within 24 hrs)**		
Project Officer	Paul Mazurkiewicz, PE	**Phone:** (315)-956-6826 **Cell:** (315)-254-4710
Project Manager	James Cavotta	**Phone:** (315)-956-6836 **Cell:** (315)-575-0729
Construction Supervisor	Kyle Lighton	**Office:** (315)-956-6100 **Cell:** (315)-882-1087
Manager of Corporate Health & Safety	Jeffrey R. Parsons, CIH	**Office:** (315)-956-6871 **Cell:** (315)-391-0638
MUNICIPAL NON-EMERGENCY NUMBERS (Emergency number is 911.)		
Kingston Police	1 Garraghan Road, Kingston, NY	(845) 331-1671
NYS Police	1791 State Route 209, Kingston, NY	(845) 338-1702
East Kingston Fire Department	885 Main St., Kingston, NY	(845) 336-8300
Kingston Hospital	396 Broadway, Kingston, NY	(845) 331-3131
Occupational Health Clinic – Emergency One	40 Hurley Ave, Kingston, NY	(845) 338-5600
Golder Associates		

EMERGENCY NOTIFICATIONS		
Project Geologist	Chris Hemingway	Office (973) 645 1922 Cell (845) 863-6461
Hydro-geologist	Daniel P Gorman	Office:(508) 366-5329 Cell: (862) 203-9509
TRS GROUP INC		
Sr. Project Manager	Chris Blundy	(843) 810-5310
Project Manager	Bob Poulin	(360) 560-0243
Corp H&S Officer	Mick Brown	(360) 562-5528
Site H&S Officer	Jason Guertin	(978) 424-7476
	STATE & FEDERAL EMERGENCY NUMBERS	
OSHA (to be notified by O'Brien & Gere for hospitalization of three workers or any fatality)	**Albany Area Office** 401 New Karner Road, Suite 300 Albany, New York 12205-3809	(518) 464-4338
NYS DEC Case Manager Wayne D, Mizerak	625 Broadway Albany NY	(518) 402 9657
NYS Spill Hotline		1-800-457-7362 (within NYS)
National Response Center (NRC) for Oil/Chemical Spills		800-424-8802

7.2. EMERGENCY ROUTE

Refer to attached ***Figure 1*** for Hospital Route Map.

7.3. EMERGENCY INVENTORY

In addition to those items specified elsewhere, O'Brien & Gere will maintain the following equipment:

- First aid / Blood borne pathogens kit – The **minimum size is a 25-person first aid kit** (Radnor RAD64058004 or larger available from Airgas)
- Fire extinguishers – located within 25' of hot work
- Spill Control Kit(s) – Provide all applicable spill control supplies to contain spills of at least 55 gallons including overpacks for 55 gallon drums

7.4. GENERAL EMERGENCY RESPONSE PLAN

7.4.1. Evacuation Signal

In addition to the site specific alarms, verbal/radio communications directing project personnel to evacuate or a building fire alarm will also be used. Do NOT leave site vehicles or equipment on access roads and emergency exits such that emergency response vehicles or personnel may be obstructed.

7.4.2. Muster Point

The muster point in event of an emergency that requires evacuation of the work area is the O'Brien & Gere's field office. The muster point will be reviewed with all personnel. SSHC or designee will account for all personnel.

7.5. CALL FOR EMERGENCY SUPPORT

In the event of a site emergency, the O'Brien & Gere SSHC or designee will call 911. When necessary, the SSHC will coordinate the arrival of on-site emergency personnel with the site owner's security, safety, and/or emergency response employees.

The SSHC or designee will briefly explain the nature of the emergency and site conditions as follows:

- Indicate his/her name
- Location of emergency (site address, support zone or exclusion zone)
- Description of emergency conditions that may require special rescue equipment, such as confined spaces; excavations, and elevated work platforms
- Potential chemical hazards and recommended PPE
- Emergency decontamination procedures
- Incident Command System (ICS)

7.5.1. Incident Command System (ICS)

The O'Brien & Gere SSHC or designated alternate shall function as the initial Incident Commander when the emergency plan is initiated by calling 911. The SSHC will decide whether site personnel will evacuate to the Muster Point or divert site resources (personnel and equipment) to provide initial response actions in accordance with this HASP until emergency responders arrive on site. When emergency responders arrive, the SSHC will identify him or herself as "in charge" and transfer authority to the arriving Incident Commander.

7.6. FIRE & EXPLOSION RESPONSE PLAN

NOTE – Site personnel will respond to incipient stage fires using 20 lb Type ABC dry chemical fire extinguishers. Nitrocellulose is not easily extinguished with "smothering" type fire extinguishers such as dry chemical and carbon dioxide. Heavy water spray is best for larger nitrocellulose fires which will be applied by the fire department responding to our "911" call.

All fires or explosions must be reported to the O'Brien & Gere Site/Project Manager. A fire that CANNOT be readily extinguished with a fire extinguisher will be considered major and will require evacuation of the work area personnel to *Muster Point* areas per this HASP. However, the SSHC or designee may only approach fires/explosions to the extent that fire safety considerations allow. If personal injuries result from any fire or explosion, the procedures outlined in the *Personal Injury Response Plan* will also be followed.

7.7. PERSONAL INJURY RESPONSE PLAN

Treatment for minor injuries will be provided on site using available first aid supplies and personnel trained in first aid. For **minor injuries** that are not life-threatening but require further medical attention, all O'Brien & Gere subcontractors must agree to have their employees treated by occupational physicians at occupational clinics whenever possible. **Treatment of minor injuries by emergency room or personal physicians should**

be AVOIDED. When injured workers are released back to work with restrictions, all subcontractors are expected to accommodate those restrictions.

The preferred occupational clinic for non-emergency medical treatment during normal business hours is **Occupational Health Services in Hopewell Junction, NY.** Emergency rooms may be used to treat minor injuries that require further medical treatment after normal business hours.

Emergency or life-threatening injuries, including puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room.

Route maps to the hospital (***Figure 1***) must be posted in the O'Brien & Gere on-site office trailer and all subcontractor office trailers (if any).

7.8. SPILL RESPONSE

Site personnel should expect and be properly trained and equipped to handle small spills since the project involves handling drums which may have poor structural integrity and leak or rupture. Although overpacks and spill sorbents will be staged to support drum handling, equipment dedicated for emergencies must be stored separately in a readily visible location(s). The minimum size spill kit should have the capacity to cleanup and containerize spills of **55 gallons**. In addition to drums, other potential spills include leaking gasoline, diesel, antifreeze, hydraulic fluid, or oil from heavy equipment. If a spill of any type should occur, the SSHC or designee should report the spill immediately to a site owner representative and implement procedures in this Spill Response Plan. Site personnel will generally respond to spills as follows:

- **Stop the leak immediately** if it can be done without directly contacting the leaking material. Generally, this will consist of turning heavy equipment off to remove pressure on various fluid systems.
- Remove or stop all **ignition sources** (hot work, generators, etc.) that are within 25' of any part of the spill.
- On-site personnel should immediately secure the area to **prevent unauthorized entry** into the spill area.
- Although not likely given the anticipated types of spills, the SSHC or designee should initiate the *General Emergency Response Plan* in this HASP if a spill may cause an explosion, death, or serious injury.
- Site personnel may only respond to **incipient stage fires** regardless if such fires are associated with a spill.
- **Confined Space Issue** – If the leak occurs in an excavation where natural ventilation is limited, air monitoring will be required prior to entering the spill area. This is primarily an issue for fuel (gasoline, diesel, and kerosene) spills. The SSHC will determine if a fuel spill requires air monitoring.
- **PPE for Spills ≤55 gallons** to open areas generally requires Modified Level D PPE (poly-coat Tyvek, nitrile gloves, and boot covers or boot decontamination). Over-boots or boot covers may also be used if persons cleaning the spill would have to walk on spilled materials. Latex gloves are not acceptable and will degrade with exposure to petroleum products. Spills into confined spaces will require following PPE and other safety procedures specified on Confined Space Entry Permit.

7.9. EMERGENCY REPORTING

Any emergency or accident will be reported to O'Brien & Gere Manager of Corporate H&S and the Site/Project Manager. The O'Brien & Gere Corporate Manager of Corporate H&S will review all emergency or accident reports and may further investigate any such report if necessary. The O'Brien & Gere Manager of Corporate H&S will see that the area officer of OSHA is notified within 8 hours should the emergency cause three (3) or more personnel to be injured and transported to the hospital, or if there is a fatality. If the Corporate Safety Manager cannot be located, then the SSHC will make such notification.

An **Incident Investigation Form** (***Attachment 12***) must be completed for all injuries, illnesses, spills, fire, explosion, or property damage greater than $1,000. The absence of an injury does not preclude the need to complete an Accident Investigation Form as such incidents will be classified as "near miss" or "other." The form must be completed or reviewed by the SSHC or designee. It will include, but is not limited to, the nature of the problem, time, location, and corrective actions taken to prevent recurrence. This **report must be completed and sent to the O'Brien & Gere Corporate Safety Manager and site owner's representative within 24 hours**. If all the "facts" cannot be determined in that period of time, then draft report will be submitted and a final report will be submitted immediately upon completing the investigation.

7.10. INCIDENT INVESTIGATION

The purpose of an incident investigation is to determine the ***root causes*** of an incident or near miss, so that a repeat of the incident can be avoided. The ***"root" causes*** of an incident are the system level causes that can reasonably be identified and that we have control to fix. Mature incident investigation systems look beyond human/behavior causes to determine root causes in the management systems.

Other definitions of causes that we will need are:

Physical Causes are the equipment failures or changes in physical conditions that lead to an incident. Some examples of physical causes are: piping broke/leaked, pump was vibrating, temperature indicator failed, furnace tubes developed coking, tank was struck by lightning, or electrical circuit was shorted out.

Human or Behavioral Causes are human actions or lack of action that caused the undesirable physical condition or action. Examples are: did not open the valve, did not perform inspections for corrosion, lit the furnace without sufficient purging, read the gauge incorrectly, used the wrong design code, or skipped a step in the shutdown procedure. Deciding to take action or not take action is a human cause. These causes may or may not be human error, because sometimes the human may be following a procedure that is incorrect.

System Level Root Causes are generally management system failures which result in physical causes or human causes. Management systems constitute a mix of policies, procedures, roles & responsibilities, controls, training, people, culture, and work processes that make up the support network for individuals. Management systems are formalized work processes we use to do our work. Examples of system level causes include: procedures not enforced, preventive maintenance procedure not documented, or previous deficiencies not corrected.

In general, fixing the physical and human causes will only lead to short term fixes. The goal of your incident investigation system is to work through physical and human/behavioral causes to find and remove the system level root causes that result in incidents.

7.10.1. Performing Root Cause Analysis / Incident Investigations

The following describes the steps of the Root Cause Analysis / Incident Investigation procedure to be used.

- Gathering Data
- Forming the Investigation Team
- Developing the Sequence of Events
- Identifying Protective Systems
- Determining Root Causes (Five Why, Why Tree)
- Verifying Potential Causes
- Developing Recommendations
- Documenting the Investigation
- Reviewing & Issuing the Report

- Categorizing the Root Causes

7.10.2. When the Incident Occurs

Securing the Area:

Safety of life and health for people and the environment is more important than incident investigations. Don't begin the incident investigation until medical care has been given to anyone who has been hurt, and/or the abnormal situation has been brought under control and area secured. **Don't take any incident investigation actions until they can be done safely.** It may also be necessary to identify if the potential risk exists elsewhere. If so, an immediate response to address the hazard is warranted.

Responsibility:

Generally it will be the first line supervisor who will be on the scene and tasked with the initial steps to gather data. If a team is needed for the investigation, the team leader or facilitator will take over the responsibility for continued data gathering.

Initial Steps:

The initial data gathering often is critical in determining the cause of the incident. The following steps should be taken as soon as possible after the incident site is secured and any safety issues resolved:

- Protect physical data at the incident area. Rope or tape off the area to keep people out. Sometimes physical data is destroyed simply because people track through the area or try to clean up the mess.
- Interview people who were involved in the incident as quickly as possible and definitely before they go off shift. As an alternative, initially have witnesses and persons involved in the incident prepare a written statement of their observations and actions leading up to and including the incident.
- Take pictures of the area. Draw sketches. Record what the area looked like after the incident.
- Gather and save physical data like parts, pieces and other small objects, recording the location where they are found. Especially gather things that might be moved, cleaned up, or damaged if they are left where they are. If the physical data is too large to move or would need disassembly, makes notes to investigate those things later once the team is formed.
- Take necessary samples. Sample handling will be discussed below
- Capture process data before it is lost

7.10.3. The 4 P's of Data Gathering – People, Position, Paper and Parts

People

People are important as data sources because they can relay information about everything that they were aware of before and at the time of the incident. Interviews and written statements are the two modes for documenting people's recollections of what happened leading up to and after the incident. Often, combining the two is the most effective approach.

The purpose of interviews and written statements is to obtain information which can be used in preparation of the sequence of events and in determining the root causes. At this point in the investigation you are interested in figuring out what happened and in gathering data. Focus on what they saw, heard, and smelled.

> ***To help determine their perspective of the event – focus on what & when they were doing, and where they were.***

- Interview people who were involved in the incident as quickly as possible and definitely before they leave the facility.
- If appropriate, interview Emergency Response personnel to determine if their response had an impact on the area or physical data.

Interviews:

The quality of interviews is critical to the success of the incident investigation. Here are some good guidelines for successful interviews:

- Interview people, if possible, before they talk to each other, or to others not involved in the incident. When people talk to others, or when they sleep, they unconsciously edit their memories. The idea is to interview them before their memory changes.
- Choose a setting that is comfortable for the person being interviewed. A place where the person works or relaxes is sometimes a good place. Walking through the facility or site of the incident might also be a good idea.
- Use one or two interviewers. Two is a good number since one person can ask the questions and the other keep notes. More than two may make the person being interviewed feel uncomfortable.
- Do not interview more than one person at a time. In general, group interviews always reflect only the views of one or two people in the group.
- During the interview, put the person being interviewed at ease before questioning; explain that your purpose is fact-finding, not fault finding. Empathize how they might feel as a result of the incident.
- Ask open ended, non-leading questions. For example, ask, "What did you see then?" instead of "Is that when you saw the leak?" When you have asked the question, listen for the complete answer. Try not to interrupt before the person being interviewed has completed his or her answer.

A good rule of thumb: If the interviewer is talking more than 20% of the time, then he/she is probably asking leading questions.

