Sanitary Sewer Pump Station Design Manual

CITY OF CAMAS
PUBLIC WORKS DEPARTMENT

SANITARY SEWER
PUMP STATION DESIGN MANUAL

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City of Camas WASHINGTON

SANITARY SEWER DETAIL
PUMP STATION DESIGN MANUAL

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City of Camas Pump Station Design Manual

1.1 Introduction

This design manual is typical for a City of Camas (City) sewage pump station (pump station) installation – both new and retrofits. Each pump station design shall comply with this design manual and the City's standard drawings to the extent possible. The design of each pump station must be specific to the conditions and requirements of the sanitary sewer basin for which the pump station in question is being designed.

1.2 Design Codes & Standards

- National Fire Protection Association (NFPA) 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
- NFPA 70: National Electric Code.
- National Electrical Safety Code (NESC) or ANSI Standard C2.
- Washington State Building Code – International Building Code.
- Washington State Building Code – International Mechanical Code.
- Washington State Building Code – Uniform Plumbing Code.
- Criteria for Sewage Works Design, Department of Ecology, State of Washington, August 2008.
- Camas Muncipal Code.

1.3 General Requirements

1.3.1 Safety

The pump station design must consider the health and safety of the operations and maintenance personnel. Design engineers should consider and mitigate confined space, engulfment, hazardous atmosphere and other risks to peronnel health and safety while working in and around pump stations.

1.3.2 Basin Plan

Submit a basin plan that identifies the proposed development flows and any contributing basin flows. The calculation of flows shall be consistent with the City's current Wastewater Facilities Plan.

1.3.3 Location

Pump stations are required when gravity flow is not possible to deliver sewage to treatment facilities or high points in the sewer system. Therefore, pump stations are typically located at low points in the service area. Location considerations should also include:

- Pumping head, force main length and depth of the gravity influent sewer(s).
- Local and adjacent land use and zoning regulations. Ideally, pump stations should be located away from present or proposed built-up residential areas.
- Location on public right-of-ways versus private easements or site acquisitions by the City.
- Required permits (or variances), such as grading, building, mechanical, etc.
- Availability of required utilities (i.e. water, electricity and natural gas).
- Traffic patterns near the pump station entrance and exit.
- Noise ordinances.
- Space for future expansion.
- Local, state and federal critical areas, regulations, etc.

Final pump station locations require City approval and are located on a separate tract of land dedicated to the City along with the recording of the development plat.

1.3.4 Size

The size and shape of the land area for a pump station is dependent on several factors and include the pump station's size, type and need or desire for ancillary facilities, such as a maintenance building, odor control, pig launching station, surge protection, etc. However, the minimum size of the pump station shall be 50' by 50' as shown on Standard Drawing #1.

1.3.5 Site Accessibility

The layout of the pump station should provide safe and convenient access for operations and maintenance personnel. Maintenance vehicles can include vactor trucks, service trucks and crane trucks. Additional access requirements include:

- The access road shall be paved and the grade shall not exceed 10%.
- Space for vehicle turnaround or allowance for one-way access, minimum 40' x 12'.
- Access for large vehicles and equipment during pump station construction.
- Bollards to protect equipment such as panels, generators, tanks and components that are not drive-over rated.
- Single-wide access gate.

1.3.6 Equipment Servicing

The pump station design shall include the capability to remove and replace major equipment items, including:

- Pumps and motors.
- Electrical panels.
- Piping and valves.
- Odor control system components.
- Surge control components.
- Engine generators.

1.3.7 Site Lighting

Automatic lights should be designed and placed to meet local and state standards. Site lighting shall be easily accessible for manual operation during nighttime repair and maintenance.

1.3.8 Potable Water Supply

Provide a water hydrant (level-style) at every pump station. Cross-connection mitigation is required and shall consist of a reduced pressure backflow preventer with double-check valves and an independent relief located between valves. Cross-connection mitigation shall meet the requirements of the Department of Health.

1.3.9 Stormwater

Design of pump stations shall comply with the following City Code of Ordinances:

- Title 13 – Public Services, Division IV – Stormwater Drainage
    - Chapter 13.88 – Stormwater Drainage Utility.
    - Chapter 13.89 – Stormwater Utility Services Charges.
- Title 14 – Offenses and Miscellaneous Provisions
    - Chapter 14.02 – Stormwater Control.
    - Chapter 14.04 – Illicit Discharges, Dumping and Illicit Connections.

1.3.10 Flood Protection

Design pump stations to remain fully operational during the 100-year flood/wave action.

1.3.11 Fire Protection

Design pump stations to conform with the requirements of NFPA 820. Contact the local fire jurisdiction and City's Operations Center for local requirements and fire flow availability to the pump station, respectively.

