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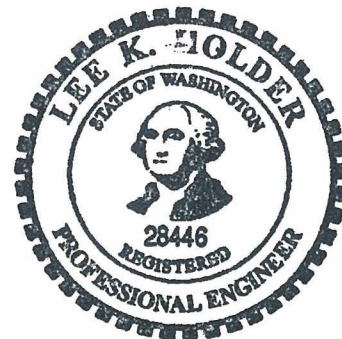
ENGINEERING DESIGN REPORT AND PLANS AND SPECIFICATIONS FOR THE SEA-TAC DEVELOPMENT SITE

Seatac, Washington

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ACRONYMS AND ABBREVIATIONS

BACT	best available control technology
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAP	Cleanup Action Plan
COC	contaminant of concern
Ecology	Washington State Department of Ecology
EDB	ethylene dibromide
EPA	United States Environmental Protection Agency
FS	Feasibility Study
HOA	hand-off-auto switch
IAS	in-situ air sparging
MTCA	Model Toxics Control Act
PLC	programmable logic controller
Qva	Quaternary Advanced Outwash Deposits
RCW	Revised Code of the State of Washington
RI	Remedial Investigation
ROI	radius of influence
scfm	standard cubic feet per minute
SWPPP	Stormwater Pollution Prevention Plan
SVE	soil vapor extraction
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code



1.0 INTRODUCTION

This document is a combination of the Engineering Design Report and Plans and Specifications for remediation of the Sea-Tac Developmental Site (the Site).

1.1 Site Location and Background

The MasterPark C Facility (the Facility) is approximately 7 acres, located at 16025 International Boulevard, SeaTac, Washington within Section 28, Township 23 North, Range 4 East and is called "MasterPark Lot C" (Figures 1 and 2). The known soil contamination, the highest levels of groundwater contamination, and possible primary source of contamination (former underground storage tanks [USTs]) are located on the Facility, but groundwater impacts extend beyond the Facility boundaries. The Site consists of the Facility property and off-property areas with groundwater affected by the Facility.

Golder Associates, Inc. (Golder) completed a Remedial Investigation and Feasibility (RIFS) Report (Golder 2010) pursuant to Washington State Department of Ecology (Ecology) Order No. DE 6844. Following the RI/FS, Golder prepared a Cleanup Action Plan (CAP, Golder 2011), including proposed cleanup levels. After public review and comment, the CAP was finalized in November 2011 (Golder 2011) and approved by Ecology on June 14, 2012. The CAP is being implemented pursuant to a Consent Decree.

The Site history is summarized in the CAP. A legal description of the Facility is provided in Attachment A of the CAP.

1.2 Purpose and Scope

This report has been prepared to fulfill the requirements of WAC 173-340-400(4)(a) (Engineering Design Report) and WAC 173-340-400(4)(b) (Plans and Specifications). Design Drawings are provided in Appendices A and B. Technical Specifications are provided in Appendices C and D. An Operations and Maintenance Plan per WAC 173-340-400(4)(c) will be submitted separately.

This report provides:

- Goals of the cleanup action (Section 1.3)
- General facility information (Section 2.1)
- A summary of the remedial investigation (Section 2.3)
- A summary of the feasibility study is provided in the CAP
- Identification of who will own, operate, and maintain the cleanup action during and following construction (Section 2.2)
- Facility maps showing existing site conditions, facilities and the proposed location(s) of the cleanup action(s) (Figure 2 and the Drawings in Appendix A)



- Characteristics, quantity, and location of materials to be treated or otherwise managed (Section 2.3)
- Schedule for final design and construction (Section 3.2)
- Conceptual plan of the cleanup actions and conceptual design of treatment units, facilities and processes (Section 3)
- Engineering justification for design and operating parameters (Section 3). Note that demonstration that the cleanup action will achieve cleanup requirements was provided in the CAP.
- Design features for control of spills and accidental discharge (Section 3.8)
- Design features to assure long-term safety of workers and local residences (Section 3.9)
- Management of treatment residuals and other waste materials generated as a result of the cleanup actions (Section 3.10)
- Facility characteristics that could affect design, construction, or operation of the cleanup action (Sections 2.1 and 2.3)
- Construction quality control testing (Section 3.11)
- Any other information needed to address applicable state, federal and local requirements, including the substantive requirements for any exempted permits (Section 3.14)
- Detailed plans, procedures, and material specifications necessary for construction of cleanup action (Appendices A through D)
- Startup procedures and criteria to demonstrate the cleanup action is prepared for routine operation (Section 3.12)

A State Environmental Policy Act checklist was prepared and submitted for public review and comment along with the CAP (Appendix B of CAP). No additional information is required to meet the applicable requirements of the State Environmental Policy Act (RCW 43.21C).

Appendix E of the CAP (Golder 2011) contains a compliance monitoring plan prepared per WAC 173-340-410 and the Site Health and Safety Plan.

Financial assurance has been addressed separately with Ecology.

Institutional controls are discussed in Section 1.5.

1.3 Remediation Goals

The remedial action goals are intended to protect human health and the environment by eliminating, reducing, or otherwise controlling the risks posed through each exposure pathway and migration route. Based upon potential exposure pathways, the following remedial action goals were identified in the CAP for the Site:



- Eliminate potential exposure to potential future human residents to contaminated near-surface source soils at the Site via direct contact exposure pathways. This potential risk has been mitigated by placing pavement over the Site and filing a restrictive covenant on the near-surface soils within 15 feet of the ground surface.
- Eliminate potential exposure to humans from vapor intrusion into future commercial buildings from vadose zone source soils at the Site near well MW-18 and MW-13 and future residential buildings over impacted groundwater.
- Eliminate the potential for Site-impacted groundwater to migrate and impact additional Quaternary advanced outwash deposits (Qva) aquifer in the future.

1.4 Cleanup Levels and Points of Compliance

Contaminants of concern (COCs) have been identified for the Site. Site cleanup levels for COCs were established in the CAP, and are given in Table 1.

Two applicable Model Toxics Control Act (MTCA) points of compliance for soils at the Site are:

- From 0 to 15 feet depth for the protection of humans, terrestrial ecology, and groundwater
- Below 15 feet for the protection of groundwater.

A conditional point of compliance applies for shallow soil at the MasterPark Facility because some residual impacted soil may remain under the asphalt pavement. Institutional controls specified in the CAP and compliance monitoring will ensure the long-term effectiveness of the remedy.

Groundwater cleanup levels will meet MTCA Method A. The groundwater point of compliance will be everywhere on the Site.

1.5 Institutional Controls

There is a restrictive covenant for the Facility property that prohibits (1) any use of groundwater from the Site, (2) any activity on the Facility property that may interfere with the integrity of remedial actions and protection of human health and the environment, and (3) any activity on the Facility property that may result in the release of a hazardous substance from the property.



2.0 SITE DESCRIPTION

2.1 General Information

The Site and Facility boundaries are given in Section 1.1. SeaTac Investments is currently operating the Facility as a public valet parking lot, doing business as “MasterPark Lot C” (Figure 2). SeaTac Investments leases the majority of the land from ANSCO Properties, LLC (land owner of the north portion of the Site).

The Facility consists of relatively flat ground covered by an asphalt parking lot with a single administrative building. The parking lot was recently expanded to include property to the west that formerly belonged to a cemetery (M Park). The northern portion of the Site includes the Loudon property and South 160th Street. Master Park C will continue normal operations as an off-site airport parking lot during remediation, and so remediation efforts must take into consideration the schedule of the operating business.

No landslide or seismic hazards have been identified for the Site. The Site is not in a flood hazard area.

2.2 Owner and Operator Information

The SeaTac Investments LLC, Scarsella Brothers Inc. and ANSCO Properties, LLC (the PLP group) will conduct the cleanup action. They have contracted Golder of Redmond, Washington to design, operate, maintain, and monitor the cleanup action during and following construction.

SeaTac Investments LLC is currently operating the Facility as a public valet parking lot, doing business as MasterPark Lot C. SeaTac Investments LLC leases the majority of the land from ANSCO Properties, LLC (current land owner of the north portion of the MasterPark Facility) under the terms of a long-term lease agreement.

2.3 Site Conditions and Extent of Contamination

2.3.1 Soil

Near-surface soils consist of a layer of fill that may be up to approximately 10 feet thick in places. Beneath the fill, till and/or layers of outwash sand are encountered. In general, the till occurs in the range of 10 to 30 feet below ground surface (bgs). Below the till is dense to very dense Qva consisting of unstratified fine to coarse grained sandy deposits. Regional geologic maps indicate the potential presence of lacustrine clayey silts and silty clay deposits beneath the Qva stratum at an unknown depth (USGS 2004), but lacustrine deposits were not encountered in any of the borings on or in the vicinity of the Facility.

There are soils impacted by gasoline within the Facility near the former location of former gasoline USTs, in the vicinity of MW-18. The highest concentrations in soil in the source area were between 10 and 50



feet bgs and consisted of gasoline concentrations ranging between 10 milligrams per kilogram (mg/kg) to 1,800 mg/kg. Available information does not suggest near-surface soils are impacted off of the Facility, except for allegations that there were petroleum USTs on the Loudon property in the past. The following COCs have been established for Site soils:

- Petroleum Hydrocarbons - Gasoline
- Volatile Organic Compounds (VOCs) – Benzene, toluene, ethylbenzene, and xylenes.

Although no surface soil samples were collected during the RI, it is assumed that there are localized areas of surface soil beneath the asphalt cap outside of the source area at the MasterPark Facility that exceed cleanup levels for petroleum hydrocarbons. The presence of these localized impacted areas was identified through observation of the surface soil prior to MasterPark Facility redevelopment (to its current configuration), when vehicles were parked on top of bare soil. During MasterPark Facility remediation and redevelopment, the asphalt cap was placed over the entire MasterPark Facility property to prevent any potential direct contact with these surface soils that remained in place.

2.3.2 Groundwater

A continuous zone of groundwater representing a regional aquifer occurs across the Site at a depth of approximately 45 feet bgs. This water-bearing unit is contained within Qva sand present beneath till. The thickness of this saturated coarse-grained deposit is at least 40 feet based on the drilling of a monitoring well (MW-10) to a depth of 92 feet bgs. Above this regional aquifer, isolated pockets of perched groundwater occur at selected locations at depths less than about 20 feet bgs. These zones are limited in occurrence, not hydraulically continuous across the Site, and likely form over layers of till.

The results of all of the hydraulic gradient events indicate that the groundwater flow direction is predominantly to the west (with some flow components to the northwest and southwest) and is not appreciably affected by seasons.

The RI defined the location of the groundwater plume, with the exception of the corner of the plume to the northwest of MW-22. Since the submittal of the CAP, two wells were installed and sampled at the Port of Seattle, north of 160th Street. No contamination above MTCA A levels was detected in these wells. Therefore, the groundwater plume is bounded to the north by the north side of 160th Street. The RI/FS report (Golder 2010) provides a detailed narrative of the groundwater sampling results over the course of the RI.



The following is a brief summary of the COCs for the Site groundwater:

- Gasoline range petroleum hydrocarbons were detected in groundwater samples collected at the Site and on downgradient portions of the Site at concentrations exceeding MTCA Method A cleanup levels. Diesel was also detected in groundwater at one well on the Facility and two downgradient wells on adjacent properties. It is likely that the gasoline is mobilizing the diesel and carrying it downgradient.
- Detections of benzene, toluene, ethylbenzene, and xylenes (BTEX) occurred in twelve wells at the Site and were at concentrations well above cleanup levels.
- Naphthalene was detected in eight wells at the Site and was detected at concentrations more than double the cleanup level.
- Ethylene dibromide (EDB) was detected in seven wells at the Site and was at concentrations well above the cleanup level.

The source of the groundwater impact historically was a leaking UST that has since been removed. Since the original source has been removed, the current source to groundwater is related to gasoline entrained in vadose zone soil. Groundwater analytical results confirm that the source of impact is bounded by MW-12 to the north, MW-14 to the south, MW-18 to the east, and MW-13 to the west based on the highest concentrations of COCs located within this area. This is demonstrated by gasoline, benzene, and EDB isoconcentration contour maps which can be found in the CAP.

2.3.3 Other Media

No remediation is required for air, surface water, or sediments at the Site.



3.0 REMEDIATION SYSTEM DESIGN

3.1 Overview

Cleanup of the Site will be accomplished by treatment consisting of in-situ air sparging (IAS) in combination with soil vapor extraction (SVE). Design of the remediation system is divided into the following components:

- IAS trailer
- IAS wells and piping
- SVE trailer
- SVE wells and piping
- SVE offgas treatment

3.1.1 Description of In-Situ Air Sparging

IAS is a process whereby atmospheric air is injected into an aquifer containing volatile and/or biodegradable COCs, affecting remediation of the aquifer. IAS involves two removal mechanisms: 1) in-situ air stripping, and 2) enhancement of in-situ biodegradation. For the Site, both processes will be involved. In-situ air stripping involves the transport of volatile COCs from the groundwater and into the vadose zone. This transport occurs through advection with forced air and diffusion from adjacent soil into the advecting air flow. In-situ biodegradation occurs as the presence of oxygen introduced into ground water and transport of volatile COCs into the vadose zone, stimulate consumption of biodegradable compounds by microorganisms.

3.1.2 Description of Soil Vapor Extraction

SVE is a process whereby vacuum is applied to the subsurface, collecting subsurface vapor. The collected vapor (SVE offgas) will be treated by carbon adsorption or catalytic oxidation before discharge to the atmosphere.

For the source area, SVE will be used to directly remove COCs from vadose zone (unsaturated) soil in the source area. In this case, the vacuum causes the volatile COCs in the soil to desorb into the subsurface vapor, which the SVE system then collects.

For the rest of the Site, SVE will collect the air with COCs generated by IAS. It is not necessary to intersperse SVE wells between IAS wells because of the asphalt parking lot serves as a surface seal that prevents subsurface vapors from escaping into the atmosphere. SVE wells around the perimeter of the treatment area will collect contaminated vapors beneath the asphalt.



3.1.3 Enhanced Biodegradation

Enhanced biodegradation will be used for downgradient (off-property) contaminated groundwater. The oxygen added to the groundwater by IAS will enhance natural biodegradation as the oxygen-enriched Site groundwater migrates downgradient and off the Facility property.

3.2 Implementation Schedule

Figure 3 presents a schedule for remediation construction. The treatment operating time (i.e., time to achieve cleanup levels) is estimated to be approximately 5 years. Enhanced biodegradation on the Site (in the downgradient portion of the plume) will be approximately 15 years after installation.

3.3 In-Situ Air Sparging

In general, IAS equipment will consist of IAS blowers, air distribution piping, IAS wells for air injection, and associated instrumentation and controls.

3.3.1 Process Description

Figure 4 presents a process schematic for IAS. Drawing 300 (Appendix A) is the Process & Instrumentation Diagram for IAS. Air injection for IAS will be accomplished using IAS wells; the IAS well design is shown in Figure 5.

IAS will use pulsed air injection; that is, air will be injected into a set of wells for a short period of time. Air injection will be cycled between 2 or 3 sets of wells. Wellhead pressure first increases, and then decreases asymptotically as subsurface backpressure is overcome (Leeson et al. 2002). Bubbles of sparge air tend to coalesce into air channels. Once air pathways have formed, the air will travel upwards more quickly with a resulting decrease in mass transfer efficiency (of COCs into the air and of oxygen into the subsurface). For this reason, pulsed injection results in more efficient use of the injected air. The improved efficiency of pulsed air sparging has been demonstrated experimentally (Johnson et al. 1999).

3.3.2 Design Basis

A pilot test was not performed to determine IAS radius of influence (ROI). Instead, a conservative well spacing will be used. Air will be injected approximately 20 feet below the water table. The shallow aquifer consists of fine sandy soils. Considering experience with sandy soils at other sites, and the geometry of air dispersion from IAS wells, it is expected that ROI will be greater than the 18-foot ROI needed for the selected well spacing of 36 feet (Bruell et al. 1995; Weitzman et al. 1998).

The total IAS flow rate will be up to 250 scfm. IAS will be operated with an instantaneous injection rate of 10 to 20 scfm per well. Pressure response in IAS wells will be measured during startup and used to determine the duration of air injection. The duration of injection and duration between injection periods



will determine the average injection rate. Ball valves on the flow lines will allow for equilibrating flow rates across all IAS wells in the network.

3.3.3 IAS Blower Trailer

Major above-ground components of the IAS system will be provided on a trailer:

- IAS Blowers
- IAS Surge Tank
- IAS Air Cooler
- Variable Frequency Drives
- Electronically Actuated Valves
- Air Flow Transmitters
- Pressure/Vacuum Transmitters
- Temperature Transmitters
- Control Panel
- Programmable Logic Controller (PLC)

The IAS trailer intended to be used will be purchased used. It has been used successfully by Golder at another petroleum-contaminated site for treatment of a similar area.

3.3.4 IAS Wells and Piping

Figure 6 provides specifications for well installation. Design drawings are provided in Appendix A and technical specifications in Appendix C.

3.4 Soil Vapor Extraction (SVE)

In general, SVE equipment will consist of vapor extraction wells, collection piping, SVE vacuum blowers, treatment equipment for the SVE offgas (extracted soil vapor), and associated instrumentation and controls.

3.4.1 Process Description

Figure 6 presents a process schematic for SVE. Drawing 350 (Appendix A) is the Process & Instrumentation Diagram for SVE. Subsurface vapors will be collected using SVE wells; the SVE well design is shown in Figure 7. The SVE wells to collect IAS-generated vapor will be installed along the perimeter of the treatment area. A single SVE well will be installed in the source area.

3.4.2 Design Basis

A pilot test was not performed to determine SVE radius of influence (ROI). Instead, a conservative well spacing will be used. The ROI will be enhanced by the asphalt paving over the entire treatment area that provides a surface seal. Different spacing will be used for SVE wells along the west boundary of the



Facility at the edge of the asphalt and for SVE wells within the parking lot. On the edge, a spacing of 36 feet will be used (ROI of 18 feet). Away from the edge, a spacing of no more than 100 feet will be used (ROI of at least 50 feet). As a contingency, extra SVE piping will be installed in the trenches to allow for future connection to new SVE wells should the need arise.

The SVE flow rate will be based on the associated IAS air injection flow rate. The overall SVE flow rate will be at least as much as the overall IAS injection rate. The total SVE offgas flow rate will be approximately 250 scfm. Ball valves on the flow lines will allow for equilibrating flow rates across all SVE wells in the network.

3.4.3 SVE System Design

Major components of the SVE system are:

- SVE Blowers
- SVE Moisture Knock-Out Vessel
- SVE Offgas Treatment (see Section 3.5)
- Variable Frequency Drives
- Air Flow Transmitters
- Pressure/Vacuum Transmitters
- Temperature Transmitters
- Control Panel
- Programmable Logic Controller (PLC)

The SVE trailer intended to be used will be purchased used. It has been used successfully by Golder at another petroleum-contaminated site for treatment of a similar area.

3.4.4 SVE Wells and Piping

Figure 7 provides specifications for well installation. Design drawings are provided in Appendix A and technical specifications in Appendix C.

3.5 SVE Offgas Treatment

Offgas treatment will consist of either vapor-phase carbon adsorption or catalytic oxidation. Both technologies are in common use for treatment of SVE offgas; both technologies have been accepted as Best Available Control Technology (BACT) by air permitting authorities.

Air emission limits for the stack (where the treated offgas is discharged into the atmosphere) will be established based on applicable ambient air standards in accordance with Ecology's normal procedures for air permitting (even though a permit is not required, as discussed in Section 3.14).



During startup, carbon adsorption will be used for SVE offgas treatment. A choice between the two offgas treatment technologies will then be made based on the hydrocarbon concentration in the offgas. This choice will be based on economics; the less expensive treatment method will be used. Catalytic oxidation equipment costs more than corresponding carbon adsorption equipment. At lower contaminant concentrations, operating costs for carbon adsorption are lower. However, carbon usage increases with increasing offgas concentrations. In contrast, costs for supplemental fuel (or power for electric units) decrease with increasing offgas concentrations for catalytic oxidation. At a high enough offgas concentration, catalytic oxidation will be less expensive in the long term.

However, SVE offgas concentrations typically decrease over time. Therefore, even if catalytic oxidation is used initially, at some point the SVE offgas concentrations will decrease to the point that it is more economical to switch treatment to vapor-phase carbon adsorption.

3.5.1 Vapor-Phase Carbon Adsorption

Vapor-phase carbon treatment removes contaminants from the offgas by adsorption onto carbon in a vessel. Two carbon vessels will be used in series after the SVE blower, as illustrated in Figure 6.

The system will be operated until the carbon in the first “primary” vessel is exhausted; the second “polishing” vessel will ensure that discharge limits are met even after breakthrough occurs in the primary vessel. After the first vessel is exhausted, the carbon will be replaced in the primary vessel and the order of the two vessels will be switched (i.e., the polishing vessel will become the primary vessel and the primary vessel will become the polishing vessel). Spent carbon will be regenerated off-site.

Two vapor-carbon vessels will be purchased for use at the Site that were previously used successfully to treat SVE offgas at a petroleum cleanup site. The SVE flow rate at that site was approximately the same as will be used for this Site (the same SVE blowers will be used). The other site had SVE offgas concentrations higher than are expected for this Site.

3.5.2 Catalytic Oxidation

Catalytic oxidation is a process for thermal destruction of organic compounds in air. The organic compounds in the air stream, which will be SVE offgas for this site, are destroyed by high-temperature oxidization in the combustion chamber. A catalyst is used to reduce the temperature required to achieve the desired destruction efficiency, thereby reducing the need for supplemental energy. Temperature is maintained in the combustion chamber by a combination of the heat of combustion from the organic compounds in the offgas and supplemental energy as needed. As the offgas VOC concentration decreases, the need for supplemental energy will increase. Supplemental energy may be provided by either supplemental fuel (e.g., natural gas or propane) or electrically. Because it will be easier to install and operate, an electrical catalytic oxidizer would be used at this site.



The size and design of the catalytic oxidizer would be chosen to meet the site-specific treatment conditions. The destruction efficiency for the unit would be at least as high as that required such that treated offgas will not cause exceedance of ambient air standards.

3.6 Electrical Design

Electrical design drawings are provided in Appendix B and electrical technical specifications in Appendix D.

3.7 Access Controls

Above-ground remediation equipment will be kept within fencing or other locked enclosure to prevent unauthorized access. Piping outside of fenced areas (e.g., SVE collection piping and groundwater discharge piping) will be buried in shallow trenches.

3.8 Spill Control

The planned remediation system will have minimal spill potential. However, contaminated air could leak from an SVE system. The adverse effects of such a release should be minimal, given current site conditions and configuration. Piping and equipment containing untreated SVE offgas will be kept within the Facility boundaries and be buried in shallow trenches. Spill potential will also be minimized by leak testing per Section 3.10.

During operations, the operator will check above-ground equipment for indications of leakage or spillage by visual observation and pressure gauge readings. This checking will be performed at least monthly when the equipment is in operation, and the inspection will be noted in a treatment system log maintained at the Facility. Any leaks found will be repaired, and the repair noted in the treatment system log.

The selected contractor will be responsible for spill control during construction (e.g., from construction equipment).

3.9 Design Features for Long-Term Safety of Workers and Local Residences

Treatment system design will incorporate typical safety design features appropriate for the particular equipment. Examples include:

- Blowers, catalytic oxidizers, and similar equipment will include appropriate safety controls and shutoffs (e.g., pressure and temperature) as provided by the manufacturer.
- Pressure-relief valve on pressurized systems (e.g., IAS).
- High- and low-level switches (liquid level, pressure, temperature) triggering alarms and/or shutoff.
- Automated system monitoring via a PLC with appropriate logic for system shutdown when needed.



Remediation equipment will be kept within fencing to prevent unauthorized access.

The only potential threat to off-property personnel would be air emissions from SVE offgas treatment. This will be addressed by meeting air emission limits as discussed in Section 3.14 with monitoring per Section 3.13.

3.10 Management of Treatment Residuals

Management of treatment residuals is addressed in the Investigative Waste Management Plan, which is part of the Compliance Monitoring Plan (Attachment E of the CAP). This includes the production of well cuttings and purge water from the installation of IAS and SVE wells, and any potentially contaminated soils excavated in shallow trenches.

Spent activated carbon will be transported off-site for regeneration.

3.11 Construction Quality Control and Quality Assurance

Construction activities for remediation systems will be performed by appropriately qualified individuals and contractors. The construction will be performed under the oversight or supervision of a professional engineer registered in the State of Washington or a qualified technician under the direct supervision of a professional engineer registered in the State of Washington. Excavation and trench installation will be observed for adherence to the design drawings (Appendices A and B), and documented with photographs and written notes. Any deviations from design drawings found necessary during installation will be noted and documented in as-built drawings.

Trench compaction will be verified as detailed in Specification 2300 (Appendix C).

Leak testing on piping will be performed as detailed in Specification 15210 (Appendix C).

The IAS and SVE blower trailers have been in operation at another site, and thus are known to operate properly, and will be verified during startup. After placement at the Facility, instrumentation will be recalibrated per manufacturers' recommendation.

If any deficiencies are noted in quality control test, they will be corrected and the test re-run.

3.12 Treatment System Startup

After completion of IAS and SVE system construction, startup will occur in the following general steps:

1. Connect the IAS trailer to IAS piping, including pressure measurement tubing and wiring to the electrical valves.
2. Connect the SVE trailer to SVE piping, including vacuum measurement tubing.
3. Connect the SVE offgas line from the SVE trailer to the offgas treatment system.



4. Check setup of the offgas treatment system, including connection piping.
5. Verify that the main system on/off switches in both the IAS and SVE trailers are “off”.
6. Check that manual valves on the piping manifolds for the IAS and SVE wells are open.
7. Connect the power to the IAS and SVE trailers by plugging into the electrical outlet(s).
8. Verify that all valves in the IAS and SVE trailers are open or closed as appropriate.
9. Check IAS and SVE setpoints using the PLC software.
10. Set all control panel Hand Off Auto (HOA) switches to “auto” (in the IAS and SVE trailers).
11. Turn the main system on/off switches in both the IAS and SVE trailers to “on”.
12. Turn the SVE system on via the PLC software and verify normal SVE operation. Ensure that there are no alarms and check that operation coincides with desired operating conditions.
13. Turn the IAS system on via the PLC software and verify normal IAS-SVE operation. Ensure that there are no alarms and check that operation coincides with desired operating conditions.
14. Where practical, simulate alarm conditions for IAS and SVE and observe the system for the correct response (see Drawings 300 and 350).
15. Determine pressure-response curves for IAS wells.

After successful completion of the testing, the IAS and SVE systems will be ready for “normal” operation.

3.13 Treatment System Monitoring

Operation of the IAS and SVE systems will be checked weekly. This will include recording key operating parameters (flows, IAS system pressure and temperature and SVE system vacuum and temperature, etc.).

SVE offgas after treatment will be monitored quarterly. One grab sample will be obtained from the untreated offgas and from the discharge of the treatment system. The sample will be analyzed using EPA Method TO-14 and compared to air emission limits set by Ecology. Limits for offgas treatment by carbon adsorption will be set as maximum concentrations of COCs. Limits for offgas treatment by catalytic oxidation will be set as a minimum percent removal.

3.14 Permitting and Applicable State, Federal and Local Requirements

Because of the permitting exemption for MTCA cleanup actions conducted under a Consent Decree (RCW 70.105D.090), no permits are required for the remedial actions described in this report. “Substantive requirements” must be met, however.



3.14.1 Air

There will be a discharge of treated offgas from the SVE system into the atmosphere. Appendix E contains a completed air permit application form to assist Ecology in review of substantial compliance for air emissions from the SVE system.

3.14.2 Stormwater

The contractor selected to perform the remediation construction will prepare a Stormwater Pollution Prevention Plan (SWPPP) for the work and will follow the substantive requirements of the Construction Stormwater General Permit issued by Ecology.



