September 11, 2013 Order on Consent Index No.: D3-10023-6-11

VIA EMAIL

Mr. Wayne Mizerak
New York State Department of Environmental Conservation
Department of Environmental Remediation
625 Broadway
9th Floor
Albany, NY 12233-7250

RE: BASIS OF DESIGN – ISTD REMEDY
SOLID WASTE MANAGEMENT UNIT S
FORMER IBM KINGSTON FACILITY
KINGSTON, ULSTER COUNTY, NEW YORK

Dear Mr. Mizerak:

Golder Associates Inc. (Golder) is pleased to provide this letter summarizing the in situ thermal desorption (ISTD) remedy selected for Solid Waste Management Unit S (SWMU S) at the former International Business Machines Inc. (IBM) Kingston Facility located at 300 Enterprise Drive in Kingston, New York (site). ISTD was identified and proposed for implementation as a remedy for SWMU S in the *Supplemental Feasibility Study: SWMU S: Former Building B001 Waste TCA Tanks* (SWMU S FS) submitted to the New York State Department of Environmental Conservation (NYSDEC) on March 21, 2013. The information presented herein includes a 30%-level design description of the ISTD technology and a discussion of the means and methods by which the remedy will be implemented. A comprehensive remedial action work plan (RAWP) will be submitted to NYSDEC upon completion of the 90%-level remedy design.

1.0 PROJECT BACKGROUND

The site was formerly 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 the October 4, 1996 Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Permit #3-5154-00067/00090 (6 NYCRR Part 373) (Permit) until the Administrative Order on Consent Index No. D3-10023-6-11 (Order) was signed with NYSDEC by IBM and TechCity Inc. (TechCity) on July 8, 2011.

The current site owner, TechCity, is in the process of redeveloping the property. As part of its redevelopment plans, TechCity intends to demolish or decommission portions of buildings and historical infrastructure. These activities will make SWMU areas that were previously inaccessible available for further investigation.

Pursuant to requirements in the Order, which replaced the RCRA Permit in 2011, IBM performed supplemental investigations of SWMU S to evaluate the subsurface for the presence of potential sources of volatile organic compound (VOC) impacts to site soil and groundwater. The supplemental investigation performed in the SWMU S area identified the presence of a dense non-aqueous phase liquid (DNAPL) composed predominantly of 1,1,1-trichloroethane (TCA). The following presents a description of the remedial technology selected following evaluation of alternatives in the SWMU S FS to remove and/or treat DNAPL and associated soil and groundwater impacts in the SWMU S area and a discussion of the means and methods by which this remedy will be implemented.

2.0 IN-SITU THERMAL DESORPTION

The ISTD remedy is designed to remove/treat DNAPL and associated impacted soil and groundwater via contaminant volatilization, enhanced soil vapor extraction efficiency, and increased biological degradation and chemical dechlorination reaction rates. For the purposes of this remedial action, ISTD will be implemented utilizing electrical resistive heating (ERH). The 30%-level Basis for Design document (BOD) developed by the selected ISTD remedy subcontractor, TRS Group Inc., is included as an attachment to this letter (Attachment A). The BOD provides a conceptual level description of the ERH remedy that will be implemented for SWMU S as summarized herein.

ERH consists of introducing a flow of electrical current between electrodes installed in the subsurface to elevate subsurface temperatures (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 contaminants. 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 a carbon vessel.

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 introduced by the ERH system. 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. Liquid TCA azeotropically boils at 65 ºC when in contact with water. Therefore, hydrolysis and azeotropic boiling of TCA will occur simultaneously.

Three-phase 220-volt electricity will be obtained from the municipal utility provider. A power control unit will distribute electrical current through subsurface electrodes installed in the treatment area. The electrode array will be 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.

2.1 Remedy Implementation

Golder anticipates the ISTD remedy will be operated for approximately four months. The preliminary design for implementation of the ISTD remedy includes the installation of approximately 60 variably-spaced electrodes to a depth of approximately 34 feet bgs (see Attachment A for 30% BOD) within a treatment area comprising approximately 2,532 square feet (ft^2), as indicated on Figure 1.

Electrodes installed in the center of the treatment area, where TCA impacts are the highest, will be placed closer together while electrodes installed on the periphery of the treatment area will have a greater spacing. The increased density of electrodes in the area of greatest impact will enable a larger amount of energy to be directed to portions of the treatment area requiring more power to achieve the remedial action objective (RAO) and provide increased control over the distribution of energy to the subsurface as well as the necessary energy to overcome the effects of the high groundwater flux (i.e., up to 2 feet per day) in the saturated Surficial Sand Unit that will act as a heat sink.

Temperature monitoring probes will be installed with the electrodes to provide continuous temperature monitoring data. The electrodes and associated piping and cables will be completed above grade. Piezometers will be installed at each of the temperature monitoring probe locations to provide subsurface pressure monitoring capabilities to confirm that negative pressure is maintained for capture of the steam vapors generated during ISTD.

2.2 Environmental Controls

The following sections discuss the environmental controls that will be employed to manage the waste streams (i.e., vapor, water, and recoverable liquid DNAPL) generated during remedy operation.

To control public access and secure infrastructure integrity, a security fence will be constructed around the treatment area and associated remedy infrastructure. Treatment area security will include video monitoring and motion sensing devices within the interior of the fence that will de-energize the ERH system and immediately notify responsible personnel in the event of an unauthorized breach of the perimeter.

2.2.1 Vapor Collection and Emission Monitoring

During the ISTD process, a vacuum is applied to the 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. Recovered steam will be passed through a condenser that will include a heat exchanger and two cooling towers. An automatic shutdown alarm will be incorporated into the vapor recovery system that will de-energize the system in the event that a low vacuum is detected in the manifold to the electrode array. Condensed steam will be directed through two knock-out tanks and will be recovered for use as process cooling water.

Vapor treatment will be achieved using a steam regenerated granular activated carbon (SRGAC) system. The SRGAC system will consist of two carbon vessels that will operate in alternating cycles. While one unit is in operation, the second unit will be undergoing 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.

The steam utilized to regenerate the SRGAC vessels will be produced by a propane-fired boiler. 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 vapor granular activated carbon (VGAC) vessel that will provide final contaminant removal on the treated SRGAC effluent prior to discharge to the atmosphere.

A remedy-specific Community Air Monitoring Plan (CAMP) will be prepared and incorporated as an addendum to the existing site-wide CAMP. The remedy-specific CAMP will include ambient air monitoring requirements upwind and downwind of the treatment area and at the site perimeter, ambient air action levels for VOCs, and corrective action measures that will be implemented in the event action levels are exceeded. The air monitoring program will include:

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

2.2.2 Hydraulic Control

To prevent mobilization of VOCs, hydraulic control of the treatment area will be maintained through groundwater recovery wells installed downgradient of the treatment area. Sentinel groundwater monitoring locations will be installed approximately five feet downgradient of the groundwater recovery wells to monitor groundwater temperature and dissolved-phase concentrations of VOCs to confirm that groundwater capture has been achieved.

Groundwater collected during operation of the recovery wells will be directed through the SRGAC system. Treated effluent will be discharged to the existing site Groundwater Treatment system via new subsurface piping. The effluent will undergo additional processing prior to discharge under the existing State Pollutant Discharge Elimination System (SPDES) permit.

2.3 Performance Monitoring

To evaluate the progress of the ISTD remedy, Golder will collect soil and groundwater samples at the anticipated mid-point of remedy operation. Golder will collect soil samples from 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 (i.e., the contact between the Surficial Sand Unit and the underlying Transition Zone). Groundwater samples will be collected from temporary monitoring wells installed in the center of the observed DNAPL area and screened within the saturated portion of the Surficial Sand Unit and across stratigraphic the contact between the saturated Surficial Sand Unit and the Transition Zone. Analytical results from these performance monitoring samples will be used to evaluate relative progress of the ERH remedy.

Successful completion of remedial actions will be evaluated based on achieving the RAO as presented in the SWMU S FS (Golder, 2013): the removal and/or treatment DNAPL located in the SWMU S area, to the extent practicable, that serves as a source of impact to downgradient groundwater. Following remedy completion, Golder will conduct confirmation soil and groundwater sampling to demonstrate that ERH treatment is complete and begin demobilization and restoration efforts.

3.0 SCHEDULE

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 / vendors (free of electric or other energized sources, free of asbestos containing materials, etc.). The generic time table attached herein presents the estimated timeline for remedial execution upon IBM receiving unencumbered access to the treatment zone.

4.0 CLOSING

If you have any questions or require additional information, please contact the undersigned at (973) 645-1922.