- While it is OK to speculate when you ask questions, ensure that answers based on speculation are not misrepresented as fact.
- Don't imply blame in your questions. Avoid the use of the word "you" in your questions, as it puts the interviewee on the defensive.
- Keep your notes in a timeline format for ease of transfer to the sequence of events.
- Analyze what is said and obtain agreement, i.e., ensure that your understanding and written notes accurately reflect the intended message of the interviewee. This is done using the "repeat back" process both during and at the end of the interview.
- Close interview and thank interviewee.

Position

Position refers to what the status was **before** the incident occurred. This includes:

- Weather conditions
- Process & equipment status (i.e. normal operations, start-up, shutdown, maintenance, within operating limits / intended function)
- Job / work status (i.e. shift change, operating, maintaining)

- Human Factors issues (facility layout, design considerations, etc)

Paper

Paper refers to the document trail both before and after the incident including:

- Logs, charts, notes, turnovers/hand back logs, work orders, permits, JSA's, tags, or printouts which indicate what was going on at the time or the state of equipment when the incident occurred.
- Electronic records and data in control systems, including trends or process variables and listings of alarms.
- Lab reports, metallurgical reports of broken parts. You may need to send off for these if they are important to the investigation. Your safety team or engineering department can help.
- Copies of standing orders, procedures in use or applicable to the situation when the incident occurred.
- Training records

Parts

Parts refers to how the incident sight looks after the incident occurred and what the physical data is telling us.

Examples of physical data to gather are:

- Parts, pieces and other things that you can pick up and carry away. Gather and save physical data like parts, pieces and other small objects, recording the location where they are found. Especially gather things that might be moved, cleaned up, or damaged if they are left where they are. If the physical data is too large to move or would need disassembly, make notes to investigate those things later once the team is formed. As necessary, prepare area so evidence is not lost.
- Pictures, videos, sketches or diagrams of the scene, equipment involved, or what was going on at the time. For pictures and videos, use the time/date logger on the camera to help understand when they were taken.
- Take necessary process and equipment samples. Document all samples with:
  - Name of person collecting the sample
  - Date and time sample taken
  - Exact location/source of sample
  - Record all samples taken on a sample log. If litigation is expected, chain of custody procedures may be necessary.

7.10.4. Five Why Method:

The Five Why process is a simplified version of Why Tree. It is designed for use by a single individual or a small team on simple, straightforward incidents. The thought process and objectives are very similar to the Why Tree process except that with the Five Why process, the focus is on the one or two root causes that most likely would have prevented the event.

The Five Why process can be broken up into the following steps:

- Define the top level incident
- Investigate a failure by simply asking and answering the question "Why".

(Don't do it in your head!)

- At each level, verify the result before moving on, don't make assumptions

- The root cause will likely be determined by the 5th answer or level. However, it can take more than five questions. Continue until you have reached a system level cause.
- Identify the one or two root causes that most likely would have prevented the event.
- If you determine that there are clearly multiple branches and root causes, stop and initiate a Why Tree investigation (contact Corporate Health and Safety for assistance)

Five Why Critical Success Factors

- Remember -- nothing is obvious. At some point in almost every investigation someone will say, ***"But it's obvious what happened!"*** Urge them to follow the process and keep an open mind and they will sometimes be surprised at what they find.
- Always work past the physical and human/behavioral causes to the system level causes. We know that people are not perfect so we have support systems in place to help keep imperfect people from causing incidents, for example, training, permits, procedures, standing orders, design standards, routine maintenance, observations, audits, authorizations and so forth. The goal of this process is to improve those support systems.
- If the team gets stuck, step back and check to make sure that the logic used is really correct. Does the cause in each box directly relate to the cause or event directly above it?
- Use meeting time effectively. ALWAYS have a clear agenda of what you want to accomplish during the meeting.

7.10.5. Developing Recommendations

The team needs to identify corrective actions or recommendations which address the immediate hazard and eliminate the system causes identified in the incident. Use the following process to identify and document the recommendations:

- Identify those root causes which had the greatest impact on the incident. If these causes are eliminated, they will eliminate or greatly reduce the likelihood of a similar incident recurring in the future. It is not unusual for a complex incident to have 5-10 root causes of which 2-3 had the most significant impact on the incident.
- Identify immediate corrective actions to prevent recurrence. For example if the cause of an incident was a design flaw that could exist here or on similar equipment, then immediate steps need to be taken to identify that equipment and take the necessary safeguards.
- Identify corrective actions based on the list of root causes. There may be corrective actions that address multiple root causes. That is why it is important to look at the root causes in total.
- Develop **SMART** recommendations:
  - **S**pecific – Does the corrective action pinpoint what needs to be done? Ask yourself "If I was assigned this corrective action would I know what to do?"
  - **M**easurable **-** Can the corrective action be measured quantitatively?
  - **A**ccountable **-** Is the corrective action assigned to a person with target date for completion?
  - **R**elevant- Will the corrective action prevent or significantly reduce the odds of this problem happening again? Is it cost effective, feasible, and practical and can it be implemented? Will this corrective action cause any problems? Has someone independent from the team reviewed the corrective action for unintended negative impacts on the process or the people?
  - **T**ime limits **-** Is the due date for corrective action reasonable?

Figures

FIGURE 1 – HOSPITAL ROUTE MAP

From 300 Enterprise Drive, Kingston, NY

Start North on Enterprise Drive	0.3 mi.
Merge onto US-209 N	0.5 mi.
Merge onto US-9W S towards Kingston	2.5 mi.
Stay straight onto E. Chester Street	1.2 mi.
Turn right onto Broadway (just past Jansen Ave.)	0.2 mi.

396 Broadway is on right hand side (just past Andrew St.)

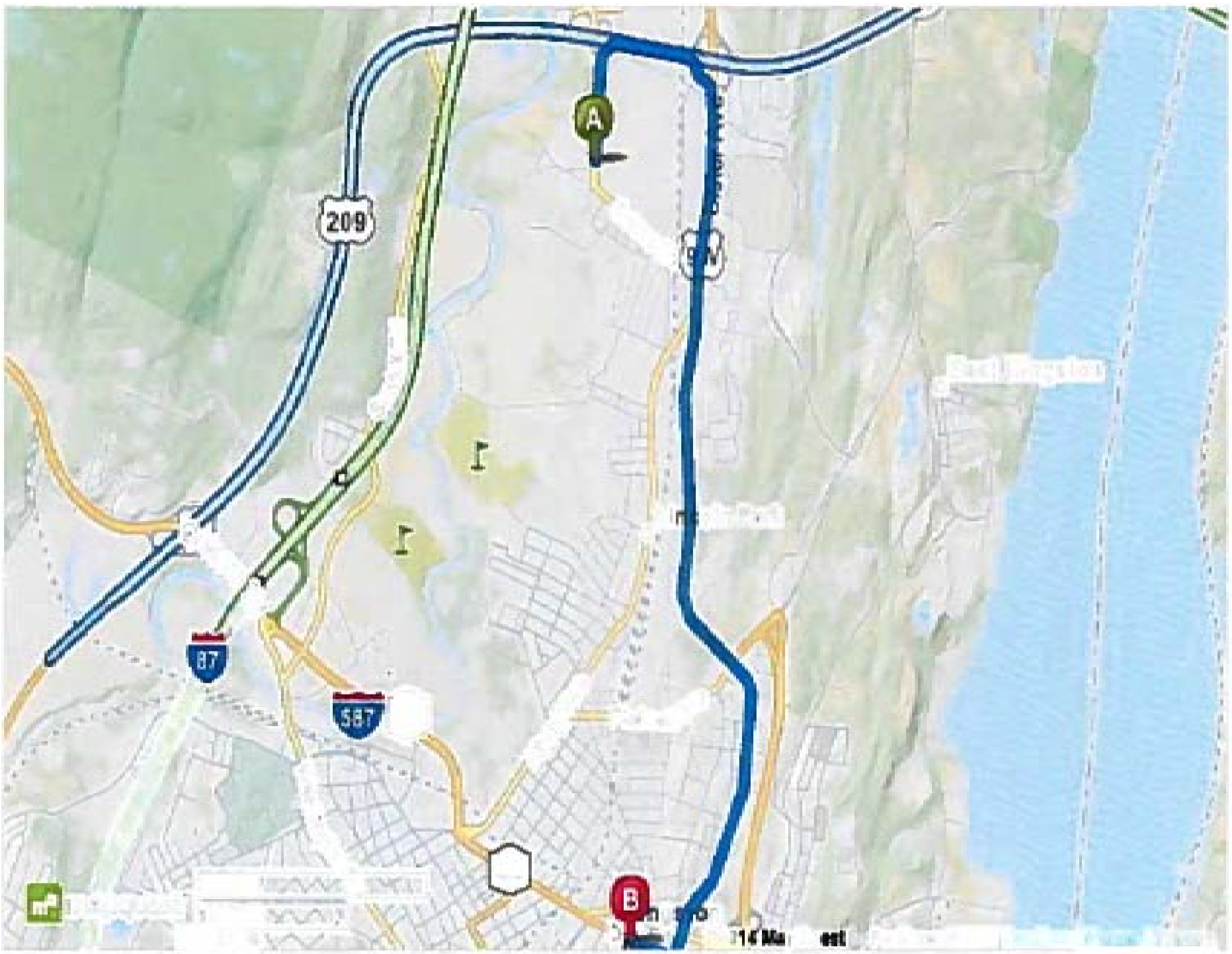


FIGURE 2 – OCCUPATIONAL CLINIC ROUTE MAP

From 300 Enterprise Drive, Kingston, NY:

Start North on Enterprise Drive	0.4 mi.
Merge onto US-209 S	0.8 mi.
Take County Highway 31 / Sawkill Rd. exit	0.2 mi.
Turn left onto County Highway 31 / Sawkill Rd.	2.7 mi.
Turn left onto Washington Ave.	0.3 mi.
Turn right onto Schwenk Dr.	0.04 mi.
Turn slight right onto Hurley Ave.	0.05 mi.

40 Hurley Ave is on the left

Urgent Care / Occupational Clinic Facility – Emergency One

40 Hurley Ave, Kingston, NY 12401-3700

Attachments

Appendices

APPENDIX D

COMMUNITY AIR MONITORING PLAN

APPENDIX D

COMMUNITY AIR MONITORING PLAN

INTERIM CORRECTIVE MEASURE - SOLID WASTE MANAGEMENT UNIT S: FORMER B001 WASTE TCA TANKS

Former IBM Kingston Facility
Site #356002
Order on Consent Index No. D3-10023-6-11

Prepared By: International Business Machines Corporation
8976 Wellington Road
Manassas, VA 20109

September 2014 **Project No.: 083-87071.05**

A world of capabilities delivered locally

Table of Contents

List of Figures

1.0 INTRODUCTION

Golder Associates Inc. prepared this Community Air Monitoring Plan (CAMP) on behalf of International Business Machines Corporation (IBM). This CAMP describes the specific monitoring protocols and response actions to be performed during implementation of the in-situ thermal desorption (ISTD) interim corrective measure (ICM) for Solid Waste Management Unit (SWMU) S: Former Building B001 Waste 1,1,1-Trichloroethane (TCA) Tanks (SWMU S) at the former IBM Kingston Facility (site) located at 300 Enterprise Drive, Kingston, Ulster County, New York (see Figure D-1).

This CAMP is consistent with the requirements for community air monitoring at remediation sites established by the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC). This CAMP was prepared as an ICM-specific air monitoring plan and is intended to supplement the existing site-wide CAMP which was included as Attachment 1 to *Appendix C: Intrusive Activities Work Plan / Community Air Monitoring Plan* of the *Draft Interim Site Management Plan* (ISMP) submitted to NYSDEC on October 20, 2011. A description of air monitoring for volatile organic compounds (VOCs), locations at which air monitoring will be conducted, and air monitoring action levels are presented herein.

1.1 Purpose and Objective

The purpose of this CAMP is to establish a program to monitor air quality for the protection of on-site workers not directly involved in remedial activities, the general public, and potential off-site receptors including residences and businesses. Respiratory protection provisions for contractor workers during ICM implementation are included in the SWMU S ISTD ICM-specific Health and Safety Plan (HASP) prepared to address health and safety concerns associated with ICM implementation activities. The ICM-specific HASP is included as Appendix C of the ICM Work Plan.

This CAMP includes the following:

- An evaluation of the constituents of concern
- Identification of potential receptors
- Continuous air monitoring requirements
- Confirmation sample laboratory analysis requirements
- Action levels and response actions
- Record keeping and data evaluation requirements

2.0 CONSTITUENTS OF CONCERN EVALUATION

IBM performed an evaluation of constituents of concern (COCs) that may be present in air emissions generated as a result of ISTD ICM operations. The following sections summarize general site and SWMU S area history and subsurface conditions to identify potential COCs.

2.1 Site Background

The approximately 258-acre site is located at 300 Enterprise Drive, north of the City of Kingston in the Town of Ulster, Ulster County, New York and was first developed from farmland by IBM in the 1950's. IBM's primary activities included the manufacturing of electric typewriters and the development, manufacture and testing of computer systems and related components and technologies. IBM ceased operations during the early-1990s and the property was subsequently subdivided into multiple parcels. In 1998, IBM sold the site to AG Properties of Kingston, LLC and Ulster Business Complex, LLC. The site is currently managed by TechCity.

IBM completed extensive Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) beginning in the 1990s through 2002 to delineate the occurrence and extent of VOCs in groundwater beneath the site. The site-wide VOC groundwater plume comprises four distinct groundwater plumes that have been described as follows:

- **North Parking Lot Area Plume (NPLA):** located to the north of Buildings B001 and B003, primarily composed of trichloroethylene (TCE) and TCA, and to a lesser degree tetrachloroethene (PCE). Based on previous investigations, the primary source area appears to be the portion of IW sewer lines located north of Building B001 and northeast of Building B003 (i.e., SWMUs M and T).
- **Building B005 Plume:** located beneath Buildings B001, B002, B003, B004 and B005, primarily composed of TCE and TCA. The plume is believed to have originated from activities in Buildings B001, B003, B004 and B005S. The primary source area appears to be the IW sewer lines located in Building B003 (i.e., SWMU M) but the elevated concentrations of TCA detected within a portion of the Building B005 Plume are likely attributable to the presence of the specific TCA source in the in the SWMU S area.
- **Industrial Waste Treatment Facility (IWTF) Plume:** located in the vicinity of the former IWTF near Building B036, primarily composed of low-level concentrations of TCE and TCA. The plume in this area is not likely to have originated from the IWTF, but is believed to have migrated from the NPLA plume on the eastern campus along the underground utility pipes prior to the installation of the utility trench barrier wall.