4.0 REFERENCES

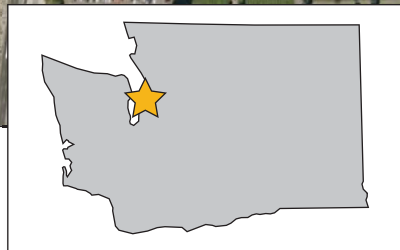
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TABLE

Table 1: Site Cleanup Levels

Soil		Groundwater	
Parameter	MTCA A Cleanup Levels (µg/kg)	Parameter	MTCA A Cleanup Levels (µg/L)
Gasoline	30,000	Diesel	500
Benzene	30	Gasoline	800
Toluene	7,000	Benzene	5
Ethylbenzene	6,000	Toluene	1,000
Total Xylenes	9,000	Ethylbenzene	700
		Total Xylenes	1,000
		Naphthalene	160
		Ethylene dibromide	0.01

FIGURES

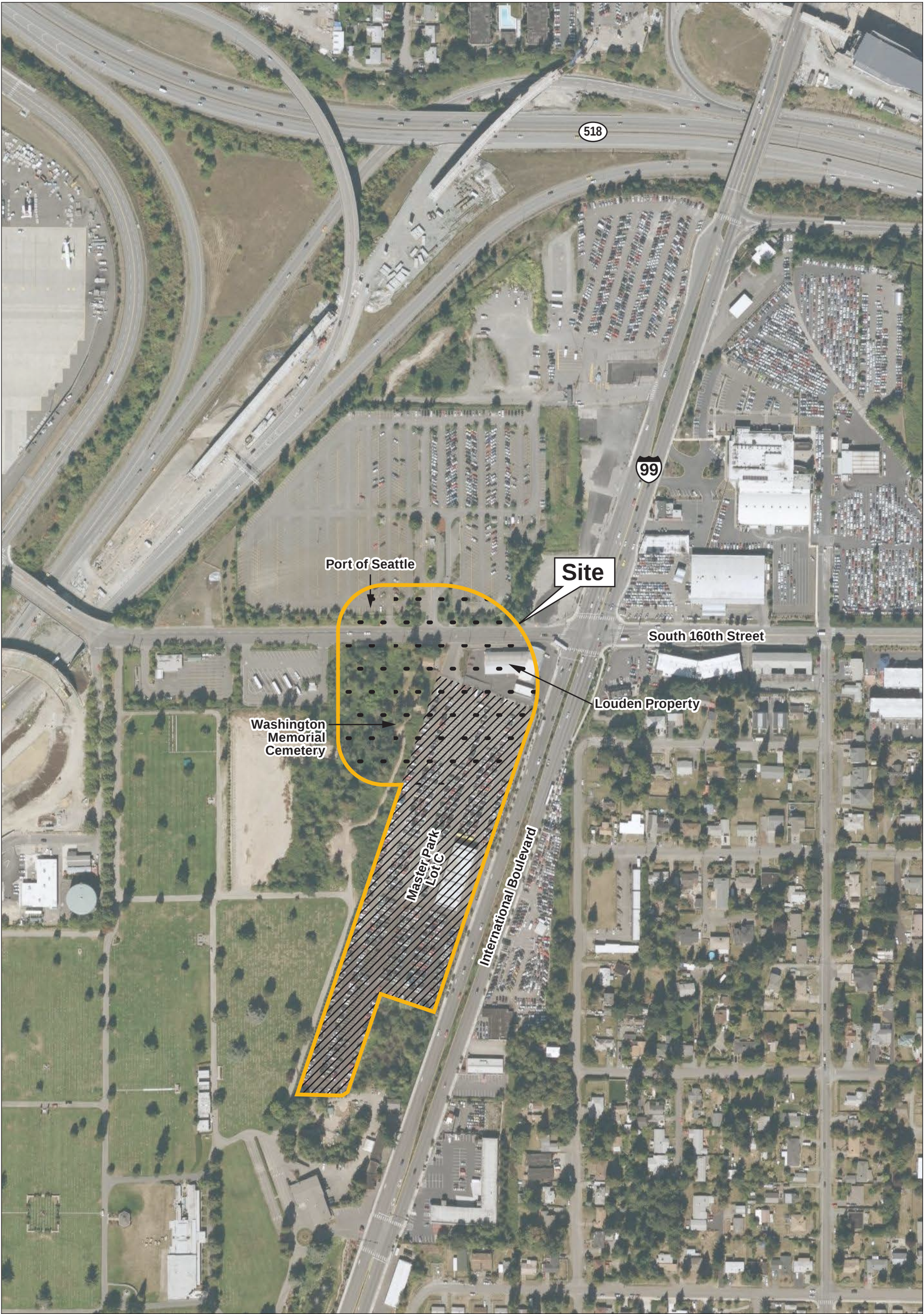


0 2000
SCALE IN FEET



Source: Google Earth Pro

FIGURE 1
SITE LOCATION MAP
SEATAC DEVELOPMENT SITE/EDR/WA



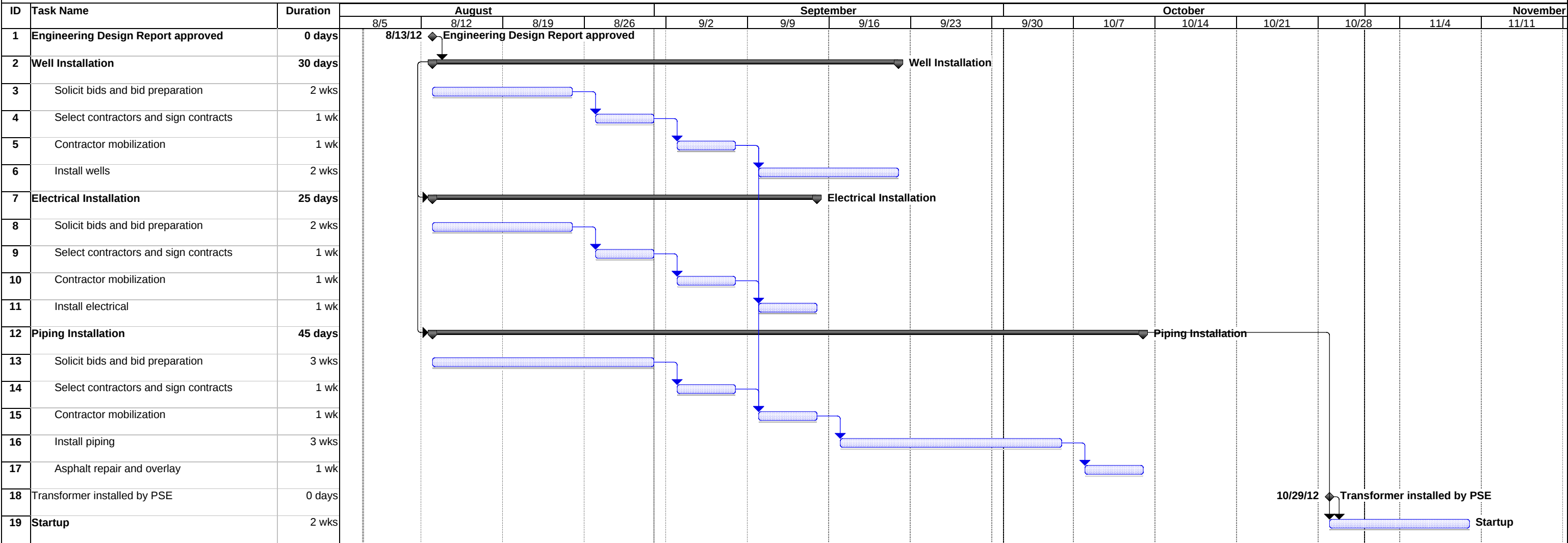
LEGEND

- Approximate Site Boundary
- 2003 Restrictive Covenant Boundary & Asphalt Cap Institutional Control
- Approximate Groundwater Plume

Source: Google Earth Pro

FIGURE 2
APPROXIMATE SITE BOUNDARY
SEATAC DEVELOPMENT SITE/EDR/WA

FIGURE 3. IMPLEMENTATION SCHEDULE
SeaTac Development Site



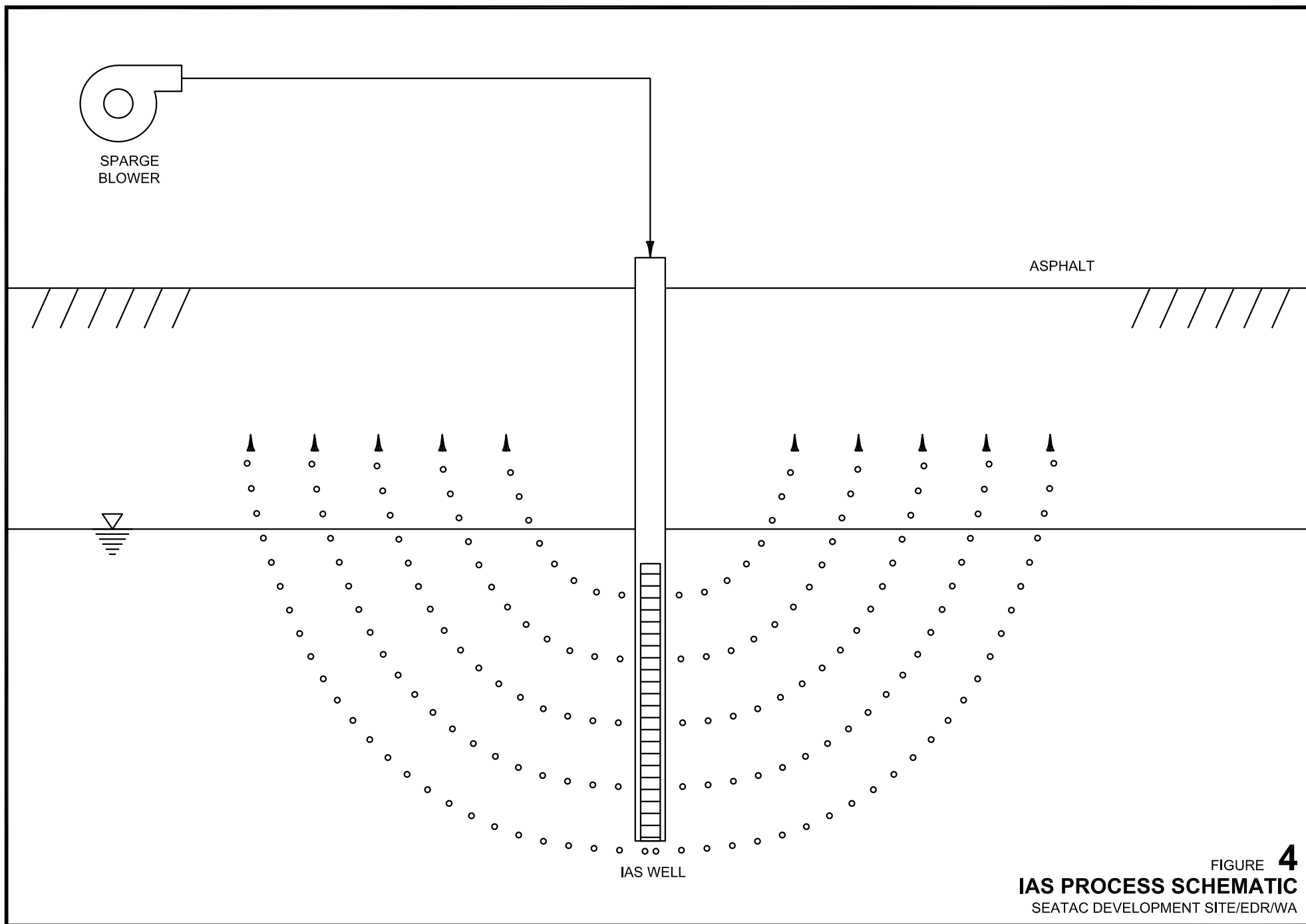


FIGURE **4**
IAS PROCESS SCHEMATIC
 SEATAC DEVELOPMENT SITE/EDR/WA

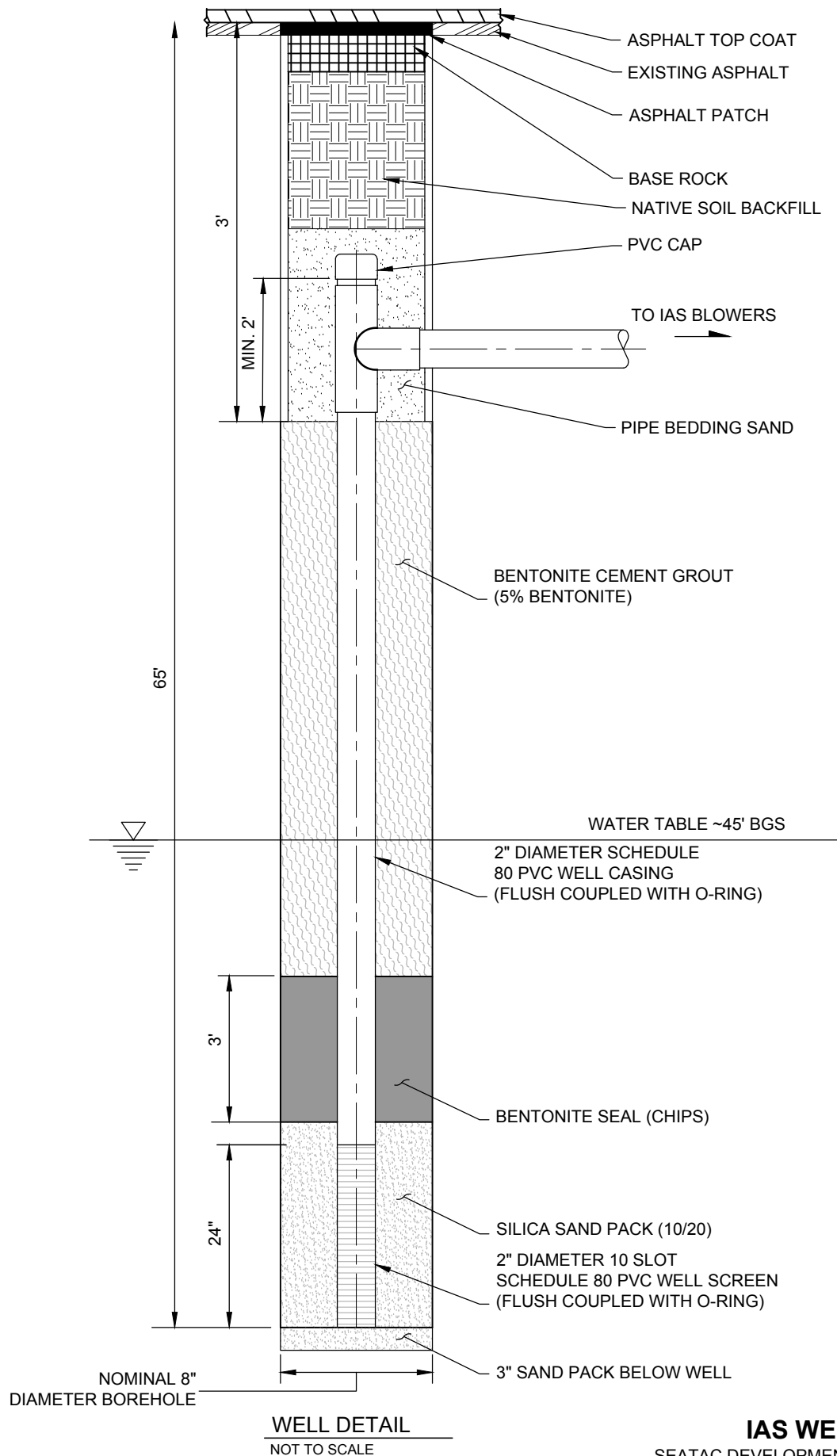


FIGURE **5**
IAS WELL DESIGN
 SEATAC DEVELOPMENT SITE/EDR/WA

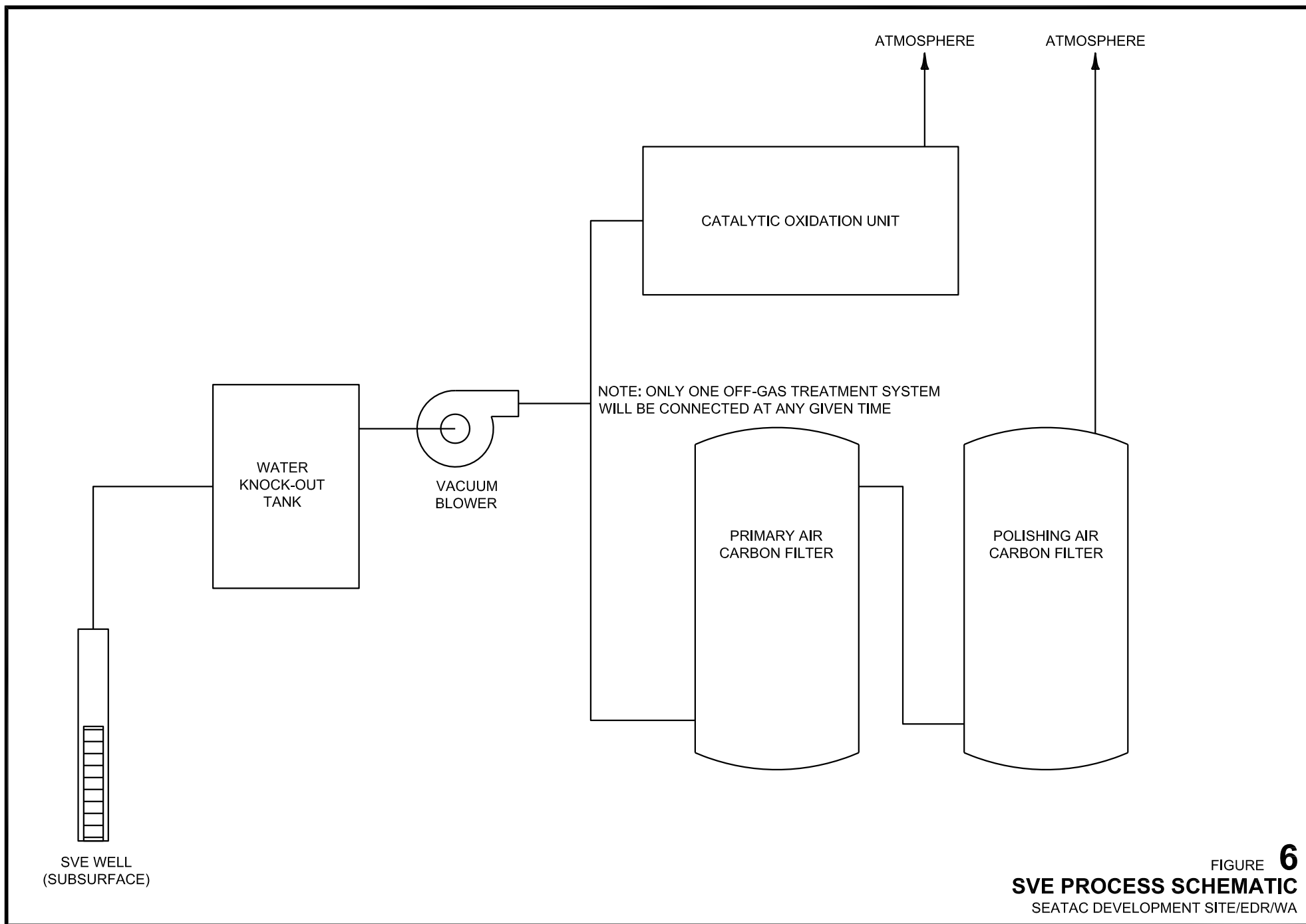
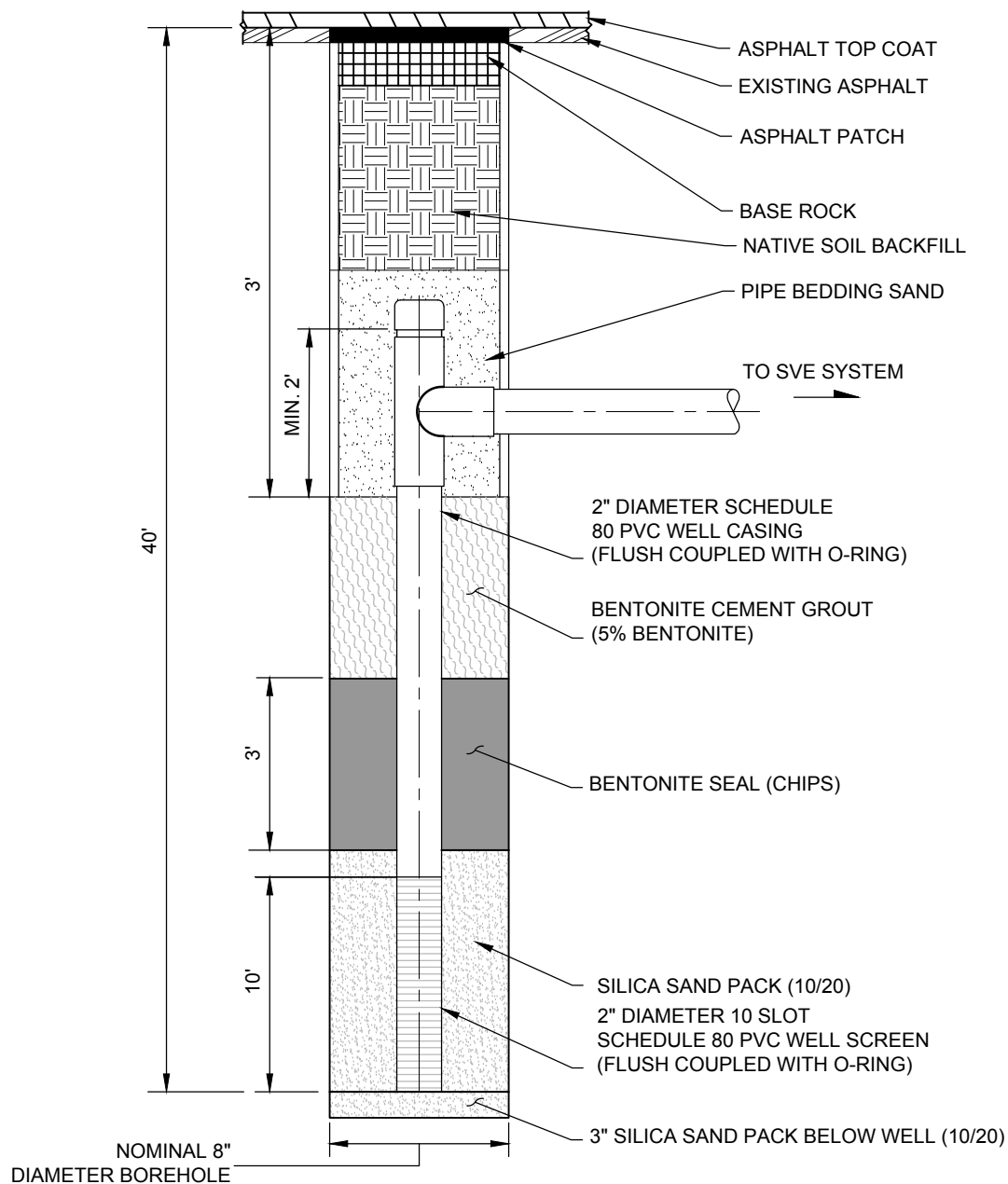


FIGURE 6
SVE PROCESS SCHEMATIC
SEATAC DEVELOPMENT SITE/EDR/WA



WELL DETAIL
NOT TO SCALE

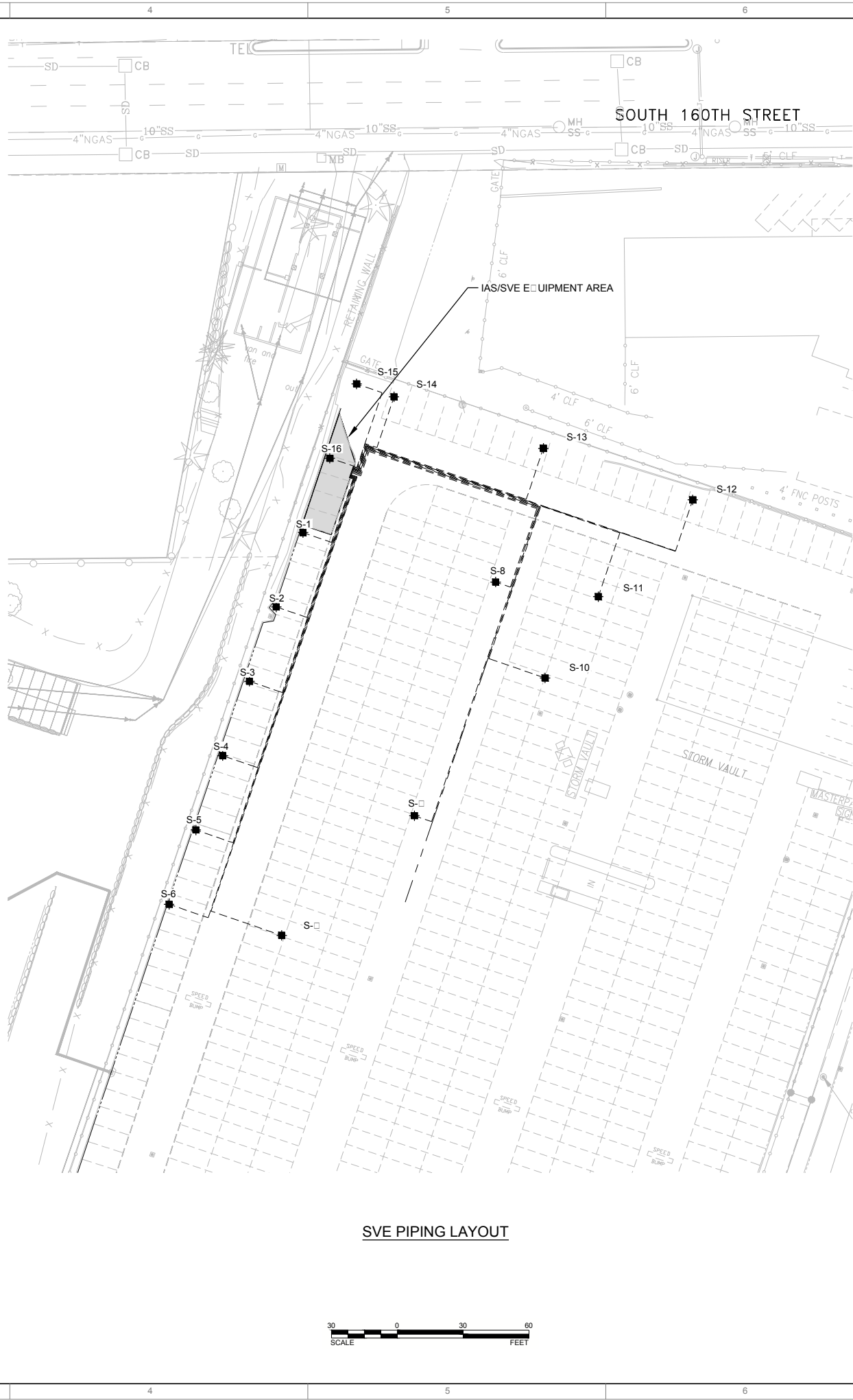
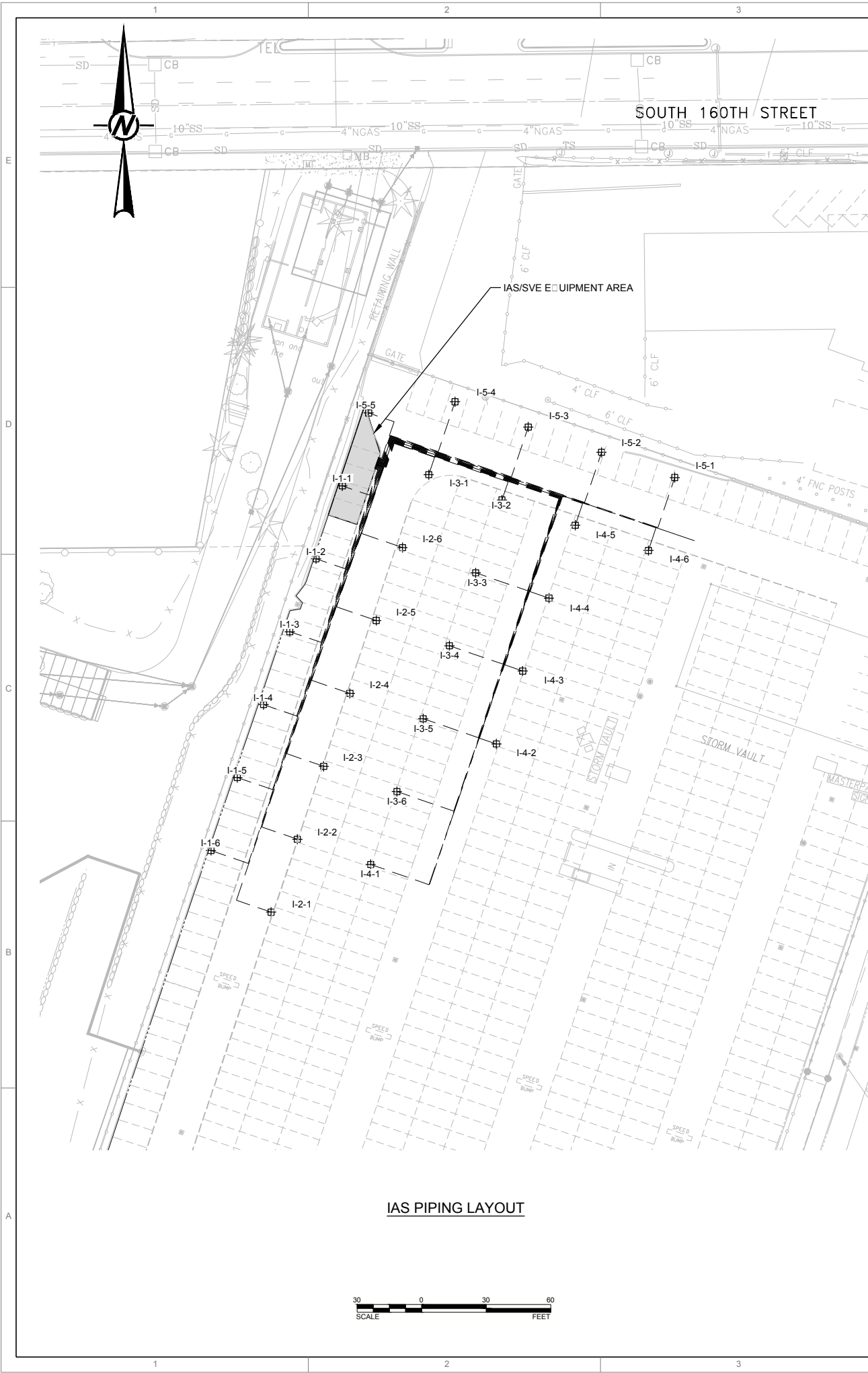
FIGURE 7
SVE WELL DESIGN
SEATAC DEVELOPMENT SITE/EDR/WA

APPENDIX A
TREATMENT SYSTEM DESIGN DRAWINGS

E

CB

Drawing File: C:\CAD\Projects\2007\0733368\08\05\Sheet\IAS AND SVE PIPING LAYOUTS (SEPERATE). Friday, August 10, 2012 8:02:01 AM By: daniel



LEGEND

●

SVE WELLS

⊕

IAS WELLS

1.5" SVE BRANCH PIPING

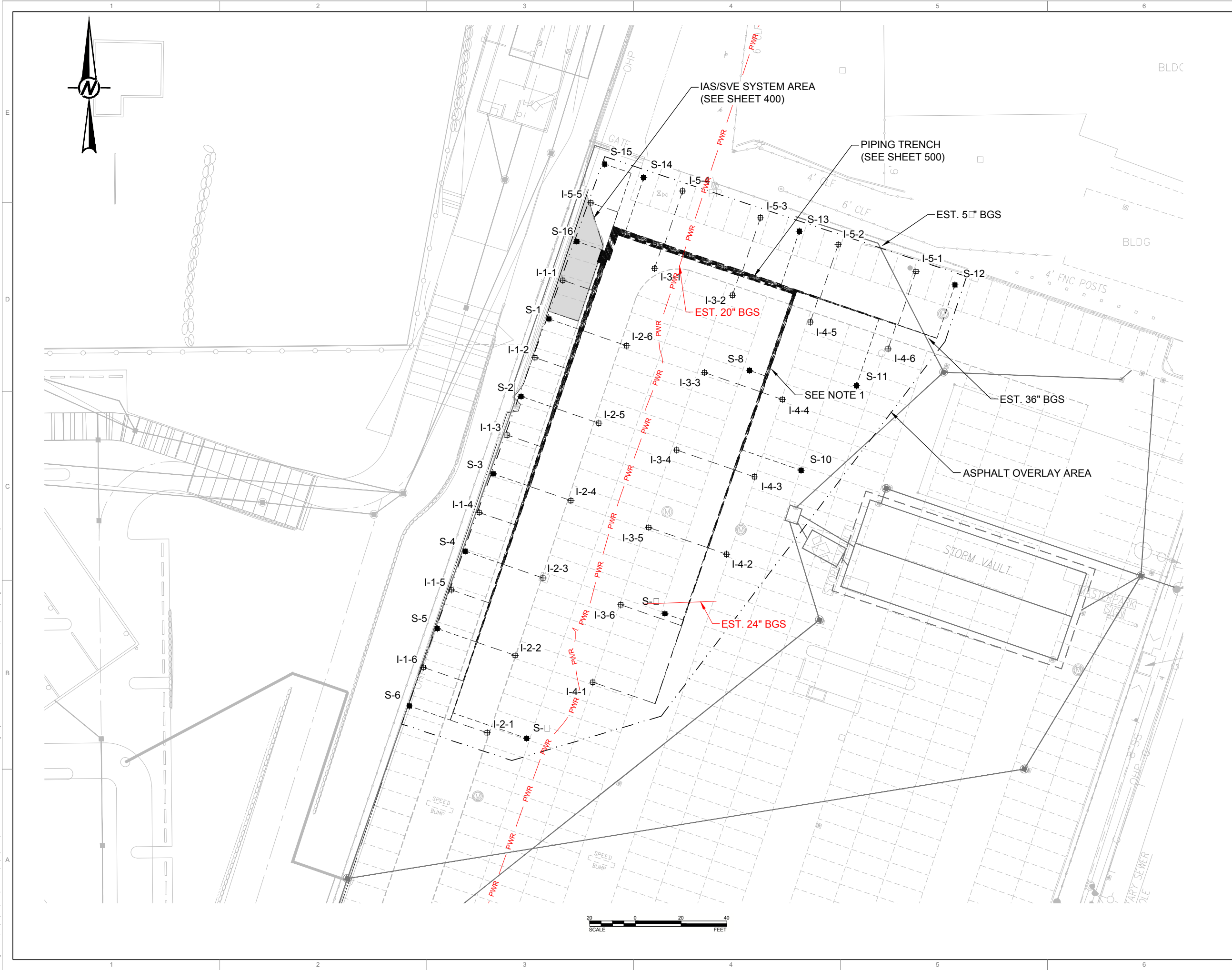
1.5" IAS BRANCH PIPING

2" SPARE SVE BRANCH PIPING

A	MM/DD/YY	GLOBAL DESCRIPTION	CAD	DES	CHK	RW
REV	DATE	DESCRIPTION	DRW	DES	CHK	RW
SEAL / PERMIT						
CLIENT						
SEA-TAC INVESTMENTS LLC						
CONSULTANT						
Golder Associates						
PROJECT		08/31/2012 3368.06/05				
SEATAC DEVELOPMENT SITE SEATAC WA.						
TITLE						
IAS AND SVE PIPING LAYOUTS (SEPERATE)						
DRAWING NO.			100		SHEET NO.	
					OF	