Sincerely,

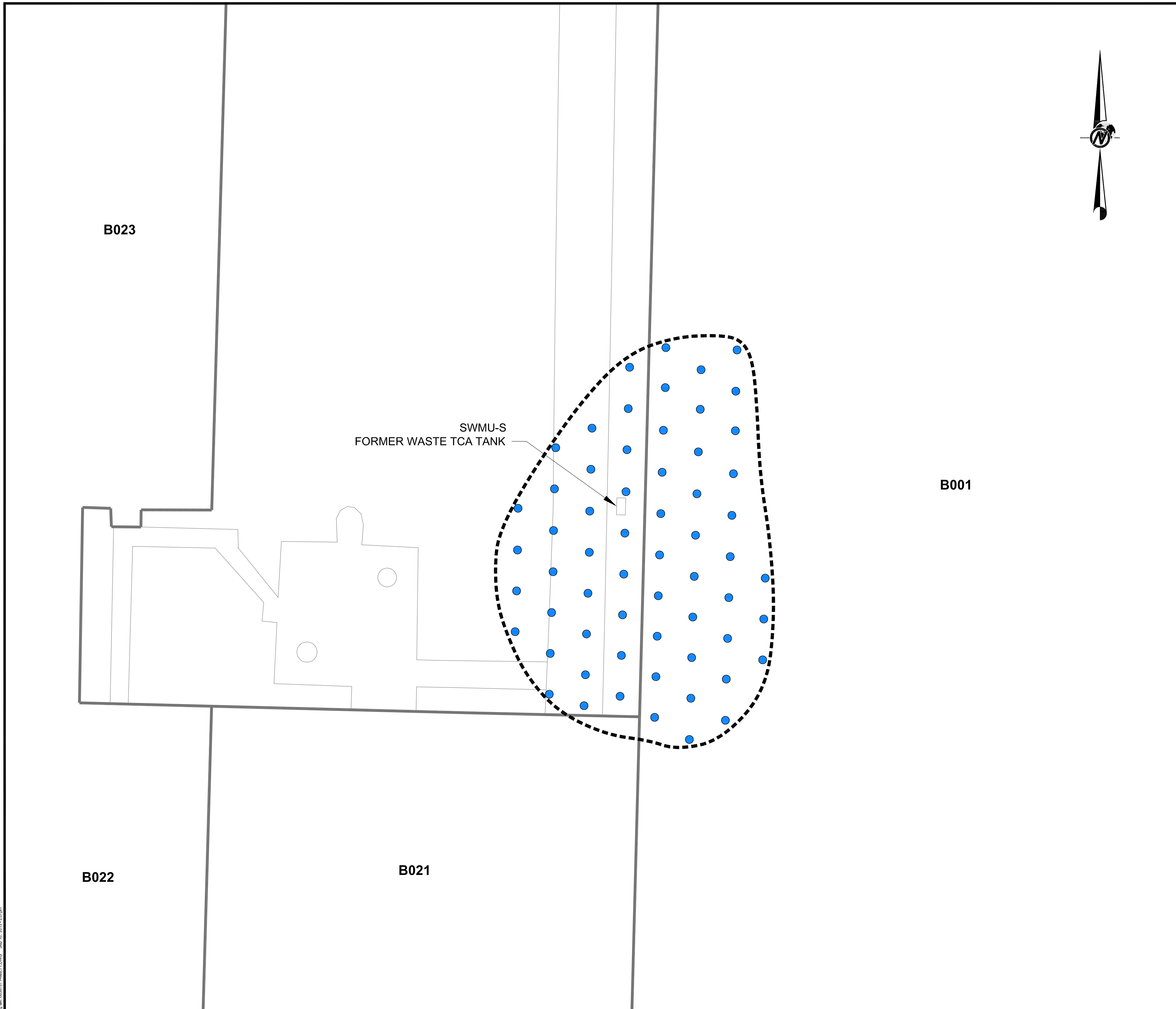
GOLDER ASSOCIATES INC.

Daniel P. Gorman
Senior Project Geologist

Christopher D. Hemingway, P.G.
Senior Consultant

cc: Michael J. Kominek, IBM
Patrick T. Martin, Golder Associates
Alistair P.T. Macdonald, Golder Associates
Dan Wieneke, TechCity

Attachments: Figure 1
Project Schedule
Attachment A: TRS Group 30% Basis of Design – ERH Remedy



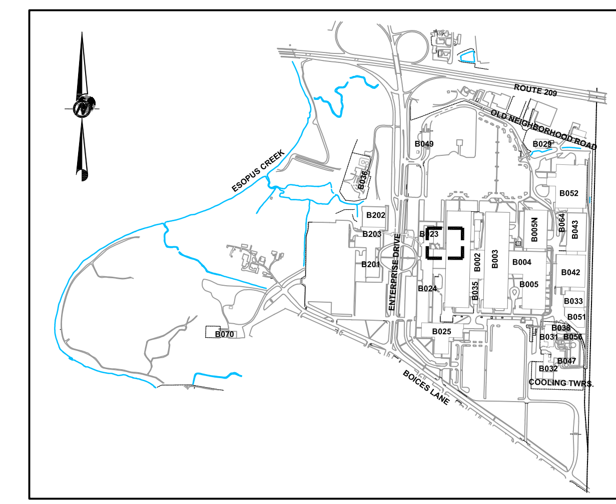
LEGEND

B005	BUILDING NUMBER
●	PROPOSED ERH ELECTRODE LOCATION
▬ ▬ ▬	ESTIMATED TREATMENT AREA

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.) ELECTRODE LOCATIONS DIGITIZED FROM A HARDCOPY FILE ENTITLED "SITE PLAN WITH ELECTRODE LAYOUT," SHEET Y-1, DATED JUNE 10, 2013, PREPARED BY TRS GROUP, INC.



KEY MAP

15 0 15 30
SCALE FEET

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW

PROJECT

FORMER IBM FACILITY
KINGSTON, NEW YORK

TITLE

SWMU S
REMEDY LOCATION MAP

NJ Authorization #24GA28029100

Golder Associates

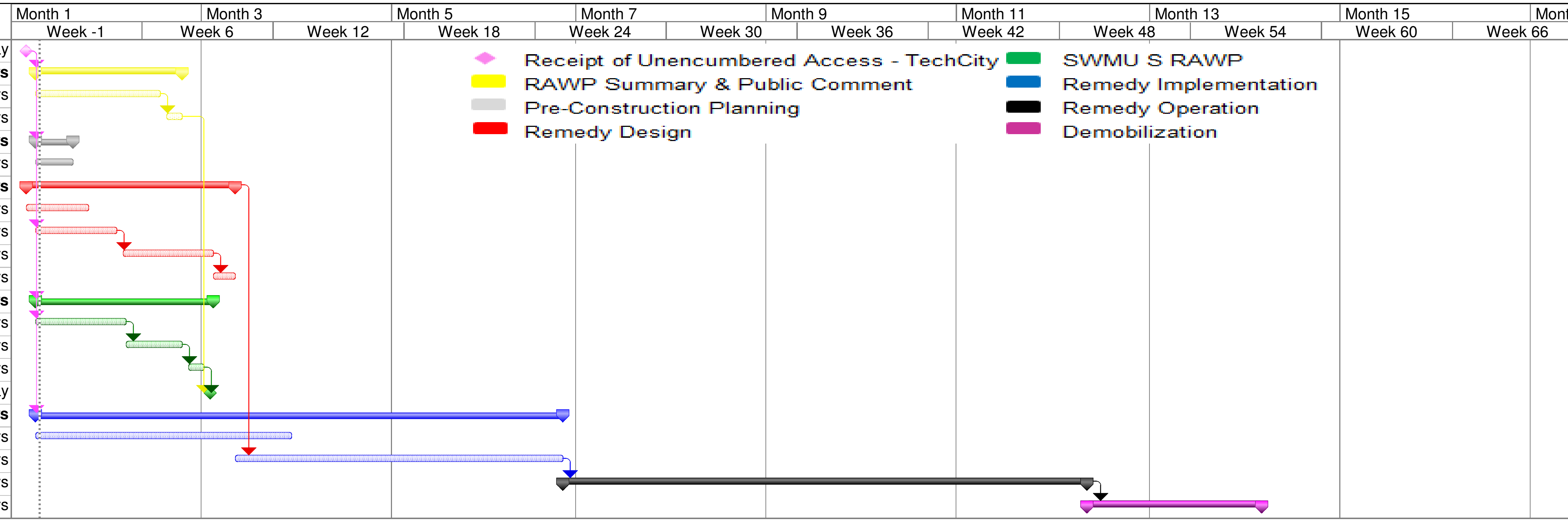
PROJECT No.		083-87071	FILE No.	08387071-Misc71
DESIGN	DPG	09/10/13	SCALE AS SHOWN	REV. 0
CADD	RG	09/10/13		
CHECK				
REVIEW				

FIGURE 1

Drawing file: 08387071-Misc71.DWG Sep 10, 2013 - 2:07pm

Former IBM Kingston SWMU S ISTD Remedy Implementation Schedule

ID	Task Name	Duration
1	**Receipt of Unencumbered Access to Building B001 from TechCity**	1 day
2	**RAWP Summary and Public Comment Period**	**35 days**
3	Public Comment Period	30 days
4	Response to Comments	5 days
5	**Pre-Construction Planning**	**10 days**
6	Utility Survey and Confirmation	10 days
7	**Remedy Design**	**47 days**
8	Electrical Design	14 days
9	90% Design	20 days
10	Site Civil Design	21 days
11	100% Design and Submittal	5 days
12	**SWMU S RAWP**	**41 days**
13	Submit DRAFT RAWP to NYSDEC	21 days
14	NYSDEC Review and Comment	14 days
15	DRAFT RAWP revisions	5 days
16	Submit FINAL RAWP to NYSDEC	1 day
17	**Remedy Implementation**	**121 days**
18	Procurement	60 days
19	Construction	75 days
20	**Remedy Operation**	120 days
21	**Demobilization**	40 days



Attachment A

TRS GROUP, Inc.