2.2 SWMU S Background

SWMU S includes a former 4,000-gallon waste TCA underground storage tank (UST) and associated 1,000-gallon TCA supply UST (collectively, the TCA tanks), which were co-located on the west side of Building B001 north of Building B021, between Buildings B001 and B023 (see Figure D-2). TCA and associated degradation compounds (i.e., 1,1-dichloroethene [1,1-DCE] and 1,2-dichloroethane [1,2-DCA]) were detected during this investigation. Elevated concentrations of TCA in groundwater were subsequently detected in a temporary monitoring well (TMP-8) located approximately 400 feet downgradient of the TCA tanks.

Historical groundwater quality investigations reported continued detections of elevated dissolved-phase concentrations of TCA in groundwater samples collected downgradient of SWMU S. Subsequent investigations identified a dense non-aqueous phase liquid (DNAPL) composed predominately of TCA beneath Building B001 and elevated dissolved-phase concentrations of 1,1,2-trichlorethane (1,1,2-TCA), 1,1,-dichloroethane (1,1-DCA), 1,1-DCE, 1,2-DCA, PCE, toluene, TCE, and xylenes in groundwater.

2.3 SWMU S ISTD ICM Constituents of Concern

Based on historical site use and the results of previous investigations, the identified COCs in soil and groundwater in the SWMU S investigation area that shall be subject to monitoring in air emissions resulting from SWMU S ISTD ICM operations consist of the following:

Chlorinated VOCs

- TCA
- 1,1,2-TCA
- 1,1-DCA
- 1,1-DCE
- 1,2-DCE
- PCE
- TCE

Aromatic Hydrocarbons

- Toluene
- Xylenes

3.0 ISTD SYSTEM AND TREATMENT AREA

The ISTD ICM for the SWMU S area involves treating DNAPL and associated impacted soil and groundwater via contaminant hydrolysis and volatilization utilizing electrical resistive heating (ERH). The SWMU S ICM consists of the ERH electrode array, a vapor capture and treatment system and a hydraulic control and treatment system with associated infrastructure and monitoring elements.

During the ERH process, elevated temperatures are generated by the natural resistance of subsurface materials to the flow of electrical current between electrodes installed in the subsurface. Heat generated in this manner converts groundwater, soil moisture, and contaminants to steam which are subsequently removed and treated utilizing a vapor extraction system. A vacuum is applied to a vapor recovery system, consisting of vapor recovery wells co-located with the ERH electrodes, to recover the vapors generated during the heating process and prevent volatilized contaminants and the carrier steam gas from escaping the treatment area. The vacuum necessary to recover generated vapors via the vapor recovery wells is created using a positive displacement blower. Recovered vapor treatment will be achieved using a steam-regenerated granular activated carbon (SRGAC) system. The SRGAC system will consist of two 1,400-pound carbon vessels that will operate in alternating cycles. While one unit is in operation, the second unit will be undergoing steam regeneration.

Each carbon vessel is designed to adsorb approximately 75 pounds of VOCs before it requires regeneration, assuming that two-thirds of the available carbon bed is utilized between each cycle. In addition, the vapor treatment system will include a 2,000-lb vapor granular activated carbon (VGAC) vessel that will provide final contaminant removal on the treated SRGAC effluent air prior to discharge to the atmosphere through a dedicated exhaust stack located adjacent to the western exterior wall of Building B001.

SWMU S ISTD remedial activities will be conducted in the treatment area comprising approximately 3,000 square feet (ft^2) located to the north of Building B021 between Buildings B001 and B023 as shown on Figure D-2. A security fence will be constructed to restrict access to the treatment area and associated infrastructure. The ISTD remedial system is anticipated to operate over a period of approximately 120 days.

3.1 Exclusion Zone

The treatment area exclusion zone will consist of the area enclosed within the treatment area perimeter security fence (i.e., the SWMU S ISTD Treatment Area) shown on Figure D-2.

3.2 Prevailing Wind Direction

Wind direction is defined as the direction a wind is blowing *from* (i.e., a south wind is blowing from south to north). Prevailing winds are defined as the predominant wind direction in a particular location with reference to a fixed point at that location at a particular time. Thus the prevailing wind direction for a defined location at a particular point in time is the predominant wind direction observed at that location.

The terms “downwind” and “upwind” refer to an object’s position with respect to a fixed point and wind direction. Downwind is defined as being in the direction to which the wind is blowing from a fixed point (i.e., in a south wind, a location north of the fixed point is in the downwind direction). Conversely, upwind is defined as being the direction from which the wind is blowing with reference to a fixed point (i.e., in a south wind, a location south of the fixed point is in the upwind direction).

Based on a review of historical data collected at NYSDEC monitoring sites, the prevailing wind direction in the vicinity of Kingston, New York during the spring and summer seasons is from the south, that is, the prevailing wind blows predominantly from the south toward the north. In the fall and winter seasons, the prevailing wind direction is predominantly from the northwest, that is, the prevailing wind blows from northwest toward the southeast.

As the regional prevailing wind direction is subject to change based on seasonal variations, a site-specific prevailing wind direction will be determined prior to ISTD system operation. During mobilization and construction of ISTD system infrastructure, a weather station (described in Section 4.1.1 below) capable of monitoring wind speed and direction will be installed to record continuous real-time readings at the site to support a determination of prevailing wind direction and establish site-specific generalized downwind and upwind directions appropriate to the time frame within which the SWMU S ISTD ICM will be implemented. The weather station will be operated for a minimum period of two weeks prior to initiating ISTD system operation to acquire sufficient data to evaluate prevailing wind direction. Wind direction from the weather station will also be evaluated at the start of work each day and adjustments will be made to the positions of the upwind and downwind monitors if the wind direction is not consistent with the prevailing wind direction determined during the two week assessment period.

3.3 Downwind Perimeter

The downwind perimeter for the treatment area is defined as a distance of 500 feet from the ISTD treatment system air stripper exhaust stack in the downwind direction. This perimeter monitoring distance was selected on the basis that it will allow for a reasonable degree of dispersion of potential air impacts from one time upset or short–term releases from the system but still provide a buffer zone between potential off-site receptors that allows for earlier warning, response and evaluation of exceedance conditions that may impact the site boundaries.

3.4 Permits

In accordance with 6 New York Codes, Rules and Regulations (NYCRR) Part 201-3 *Permit Exempt and Trivial Activities*, Section 3.2(c)(1)(i), "*Stationary or portable combustion installations with a maximum rated heat input capacity less than 10 million Btu/hr burning fuels other than coal or wood*" are exempt activities. The operation of the ISTD system boiler to generate steam for the steam regenerated granular activated carbon unit qualifies as an exempt activity. Under 6NYCRR Part 201-3.3(c)(29), covering trivial activities, "*Air strippers and soil vents required under the provisions of an Order on Consent*" represent trivial activities and as such are treated as essentially identical to exempt activities, except for the purposes of major source permitting. Therefore, the operation of the steam regenerated granular activated carbon air stripper is defined as a trivial activity and a NYSDEC air permit is not required.

4.0 AIR MONITORING PROGRAM

The following sections describe the design basis for the air monitoring program to be implemented during ISTD ICM operation.

4.1 Receptor Evaluation

Potential receptors of vapor emissions generated during ISTD system operation were identified based upon on-site and adjacent property land use and include on-site workers not associated with remedial activities, members of the general public that utilize on-site public transportation facilities (i.e., Ulster County Area Transit Bus Station), and off-site residences and businesses.

4.1.1 Unaffiliated On-site Workers

On-site workers not associated with remedial activities include TechCity operations, maintenance and security personnel and existing tenants (see Figure D-2 for occupied building locations). Modeling of the anticipated short term exposures for anticipated VOCs in the vapor treatment system emissions indicates that no Short Term Guidance Concentrations established by NYSDEC will be exceeded. Based upon the location of the treatment area north of Building B021 and between two currently unoccupied buildings (i.e., Buildings B001 and B023, though Building B023 has the potential for future occupation) and the predominant prevailing wind directions during the year (i.e., from either the south or northwest), the potential for short-term exposure of TechCity personnel and tenants to ISTD system air emissions (i.e., very low concentrations of chlorinated and non-chlorinated VOCs such as TCE, 1,1,1,-TCE, xylene and toluene) during performance of their daily responsibilities (i.e., administrative activities in interconnected Buildings B021, B022, B023, and B024 office complex, facility operations and maintenance, landscaping activities, and security patrols) will be infrequent and limited based on these job activities during the anticipated 120-day period the ISTD treatment system will be in operation.

4.1.2 Ulster County Transit Bus Station

The Ulster County Area Transit Bus Station located approximately 500 feet northwest of the treatment area in the southwestern corner of the North Parking Lot Area is shown on Figure D-2. This bus station is located in a cross-gradient position with respect to the treatment area and regional prevailing wind direction during spring and summer and in an upwind position during fall and winter. Typically, exposures constituting a health risk to the general public are calculated based on assumed exposure durations of 16 hours per day, seven days per week on an annual basis. The amount of time that members of the general public spend waiting for bus service at this location is typically less than 15 minutes per day. Potential exposure of the general public to ISTD treatment system vapor emissions at this receptor during the anticipated 120 day ISTD treatment system operation period is expected to be infrequent and limited in duration. Therefore, while the bus station is located within 500 feet of the treatment area, potential exposure to human receptors at this location is considered limited.

4.1.3 Abutting Residences and Businesses

A limited potential for exposure of the general public to SWMU S ISTD system vapor emissions exists at abutting residential and commercial properties. However, these properties are located between approximately 500 and 1,500 horizontal feet from the proposed source and therefore are considered to have a very low potential for exposure to vapor emissions at concentrations that would that would exceed NYSDEC guidance concentration thresholds. The commercial property located west of the site, the former Bank of America facility located on the West Campus (i.e., former Buildings B201, B202 and B203), is currently unoccupied and is located in a cross-gradient location with respect to the treatment area and prevailing wind direction during spring and summer and in an upwind direction during fall and winter.

The commercial properties south of the site, along Boices Lane, are located approximately 1,500 feet from the treatment area in an upwind direction with respect to the treatment area and prevailing wind direction in the spring and summer and in a cross-gradient direction during the fall and winter. Residential properties are located north of the site, along Old Neighborhood Road, approximately 1,500 feet northeast of the treatment area. The residences along Old Neighborhood Road are located in a cross-gradient direction with respect to the treatment area and prevailing wind direction, regardless of season. Similarly, commercial properties west of the site, along John M. Clark Drive, are located approximately 1,500 feet in a cross-gradient direction with respect to the treatment area and prevailing wind directions during all seasons.

Therefore, based on the estimated concentrations of air emissions resulting from the ISTD system, calculated in accordance with Division of Air Resources Air Guide 1 (DAR-1) guidance, at ground level immediately adjacent to the system, which meet both the NYSDEC Short- and Long-term exposure guidance concentrations per DAR-1 guidance, the air emissions at locations approximately 1,500 feet from the treatment area will not constitute a potential health hazard to these receptors.

4.2 Air Monitoring

The following sections describe the air monitoring activities that will be conducted to evaluate the impact of ISTD system air emissions to air quality during ISTD system operation.

4.2.1 Continuous Monitoring

During ISTD system operation, four VOC air monitoring stations will be set up utilizing RAE Systems AreaRae photoionization detectors (PIDs) equipped with 11.7 electron-volt (eV) lamps. The AreaRae is capable of detecting VOCs in air at concentrations ranging from zero parts per million volume (ppmv) to 200 ppmv with a precision of 0.1 ppmv and concentrations ranging from 200 ppmv to 2,000 ppmv with a precision of 1 ppmv. The AreaRae and is equipped with temperature and humidity sensors and a built-in wireless radio frequency (RF) modem for remote telemetry. VOC air monitoring devices will continuously record air concentration data and calculate 15-minute running average concentrations.

Three of the four VOC air monitoring stations will be located downwind of the treatment area. The three downwind air monitoring stations will be located at distances approximately 500 feet from the treatment area perimeter security fence and arranged such that one station is located in alignment with the prevailing wind direction and the remaining two downwind monitoring stations are located in positions greater than 45° but less than 90° from the prevailing wind direction. Each air monitoring station will be installed at an elevation approximately ten feet above ground surface to minimize tampering or other incidental damage to the monitoring equipment and monitor as close as is practical to the typical breathing zone.

A weather station will be established at an upwind monitoring location to mitigate the effects of potential localized wind patterns created by structures immediately adjacent to the treatment area. The upwind monitoring location will be equipped to record site conditions including temperature, air pressure, wind direction, wind speed, relative humidity, and precipitation type, quantity and intensity. IBM will utilize a weather station provided with remote telemetry capabilities equipped to record the above parameters with sensitivity resolutions of plus or minus (±) 0.1 degree (°) Celsius (C) for temperature, ±0.1 hectopascals (hPa) for air pressure, ±3° for wind direction, ±0.4 meters per second (m/s) for wind speed, ± 1 percent (%) relative humidity (RH), precipitation type (rain/snow), and ±0.2 millimeters (mm) for precipitation quantity.

The four continuous air monitoring stations (i.e., one upwind and three downwind) will be programmed to operate 24 hours per day, seven days per week during system operation. The air monitoring devices (i.e., PIDs) will be calibrated once daily during the business week (i.e., Monday through Friday) to adjust for instrument drift. Air monitoring data will be uploaded remotely to a central database and reviewed daily during the business week and a summary evaluation will be prepared on a weekly basis.

4.2.2 Periodic Subsurface Vapor Pressure Monitoring

Periodic subsurface vapor pressure monitoring will be conducted in accordance with the Performance Monitoring and Waste Management (PMWM) Plan (Appendix E) within and along the western perimeter of the ISTD treatment area to evaluate the effectiveness of the vapor control system in capturing volatilized contaminants and steam generated during ISTD system operation.

4.2.3 Periodic Analytical Sampling

To supplement and confirm continuous perimeter VOC air monitoring results, perimeter air samples will be collected periodically during ISTD operation and submitted for laboratory analysis to validate PID monitoring station data. In addition, IBM will collect indoor air analytical samples from one location within

Building B021 and from one location within Building B023 (Figure D-2) to evaluate indoor air quality on a periodic basis, as described in Section 4.4.

4.3 Background/Baseline Monitoring

In order to evaluate background conditions and establish a baseline air quality for the site, one weather station and one continuous VOC air monitoring device will be installed approximately 500 feet from the steam regenerated granular activated carbon (SRGAC) system in the upwind direction as determined by the site-specific prevailing wind assessment described in Section 3.2. Background conditions will be established based on the average concentrations of compounds detected in analytical samples collected during the baseline air sampling program.