SHEET SIZE ANSI D

Drawing File: K:\CAD\Projects\2007\07303368\08\05\Sheet\COMPLETE REMEDIATION SYSTEM-SITE PLAN.dwg Layout:200 INS AND SVE PIPING LAYOUT (COMPLETE) Friday, August 10, 2012 8:03:08 AM By: elorcer



LEGEND

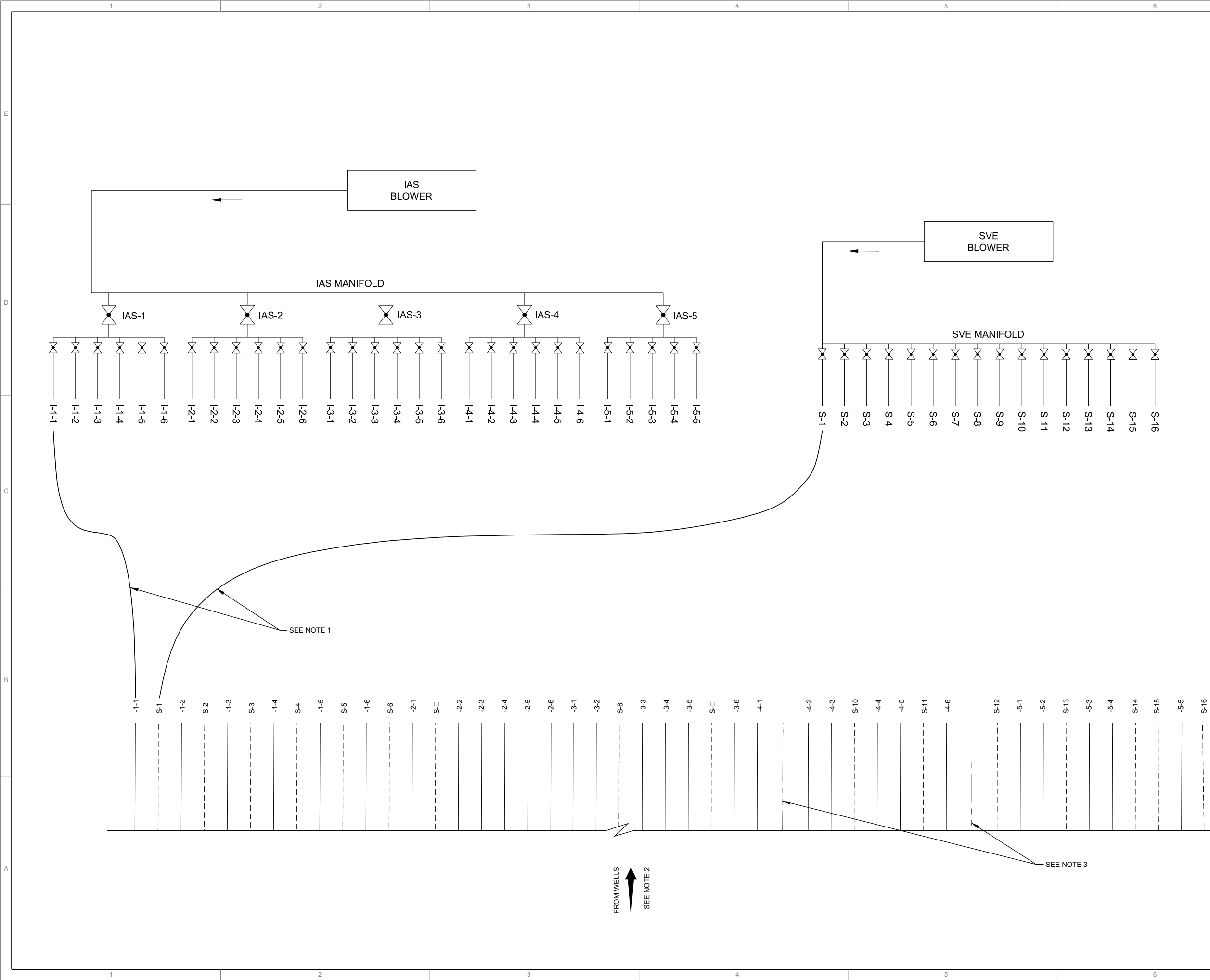
- SVE WELLS
- IAS WELLS
- CATCH BASIN
- 1.5" SVE PIPING
- 1.5" IAS PIPING
- SPARE 2" LINE
- EXISTING STORM DRAIN (APPROXIMATE LOCATION)
- EXISTING UNDERGROUND POWER (APPROXIMATE LOCATION PER GEOPHYSICAL SURVEY)

NOTES

1. THIS SECTION OF PIPING WHICH RUNS APPROXIMATELY NORTH - SOUTH WILL BE SLOPED AT 0.8% SUCH THAT CONDENSATE WILL DRAIN TOWARDS WELLS.

A	MM/DD/YY	GLOBAL DESCRIPTION	CAD	DES	CHK	RW
REV	DATE	DESCRIPTION	DRW	DES	CHK	RW
SEAL / PERMIT						
CLIENT						
SEA-TAC INVESTMENTS LLC						
CONSULTANT						
PROJECT						
03-3368.06/05						
TITLE						
SEATAC DEVELOPMENT SITE SEATAC WA.						
DRAWING N°						
200						
SHEET N°						
OF						
SHEET SIZE ANSI D						

Drawing File: I:\CAD\Projects\2007\0733368\08\05\Sheet\07-33368-06_Diagram.dwg Layout250 PIPING CONNECTION DIAGRAM Friday, August 10, 2012 8:04:56 AM By: elordcr



LEGEND

1.5" SVE PIPING

1.5" IAS PIPING

SPARE 2" LINE

NOTES

1. FLEXIBLE HOSE WILL CONNECT THE SUBSURFACE PIPES TO THE MANIFOLDS. SEE DRAWING 500

2. THE PIPES ARE SHOWN IN THE ORDER THEY DAYLIGHT. SEE DRAWING 400

3. SPARE 2" LINES WILL BE CAPPED WITH A PVC CAP.

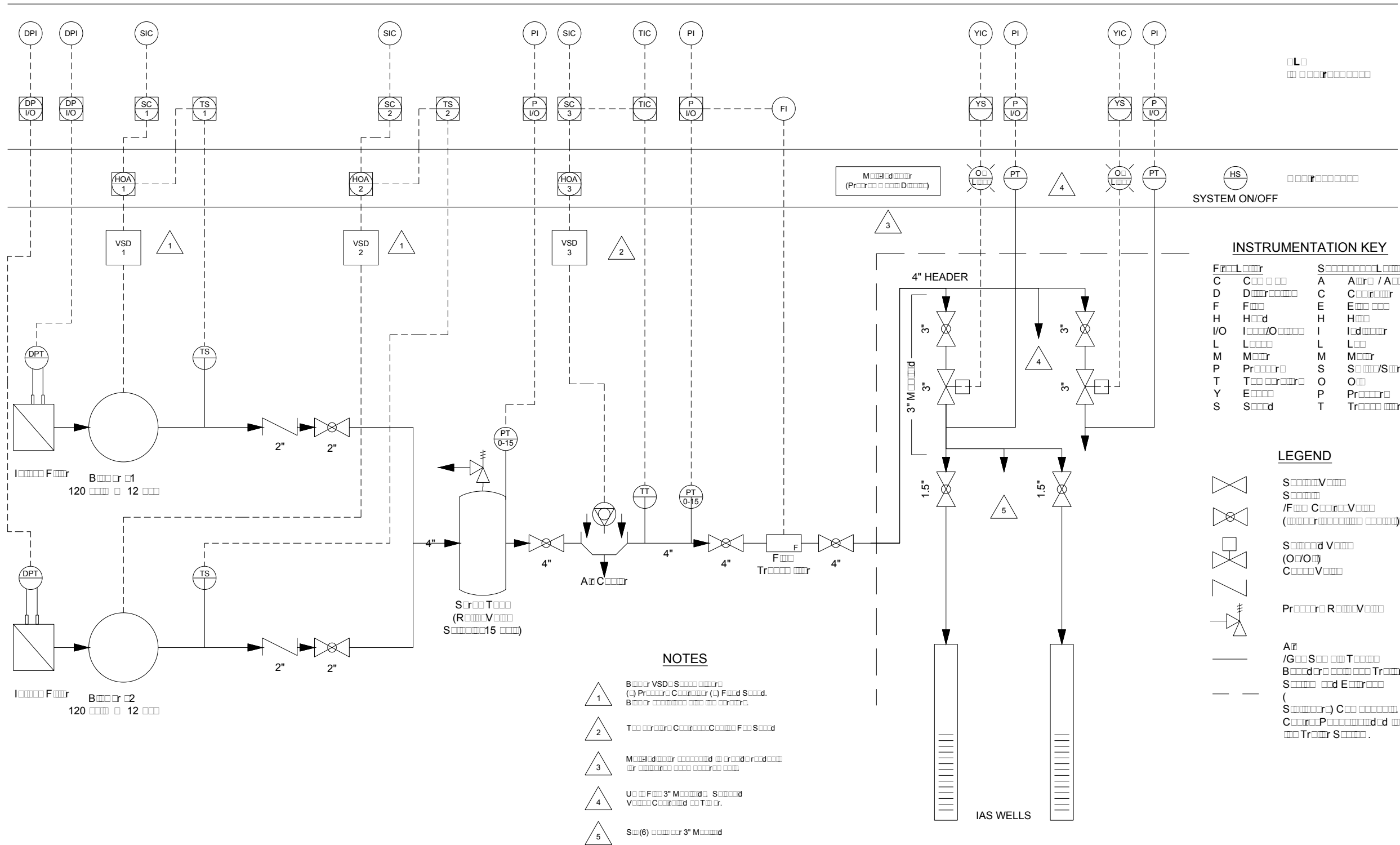
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SCALE FEET

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SEAL / PERMIT						
CLIENT						
SEA-TAC INVESTMENTS LLC						
CONSULTANT						
PROJECT						
07-33368.06/05						
TITLE						
SEATAC DEVELOPMENT SITE SEATAC WA						
DRAWING NO.						
250						
SHEET NO.						
OF						

SHEET SIZE ANSI D

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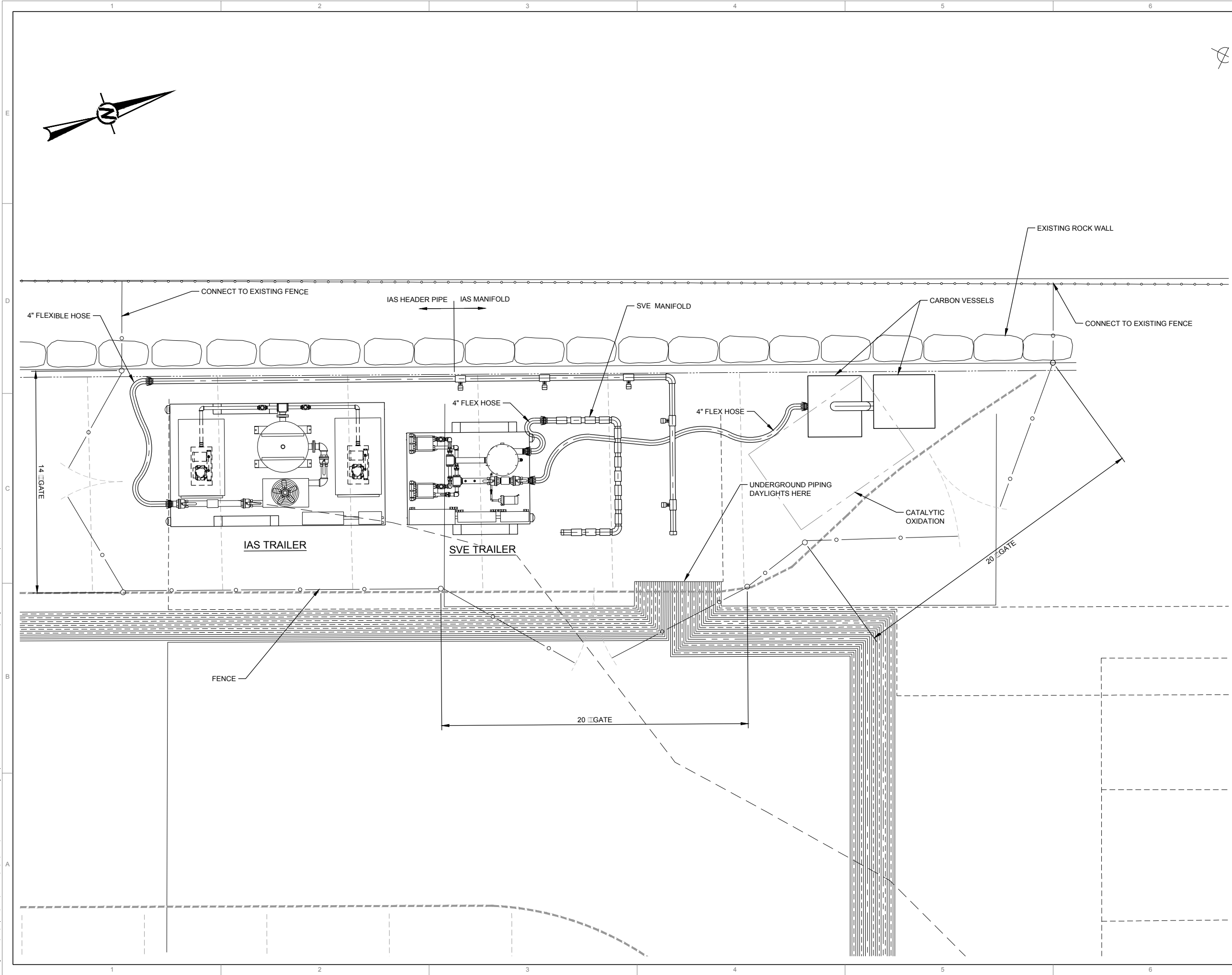
INSTRUMENTATION KEY	
Flowmeter	Storage Tank
C Control	A Air / Air
D Distributor	C Control
F Flow	E Electric
H Header	H Header
I/O Input/Output	I Indicator
L Level	L Level
M Motor	M Motor
P Pressure	S Solenoid/Sensor
T Temperature	O On
Y Electric	P Pressure
S Solid	T Transmitter

LEGEND	
	Solenoid Valve
	Solenoid Valve with Flow Control
	Solenoid Valve with On/Off Control
	Solenoid Valve with Pressure Control
	Air
	Gas Solenoid Valve
	Bore Control Valve
	Solenoid Valve with Electric Control
	Solenoid Valve with Control Pressure
	Solenoid Valve with Transmitter

- NOTES**
- 1 Bore VSD Solenoid Valve (3) Pressure Control (3) Flow Solenoid. Bore Solenoid Valve Control Valve
 - 2 Temperature Control Control Flow Solenoid
 - 3 Motor Solenoid Valve Control Valve
 - 4 U (6) Flow 3" Motor Solenoid Valve Control Valve
 - 5 Solenoid Valve 3" Motor

A	MM/DD/YY	GLOBAL DESCRIPTION	CAD	DES	CHK	RW
REV	DATE	DESCRIPTION	DRW	DES	CHK	RW
SEAL / PERMIT						
CLIENT						
SEA-TAC INVESTMENTS LLC						
CONSULTANT						
PROJECT						
SEATAC DEVELOPMENT SITE SEATAC WA.						
TITLE						
IAS PROCESS AND INSTRUMENTATION DIAGRAM						
DRAWING N:						
300						
SHEET N:						
OF						

Drawing File: C:\CAD\Projects\2007\0733368\08\05\Sheet\073-33368-06_TRAILER.dwg Layout:400 IAS AND SVE TRAILER LAYOUT AND PIPING DIAGRAM Friday, August 10, 2012 8:15:40 AM By: drcorcor



LEGEND

- SVE WELLS
- IAS WELLS
- 1.5" SVE PIPING
- 1.5" IAS PIPING
- SPARE 2" LINE
- NEW CHAIN LINK FENCE
- EXISTING CHAIN LINK FENCE
- FIRE LANE BOUNDARY

3 0 3
SCALE FEET

REV	DATE	DESCRIPTION	CAD	DES	CHK	R/W

SEAL / PERMIT

CLIENT

SEA-TAC INVESTMENTS LLC

CONSULTANT

Golder Associates

PROJECT

073-3368.06/05

SEATAC DEVELOPMENT SITE
SEATAC WA.

TITLE

IAS AND SVE TRAILER LAYOUT AND PIPING
DIAGRAM

DRAWING NO.

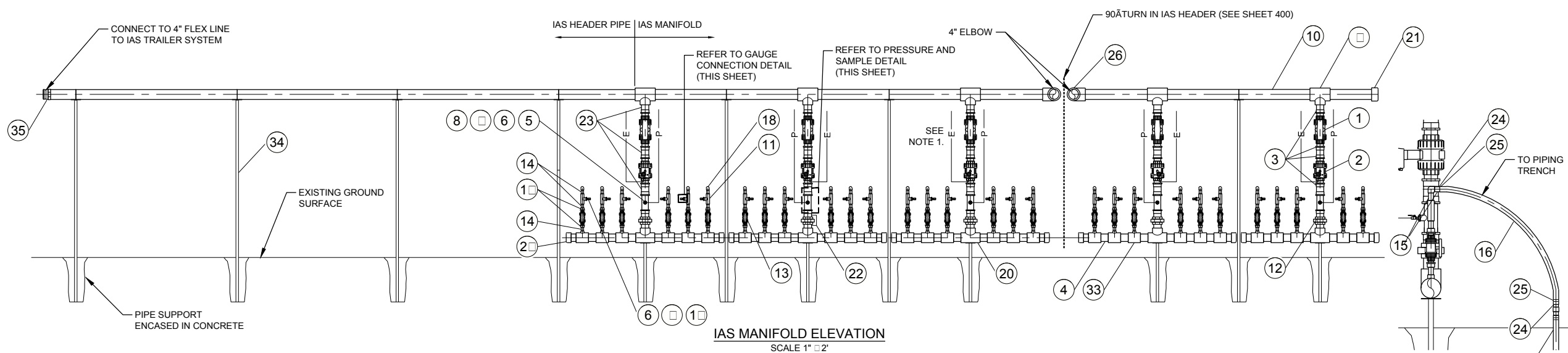
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SHEET NO.

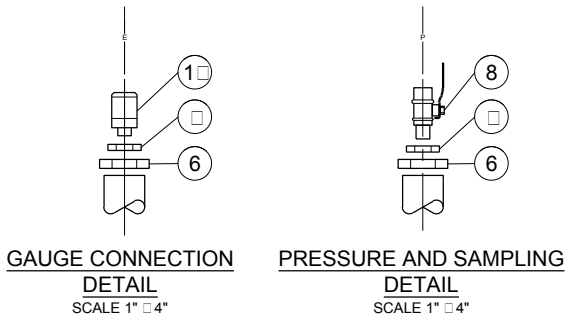
OF

SHEET SIZE ANSI D

Drawing File: C:\CAD\Projects\2007\0733368\08\05\Sheet\073-33368-06-05.dwg IAS MANIFOLD PIPING AND WELL HEAD DETAILS Friday, August 10, 2012 2:58:48 PM By: drcorder

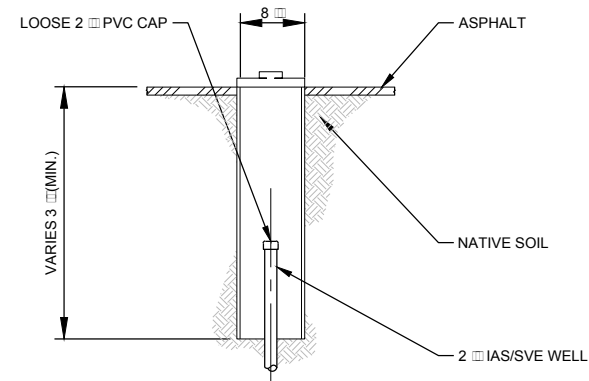


IAS MANIFOLD SIDE VIEW
SCALE 1" = 1'
SEE NOTE 3

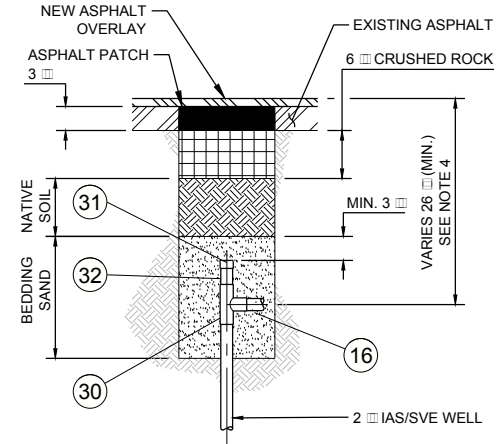


Gauge Connection
DETAIL
SCALE 1" = 4"

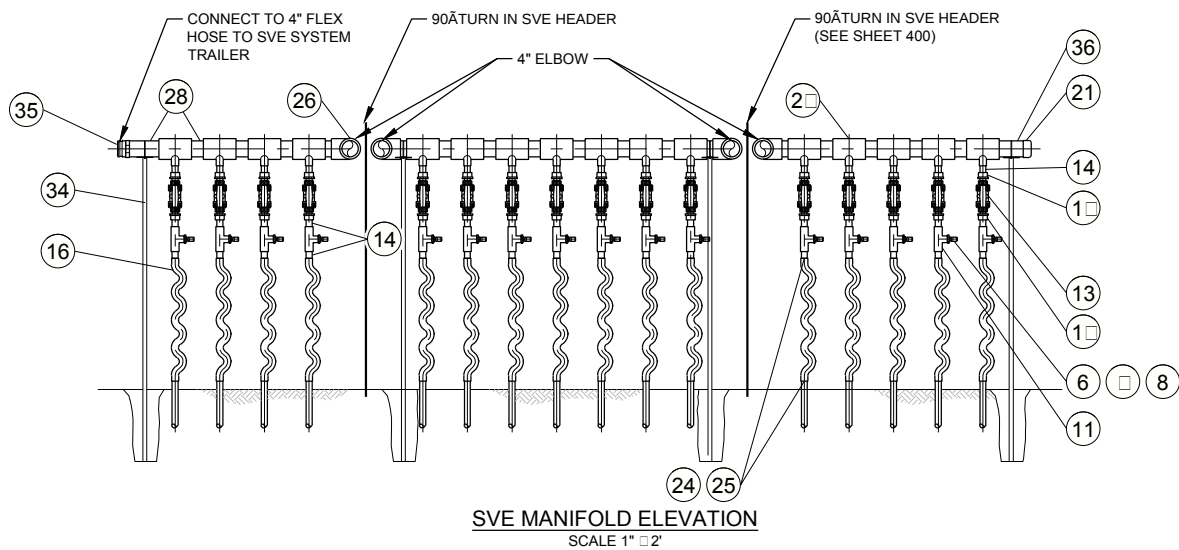
Pressure and Sampling
DETAIL
SCALE 1" = 4"



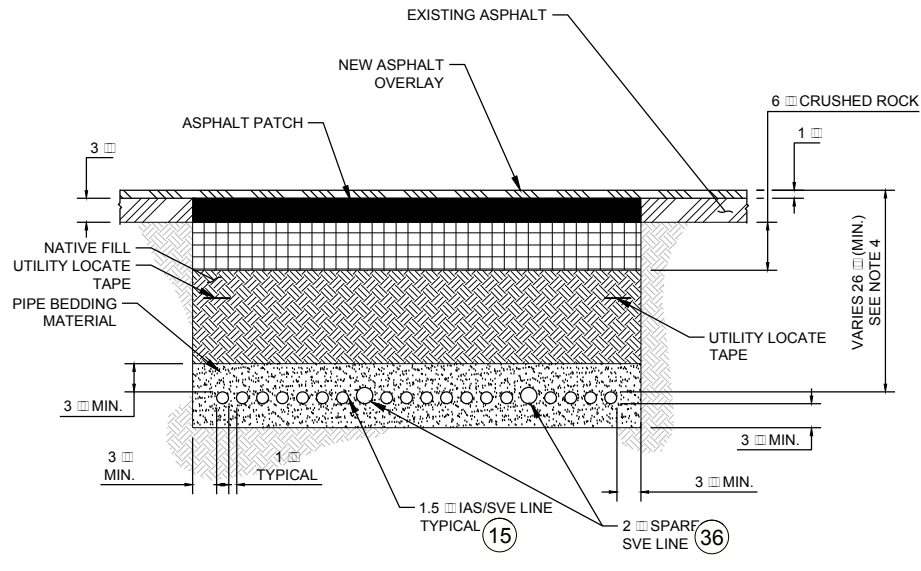
WELLHEAD PRE-CONSTRUCTION (IAS/SVE)
SCALE 1" = 2'



WELLHEAD POST-CONSTRUCTION (IAS/SVE)
SCALE 1" = 1'



SVE MANIFOLD ELEVATION
SCALE 1" = 2'



PIPING TRENCH - TYPICAL
SCALE 1" = 1'
SEE NOTE 2

MARK	DESCRIPTION
1	3" BALL VALVE, PVE, FULL PORT, QUARTER TURN SHUT-OFF, FNPT X FNPT, LEGEND BRAND OR APPROVED EQUAL
2	3" FULL PORT BRASS BALL VALVE; NPT; PTFE SEATES, VITON SEALS, NEMA 4, ELECTRIC ACTUATOR 24 VDC BITORQ OR APPROVED EQUAL
3	3" MALE ADAPTER, PVC, SCH 40, SOC X MNPT
4	PIPE, 3", 3" LONG, PVC, SCH 40
5	REDUCING TEE, 3" X 3" X 1" PVC, SCH 40, SOC X SOC X FNPT
6	BUSHING, 1" X 1/2", MNPT X FNPT
7	BUSHING, 1/2" X 1/4", MNPT X FNPT
8	VALVE, 1/4" VALL, MNPT X FNPT
9	REDUCED TEE, 4" X 4" X 3", PVC, SCH 40, SOC X SOC X SOC
10	PIPE, 4", PVC, SCH 40, LENTH AS REQUIRED
11	REDUCING TEE, 1-1/2" X 1-1/2" X 1", PVC, SCH 40, SOC X SOC X MNPT
12	3" UNION, PVC, SOC X SOC, O-RING SEAL
13	BALL VALVE, 1-1/2", PVC, FULL OPENING, 31 QUARTER TURN SHUT-OFF, BALL VALVE, 1-12/", PVC FULL OPINGING, FNPT X FNPT, LEGEND BRAND OR APPROVED EQUAL
14	1-1/2" PIPE, 3" LONG, PVC, SCH 80
15	PIPE, 1-1/2", SCH 80, LENGTH AS REQUIRED
16	FLEXIBLE HOSE, 1/1/2", LENGTH AS REQUIRED
17	FEMALE QUICK DISCONNECT, ZINC PLATED, CONNECT. X 1/4" MNPT
18	ELBOW, 1-1/2", PVC, SCH 40, SOC X SOC
19	1-1/2" MALE ADAPTER, PVC, SCH 40, SOC X MNPT
20	TEE, 3", PVC, SCH 40, SOC X SOC X SOC
21	CAP, 4", PVC, SCH 40, SOC
22	PIPE, 3", PVC, LENGTH AS NEEDED
23	PIPE, 3", 2" LONG, PVC, SCH 40
24	INSERT ADAPTER, 1-1/2", PVC, INSERT X SOC
25	HOSE CLAMP, 1-1/2"
26	ELBOW, 4", PVC, SCH 40, SOC X SOC
27	CAP, 3", PVC, SCH 40, SOC
28	PIPE, 4", 3" LONG, PVC, SCH 40
29	REDUCER TEE, 4" X 4" X 1-1/2", PVC, SCH 40, SOC X SOC X SOC
30	REDUCING TEE, 2" X 2" X 1-1/2", PVC, SCH 40, SOC X SOC X SOC
31	CAP, 2", PVC, SCH 40, SOC
32	PIPE, 2", SCH 40, LENGTH AS REQUIRED
33	REDUCING TEE, 3" X 3" X 1-1/2", PVC, SCH 40, SOC X SOC X SOC
34	PIPE SUPPORT
35	CAM LOCK, 4", MALE FITTING, SOC X CAM
36	PIPE, 4", 6" LENGTH, SCH 40

LEGEND

P PRESSURE TUBING
E ELECTRICAL WIRING

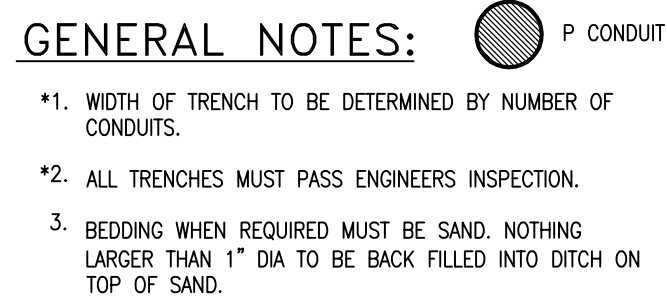
NOTES

- ROUTING OF ELECTRICAL WIRING AND PRESSURE TUBING WILL BE FIELD DETERMINED.
- TRENCH WIDTH AND NUMBER OF PIPES WILL VARY WITH LOCATION.
- ALL IAS MANIFOLDS WILL BE SIMILARLY ATTACHED TO BRANCH PIPING.
- PIPING SHALL HAVE NO LOW OR HIGH POINTS TO COLLECT CONDENSATE. SEE DRAWING 200 FOR SECTION OF PIPING WHICH WILL BE INSTALLED AT A SLOPING DEPTH.