Basis of Design
Electrical Resistance Heating

Basis of Design

Electrical Resistance Heating

300 Enterprise Drive

Kingston, New York

Issued: September 2013

TRS Group, Inc.
2325 Hudson Street Longview, Washington 98632 www.thermalrs.com

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

BTU	British thermal unit
CAMP	community air monitoring program
CPVC	chlorinated polyvinyl chloride
CVOC	chlorinated volatile organic compound
1,1-DCA	1,1,-dichloroethane
1,2-DCA	1,2-dichloroethane
DNAPL	dense non-aqueous phase liquid
ERH	electrical resistance heating
ft	feet
ft^2	square foot
ft bgs	feet below grade surface
GAC	granular activate carbon
hp	horsepower
hr	hour
kW	kilowatt
lb	pound
LGAC	liquid-phase granular activated carbon
mg/kg	milligrams per kilogram
µg/l	micrograms per liter
OBG	O'Brien and Gere
PCE	Tetrachloroethene
PCU	power control unit
PEX	cross-linked polyethylene
PVC	polyvinyl chloride
RAWP	remedial action work plan
scfm	standard cubic feet per minute
SRGAC	steam regenerated granular actived carbon
1,1,1-TCA	1,1,1-trichloroethane
TCE	Trichloroethene
TMP	temperature monitoring point
TRS	TRS Group, Inc.
VGAC	vapor-phase granular activated carbon
VOC	volatile organic compound
VR	vapor recovery
yd^3	cubic yard

1.0 THERMAL REMEDIATION TECHNOLOGY

Electrical Resistance Heating (ERH) is an *in-situ* technology that uses the resistance of soil to generate heat in the subsurface. Groundwater and soil moisture are converted to steam and as a result, volatile organic compounds (VOCs) are removed via steam stripping and *in-situ* degradation to accomplish subsurface remediation. For some compounds like 1,1,1-trichloroethane (1,1,1-TCA), 1,2-dichloroethane (1,2-DCA), and 1,1,-dichloroethane (1,1-DCA) (the predominant compounds at this site), *in-situ* destruction by heat-enhanced hydrolysis a water substitution reaction) may be the primary mechanism of treatment rather than volatilization.

The ERH PCU uses 60-hertz utility transformers to direct conventional three-phase electricity from a municipal power line into the subsurface treatment region. The electricity is delivered throughout the subsurface by electrodes installed using standard drilling or construction techniques. The electrodes are connected to the power control unit (PCU) so that adjacent electrodes are in electrical contact, but out of phase, with one another. Because each electrode is electrically out of phase with the electrodes surrounding it, current flows between it and all adjacent electrodes. In this manner, the subsurface soil within the electrode array is saturated by the electrical current moving between the electrodes. It is the resistance of the subsurface to this current movement that causes heating. This electrical resistance warms the soil until the compounds are destroyed *in-situ* by hydrolysis or until the boiling point of the contaminant/water mixture is reached. The heat boils a portion of the soil moisture into steam and the steam causes the volatile contaminants to vaporize out of the soil and groundwater with steam serving as the carrier gas to sweep contaminants to the vapor recovery (VR) wells. Air withdrawn by vacuum from the vadose zone also serves as a carrier gas to convey the vapors to the VR wells.

The movement of steam is the driving mechanism for the transport of contaminant vapors in the subsurface. Because steam is produced *in-situ* during ERH and not injected under pressure, the only driving force for steam migration is gravity. The effect of buoyancy on steam below the water table is to force it directly upward toward the surface. The buoyant force is very strong and will find an upward path to the VR wells. Since the electrodes are constructed with a permeable backfill, they often provide the pathway of least resistance to the VR wells. By generating steam *in-situ*, ERH provides a carrier gas that sweeps VOCs out of all soil types, without regard to their permeability. *In-situ* steam generation allows TRS to effectively remediate low permeability and heterogeneous soils such as those found at the Site.

1.1 ERH at SWMU-S

The design for this project involves the installation of 61 electrodes installed to 34 feet below grade surface (ft bgs) over an 8,500 square foot (ft^2) area . On average, electrodes will be spaced between 12.5 and 13 feet (ft) apart. A typical ERH remediation has electrodes that are spaced between 15 and 20 ft apart. A tighter spacing design for this project provides the ability to put in the additional energy required to overcome any heat sink associated with a high groundwater flux through the upper sand interval. The electrodes will be installed using 12-inch outside-diameter hollow stem augers.

As a means of monitoring the ERH process, TRS will install temperature monitoring probes (TMPs) to provide continuous temperature data collection within the subsurface. Temperature data will be automatically recorded at least once per day from 6 TMPs at 6 different depth intervals. Each TMP will be constructed using 1¼-inch chlorinated polyvinyl chloride (CPVC) pipe and will include a TRS-installed string of temperature sensors that monitor temperatures at 5, 10, 15, 20, 25 and 30 ft bgs.

A pressure monitoring point will be co-located with each TMP to allow monitoring of the subsurface vacuum throughout operations.

The electrodes and associated piping and cables will be completed above grade. After drilling is complete, a security fence and security system will be installed to restrict access to authorized personnel only.

2.0 SYSTEM COMPONENTS AND MODE OF OPERATION

TRS has a large inventory of ERH specific components and will provide the following materials and equipment for the project.

- One TRS 2000-kW PCU that will delivery power to the electrodes and distribute 480 volt power to ancillary equipment;
- One TRS Condenser with heat exchanger, two 100-ton cooling towers, two knock-out tanks and associated pumps, controls and piping;
- One TRS 40-hp rotary lobe blower;
- A TRS dual-vessel steam regenerated granular activated carbon (SRGAC) system with associated controls, air diaphragm pumps and decanter;
- A TRS 680,000 BTU/hr boiler to supply steam to the SRGAC;
- A TRS 20 hp rotary screw compressor to supply air to SRGAC pumps and controls;
- A TRS Cooling tower & pump for SRGAC;
- A TRS Desiccant air drier for air-driven SRGAC controls;
- A TRS Ion exchange system to provide softened water for boiler;
- Two TRS autotransformers for improved voltage control at electrodes;
- One air stripper for water treatment;
- Three pneumatic hydraulic control pumps;
- One rented 2,000-lb VGAC;
- Two rented 1,000-lb LGAC vessels;
- Solenoids and piping for drip system, if needed;
- Conductive elements and backfill for electrodes;
- Cables and wiring for current delivery to electrodes and communications between equipment;
- Chemical resistant hose for VR wellhead assemblies;

- Fiberglass piping for small diameter runs of VR piping;
- Chlorinated polyvinyl chloride (CPVC) piping for piping diameters of 4-inch or greater and for piezometer construction;
- Polyvinyl chloride (PVC) piping for cooled vapor runs and cross-linked polyethylene (PEX) for water transport;
- Outside fence and TRS security system;
- Rented stainless steel dense nonaqueous phase liquid (DNAPL) storage totes; and
- Rented propane tank (if natural gas is not available) for boiler.

Once each of the components listed above are installed by TRS, or a TRS subcontractor, the system will be built to operate 24 hours per day for the anticipated operational duration of approximately 90 days. The system will have periods of downtime related to performance optimization and maintenance that will include the electrodes and vapor recovery system. Each of the components will be interlocked together to provide protection in the event of a malfunction. The interconnection and telemetry of the system will be finalized during the design process.

Based on the unique and varied distribution of soil electrical resistivity and VOC mass within the vertical and horizontal profile of the treatment area, TRS plans to incrementally heat different areas to better manage the impact of VOC solubility in the groundwater. Each electrode will have two conductive elements to provide this level of control. TRS plans to heat zones of low VOC mass first. These zones would be the shallow sand layer and the perimeter of the treatment area. These zones would be heated to a desired temperature before the high mass zones were turned on. The high VOC mass zones will be more electrically conductive and will more quickly heat up once turned on. With the shallow soils and groundwater pre-heated, the steam and volatilized VOCs produced from the transition zone and clay layer will have a continuous, warm, upwards path directly to the vapor recovery wells. This phased heating approach will reduce the potential for any condensation of VOCs in overlying, cool groundwater.

Due to the relatively high rate of groundwater flow through the upper saturated zone and to further reduce the potential impact of CVOC contamination from the heated zone, TRS will implement a hydraulic control system. The system will use three hydraulic control wells on the down gradient side of the treatment area and three sentinel wells five feet further down gradient to ensure that hydraulic control is maintained. The sentinel wells will be monitored for VOC concentrations, temperature and water level on a weekly basis. Groundwater from the wells will be treated by an air stripper and liquid granular activated carbon (LGAC) prior to discharge to the existing onsite water treatment facility.

The site-specific compounds for the SWMU-S have a moderatley low carbon adsorption rate, therefore TRS will be using a steam regenerated granular activated carbon (SRGAC) system for vapor treatment. The SRGAC system allows for on-site regeneration of the activated carbon to significantly decrease the costs associated with vapor treatment at sites that contain high VOC mass. The SRGAC contains two vessels, one of which is regenerated while the other is in operation. The SRGAC tolerates wide fluctuations in VOC influent concentrations. Each carbon vessel holds 1,400 pounds of a pelletized granular activated carbon. 1,1,1-TCA makes up 98% of the VOC mass so it will drive the carbon regeneration rate. The design will assume an 8% VOC loading using 2/3rds of the vessel capacity between regeneration cycles, each 1,400-pound carbon vessels will remove approximately 75 pounds of VOC mass between regenerations. The system can regenerate 14 times per day, thus providing treatment for a mass loading as high as 1,050 pounds of VOCs per day. There will be a secondary 2,000-lb polish VGAC vessel in line after the SRGAC system to provide additional protection from VOC emission, as needed. Should the SRGAC system meet the air permit discharge limits without the use of the 2,000-lb VGAC, the polish VGAC will be bypassed.

3.0 OPERATION GOALS AND OBJECTIVES

The primary operational goal is to complete each task and the entire project as safely as possible. The system will be engineered and operated to protect site personnel and the public from any physical hazards. The objective of the remediation is to remove the VOC source from the soil below SWMU-S that has been defined as achieving the soil and groundwater concentrations summarized in the table below.