1.3.12 Landscaping

The pump station shall be paved, fenced and landscaped in a manner acceptable to the City. Submit landscaping plans designed by a landscape architect licensed in the State of Washington for review and approval. Design the landscaping plan in accordance with governing land use regulations and incorporate the following:

- a landscaping plan that fits the context of the site and also is aligned with the pattern or theme of the neighboring area.
- low maintenance landscaping whenever possible.
- account for factors that will affect plant health and survivability (i.e. sun and wind exposure, soil conditions). The use of native and drought tolerant plants is encouraged.
- Temporary irrigation.

1.3.13 Site Identification

Each pump station location shall be identified with signage containing the City's logo, the name of the pump station, station address, description and phone number for additional information. The sign shall be 18" high x 24" wide. A template with dimensions is provided in Standard Drawing #1A.

1.3.14 Engineering Drawings

Submit two (2) sets of engineering drawings to the City for each pump station design for review and approval. Engineering drawings includes plans, elevations, sections and details. Each drawing should have a title block that contains the following information at a minimum:

- Drawing title.
- Subtitles describing the drawing contents.
- Drawing number.
- Date.
- Revision.
- North arrow (when applicable).
- Engineer of Record's professional seal with date of signature.
- City signature block per City standard details.

After approval, submit four (4) final engineering drawing sets to the City at least five (5) working days prior to holding a preconstruction conference.

The following information is required on the engineering drawings:

1. Title sheet containing the following information:
    - Owner's name, address, telephone, e-mail address, and FAX numbers.
    - Developer (including contact name) and the design engineer.
    - Vicinity map with section, township and range.
    - Legend including symbols and abbreviations.
    - General construction notes.
    - Sheet index.
    - Bench mark(s) based on the North American Datum 1988 (NAVD88). The horizontal datum is NAD83.
2. Construction notes.

3. Horizontal dimensions from right-of-way, centerline of road, easement lines or property lines and other utilities or structures.
4. Adjacent streets, property lines, tax lot numbers and serial numbers.
5. Identified existing and proposed easements with dimensions.
6. Existing survey monumentation within 100 feet of the project limits.
7. Applicable City Standard Details.
8. Site and landscape plans with dimensions and finished grade elevations.
9. Location of critical areas including buffers, watercourses, wells, septic systems, stream and railroad crossings, water mains, gas mains, culverts, telephone, underground power, cable television and other utilities or structures based on best available information and field locates.
10. Existing gravel and hard surface paving including width(s) and distance(s) from existing right-of-way, easement or property line.
11. Contours for the proposed pump station site extending at least 10 feet outside of the site. If site grading is anticipated, provide a final site contour map. Contour interval shall not be greater than two (2) feet in elevation except in steep terrain where contours are not easily distinguished at two (2) foot intervals.
12. Spot elevations and slopes indicating how the proposed pump station site will be drained of storm water runoff.
13. Plan and elevation cross-section of the drywell (if applicable), wet well and valve vault with elevations and dimensions for each component of the system.
14. Elevation view of the electrical panels with components outlined and named and conduit sizes and their intended use. If a permanent standby power generator (motor generator) is required by the City, show wiring, connections and conduits.
15. Profiles of existing and proposed ground surface or road finished grade.
16. Length, pipe-size and material type for onsite force or gravity sanitary sewers.

Produce engineering drawings at a scale that is legible at 50% reduction. If the entire project plans cannot be shown on one (1) sheet, provide a key map noting the sheet that each individual section of the drawings is located. Where multiple sheets are used for drawings, show match lines. Where multiple sheets are used for plans, provide a master utility plan. Sheet size shall be 24" x 36" or 22” x 34”.

1.3.15 Construction Notes

Include the following minimum construction notes on plan drawings:

- Pump station construction will conform to the City adopted specifications.
- Work in the City right-of-way will conform to the requirements of the City encroachment utility permit or City requirements, whichever is more restrictive.
- Contact the NW Utility Notification Center at 1-800-424-5555 at least two (2) working days before but not more than (10) ten working days before the start of construction.
- Hold preconstruction conference prior to the start of construction.
- Backfill of trenches in traveled areas (roads, driveways or parking lots) shall conform to City requirements. Compaction for backfill shall be at 95% of the maximum density for the material.
- Testing shall be in accordance with the City’s requirements.
- Submit record drawings to the City prior to final acceptance.

1.3.16 Record Drawings

Submit record drawings to the City prior to final acceptance. Submit both an electronic (i.e. PDF) and hard copy. Record drawings shall be clearly marked “Record Drawings”, dated and contain the seal of the Engineer of Record. The record drawings become the permanent property of the City. Ensure the record drawings are placed on the approved drawings and include the following:

- Final elevations and measurements of the installed structures and facilities.