0	08/10/12	GLOBAL DESCRIPTION	DBC	LH	CHK	RWV
REV	DATE	DESCRIPTION	DRW	DES	CHK	RWV
SEAL / PERMIT						
CLIENT SEA-TAC INVESTMENTS						
CONSULTANT 						
PROJECT SEATAC DEVELOPMENT SITE SEATAC WA.						
DRAWING N.: 500						
SHEET N.: OF						

SHEET SIZE ANSI D

APPENDIX B
ELECTRICAL DESIGN DRAWINGS



SCALE: NONE



CONDUIT & WIRE SCHEDULE						
COND#	CONDUIT		WIRE	FROM	TO	
F1	3"	PVC	3,350 KCMIL,#2 NEUTRAL	PSE TRANSFORMER	METER	UTILITY FEED
F2	2 1/2"	GRC	3,350 KCMIL,#2 GND	METER	PANELBOARD	METER TO FUSED PANELBOARD
G	NC	PVC	#2 GND	MAIN DISCONNECT	GROUND ROD	
P-P1	1"	GRC	3#8,#2GND	PANELBOARD	EQUIPMENT VACUUM SKID 1 RECEPTACLE	HUBBELL CS8364C TWIST LOCK 50 AMP 250 VOLT 3 PHASE RECEPT WITH CONNECTOR BODY AND CAST BACK BOX
P-P2	1 1/2"	GRC	3#2,#2GND	PANELBOARD	EQUIPMENT AIR SPARGE SKID 2 RECEPTACLE	HUBBELL 4100R9W 100 AMP 250 VOLT 3 PHASE RECEPT WITH CONNECTOR BODY AND CAST BACK BOX
P-P3	1 1/2"	GRC	3#2,#2GND	PANELBOARD	EQUIPMENT VACUUM OXIDATION RECEPTACLE	HUBBELL 4100R9W 100 AMP 250 VOLT 3 PHASE RECEPT WITH CONNECTOR BODY AND CAST BACK BOX
P-P10	1"	GRC	3#12,#12 GND	PANELBOARD	LIGHTING POLE	LIGHTING POLE
P-P10A	3/4"	GRC	2#12	WP LOCKING LIGHT SWITCH	LIGHTING POLE	SWITCH CIRCUIT

N.T.S.

SeaTac Development Site Remediation System

SITE PLAN

ELECTRICAL DETAILS

SHEET
E-3

APPENDIX C
TREATMENT SYSTEM TECHNICAL SPECIFICATIONS

SECTION 01100 SCOPE OF WORK

PART 1: GENERAL

1.01 GENERAL SCOPE

- A. CONTRACTOR shall supply all labor, materials, equipment, tools, and supplies necessary to perform the work described herein ("Work").
- B. CONTRACTOR shall install above-ground and buried piping for in-situ air sparging (IAS) and soil vapor extraction (SVE) remediation system as described in the Drawings and these Specifications.
- C. The Work includes trenching, installation of pipe and fittings, asphalt repair, placing an asphalt overlay over the Work area, and fencing.
- D. CONTRACTOR shall supply all equipment and materials except that specifically identified in article 2.01 of this specification.

1.02 THE SITE

The "Site" as referenced herein shall refer to the area where the remediation systems are to be installed. The Site is located at MasterPark Lot C near the SeaTac airport as shown on the Drawings.

1.03 DEFINITION OF PARTIES INVOLVED

- A. "OWNER" refers to Sea-Tac Investments, LLC.
- B. "ENGINEER" refers to Golder Associates Inc. (Golder).
- C. "CONTRACTOR" refers to the company selected by the OWNER to perform the pipe installation, trenching/backfilling, asphalt pavement, and electrical Work.
- D. "ELECTRICAL CONTRACTOR" refers to the company to perform electrical, instrumentation, and controls work, either selected by the OWNER under separate contract or subcontractor to the CONTRACTOR.
- E. "WELL CONTRACTOR" refers to the company selected by the OWNER under separate contract to install new wells at the Site.

1.04 RELATION TO OTHER WORK AND COORDINATION

- A. The complete project includes installation of wells, installation of piping from the wells to the IAS and SVE blowers, installation of flexible hose from buried piping to IAS and SVE manifolds, installation of header pipe from manifolds to trailers, construction of a fence around the equipment area, installation of IAS and SVE equipment, installation of a series of gates and fence to enclose the trailer area.

- B. CONTRACTOR'S Work does not include:
 - 1. Installation of IAS and SVE wells.
 - 2. Providing IAS and SVE blower trailers and connection of these trailers to piping installed by CONTRACTOR.
 - 3. Providing carbon vessels of SVE offgas treatment and connection of these to the SVE blower trailer.
 - 4. Instrumentation on blower trailers.
- C. CONTRACTOR shall coordinate his work through the ENGINEER with any other contractors or other personnel involved in the project. The CONTRACTOR shall provide full cooperation with others as necessary for smooth and successful construction, startup, and operation of the complete system.

1.05 REGULATORY REQUIREMENTS

- A. CONTRACTOR shall be responsible for obtaining any construction or installation permits required for the Work.
- B. CONTRACTOR shall execute the Work in complete compliance with all applicable laws, regulations, codes, and ordinances.
- C. CONTRACTOR shall execute the Work in complete compliance with all applicable codes and standards for equipment installation and construction, whether or not explicitly specified herein.
- D. CONTRACTOR shall prepare a Stormwater Pollution Prevention Plan (SWPPP) for the Work and follow the substantive requirements of the Construction Stormwater General Permit issued by the Washington State Department of Ecology.

1.06 HEALTH AND SAFETY REQUIREMENTS

- A. CONTRACTOR shall be responsible for compliance with all applicable health and safety regulations during the Work. The CONTRACTOR shall be responsible for the safety of all employees, subcontractors, other persons under his direction, and any other personnel entering the Work area. Before Work commences, the CONTRACTOR shall submit a Health and Safety Plan developed consistent with the Site Health and Safety Plan and meeting all applicable regulations.
- B. CONTRACTOR is responsible for being cognizant of and ensuring compliance with the requirements set forth in 29 CFR 1910 and WAC 296-843. Such responsibility shall apply to both the CONTRACTOR'S operations and those of the CONTRACTOR'S subcontractors.
- C. Personnel directly involved with excavating, handling, and disposing of contaminated soil or water shall have current HAZWOPER training meeting 29 CFR 1920.120 and WAC 296-843. Submit evidence of training.

- D. When violations of the health and safety requirements contained in this specification are called to the CONTRACTOR'S attention, the CONTRACTOR shall immediately correct the condition to which attention has been directed. Such notice, either oral or written, when served on the CONTRACTOR or the CONTRACTOR'S representative(s), shall be deemed sufficient. In the event that the CONTRACTOR fails or refuses to promptly comply with the compliance directive issued, the ENGINEER may issue an order to stop all or any part of the Work. When satisfactory corrective action is taken, an order to resume work will be issued. The CONTRACTOR shall not be entitled to any extension of time, nor any claim for damage or for additional compensation, by reason of either the directive or the stop work order. Failure of the ENGINEER to order discontinuance of any or all of the CONTRACTOR'S operations shall not relieve the CONTRACTOR of his responsibility for the safety of personnel and property.
- E. Submittals – CONTRACTOR shall prepare a site-specific health and safety plan in conformance with 29 CFR 1910. Two (2) copies of the CONTRACTOR'S Health and Safety Plan shall be submitted to the ENGINEER within seven (7) days following the Notice to Proceed. Submittal of CONTRACTOR'S health and safety plan shall in no way relieve CONTRACTOR of his responsibilities for protection of the health and safety of workers and other Site personnel.

PART 2: PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

- A. This section describes major equipment and special order components to be furnished by the OWNER. CONTRACTOR will install new piping to connect to major equipment and wells.
- B. Existing IAS trailer (includes two blowers, an air cooler, surge tank, and associated valves, gages, and meters, and instrumentation).
- C. Existing SVE trailer (includes two vacuum blowers, knockout drum, associated valves, gages, and meters, and instrumentation).
- D. Two granular activated carbon vessels (2,000 lb each).
- E. IAS and SVE wells, installed by the WELL CONTRACTOR under a separate contract.
- F. Electrical supply box, installed by the ELECTRICAL CONTRACTOR under a separate contract.

PART 3: EXECUTION

NOT USED

*** END OF SECTION ***

**SECTION 01330
SUBMITTALS**

PART 1: GENERAL

1.01 SUMMARY

Requirements for submittals for the Work are described in this section.

1.02 SUBMITTAL PROCEDURES

- A. Submittals requiring ENGINEER'S review and approval shall be submitted prior to procurement, fabrication, or start of the associated construction activity. A minimum of 10 calendar days shall be allowed for the ENGINEER'S review, unless stated otherwise in these Specifications or on the Drawings.
- B. Submittals shall identify the project, CONTRACTOR, subcontractor, supplier or manufacturer, pertinent drawing sheet and detail number(s), and specification section number, as appropriate. Submittals shall be sequentially numbered.
- C. Schedule submittals to expedite the project.
- D. Deliver submittals to ENGINEER on site. Provide three (3) copies unless noted otherwise in this section.
- E. Identify any variations from Contract Documents and product or system limitations which may be detrimental to successful performance of the completed Work.
- F. Space for ENGINEER review signature shall be provided on the submittal.
- G. Revise and resubmit submittals as required by ENGINEER; identify all changes made since previous submittal.
- H. Distribute copies of approved submittals to affected parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 CONSTRUCTION SCHEDULES

- A. The CONTRACTOR'S construction schedule shall be prepared and submitted with the CONTRACTOR'S bid.
- B. Schedule shall be updated and submitted weekly by the CONTRACTOR. The schedule shall include the CONTRACTOR'S planned activities that will occur during the subsequent two weeks.
- C. Indicate submittal dates proposed for shop drawings, product data, samples, and product delivery.

1.04 PRODUCT DATA

- A. With his bid, the CONTRACTOR shall submit a list of major products proposed for use, with the manufacturer name, trade name, and model number of each product.
- B. For other products, the CONTRACTOR shall submit information on the product proposed for use, including but not limited to the manufacturer name, trade name, and model number of each product. Submit at least 14 calendar days before scheduled use of proposed product.
- C. For products specified only by reference standard, give manufacturer, trade name, model or catalog designation, and reference standards.
- D. For all products, provide sufficient information, including but not limited to, manufacturer's descriptive literature, specifications, cut sheets, and other materials, to demonstrate compliance with the requirements of these Specifications.

1.05 SHOP DRAWINGS

- A. Wherever called for in the Contract Documents, or where required by the ENGINEER, the CONTRACTOR shall submit Shop Drawings. The term "Shop Drawings" as used in these Specifications shall be understood to include detail design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, and similar items.
- B. All CONTRACTOR Shop Drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submittal.
- C. Shop Drawings shall be submitted a minimum of seven (7) calendar days prior to construction of the pertinent feature.

1.06 MANUFACTURERS' INSTRUCTIONS

- A. When required in individual specification Sections, or where recommended by the manufacturer, submit two copies of the manufacturers' printed instructions for delivery, storage, assembly, installation, adjusting, finishing, operating, and maintenance, as applicable.
- B. Identify any conflicts between manufacturers' instructions and Contract Documents and notify ENGINEER immediately.
- C. Manufacturer's instructions shall be submitted a minimum of seven calendar days prior to delivery of the associated product to project Site.

1.07 MANUFACTURERS' CERTIFICATES

- A. When required in the Specifications, submit manufacturers' certificates.

- B. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to the ENGINEER. Where applicable, certificates shall be from the same production lot of material as the material delivered to the Site, and shall include results from the manufacturer's standard Quality Control and Quality Assurance testing.
- D. Certificates shall be submitted a minimum of seven days prior to delivery of the associated material at the Site.

1.08 PROPOSED SUBSTITUTES OF "OR APPROVED EQUAL" ITEMS

- A. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular manufacturer or supplier, the naming of the item is intended to establish the type, function, and quality required. If such description is followed by the words "or approved equal" indicating that a substitution is permitted (i.e., if "or approved equal" is not indicated, substitutes are not allowed), other materials or equipment may be acceptable if sufficient information is submitted by the CONTRACTOR to allow the ENGINEER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:
 - 1. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the CONTRACTOR.
 - 2. The ENGINEER will be the sole judge as to the type, function, and quality of any such substitute material or equipment. The ENGINEER'S decision is final.
 - 3. The ENGINEER may require the CONTRACTOR to furnish at the CONTRACTOR'S expense additional data about the proposed substitute.
 - 4. The ENGINEER may require the CONTRACTOR to furnish at the CONTRACTOR'S expense a special performance guarantee or other surety with respect to any substitute.
 - 5. Acceptance by the ENGINEER of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
 - 6. The CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the CONTRACTOR'S work, the work of its subcontractors, and of other contractors, and shall effect such changes without cost to the OWNER.
- B. The procedure for review by the ENGINEER shall include the following:

1. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application to the ENGINEER for acceptance of the substitute item.
 2. Requests for substitutes shall be submitted with the CONTRACTOR'S Bid, unless required during the WORK by circumstances beyond the CONTRACTOR'S control and authorized in writing by the ENGINEER.
 3. Wherever a proposed substitute material or equipment has not been submitted as part of the Bid, or wherever the submission of a proposed substitute material or equipment has been judged to be unacceptable by the ENGINEER, the CONTRACTOR shall provide the material or equipment named in the Contract Documents.
 4. The CONTRACTOR shall certify in writing that the proposed substitute will a) adequately perform the functions and achieve the results called for by the general design, b) be similar and of equal substance to that specified, and c) be suited to the same use as specified.
 5. As applicable, no Shop Drawing submittals shall be prepared for a substitute item nor shall any substitute item be ordered, installed, or utilized without the ENGINEER'S prior written acceptance of the CONTRACTOR'S written request.
- C. The CONTRACTOR'S written request shall contain the following statements and/or information which shall be considered by the ENGINEER in evaluating the proposed substitution:
1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR'S achievement of substantial completion on time.
 2. Whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents to adopt the design to the proposed substitute.
 3. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
 4. All variations of the proposed substitute for that specified shall be identified.
 5. Available maintenance, repair, and replacement service shall be indicated.
 6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change.

1.09 SAMPLES SUBMITTAL

- A. Whenever in the Specifications samples are required, the CONTRACTOR shall submit not less than three samples of each such item or material unless indicated otherwise at no additional cost to the OWNER.

- B. Samples shall be submitted for acceptance a minimum of seven calendar days prior to ordering such material for delivery to the Site, and shall be submitted in an orderly sequence so that dependent materials or equipment can be submitted and reviewed without causing delays in the Work.
- C. All samples shall be individually, legibly, and indelibly labeled or tagged, indicating the material or product type, intended use (specification section), and Supplier's name for identification.
- D. For manufactured materials other than bulk soil samples, upon receiving acceptance, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set will be retained by the ENGINEER, and one set of samples shall remain at the Site until completion of the Work.
- E. Unless otherwise specified, all colors and textures of specified items will be selected by the ENGINEER from the manufacturer's standard colors and standard materials, products, or equipment lines.

1.10 REVIEW BY ENGINEER

- A. Distribute submittals promptly for review.
- B. Verify that review comments are technically correct and are consistent with technical and contractual requirements of the Work.
- C. Return submittals to the CONTRACTOR for distribution or resubmittal.
- D. The ENGINEER'S review of CONTRACTOR shop drawing submittals shall not relieve the CONTRACTOR of the entire responsibility for the correctness of details and dimensions. The CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.11 RESUBMITTAL REQUIREMENTS

- A. Resubmittals are required until all comments by the ENGINEER are satisfactorily addressed.
- B. Revise initial submittal and resubmit as specified for initial submittal.
- C. Indicate any changes made other than those requested by the ENGINEER.

1.12 RECORD DRAWINGS

- A. The CONTRACTOR shall keep and maintain, at the Site, one record set of drawings. On these, mark all project conditions, locations, configurations, and any other changes or deviations which may vary from the details shown on the original Contract Drawings, including but not limited to buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that

differ from the locations indicated, or which were not indicated on the Contract Drawings.

- B. The record drawings shall be supplemented by any detailed sketches as necessary or directed to indicate, fully, the Work as actually constructed.
- C. The record drawings of the as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the Work.
- D. In the case of those drawings which show the detailed requirements for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record drawings shall be updated by indicating those portions which are superseded by change order drawings or final shop drawings, and by including appropriate reference information describing the change orders by number and the shop drawings by manufacturer, drawing, and revision numbers.
- E. Record drawings shall be accessible to the ENGINEER at all times during the construction period and shall be delivered to the ENGINEER upon completion of the Work.

PART 2: PRODUCTS

NOT USED

PART 3: EXECUTION

NOT USED

END OF SECTION

SECTION 1600 WASTE MANAGEMENT

PART 1: GENERAL

1.01 SUMMARY

This section describes the characterization, transportation, and disposal of waste and recyclable materials generated during construction activities.

1.02 DEFINITIONS

Waste materials include any materials that will not be reused or recycled and will be shipped off-site for permanent treatment and/or disposal.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01330 – Submittals.
- B. With Bid, submit list of specialist subcontractors, including transporters and waste disposal facilities, proposed for this project together with sufficient supporting information to demonstrate compliance with these specifications.
- C. Within fourteen (14) calendar days after Notice to Proceed, submit a Waste Management Plan (WMP) describing equipment, materials, and procedures that will be used to manage waste for this project. Include a Spill Control Plan as part of the WMP.
- D. Submit the following during construction:
 - 1. Waste profiles
 - 2. Waste management records
 - 3. Waste manifests and bills-of-lading
 - 4. Weigh tickets and disposal receipts

1.04 QUALIFICATIONS

- A. All waste management firms, waste transportation firms, and treatment/disposal facilities shall be properly licensed and permitted to handle and accept the wastes generated during this project.
- B. All disposal facilities shall be approved of in writing by the ENGINEER prior to use.

1.05 PERMITS

The CONTRACTOR shall obtain any permits required for handling, transport, and disposal of regulated or hazardous wastes generated during the course of the Work.

PART 2: PRODUCTS

The CONTRACTOR shall provide the following materials for waste management:

- A. Provide waste containers which conform to regulatory requirements.
- B. Drum labels and markings shall conform to 29 CFR 1926 and all other Federal, State, or local codes and regulations.
- C. Water and liquid storage tanks shall be chemically compatible with liquid wastes generated during the Work, as determined by the CONTRACTOR.
- D. Provide spill prevention and countermeasure materials and control products in accordance with CONTRACTOR'S Spill Control Plan, including plastic sheeting and absorbent materials consistent with the requirements of Title 49 CFR 173 and applicable State and local regulations.

PART 3: EXECUTION

3.01 GENERAL

The CONTRACTOR shall furnish all labor, materials, equipment, and related items required for the proper handling and disposal of waste material/recyclable material generated during the Work.

3.02 WASTE CHARACTERIZATION

- A. The ENGINEER will sample and analyze wastes for characterization and profile determination purposes in accordance with the receiving facility and federal, state, and local requirements.
- B. The ENGINEER will screen excavated soil in the field to provide an initial indication of whether it is contaminated for purposes of segregating clean and contaminated soil into stockpiles.
- C. The ENGINEER will sample and analyze soil from the stockpiles and provide waste characterization results to the CONTRACTOR within 48 hours of sampling. The CONTRACTOR shall be responsible for sequencing his work and managing waste materials to avoid delays due to sampling and analysis activities. Costs associated with waiting time for sampling and analysis activities shall be included in the firm fixed price for the Work.

3.03 STORAGE AND PACKAGING OF WASTES AND RECYCLABLE MATERIALS

- A. Store all wastes in containers appropriate for transport as specified by applicable regulations and permit requirements.

B. Labeling

1. The CONTRACTOR shall properly label and mark waste containers immediately upon placement of waste in the container.
 2. Bulk-stored waste shall be identified with a sign that bears an appropriate waste label and any additional information that is required for waste area demarcation.
 3. Hazardous wastes shall be labeled and marked in accordance with the requirements of applicable Federal and State regulations.
- C. Package all wastes for transport in containers that comply with the requirements of Federal and State DOT regulations and/or the requirements of the transporter, whichever are more stringent.

3.04 SELECTION OF WASTE DISPOSAL METHOD

- A. The CONTRACTOR shall dispose of non-hazardous and non-recyclable waste at an appropriate permitted solid waste landfill. The solid waste shall comply with the facility operator's waste acceptance requirements.
- B. Disposal methods for hazardous wastes shall be selected based on the generic or facility-specific waste profile for the material.

3.05 TRANSPORT FOR OFF-SITE DISPOSAL

CONTRACTOR shall use only licensed and bonded transporters for off-site transport and disposal of all solid wastes, recyclable materials, and hazardous/special wastes generated during the construction activities. CONTRACTOR shall verify that transporters have the necessary permits, equipment, experience, safety programs, and other requirements to satisfy applicable regulations.

3.06 MANIFEST AND BILL-OF-LADING

- A. Prepare a waste manifest for each shipment of hazardous waste as required under applicable State and Federal regulations. Submit the manifest for review and approval at least 24 hours prior to off-site transport. Under no circumstances shall regulated materials be removed from the site without authorized signature.
- B. Prepare a bill-of-lading for transport of waste as required by the transporter and in conformance with all applicable transport regulations and requirements.

3.07 DISPOSAL RECEIPTS AND EXECUTED MANIFESTS

Submit copies of weigh tickets, disposal receipts, and / or fully executed manifest copies for all wastes to the ENGINEER. All such copies shall be submitted within 48 hours of material receipt at the disposal facility. All such copies will be required as a condition of substantial completion of the Work.

END OF SECTION

SECTION 02315 TRENCHING AND BACKFILLING

PART 1: GENERAL

1.01 SUMMARY

CONTRACTOR shall excavate and backfill trenches for piping for the IAS and SVE remediation system as described in the Drawings and these Specifications. CONTRACTOR shall supply all labor, materials, equipment, tools, and supplies necessary to perform the Work described herein.

1.02 QUALITY ASSURANCE

- A. Quality assurance is required to confirm that all aspects of the Work achieve the intent of the design Drawings and the technical Specifications. Quality assurance activities for this trenching and backfilling will include:
 - 1. Laboratory testing of soils, as described in subsequent articles of this specification.
 - 2. Compaction testing of placed fill materials, as described in subsequent articles of this specification.
 - 3. Visual inspection of materials, placement activities, lift thickness, subgrade condition, and other aspects of the Work.
- B. Quality assurance activities will be performed by the ENGINEER. The CONTRACTOR shall provide incidental labor, equipment, and material as required to support these activities at no additional cost. The CONTRACTOR shall notify the ENGINEER and interrupt Work as required for testing and inspection activities and shall comply with all pertinent requirements of this specification.
- C. Any delays due to quality assurance activities are included in the Work and shall not incur additional cost to OWNER.

1.03 PRODUCT STORAGE AND HANDLING

All products shall be stored and handled in such a manner as to prevent degradation of the materials.

1.04 SUBMITTALS

- A. For all backfill materials other than native soil, submit supplier's test data or other documentation demonstrating compliance with these specifications.
- B. For all backfill materials other than native soil, submit minimum sixty (60) pound bulk sample at least two (2) weeks prior to planned use.

- C. If, in the opinion of the ENGINEER, material from a particular supplier changes noticeably during the course of construction, or if a different material source is used, resubmit supplier's data and bulk sample for the new material as described in this article.
- D. Documentation shall be provided to the ENGINEER demonstrating the proper certification of the asphalt recycling facility chosen by the CONTRACTOR.
- E. Submit in accordance with Section 01330 – Submittals.

1.05 REFERENCES

- A. ASTM International, versions current at time of bid:
 - 1. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils
 - 2. ASTM D1140 – Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75 micrometers) Sieve
 - 3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - 4. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
 - 5. ASTM D4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating
 - 6. ASTM D4959 - Standard Test Method for Determination of Water (Moisture) Content of Soil By Direct Heating
 - 7. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
- B. Washington State Department of Transportation (WSDOT) 2012 Standard Specifications for Road, Bridge, and Municipal Construction.

PART 2: PRODUCTS

2.01 GENERAL

- A. All materials shall meet the requirements of this section.
- B. All materials shall be free of organics, debris, roots, sod, brush, trash, ice, frozen soil, and other deleterious materials.

2.02 SUMMARY OF EARTH MATERIALS

- A. Pipe Bedding Sand
 - 1. Well-graded, clean sand.
 - 2. The gradation shall conform to the specifications in the WSDOT Section 9-03.2(1), Manufactured Sand

B. Crushed Rock

Crushed rock shall conform to Section 9-03.4 Aggregate for Bituminous Surface Treatment of the WSDOT Standard Specifications, three-quarter (3/4) to one-half (1/2) inch gradation.

C. Structural Fill

Structural fill shall conform to Section 9-03.9(3) Crushed Surfacing of the WSDOT Standard Specifications, top course and keystone gradation.

D. Clean Native Soil

1. Native soil excavated from trenches on-site which is not contaminated by petroleum, as determined by the ENGINEER.
2. When used as trench backfill, the maximum particle size shall not exceed three (3) inches in the greatest dimension. Oversized material shall be removed by screening or other approved method.

E. Petroleum-Contaminated Soil

Excavated soil determined by ENGINEER to require off-site disposal. (see Section 01600 – Waste Management).

F. Asphalt for Off-Site Recycling

Existing asphalt pavement that will be excavated for trenching.

2.03 UTILITY WARNING TAPE

Utility warning tape shall be six (6) inches wide and yellow in color with an integral metallic wire for tracing and shall be labeled "Caution Utilities Below" or approved equal.

PART 3: EXECUTION

3.01 GENERAL

- A. CONTRACTOR shall be responsible for ensuring that utility location and clearance surveys have been performed prior to excavation and shall be responsible for any damage to existing utilities that occurs as a result of excavation.
- B. All excavations shall meet OSHA requirements.
- C. Inspect all excavations on a regular basis for signs of instability and undertake remedial measures as needed. Maintain excavations in a safe and stable condition.

3.02 EXCAVATION

- A. All excavations shall be made to the lines and grades shown on the Drawings.
- B. Saw-cut existing asphalt prior to excavation.

- C. Asphalt excavated for trenching shall be segregated from other materials, and shall be delivered to a permitted asphalt recycling facility of the CONTRACTOR'S choosing.
- D. Clean soil and petroleum-contaminated soil shall be segregated during excavation as directed by the ENGINEER to determine which soil is clean and which is contaminated (and thus requires off-site disposal; see 01600 – Waste Management).
- E. Protect excavated subgrade from disturbance and erosion.

3.03 STOCKPILES

- A. Stockpiles shall not exceed six (6) feet in height. Side slopes shall not exceed 1H:1V, or shallower as necessary to maintain stable slopes.
- B. Stockpiles shall be protected from wind and water erosion, unnecessary compaction, and contamination. Direct surface water away from stockpiles.
- C. Petroleum-contaminated soils shall not be mixed with uncontaminated soils.
- D. Stockpiles shall not be placed immediately adjacent to any open storm drains.
- E. Petroleum-contaminated soil shall remain stockpiled as required for sampling and laboratory analysis to be completed.

3.04 WATER CONTROL

- A. Control of surface water and dewatering shall be implemented as needed to prevent surface water from entering excavations and to maintain all excavations free of standing water.
- B. CONTRACTOR shall operate in compliance with the CONTRACTOR's Stormwater Pollution Prevention Plan (see Section 01100).

3.05 SUBGRADE PREPARATION

- A. Prior to placing bedding sand, the trench floor (the subgrade) shall be compacted using a vibrating plate compactor, power tamper, hoe-pack, or other approved equipment to provide a firm and unyielding base.
- B. Subgrade shall be prepared and accepted in writing by the ENGINEER prior to placement of fill.
- C. Prepared subgrade shall be protected from disturbance from weather, construction equipment, or other factors.
- D. Subgrade which becomes softened or otherwise unsuitable shall be repaired.

3.06 FILL – GENERAL

- A. Fill material shall be approved in writing by the ENGINEER prior to placement.
- B. Place all fill material to the lines and grades shown on the Drawings.
- C. Fill material shall be moisture conditioned, including wetting or drying, as necessary to achieve the required compaction.

- D. Fill shall not be placed on overly wet or dry surfaces. Moisture conditioning of lift surfaces may be necessary to achieve suitable compaction and bonding between layers of fill.
- E. Placed fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from surrounding material.
- F. Fill placement shall be temporarily stopped during precipitation or other weather that could compromise the quality of the fill, as determined by the ENGINEER.
- G. Placed fill that has been disturbed or becomes otherwise unsuitable shall be reworked or replaced with suitable material.
- H. Utility warning tape shall be installed in all piping trenches as shown on the Drawings.

3.07 PIPE BEDDING SAND

- A. Place pipe bedding sand below, around, and above pipes to the minimum dimensions shown on the Drawings.
- B. Place pipe bedding in a manner to completely surround the pipes, in particular that no voids remain under the haunches.
- C. Compaction procedures shall achieve a minimum ninety-five percent (95%) of the material-specific D1557 modified Proctor dry density without damaging the pipes.
- D. Do not place material above final lift of pipe bedding sand until approved in writing by the ENGINEER to do so.

3.08 CLEAN NATIVE FILL

- A. Clean native fill shall be used to backfill trenches above the pipe bedding sand, as shown on the Drawings.
- B. Place native soil backfill in maximum 6-inch-thick loose lifts.
- C. Compact native soil backfill to a minimum ninety-five percent (95%) of the material-specific D1557 modified Proctor dry density.
- D. If a sufficient volume of clean native fill is not available for backfill, structural fill shall be imported and used. Place and compact structural fill in the same manner as native trench soil, as specified in this article.

3.09 CRUSHED ROCK

- A. Crushed rock shall be used to fill the trenches above the native soil backfill to the base of the existing asphalt pavement, as shown on the Drawings.
- B. Place crushed rock in a single lift with an appropriate thickness so that the elevation of the crushed rock layer is even with the base of the existing asphalt pavement after compaction.
- C. Compact crushed rock to a minimum ninety-five percent (95%) of the material-specific D1557 modified Proctor dry density or as approved by the ENGINEER.

3.10 EXCESS CLEAN NATIVE SOIL

- A. CONTRACTOR shall haul excess clean soil excavated during trenching off-site for reuse or disposal at a appropriately permitted facility.

3.11 PETROLEUM-CONTAMINATED SOILS

- A. Petroleum-contaminated soils encountered during excavation shall be temporarily stockpiled on-site, segregated from excavated clean soil, and covered with plastic.
- B. Petroleum-contaminated soils shall be disposed of an appropriately permitted landfill in accordance with Section 1600 – Waste Management.

3.12 QUALITY ASSURANCE AND QUALITY CONTROL

A. Prior to construction

- 1. Particle size will be determined for each backfill material in accordance with ASTM D422 at a frequency of 1 test per 50 cubic yards of material, or one test per material source, whichever results in the greater number of tests.
- 2. Modified Proctor testing in accordance with ASTM D1557 will be performed on each backfill material at a frequency of 1 test per 50 cubic yards of material, or one test per material source, whichever results in the greater number of tests.

B. During construction

- 1. Moisture content will be determined in accordance with ASTM D2216, D4643, or D4959 on each backfill material at a frequency of 1 test per 10 cubic yards of material.
- 2. Testing for the amount of material passing the U.S. #200 sieve per ASTM D1140 may be performed on any material at any time at the discretion of the ENGINEER.
- 3. In-place density of compacted backfill will be determined in accordance with ASTM D6938 at a frequency of one test per 25 lineal feet of trench per lift.