Constituent of Concern	CAS No.	Free-Phase COC RAO	Sorbed-Phase Soil RAO	Dissolved-Phase Groundwater RAO
		-	(mg/kg)	(µg/l)
1,1,1-Trichloroethane	71-55-6	none present	1.0	10.0
1,1,2-Trichloroethane	79-00-5	none present	1.0	1.0
1,1-Dichloroethane	75-34-3	none present	1.0	50.0
1,1-Dichloroethene	75-35-4	none present	1.0	65.0
1,2-Dichloroethane	107-06-2	none present	1.0	1.0
1,2-Dichloroethene, total	540-59-0	none present	1.0	25.0
Freon 113	76-13-1	none present	1.0	5.0
Tetrachloroethene	127-18-4	none present	1.0	5.0
Toluene	108-88-3	none present	1.0	5.0
Trichloroethene	79-01-6	none present	1.0	200.0
Xylenes (mixed)	1330-20-7	none present	1.0	5.0

4.0 PERFORMANCE MONITORING AND DATA COLLECTION

The ERH system is designed with a central computer which uses custom software to automatically record performance data on a continuous or daily basis. TRS personnel will also monitor the system when on site and record manual readings to provide long term trending. The table below describes the operation and monitoring items that will be required during the ERH remediation.

A site specific sampling and analysis plan will be developed by OBG as part of the remedial action work plan (RAWP). When developed, the number and position of soil sampling locations will be established as well the locations for groundwater sampling. Each well inside the treatment area and the three sentinel wells down gradient will be sampled two times prior to starting the remediation. OBG will conduct one round of interim soil and groundwater sampling during ERH operations and one round of final soil sampling. The interim sampling events will occur at approximately 50 to 60% energy input unless TRS requests a delay due to operational information. Samples can be collected from any depth between grade and 32 feet below grade (ft bgs).

Golder will prepare a Community Air Monitoring Plan (CAMP) as part of the RAWP to monitor the air quality inside and around the ERH remediation. The CAMP will include the use of real time and laboratory monitoring techniques.

Operation/Maintenance Item	Performance Schedule	Performed By
Subsurface Temperatures	Daily	TRS
ERH Voltage, Current, and Power	Daily	TRS
Energy Input	Daily	TRS
Vapor Stream Concentration	Daily/As permit requires	OBG
Vapor Treatment System	Daily	TRS
Vacuum Piezometer	Daily	TRS
Total VR System Airflow and Vacuum	Daily	TRS
Individual Electrode Currents	Weekly	TRS
ERH Equipment Inspection	Daily	TRS
CAMP Monitoring	Daily	Golder
Surface voltage inside and around the treatment area (including inside building)	Weekly	TRS
Sentinel Well VOC concentration	Weekly	OBG
Confirmatory Soil Sampling	50% and Final	OBG
Confirmatory Groundwater Sampling	50% and Final	OBG

ELECTRICAL RESISTANCE HEATING DESIGN PACKAGE

Prepared by:

TRS
Accelerating Value

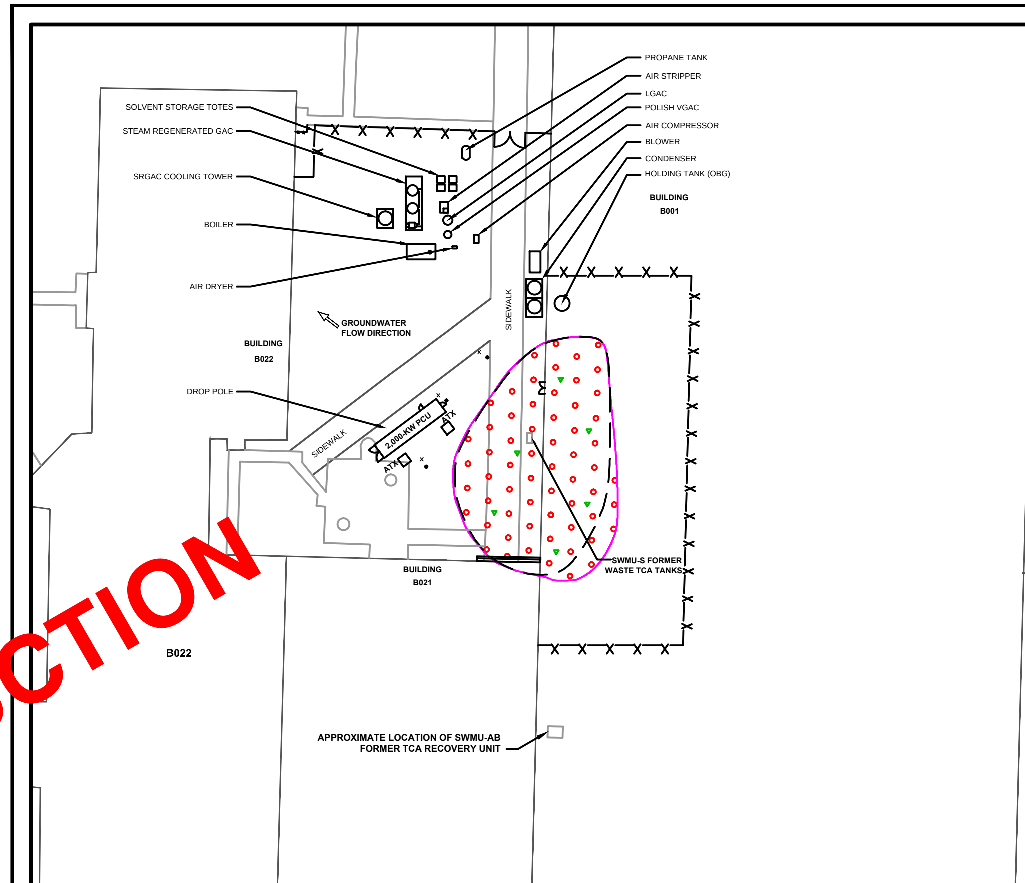
SEPTEMBER 2013

FORMER IBM FACILITY
KINGSTON, NEW YORK

SITE LOCATION MAP

N

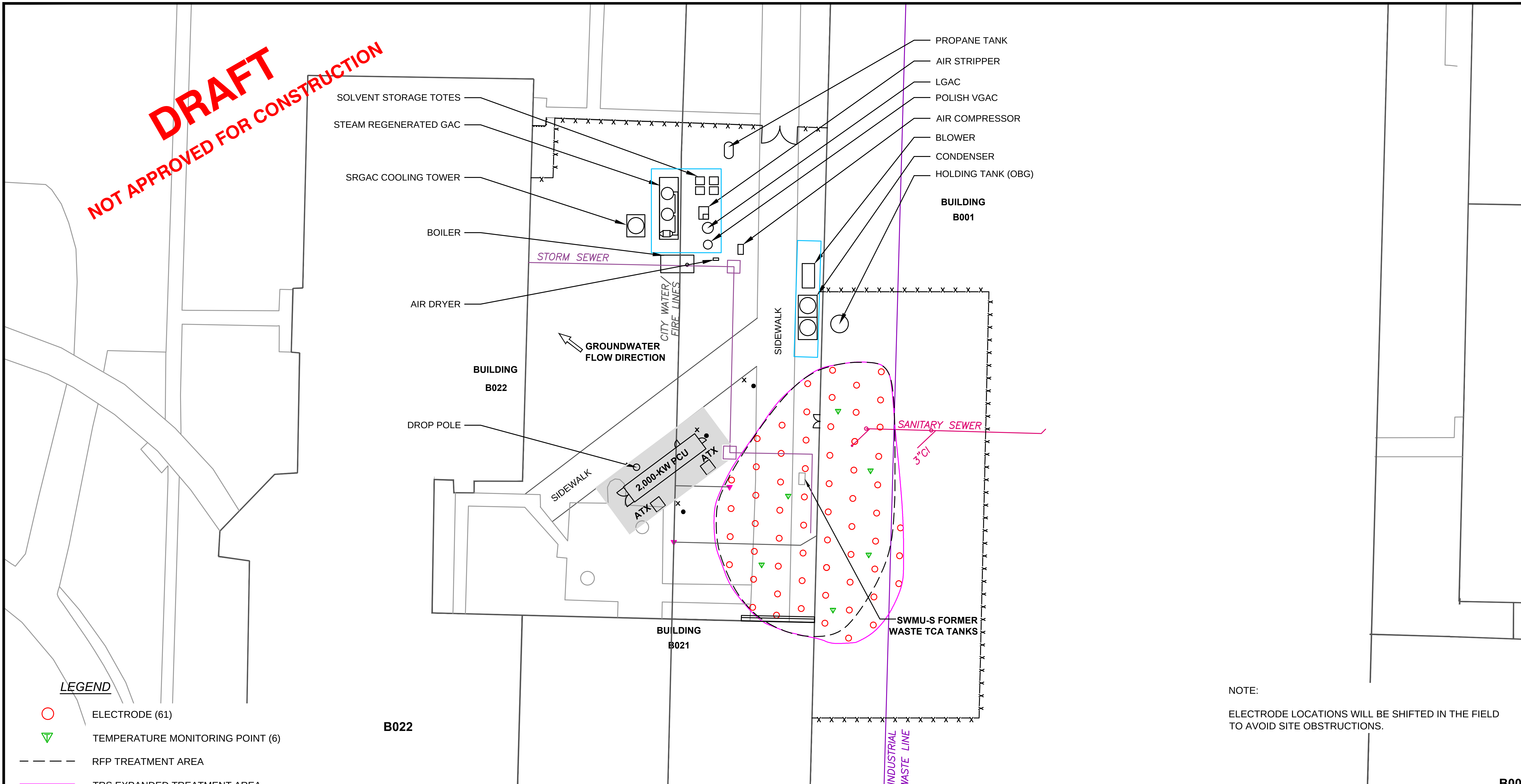
SHEET INDEX	
DRAWING NUMBER	TITLE AND DESCRIPTION
Y–1	SITE PLAN WITH ELECTRODE LOCATIONS
M–1	INTERIOR ELECTRODE DETAIL
M–2	EXTERIOR ELECTRODE DETAIL
M–3	INTERIOR TMP DETAIL
M–4	EXTERIOR TMP DETAIL
M–5	HYDRAULIC CONTROL WELL DETAIL
M–6	FENCE DETAIL
M–7	SENTINEL WELL DETAIL
P–2	VAPOR RECOVERY AND CONDENSING PROCESS FLOW DIAGRAM
E–1	ELECTRICAL ONE LINE