- Any changes made to pipe material, slope, length of pipe, finished grade, etc.

1.4 System Hydraulics

System hydraulics provide an optimum balance for the force main characteristics, pump selection and minimum and maximum flows. Force main diameters are small enough to minimize solids deposition yet large enough that the total head permits a good pump selection and minimizes the requirements for surge protection facilities. A cost-benefit analysis is often useful in selecting the best alternative.

The pump station firm capacity is equal to or greater than the peak hourly design flow. This peak design flow is based on projected growth in the service area, future improvements anticipated in the collection system, and any phased improvements planned for the pump station and force main. It also allows for a reasonable amount of wear to pump equipment, particularly in a service area that is at or near build out. The peak design flow is based on a 20-year forecast or greater.

The flow rates shall be determined by the engineer with guidance from the City. In addition to establishing the peak design flow, it is also necessary to review minimum flows and determine how the station will operate under low flow conditions.

Design pump stations to operate under the full range of projected system hydraulic conditions. Evaluate both new and old pipe conditions, along with various combinations of operating pumps and minimum and maximum flows, to determine the highest head and lowest head pumping conditions. Additionally, perform a review of the downstream piping and pump stations. Design the system to prevent a pump from operating for long periods of time beyond the manufacturer's recommended normal operating range. Select conservative head loss coefficients for pipes and valves allowing for installation and equipment variations and normal aging of the pumping system.

1.5 Wet Well Design

Design wet wells to provide acceptable pump intake conditions, adequate volume to prevent excessive pump cycling and sufficient depth for pump control, while minimizing solids deposition.

Recommendations for various pump intake designs can be found in the references included at the end of this standard. At normal operating levels, consider the following design strategies:

- Reduce or eliminate the free fall of sewage into the wet well.
- Minimize pre-rotation of water at the pump intake.
- Provide adequate submergence to minimize surface vortices.
- Locate the pump intakes to minimize the forming of subsurface vortices from the walls or floor.

Note, a pre-rotation chamber can be used to swirl the water in the same direction as the pump rotation in order to reduce flow through the pump at low wet well levels. This provides turndown ability for the pump without requiring a variable speed drive.

The pump station capacity and configuration shall be designed for a maximum of four (4) pump start cycles per hour with a minimum of 9 minutes of volume storage from high level alarm to the lowest inflow invert elevation.

For constant speed pumps, the minimum volume between pump on and off levels can be calculated using the following general formula: $V = tQ/4$, where

- V = minimum volume (gallons).
- t = minimum time between pump starts.
- Q = pump capacity (gallons per minute).

Incorporate the following strategies to minimize solids buildup in wet wells:

1. Construct wet well side slopes of 45 degrees or steeper (60 degrees is preferred).

2. Provide pump-mounted mixing / flush valves or other mixing / flush system such as a recycle pipe to temporarily route pumpage to the bottom of the wet well.
3. Periodically operate the wet well below its normal level, increasing velocities to allow the pumps to remove deposited solids.
4. Design wet wells to incorporate the following:
   - a pre-rotation pumping system; or
   - a self-cleaning pit using the Ogee ramp.

Wet well design should incorporate the latest standards from NFPA 820, the NEC and L&I confined space regulations (Chapter 296-62 WAC, Part M). Install gas (H_2S) monitor in wet well.

1.6 Pumps

Provide submersible, centrifugal pumps with a non-clog, self-cleaning impeller design for each pump station. The selected pumps shall pass solids at least 3" in diameter. Size pumps to handle the peak design flow with one pump out of service. Avoid excessively short periods between pump starts. On constant speed pump stations, the number of pumps is often based on the pumping capacity required to provide a minimum scour velocity in the force main. Provide explosion-proof pumps unless the control system provides adequate assurance that pump motors in operation are submerged at times. Provide each supplied pump with a rebuild kit and a spare mechanical seal. Final pump selection shall be approved by the City.

Provide lifting eye on each pump. Install pumps on stainless steel guide rails with welded joints for easy removal and replacement without dewatering the wet well or requiring personnel to enter the wet well.

Mount check and isolation valves in a separate valve vault outside the wet well to facilitate access and inspection, minimize corrosion and provide suitable protection against vandalism and the elements.

1.7 Surge Analysis

1.7.1 General

Consider hydraulic surges and transients (i.e. water hammer) during design of pump stations. During design, review pump stations for the possibility of damaging hydraulic transients. Transients can cause vapor cavities, pipe rupture or collapse, joint weakening or separation, deterioration of pipe lining, excessive vibration, noise, deformation, or displacement and otherwise unacceptable pressures for the system.