C. Modifications

The ENGINEER may change the frequency or type of testing at his discretion at any point during construction.

D. Quality Control

- 1. Quality Assurance (QA) test results will be provided to the CONTRACTOR as they become available.
- 2. The CONTRACTOR may perform additional quality control (QC) testing at his discretion to facilitate his operations or for other reasons.
- 3. QC testing shall be performed at the CONTRACTOR'S sole expense.
- 4. QC test results shall be provided to the ENGINEER within 24 hours of testing.

5. In the event of discrepancy between the QA and QC test results, the QA test results shall prevail.

END OF SECTION

SECTION 02740 ASPHALT PAVING

PART 1: GENERAL

1.01 DESCRIPTION

The work described in this section consists of asphalt paving to overlay the existing parking area, including patches (pavement) at the top of backfilled soil vapor extraction trenches, to be completed by the CONTRACTOR.

1.02 REFERENCES

Washington State Department of Transportation (WSDOT) 2012 Standard Specifications for Road, Bridge, and Municipal Construction.

1.03 QUALITY ASSURANCE

Test asphalt mix and placed asphalt in accordance with the requirements of WSDOT Section 5-04.

1.04 SUBMITTALS

- A. Mix design, test results, and other information required by WSDOT Section 5-04.
- B. Submit in accordance with Section 01330 "Submittals" of these specifications.

PART 2: PRODUCTS

2.01 HOT MIX ASPHALT

Class one-half inch (1/2") per WSDOT Section 9-03.8. Recycled asphalt pavement shall not be used in the hot mix asphalt.

2.02 ASPHALT BINDER

PG 64-22 per WSDOT Section 9-02.1(4).

PART 3: EXECUTION

3.01 GENERAL

- A. Place asphalt overlay, trench patches, and other asphalt pavement in accordance with the pertinent requirements of WSDOT Section 5-04.3.
- B. Place asphalt patches at the top of backfilled trenches in conformance with the requirements of this section to the minimum thickness shown on the Drawings.

- C. Other areas requiring asphalt pavement or patches may be identified by the ENGINEER during the course of the Work. Place all asphalt pavement in conformance with the requirements of this Section unless directed or approved otherwise.

3.02 PREPARATION

- A. In areas of broken and "alligatored" pavement, remove broken pavement and dispose of in permitted asphalt recycling facility. Replace and/or recompact subgrade to provide firm support equivalent to undamaged pavement section, as indicated by section and conditions observed during trench excavation. Repave area to match thickness of adjacent areas, using asphalt mix and placement methods specified in this section.
- B. Fill individual cracks in accordance with WSDOT Section 5-04.3(5)(C).
- C. Immediately prior to applying overlay, thoroughly clean all asphalt surfaces to remove dust, stones, debris, and any other deleterious materials which could adversely affect the adhesion between the overlay and existing asphalt.
- D. A tack coat will not be required for this project.

3.03 OVERLAY THICKNESS

One inch minimum after compaction.

3.04 RESTRIPIING AND RENUMBERING PARKING STALLS

The stripes and the numbers on parking stalls which are paved over during Work shall be repainted on the new asphalt to restore the original locations and designations.

END OF SECTION

SECTION 02820 FENCING

PART 1: GENERAL

This section describes the installation of permanent fencing and gates around the trailer area.

PART 2: PRODUCTS

2.01 FENCING

- A. CONTRACTOR shall supply equipment, materials, and labor to install fencing and gates as shown in the Drawings.
- B. Fence materials shall be chain link fence conforming to the requirements of Washington Department of Transportation 2012 Standard Specification for Road and Bridge Construction, section 9–16.1.
- C. Posts shall be galvanized Grade 1.
- D. Chain link material shall be galvanized 11 gage and shall satisfy all other requirements of the Standard Guide for Metallic-Coated Steel Chain Link Fence & Fabric, produced by the Chain Link Fence Manufacturers Institute (CLFM Standard Guide).
- E. All other chain link fence materials and hardware shall conform to the requirements of the CLFM Standard Guide unless indicated otherwise in the design documents.
- F. Provide privacy slats for fence and gates. Vertical slats, full height, vinyl or other non-corrosive material, dark green color or as directed by the ENGINEER.
- G. Provide high-strength hardened steel padlocks and, if necessary, chains for all gates. All locks for gates shall be keyed the same. Provide 3 sets of keys of each type to the ENGINEER.
- H. Details shown on the Drawings are illustrative and shall not limit hardware design or selection.

2.02 CONCRETE

Concrete for posts shall have a minimum 28-day compressive strength of 3,000 psi. High-early strength concrete may be used.

PART 3: EXECUTION

3.01 FENCE INSTALLATION

- A. Permanent fencing shall not be installed until installation of wells, trenching (including below grade piping), above-grade piping, and lights has been completed.
- B. The CONTRACTOR shall be responsible for the repair or replacement of any damage caused by the work to existing structures at no additional expense to OWNER.
- C. The CONTRACTOR shall be responsible for ensuring that utility location and clearance surveys have been performed prior to fence installation and shall be responsible for any damage to existing utilities that occurs as a result of fence installation.
- D. All line posts shall be spaced at 10-foot maximum intervals.
- E. After posts are set, other components shall not be erected until concrete has cured sufficiently to provide adequate support.

END OF SECTION

SECTION 15210 PIPE AND FITTINGS

PART 1: GENERAL

1.01 DESCRIPTION OF WORK

This section describes materials and methods to be used by CONTRACTOR for pipe, pipe fittings, and valve installation.

1.02 SUBMITTALS

- A. CONTRACTOR shall submit to the ENGINEER for approval manufacturer's technical data for all materials to be provided under this section.
- B. CONTRACTOR shall submit documentation to the ENGINEER documenting the results of pressure testing.

1.03 REFERENCES

- A. All pipe materials and methods shall conform to applicable requirements of documents listed in this section. In case of conflict between these Specifications and the listed documents, the requirements of these Specifications shall prevail.
- B. Most current versions of the following documents:
 - ANSI A13.1 Piping and Piping Systems
 - ANSI B2.1 Pipe Threads (except Dryseal)
 - ASME B31.3 Process Piping
 - ASTM D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - ASTM D2513 Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
 - ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside-Diameter Controlled Polyethylene Pipe and Tubing
 - ASTM D2737 Standard Specification for Polyethylene (PE) Plastic Tubing
 - ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping
 - ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
 - UPC Uniform Plumbing Code

PART 2: PRODUCTS

2.01 GENERAL

- A. All materials shall be provided by the CONTRACTOR and shall be new.

- B. Materials required for all piping and connections shall be as specified in the Drawings and these Specifications. All pipe sizes as shown on the Drawings and as specified herein are in reference to "nominal" diameter, unless otherwise indicated.
- C. The piping systems shown on the Drawings indicate the approximate horizontal and vertical configuration required. The CONTRACTOR shall determine the exact layout of piping, fittings, and joints necessary to fit actual field conditions.
- D. Whether shown or not, pipe shall be installed with unions, couplings, and flanged coupling adapters as required to allow placement of the pipe and removal of valves and equipment.
- E. Each pipe system including fittings and couplings shall be provided by a single manufacturer.

2.02 PVC PIPE AND PVC FITTINGS

- A. PVC pipe shall be schedule 40 or 80 as indicated on the Drawings.
- B. PVC pipe and fittings shall conform to ASTM D1785.
- C. The pipe shall have uniform wall thickness and shall be uniform in color, opacity, density, and other physical properties. Pipe shall be homogeneous throughout and free of visible cracks, holes, blisters, bubbles, undispersed raw materials, or any contamination by foreign matter. Any pipe with nicks, scrapes, or gouges deeper than five (5) percent of the nominal wall thickness shall be rejected.
- D. Pipe shall be supplied in manufacturer's standard-length sections.
- E. All pipe shall be provided by the same manufacturer.

2.03 FLEXIBLE HOSE

- A. All flexible hose shall be sufficiently flexible to provide the connections shown on the Drawings.
- B. All flexible hose at a minimum shall be rated to:
 - 1. a positive pressure of thirty (30) psi
 - 2. a vacuum of eight (8) in Hg.
 - 3. a minimum temperature of zero (0) degrees Fahrenheit
 - 4. a maximum temperature of two-hundred (200) degrees Fahrenheit
 - 5. resistant to degradation by gasoline products.
- C. All hose shall be supplied by the same manufacturer.

2.04 ELECTRONICALLY-ACTUATED VALVES

BI-Torq Automated Full Port Brass Ball Valves, or approved equal, shall be used. These include IP-series 2-piece 3-inch brass ball valves with electric actuators.

2.05 HOSE FITTINGS

- A. CONTRACTOR shall provide cam locks to be attached to the end of header pipes for the IAS and SVE trailers as shown on the Drawings.
- B. CONTRACTOR shall provide hose fittings and clamps to connect flexhose to branch piping and manifold.

2.06 PIPE SUPPORTS

- A. CONTRACTOR shall furnish all pipe supports and anchors required to provide a complete system of pipe and conduit supports, whether or not shown on the Drawings. Pipe and equipment hangers shall be rated to carry the weight of piping in addition to the weight of the fluid (air) within the pipe.
- B. Pipe support systems shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, structural attachments, and other accessories as shown on the Drawings and as specified herein.
- C. Place Unistrut supports, or approved equal, to support the IAS and SVE header pipes and manifolds as shown on the Drawings
- D. Specific components of the UniStrut system shall include:
 - 1. Channel Section – 12 gauge, 1-5/8" x 1-5/8", Model P1000, or approved equal
 - 2. Rigid Steel Conduit Clamp – Model P1119, or approved equal
 - 3. 90° Fitting - Model P1033, or approved equal
 - 4. Post Base – 1-5/8" series, Model P02072SQ, or approved equal.

PART 3: EXECUTION

3.01 PVC PIPE

- A. All PVC pipe and socket fitting connections shall be connected using PVC primer (Weld On P-70 primer or approved equal) and PVC cement (Weld On 711 for PVC or approved equal).
- B. All threaded connections shall be connected using tape containing Teflon (Select Unyte #TF16 or approved equal).

- C. Soil, PVC chaff, excess glue, and any other foreign material shall be prevented from being incorporated into the IAS and SVE wells and piping systems during construction.

3.02 ABOVE-GROUND PIPE SUPPORTS

- A. Where pipe transitions are required from one elevation to another, the CONTRACTOR shall field verify and adjust the pipe and associated support system to provide a complete, safe, and satisfactory installation.
- B. Pipe support system shall be installed strictly in accordance with applicable standards and codes, piping support system manufacturer's recommendations, and piping manufacturer's recommendations. In addition, all piping shall be rigidly supported and/or anchored so that there is no movement or visible sagging between supports.
- C. Pipe supports shall be installed along header pipes, supporting piping at a height as shown on the Drawings, at a frequency of: a support every four (4) feet along the header pipe in the area of the IAS manifolds; every five (5) feet along the header pipe between the manifold area the flex hose to trailer; every (5) feet along the SVE manifold.
- D. Pipe supports shall be installed at each manifold, supporting it approximately six (6) inches above ground surface, as shown on the Drawings.

3.03 BELOW-GROUND PIPING

- A. Below-ground pipe shall be placed at a minimum of twenty-six (26) inches below the top of asphalt, except when transitioning from surface to depth, which will be done in a vertical run as shown on the Drawings.
- B. The bedding and backfilling materials which shall be used in the installation of below ground piping and fittings are discussed in Section 02315 "Trenching and Backfilling".
- C. Backfill around pipes in accordance with the requirements of Section 02315 "Trenching and Backfilling".

3.04 ELECTRONICALLY-ACTUATED VALVES

- A. Valves shall be installed per manufacturer's recommendations.
- B. ENGINEER will connect power to valves from electrical box in trailer area.

3.05 PIPE INSTALLATION

- A. Piping installation from the well heads to the blower trailers shall be completed in accordance with the Drawings.

- B. ENGINEER will complete connection of flexible hose from trailer header pipes to the blowers.

3.06 PRESSURE TESTING

- A. Pressure testing shall be performed on newly installed IAS and SVE piping from the blowers to the end of each well head assembly.
- B. Prior to connecting piping to the respective wells, each newly constructed branch of piping shall be individually flushed with at least one-hundred (100) scfm of clean air to remove any debris.
- C. After flushing the pipelines with clean air and prior to conducting the pressure test, a temporary cap shall be placed at the end of each branch pipe where it will attach to the well head.
- D. Each branch line shall be tested from the blower end to the capped end of the branch pipe.
- E. Pressure test IAS and SVE pipe manifolds by pressurizing each line with air to fifteen (15) psi, closing the manual ball valves to shut in the pressure, and observing the pressure.
- F. Pressure test IAS and SVE piping from the manifolds to the wells by pressurizing each line with air to fifteen (15) psi, closing the manual ball valves to shut in the pressure, and observing the pressure.
- G. Monitor the pressure in the piping for fifteen (15) minutes for a decrease in pressure that could indicate a leak. Pressure loss after fifteen (15) minutes shall be less than one (1) psi.
- H. Visually check all pipe joints and connections for leaks while the piping is under pressure using soapy water solution.
- I. All leaks shall be repaired and the pressure testing repeated as necessary until a passing result is achieved.
- J. Once all system components pass the pressure test, the branch pipes shall be connected to each well with the well head assembly.
- K. Once the well head assemblies are connected to each well, turn on the compressor, with valves open, and perform a soapy water check on the unions and the connections at the well caps. Do not shut-in the pressure.

3.07 SYSTEM CHECK

- A. After the pressure testing has been completed and all components of the IAS and SVE treatment system have been installed and connected, the ENGINEER will perform a final system check. This will include starting up the system and verifying that the system is operating correctly.

- B. Any problems related to the piping system found during the System Check shall be fixed and the testing repeated as necessary until the system is operating and the ENGINEER accepts the results.

END OF SECTION

APPENDIX D
ELECTRICAL SPECIFICATIONS

SECTION 02200**EARTHWORK****PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Excavate for below grade structures.
- B. Backfill below grade structures.
- C. Structural fill.
- D. Fine grade site.

1.2 RELATED SECTIONS

Section 16110 – Electrical Conduits

1.3 REFERENCED STANDARDS

- A. American Society for Testing and Materials: ASTM:
 - ASTM C 33-86 Standard Specification for Concrete Aggregates
 - ASTM D 1557-78 Standard Test Methods for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb (4.54-kg) Rammer and 18 in. (457-mm) Drop
- B. Washington Industrial Safety and Health Act (Reference is made to all WISHA standards; and particularly to those listed below).
 - WISHA Chapter 296-155 WAC, Part N (Excavation, Trenching and Shoring)
 - WISHA Chapter 296-155 WAC, Part R (Miscellaneous Construction Requirements)
- C. Washington State Department of Transportation (WSDOT):
 - 1991 Standard Specifications for Road, Bridge and Municipal Construction

1.4 SUBMITTALS

- A. Screen analysis: Submit for:

1. Structural fill material.

2. Crushed stone ballast.

3. Crushed topcourse.

B. Identify all persons (competent person, registered professional engineer, etc.) responsible for excavation activities and/or operations.

1.5 PRE-EXCAVATION CONFERENCE

A. Arrange for and hold a conference before starting work of this section.

B. Conference attendees, at minimum:

1. Contractor Superintendent

2. Construction Manager

3. Geotechnical Engineer

4. Subcontractor Foreman

5. Others as needed to coordinate related work.

1.6 SITE CONDITIONS

A. Subsurface conditions: The top of the seasonal water table is well below the existing finish grade.

PART 2 - PRODUCTS

2.1 BACKFILL AND FILL

A. Excavated existing onsite soils: May be used for fill or backfill if determined suitable and not containing contaminants. Excavated soil shall be stockpiled along trenches as approved and tested prior to reuse onsite or depositing off-site. Refer to Supplemental Conditions requirements for disposal of existing onsite soils. Conform to environmental requirements for stockpiling, stockpile protection, stockpile separation. Recording, identification & testing and reuse as backfill.

B. Structural fill: From offsite, gravel borrow, WSDOT 9.03.14 modified to 100% passing four inch screen, 3% maximum passing Number 200 screen.

- C. Crushed stone ballast: WSDOT 9-03.9(1).

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect existing utilities and structures to remain. If damaged, repair to match condition at start of Project.

3.2 SHORING

- A. Provide shoring and bracing where necessary:
 - 1. Comply with WISHA requirements for safety.
 - 2. Protect existing structures from settlement and other damage.
 - 3. Protect below grade installations during construction.
- B. Removal: Remove shoring and bracing before backfilling excavations.

3.3 SURFACE WATER CONTROL

- A. Divert surface runoff from excavations and maintain discharge points established on water pollution/erosion control plan.
- B. Maintain excavations free from standing water (refer to Contract for dewatering procedures).

3.4 EXCAVATION

- A. General: Provide adequate workspace in excavation for placement and inspection of installations.
- B. Foundations:
 - 1. Excavate to elevations shown.
 - 2. Unauthorized overexcavation: Fill with concrete or extend foundations to new elevations at no additional expense to the Owner.
 - 3. Obtain approval of bearing surfaces before placing concrete.

3.5 BACKFILLING AND FILLING

- A. Protect previously placed subgrade work from damage.
- B. Preparation, backfilling:
 - 1. Formwork: Remove entirely.
 - 2. Concrete: Allow to cure seven days minimum. Support as necessary to prevent damage.
 - 3. Subgrade work: Complete, obtain approval.
 - 4. Debris: Remove.
 - 5. Shoring: Remove with care to avoid damage to adjacent structure or grade.
 - 6. Verify that subgrade work is complete and approved before starting backfilling.
- C. Fill: Place in eight inch loose lifts, compact each lift.
- D. Foundation walls:
 - 1. Place backfill in eight inch loose lifts, compact each lift.
- E. Compaction: Percent of maximum density determined according to ASTM D 1557:
 - 1. Along trenches in planted areas: 95%.
 - 2. At Panel structures: 95%

3.6 FINE GRADING

- A. Fine grade to subgrades shown within the following tolerances after compaction: Not Applicable.
 - 1. Ballast under concrete slabs: +0 inch
- $\frac{1}{2}$ inch
 - 2. Earth under concrete slabs: +0 inch
- $\frac{1}{2}$ inch

- 3. Under asphalt pavement base course: $+1\frac{1}{2}$ inch
 $-1\frac{1}{2}$ inch

3.7 FIELD QUALITY CONTROL

- A. Earthwork will be monitored by Construction Manager.
 - 1. Soil moisture test will be conducted by owners testing lab as needed.
 - 2. Soil compaction tests will be conducted by owners testing lab as needed.
- B. Environmental quality will be monitored continuously.

3.8 CLEANUP

- A. Excess materials: Remove from site.
- B. Waste and debris: Remove from site.
- C. Disposal: Off site. Comply with conditions of the Contract.

END OF SECTION

SECTION 16010**ELECTRICAL GENERAL****PART 1 GENERAL****1.1 DEFINITIONS:**

- A. The words "**plans**" and "**drawings**" are used interchangeably in this specification and in all cases shall be interpreted to mean "drawings".
- B. The word "**provide**" shall be interpreted to mean furnish and install.
- C. "**OWNER**" shall be ANSCO PROPERTIES
- D. "**OWNERS REPRESENTATIVE**" refers to Golder Associates Inc. (Golder) who is the engineer and owner's representative and prime contractor for the Work.
- E. "**ELECTRICAL CONTRACTOR**" refers to the company selected by the OWNER to perform electrical, instrumentation, and controls work.

1.2 GENERAL DESCRIPTION OF WORK:

- A. The Electrical Contractor shall provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the plans and these specifications.
- B. Complete the wiring to, connection to, adjustment and calibration of, testing of equipment having electric motors and/or built-in or furnished electrical components. Install electrical components that are furnished with mechanical equipment.
- C. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components, accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified function properly.
- D. The Electrical Contractor shall install and make all connections to the equipment furnished by the Owner.
- E. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.
- F. Provide adequate space for the electrical installation, including but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the drawings. All equipment shall be readily accessible for maintenance, shall have electrical

clearances in accordance with NEC and shall be installed in locations that will provide adequate cooling.

- G. Check electrical equipment prior to installation so that defective equipment is not installed.
- H. Provide start-up, follow-up and training of the Owner's personnel for electrical systems. Make all corrective measures required during start-up. See specific requirements for training and start-up in other specification sections.
- I. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up of operation of the equipment, and to correct any problems, which occur during start-up.
- J. Provide circuit breakers, fusing, conduit, wire and installation for all items, which require 480VAC, or 120 VAC power.

1.3 EQUIPMENT COORDINATION

- A. The Electrical Contractor is responsible to coordinate the equipment supplied from various manufacturers. This includes but is not limited to:
 - 1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.
 - 2. Verifying the equipment supplied will fit within the space allocated.
 - 3. Coordination of equipment and the electrical power and control requirements. Provided in all sections of the specifications and drawings.
 - 4. Providing power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.
 - 5. Providing all necessary control wiring and components for any special requirements from an equipment manufacturer.
- B. The Electrical Contractor shall verify as a minimum:
 - 1. Correct voltage, phase and frequency
 - 2. Size and space requirements
 - 3. Mounting requirements
 - 4. Correct motor starter type
 - 5. Proper coordination with the pump controls.
- C. Any discrepancies between the electrical and other equipment shall be brought to the immediate attention of the Engineer.
- D. Selective Coordination: The contractor shall provide a selectively coordinated power system of fuses. The design on the plans may be altered if submitted with documentation that shows that the system is selectively coordinated.

1.4 PROJECT DESCRIPTION:

- A. In general the project consists of a new electric service and panel board and connections to existing equipment skids with new receptacles.
- B. The following statements highlight the main portion of the electrical work:
 - 1. Provide a 300 Amp 3 phase 208/120 VAC underground service with CT and meter base, fused disconnect and fused panel board.
 - 2. Coordinate with the PSE / Potelco engineer for installation.
 - 3. Provide one pole mounted light fixture with base for local lighting.
 - 4. Provide Electrical receptacles for existing equipment connection as shown.
 - 5. Coordinate with the local power utility and provide power service to the site.

1.5 TEMPORARY OPERATION AND CONSTRUCTION POWER:

- C. Facility Operation Power:
 - 1. If necessary, provide temporary power service for facility operation during construction. Provide power and control systems, circuits and components, and connections for all motors and equipment that remains in operation during construction. The Electrical Contractor shall pay for all coordination with the utility and associated construction costs for temporary facility power.
 - 2. Any necessary modifications to the existing electrical system for construction power shall be coordinated and paid for by the Electrical Contractor
 - 3. The Owner shall pay for the energy costs as billed by the utility and these costs shall not be included in the Electrical Contractor bid price.

1.6 NAMEPLATES:

- A. Nameplates shall be provided on all electrical devices, (including but not limited to motor control equipment, MCC cubicles, control stations, junction boxes, panels, motors, instruments, switches, indicating lights, meters, and all electrical equipment enclosures.)
- B. Nameplates shall also be provided on all electrical panel interior equipment, including but not limited to: relays, circuit breakers, power supplies, terminals, contactors, and other devices.)
- C. Nameplates shall be made of 1/16" thick machine engraved laminated phenolic having black letters not less than 3/16" high on white background or as shown on the drawings or other sections of the specifications. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or equal.

- D. All nameplates shall include the equipment name and number (and function, if applicable).
- E. Provide warning nameplates on all panels and equipment, which contain multiple power sources. Lettering shall be white on red background.
- F. Nameplates shall be secured to equipment with stainless steel screws/fasteners. Epoxy glue may be used where fasteners are not practical if first approved by the Engineer.

1.7 THERMAL (TEMPERATURE) RATINGS OF EQUIPMENT TERMINATIONS:

- A. This section covers the temperature ratings of all electrical equipment terminations provided under this contract.
- B. All materials shall conform to the National Electrical Code Article 110-14C. Wiring and circuit breakers on this project are designed for 75°C operation above 30 amperes; 60°C for 30 amperes and below.
- C. All products furnished on this project shall have electrical terminations rated for 60°C for ampacities of 30 amperes or less and rated for 75°C for ampacities above 30 amperes.

1.8 STANDARDS AND CODES:

- A. Permits, licenses, approvals and other arrangements for work shall be obtained and paid for by the Electrical Contractor and included in the bid price.
- B. Electrical work shall be executed in strict accordance with the latest edition of the National Electrical Code and local ordinances and regulations.
- C. All electrical equipment, materials, construction methods, tests and definitions shall be in strict conformity with the established standards of the following in their latest adopted revision:
 - 1. Underwriters' Laboratories, Inc. (UL)
 - 2. National Electrical Manufacturers Association (NEMA)
 - 3. Canadian Standards Association (CSA)
 - 4. Electrical Testing Laboratories (ETL)
 - 5. Factory Mutual (FM)
- D. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- E. All materials shall be new, free from defects, of current manufacture, of quality specified or shown. Each type of material shall be of the same manufacturer throughout the work.

1.9 HEALTH AND SAFETY REQUIREMENTS

- A. The ELECTRICAL CONTRACTOR shall be responsible for compliance with all applicable health and safety regulations during the Work. The

ELECTRICAL CONTRACTOR shall be responsible for the safety of all employees, Subcontractors, other persons under his direction, and any other personnel entering the Work area. Before Work commences, the ELECTRICAL CONTRACTOR shall submit a Health and Safety Plan developed consistent with the Site Health and Safety Plan and meeting all applicable regulations.

- B. The ELECTRICAL CONTRACTOR is responsible for being cognizant of and ensuring compliance with the requirements set forth in 29 CFR 1910. Such responsibility shall apply to both the ELECTRICAL CONTRACTOR'S operations and those of the ELECTRICAL CONTRACTOR'S Subcontractors.
- C. When violations of the health and safety requirements contained in this specification are called to the ELECTRICAL CONTRACTOR'S attention, the ELECTRICAL CONTRACTOR shall immediately correct the condition to which attention has been directed. Such notice, either oral or written, when served on the ELECTRICAL CONTRACTOR or the ELECTRICAL CONTRACTOR'S representative(s), shall be deemed sufficient. In the event that the ELECTRICAL CONTRACTOR fails or refuses to promptly comply with the compliance directive issued, the OWNER'S REPRESENTATIVE may issue an order to stop all or any part of the Work. When satisfactory corrective action is taken, an order to resume work will be issued. The ELECTRICAL CONTRACTOR shall not be entitled to any extension of time, nor any claim for damage or for additional compensation, by reason of either the directive or the stop work order. Failure of the OWNER'S REPRESENTATIVE to order discontinuance of any or all of the ELECTRICAL CONTRACTOR'S operations shall not relieve the ELECTRICAL CONTRACTOR of his responsibility for the safety of personnel and property.
- D. Submittals

ELECTRICAL CONTRACTOR shall prepare a site-specific health and safety plan in conformance with 29 CFR 1910. Two (2) copies of the ELECTRICAL CONTRACTOR'S Health and Safety Plan shall be submitted to the OWNER'S REPRESENTATIVE within seven (7) days following the Notice to Proceed. Submittal of ELECTRICAL CONTRACTOR'S health and safety plan shall in no way relieve ELECTRICAL CONTRACTOR of his responsibilities for protection of the health and safety of workers and other Site personnel.

1.10 CONTRACT DOCUMENTS:

- A. The electrical layouts are generally diagrammatic. The location of equipment is approximate unless dimensioned. Exact locations and routing of conduits shall be governed by structural conditions and physical interference's and by locations of electrical terminations on equipment.

1.11 REFERENCE DOCUMENTS:

- B. The Electrical Contractor shall refer to the drawings, project data and shop drawings of other trades for additional details, which affect the proper

installation of the work. Diagrams and symbols showing electrical connections are diagrammatic only, and so do not necessarily show the exact physical arrangement of the equipment.

1.12 SITE FAMILIARIZATION:

- A. Before submitting a bid, the Electrical Contractor shall familiarize himself with all features of the site, which may affect the execution of his work. The Electrical Contractor shall take all field measurements necessary for his work and shall assume full responsibility for their accuracy. The Electrical Contractor shall take full responsibility for locating and avoiding all substructures. Any damage to existing equipment shall be repaired or replaced by the Electrical Contractor at the Electrical Contractor expense

1.13 ELECTRICAL SUBMITTALS:

- A. Electrical submittals shall be submitted bound in a three (hole or –ring) binder, labeled with the project name and Electrical Contractor 's name and an index sheet showing each product being submitted. Provide with section tabs per the electrical specifications by section and paragraph or equipment name e.g. provide a minimum of one tab section for each piece of equipment in all of the PART 2 PRODUCT Sections 2.01 - 2.**. Label each equipment submittal sheet with equipment name and number. Indicate location where each item of equipment submitted will be used on the job. Use equipment numbers when available.
- B. Submittals shall include the manufacturer's name, address, trade name, catalog model or number, nameplate data, size, layout dimensions, capacity, project specification and paragraph reference. Include other information necessary to establish contract compliance of each item proposed to furnish.
- C. The package of submittals shall be largely complete when first submitted. Long lead items may be submitted separately. Each item shall be clearly marked and provided with adequate sales and technical information to clearly show conformance with all aspects of the specification. Packages not provided as described above or largely incomplete shall be returned to the Electrical Contractor, without comment.
- D. Control panels and control systems submittals may be provided separately, but must be followed in a timely manner as to allow coordinated review. Control submittals shall be provided with a Bill of Materials showing quantity, manufacturer's name, catalog number, and supplier name and phone number.
- E. Certify on all submittals that the material being proposed conforms to the contract requirements. In the event of any variance, state specifically which portions vary and request a variance in writing.
- F. Certify that all furnished equipment is able to be installed in the allocated spaces by stating on each item:
- G. "This equipment will be able to be installed in the spaces allocated."
- H. Shop Drawings shall be provided on 11" x 17" sheets maximum size, and shall be scaled using standard engineering or architectural scales. Wiring

diagrams shall identify circuit terminals, and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment.

- I. The Engineer will review the original submittal and one resubmittal on each item. Subsequent submittal reviews shall be conducted at the Electrical Contractor's expense. The Electrical Contractor shall be billed at the Engineer's current hourly rates.
- J. Selective Coordination: For legally required standby power systems the contactor shall provide a selectively coordinated power system of fuses or breakers. The design on the plans may be altered if submitted with documentation that shows that the system is selectively coordinated.

1.14 STORAGE AND INSTALLATION ENVIRONMENT:

- A. All electrical equipment shall be stored in a dry environment free from dust, moisture, sprays or vapors, which may be detrimental to their new condition. After installation of equipment, care shall be taken to protect all equipment from all dust, moisture, paint and other spray, harmful vapors, etc. until final acceptance and certificates of occupancy have been obtained.
- B. Equipment shall not be installed in indoor areas until the area is covered, dry and finished to the point that other work will not create dust, vapors, or moisture. Equipment with integral heaters and fans shall not be installed until power is available at the location and the heater and fan shall be energized within 6 hours of the equipment being installed.