EXTENDED SITE PLAN

N

30% DESIGN
NOT APPROVED FOR CONSTRUCTION



LEGEND

○	ELECTRODE (61)
▽	TEMPERATURE MONITORING POINT (6)
— — —	RFP TREATMENT AREA
——	TRS EXPANDED TREATMENT AREA
X	SENTINEL WELL
●	GROUNDWATER RECOVERY WELL
——	SECONDARY CONTAINMENT
▼	FIRE HYDRANT (2)
▬	GRAVEL BASE FOR EQUIPMENT

0 20 40 80

SCALE IN FEET

NOTE:

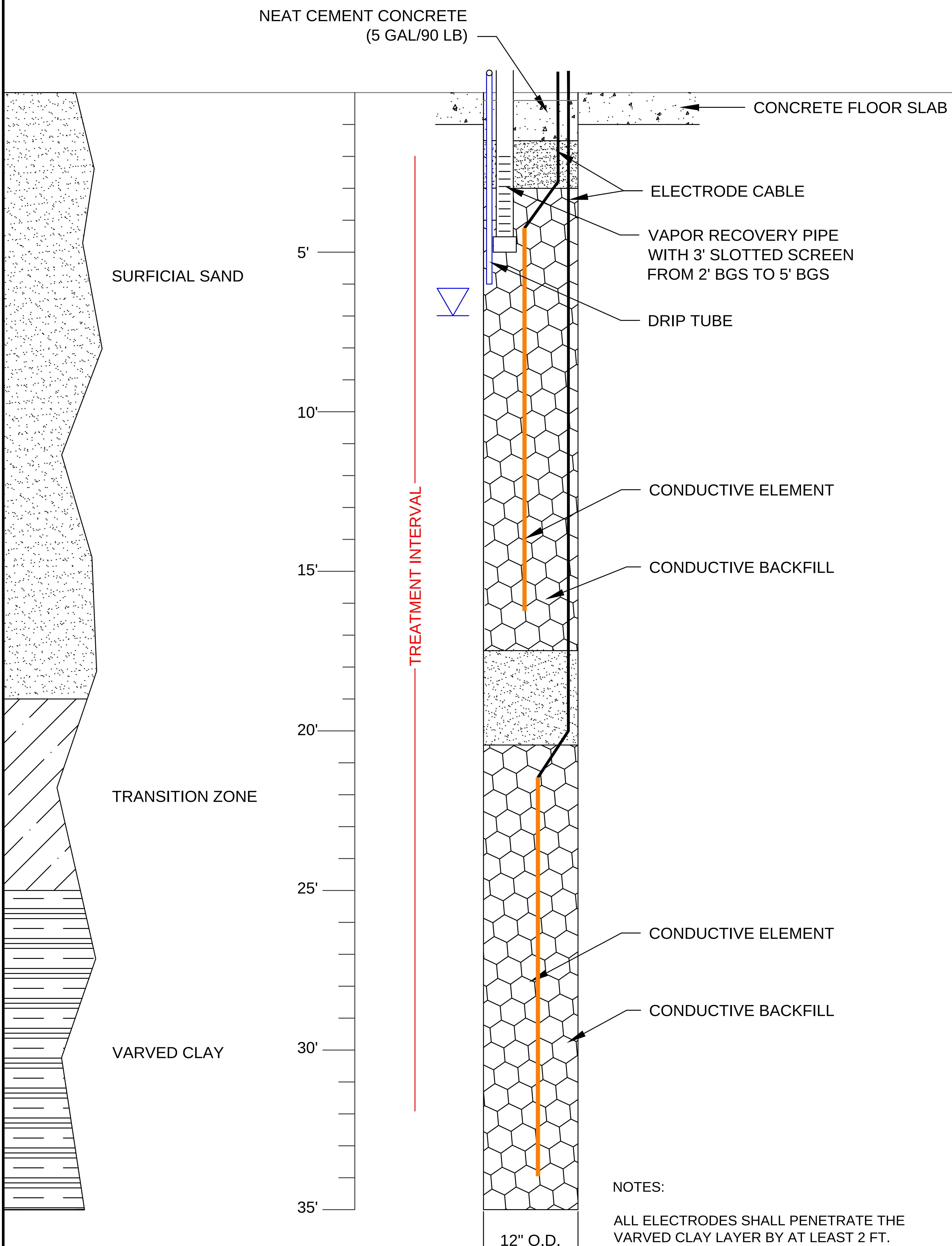
ELECTRODE LOCATIONS WILL BE SHIFTED IN THE FIELD TO AVOID SITE OBSTRUCTIONS.

DESIGNED BY	M. NANISTA
DRAWN BY	M. NANISTA
CHECKED BY	NOT CHECKED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY KINGSTON, NEW YORK
	SITE PLAN WITH ELECTRODE LOCATIONS
APPROVED FOR IMPLEMENTATION	BY ______ FOR ______ DATE
DATE	9/4/13
PROJECT	KIN41
SHEET	Y-1

DRAFT

Not Approved for Construction

INTERIOR ELECTRODE (TYPICAL OF 33)



NOTES:

ALL ELECTRODES SHALL PENETRATE THE VARVED CLAY LAYER BY AT LEAST 2 FT.

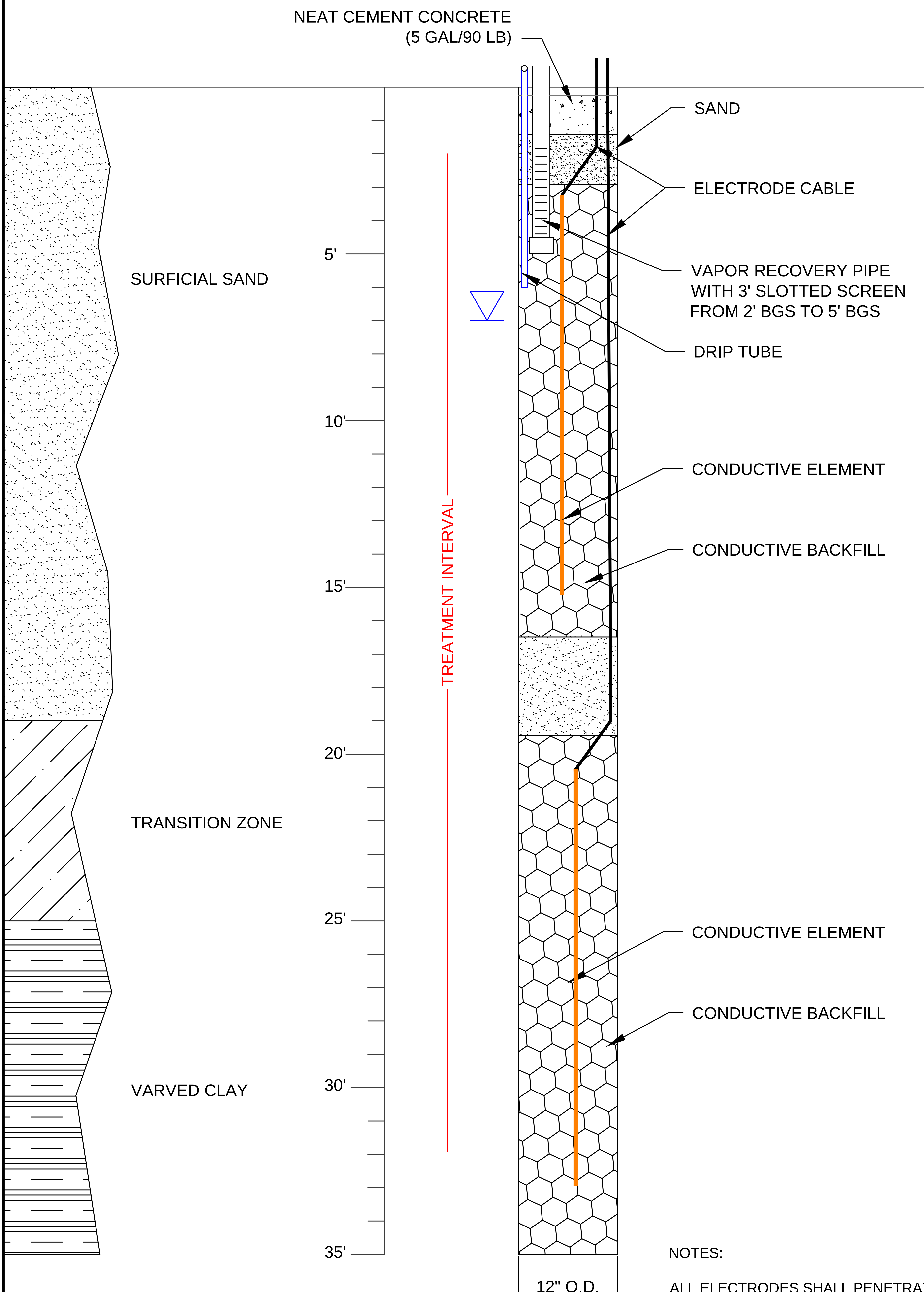
TRS Accelerating Value

DESIGNED BY: M. NANISTA	FOR: FORMER IBM FACILITY, KINGSTON, NEW YORK
DRAWN BY: A. PEABODY	INTERIOR ELECTRODE DETAIL
CHECKED BY: NOT APPROVED	
PROJECT MANAGER: B. POULIN	
APPROVED FOR CONSTRUCTION — BY: ____ DATE: ____	DATE: 8/27/13 — PROJECT: KIN41 — SHEET: M-1

DRAFT

Not Approved for Construction

EXTERIOR ELECTRODE (TYPICAL OF 28)



NOTES:

ALL ELECTRODES SHALL PENETRATE THE VARVED CLAY LAYER BY AT LEAST 2 FT.