If the ISTD system is operated during the spring and summer, the upwind monitoring station will be located in the courtyard south of Building B021 (i.e., between Buildings B001 and B024) as illustrated on Figure D-2. If the ISTD system is operated during the fall and winter, the upwind monitoring station will be located approximately 25 feet southeast of the Ulster County Area Transit bus station (Figure D-2).

The upwind monitoring station will consist of one of the four VOC air monitoring devices and a co-located weather station. The upwind monitoring devices will be installed at an elevation no less than ten feet above ground surface to elevate the station above the reach of the general public and on-site workers not associated with remedial activities but maintain representativeness of breathing zone conditions.

VOC air monitoring and weather station data will be collected continuously for a period of no less than two weeks and two air samples will be collected from this upwind location prior to initiating ISTD system operations. These data will be used to establish an average background total VOC concentration and baseline site air quality as well as establish prevailing wind direction to guide the placement of the downwind perimeter air monitoring stations.

At the beginning of each workday during the ISTD system operation, one 15 minute average reading from the upwind VOC monitoring device will be compared to the established average background total VOC concentration to account for fluctuations that may occur over time during the proposed 120 day treatment cycle. If the daily background concentration reading is more than 15% higher than the established average background, the daily value will be used to establish action and response levels described in Section 5.0 for that day's activities.

4.4 Analytical Sampling

The following sections describe the perimeter and indoor air analytical sampling activities that will be performed to confirm continuous total VOC air monitoring results recorded at perimeter air monitoring stations and to evaluate potential vapor intrusion conditions in occupied buildings abutting the treatment area.

4.4.1 Perimeter Sampling

Perimeter air samples will be collected on a bi-weekly basis. Air samples will be co-located with the four VOC air monitoring stations at an elevation approximately ten feet above ground surface and will be collected continuously over an eight hour period. Perimeter air sample analytical results will be uploaded to the central database and correlated with continuous VOC air monitoring data recorded during the duration of air sample collection to demonstrate and document that the data collected from the continuous VOC monitoring stations is a reliable measure of the potential exposures to off-site receptors and that the response and action levels are being reliably monitored on a daily.

In the event that the prevailing wind direction is from the south, the two background upwind air samples and the bi-weekly perimeter air sampling (discussed in Section 4.4.2 below) will be conducted at an elevation of approximately ten feet above ground surface at the location indicated on Figure D-2. This air sample will be representative of air quality in the courtyard south of Building B021 and east of Building B023 (i.e., the potentially occupied buildings) where exposure of on-site workers not associated with remedial activities to ISTD system air emissions could potentially occur on an intermittent basis.

If the prevailing wind direction is from the northwest, the two background upwind air samples and the bi-weekly perimeter air samples will be collected at the elevation of the continuous VOC air monitoring device.

These data results will be tracked and included as part of the assessment to evaluate the need for continued indoor air sampling. Samples will be collected at the upwind and downwind perimeter air monitoring stations over a continuous eight hour collection period utilizing laboratory provided stainless-steel, negative pressure vessels (e.g., summa canisters) and submitted to Lancaster Laboratories, Inc (Lancaster) for analysis of SWMU S air COCs by Environmental Protection Agency (EPA) Method TO-15 via secondary ion mass spectrometry (SIM).

4.4.2 Vapor Intrusion Sampling

As described in the PMWM Plan, subsurface vapor pressure monitoring will be conducted at five vacuum piezometers to demonstrate that a negative pressure gradient in the subsurface has been established. To demonstrate that volatized contaminants and steam generated during ISTD system operation is not migrating into proximal occupied buildings, IBM will perform baseline and periodic indoor air sampling. Indoor air samples will be collected using summa canisters over a continuous eight hour collection period and submitted to Lancaster for analysis of SWMU S COCs by EPA Method TO-15 SIM. Initially, indoor air samples will be collected approximately every two weeks.

Prior to ISTD system operation, IBM will collect initial indoor air samples from one location each within Building B021 and Building B023 to establish baseline indoor air quality conditions. The detected concentrations of compounds reported in indoor air samples collected during this baseline sampling event and the concentrations reported in indoor air samples collected in association with the most recent annual indoor air monitoring program will be averaged to develop background indoor air concentrations.

Following the first month of ISTD system operation, IBM will collect one indoor air sample from one location each within Building B021 and Building B023 to evaluate the potential for indoor air exposure. Indoor air quality samples will be collected from the northwest corners of Buildings B021 and B023 and from an elevation approximately three feet above surface grade consistent with the NYSDEC-approved sampling procedures and protocols utilized during annual indoor air monitoring events.

If subsurface vapor pressure monitoring conducted in accordance with the PMWM Plan (Appendix E) indicates a negative pressure gradient has been maintained and indoor air sample analytical results indicate that vapors generated as a result of ISTD system operation are not migrating into Buildings B021 and B023, indoor air sampling frequency reduction or elimination will be discussed with NYSDEC prior to implementing any proposed sampling program changes. If subsurface vapor pressure readings indicate that a negative pressure gradient in the subsurface is not being maintained between the treatment area and the immediate surrounds for a sustained period (i.e., five consecutive days), the need for additional indoor air sampling will be evaluated and discussed with NYSDEC.

5.0 ACTION LEVELS AND RESPONSE ACTIONS

The following sections present the ambient air concentration action levels, reported in ppmv, for total VOCs detected at the continuous air monitoring stations and describe the measures that will be implemented in the event that downwind perimeter ambient air concentrations exceed allowable action levels.

5.1 Ambient Air Action Levels

During operation of the ISTD system, continuous VOC monitoring will be conducted at the four perimeter monitoring stations. The 15-minute running average concentrations recorded at each air monitoring station will be compared to the following ambient air concentration action levels:

- **Low Level "Warning" Alarm Limit:** The low level or "warning" alarm limit for the downwind perimeter air total VOC concentration is five (5) ppmv above background (as established in accordance with procedures described in Section 4.3).
- **High Level Alarm Limit:** The high level alarm limit for the downwind perimeter air total VOC concentration is twenty-five (25) ppmv above background.

5.2 Response Actions

The following measures will be implemented in the event recorded perimeter air total VOC concentrations, reported in ppmv, exceed one of the established alarm levels at a perimeter air monitoring station. Response actions have been categorized by potential operational scenario (i.e., alarm notification received while the ISTD system is unattended or attended).

5.2.1 ISTD System Unattended

In the event of a perimeter air monitoring station alarm notification, either low or high level, before or after normal business hours (i.e., Monday through Friday between 0800 and 1700 hours) when ISTD system operation personnel are not on-site, the ISTD system ERH electrode array will be automatically de-energized. An evaluation to determine the cause of the perimeter air action level exceedance will be conducted prior to system re-starts. The vapor extraction system and the groundwater containment system will continue to operate during a potential ERH electrode array de-energization to maintain vapor recovery and hydraulic control within the treatment area.

5.2.2 ISTD System Attended

In the event of a perimeter ambient air monitoring station alarm notification during normal business hours and therefore while ISTD system operation personnel are on-site, ISTD system operation on-site personnel will implement the procedures presented in the following sections and record the time and location (i.e., identify the downwind perimeter air monitoring station) of the alarm exceedance and record instantaneous PID readings collected manually throughout the duration of response actions on the daily log sheet until such a time as ISTD system operation resumes routine operation or the ERH electrode array is de-energized in compliance with the measures described below.

5.2.2.1 Low Level "Warning" Alarm Response Actions

1) If the 15-minute running average air concentration of total VOCs recorded at a downwind (as defined in Section 3.2) perimeter air monitoring station (see Section 4.4) by one of the continuous air monitoring devices persists for more than five (5) consecutive minutes at a level of five (5) ppmv but less than twenty-five (25) ppmv above background (established as described in Section 4.3), the manual collection of instantaneous air monitoring readings utilizing a hand-held PID will be initiated and the system operator will be notified that a potential reduction in electrical power load to the ERH electrode array may be necessary.

2) While collecting instantaneous hand-held PID readings, ISTD system operation on-site personnel will perform an evaluation in the vicinity and in the upwind direction of the perimeter air monitoring station where the low level alarm was reported for potential intermittent emissions sources that may be impacting ambient air quality, such as idling engines.

3) If a potential intermittent emission source is identified in proximity to the perimeter air monitoring station where the low level alarm was reported that satisfactorily explains the alarm notification and attributes the alarm to a source other than ISTD system emissions, routine ISTD system operation air monitoring will resume and on-site personnel will document the cause for the alarm and record the estimated duration that air quality at the perimeter air monitoring station was impacted by emissions generated by the intermittent source.

4) If no potential intermittent emission sources are identified in proximity to the perimeter air monitoring station where the low level alarm was reported that satisfactorily explain the alarm notification and attribute the alarm to a source other than ISTD system emissions but the total VOC concentration recorded in an instantaneous downwind perimeter air monitoring reading collected utilizing a hand-held PID at the perimeter air monitoring station immediately after the low level alarm notification was received is less than five (5) ppmv above background and persist at levels less than five (5) ppmv above background for 15 consecutive minutes, routine operation of the ISTD system may resume.

5) If no potential intermittent emission sources are identified in proximity to the perimeter air monitoring station where the low level alarm was reported that satisfactorily explain the alarm notification and attribute the alarm to a source other than ISTD system emissions and the total VOC concentration recorded in downwind perimeter air monitoring readings collected utilizing a hand-held PID at the perimeter air monitoring station immediately after the low level alarm notification was received are greater than or equal to five (5) ppmv but less than or equal to twenty-five (25) ppmv above background, ISTD system operation may continue provisionally as long as instantaneous PID readings collected every 30 seconds at the perimeter air monitoring station remain at a level of less than ten (10) ppmv above background.

6) Provisional operation of the ISTD system may continue under conditional air monitoring utilizing manually collected PID readings for no longer than a period of 30 consecutive minutes. If after 30 minutes of provisional operation of the ISTD system, the 15-minute running average concentration recorded on the continuous VOC air monitoring device at the perimeter air monitoring station where the low level alarm was reported is less than five (5) ppmv above background, routine operations may resume.

7) If the 15-minute running average concentration recorded on the continuous VOC air monitoring device at the perimeter air monitoring station where the low level alarm was reported remains at a level greater than or equal to five (5) ppmv above background levels for more than 30 minutes consecutively, the ISTD system will be de-energized and an evaluation to determine the cause of the perimeter air action level exceedance will be conducted.

5.2.2.2 High Level Alarm Response Actions

1) If the 15-minute running average air concentration recorded on a continuous VOC air monitoring device at a downwind perimeter air monitoring station is reported at a level of twenty-five (25) ppmv above background, the ISTD system operation on-site personnel will immediately proceed to the perimeter air monitoring station where the high level alarm was reported to collect manual PID readings and perform an evaluation in the vicinity and in the upwind direction of the perimeter air monitoring station for potential intermittent emissions sources that may be impacting perimeter air quality, such as idling busses or diesel trucks.

2) If a potential intermittent emission source is identified in proximity to the perimeter air monitoring station where the high level alarm was reported that satisfactorily explains the alarm notification and attributes the alarm to a source other than ISTD system emissions, on-site personnel will remain at the perimeter air monitoring station and collect manual air monitoring readings utilizing the hand-held PID and notify the ISTD system operator that routine ISTD system operations may resume. The on-site personnel will document the cause for the alarm and record the estimated duration that perimeter air quality was impacted by emissions generated by the intermittent source at that location.

3) If no potential intermittent emission sources are identified in proximity to the perimeter air monitoring station that satisfactorily explain the alarm notification and attribute the alarm to a source other than ISTD system emissions but the downwind perimeter air concentrations collected utilizing a hand-held PID at the downwind perimeter ambient air monitoring station are less than twenty-five (25) ppmv above background, response actions for a low level alarm (as described in Section 5.2.2.1 above) will be implemented until such a time as either the ISTD system resumes routine operation or is de-energized for an evaluation to determine the cause of the perimeter air action level exceedance.

4) If no potential intermittent emission sources are identified in proximity to the perimeter air monitoring station that satisfactorily explain the alarm notification and attribute the alarm to a source other than ISTD system emissions and the manual downwind perimeter air concentrations collected utilizing a hand-held PID at the downwind perimeter ambient air monitoring station persist for 15 minutes consecutively immediately following notification of the high level alarm at levels greater than or equal to twenty-five (25) ppmv above background, the ISTD system will be de-energized and an evaluation to determine the cause of the perimeter air action level exceedance will be conducted.

5.3 Notifications

If de-energization of the ISTD system is required as prescribed by the response action procedures identified above for either a Low Level “Warning” or High Level alarm limit exceedance, NYSDEC will be notified verbally and via electronic mail within 24 hours.

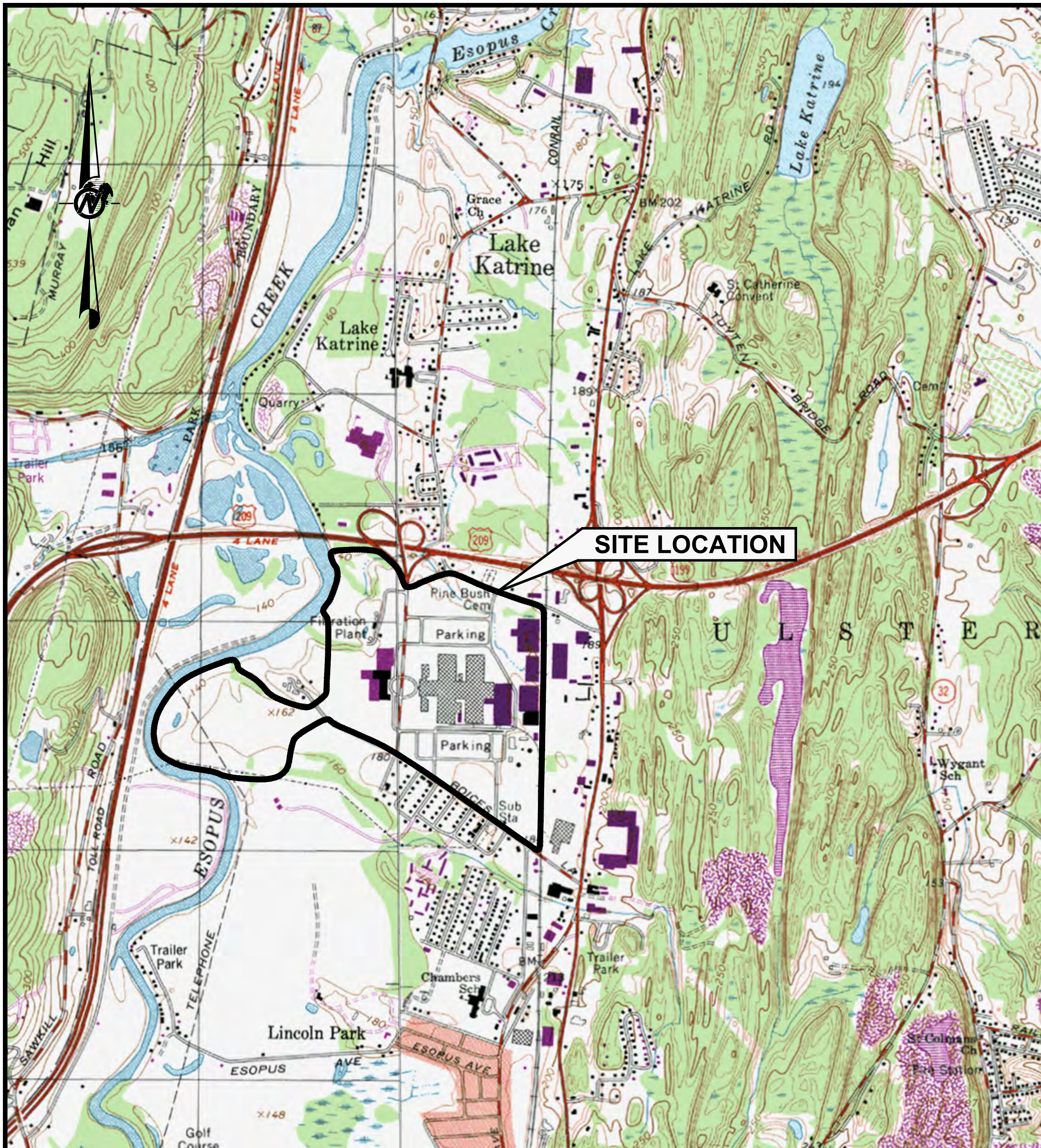
6.0 RECORD KEEPING AND DATA EVALUATION

Continuous weather station and VOC ambient air monitoring device data will be saved on the devices and backed up on the project database. Air monitoring data will be uploaded to the project database and reviewed on a daily basis during the business week. ISTD system operations personnel will record readings collected during response action activities on the daily log sheet and manually enter the information into the air monitoring database on a weekly basis.