1.15 FINAL ACCEPTANCE:

- A. Prior to final acceptance the Engineer will perform one or more site observation trips to develop a "punch list" of items deemed incomplete. The Electrical Contractor shall be present while these inspections are taking place and shall be available for opening cabinets and operating and adjusting the system as is necessary for the Engineer to verify all equipment is installed and operates to the requirements of the contract documents. The contractor shall anticipate a minimum of 4 hours to complete the final acceptance testing.
- B. Prior to the Electrical Contractor calling for this observation, the Electrical Contractor shall have completed all items of work, including wire markers, nameplates, final tests and final test reports. All equipment shall be checked for proper operation and all signals verified for correct calibration and wiring.
- C. Final acceptance will not be given until:
 - 1. All work is complete
 - 2. All punch-lists are checked off and returned to the Engineer
 - 3. All test reports are received
 - 4. All O&M manuals are received
 - 5. All spare parts are received
 - 6. All project record drawings are received.

D. Punch Lists

1. Each punch list item shall be completed by the Electrical Contractor and checked off of the list. When all of the items on the list are completed or commented on, the list shall be signed by the Electrical Contractor and returned to the Engineer for verification.

1.16 PROJECT RECORD DRAWINGS:

- A. A set of drawings shall be maintained at the job site (by the Electrical Contractor) showing any deviations in the electrical systems from the original design.
- B. This set of drawings shall be readily available for inspection by the Engineer at all times.
- C. Another complete set of drawings shall be marked up in the office showing the changes made on the field set of drawings. All changes shall be clearly marked in red on the drawings. Drawings shall be submitted to the Engineer at the completion of the project.
- D. A set of electrical drawings marked in red to indicate the routing of conduit runs, shall be submitted to the Engineer for review at the completion of conduit rough-in and prior to cover or pouring of concrete.

1.17 GUARANTEE:

- A. The Electrical Contractor shall guarantee his work and all components thereof, excluding incandescent and fluorescent lamps for a period of 1 year from date of acceptance of the installation. The Electrical Contractor shall remedy any defects in workmanship and repair or replace any faulty equipment that shall appear within the guarantee period without additional cost to the Owner.

1.18 CLEANUP:

- A. The premises must be kept free of accumulated materials, rubbish and debris at all times. Surplus material, tools and equipment must not be stored at the job site. At the completion of the job, all equipment and fixtures shall be left clean and in proper condition for their intended use.
- B. All motor control centers (MCC's) and main control panels (MCP's) shall be cleaned inside and out at the completion of the project.

1.19 TESTS:

- A. Testing for installed feeder cables and motors is required as specified in Sections 16120. Test reports shall be submitted to the Engineer prior to final acceptance. All tests shall be performed in accordance with the applicable sections of NETA.

1.20 OPERATION AND MAINTENANCE MANUALS:

- A. The Electrical Contractor shall prepare and assemble detailed operation and maintenance manuals. The manuals shall be bound in a 3 ring binder and tabbed with an index, in general the O&M manual format shall meet that of the submittal data in section 16010. The manuals shall include, but not be limited to, the following:
 - 1. Catalog data and complete parts list for all equipment and devices
 - 2. All cut sheets of equipment and components.
 - 3. Preventative maintenance procedures
 - 4. Trouble-shooting
 - 5. Calibration
 - 6. Testing
 - 7. Replacement of components
 - 8. Automatic mode operation
 - 9. Manual mode operation
 - 10. System schematics / shop drawings and record drawings.
 - 11. As-built wiring diagrams of cabinet and enclosure contained assemblies
 - 12. As-built wiring diagrams of overall system
 - 13. Listing of recommended spare parts
 - 14. Listing of recommended maintenance tools and equipment.

1.21 TRAINING:

- A. Training shall be provided per the specific requirements in other Sections of these specifications. In addition to training required in other Sections of the specifications, The Electrical Contractor shall conduct specifically organized training sessions in the overall operation and maintenance of the electrical system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in operations and maintenance of all components of the electrical system outside the training requirements in the other Sections. Training shall include, but not be limited to, the following:
 - 15. Preventative maintenance procedures
 - 16. Trouble-shooting
 - 17. Calibration
 - 18. Testing
 - 19. Replacement of components
 - 20. Equipment operation
- B. At least one (1) training sessions, each at least one (1) hours in duration, shall be conducted at the facility after start-up of the system. The Electrical Contractor shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least 2 weeks prior to the time of the training.

END OF SECTION

SECTION 16110**ELECTRICAL RACEWAYS****PART 1 GENERAL****1.1 DESCRIPTION OF WORK:**

- A. This section covers the furnishing and installation of all raceways, fittings and boxes used in this project. All wiring shall be in a raceway system.
- B. Ground Conductor:
 - 1. All power distribution raceways shall contain a minimum of one continuous copper equipment grounding conductor sized in accordance with the N.E.C.

1.2 STANDARDS AND CODES:

- A. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C..

1.3 SUBMITTALS:

- A. In accordance with the "submittals" requirements in Section 16010 submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.
- B. For each area, submit a tabbed section for raceway, boxes, support materials, etc. to be used in each of the designated areas defined below in "Area Classifications".

1.4 AREA CLASSIFICATIONS:

- A. The following classification of areas shall be used as a reference in determining application of material covered by this Section unless specifically shown otherwise on the drawings. Areas which fall under two or more of the following classifications shall conform to the minimum requirements of all of the area classifications listed for that area.
- B. Hazardous area classifications shall be defined by NFPA 820.

1.4.2 HAZARDOUS AREAS: NONE

1.4.3 OUTDOOR AND DAMP AREAS:

- A. All outdoor areas
 - 1. Raceway shall be rigid galvanized steel (GRS) or Intermediate Metal Conduit (IMC) above grade and sweeps to below grade. Conduit entrances shall be threaded and fittings shall have gasketed covers. Threaded fastening hardware and rods shall be stainless steel. Raceway supports such as channel, clamps, and brackets shall be stainless steel or non-metallic. Panels and boxes shall be NEMA 3R - aluminum, stainless steel or non-metallic (or as shown on the drawings). Device boxes shall be cast, copper free aluminum.
 - 2. Raceway shall be PVC schedule 40 below grade.

1.4.4 CORROSIVE AREAS: NONE**PART 2 PRODUCTS****2.1 GENERAL:**

All materials shall be new, free from defects, of current manufacture, of quality specified or shown. Each type of material shall be of the same manufacturer throughout the work.

2.1.1 RACEWAY APPLICATION:

- A. ABOVE GRADE CONDUITS shall meet the requirements of the "area classification" listed above and shall be:
 - 1. GRC or IMC for power and control wiring
 - 2. GRC or IMC for signal & communications wiring.
- B. CONDUITS BELOW GRADE shall be:
 - 1. Schedule 40 PVC for power and control wiring
 - a) Sweeps and risers for transition of PVC from below grade to above grade shall be GRC.
- C. ALL CONNECTIONS TO VIBRATING EQUIPMENT or motors shall be:
 - 1. liquidtight flexible metallic conduit for indoor, non corrosive areas and all motor leads from VFD's.
 - 2. Connections to equipment outdoors or in corrosive areas shall be with non metallic liquidtight flexible conduit (except for motor leads from VFD's shall be flexible metallic.)

2.1.2 RIGID STEEL CONDUIT:

- A. Rigid conduit shall be steel, galvanized. Terminations shall be by means of threaded hubs or double locknuts and insulating grounding type bushings.

2.1.3 INTERMEDIATE METAL CONDUIT:

- A. Intermediate metal conduit shall be of steel and shall be hot dipped galvanized in accordance with UL 1242. Fittings shall be threaded.

2.1.4 FLEXIBLE CONDUIT:

- A. Flexible conduit shall be interlocking single strip, hot dipped galvanized and shall have a polyvinyl chloride jacket extruded over the outside to form a flexible watertight raceway. Non-metallic flexible conduit shall have non metallic threaded fittings.

2.1.5 NONMETALLIC CONDUIT:

- A. Nonmetallic conduit shall be rigid PVC, Schedule 40 or 80. PVC installed above grade shall be UV resistant schedule 80. Fittings shall be of the same material as the raceway and installed with solvent per the manufacturer's instructions. Conduit, fittings and solvent shall all be manufactured by the same manufacturer.

2.2 WIRE WAYS:

- A. Wire ways for use indoors shall be NEMA 12 lay-in type with integral quick release latches and gasketed. All straight sections and fittings shall be completely open on one side so wires can be laid in along an entire wireway run with no "pulling through" or wires required. Size shall be as shown on the drawings. All seams shall be continuously welded and ground smooth. Provide flange connections with gasket between flanges.
- B. Provide all necessary elbows, tee's, junction boxes, and hardware, etc. for a complete installation. Install per the contract drawings and the manufactures recommendations. Wireway shall be HOFFMAN, LAY-IN TYPE 12 WIREWAY or equal.

2.3 FITTINGS AND BOXES:

- A. Materials for fittings and boxes shall be chosen to satisfy the requirements of Section 16110.1.04 - Area Classification.
- B. All screws, nuts, bolts, and other hardware used with fittings and boxes shall be stainless steel unless installed in General Purpose areas.

2.3.2 UNIONS:

- A. Provide unions of the type designated as UNF and UNY and shall be suitable for use in moist atmospheres. Unions shall be of cast ferrous alloy, electroplated with zinc. Unions for use in outdoor or corrosive areas shall be stainless steel or non-metallic.

2.3.3 LOCKNUTS:

- A. Provide locknuts used in general purpose areas shall be extra heavy steel electroplated with zinc for sizes 3/4" to 2". Locknuts larger than 2" shall be of malleable iron, electroplated with zinc. Locknuts used in damp and outdoor areas shall be stainless steel. Locknuts in corrosive areas shall be stainless steel or, non-metallic.

2.3.4 BUSHINGS:

- A. All bushings shall be steel or malleable iron threaded type electroplated with zinc or hot-dip galvanized. Bushings shall have a molded-phenolic or nylon insulating collar.
- B. Bushings for use in outdoor or corrosive areas shall be stainless steel or non-metallic
- C. Grounding Bushings: Grounding-type bushings shall have a projecting portion drilled for the size grounding cable used and shall be provided with a clamp or set screw for securing the cable. In addition, a set screw shall be provided to securely lock the bushing to the conduit. Grounding bushings shall be GEDNEY Type IBC-LS, Type BL, or T&B No. 3870 through 3880.
- D. Bushed Openings: Bushings for protection of cables passing through metal boxes or troughs shall all be phenolic type and shall be OZ Type ABB.
- E. Hubs for connection of conduit to boxes shall be of zinc. Hubs for use in damp or corrosive areas shall be non metallic or aluminum to match the raceway. The hubs shall provide a liquidtight connection to the box and an insulating bushing for the wiring. Hubs shall be Thomas and Betts - bullet type.
- F. Connectors for liquidtight conduit shall be electroplated zinc malleable iron. An O-ring gasket and an approved grounding insert shall be part of the unit. 45 degree and 90 degree fittings shall be used where applicable. Liquid-tight connectors shall be by O.Z. GEDNEY.

2.3.5 EXPANSION FITTINGS:

- A. Expansion fittings in exposed runs shall be of the weatherproof type and shall be provided with an external bonding jumper. The expansion fittings shall allow for 4" longitudinal movement and shall be designed so that when completely assembled the end of each conduit entering the fitting is bushed. Fittings shall be O.Z. GEDNEY, Type EX.
- B. Expansion fittings in embedded runs shall be of the watertight type and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 3/4" movement in any direction. Fittings shall be O.Z. GEDNEY, Type DX.

2.3.6 BOXES:

- A. Junction boxes, device boxes, fixture support boxes, oblong, round and rectangular conduit fittings (condulets) shall be of the same material as required by the Area Classification for the raceway.
 - 1. All metallic hardware shall be made of stainless steel; Galvanized is acceptable in general purpose areas.
- B. Fittings and boxes for use in **GENERAL PURPOSE AREAS** shall be: Cast ferrous alloy, or NEMA 12
 - 1. Cast fittings and boxes shall be:
 - a) zinc electroplated cast ferrous alloy:.

- b) Integrally cast threaded hubs or bosses shall be provided for all conduit entrances and shall provide for full 5 thread contact on tightening. Drilling and threading shall be done before finishing.
 - c) The cover plate shall be of similar cast ferrous alloy material and finish. A full body neoprene gasket shall be provided with the cover. Stainless steel screws shall be provided for all covers.
- 2. NEMA 12 boxes shall be:
 - a) Made of heavy gauge sheet steel, aluminum, or non-metallic, or if they are device boxes they shall be cast metal.
 - b) UL labeled, provided with a 5 mil thick light gray thermo-epoxy finish, and designed so that moisture will drain away from the gasketed cover joint.
 - c) Covers shall have turned edges, ground smooth to form a tight seal against the gasket when the cover is closed.
- C. Fittings and boxes in **HAZARDOUS AREAS** shall be:
 - 1. Rated for Class I, Division 1 or 2 to match Area Classification and made from copper free aluminum.
 - 2. Conduit fittings shall be GRC, PVC coated GRC, or aluminum. Seal fittings for hazardous areas shall be CROUSE HINDS "EYS".
 - 3. All hardware shall be stainless steel.
- D. Fittings and boxes in **OUTDOOR OR CORROSIVE AREAS** shall be:
 - 1. Non metallic or aluminum.
 - 2. All metallic hardware (hinges, screws, bolts, etc.) shall be 316 stainless steel.
- E. Outlet and device boxes shall be ganged where two or more devices are to be installed side-by-side. Device covers shall be provided with neoprene gaskets. Covers shall be of cast ferrous alloy finished as described for box unless the particular device requires a cover that is not manufactured in this material.
- F. Outlet boxes in non-classified areas shall be recessed where conduit is recessed and surface mounted "FS" or "FD" boxes where conduit is surface mounted.

2.4 CONDUIT & CABLE SUPPORTS:

- A. Rivet-type or Zamac fasteners are not allowed. All fasteners between channel, strut, etc. and walls shall be removable with a screwdriver.
- B. Support materials in general purpose areas may be hot-dip or electro-galvanized. All support materials used in corrosive areas shall be NEMA 4x Aluminum, Stainless steel, or non-metallic.
- C. All screws, nuts, bolts and other hardware used with conduit and cable supports shall be stainless steel if used outdoors or in corrosive areas; in general purpose / indoor areas they may be galvanized steel.

2.4.2 CONDUIT CLAMPS:

- A. Conduit clamps shall be of the one-hole type. Clamp backs and nesting backs shall be of similar material and finish. Clamps shall be as manufactured by O.Z. GEDNEY Electric Company.
- B. Conduit clamps for use in outdoor or corrosive areas shall be stainless steel or non-metallic

2.4.3 CEILING HANGERS:

- A. Ceiling hangers for single conduit shall be of the adjustable ring type. Hanger rods shall be 1/2" all-thread rod. Galvanized hangers and rods shall be electro-galvanized after fabrication. Hangers shall be as manufactured by GRINNEL Company or equal
- B. Hangers for use in outdoor or corrosive areas shall be stainless steel or non-metallic

2.4.4 RACKS:

- A. Provide Racks constructed from framing channel. Galvanized channels and hanger rods shall be steel, hot dip galvanized, 1.5 oz. / sq. ft. after fabrication. Field cuts shall be re-galvanized by the Galv-A-Weld process or by GAL-VAN-IZE as manufactured by LAWSON Products Inc. Channels attached directly to building surfaces shall be 14 gauge minimum thickness, 1-5/8" deep. Channel section shall be sufficient to limit deflection to 1/360 of span.
- B. Framing channels on all exterior areas and in corrosive areas shall be aluminum, stainless steel, or non-metallic, Fiberglass. All hardware shall be 316 stainless steel. Channel section shall be sufficient to limit deflection to 1/360 of span. Framing channel shall be as manufactured by Unistrut or approved equal.

2.5 CONDUIT SCHEDULE:

- A. Refer to conduit and cable schedule for raceway sizing and routing description.

2.6 CONDUIT TAGS:

- A. Conduit tags shall be corrosion resistant and remain legible after exposure to abrasion or aggressive fluids. Tags shall be as manufactured by Impact Industries from cross-linked polyolifin or equal.

2.7 HAND HOLES AND VAULTS:

- A. Hand holes and vaults shall be 24" X 36" X 36" deep minimum size or as shown on drawings. All handholes and vaults shall be of reinforced concrete construction and shall have concrete bottoms with sumps.
- B. Covers shall be hinged and watertight. Covers shall be provided with a screw driver operable latch. Covers shall be made of aluminum or

galvanized steel and shall be minimum H20 loading. Covers shall be provided with a piston for easy opening; piston and latching mechanism shall hold the cover in the open position at 90 degrees.

- C. Handholes and vaults and covers shall constructed per standards and quality of Utility Vault Company 233-LA, 444 LA or approved equal. Covers shall be constructed per standards and quality of HALLIDAY Products or equal.

PART 3 EXECUTION

3.1 CONDUIT:

- A. Provide conduits per the conduit and wire schedule and additional as necessary to meet the requirements of the wiring.
- B. Scheduled conduit sizes are minimum. Electrical Contractor shall upsize conduits if necessary or if required by the NEC.
- C. Non scheduled conduits shall be a minimum of $\frac{3}{4}$ " or sized per the NEC for the wiring installed plus 20%.
- D. For conduit spacing requirements refer to "conductor spacing requirements in Section 16120 part 3.
- E. All conduits embedded in concrete or underground shall be a minimum of $\frac{3}{4}$ ".

3.1.2 EXPOSED CONDUIT:

- A. Exposed conduit shall be installed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceiling. No conduit shall approach closer than 6" to any object operating above the rated temperature of the insulation of the wiring in the conduit. Frequency of conduit supports shall be per N.E.C.
- B. Conduit supported directly from the building structure shall be spaced out at least $\frac{5}{8}$ " using framing channel
- C. Where three or more conduits are suspended from ceiling or overhang, they shall be supported by racks of threaded rod and framing channel.
- D. Welding, brazing or otherwise heating of the conduit is not allowed. Plumber's perforated strap hanger iron shall not be used for any purpose.
- E. All joints shall be made with standard couplings or specified unions. Running threads shall not be used in lieu of conduit nipples, nor shall excessive threads be used on any conduit.
- F. Exposed threads on PVC coated GRC conduits located below grade and all surfaces of GRS conduit routed in damp or corrosive areas are to be coated in the field following installation with either BITU-MASTIC or brush applied ROB-ROY coating. Spray-on coating is not allowed.

3.1.3 PULL AND JUNCTION BOXES:

- A. Where required for ease of pulling and as necessary to meet codes, install junction boxes, pull boxes or handholes even though not shown on the drawings.
- B. Conduit shall terminate in junction boxes, outlet boxes or panels with proper fittings. Conduit entering free-standing panels shall terminate in clear wiring space. Where such conduits are located on drawings with dimensions or elevations, adjust as necessary for conduits to enter clear wiring space and they shall be terminated with a grounding bushing.
- C. All conduit entering sheet-steel NEMA 1 boxes or cabinets shall be secured by locknuts on both the interior and exterior and an insulating bushing installed over the conduit end. All conduit entering NEMA 12 or JIC boxes shall be terminated with a raintight hub. All surface-mounted cast boxes shall have threaded hubs.
- D. Conduit terminated in NEMA 4 boxes shall be terminated with raintight hubs. Conduits terminated in cast boxes shall have five full threads of contact. The ends of all conduit shall be cut square, reamed and threaded with straight threads. Conduit joints shall be made up with T&B KOPR-SHIELD which shall be applied to the male threads only.

3.1.4 UNDERGROUND CONDUIT:

- A. Exposed threads on GRC and PVC coated GRC conduits located below grade shall be coated in the field following installation with either BITU-MASTIC or brush applied ROB-ROY coating. Spray-on coating is not allowed.
- B. Underground electrical power feeders shall be separated by a minimum of 7½" spacing on center. Control and instrumentation conduits shall maintain a minimum of 2" separation between conduit walls.
- C. See Section 02200 Underground electrical conduit shall be kept 3' - 0" horizontally and 1' - 0" vertically at crossings from other underground utilities except telephone. Minimum cover shall be 2' - 0". After trench excavation, the bottom of the trench shall be trimmed by hand to prepare a smooth, even bed. Underground conduits called out to be encased in concrete (CE) or control density fill (CDF) shall be installed in the trench utilizing conduit spacers with a minimum of 7½ inches separation between conduits.
- D. Excavated material shall be examined to be acceptable for backfill by the Engineer. If deemed not acceptable, then borrow material which possess a 1/2" screen shall be used. Six inches of backfill shall be required above and below conduit or direct buried cable installation. After 12" of compacted backfill is installed above the conduit, a yellow warning tape shall be placed in the trench. The warning tape shall be of a non-biodegradable material and shall have the words "caution buried electrical conductors below."
- E. A separate foil type warning tape is to be installed directly above PVC conduits which have been installed as spares, for future location of the conduit.

3.1.5 CONDUIT IN CONCRETE FLOORS OR WALLS:

- A. Conduit installed in concrete slabs or walls shall be placed in the middle third where possible. Slabs laid on the earth shall be thickened by trenching, if the conduit cannot be placed within the slab thickness shown. Conduits under floating slabs shall be separately encased from the slab and care shall be taken to avoid tying non-floating beams to the floating slab through the encasement.
- B. Conduits rising through floating slabs shall be brought through sleeves in the slab which shall be sealed with non-hardening mastic after installation. Where the conduit is subject to movement (embedded in a floating slab) any extension to fixed walls or equipment shall be made through a suitable expansion fitting or flexible jacketed conduit.
- C. Clearances within concrete shall be the same as for underground conduits.

3.1.6 FLEXIBLE CONDUIT:

- A. Flexible conduit shall not be used as a general purpose raceway, but shall be provided in locations requiring flexibility. Flexible conduit shall be used for all motor connections and for all connections to vibrating equipment. Where flexibility is required for electrical raceways on equipment, flexible conduit shall be used in accordance with JIC standards, these specifications, and the local inspection agency. The maximum length of flexible conduit shall be 72" unless otherwise shown, and the terminating fittings and sealing shall be similar to existing installations.

3.1.7 CONDUIT MARKERS:

- A. All conduits scheduled shall be identified at each end with a permanent marker. Conduits shall be labeled as identified on the Conduit and Cable Schedule. Attach tags to cables or conduit by using a nylon cable tie. Identify conduits entering equipment, panelboards, or enclosures by attaching marker tag to cables as they exit the conduit. Embedded conduits and conduits routed underground shall be labeled also at all points of entry and exit including handholes and buildings, by attaching a marker tag to the exterior of the conduit.
- B. Spare conduits shall contain one 3/16" diameter nylon pull rope.

3.1.8 CONDUIT INSTALLATION:

- A. Exercise the necessary precautions to prevent the lodging of dirt, concrete or trash in the conduit, fittings and boxes during the course of installation.
- B. After the conduit has been installed, the conduit shall be tested for obstructions or flattening by pulling a mandrel of appropriate size through the conduit. If an obstruction is found, that section is to be replaced. Cleaning conduits shall be performed by drawing a brush with stiff bristles and a swab through each duct and conduit to make certain no foreign materials are left in the conduit. Cleaning and mandrelling operations may be performed simultaneously.

- C. Where conduit enters the facility below grade, the conduit shall be sealed with a waterproof sealant.
- D. When rigid steel and PVC coated rigid steel conduit is threaded in the field, the threads shall be re-galvanized by the GALV-A-WELD process or by GAL-VAN-IZE as manufactured by LAWSON Products, Inc.
- E. Where conduit rises from below grade to above grade, the transition from PVC conduit to PVC/GRS or GRS conduit shall be for the sweep and riser.

3.2 OUTLET BOXES:

- A. Outlet boxes shall be located to provide ample clearance between fixtures, pipes, beams and ducts. The location of all outlets shown is approximate. The exact location shall be verified on the job to avoid conflict with other work. Boxes shall be accurately placed and independently and securely supported. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes. Boxes shall be secured by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws depending on the type of construction.

3.3 HANDHOLES AND VAULTS:

- A. Sizes of handholes and vaults shown on the drawings are minimum sizes. If space allows the Electrical Contractor may upsize the structures for ease of pulling or if required by the NEC.
- B. Conduits entering energized equipment shall have both conduit ends sealed with a waterproof duct sealing compound - WATERGUARD Industrial Encapsulant or equal. Where conduits enter through sides of handholes the penetration shall be made watertight.
- C. Provide a minimum of ten inches of drainage gravel under entire surface of all vaults and handholes.
- D. All wire installed in handholes and vaults shall be neatly bundled and racked to the handhole or vault side walls.
- E. Provide welded stainless steel nameplate on each handhole and vault cover with the tag number and contents (480v,120v, power, control, signal, etc.) clearly indicated.

3.4 FIELD INSPECTION:

- A. Prior to backfilling and encasing conduits installed underground or covering conduits concealed in walls and ceilings, all raceways shall be inspected by the Engineer. Engineer shall be contacted a minimum of one week in advance for field inspection of concealed raceway. No raceway shall be concealed or backfilled until inspected by the Engineer.

END OF SECTION

SECTION 16120**WIRE AND CABLE****PART 1 GENERAL****1.1 DESCRIPTION OF WORK:**

- A. This section covers furnishing and installation of all wiring and connections used in the construction of this facility. All wiring shall be in raceways.

1.2 STANDARDS AND CODES:

- A. All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C..

1.3 SUBMITTALS:

- A. In accordance with the "submittals" requirements in Section 16010, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

1.4 WIRING SCHEDULE:

- A. Refer to conduit and cable schedule for description of conductors required.

PART 2 PRODUCTS**2.1 CONDUCTORS:**

- A. Conductors shall be stranded copper. Sizes AWG No. 14, 12 and 10 for general purpose lighting and receptacle wiring and all wiring within circuit breaker panels, may be solid. All other conductors shall be stranded. Insulation shall be THW, THWN, or THHN, chosen to satisfy environmental conditions. Conductors used for power circuits shall not be smaller than No. 12. Control conductors may be No. 14.

2.2 CONNECTORS

- A. Ideal Industries "Wing Nut" or 3M Company "SCOTCHLOCK" pre-insulated connectors may be used for lighting and receptacle circuits for splices and taps in

conductors No. 10 AWG and smaller. For No. 8 AWG and larger conductors, utilize T&B compression connectors. Compress using recommended die and tools.

- B. For connections of wire to cord to removable equipment provided with integral cords (such as floats, transmitters, limit switches, aerators, submersible pump motors, etc.) Provide junction box with terminals and spade/lug type terminations and coat with liquid insulation.

2.3 SPLICE INSULATION:

- A. Splice insulation shall be equal to the conductor utilized.
- B. Insulate all permanent splices that are underground or in damp or corrosive environments with cast epoxy type insulation which covers the jacket of all cords and the insulation on all wire. Epoxy splice shall be Scotch #3570 or equal.

2.4 WIRE MARKERS:

- A. Field installed wire markers shall be pre-printed, heat shrink type sleeves, Thomas&Betts Type HVM, Tyton Type THS or approved equal. See paragraph below for marking requirements.

PART 3 EXECUTION

3.1 GENERAL:

- A. Splices in power and control and signal wires or cables is not allowed. All wire transitions shall be done on terminals.
- B. Keep all conductors within the allowable tension limits during installation. Lubricants for wire pulling, if used, shall be approved for the insulation and raceway material. Observe cable manufacturer's and industry standard cable bending radius recommendations.
- C. Incoming cables in panels and motor control centers, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6" and neatly spread into trees and connected to their respective terminals.
- D. Sufficient slack shall be allowed in cables for alterations in terminal connections. Lacing shall be done with plastic cable ties using a tensioning tool designed for that purpose.
- E. Cables crossing hinges shall be made up into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.
- F. Cables installed in handholes shall be bundled and neatly racked to the side of the handhole. All splices (if allowed) shall be a minimum of six inches above the bottom of the handhole.

3.2 WIRE AND CABLE TERMINATION:

- A. Power conductors, No. 8 AWG and larger may be terminated directly in box-type lugs.
- B. Solid conductors (when allowed for lighting and receptacle circuits) of #10 and #12 may be directly terminated to screw terminals.
- C. For any power, control, or signal wire terminating on screw type terminals; provide spade or ring tongue type terminations.
- D. Stranded control conductors may be directly terminated in box type terminals at control panels. Insulated terminals shall be used also on all stranded instrumentation wiring.
- E. Special instrumentation cables shall be terminated in accordance with the recommendations of the manufacturer of the equipment and subject to review by the Engineer.
- F. No splices shall be used in power, control and/or signal wiring. The wiring shall be continuous from point-to-point. Extending existing cables will not be allowed except where shown on the drawings.
- G. Terminals and connectors shall be installed with the compression tool recommended by the terminal manufacturer. Solid wire shall not be lugged, but shall be terminated with a full ring eye of the wire under the binding-head screw or saddle of the terminal block. Electrical spring connectors may be used only on lighting circuits.

3.2.2 WIRE MARKING:

- A. All power and control conductors shall be tagged; including conductors in instrument and relay compartments of motor control centers, in control panels, instrument panels, field panels and control stations, as well as connections to mechanical equipment, shall be tagged at each end with legible, permanently coded tight fitting wire-marking sleeve showing the complete wire designation.
- B. Wire marking lettering shall be bold and type written.
- C. Wiring within a single enclosure shall be marked with the basic wire and terminal number at each end.
- D. All field wiring shall have wire labels at each end. The labels shall be marked with the output terminal number at the original equipment (control panel, MCP, or MCC) and the remote device terminal # (if applicable) and tag name separated by a slash.
- E. *EXAMPLE for a control cable from the Main Control Panel (MCP) terminal #x102 to the pump 101 check valve limit switch (ZS-101) the wire tag number at both ends shall be x102 / ZS-101.*
- F. *EXAMPLE for a control cable from the MCP to a local control panel terminal #y102, to terminal # 24 in LCP-200, the wire tag number at both ends shall be y102 / 24-lcp200*

- G. *EXAMPLE for a control cable from the MCP terminal #h32 to the NMCC1 terminal #6 the tag number at both ends shall be h32 / 6-nmcc1.*
- H. *EXAMPLE for a control cable from the NMCC1 terminal #c4 to device ZS-101, the wire tag number at both ends shall be c4 / zs-101.*
- I. Spare wiring shall be identified at each end with "SP#", and remote equipment number.
- J. *EXAMPLE for two spare control cables from the Main Control Panel (MCP) terminal to the local control panel (LCP-202), the wire tag number at the LCP shall be SP1 / MCP and SP2 / MCP. The tag at the MCP shall be SP1 / lcp202 and SP2 / lcp202.*

3.2.3 COLOR CODING:

- A. Wiring shall conform to the following color code.
- B. Insulation on phase conductor sizes #10 AWG and smaller shall be colored, #8 AWG and larger may have black insulation with plastic tape of the appropriate color from the table below.
- C. Insulation on the grounded conductor (neutral) sizes #8 AWG and smaller shall be colored, #6 AWG and larger may have black insulation with plastic tape of white or gray in accordance with the table below.

Description	120/208V	277/480V	Control
Phase A (Left)	Black	Brown	--
Phase B (Center)	Red	Orange	--
Phase C (Right)	Blue	Yellow	--
Neutral	White	Gray	White
Ground	Green	Green	Green
120 VAC Control	--	--	Red
120 VAC Control	Neutral	--	White
DC Control (+)	--	--	Blue
DC Control (-)	--	--	Gray
External Source	--	--	Yellow

- D. All control wiring in control panels or other enclosures that is powered from an external source and is not disconnected by the control panel disconnect shall be terminated at a disconnecting terminal block upon entering the enclosure. The color of the wire shall then be changed to yellow to identify it as being powered from an external source. Provide identification nameplate on exterior of enclosure to indicate sources of external power.
- E. All wiring in industrial machines and equipment shall be in accordance with NFPA 79. Notify Owner of any deficiencies noted during installation.