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

EXTERIOR ELECTRODE DETAIL

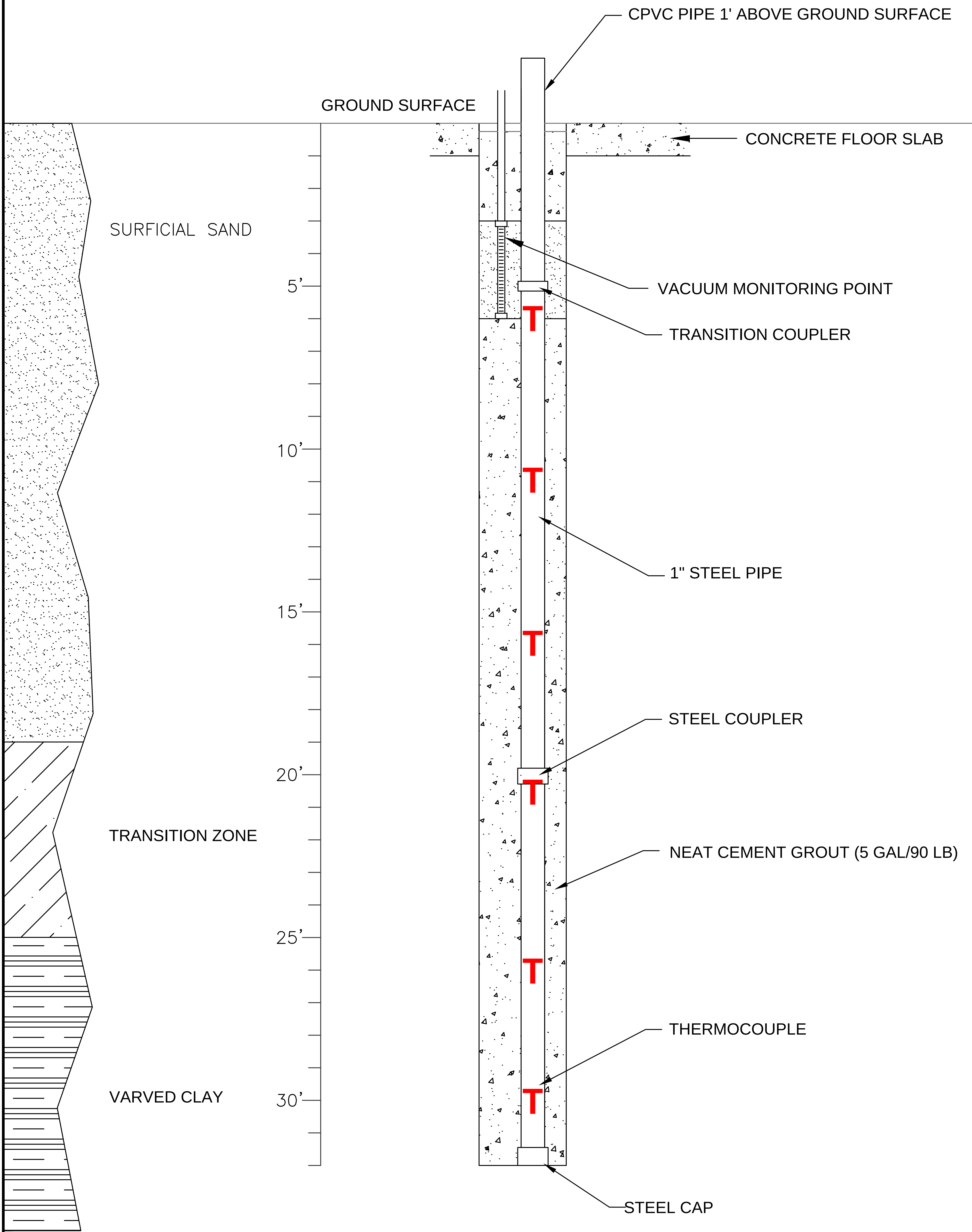
APPROVED FOR CONSTRUCTION
BY ____
DATE ____

DATE 8/27/13
PROJECT KIN41
SHEET M-2

DRAFT

Not Approved for Construction

INTERIOR TEMPERATURE MONITORING POINT (TYPICAL OF 4)



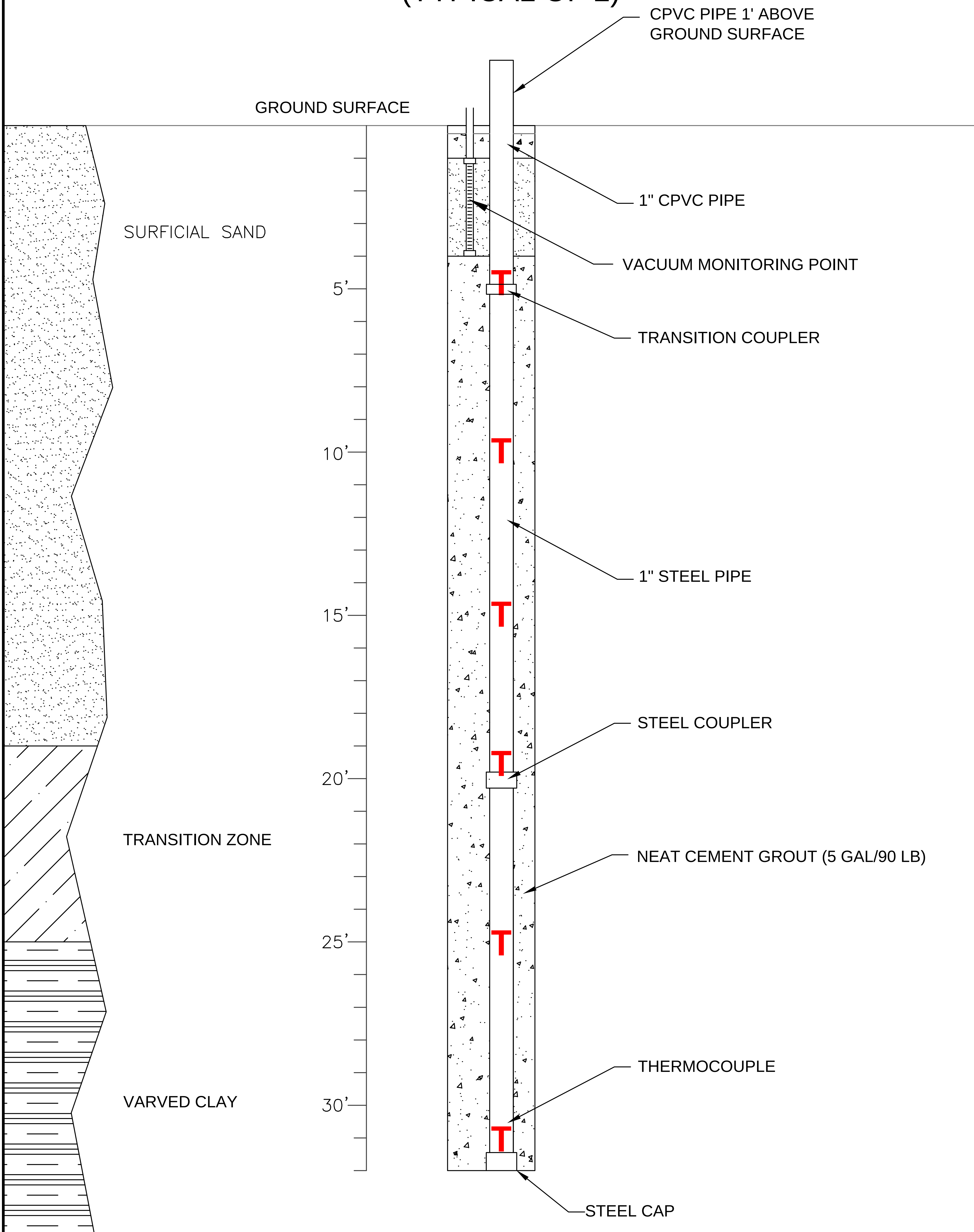
TRS Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
	INTERIOR TMP DETAIL
APPROVED FOR CONSTRUCTION	BY ____ DATE ____
DATE	8/27/13
PROJECT	KIN41
SHEET	M-3

DRAFT

Not Approved for Construction

EXTERIOR TEMPERATURE MONITORING POINT (TYPICAL OF 2)