A weekly summary will be prepared evaluating overall perimeter ambient air conditions and noting indications of changing weather conditions (i.e., wind direction, wind speed, temperature and humidity) that may affect air emission transport and/or receptors and evaluating VOC data for observable trends. Ambient air VOC data will be evaluated with respect to meteorological conditions, ISTD ICM progress and general site activities.

The weekly air monitoring program summary will include a discussion of perimeter air monitoring station alarm notifications experienced during the reporting period, a description of the response actions implemented, a summary of response action outcomes, and a list of revisions made to ISTD system operation parameters accompanied by an explanation for the noted revisions. The weekly summaries will also include figures illustrating prevailing wind direction for the preceding week, a figure illustrating prevailing wind directions since ISTD system operation began and a summary table of weekly VOC air monitoring results with graphical illustrations of cumulative VOC air monitoring data trends.

FIGURES



2000 0 2000
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT
FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE
SITE LOCATION MAP

REFERENCE

1.) BASE MAP TAKEN FROM USGS 7.5 MINUTE SERIES QUADRANGLES OF KINGSTON EAST, NY, DATED 1963, PHOTOREVISED 1980, AND KINGSTON WEST, NY, DATED 1997.

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

PROJECT No.		083-87071	FILE No.		08387071P035
DESIGN	DPG	05/22/14	SCALE	AS SHOWN	REV. 0
CADD	RG	05/22/14			
CHECK	DPG	05/22/14	FIGURE D-1		
REVIEW	CDH	05/22/14			

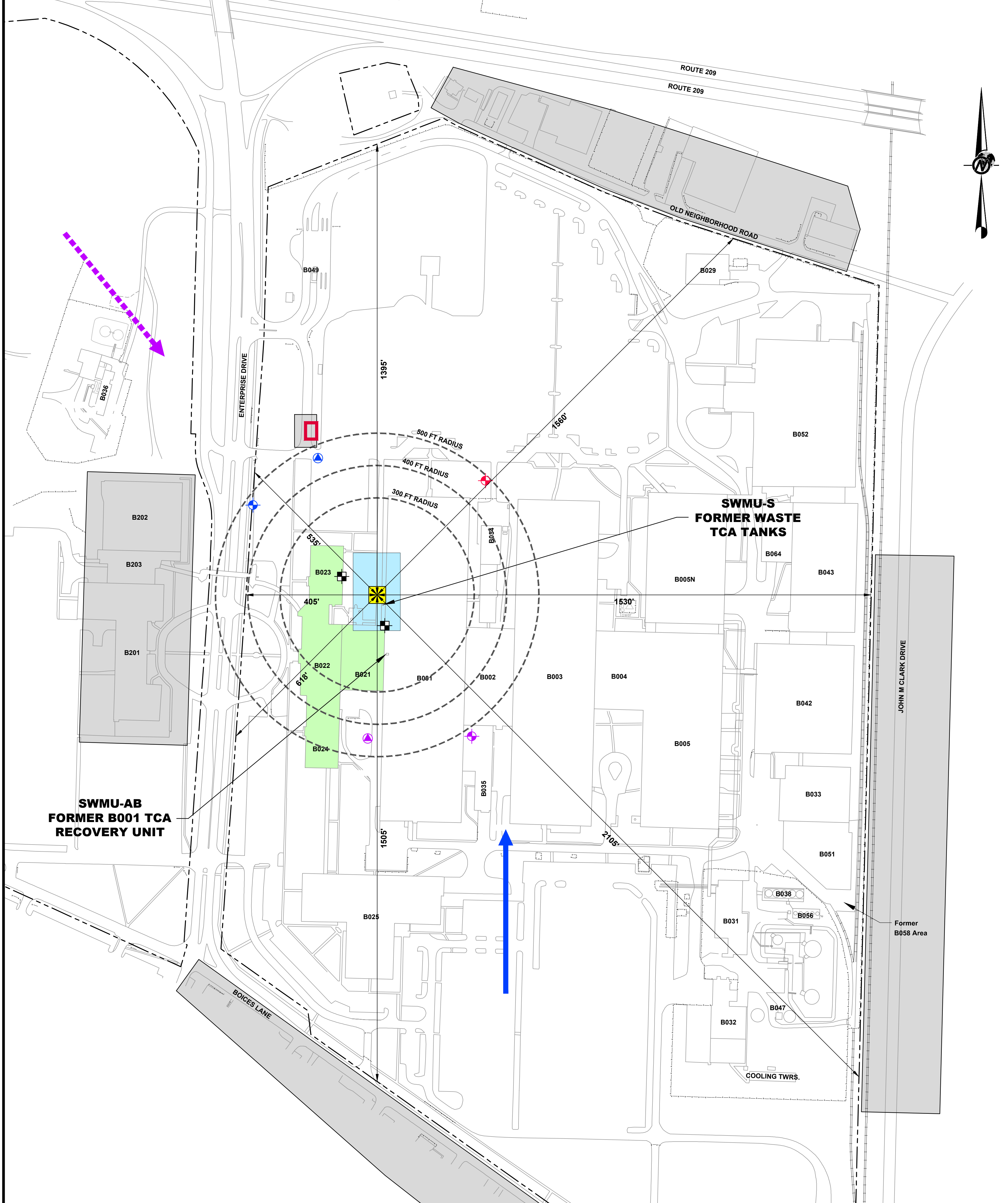
Drawing file: 08387071P035.DWG May 22, 2014 - 11:58am

Drawing file: 08387071P034.dwg May 22, 2014 - 1:56pm

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE 3002-108-I3.DWG, DRAWING NUMBER 93002-108-I3 ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) OPERABLE UNIT BOUNDARIES DIGITIZED FROM A HARDCOPY FILE ENTITLED "Operable Unit Composite MAP_2011-0830.pdf," PREPARED BY BRINNIER & LARIOS, P.C.



LEGEND

Symbol	Description
— - —	PROPERTY/PARCEL BOUNDARY
B003	BUILDING NUMBER
	SWMU S ISTD TREATMENT AREA
	POTENTIAL EXPOSURE POINTS
	APPROXIMATE LOCATION OF EXHAUST STACK
	APPROXIMATE LOCATION OF ULSTER COUNTY TRANSIT BUS STATION
	OCCUPIED BUILDINGS
	PREVAILING WIND DIRECTION, SPRING AND SUMMER SEASONS
	PREVAILING WIND DIRECTION, FALL AND WINTER SEASONS
	PROPOSED INDOOR AIR QUALITY MONITORING STATION
	FALL AND WINTER UPGRADIENT MONITORING LOCATION OR SPRING AND SUMMER DOWNGRADIENT MONITORING LOCATION
	SPRING AND SUMMER UPGRADIENT MONITORING LOCATION OR FALL AND WINTER DOWNGRADIENT MONITORING LOCATION
	FALL AND WINTER DOWNWIND PERIMETER MONITORING LOCATION
	SPRING AND SUMMER DOWNWIND PERIMETER MONITORING LOCATION
	PERENNIAL PERIMETER AIR MONITORING LOCATION

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SWMU S ICM-SPECIFIC AIR MONITORING PROGRAM LAYOUT

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

PROJECT No.		083-87071	FILE No.	08387071P034
DESIGN	DPG	05/22/14	SCALE AS SHOWN	REV. 0
CADD	RG	05/22/14		
CHECK	DPG	05/22/14		
REVIEW	CDH	05/22/14		

FIGURE D-2

APPENDIX E

PERFORMANCE MONITORING AND WASTE MANAGEMENT PLAN

APPENDIX E

IN SITU THERMAL DESORPTION PERFORMANCE MONITORING AND WASTE MANAGEMENT PLAN

SOLID WASTE MANAGEMENT UNIT S: FORMER B001 WASTE TCA TANKS

Former IBM Kingston Facility
Site #356002
Order on Consent Index No. D3-10023-6-11

Prepared By: International Business Machines Corporation
8976 Wellington Road
Manassas, VA 20109

September 2014 **Project No.: 083-87071.05**

Table of Contents

List of Tables

List of Figures

List of Attachments

1.0 INTRODUCTION

Golder Associates Inc. (Golder) prepared this Performance Monitoring and Waste Management Plan (PMWM Plan) on behalf of International Business Machines Corporation (IBM) for the in situ thermal desorption (ISTD) interim corrective measure (ICM) at Solid Waste Management Unit (SWMU) S: Former Building B001 Waste 1,1,1-Trichloroethane (TCA) Tanks (SWMU S) at the former IBM Kingston Facility located at 300 Enterprise Drive, Kingston, Ulster County, New York (site).

The sampling and monitoring methodologies described herein supplement existing site Standard Operating Procedures (SOPs) established in the Quality Assurance Project Plan (QAPP) included as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plans (RFI WPs) approved by the New York State Department of Environmental Conservation (NYSDEC) in May 2009.

1.1 Purpose

This PMWM Plan describes the procedures and frequency for the collection of environmental data of sufficient quality required to:

- Monitor and optimize system performance
- Monitor the performance of the hydraulic and vapor control systems
- Monitor the quality of air and liquid discharges from the process treatment systems
- Evaluate the effectiveness of the ICM in achieving the RAO
- Manage investigation derived waste (IDW)

Air monitoring and sampling performed to evaluate potential impacts to on-site and off-site receptors during implementation of the ICM is described separately in the *SWMU S ICM Community Air Monitoring Plan* (CAMP) included as Appendix D of the ICM Work Plan. A description of the ISTD ICM is presented in Section 4.0 of the ICM Work Plan.

2.0 SYSTEM PERFORMANCE MONITORING AND SAMPLING

The following activities will be conducted to monitor ISTD system performance:

- Hydraulic control monitoring
- Subsurface vapor control monitoring
- Vapor and water process waste monitoring and analytical sampling

IBM representatives will be on-site Monday through Friday during normal business hours (i.e., 8 AM through 5 PM) for the duration of ISTD system operation and will be responsible for conducting the daily system monitoring activities. The type and frequency of monitoring and/or sampling activities that will be conducted to evaluate the performance of individual system components is summarized in Table E-1 and described in the following sections.

2.1 Hydraulic Control Monitoring

The effectiveness of the hydraulic control system in creating a zone of capture and controlling the migration of dissolved-phase volatile organic compounds (VOCs) downgradient of the ISTD treatment area will be evaluated based on the following data collected from select groundwater monitoring wells:

- Groundwater temperature
- Water table drawdown
- Dissolved-phase concentration of VOCs in groundwater

Sentinel groundwater monitoring locations will be installed approximately five feet downgradient and at locations approximately equidistant from the two adjacent groundwater recovery wells. The following activities will be conducted to evaluate the efficacy of the hydraulic control measures:

- Continuous groundwater temperature readings will be collected via thermocouples installed in the sentinel wells.
- Depth to groundwater measurements will be collected from the five sentinel wells and existing monitoring well TMP-8 on a daily basis. Depth-to-water measurements collected in sentinel wells will be assessed with respect to depth-to-water measurements collected in TMP-8 to evaluate the groundwater gradient.
- Prior to initiating ISTD system operation, a baseline groundwater sampling event will be conducted to establish baseline groundwater quality conditions immediately downgradient of the ISTD treatment area. The baseline groundwater quality sampling program will include the collection of depth-to-water measurements and groundwater samples for laboratory analysis of VOCs from the groundwater extraction wells, the sentinel wells, the new monitoring well installed north of the SWMU S treatment area (see Figure E-1) and existing monitoring well TMP-8.
- Periodic groundwater samples will be collected for laboratory analysis of VOCs from the groundwater extraction wells, sentinel wells, new monitoring well north of the SWMU S treatment area and monitoring well TMP-8. Results will be compared to baseline conditions to evaluate the effectiveness of the hydraulic control system

The frequency and duration of hydraulic control monitoring activities will be evaluated based on the results of these performance monitoring activities. The need for hydraulic control system modification will be evaluated if any of the following conditions are observed:

- An increasing trend in groundwater temperatures, as collected on a continuous basis in the sentinel wells.
- A decreasing trend in the hydraulic gradient, as determined based on the depth-to-water measurements collected in the sentinel wells and TMP-8.
- An increasing trend in the dissolved-phase concentrations of VOCs detected in laboratory analytical samples collected from the groundwater extraction, sentinel, and monitoring wells.

Some change in groundwater chemistry is anticipated. The effectiveness of hydraulic control will be evaluated with respect to actual dissolved-phase concentrations as ISTD system operation progresses. Potential hydraulic control system modifications include increasing/decreasing the pumping rate and/or discontinuing groundwater extraction, if performance monitoring data indicate groundwater recovery is no longer necessary to mitigate the migration of dissolved-phase VOCs downgradient of the treatment area.