3.2.4 TERMINAL MARKING:

- A. All terminals in instrument and relay compartments, motor control centers, in control panels, instrument panels, field panels and control stations, as well as connections to mechanical equipment shall have reference number and letter in accordance to the following.
- h = Control power hot (usually 120v or 24v)
 - n = neutral
 - g = ground
 - x = PLC input (number shall correspond to the program input number)
 - y = PLC output (number shall correspond to the program output number)
 - ax = PLC signal/analog input (no. shall correspond to the program input number)
 - ay = PLC signal/analog output (no. shall correspond to the program output number)
 - c = control (use if none of the above letters apply)
 - p = power (usually 480v)
 - s = signal (usually 4-20ma or 1-5v) (use if none of the above letters apply)
 - B = DC + and -

3.3 CONDUCTOR SPACING

- A. Unless specifically shown otherwise on the drawings, in all areas maintain a minimum 2 inch separation between all conductors of different voltages. For parallel runs over 6 feet maintain the following minimum separation between conductors:
1. Signal (12/24) VDC and 120 VAC 6 inches
 2. Signal (12/24) VDC and 480 VAC 12 inches
 3. 120 VAC control wire and 480 VAC 2 inches

3.4 WIRE BENDING RADIUS:

- A. The radius of bends in all wire (conductors and cables) shall not be less than five (5) times the outside diameter of the wire. Any wire installed with bends less than five times the diameter which the Engineer deems has caused that insulation to be damaged shall be removed and new wire shall be installed.

3.5 GENERAL TESTS:

3.5.1 CONTROL AND SIGNAL WIRING

1. Each individual control and signal wire shall be tested by the Electrical Contractor from the field device back to the control panel or point to point to verify correct wiring.
2. For control and signal wiring terminating at a PLC, the Electrical Contractor shall force or jumper each input at the field device and verify that the PLC has

received the signal at the correct input. Each output shall be forced and checked at the field device.

B. Power Wiring

1. The Electrical Contractor shall perform voltage, current and resistance tests as required to complete the Electrical System Test Report form included herein. Test reports must be submitted to the Engineer prior to start up. The Electrical Contractor shall inform the Engineer when testing is taking place a minimum of 5 days in advance.. Testing shall not take place unless the Engineer or other Owner representative is present to witness the testing.

C. If the test results indicate corrective measures are required, the Electrical Contractor shall undertake all such corrective measures. No additional compensation will be paid for corrective measures.

D. Test Scope:

1. The Electrical Contractor shall provide all material, equipment, labor and technical supervision to perform tests and inspections as specified herein.
2. It is the intent of these tests to assure that all electrical equipment as supplied and installed by the Electrical Contractor is operational within the industry and manufacturer's tolerances and is installed in accordance with the design documents.
3. The tests and inspection shall determine the suitability for energization.

3.5.2 POWER CONDUCTOR TESTS:

A. Following the completion of installation; test the following:

1. All 480 volt Power Feeders scheduled in Conduit & Cable Schedule.
2. Service feeder and pump feeder power cabling
3. All new grounding; measure ground resistance at each ground rod.

3.5.3 VISUAL AND MECHANICAL INSPECTIONS:

- A. Inspect exposed section for physical damage.
- B. Verify cable is supplied and connected in accordance with specifications and one line diagram, and that phases are labeled correctly.

3.5.4 ELECTRICAL TESTS:

- A. Perform insulation resistance test on each cable with respect to ground and adjacent cables.
- B. Perform continuity test to ensure proper cable connection.

3.5.5 TEST VALUES:

- A. Insulation resistance tests shall be performed at 500 volts DC for one-half minute.
- B. Minimum megger readings at 20 degrees C shall be one megaohm

- C. The maximum acceptable reading for an individual ground rod shall be 25 ohms as required by the NEC and measured by the three rod method. The composite ground electrode shall have a maximum acceptable reading of 15 ohms.

END OF SECTION

ATTACHMENT: ELECTRICAL SYSTEM TEST REPORT - 600V CABLE

16120 ELECTRICAL SYSTEM TEST REPORT - 600V CABLE

ELECTRICAL SYSTEM
DESCRIPTION DATA

SERVICE DESCRIPTION:

nominal voltage, phase to phase
 phase to neutral - single or three phase-
 number of conductors

SERVICE CONDUCTORS:

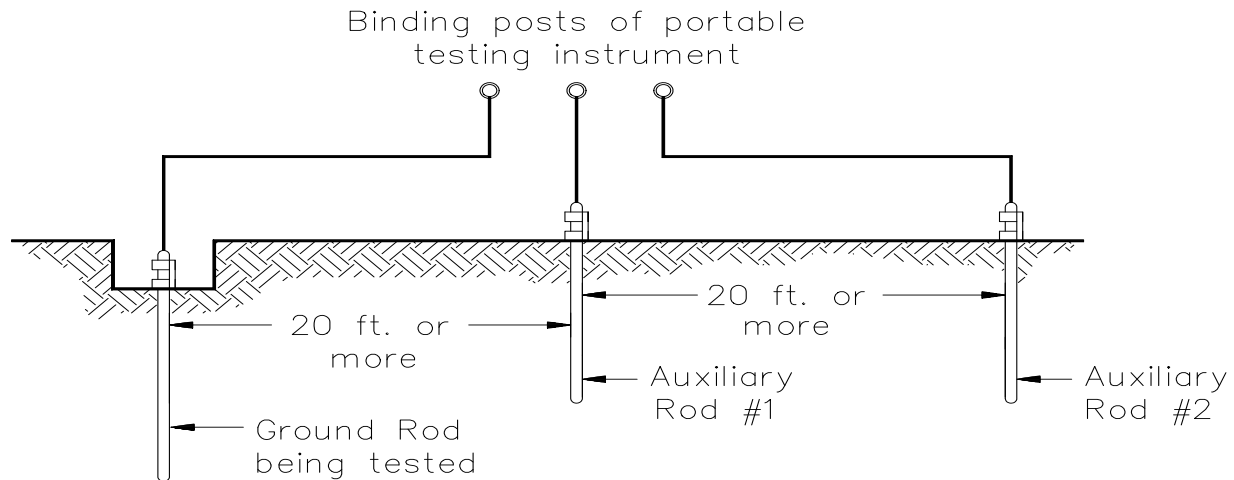
phase size and insulation type
 neutral size and insulation type
 ground size and insulation type

SERVICE DISCONNECT DESCRIPTION:

circuit breaker or disconnect switch
 size (amps)
 fuse (amps)

MEASURED CONDITIONS		DATA		
Operating Load Voltage	Volts	Vab_____	Vbc_____	Vca_____
		Van_____	Vbn_____	Vcn_____
Operating Load Feeder Current	Amps	Ia_____	Ib_____	Ic_____
Conductor Insulation Megohms Resistance (record the indicated measurement for each of the following circuits:)		a-b_____	b-c_____	c-a_____
	Megohms	a-g_____	b-g_____	c-g_____
1. Service Feeder				
2. Pump Feeders				

16120 - ELECTRICAL GROUND ROD TEST REPORT

GROUND ROD RESISTANCE TESTING

PROCEDURE:

To measure ground resistance, two additional temporary grounds, consisting of short rods 2 or 3 ft long, shall be driven in the ground at least 20 ft. away from the rod being tested. A direct-reading ground resistance tester shall then be connected to the three ground rods by means of insulated leads. The battery operated ground resistance tester reads the resistance of the ground rod being tested directly in ohms. The ground rod location / designation and its measured ohm value shall be recorded in chart below.

GROUND ROD LOCATION / DESIGNATION	OHM VALUE
1.	*
2.	*
3.	*
COMPOSITE GROUND	*

* Ohm value of a single ground rod shall not exceed 25 Ohms. If additional ground rod(s) are added, the "composite" ground electrode shall have a maximum acceptable reading of 15 Ohms which shall be recorded in chart above.

SECTION 16140**WIRING DEVICES****PART 1 GENERAL****1.1 DESCRIPTION OF WORK:**

- A. This section covers furnishing and installing all receptacles, switches and other wiring devices indicated on the drawings.

1.2 STANDARDS AND CODES:

- A. All materials and equipment specified herein shall within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C..

1.3 SUBMITTALS:

- A. In accordance with the "submittals" requirements in Section 16010, submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

PART 2 PRODUCTS**2.1 SWITCHES AND RECEPTACLES:**

- A. Standard wall switches shall be single-pole, or double-pole, three-way, as shown on the drawings and shall be AC quiet type rated 20 amp, 125/277 volt with screw terminals. Wiring devices shall be ivory colored for general use and brown when installed in service areas or dark finished walls. Receptacles on emergency or backup power shall be labeled or color coded. Approved manufacturers are:

Manufacturer

ARROW HART
BRYANT
HUBBELL
P&S

- B. Weather proof switches for use in damp, corrosive or outdoor applications shall be
- die cast aluminum housing with lever type switch CROUSE-HINDS, DS185
 - or non metallic, UL marine listed, CARLON, E98TSC or equal.
- C. Weather proof receptacles for use in damp, corrosive or outdoor applications shall be
- die cast aluminum with spring and gasketed covers CROUSE-HINDS, WL series
 - or non metallic, CARLON or equal.

2.2 PLATES:

- A. Scope: Provide plate for each wiring device, for each signal or communication outlet.
- B. Device plates on flush devices, in general, shall be satin finish stainless steel Sierra 302 stainless steel line or approved equal, modern classic design, corrosion resistant. Special finish plates shall be provided to match special paneled walls as directed by Architect.
- C. Device plates for switches and receptacles in outdoor areas shall have weatherproof plates with hinged cover and stainless steel screws. Sierra Electric WP series or equal.
- D. Plates on exposed wiring shall be of metal, of the same manufacture as the conduit fittings; specifically suited for device and fitting used.
- E. Blank, Bushed or Special Outlet Plates: Provide for all signal communication system outlets as required.

2.3 OUTLET BOXES:

- A. See Section 16110

PART 3 EXECUTION**3.1 OUTLETS:**

- A. Center all outlets with regard to building lines, furring and trim. Symmetrically arrange outlets in the room. Satisfactorily correct outlets improperly located or installed. Repair or replace damaged finished.
- B. Set outlets plumb and extend flush outlets to the finished surface of the wall, ceiling or floor without projecting beyond same.
- C. Install symmetrically all receptacles, switches and outlets shown on the trim and where necessary, set the long dimension of the plate horizontal or gang in tandem.
- D. Outlets in outdoor areas or wet areas shall be GFI – provide GFI outlets in other areas as required by Code.

3.2 MOUNTING HEIGHTS:

- A. Unless otherwise noted, wall mounted outlet devices shall generally be 24 inches above the floor, 18" in Architecturally treated areas.
- B. Switches shall be 48 inches above the floor.
- C. Outlets mounted over work tables and desks and counters shall be 2"-6" above the work surface.

END OF SECTION

SECTION 16170**DISCONNECTS AND FUSED SWITCHES****PART 1 GENERAL****1.1 DESCRIPTION OF WORK:**

- A. Provide all disconnects, fused and unfused, required by code for equipment furnished under this and other Divisions of these specifications.

1.2 STANDARDS AND CODES:

- A. All materials and equipment specified herein shall within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C..

1.3 SUBMITTALS:

- A. Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

PART 2 PRODUCTS**2.1 DISCONNECTS:**

- A. Switch shall be heavy duty type, shall be quick-make quick-break and shall be horsepower rated. Switch shall have blades as required to open all ungrounded conductors and shall be single throw unless noted.
- B. Enclosure shall be suitable for location in which mounted.
 - 1. Enclosures located outdoors or in damp or corrosive areas shall be NEMA 3R, painted steel.
- C. Fusible disconnects shall be as above with addition of fuse space and clips to accept Class R fuses. Use only where required by equipment manufacturer to meet UL installation requirements.

2.2 MANUFACTURER:

- A. Cutler Hammer, General Electric, Siemen's - ITE, Square D, Cooper Bussman or Westinghouse, no substitutions allowed.

PART 3 EXECUTION**3.1 INSTALLATION:**

- A. Mount switches at locations as required by code, shown on plans and as follows:
 - 1. Fasten securely to supporting structure at walls and stands:
 - a) Wood screws or lag screws to wood boards or timbers
 - b) Machine bolt to metal framing or plates
 - c) Expansion anchors to concrete walls
 - d) Expansion toggle wing bolts or sleeve anchors to hollow block
 - e) Provide 1 inch spacers to set panel out from concrete or block wall
 - 2. Stands and supports:
 - a) Corrosion-resistant materials and finishes
 - b) Unistrut-type materials for fabrication
 - c) Expansion anchors for bolts in concrete floor
 - d) Machine bolt to metal framing or plates
 - e) Wood screws or lag screws to wood boards or timber
 - f) Backing plate for mounting units
 - g) Fasten stand securely to floor
 - h) Dimensions as required by equipment to be mounted
 - 3. Arrange for driven equipment use or function:
 - a) Similar units adjacent
 - b) Adequate space for operation and servicing
 - 4. Mounting height:
 - a) Single unit, 4 feet 6 inch center line above floor

3.2 IDENTIFICATION:

- A. Provide engraved nameplate of 1/16 inch thick laminated phenolic plastic with 1/4 inch white letters on black background. Securely attach labels with stainless steel screws Nameplate to state equipment name and number, load designation and power source equipment.

END OF SECTION

SECTION 16400
SERVICE AND METERING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK:

- A. Work consists of installation of new **300** amp 208/120 VAC pole mounted service transformer with underground feed and service entrance equipment. The site is located at 3035 South 160th Street Seatac, WA 98188.

1.2 SCHEDULING WORK WITH THE UTILITY COMPANY:

- A. The Electrical Contractor shall be fully and completely responsible for all scheduling and coordination with the utility company. The Electrical Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required by the facility prior to Certificate of Occupancy.
- B. The Electrical Contractor shall make all necessary applications for service with the utility, and shall notify the Owner in writing of any obligations that the Owner must fulfill for service to be started, installed, or modified.

1.3 ELECTRICAL CONTRACTOR/UTILITY INTERFACE RESPONSIBILITIES:

- A. The electrical utility providing service to these facilities is Puget Sound Energy with Potelco.
- B. During design, contact was made with Scott Bostrum at (253) 606-4552 of Potelco. The division of responsibilities stated below has been determined by coordination with the utility. The Electrical Contractor shall comply with all utility company standards and requirements.
- C. All utility company charges for and related to the final permanent service to the facility will be paid by the Owner, directly to the utility company and shall not be included in the Electrical Contractor bid price.
- D. Any and all modifications to the service or power system at the facility shall be paid for by the Electrical Contractor.
- E. The Electrical Contractor shall notify the Owner (in writing) of any obligations or forms that the Owner is responsible to provide for service.

1.3.2 THE ELECTRICAL CONTRACTOR SHALL:

- A. Provide a down-comer conduit attached to the existing pole down to grade.
- B. Provide trenching, backfill and borrow material for secondary service, from the base of the new pole to the hand hole (located 5 feet off the right of way) and from the hand hole to the CT Compartment. Provide trenching, backfill and borrow material for the secondary service.

- C. Provide underground secondary conduit and wiring, from the utility Co. pole through the hand hole to the metering C.T.s. Provide a 2'x3' hand hole. Provide sufficient conductor to reach and connect to the transformer secondary terminals.
- D. Provide the CT enclosure, meter base, and conduit and wire between the CT enclosure and meter base.

1.3.3 THE UTILITY COMPANY WILL:

- A. Provide primary service conductors to the new pole mounted transformers.
- B. Provide new service transformer and terminate primary and secondary conductors.
- C. Provide and install meter in Electrical Contractor supplied enclosure. Make connections for metering, and provide C.T.s for Electrical Contractor to install in CT Compartment.

1.4 QUALITY ASSURANCE

- A. Comply with all serving utility company standards and requirements.

1.5 STANDARDS AND CODES

- A. Work involving service installation shall be done in accordance with the serving utility's standards and the National Electric Code.
- B. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment".

1.6 SUBMITTALS

- A. In conformance with the submittal requirements of Section 16010, submit catalog data showing material information and conformance with specifications on the following:
- B. Prior to submittal to the Engineer, the Electrical Contractor shall submit all equipment and construction details (such as size, mounting height, location of equipment, etc.) to the serving utility for verification of compliance to the utility's requirements.
 - 1. Meter Enclosure
 - 2. Service Entrance Switch
 - 3. CT. Enclosure

PART 2 PRODUCTS**2.1 METER ENCLOSURE**

- A. Meter enclosure shall be Circle AW and as required to meet the requirements of the serving utility. Installation shall be in vandal proof NEMA 3R enclosure with a lockable hinged door.
- B. Electrical Contractor shall coordinate with Power Co. on type of metering required and shall provide all labor and material necessary to meet Power Co. requirements.

2.2 SERVICE ENTRANCE SWITCH

- A. Service entrance shall be outdoor NEMA 3R construction and shall contain the Fused Disconnect, neutral and ground buses. Service equipment shall meet the requirements of the serving utility and shall be suitable for use as service equipment.

2.3 C.T. ENCLOSURE

- A. Utility metering CT enclosures shall meet all requirements of the serving utility and shall be located as shown on the drawings.

PART 3 EXECUTION**3.1 GROUND ELECTRODE SYSTEM**

- A. The grounded conductor and ground bus shall be connected to the grounding electrode system, via the grounding electrode conductor as indicated on system one-line diagram.
- B. The system shall be as indicated in Article 250-66 of the National Electrical Code.

3.2 UNDERGROUND SECONDARY SERVICE

- A. Install in accordance with Section 16110.

3.3 UTILITY REQUIREMENT VERIFICATION

- A. The Electrical Contractor shall coordinate and submit all equipment, materials, etc. related to the utility work to the serving utility to verify conformance to the Utility's requirements for service. The Electrical Contractor shall also submit any plans for the installation of the primary and secondary service for approval by the Utility prior to excavation. Any discrepancy between the Utility requirements and the Contract documents shall be brought to the immediate attention of the Engineer.

END OF SECTION

SECTION 16460
DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide dry type, auto-transformers for boosting 208/120Y VAC 3 phase service to 230/132Y VAC 3 phase utilization for existing equipment.
- B. Provide these three autotransformers in outdoor NEMA 3R enclosures and make the necessary wiring connections either in the transformer housing or in a wireway.

1.2 MATERIALS

- A. All materials shall be new, free from defects, of current manufacture, of quality specified or shown. Each type of material shall be of the same manufacture throughout the work.

1.3 STANDARDS AND CODES

- A. All materials and equipment specified herein shall be within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.4 EQUIPMENT SIZE

- A. Electrical equipment shall fit in the space provided on the plan drawings or as specified. Equipment heights shall not exceed those shown or specified. Larger equipment shall not be considered acceptable. Equipment that is larger than specified shall not be considered equivalent.

1.5 SUBMITTALS

- A. In accordance with the submittal requirements in Section 16010, provide the following submittal information:
- B. Catalog data showing material information and conformance with specifications.
- C. Manufacturer name and address.

PART 2 PRODUCTS**2.1 TYPE**

- A. Dry type transformers shall be constructed of heavy gauge sheet steel. Coil and terminal chamber shall be constructed with guarded opening for ventilation and convection cooling. Primary coil shall be delta connected, secondary coil wye connected.
- B. K-rated transformers shall be of common core construction, with a full width electrostatic shielding. All cores shall be constructed with low hysteresis and eddy current losses. The core flux density shall be well below the saturation point to prevent core overheating and excessive sound level caused by harmonic voltage distortion. Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermosetting varnish.

2.2 WINDINGS

- A. General purpose transformers

Separate primary and secondary windings shall have Class H insulation and shall be rated for continuous operation at rated kVA with temperature rise of not over 150 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C. Windings, core and coil assembly shall be treated and built to resist the effects of dirt and moisture.

- B. K-rated transformers

Transformer insulation shall be a UL recognized 220°C system. Neither the primary nor the secondary temperature shall exceed 220°C at any point in the coils while carrying their full rating of non-sinusoidal load. Transformers shall be UL listed and labeled for K-4 or K-13 loads as defined by UL1561. Windings shall be listed for 115°C average temperature rise.

2.3 PRIMARY TAPS

- A. General purpose transformers
- B. Unless otherwise noted or shown, transformers shall be provided with a minimum of four full capacity taps, minimum of two 2-1/2 percent above and two 2-1/2 percent below normal (rated) primary voltage.
- C. K-rated transformers
- D. Transformers 15 kVA and larger shall have a minimum of 6-2.5% full capacity primary taps for 208 volt primaries.

2.4 CAPACITY

- A. Transformers furnished shall have a continuous rating of not less than the size noted on the drawings.

- B. The secondary neutral terminal on three-phase K-rated transformers shall be sized for 200% of secondary phase current.

2.5 CONNECTIONS

- A. Provisions for external connections shall be made by means of a terminal board employing lugs compatible for the external conductors to be installed.

2.6 GROUNDING

- A. The core of the transformer shall be grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE ANSI standards.

2.7 NOISE LEVEL

- A. ASA rated quiet type.

2.8 EQUIPMENT

- A. Acceptable manufacturers for dry type transformers shall be General Electric, Westinghouse, Square D, Heavy Duty and approved equals.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Transformers shall include internal "rubber-in-shear" isolation mounts selected per manufacturer's recommendations or shall be installed with "KORFUND" or equal external vibration isolators. Wall mounting shall be allowed on masonry. Mounting hardware shall be per manufacturer's instructions. Transformers with enclosures designed for floor mounting where suspended from above shall be suspended on a trapeze constructed of a minimum of two horizontal structural channels hung from threaded rod attached to structural slab with inserts. Channel rod and inserts shall be sized for not less than 400% load safety factor. Transformer raceway connections shall be flexible metal conduit as specified herein-before for equipment subject to vibration.

3.2 CONNECTION

- A. Transformers shall be considered "grounded neutral separately derived systems" and neutral shall be grounded accordingly to the building ground grid utilizing a direct connection.

3.3 IDENTIFICATION

- A. The transformer shall be identified with phenolic nameplates. Nameplates shall be white background with 1/4" black letters, secured in place with screws.

B. The nameplate shall state the following:

	EXAMPLE
	Rating: 208V-120/230, 3ø
Primary Source:	Primary Breaker at Panel LA

END OF SECTION

SECTION 16471**PANELBOARDS****PART 1 GENERAL****1.1 DESCRIPTION OF WORK**

- A. This section covers the furnishing and installation of all panelboard equipment complete.
- B. Furnish and install fusible branch circuit panelboards as specified, and as shown on the associated drawings.

1.2 STANDARDS AND CODES

- A. All materials and equipment specified herein shall within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C.

1.3 SUBMITTALS

- A. Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

1.4 REFERENCES

- A. UL 248 – Low-Voltage Fuses.
- B. UL 98 – Enclosed and Dead-front Switches.
- C. UL 67 – Panelboards.
- D. UL 50 – Enclosures for Electrical Equipment.
- E. NEMA PB 1 – Panelboards.
- F. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

- G. NEMA FU 1 – Low Voltage Cartridge Fuses.
- H. NFPA-70 – National Electrical Code®.
- I. CSA Standard C22.2 No. 248 – Low Voltage Fuses.

1.5 SYSTEM DESCRIPTION

- A. The panelboards shall be UL and cUL Listed.
- B. Selective Coordination:
 - a. Panelboards overcurrent protective devices shall be selectively coordinated with all supply side (fed from both the normal and emergency source) Cooper Bussmann™ Low-Peak™ LPJ or LPN-RK/LPS-RK fuses sized at a minimum ampere ratio of 2:1. Consult Cooper Bussmann for coordination ratios with other fuse types.

1.6 QUALIFICATIONS

- A. The equipment manufacturer shall have a minimum five years experience in producing electrical distribution panelboards.
- B. Fusible branch circuit panelboards shall be listed to UL 67.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Equipment shall be shipped without branch circuit fuses installed. Branch circuit fuses shall be shipped separately with the chassis. Where 100A and 200A main fuses are specified, equipment shall be shipped with main fuses installed. Where 60A main fuses are specified, fuses shall be shipped separately with the chassis.
- B. Inspect equipment for possible damage during delivery and prior to installation.
- C. Handle and store in accordance with manufacturer's instructions.

1.8 INSTALLATION, OPERATION, AND MAINTENANCE MATERIALS

- A. Furnish operation and maintenance tools/key(s) if available from manufacturer.
- B. Manufacturer shall provide copies of installation, operation and maintenance manuals to owner including replacement parts list if available.

1.9 WARRANTY

- A. Manufacturer shall warrant specified equipment free of materials and workmanship defects for 18 months from the date of shipment or 12 months from date of first use, whichever occurs first.

1.10 ADDITIONAL MATERIALS

- A. Furnish [10%] [20%] or minimum of three fuses of each rating and type of fuse installed.
- B. Furnish a minimum of one spare fuse cabinet or as indicated on the drawings.

PART 2 PRODUCTS**2.1 PANELBOARD TYPE**

- A. Panelboards shall be rated at proper voltage and current for intended use with bus bars of aluminum. Panels shall have phases, voltage and current ratings as shown on the drawings. Panels shall have 100 percent neutral, with equipment ground bar, unless noted otherwise. Panelboards shall be dead front.
- B. Panels shall have as a minimum the number of circuits shown on the panel schedules on the drawings.

2.2 CIRCUIT BREAKERS

- A. The following interrupting capacity shall be considered minimum. Other ratings shall be as specified on the drawings.
- B. 240V and 208Y/120V Panelboards 10,000 AIC symmetrical
- C. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Bolt-type only. Provide common trip on all multiple pole breakers.
- D. Where noted, provide spare breakers, complete for future connection of wiring circuits. Where "Space Only" is indicated for breakers, provide all bussing and breaker mounting hardware in the panelboard; provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are removed, provide breakers in such spaces or approved cover plates. Open spaces are not permitted.

2.3 CABINET FOR EACH PANELBOARD

- A. Flush or surface as indicated; tight closing doors without play when latched. Where two cabinets are located adjacent to each other in finished areas, provide matching trim of the same height.
- B. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on drawings.
- C. Provide lock for each cabinet door. All Electrical distribution equipment locks to be keyed identically.
- D. Fasten panelboard with machine screws with oval countersunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall have trim hinged at right side in addition to hinged door over dead front.

- E. Provide factory standard lacquer or enamel finish, ASA #49 gray.

2.4 SURGE ARRESTORS

- A. Provide Surge arrestors, with indicators, where shown on the one-line diagrams to protect against overvoltage transients. GE tranquell 9L15 series with protective capacitor GE model 9L18 or equal. Select proper components for the application as shown on the drawings.

2.5 SYSTEM OF NUMBERING AND BUS ARRANGEMENT

- A. Shall be as shown on the Panel Schedules on the drawings.
- B. Provide a type written circuit directory card for each panelboard with the load name, number, location and kVA.

2.6 PANELBOARD NAMEPLATE

- A. Provide engraved (color layer - engraved through outer layer) plastic name plate with 1/2 inch high characters for panel identification (for panel name); attached with stainless steel screws to each panelboard front. Emergency system - white on red; Normal system - black letters on white. Include voltage, phase and wire (i.e., 208Y/120V, 3 phase, 4 wire) in 3/8 inch characters.

2.7 MANUFACTURERS

- A. Fusible Branch Circuit Panelboards shall be Cooper Bussmann™ Quik-Spec™ Coordination Panelboards type QSCP.
- B. Substitutions will be accepted only if the below requirements are met and written approval is provided from the engineer:
 - a. The electrical contractor supplies a written request to the engineer three weeks prior to the project bid date
 - b. The electrical contractor provides product documentation to prove complete compliance with specification and all pertinent codes and standards requirements as specified in this section

2.8 PANELBOARD RATINGS

- A. Panelboards shall be labeled with a short-circuit current rating equal to or greater than that indicated on the associated schedules or drawings.
- B. Non-service entrance rated panelboards shall be UL and cUL Listed. Service entrance rated panelboards shall be UL Listed.
- C. Panelboards shall be rated 600Vac and have a current rating as indicated on the associated schedules or drawings.

- D. Panelboard overcurrent protective device interrupting ratings shall be fully rated for the maximum available fault current and have a UL Listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
- E. Current ratings, configuration of poles and number of circuits shall be indicated on associated schedules or drawings.

2.9 CONSTRUCTION

- A. Panelboard branch circuits shall incorporate overcurrent protection and branch-circuit rated disconnecting means into a single integrated component.
- B. Interiors shall be factory assembled.
- C. Panelboard shall be equipped with a six-space spare fuse holder for storing replacement branch circuit fuses. Spare fuse holder shall be located behind locking panel door.
- D. Bus bars shall be tin-plated copper with sufficient cross sectional area to meet UL 67 temperature rise requirements.
- E. 200 ampere rated neutral shall be standard, 400 ampere rated neutral shall be provided where indicated in the associated schedules or drawings.
- F. Bonded neutral shall be provided where specified in associated drawings.
- G. Isolated or non-isolated equipment ground bar shall be provided as indicated in the associated schedules or drawings.
- H. Where a service-entrance rated panelboard is indicated in associated schedules or drawings, a bonded neutral and non-isolated equipment ground bar shall be provided by the manufacturer.
- I. Main lug conductor terminations:
 - a. MLO terminations shall be rated for 60/75°C, Cu-Al
 - b. Main disconnect terminations shall be rated for 75°C, Cu Only
- J. NEMA 1 panelboards shall be field convertible for top or bottom incoming feed. NEMA 3R panelboards are bottom feed only.

2.10 MAIN DISCONNECT

- A. Permanently installed lockout means shall be provided on the main disconnect for lockout tagout procedures.
- B. Main disconnect shall be quick-make, quick-break type.

2.11 BRANCH FUSED DISCONNECTS

- A. Device shall have visible circuit ON/OFF indication with colored and international symbol markings.
- B. Device shall provide open fuse indication via permanently installed neon indicating light.
- C. Device shall be UL and cUL Listed 600Vac, 200kA short-circuit current rating, load-break disconnect with amperage ratings and number of poles as indicated on the panelboard schedule.
- D. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
- E. Fuse and disconnect shall be mechanically interlocked so as not to allow fuse removal while fuse terminals are energized.
- F. No special tools shall be required for fuse removal.
- G. Devices shall have bolt-on style bus connectors.
- H. Device housing shall be clearly marked with device amperage.
- I. Permanently installed lockout means shall be provided on the device for lockout tagout procedures. Permanently installed means for locking device in the ON position shall also be provided.
- J. Device shall provide fuse ampere rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating: 15A, 20A, 30A, 40A, 50A, & 60A.

2.12 MAIN & BRANCH OVERCURRENT PROTECTION

- A. All overcurrent protective devices shall have a minimum UL Listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.
- B. Branch circuit overcurrent protection shall be 600Vac UL Listed minimum 300kA IR and CSA Certified minimum 200kA IR finger-safe fuse with Class J performance characteristics.
- C. Main overcurrent protective devices shall be 600Vac UL Listed inimum 300kA IR and CSA Certified minimum 200kA IR Class J time-delay fuses or Class J performance fuses.
- D. Where panelboard main fuses are installed, fuses in panelboard branch circuits shall selectively coordinate with main fuses for all overcurrents up to 200kA.