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

EXTERIOR TMP DETAIL

APPROVED FOR CONSTRUCTION

BY

DATE

DATE 8/27/13

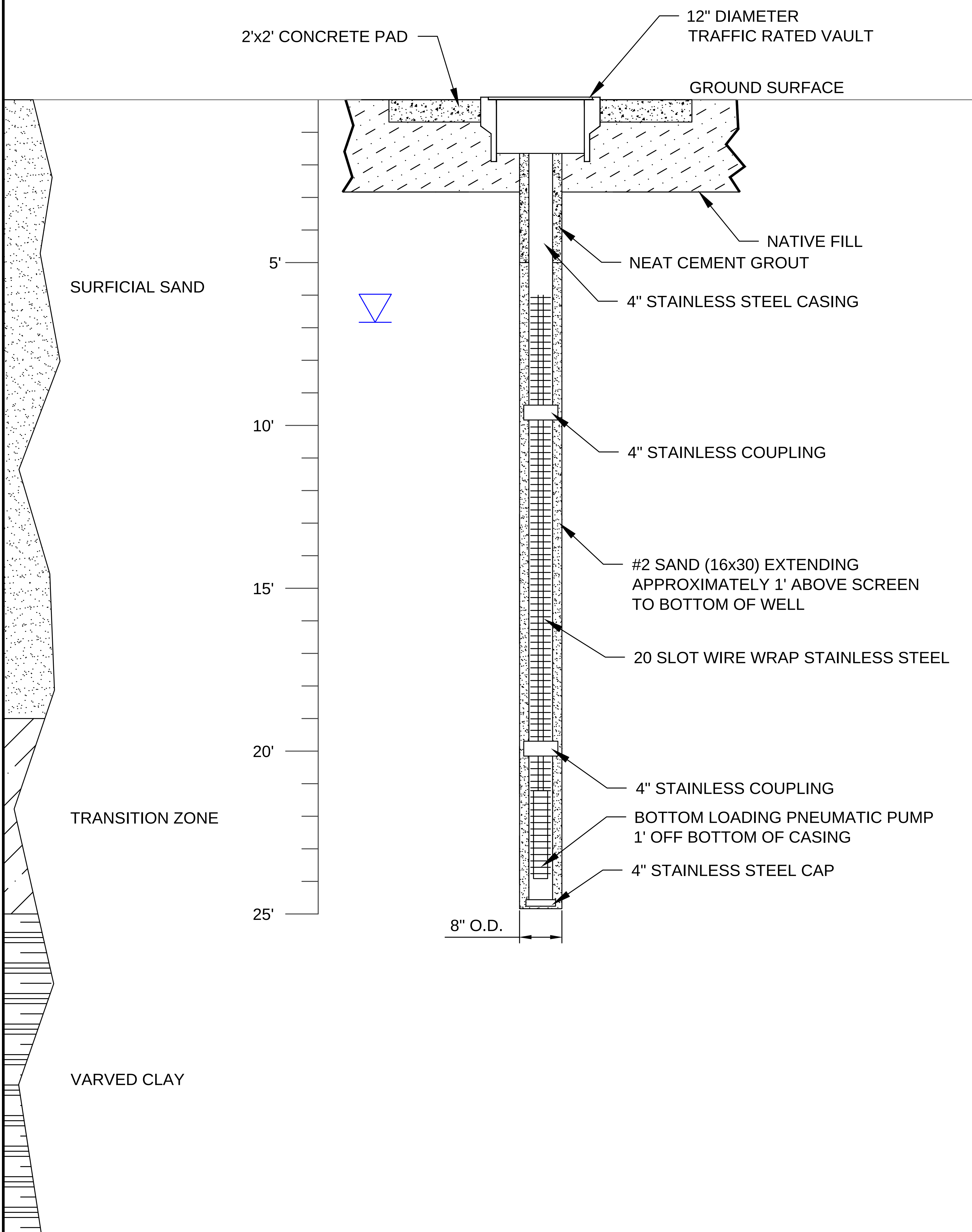
PROJECT KIN41

SHEET M-4

DRAFT

Not Approved for Construction

HYDRAULIC CONTROL WELL DETAIL

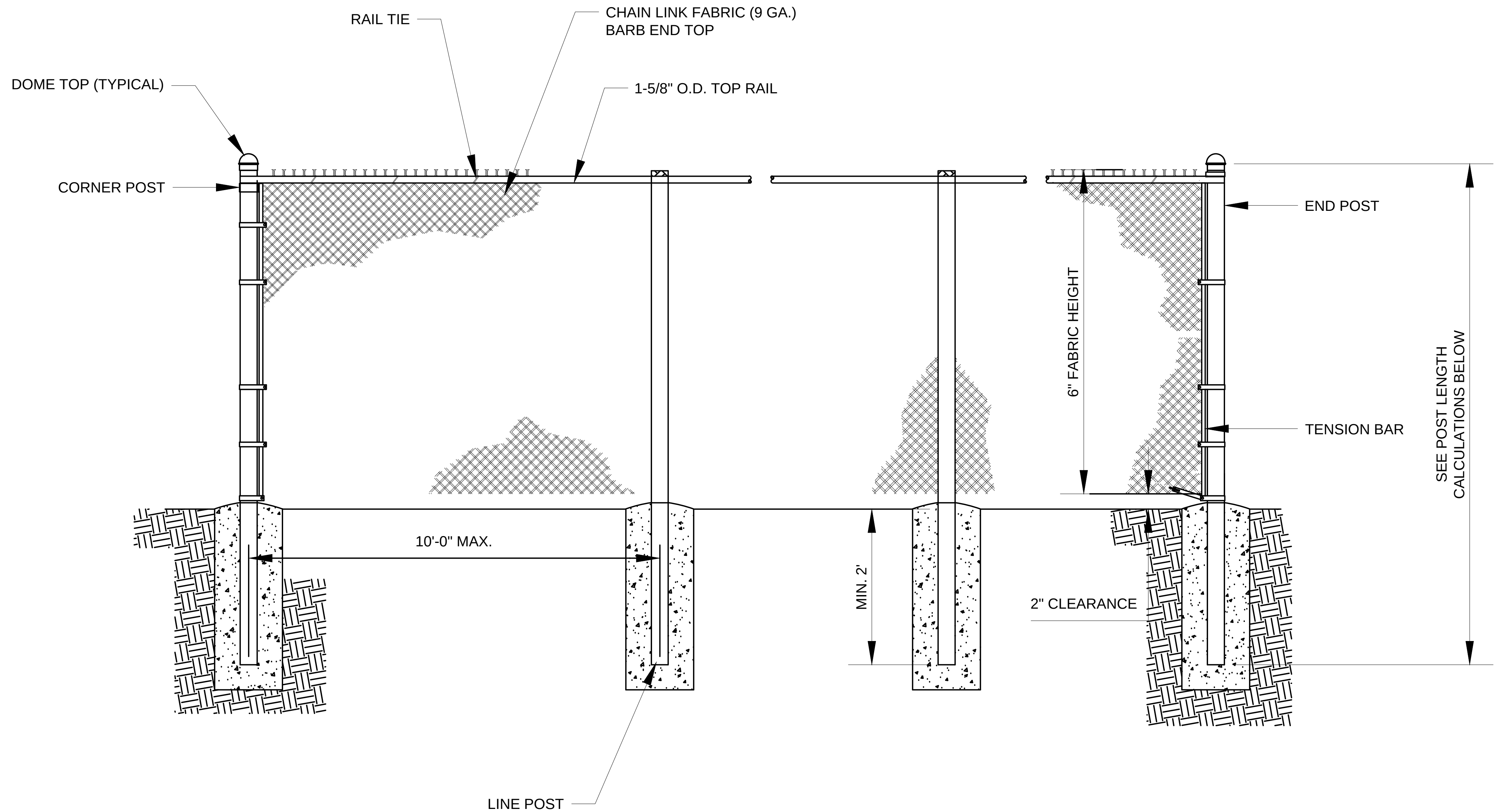


TRS Accelerating Value

DESIGNED BY	M. NANISTA
DRAWN BY	A. PEABODY
CHECKED BY	NOT APPROVED
PROJECT MANAGER	B. POULIN
FOR	FORMER IBM FACILITY, KINGSTON, NEW YORK
TITLE	HYDRAULIC CONTROL WELL DETAIL
APPROVED FOR CONSTRUCTION	BY ______ DATE ______
DATE	9/4/13
PROJECT	KIN41
SHEET	M-5

DRAFT

Not Approved for Construction



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"

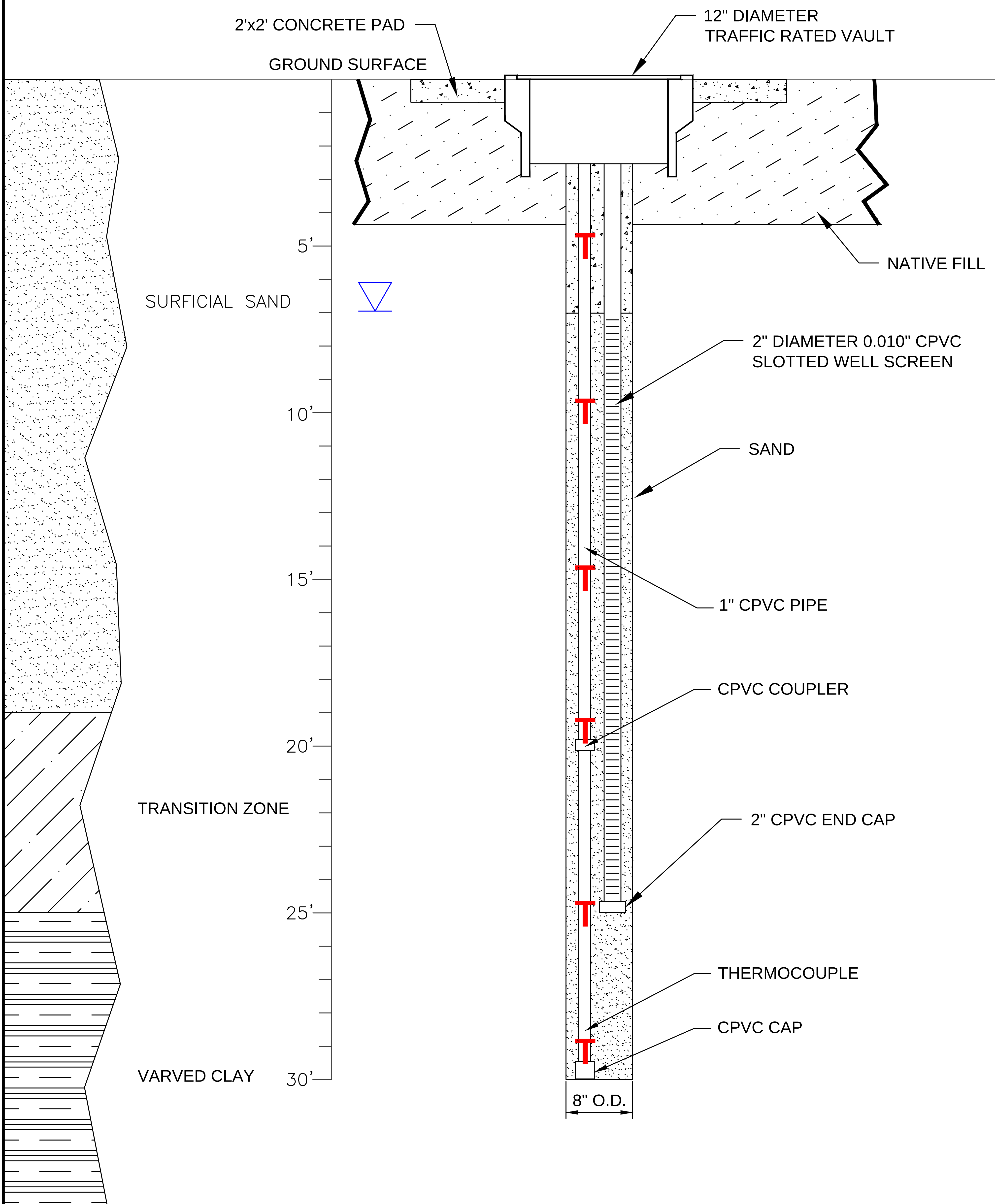
TRS Accelerating Value

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	8/27/13
PROJECT	KIN41
SHEET	M-6