Groundwater samples and depth-to-water measurements will be collected in accordance with QAPP SOP-2 *Temporary Monitoring Well Installation and Groundwater Sample Collection*. Groundwater samples will be submitted for analysis of the site-specific VOC list of constituents of concern (COCs) by United States Environmental Protection Agency (EPA) Method 8260C.

2.2 Vapor Control Monitoring

Subsurface vapor pressure monitoring will be performed to evaluate the effectiveness of the vapor control system in capturing vapors generated during the heating process and preventing volatilized contaminants within carrier steam gas from escaping the ISTD treatment area. The effectiveness of vapor control measures will be evaluated based subsurface vapor pressure measurements and indoor air quality samples.

Vapor pressure monitoring will be conducted in vacuum piezometers co-located with temperature monitoring probes utilizing a Cole-Palmer -30 to 30 pounds per square inch (psi) Handheld Differential Pressure Gauge manometer or similar equipment capable of monitoring differential pressure with an accuracy of ± 0.2% and a precision of 0.01 psi. Subsurface vapor pressure monitoring will be performed at each of the five vacuum piezometer monitoring locations (Figure E-1) on a daily basis during the first week of ISTD system operation and on a weekly basis thereafter, provided a negative pressure gradient is established between the subsurface below the treatment area and the subsurface below areas adjacent to the treatment area during the first week of ISTD system operation. After the first week of operation, vapor pressure measurements will be collected on a weekly basis to demonstrate that a negative pressure gradient is maintained in the subsurface between the treatment area and the immediate surrounds.

Vapor control measures will be considered effective if the following conditions are generally maintained:

- A pressure differential of approximately 0.05 pounds per square inch (psi) (i.e., 1 inch of water) is observed between vacuum piezometer monitoring points located within and at the perimeter of the treatment area.
- VOC concentrations in indoor air samples are less than or equal to 10 times the average concentration of analytical samples collected at that location when compared to baseline indoor air sample results.

Vapor pressure monitoring will initially be performed twice daily by onsite personnel utilizing a hand-held digital magnehelic gauge or manometer capable of reading differential pressures. The frequency and duration of vapor control monitoring activities will be evaluated based on the results of these performance monitoring activities. Results from indoor air quality samples collected during initial system operation as described in the CAMP (Appendix D) will also be used to evaluate performance of the vapor collection system.

2.3 Process Vapor and Water Monitoring

Vapor and water process waste streams will be monitored to evaluate the effectiveness of waste stream treatment measures as described in the following sections.

2.3.1 Process Vapor Monitoring

Vapor phase discharges will be generated from the following processes:

- Vapors extracted from the subsurface via the operation of the blower used to capture VOC vapors and steam generated during the operation of the ISTD treatment system.
- Vapor generated by the air stripper treatment system for the hydraulic control wells.

Both vapor streams (influent) will be directed to one of two steam-regenerated (SR) granular activated carbon (GAC) treatment units. Following SRGAC treatment, process vapor (midfluent) will be directed to a vapor-phase granular activated carbon (VGAC) unit for final treatment prior to discharge to the atmosphere (effluent).

PID readings and grab samples will be collected at influent, midfluent and effluent sample ports installed along the process vapor treatment train. On-site personnel will monitor the total VOC concentration of process vapors utilizing a handheld photo-ionization detector (PID) and record measurements twice per day. Grab samples, collected utilizing Tedlar® bags, will be collected on a daily basis and submitted for laboratory analysis with an expedited three-day turn-around-time during system startup. Once ISTD system operation becomes routine, process vapor grab samples will be collected on a bi-weekly basis, coincident with the bi-weekly perimeter air monitoring analytical sampling conducted in accordance with the CAMP (Appendix D), and submitted for laboratory analysis on a five day turn-around-time. Samples will be submitted for analysis of VOCs by EPA Method TO-15.

GAC replacement will be required if analytical sample results indicate either of the following breakthrough conditions is present:

- Midfluent analytical results for grab samples indicate steam-regeneration of the GAC treatment units is no longer effective in stripping contaminant mass from the carbon bed.
- Effluent analytical results for grab samples indicate VGAC has been depleted.

Midfluent and effluent analytical results will be compared to the NYSDEC Division of Air Resources (DAR)-1 Guidance document (NYSDEC, October 18, 2010) Maximum Short Term Guidance Concentrations (SGCs) for SWMU S COCs, presented in Table E-2, to evaluate the estimated timing of GAC breakthrough and the need for GAC regeneration or replacement.

2.3.2 Process Water Monitoring

The process water treatment system has been designed to achieve the current site State Pollutant Discharge Elimination System (SPDES) permit limits (NY0010 8138 Outfall 01A) for the existing Groundwater Treatment Facility (GTF). Process water, excluding non-contact cooling water, will be treated utilizing a two stage system:

- Process water wastes, comprising groundwater extracted to establish hydraulic control and condensate (influent), will first be processed using a shallow tray air stripper (STAS).
- Following STAS treatment, process water (midfluent) will be directed to a liquid-phase granular activated carbon (LGAC) unit for final treatment prior to discharge to the interim holding tank (effluent).

Non-contact cooling water will be discharged directly to the sanitary sewer system under TechCity's existing sanitary sewer discharge permit. Treated process water will be conveyed via temporary underground piping on an as-needed basis from the holding tank to the existing site GTF prior to discharge at the permitted SPDES outfall. Process water discharge flow readings at the LGAC effluent point, including the instantaneous flow rate and totalized flow to date, will be recorded on a daily basis. Preliminary estimates for water discharges from the ISTD treatment system indicate maximum discharge rates could be as high as 45 gallons per minute (gpm).

Grab samples for laboratory analysis will be collected on a daily basis during the first week of operation from the following locations:

- STAS influent
- LGAC influent
- Inter-bed midfluent
- Effluent

Grab samples will be submitted for analysis of the parameters listed in Table E-3. Initial (i.e., during system startup) process water sample results will be requested from the laboratory with an expedited 24 hour turn-around time. LGAC source replenishment will occur if effluent analytical sample results indicate LGAC has been depleted. LGAC breakthrough will be evaluated by comparing effluent sample analytical results to the SPDES permit discharge requirements.

Following confirmation that hydraulic control has been achieved and process water treatment is effective in reducing VOC concentrations within the acceptable limits established by the SPDES permit for the site, process water sampling frequency will be reduced to weekly and analytical result turn-around time will be reduced to standard (approximately five days). Once groundwater extraction approaches steady-state, process water sampling will be performed on a monthly basis.

3.0 ISTD PERFORMANCE AND COMPLETION MONITORING

Three ISTD ICM performance sampling events will be conducted to evaluate ISTD treatment progress and completion. ICM performance and completion sampling will be conducted in accordance with the "hot" soil and groundwater sampling protocol described in Attachment E-1. Table E-4 summarizes the type and frequency of sampling activities that will be conducted to evaluate ISTD treatment progress.

3.1 Interim ISTD Sampling

Interim performance monitoring soil and groundwater sampling will be conducted at the estimated 50% to 60% completion point of ISTD system operation, based upon energy usage and mass balance. Soil samples will be collected at approximately three locations within the area of greatest observed impact (i.e., in the center of the observed DNAPL area) at an elevation corresponding to the highest detected VOC concentrations within the contact area between the Surficial Sand Unit and the underlying Transition Zone as identified during the SWMU S Supplemental Remedial Investigation.

Groundwater samples will be collected for laboratory analysis of VOCs from approximately six temporary monitoring wells. These wells will be installed in the observed DNAPL area and screened within the saturated portion of the Surficial Sand Unit across the contact area between the saturated Surficial Sand Unit and the Transition Zone. Analytical results from these ICM performance monitoring samples will be used to evaluate relative progress of the ISTD ICM. These samples will be co-located with soil sample locations installed in the center of the DNAPL area as indicated on Figure E-1.

Preliminary completion sampling event findings will be utilized to evaluate ISTD treatment progress, estimate percentage completion and revise ISTD system operation duration estimates, as necessary. The anticipated timing of ISTD completion confirmation sampling (discussed in Section 3.2 below) will be modified accordingly.

3.2 ISTD Completion Sampling

A preliminary completion soil and groundwater sampling event will consist of the collection of three soil samples from the contact between the Surficial Sand Unit and the underlying Transition Zone in the center of the observed DNAPL area and six groundwater samples from temporary monitoring wells screened within the saturated portion of the Surficial Sand Unit and across the contact area between the saturated Surficial Sand Unit and the Transition Zone. Preliminary completion sampling will be conducted at the estimated 90% completion point of ISTD system operation, based upon energy usage, review of monitoring data and initial mass balance estimates. The results of this preliminary completion sampling event will be used to evaluate whether the ISTD system has removed and/or treated the DNAPL present in the SWMU S area.

If the results of the preliminary completion sampling event indicate the ISTD system has not removed and/or treated the DNAPL present in the SWMU S area, operation of the ISTD system will continue. The duration that ISTD system operation will continue will be based upon the estimated percentage of remedy completion achieved to date. ISTD system operation will continue while preliminary completion confirmation sampling is performed.

If preliminary completion sampling indicates the ISTD system has effectively removed and/or treated the DNAPL present in the SWMU S area at the target locations, IBM will conduct confirmation soil and groundwater sampling to demonstrate that ISTD treatment is complete and begin demobilization and site restoration efforts. Confirmation sampling will include the collection of three soil samples from approximately nine soil boring locations advanced within the treatment area at the locations shown on Figure E-1.

Confirmation completion sampling event soil samples will be collected from within the Surficial Sand Unit, the Transition Zone, and the Varved Clay Unit at each soil boring location. Monitoring wells will be installed in co-located groupings and screened to target two-foot vertical intervals within the saturated Surficial Sand Unit, across the contact area of the Surficial Sand Unit with the Transition Zone, and across the contact area of the Transition Zone with the Varved Clay Unit. Soil and groundwater samples will be submitted for analysis of the site-specific VOC list via EPA Method 8260C. ISTD system operation will continue until successful completion of the ICM has been confirmed. Successful completion of the ICM will be evaluated based on meeting the ICM performance criteria and achieving the RAO.

3.3 Post-ISTD Treatment Monitoring

Select new monitoring wells installed during ICM activities will be incorporated into the existing site groundwater monitoring program to evaluate post-ISTD treatment groundwater conditions in the SWMU S area.

4.0 WASTE MANAGEMENT AND SAMPLING

The following sections summarize activities IBM will perform to manage impacted IDW including construction and demolition debris (C&D), personal protective equipment (PPE), trash, and wastes generated during site preparation and operation of the ISTD system. Both hazardous and non-hazardous IDW will be generated during site preparation, equipment installation, and operation of the ISTD system. The regulatory status of each waste stream will be evaluated based on waste characterization analytical results received for samples collected from each waste stream. IDW will be collected and disposed in accordance with established site management protocol and local codes and regulations. A summary of anticipated waste streams is provided in Table E-5.

4.1 Site Preparation Derived Waste

The following sections summarize how solid and liquid IDW generated during site preparation activities will be managed. C&D debris generated during site preparation activates will be collected and disposed of in accordance with local codes and regulations. IDW will be managed in accordance with the Interim Site Management Plan (ISMP, TechCity, 2011) and as summarized in Table E-5. Representative composite samples, as appropriate, will be collected from IDW and submitted for analysis of select parameters as required by the selected disposal facility.

4.1.1 Solids

Solids generated during site preparation, well installation, and piping installation, including soils, equipment decontamination solids, PPE, and trash will be managed in accordance with NYSDEC protocols and the existing ISMP. Soils will be segregated and managed based on the depth below ground surface (bgs) from which they are generated, visual observations, field screening performed with a handheld PID, and analytical results, as appropriate.

4.1.2 Liquids

Liquid IDW generated during site preparation and infrastructure installation, including hydraulic control well development water and equipment decontamination fluids, will be containerized separately in new, labeled Department of Transportation (DOT)-approved 55-gallon drums or fractionation (frac) tanks. Liquid waste generated during site preparation and infrastructure installation activities will be treated utilizing the ISTD water treatment system prior to discharge to the onsite GTF.

4.2 System Operation Derived Waste

The following waste streams are expected during ISTD system operation:

- Thermal treatment condensate (primarily 111-TCA and breakdown products)
- Groundwater and equipment blow down
- Project consumables (e.g., gloves, debris)

- Bag Filters

Thermal treatment condensate is anticipated to produce DNAPL, which will be collected within a double contained system. Representative DNAPL characterization samples will be collected from recovered DNAPL, as necessary, prior to disposal at an approved facility. Management of DNAPL condensate as a hazardous material is anticipated.

Granular activated carbon used in the SRGAC, VGAC, and LGAC systems may require replenishment. In the event GAC is depleted, waste characterization sampling will be performed prior to GAC disposal. It is anticipated that expended GAC may be managed as non-hazardous waste.

Analytical sampling and monitoring of extracted groundwater is described in Section 2.3.2. PPE and other consumables generally will be collected and disposed of as non-hazardous waste. PPE or other consumables that have been potentially contaminated or contacted hazardous materials will be collected in a separate drum for waste characterization sampling and disposal.

Inline bag filters utilized within the process waste treatment system to screen out solids and protect equipment are consumables and will need to be changed periodically, depending on the rate of solids loading. Spent inline bag filters will be containerized in separate DOT-approved 55-gallon drums and labeled accordingly. Representative waste characterization samples will be collected from inline filters prior to disposal.