2.13 ENCLOSURE

- A. NEMA 1 enclosures shall be surface or flush mount as indicated in associated schedules or drawings. NEMA 3R enclosures shall be surface mount only.

- B. Boxes shall be a nominal 20 inches wide and 5- $\frac{3}{4}$ inches deep with wire bending space per the National Electrical Code®.
- C. Panelboard trim shall be supplied with lockable door covering all disconnect handles.
- D. Panelboard trim shall be dead-front construction covering all energized parts.
- E. Enclosures shall be NEMA Type 1 or Type 3R as indicated in associated schedules or drawings.
- F. Door-in-door type trim shall be provided for NEMA 1 enclosures where it is specified in the associated schedules or drawings.
- G. Front trim shall be lockable. All lock assemblies shall be keyed alike.

PART 3 EXECUTION

3.1 MOUNTING

- A. Secure in place with top of cabinet at 6' - 6", unless otherwise noted. Top of cabinet and trim shall be level.

3.2 CIRCUIT INDEX

- A. For each branch circuit panelboard: Provide neatly type written as-built information for each panelboard by circuit with its proper load designation. Mount the panelboard circuit directory inside the door of each panelboard in a clear plastic sleeve. Provide one spare blank card for each card used.

3.3 DEAD FRONT CLOSURES

- A. Close all openings in dead front with closures manufactured for the purpose or install spare breakers.

3.4 INSTALLATION

- A. Equipment shall be installed in accordance with NEMA PB1.1 and manufacturer's recommendations.
- B. Equipment shall have a nameplate installed and mounted to the front cover and indicate: panelboard type, ampere rating, voltage rating and short-circuit current rating.
- C. Verify connected load(s) and selection of fuse sizes prior to installation.
- D. Inspect completed installation for physical damage, alignment, and support.
- E. The directory card on the inside of the door shall be completed, identifying every circuit.

3.5 FIELD ADJUSTMENTS & TESTING

- A. Tighten chassis, device and termination connections in accordance with manufacturer's recommendations.
- B. Measure load currents for each branch device and balance phase loads where possible.

3.6 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

SECTION 16491

FUSES

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish and install fuses and spare fuse cabinets as shown on drawings.

1.2 RELATED SECTIONS

- A. Section 16471 – Fused Distribution Panel boards
- B. Section 16500 – Lighting

1.3 REFERENCES

- A. Fuses shall comply with:
 - 1. NEMA FU 1
 - 2. UL/CSA/ANCE 248

1.4 SUBMITTALS

- A. Submit ten copies of manufacturer's data sheets showing fuse ratings, type, electrical characteristics, and time-current curves.

1.5 CLOSEOUT SUBMITTALS

- A. Record and document all installed fuses based upon manufacturer, ratings, types, and locations.

1.6 QUALIFICATIONS

- A. The fuse manufacturer shall have a minimum of five years experience in producing electrical distribution fuses.

1.7 MAINTANENCE MATERIALS

- A. Furnish two sets of fuse pullers where specified.

1.8 ADDITIONAL MATERIALS

- A. Furnish three sets of each rating and type of fuse installed and spare fuse cabinet (Cooper Bussmann SFC) where not already provided.

PART 2 PRODUCTS

2.1 GENERAL

- A. Manufacturers:
 - 1. Cooper Bussmann, Inc.
 - 2. Substitutions will be acceptable only if the below requirements are met and written approval from engineer:
 - a. The electrical contractor supplies a written request three weeks prior to the project bid date.
 - b. The electrical contractor supplies a detailed report that verifies the substitution will provide equivalent short-circuit protection for all components and a selectively coordinated system.

2.2 CONSTRUCTION/PERFORMANCE REQUIREMENTS

- A. Fuses – above 600A
 - 1. Circuits shall be protected by current-limiting BUSSMANN® LOW-PEAK® YELLOW Time-Delay Fuses KRP-C-(amp)SP as listed on the drawings.
 - 2. Fuses shall employ “O” rings as positive seals between the end bells and the glass melamine fuse barrel.
 - 3. Fuse links shall be pure silver (99.9% pure).
 - 4. Fuses shall be time-delay and shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less, with an interrupting rating of 300,000 amperes RMS symmetrical, and be listed by a nationally recognized testing laboratory.
 - 5. Peak let-through currents and I^2t let-through energies shall not exceed the values established by UL/CSA/ANCE for Class L fuses.
- B. Fuse – 600A and below
 - 1. Circuits shall be protected by current-limiting BUSSMANN® LOW-PEAK® YELLOW Dual-Element, Time-Delay Fuses LPN-RK-(amp)SP/LPS-RK-(amp)SP, LPJ-(amp)SP or LP-CC-(amp)as listed on the drawings.
 - 2. All fuses shall have separate overload and short-circuit elements. Fuses shall incorporate a spring activated thermal overload element that has a 284 degrees Fahrenheit melting point alloy.
 - 3. The fuses shall have time-delay capabilities in accordance with UL/CSA/ANCE standards for Class RK1, J, or CC fuses and an interrupting rating of 300,000 amperes RMS symmetrical, listed by a nationally recognized testing laboratory.
 - 4. Peak let-through currents and I^2t let-through energies shall not exceed the values established by UL/CSA/ANCE for Class RK1 or J fuses.

2.3 MOTOR CIRCUITS

- A. All individual motor circuits shall be protected by BUSSMANN® LOW-PEAK® YELLOW Dual-Element, Time-Delay Fuses LPN-RK(amp)SP/LPS-RK(amp)SP, LPJ(amp)SP, KRP-C(amp)SP, or LP-CC-(amp) as indicated on the drawings.

- B. The fuses shall be applied for all motors protected by properly sized overload relays:
 - 1. LPN-RK-(amp)SP/LPS-RK-(amp)SP fuses shall be installed in ratings of 130%, or 150% for LPJ-(amp)SP fuses, of motor full-load current (or next size larger if this does not correspond to a fuse size), except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuses may be sized at 175% of the motor full-load current, or the next standard size larger if 175% does not correspond to a standard fuse size.
 - 2. KRP-C-(amp)SP fuses shall be installed in ratings of 175% of motor full-load current (or next size larger if this does not correspond to a fuse size), except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuses may be sized be sized up to 300% (or next size smaller).
 - 3. LP-CC-(amp)SP fuses shall be installed in ratings of 200% of motor full-load current (or next size larger if this does not correspond to a fuse size), except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuses may be sized up to 400% (or next size smaller).
 - 4. Fuses shall be tested and have documentation verifying compliance of Type 2 protection requirements for motor starters per UL508E or IEC 60947-4 for motor controllers.

2.4 SWITCHBOARDS, PANELBOARDS, DISCONNECT SWITCHES, BUSWAY/BUSPLUGS

- A. Utilize BUSSMANN® LOW-PEAK® YELLOW Dual-Element, Time-Delay Fuses LPN-RK(amp)SP/LPS-RK(amp)SP, LPJ(amp)SP, or KRP-C(amp)SP as shown on the drawings. Size fuses in accordance with NEC requirements based upon load supplied.
- B. Series rated combinations are only acceptable for protection of circuit breakers in lighting panelboards. Series-rated fuse/circuit breaker combinations shall utilize tested, listed and marked in accordance with NEC requirements.

2.5 Marking

- A. Fuses shall be marked "BUSSMANN LOW-PEAK YELLOW".
- B. Additional equipment labels shall be field installed by the electrical contractor to equipment to alert the end user of the engineered level of protection of the electrical equipment. The labels shall indicate "BUSSMANN LOW-PEAK YELLOW" time-delay fuses are required for replacement. The labels shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

2.6 SUPPLEMENTARY - LIGHT FIXTURE PROTECTIVE FUSES

- A. Fluorescent fixtures shall be protected by BUSSMANN® GLR or GMF Fuses in HLR Holders. These fixtures shall have individual protection on the line side of the ballast. A fuse and holder shall be mounted within, or as part of, the fixture. Size and type of fuse to be recommended by the fixture manufacturer.
- B. All other ballast-controlled light fixtures shall be protected by BUSSMANN® KTK or FNQ Fuses in HEB HEX, HEY, HPF, or HPS Holders. These fixtures shall have individual protection on the line side of the ballast. Fuse and holder shall be mounted in a location convenient for changing fuses. Holder shall be mounted in protected location or be an in-line waterproof holder (HEB, HEX, or HEY). Size and type of fuse to be recommended by the fixture manufacturer or as indicated on plans.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job site, or from water that may contact the fuse before the equipment is installed.
- B. Final tests and inspections shall be made prior to energizing the equipment. This shall include a thorough cleaning, tightening, and review of all electrical connections and inspection of all grounding conductors.
- C. All fuses shall be furnished and installed by the electrical contractor.

END OF SECTION

SECTION 16500**LIGHTING****PART 1 GENERAL****1.1 DESCRIPTION OF WORK**

- A. This section covers furnishing and installation of all light fixtures and lamps indicated on the drawings or specified herein.

1.2 STANDARDS AND CODES

- A. All materials and equipment specified herein shall within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.
- B. All materials and equipment specified herein shall conform with all applicable NEMA, ANSI and IEEE standards.
- C. All materials and equipment specified herein and their installation methods shall conform to the latest published version of the National Electric Code, N.E.C..

1.3 SUBMITTALS

- A. Submit catalog data showing material information and conformance with specifications. The intended use of each item shall be indicated.

PART 2 PRODUCTS**2.1 LIGHT FIXTURES**

- A. Fixture Schedule - Provide in accordance with Lighting Fixture Schedule at end of this section or as shown on plans.
- B. The fixture catalog numbers listed in the fixture schedule indicate manufacturer, fixture design, quality of design and manufacture, appearance, features and options required. Lighting fixtures specified will be the basis for comparison in the consideration of fixtures of other manufacturers. Fixtures of lesser quality shall not be considered equivalent.
- C. All fixture component parts shall be manufactured and/or assembled at the manufacturing plant for shipment. The shipment from the fixture manufacturer shall include integrally mounted and/or remote mounted ballasts where ballasts are required for the proper operation of the fixture lamps.

2.2 HARDWARE

- A. The Electrical Contractor shall provide any necessary hardware for mounting fixtures. The mounting hardware shall be made of materials suitable for the environment installed. Provide materials made from aluminum, non-metallic, or stainless steel in outdoor, damp, or corrosive areas.

2.3 BALLASTS

- A. Ballasts shall be of the high power factor type. All ballasts shall be rated for 0 degree F (maximum) operation and be equipped with automatic resetting protective devices in accordance with UL requirements.
- B. Ballasts for use in fluorescent fixtures shall be electronic, Advance 2P32 RH-TP or equal and shall be rated for 0 degree F starting and operation.

2.4 LAMPS

- A. Provide all lamps as specified. Refer to the Lighting Fixture Schedule at end of this section for the ordering information of lamps. Full size fluorescent lamps shall be F32T8, 3500K or as otherwise indicated. Approved manufacturers are: WESTINGHOUSE, SYLVANIA and GE. Lamps shall be provided for all lighting fixtures.

2.5 SPECIAL ACCESSORIES

- A. Provide accessories such as junction boxes, plastic frames, stem, hangers, canopies, couplings, cords, toggle bolts, etc., necessary to mount fixture in a proper and approved method.

PART 3 EXECUTION

3.1 FIXTURE MOUNTING

- A. The fixture supplier shall provide all necessary hanging or mounting devices for all fixtures and shall be responsible for checking the type needed for various ceiling conditions.
- B. The Electrical Contractor shall see that all lighting fixtures designed to be installed throughout the project shall be of the correct size and design to properly suit the requirements of each area prior to ordering fixtures.
- C. Electrical Contractor shall install fixtures to avoid access hatches, sky lights, rails, mechanical equipment, etc.
- D. Any additional hardware needed for installation of fixtures shall be provided by the Electrical Contractor; including poles, clamps, brackets, screws, bolts, etc.
- E. Fixtures and other equipment installed in hazardous areas shall be rated for the environment. Provide fittings and seals per NEC.

- F. Pendant mounted lighting fixtures shall be supported by a flexible fixture hanger CROUSE-HINDS Type "AI" and shall have locking couplings, CROUSE-HINDS Type "COUP".
- G. Pendant fixtures in hazardous areas shall have union hub fixture hangers, CROUSE-HINDS Type "EAHC".
- H. Where fixtures are indicated for installation on low-density ceiling material, mount on 1 1/2" ceiling spacers unless UL approved for mounting directly to ceiling material.
- I. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Coordinate complete fixture installation with the facility construction. Clean and mount all lighting fixtures with new lamps immediately prior to final inspection.
- J. Square and rectangular fixtures shall be mounted with sides parallel to building lines and parallel with ceiling lines.
- K. Install fluorescent fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection or angular jointing of fixtures installed in continuous rows.

END OF SECTION

SEE LIGHTING AND FIXTURE SCHEDULE ON THE DRAWINGS

APPENDIX E
AIR PERMIT APPLICATION FORM FOR SUBSTANTIAL COMPLIANCE DETERMINATION



STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47600 • Olympia, WA 98504-7600 • 360-407-6000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

July 1, 2011

NOTICE

The Air Quality Program has revised our permit fees beginning July 1, 2011. Bear with us as we fine-tune this new system. We want to give you a heads up on one point. Ecology set the initial fee rate at an amount that would cover the simplest type of permit. The amount of time required to review a permit application and issue a permit varies based on the complexity of the project. Therefore, it is possible that your initial fee will not cover the cost of processing your request. If that happens, we will send you a bill to cover our expenses.

We encourage you to work closely with your permit writer so that the permitting process, timeline, and costs are clear. These changes are our first step toward meeting the legislative mandate of shifting the cost of permitting from the state General Fund to the recipients of the permits. If you have any questions, please call the contact listed below.

Ecology Permitting Authority

Ecology Central Regional Office – Air Quality Program
Chelan, Douglas, Kittitas, Klickitat, or Okanogan County

Ecology Eastern Regional Office – Air Quality Program
Adams, Asotin, Columbia, Ferry, Franklin,
Garfield, Grant, Lincoln, Pend Oreille, Stevens,
Walla Walla or Whitman County

Ecology Northwest Regional Office – Air Quality Program
San Juan County

Ecology Industrial Section – W2Resources Program
For actions taken at
Kraft and Sulfite Paper Mills and Aluminum Smelters

Ecology Nuclear Waste Program

US Department of Energy Hanford Reservation

Contact

Lynnette Haller
(509) 457-7126
lynnette.haller@ecy.wa.gov

Greg Flibbert
(509) 329-3400
gregory.flibbert@ecy.wa.gov

David Adler
(425) 649-7000
david.adler@ecy.wa.gov

Garin Schrieve
(360) 407-6900
garin.schrieve@ecy.wa.gov

Philip Gent
(509) 372-7950
philip.gent@ecy.wa.gov



Notice of Construction Application: New Project or Modification of Existing Stationary Source

INSTRUCTIONS

This application applies statewide for facilities under the Department of Ecology's jurisdiction. Submit this form if you want approval to construct a new project or modify an existing permit. Submit the Application for a PSD Program Applicability Determination form (ECY 070-413) if you want Ecology to determine whether your project is subject to the PSD Program. The state rules exempt specific emission units, activities, and emission rates. Refer to [WAC 173-400-110\(4\) and \(5\)](#) for more information.

Fill out the front and back of this form. Attach a check for the initial fee to this form. Mail the form and your Notice of Construction application to: **Department of Ecology**

Cashiering Unit
P.O. Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only:
001-NSR-216-0299-000404

Check the box that applies to your application. Not Applicable

☐	\$1,500: Basic project initial fee covers 16 hours of review. Ecology may determine your project is complex during completeness review of your application. If your project is complex, you must pay the additional \$8,500 before we will continue working on your application.
☐	\$10,000: Complex project initial fee covers 106 hours of review. Submit this fee if you know your project is complex based on emissions.

Check the box for the location of your proposal. For assistance, call the contact listed below:		
	Ecology Permitting Authority	Contact
☐ CRO	Chelan, Douglas, Kittitas, Klickitat, or Okanogan County Ecology Central Regional Office – Air Quality Program	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☐ ERO	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla or Whitman County Ecology Eastern Regional Office – Air Quality Program	Greg Flibbert (509) 329-3452 gregory.flibbert@ecy.wa.gov
☐ NWRO	San Juan County Ecology Northwest Regional Office – Air Quality Program	David Adler (425) 649-7082 david.adler@ecy.wa.gov
☐ IND	For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters Ecology Industrial Section – W2Resources Program Permit manager: _____	Garin Schrieve (360) 407-6916 garin.schrieve@ecy.wa.gov
☐ NWP	For actions taken on the US Department of Energy Hanford Reservation Ecology Nuclear Waste Program	Philip Gent (509) 372-7924 philip.gent@ecy.wa.gov



Notice of Construction Application: New Project or Modification of Existing Stationary Source

Read each statement, then check the box next to it to acknowledge what you have read.

Not Applicable

☐	The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours exceeds the number of hours included in your initial fee, Ecology will send you a bill for that extra time.
☐	Ecology will bill you \$95 per hour for each hour worked beyond the initial hours. You must pay the bill before we will issue your permit.
☐	When you get a permit, you give permission for Ecology staff to enter the premises for inspection.

Applicant Information

The applicant is the business requesting services from Ecology and is responsible for paying the costs incurred by Ecology.

Name of business MasterPark Lot C

Physical location of project (city) SeaTac

Name of project SeaTac Development Site (MTCA)

Responsible Official

The responsible official is the person responsible for overall operation of and ongoing compliance at the facility.

Name, Title Harry Grant, Attorney at Riddell Williams P.S.

Mailing address 1001 Fourth Avenue, Suite 4500

City, State, Zip Seattle, Washington 98154

Phone, Fax, E-mail 206-624-3600

Project Billing Contact Information. Not Applicable

Ecology will send the responsible official the bills if there are any.

☐ If the project billing contact is different from the responsible official, check this box and provide the required information.

Name, Title _____

Mailing address _____

City, State, Zip _____

Phone, Fax, E-mail _____

Project Consultant Information

X If you hired a consultant to prepare the application (or materials), check this box and provide the required information.

Consultant Name, Title Doug Morell, Principle Hydrogeologist

Organization Golder Associates, Inc.

Mailing address 18300 NE Union Hill Road, Suite 200

City, State, Zip Redmond, WA 98052

Phone, Fax, E-mail 425-883-0777



Notice of Construction Application: New Project or Modification of Existing Stationary Source

I. RESPONSIBLE OFFICIAL SIGNATURE BLOCK (The responsible official is the person responsible for overall operation of and ongoing compliance at the facility.)

I certify, based on information and belief formed after reasonable inquiry, the statements and information in this application are true, accurate, and complete.

Printed Name _____ Title _____

Signature _____ Date _____

II. COMPANY INFORMATION

1. Legal Name of Company
ANSCO Properties, LLC

2. Company Mailing Address (street, city, state, zip)
c/o Harry Grant, 1001 Fourth Avenue, Suite 4500, Seattle, Washington 98154

3. Company Responsible Official & Title
Harry Grant, Attorney at Riddell Williams P.S.

4. Company Phone Number
(Harry Grant) 206-624-3600

5. Company FAX Number

III. FACILITY INFORMATION

1. Facility Name (if different from Legal Company Name above)
SeaTac Development Site

2. Facility Mailing Address (if different from Company Mailing Address above)
16025 International Boulevard, SeaTac, WA

3. Facility Site Legal Description
Legal definition and description contained in the Cleanup Action Plan for the SeaTac Development Site

4. Facility Contact Person (if different from Company Responsible Official above)
Harry Grant

5. Facility Phone Number (if different from
Company Phone # above)
206-624-3600

6. Facility FAX # (if different from Company
FAX # above)

7. General Proposal for Facility (see section on next page for specific description of proposal).
Installation and operation of in-situ air sparge (IAS) and soil vapor extraction (SVE)

8. Proposal Construction Starting Date
Per schedule in Engineering Design Report

9. Proposal Construction Completion Date
Per schedule in Engineering Design Report

Notice of Construction Application: New Project or Modification of Existing Stationary Source

IV. PROPOSAL INFORMATION

1. Complete Description of Specific Proposal (attach Drawings, Schematics, Prints or Block Diagrams): See Engineering Design Report			
2. This Application is for (Check one): ☒ New Construction ☐ Existing Equipment / Facility Operating without a Permit ☐ Change of Control Technology ☐ Modification to Facility ☐ New Permit Conditions ☐ Production Increase			
3. Complete Description of Best Available control Technology (BACT) for Proposal (see attached Summary of BACT Process): SVE offgas will be treated by carbon adsorption (two vapor-phase carbon vessels in series), or a catalytic oxidation. See Engineering Design Report for description.			
4. Maximum Potential Production Output per Year 250 scfm		5. Maximum Potential Production Output per Hour 250 scfm	
6. Actual Production Output per Year 250 scfm		7. Actual Production Output per Hour 250 scfm	
8. Operating Schedule	Hours Per Day <u>24</u>	Days Per Week <u>7</u>	Weeks per Year <u>52</u>
9. Percentage of Production Year-round operation			

Notice of Construction Application: New Project or Modification of Existing Stationary Source

V. EMISSIONS ESTIMATIONS OF CRITERIA POLLUTANTS

1. Particulate Matter (PM) (Pounds or Tons per Year)	NONE	Actual Emissions =	Potential Emissions =
2. Nitrogen Oxides (NO _x) (Pounds or Tons per Year)	NONE	Actual Emissions =	Potential Emissions =
3. Carbon Monoxide (CO) (Pounds or tons per Year)	NONE	Actual Emissions =	Potential Emissions =
4. Sulfur Dioxide (SO ₂) (Pounds or Tons per Year)	NONE	Actual Emissions =	Potential Emissions =
5. Volatile Organic Compounds (VOCs) (Pounds or Tons per Year)	See Section VI. Actual Emissions =		Potential Emissions =
6. Lead (Pb) (Pounds or Tons per Year)	NONE	Actual Emissions =	Potential Emissions =

VI. EMISSIONS ESTIMATIONS OF TOXIC AIR POLLUTANTS (consult Chapter 173-460 WAC)

Pollutant #1 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant BENZENE (Class A)	Actual Emissions = <=potential emissions	Potential Emissions = 0.331 lb/year
Pollutant #2 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant N-HEXANE (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 4.60 lb/24-hr
Pollutant #3 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant CYCLOHEXANE (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 39.4 lb/24-hr
Pollutant #4 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant ETHYLBENZENE (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 3.84 lb/year
Pollutant #5 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant TOLUENE (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 32.9 lb/24-hr
Pollutant #6 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant M-XYLENES (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 1.45 lb/24-hr
Pollutant #7 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant O-XYLENES (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 1.45 lb/24-hr
Pollutant #8 (List Pollutant Name, Pounds per Hour/Pounds per Year)	Pollutant P-XYLENES (Class B)	Actual Emissions = <=potential emissions	Potential Emissions = 1.45 lb/24-hr

VII. EMISSIONS ESTIMATIONS OF FUGITIVE AIR POLLUTANTS

Pollutant #1 (List Pollutant Name, Pounds per Hour/Pounds per Year)	NONE		
	Pollutant	Pounds per Hour =	Pounds per Year =
Pollutant #1 (List Pollutant Name, Pounds per Hour/Pounds per Year)			

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NONE		
Pollutant	Pounds per Hour =	Pounds per Year =

VIII. MODELING RESULTS

1. List Modeling Results of Criteria Air Pollutants (attach any Modeling Printouts) NOT APPLICABLE
2. List Modeling Results of Toxic Air Pollutants (attach any Modeling Printouts) NOT APPLICABLE

IX. EMISSIONS DATA AT DISCHARGE POINT

Stack Parameters	Other than Stack Parameters
1. List the Number of Stacks under this Proposal One	1. List the Number of Discharge Points under this Proposal
2. List the Gas Velocity for each Stack 250 scfm, 4-inch diam.: 48 ft/sec	2. List the Gas Velocity for each Discharge Point
3. List the Height for each Stack > 6 ft	3. List the Height for each Discharge Point
4. List the Inside Diameter or Dimensions for each Stack Both approximately 4 inches (4-inch sch.40 PVC pipe)	4. List the Inside Diameter or dimensions for each Discharge Point
5. List the Gas Exit Temperature for each Stack Approx. ambient	5. List the Gas Exit Temperature for each Discharge Point
6. List the Building Height, Width, Length for each Stack Not applicable	6. List the Building Height, Width, Length for each Discharge Point
7. List the Height of the Tallest Building On-site or in the Vicinity 15 feet	7. List the Height of the Tallest Building On-site or in the Vicinity
8. List Whether the Facility is in an Urban or Rural Location Urban	8. List Whether the Facility is in an Urban or Rural Location
9. List the Distance from each Stack to the Property Line See Figures and Drawings in the Site Engineering Design Report	9. List the Distance from each Discharge Point to the Property Line
10. Is this Stack Shared by more than One Source? No	10. Is this a Shared Discharge Point?
11. List the Volumetric Flow Rate for each Stack 250 scfm	11. List the Volumetric Flow Rate for each Discharge Point
12. How does each Stack Discharge, Vertically or Horizontally? Vertically	12. How does each Discharge Point Vent, Vertically or Horizontally?

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X. FUEL DATA- NOT APPLICABLE

	PRIMARY FUEL	SECONDARY FUEL
1. Type (Natural Gas, Oil, Coal, Hogged Fuel, etc.)		
2. Unit of Measure (Gallons, Cubic Feet, Tons, etc)		
3. Maximum Consumption Units per Hour		
4. Maximum Consumption Units per Year		
5. Actual Consumption Units per Hour		
6. Actual Consumption Units per Year		
7. BTU per Unit of Measure		
8. Percent Sulfur (if applicable)		
9. Percent Ash (if applicable)		

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XI. AIR POLLUTION CONTROL EQUIPMENT (ATTACH VENDOR'S INFO.)

BAGHOUSE	SCRUBBER	CYCLONE	E.S.P.	ADSORPTION
1. Type _____	1. Type _____	1. Type _____	1. Type _____	1. Type <u>Activated Carbon</u>
2. Efficiency _____	2. Efficiency _____	2. Efficiency _____	2. Efficiency _____	2. Efficiency _____
3. Bag height _____	3. Dimensions _____	3. Dimensions _____	3. Dimensions: Plate spacing, height, length (attach layout) _____	3. Gas Flow Rate (cfm) _____
4. Bag diameter _____	4. Gas Differential Pressure _____	4. Gas Differential Pressure _____	4. Fields _____	4. Bed Media _____
5. Number of bags _____	5. Type of scrubber liquid _____	5. Gas Flow Rate (cfm) _____	5. Configuration _____	5. Adsorption Isotherm (attach graph) _____
6. Filter Area (sq. feet) _____	6. Liquid Flow Rate _____	6. Other _____	6. Gas Velocity (fpm) _____	6. Surface Area (sq. feet) _____
7. Filter Media _____	7. Gas Flow Rate (cfm) _____		7. Gas Flow Rate (cfm) _____	7. Gas Velocity (fpm) _____
8. Gas Flow Rate (cfm) _____	8. Scrubber Packing Material _____		8. Residence Time _____	8. Gas Temperature (deg. F) _____
9. Air- to-Cloth Ratio _____			9. Gas Differential Pressure _____	9. Bed Volume (cubic feet) _____
10. Overall Dimensions _____			10. Precipitation Rate _____	10. Bed Dimensions _____
11. Cleaning Mechanism _____			11. Prim/Sec. Voltage _____	11. Capacity (hours) <u>All</u>
12. Other _____			12. Prim/Sec. Current _____	12. Contaminant _____
13. Other _____			13. Corona Strength _____	13. Regeneration Time _____
14. Other _____			14. Gas Temperature (deg. F) _____	14. Regeneration Type <u>Offsite</u>



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XII. OTHER DATA- SEE SITE ENGINEERING DESIGN REPORT

1. Site Plan and Equipment Layout for the site attached?	X YES ☐ NO
2. MSDS Sheets for Chemicals or Materials related to this proposal attached? NONE NEEDED	☐ YES ☐ NO
3. Vendor's and/or Manufacturer's information attached?	X YES ☐ NO
4. Modeling Information attached?	☐ YES X NO
5. Fugitive Dust Control Plan attached? NONE NEEDED	☐ YES ☐ NO
6. All Enclosures for your Specific Proposal attached?	X YES ☐ NO
7. Name and Title of Person Filling out this Form	
Printed Name _____ Signature _____ Date _____	
8. Name and Title of Responsible Official	
Printed Name _____ Signature _____ Date _____	

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XIII. ADDITIONAL INFORMATION FOR SPECIFIC EQUIPMENT (Attach Vendor's Information)

BOILER	BURNER	ASPHALT PLANT	SAND / GRAVEL	PAINT BOOTH
NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
1. Type and Number _____	1. Type and Number _____	1. Type (Drum, Batch) _____	1. Crusher Type (Prim., Sec., Tertiary) (attach layout) _____	1. Operation Type _____
2. Size (BTU per hour input _____	2. Size (BTU per hour input _____	2. Size (tons per hour) _____	2. Size (tons per hour) _____	2. Application Method _____
3. Size (steam pounds per hour) _____	3. NOx Rating (PPPM@7% Oxygen) _____	3. VOC Emission Points (attach layout) _____	3. Number of Screens _____	3. Filter Bank Area _____
4. Efficiency _____	4. CO Rating (PPM @ 7% Oxygen) _____	4. VOC Controls _____	4. Number of Conveyors _____	4. Filter Exhaust Flow _____
5. NOx Rating (PPM@ 7% Oxygen) _____	_____	5. Aggregate Piles (acres) _____	5. Fog Spray Location (attach layout) _____	5. Coating & Solvent Types & MSDS Sheets (attach details) _____
6. CO Rating (PPM @ 7% Oxygen) _____	_____	6. Off Road Vehicle Use (miles per year) _____	6. Aggregate Piles (acres) _____	6. Gun Cleaning Method _____
_____	_____	7. Power (Line, Genset, etc.) _____	7. Off Road Vehicle Use (miles per year) _____	7. Drying Method _____
_____	_____	8. Number of Vehicles _____	8. Number of Vehicles _____	_____

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LANDFILL	ABRASIVE BLASTING	CONCRETE BATCH	OTHER	OTHER
NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE		
1. Type _____	1. Attach details of booth or hanger to be used _____	1. Size (tons or cubic yards of product)) _____		
2. Capacity (tons) _____	2. Abrasive Materials to be used. Attach MSDS Sheet(s) _____	2. Cement Silo Controls (baghouse, etc.) _____		
3. Year started _____	3. Filter Bank Area _____	3. Charging Station Controls (baghouse, enclosure, etc.) _____		
4. Year closed _____	4. Filter Exhaust Flow _____	4. Conveyor Controls _____		
5. Area of Landfill (attach site plan) _____	5. Approximate Number of Items to be Abrasively Blasted each Calendar Year. _____			

If you need this document in a format for the visually impaired, call the Air Quality Program at 360-407-6800. Persons with hearing loss can call 711 for Washington Relay Service. Persons with a speech disability can call 877-833-6341.