DRAFT

Not Approved for Construction

SENTINEL WELL DETAIL



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 DETAIL

APPROVED FOR CONSTRUCTION

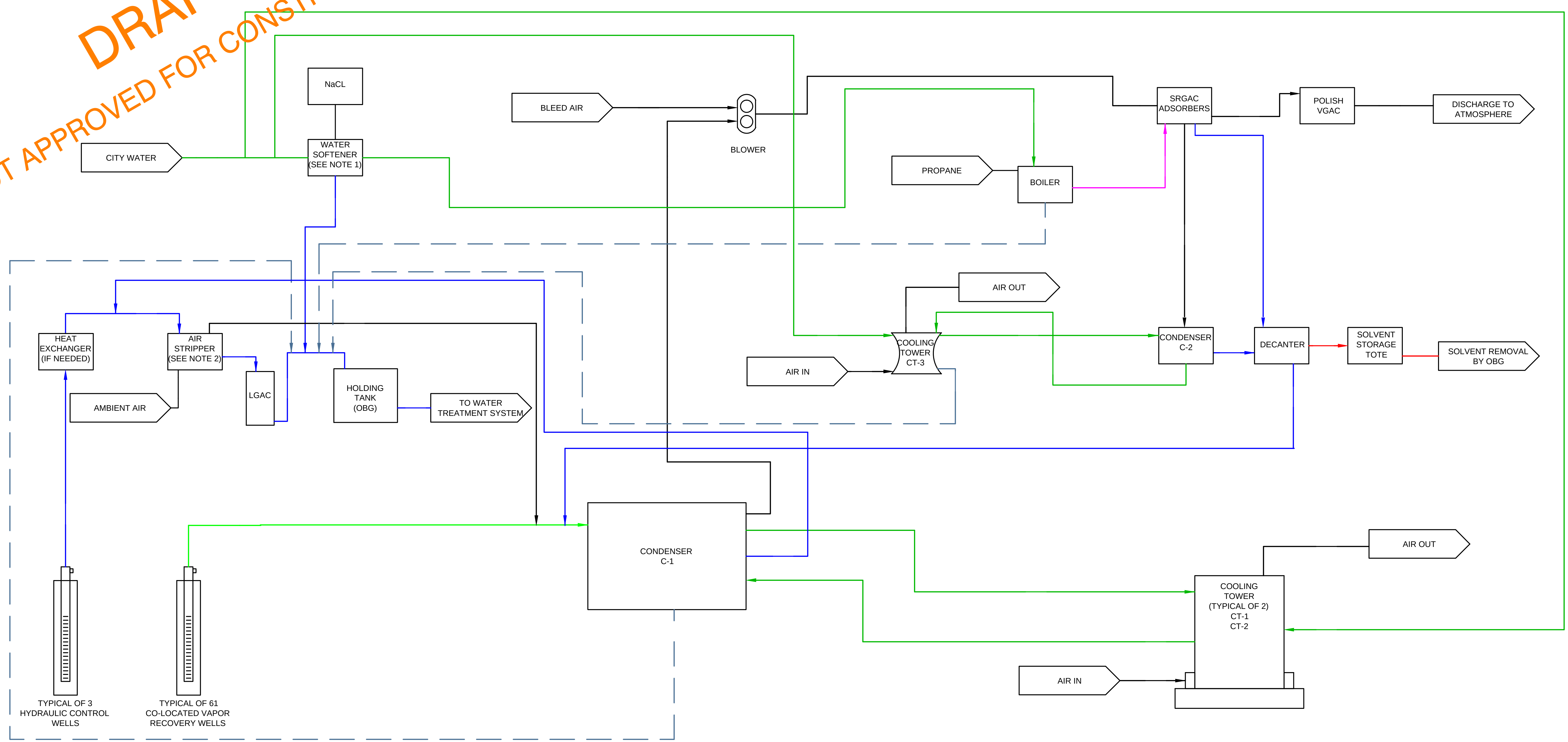
BY ____________________

DATE ____________________

DATE: 8/30/13

PROJECT: KIN41

SHEET: M-7



STREAM TYPES

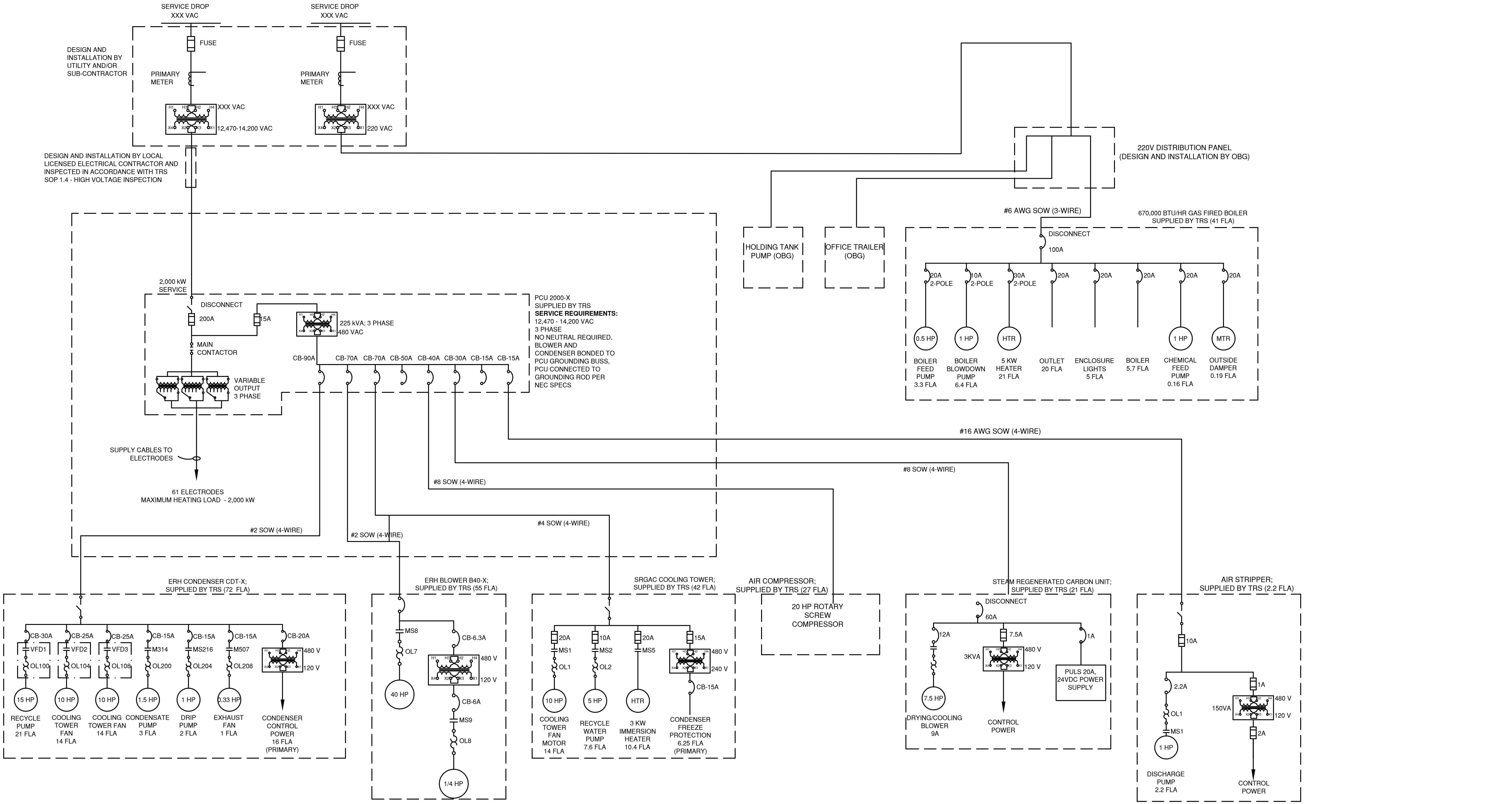
- POTABLE/SOFTENED WATER
- PROCESS WATER
- SOLVENT
- AIR/STEAM
- STEAM
- AIR
- BLOWDOWN

NOTES:

1. REFER TO WATER SOFTENER SPECIFICATIONS PACKAGE (EVERSOFT MODEL C-72F9801)
2. QED MODEL EZ-4.4SS

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: 9/4/13 — PROJECT: KIN41 — P-2



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 C. BLUNDY		
APPROVED FOR CONSTRUCTION BY DATE	DATE 9/4/13	PROJECT KIN41
	SHEET	E-1

TRS Accelerating Value