TABLES

TABLE E-1: SUMMARY OF SYSTEM PERFORMANCE MONITORING PROGRAM

Process	Media	Monitoring Type	Location	Purpose	Frequency	Equipment/Analysis
Containment Monitoring						
Hydraulic Control	Groundwater	Field Measurement: depth to water	Five (5) sentinel monitoring wells: SW-1 - SW-5	Direct measurement of groundwater to evaluate effectiveness of hydraulic control wells in capturing groundwater impacted with VOCs mobilized by the operation of the ISTD system	Twice (2) daily during normal work week	Electronic water level meter
	Groundwater	Laboratory Analytical Sample	Five (5) sentinel monitoring wells: SW-1 - SW-5	Collection of groundwater samples for laboratory analysis to establish baseline dissolved-phase concentrations in groundwater downgradient of the treatment area prior to ISTD system operation	Once, prior to system operation	Site-specific VOC list via EPA Method 8260C
	Groundwater	Laboratory Analytical Sample	Five (5) sentinel monitoring wells: SW-1 - SW-5	Collection of groundwater samples for laboratory analysis to evaluate dissolved-phase concentrations in groundwater downgradient of the treatment area during ISTD system operation	Bi-monthly, coincident with bi-monthly perimeter ambient air sampling events	Site-specific VOC list via EPA Method 8260C
Vapor Capture	Subsurface Air Pressure	Field Measurement: subsurface vapor pressure	Seven (7) vacuum piezometers: VP-1 - VP-7	Direct measurement of subsurface vapor pressure to evaluate effectiveness of the vapor control system in capturing steam and volatized contaminants generated by the operation of the ISTD system	Twice (2) daily during normal work week	Manometer
	Indoor Air	Laboratory Analytical Sample	Two (2) indoor air quality monitoring stations, one each in Buildings B021 and B023: IA-1 and IA-2	Collection of indoor air samples for laboratory analysis to establish a baseline indoor air quality prior to ISTD system operation	Once, prior to system operation	Site-specific VOC list via EPA Method 8260C
	Indoor Air	Laboratory Analytical Sample	Two (2) indoor air quality monitoring stations, one each in Buildings B021 and B023: IA-1 and IA-2	Collection of indoor air samples for laboratory analysis to evaluate indoor air quality during ISTD system operation	Initial: Bi-weekly Conditional: as needed following demonstration of negative pressure gradient	Site-specific VOC list via EPA Method 8260C
Process Waste Monitoring						
Process Vapor	Volatized VOCs and Steam	Field Measurement: total VOCs	Three process vapor monitoring locations: influent, midfluent, and effluent	Direct measurement of process vapor to evaluate the effectiveness of process vapor treatment in removing VOCs from vapor waste stream and monitor potential granular activated carbon breakthrough	Twice (2) daily during normal work week	PID
	Volatized VOCs and Steam	Laboratory Analytical Sample	Three process vapor monitoring locations: influent, midfluent, and effluent	Collection of process vapor samples utilizing Tedlar® bags for laboratory analysis to evaluate the effectiveness of process vapor treatment in removing VOCs from vapor waste stream and monitor potential granular activated carbon breakthrough	Initial: one daily during startup Bi-monthly, coincident with bi-monthly perimeter ambient air sampling events	Site-specific VOC list via EPA Method 8260C
Process Water	Groundwater, condensate, and blowdown	Laboratory Analytical Sample	Three process water monitoring locations: influent, midfluent, and effluent	Collection of process water samples for laboratory analysis to evaluate the effectiveness of process water treatment in removing VOCs from water waste stream and monitor potential granular activated carbon breakthrough	Bi-monthly, coincident with bi-monthly perimeter ambient air sampling events	Site-specific VOC list via EPA Method 8260C

Notes:
1) VOCs = Volatile Organic Compounds
2) ICM = Interim Corrective Measure
3) ISTD = In situ thermal desorption
4) EPA = Environmental Protection Agency
5) Normal work week is Monday through Friday
6) NA = not applicable
7) PID = Photoionization detector
8) Additional analytical samples beyond those prescribed in the schedule presented herein may be collected at IBM's discretion

TABLE E-2: NYSDEC Short Term Guidance Concentrations

Compound	CAS Number	Unit	Concentration
1,1-Dichloroethane	75-34-3	µg/m^3	1,000
1,1-Dichloroethene	75-35-4	µg/m^3	No Value
1,2-Dichloroethane	107-06-2	µg/m^3	1,000
1,1,1-Trichloroethane	71-55-6	µg/m^3	68,000
Freon 13	75-72-9	µg/m^3	68,000
Tetrachloroethylene	127-18-4	µg/m^3	1,000
Trichloroethylene	79-01-6	µg/m^3	14,000
Toluene	108-88-3	µg/m^3	37,000
Vinyl Chloride	75-01-4	µg/m^3	180,000
Xylenes (total)	1330-20-7	µg/m^3	4,300

Notes:
1) NYSDEC = New York State Department of Environmental Conservation
2) CAS = Chemical Abstracts Service
3) µg/m^3 = microgram per cubic meter

TABLE E-3: SUMMARY OF WASTEWATER DISCHARGE SAMPLING PLAN

Sample Location	Equipment/ Location	Drawing	Node	Description	Potentially Hazardous	Potential Waste Code:		Recoverable	Handling	Start-Up Sampling Frequency	Sample Type	Parameter and EPA Method										Normal Operation							
						TCLP/Toxicity						Flow	pH	Temp °F	Settleable Solids	TDS	TSS	O&G	Total Lead	Total Zinc	VOCs	Sample Frequency	pH	Temp °F	Settleable Solids	TDS	TSS	Total Lead	VOCs
												NA	SM4500	NA	NA	SM2540C	SM2540D	1,664	200.7	200.7	E624E624/8260		SM4500	NA	NA	SM 2540C	SM 2540D	200.7	E624/8260
Hydraulic Control Well Development																													
Well Installation (Groundwater)	Groundwater/ DNAPL Area	P-4	26	Clear, solvent odor; will contain LNAPL/DNAPL	Y	D040, D039	Other possible - D028, D029	N	Accumulate in drums/tote or Frac Tank container. Collect sample, submit for analysis. Run through condenser/discharge to GTF, or ship off site for disposal.	Installation	Composite	Volume Estimate	X	X	X	X	X	X	X	X	X	NA	NA	NA	NA	NA	NA	NA	NA
Water Treatment Train																													
STAS Influent	STAS	TRS P-12	26, 3	Combined hydraulic control wells and condensate	Y	D040, D039	Other possible - D028, D029	N	Treated in STAS	Daily for 1 week; weekly	Grab		X						X	X	X	Monthly	X					X	X
LGAC Influent	LGAC (lead)	TRS P-12	28	Liquid GAC influent, possible solvent odor	Not expected	NA	NA	N	NA	Daily for 1 week; weekly	Grab	Totalizer	X						X	X	X	Monthly	X					X	X
LGAC Lead Unit Effluent	LGAC (lead)	TRS P-12	NA	Inter bed sample	Not expected	NA	NA	N	NA	Daily for 1 week; weekly	Grab		X								X	Monthly							X
LGAC Lag Effluent	LGAC (lag)	TRS P-12	33	Liquid GAC effluent	Not expected	NA	NA	N	Discharged to O'Brien & Gere pump out tank. Final treatment in on-site GTF	Daily for 1 week; weekly	Grab		X	X	X	X	X	X	X	X	X	Monthly	X	X	X	X	X	X	X
O'Brien & Gere Wastewater Holding Tank	T-1201/ TA-100	TRS P-12	31	Effluent from TRS CT blow down; regen water from softener; liquid GAC effluent	Not expected	NA	NA	N	Discharged to O'Brien & Gere pump out tank. Final treatment in on-site GTF	Daily for 1 week; weekly	Grab	Totalizer	X	X	X	X	X	X	X	X	X	Monthly	X	X	X	X	X	X	X

Notes:

1) Process water waste management sampling schedule based on information provided by O'Brien & Gere
2) TCLP = toxicity characteristic leaching procedure
3) LNAPL = light non-aqueous phase liquid
4) DNAPL = dense non-aqueous phase liquid
5) STAS = shallow tray air stripper
6) LGAC = liquid granular activated carbon
7) VOC = volatile organic compound
8) NA = not applicable
9) GTF = groundwater treatment facility
10) Samples will be collected daily for the first week of startup, and then weekly until steady state has been reached.
11) Groundwater collected and temporarily stored in holding tank during thermal treatment well installation will be treated in the existing GTF prior to discharge

TABLE E-4: SUMMARY OF ISTD PERFORMANCE MONITORING PROGRAM

Process	Media	Monitoring Type	Location	Purpose	Frequency	Analysis
Intermediate ICM Sampling						
Progress Evaluation	Soil	Laboratory Analytical Sample	One (1) elevation from each of three (3) locations within the ISTD treatment area	Collection of soil samples for laboratory analysis to evaluate VOC concentrations in soil at locations within the area of greatest observed impact at the anticipated midpoint of ISTD treatment	Once, at anticipated midpoint of ICM operation (i.e., approximately 50-60% estimated energy use)	Site-specific VOC list via EPA Method 8260C
	Groundwater	Laboratory Analytical Sample	One (1) elevation from each of three (3) locations within the ISTD treatment area	Collection of groundwater samples for laboratory analysis to evaluate dissolved-phase VOC concentrations in groundwater at locations within the area of greatest observed impact at the anticipated midpoint of ISTD treatment	Once, at anticipated midpoint of ICM operation (i.e., approximately 50-60% estimated energy use)	Site-specific VOC list via EPA Method 8260C
ICM Completion Sampling						
Completion Evaluation	Soil	Laboratory Analytical Sample	One (1) elevation from each of three (3) locations within the ISTD treatment area	Collection of soil samples for laboratory analysis to evaluate VOC concentrations in soil at locations within the area of greatest observed impact to evaluate potential ISTD completion	Once, at anticipated completion of ICM operation (i.e., approximately 95% of estimated energy use)	Site-specific VOC list via EPA Method 8260C
	Groundwater	Laboratory Analytical Sample	One (1) elevation from each of three (3) locations within the ISTD treatment area	Collection of groundwater samples for laboratory analysis to evaluate dissolved-phase VOC concentrations in groundwater at locations within the area of greatest observed impact to evaluate potential ISTD completion	Once, at anticipated midpoint of ICM operation (i.e., approximately 95% of estimated energy use)	Site-specific VOC list via EPA Method 8260C
Completion Confirmation	Soil	Laboratory Analytical Sample	Three (3) elevations from each of nine (9) locations within the ISTD treatment area	Collection of soil samples for laboratory analysis to evaluate VOC concentrations in soil at locations within the area of greatest observed impact to confirm ISTD completion	Once, following assessment of completion evaluation sampling results	Site-specific VOC list via EPA Method 8260C
	Groundwater	Laboratory Analytical Sample	Three (3) elevations from each of nine (9) locations within the ISTD treatment area	Collection of groundwater samples for laboratory analysis to evaluate dissolved-phase VOC concentrations in groundwater at locations within the area of greatest observed impact to confirm ISTD completion	Once, following assessment of completion evaluation sampling results	Site-specific VOC list via EPA Method 8260C

Notes:
1) ISTD = In situ thermal desorption
2) VOCs = Volatile Organic Compounds
3) ICM = Interim Corrective Measure
4) EPA = Environmental Protection Agency
5) Additional analytical samples beyond those prescribed in the schedule presented herein may be collected at IBM's discretion

TABLE E-5: SUMMARY OF WASTE MONITORING PROGRAM

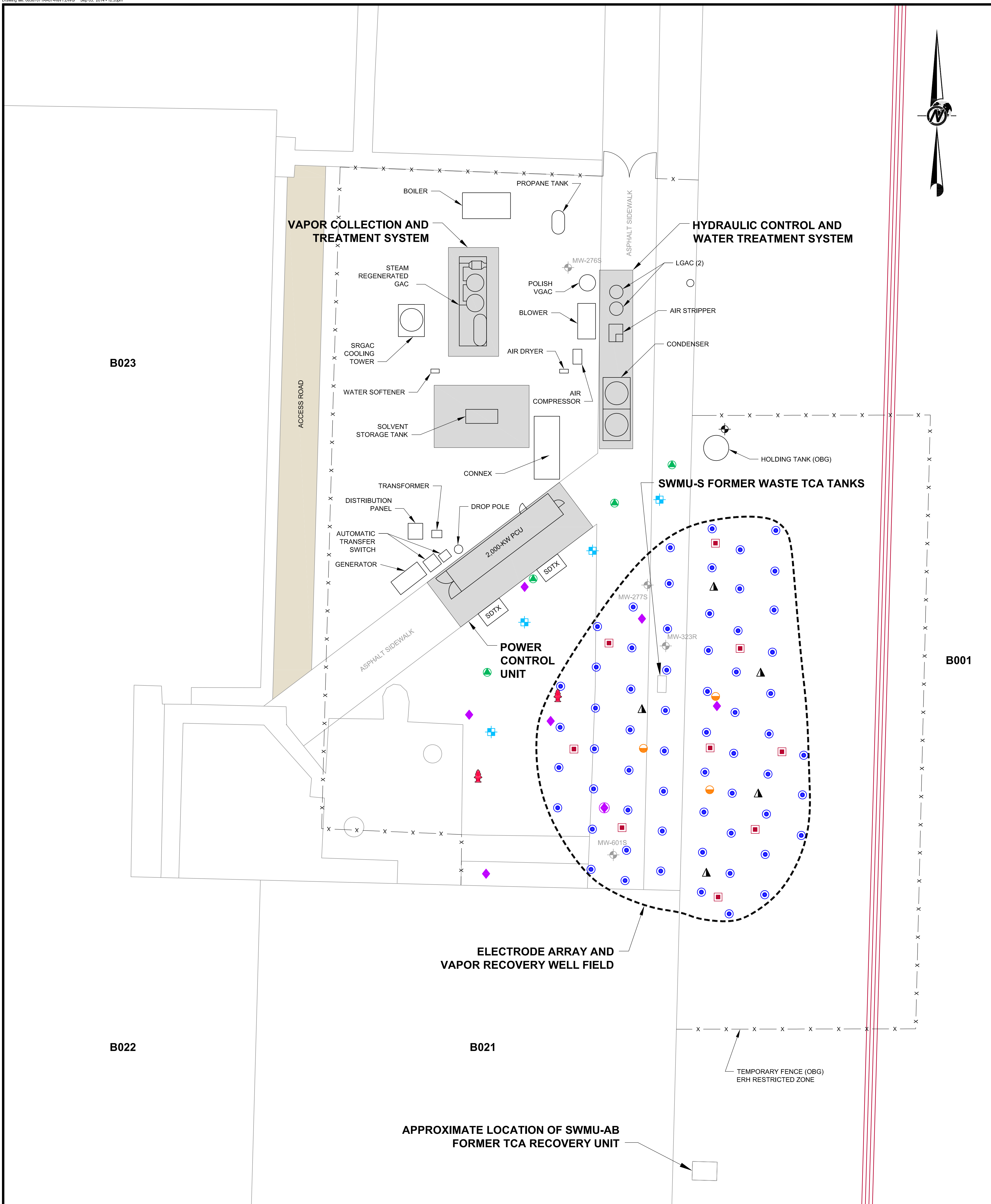
Description	Waste Stream	Media	Layers	Description	Potentially Hazardous	Potential Waste Code TCLP/Toxicity		Recoverable	Site Handling	Approximate Quantity	Transporter	Preliminary Disposal Facility
Thermal Treatment Well installation (electrodes, hydraulic control wells, monitoring well)	Soils: 7 to 35 ft bgs	Solid	NA	Subsurface soils in treatment area; high odor, high VOC, assumed hazardous	Y	D040	Other possible - D028, D029	N	Stored on protective sheeting or in hazardous roll off. Covered with protective sheeting.	2 drums	TBD	CWM Model City Ultimate Incineration Facility TBD
	Soils: 7 to 35 ft bgs	Solid	NA	Subsurface soils on periphery of treatment area; low odor, low VOC, hazard classification pending analysis	Y	D040	Other possible - D028, D029	N	Stored on protective sheeting or in hazardous roll off. Covered with protective sheeting.	51 tons	TBD	CWM Model City
	Soils: ground surface to 7 ft bgs	Solid	NA	Shallow subsurface soils; generator knowledge, not contaminated	N	NA	NA	N	Stored on protective sheeting or in roll off. Covered with protective sheeting. Re-use onsite in accordance with ISMP.	12.2 tons	NA	NA
	NAPL	Liquid	Single	Brownish-yellow liquid; likely hazardous waste	Y	D040, D039	Other possible - D028, D029	N	Accumulated in drums. < 90 day storage within secondary containment, secured area.	3 gal	TBD	CWM Model City Ultimate Incineration Facility TBD
	Groundwater	Liquid	Single	Water generated during well installation; hazard classification pending analysis	Y	D040, D039	Other possible - D028, D029	N	Accumulated in drums. < 90 day storage within secondary containment, secured area.	8 drums	TBD	CWM Model City Ultimate Incineration Facility TBD
Hydraulic Recovery Well installation (4 wells with accompanying sentinel wells)	Groundwater	Liquid	Single	Water generated during well installation/testing; hazard classification pending analysis	Y	D040, D039	Other possible - D028, D029	N	Accumulated in frac tank(s). Hold in <90 day storage within secondary containment, secure area. Treat in ISTD water treatment system.	2,400 gal	TBD	CWM Model City Ultimate Incineration Facility TBD
New Discharge Line Installation	Soils: ground surface to 4 ft bgs	Solid	NA	Shallow subsurface soils; generator knowledge, not contaminated	N	NA	NA	N	Perform confirmatory sampling. Return to trench.	140 tons	TBD	TBD
Contractor Remediation Contact Material	Gloves, Tyvek, tarps	Solid	NA	Assumed non-hazardous	N	NA	NA	N	Disposal in industrial waste landfill.	0.5 ton	Waste Management	WM of NY - High Acres Landfill Fairport, NY
Thermal Treatment Condensate	Vapor Condensed NAPL (from VGAC)	Liquid	Single	Brownish-yellow liquid; hazard classification pending analysis	Y	D040, D039	Other possible - D028, D029	Y	Accumulated in containers. < 90 day storage within secondary containment, secured area.	2,195 gal	TBD	TBD
Liquid Phase GAC	GAC	Solid	NA	Depleted liquid GAC; hazard classification pending analysis	N	NA	NA	N	Disposal in industrial waste landfill.	7,000 lb	Waste Management	WM of NY - High Acres Landfill Fairport, NY
Vapor Phase GAC	GAC	Solid	NA	Depleted vapor-phase GAC; hazard classification pending analysis	N	NA	NA	N	Disposal in industrial waste landfill.	1 ton	Waste Management	WM of NY - High Acres Landfill Fairport, NY
Inline Bag Filters	Filter media/cartridges	Solid	NA	Spent filter cartridge; hazard classification pending analysis	N	NA	NA	Y	Disposal in industrial waste landfill.	2 drums	TBD	TBD
Contractor Rubbish/Debris - Non-Contact	General trash	Solid	NA	General contractor trash; assumed non-hazardous	N	NA	NA	N	Off-site disposal. Accumulate for sanitary landfill disposal.	1 ton	Waste Management	WM of NY - High Acres Landfill Fairport, NY
	Construction Debris	Solid	NA	Construction Debris; assumed non-hazardous	N	NA	NA	N	Disposal in industrial waste landfill.	200 tons	Waste Management	WM of NY - High Acres Landfill Fairport, NY

Notes:

1) Summary of waste stream monitoring program based on information provided by O'Brien & Gere
2) ft bgs = feet below ground surface
3) TCLP = toxicity characteristic leaching procedure
4) NA = not applicable
5) VOC = volatile organic compound
6) TBD = to be determined
7) NAPL = non-aqueous phase liquid
8) GAC = granular activated carbon
9) VGAC = vapor-phase granular activated carbon
10) Disposal facility must be approved by IBM
11) Waste accumulation areas to be defined by IBM, TRS and O'Brien & Gere.
12) No Hazardous Waste shall be accumulated on site for more than 90 days.
13) Depth from ground surface to 7 ft bgs is unsaturated sand and estimates to date indicate this layer is largely free of contamination
14) Depth to confining layer is approximately 33 to 35 ft bgs; maximum well depth is anticipated to be 35 ft bgs
15) Groundwater collected and temporarily stored in holding tank during thermal treatment well installation will be treated in the existing GTF prior to discharge
16) Waste Characterization Parameters will be identified based on requirements of the selected disposal facility

FIGURES

Drawing file: 08387071AA07-Rev1.DWG Sep 03, 2014 - 12:35pm



LEGEND

- INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES
- B005 — BUILDING NUMBER
- EXISTING MONITORING WELL
- SWMU S ISTD TREATMENT AREA
- CO-LOCATED ELECTRODE AND VAPOR RECOVERY WELL LOCATION
- SENTINEL WELL
- GROUNDWATER RECOVERY WELL
- TEMPERATURE MONITORING POINT
- FIRE HYDRANT
- INTERIM PERFORMANCE MONITORING SAMPLING LOCATION
- PRELIMINARY AND CONFIRMATION COMPLETION PERFORMANCE MONITORING SAMPLING LOCATION
- VACUUM MONITORING POINT
- CO-LOCATED TEMPERATURE AND VACUUM MONITORING POINT
- NEW MONITORING WELL

NOTE

1.) ALL LOCATIONS ARE APPROXIMATE AND WILL BE ADJUSTED AS APPROPRIATE BASED ON ACTUAL FIELD CONDITIONS.

REFERENCES

1.) BASE MAP TAKEN FROM DIGITAL CAD FILE SITEMAP.DWG, DRAWING NUMBER 93002-SITEMAP/2 ENTITLED "SITE MAP," DATED MAY 9, 2005, PROVIDED BY GROUNDWATER SCIENCES CORPORATION.

2.) INACTIVE SUBSURFACE INDUSTRIAL WASTE LINES TAKEN FROM DIGITAL FILE 3002-108-I3.DWG, ENTITLED "LOCATION MAP," DATED MARCH 5, 2009, PREPARED BY GROUNDWATER SCIENCES CORPORATION.

3.) ASPHALT SIDEWALK, TEMPORARY FENCE, SECONDARY CONTAINMENT STRUCTURES, ELECTRODES, TEMPERATURE MONITORING POINTS, SENTINEL WELLS, GROUNDWATER RECOVERY WELLS, FIRE HYDRANTS AND TREATMENT AREA DIGITIZED FROM A HARDCOPY FILE ENTITLED "SITE PLAN WITH ELECTRODE LOCATIONS," SHEET Y-1, DATED ,MAY 9, 2014, PREPARED BY TRS.

15 0 15 30
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
1	09/03/14	DPG	ADDED NOTE 1	RG	DPG	CDH

PROJECT
FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE
SWMU S ISTD SYSTEM PERFORMANCE MONITORING SAMPLE LOCATION MAP

NJ Authorization #24GA28029100

Golder Associates
Newark, New Jersey

PROJECT No.		083-87071
DESIGN	DPG	05/22/14
CADD	RG	05/22/14
CHECK	DPG	05/22/14
REVIEW	CDH	05/22/14

FILE No. 08387071AA07
SCALE AS SHOWN REV. 1

FIGURE E-1

ATTACHMENT E-1

"HOT" SAMPLING STANDARD OPERATING PROCEDURE

ATTACHMENT E-1

"HOT" SAMPLING STANDARD OPERATING PROCEDURE

SOLID WASTE MANAGEMENT UNIT S: FORMER B001 WASTE TCA TANKS

Former IBM Kingston Facility
Site #356002
Order on Consent Index No. D3-10023-6-11

Prepared By: International Business Machines Corporation
8976 Wellington Road
Manassas, VA 20109

September 2014 **Project No.: 083-87071.05**

A world of capabilities delivered locally

Golder Associates

Table of Contents

1.0 INTRODUCTION

Golder Associates Inc. prepared this Standard Operating Procedure (SOP) for the performance of “hot” (i.e., soil and/or groundwater at temperatures greater than 38 degrees Celsius [°C] or 100 degrees Fahrenheit [°F]) soil and groundwater sampling that will be utilized to collect system performance samples during the operation of the in situ thermal desorption (ISTD) interim corrective measure (ICM) recommended to remove and/or treat dense non-aqueous phase liquid (DNAPL) present in Solid Waste Management Unit (SWMU) S: Former Building B001 Waste 1,1,1-Trichloroethane (TCA) Tanks (SWMU S) at the former IBM Kingston Facility (site) located at 300 Enterprise Drive, Kingston, Ulster County, New York.

The sampling methodologies described herein are intended to supplement Standard Operating Procedure (SOP)-2 *Temporary Monitoring Well Installation and Groundwater Sample Collection* and SOP-6 *Soil Boring and Soil Sampling Procedures* contained in the Quality Assurance Project Plan (QAPP) attached to the Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plans (RFI WPs) submitted to the New York State Department of Environmental Conservation (NYSDEC) in March 2009.

1.1 Purpose and Objective

The purpose of this SOP is to describe the methodology to be utilized for the routine collection of ISTD system performance “hot” soil and groundwater samples. Soil and groundwater samples collected from within the SWMU S ISTD ICM treatment area during ICM system operation to evaluate remedial progress and following ICM operation to confirm the Remedial Action Objective (RAO) has been achieved will be collected from the treatment area while the subsurface remains at elevated temperatures, due to the use of electrical resistance heating (ERH) technology to achieve thermal desorption.

This SRP Monitoring Plan describes the means and methods by which system performance monitoring will be conducted and soil and groundwater samples will be collected and submitted for analysis of the site-specific volatile organic compound (VOC) list of constituents of concern (COCs) by Environmental Protection Agency (EPA) Method 8260C.

2.0 HOT SAMPLING PROTOCOL

The following sections describe the protocol for SWMU S treatment area hot sampling events.

2.1 Safety Concerns

The implementation of the ISTD ICM in the SWMU S area utilizes ERH to heat the subsurface to elevated temperatures (i.e., up to 100°C) by the natural resistance of the subsurface materials (i.e., sands, silts, and clays) to the flow of electrical current between electrodes installed in the subsurface. To eliminate the risk posed by electrical hazards to site personnel conducting performance monitoring sampling, the ERH power control unit (PCU) must be de-energized prior to each sampling event and lockout/tagout (LOLTO) procedures implemented for the duration of the sampling event. LOTO procedures are included as Attachment E-1 of this SOP.

Sampling personnel must be aware that steam, hot water, hot soil, and other hot surfaces may be encountered during ICM performance evaluation sample collection activities and use proper precautions and the appropriate personal protective equipment (PPE).

2.2 Equipment

In addition to the equipment described in SOP-6 *Soil Boring and Soil Sampling Procedures* included in the QAPP, the following reusable and expendable equipment and materials are required to conduct hot soil sampling:

- LOTO equipment
- Ice
- Ice bath for soil samples: a large cooler (i.e., of sufficient length to fully accommodate the five foot inner macro-core sleeves) filled with ice, cooler must be equipped with a drain to allow melted water to be removed from the cooler
- Standard cooking thermometer, calibrated to zero (0) degrees Celsius (°C) and 100°C

2.3 Soil Procedures

In addition to the methods described in SOP-6 *Soil Boring and Soil Sampling Procedures* included in the QAPP, the following procedures will be utilized during the performance of SWMU S treatment area hot soil sampling events:

1) Schedule the ERH PCU de-energization for 12 hours prior to field mobilization.
2) Upon arrival, confirm ERH PCU is de-energized and institute LOTO procedures.
3) Fill the cooler obtained for use as an ice bath with ice; open the drain valve.
4) Collect soil samples cores via Geoprobe® Direct Push Technology (DPT) using a Geoprobe® steel macro-core sampler and procedures described in SOP-6 utilizing either dedicated inner Teflon® sleeves or reusable brass or stainless steel sleeves. If reusable

sleeves are utilized, follow decontamination procedures described in SOP-5 *Equipment Decontamination*.

5) Following removal of sample core sleeves from the macro-core sampler, immediately cap sample core sleeves and place in the ice bath to begin cooling process. Make sure the drain valve on the cooler is open as the sample core sleeves should not be submerged in water at any time.

6) Allow sample core sleeves to cool until temperatures reach approximately 20°C (i.e., 70° Fahrenheit [F]); insert the standard cooking thermometer through the sample core sleeve end cap to monitor soil temperature.

7) Collect soil samples for analysis of VOCs in accordance with procedures described in SOP-6 and handle in accordance with SOP-3 *Chain-of-Custody Procedures*.

8) Residual soil cuttings not utilized for analytical samples will be handled in accordance with SOP-8 *Investigative Derived Waste Procedures*.

2.4 Groundwater Procedures

In addition to the methods described in SOP-2 *Temporary Monitoring Well Installation and Groundwater Sampling Procedures* included in the QAPP, the following procedures will be utilized during the performance of SWMU S treatment area hot groundwater sampling events:

1) Schedule the ERH PCU de-energization for 12 hours prior to field mobilization.

2) Upon arrival, confirm ERH PCU is de-energized and institute LOTO procedures.

3) Fill the cooler obtained for use as an ice bath with ice; make sure the drain valve is closed.

4) Collect groundwater grab samples utilizing Geoprobe® techniques (i.e., SP-15-Sampler or DT-21-Profiler) via procedures described in SOP-2 *Temporary Monitoring Well Installation and Groundwater Sampling Procedures.* Groundwater may be hot therefore all glassware should be handled appropriately, placing bottles either in their foam holders or on the ground prior to filling. Follow decontamination procedures described in SOP-5 *Equipment Decontamination* between samples.

5) After collecting the appropriate sample volume, place sample in cooler on ice and handle in accordance with SOP-3 *Chain-of-Custody Procedures*.

2.5 Quality Assurance/Quality Control

Various quality assurance/quality control (QA/QC) samples will be collected in accordance with the procedures described in SOP-2 *Temporary Monitoring Well Installation and Groundwater Sampling Procedures*.

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

Africa	+ 27 11 254 4800
Asia	+ 852 2562 3658
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Inc.
744 Broad Street, 25th Floor
Newark, NJ 07102 USA
Tel: (973) 645-1922
Fax: (973) 645-1588

Golder Associates