Possible sources of damaging conditions include closing or opening a valve, pump starts and stops, sudden power loss, rapid changes in demand, closure of an air release valve, pipe rupture and failure of surge protection facilities. Care should be taken in design if the expected change occurs in less than two wave periods, velocities are high (greater than 4 feet per second), the force main is long, the piping system has dead ends, or significant grade changes occur along the force main.

1.7.2 Surge Modeling

Utilize computer modeling to ensure that the pump station is safe from excessive water hammer conditions. Select a computer modeling program that suits the complexity of the project and has proven accuracy when compared to field-test results. The design methodology should include some method of checking the model results before construction. During facility startup, verify modeled results by gradually generating increasingly severe conditions. In this way it can be shown that the system will work as predicted prior to generating the worst-case design conditions.

1.7.3 Surge Protection Facilities

There are many methods to provide surge protection, including the following:

- Open surge tanks.

- Pressurized surge tanks.
- One-way surge tanks.
- Appropriate check valve attachments.
- Pump control valves.
- Surge relief valves.
- Surge anticipator valves.
- Vacuum relief valves.
- Regulated air release valves.
- Optimizing the force main size and alignment.
- Electric soft start/stop and variable speed drives for pumps.
- Electric interlocks to prevent more than one pump from starting at the same time.
- Slow opening and closing valves.
- Increasing the polar moment of inertia of the rotating pump/motor assembly.
- Different pipe material to reduce surge forces.
- Combination air release valves on force mains.

Some of these techniques are not suitable for raw sewage. A combination of methods may be necessary to provide a safe operating system. Take care during design so that adding a protection device does not precipitate a secondary water hammer equal to or worse than the original water hammer. Reliability of the surge protection facilities is critical. Routine inspection and maintenance must be incorporated into the design. Where appropriate, provide redundancy for essential pieces of equipment, such as vacuum relief valves. Provide adequate alarms on surge tanks and similar equipment to give operators early warnings.

1.8 Operations and Maintenance Manual

The primary purpose of the Operations & Maintenance (O&M) manual is to provide operations staff with the necessary instructions, and documentation to properly operate and maintain the pump station. In addition, the manual should include relevant design assumptions and construction documentation to provide to facilitate future troubleshooting, repairs or modifications.

Submit four (4) print copies of the O&M manual, which shall include sequentially-numbered pages with labeled section dividers that are referenced in a table of contents. A digital copy of the manual, in PDF format, must also be provided. The O&M manual structure is shown below:

1. Cover Page:
    - Name of development.
    - Name of pump station (if applicable).
    - Address/location of pump station.
    - Date of startup.
2. Table of Contents.
3. Project Summary Sheets:
    - Pump station name/development Name.
    - Names and contact info for:
        i. Project engineer.
        ii. Project inspector.
        iii. General contractor.
        iv. Subcontractors.
    - List of major equipment (pumps, generator, odor control unit, surge control unit), Noting the make, model, serial number, nameplate data and local representative/supplier contact info.
    - Maintenance summary sheet(s) for major equipment.

- List of any spare parts and tools provided.
- List of expendable parts and recommended spare parts.
- Health and safety considerations and warnings.

4. Warranty information.
5. Basin analysis report.
6. Capacity analysis report.
7. Design assumptions and data for:
    - Served ERUs/population.
    - Expected startup and buildout flows.
    - List of important elevations (e.g. bottom of well, pumping range, well overflow, surface).
    - Pumps.
    - Force main.
    - Standby power.
    - Odor control.
    - Surge control.
    - Telemetry and communications.
8. Pump curve with computed system curve showing design operating point.
9. Station drawings, process & instrumentation diagrams, PLC I/O.
10. Operation manual for pump station controller.
11. Manufacturer O&M manuals for major components, electrical devices and mechanical devices containing the following content:
    - Table of contents.
    - Operations procedures.
    - Installation requirements and procedures.
    - Maintenance requirements and procedures.
    - Troubleshooting procedures.
    - Calibration procedures.
    - Internal schematic and wiring diagrams.
    - Component and I/O module calibration sheets from field quality control calibrations.
12. Manufacturer manuals/cut-sheets for other components.
13. Performance testing procedures and results.
14. Training plan and cocumentation.
15. Maintenance service agreements, if any.

1.9 Reliability

Reliability is achieved by specification of quality components, proper design and planning and redundancy of key equipment items. Design pump stations to eliminate accidental spills of sewage into the environment or backups of sewage into structures. Pump stations shall comply with EPA Class 1 reliability standards, unless otherwise approved by Department of Ecology.

At locations were severe property damage could result from sewage backups caused by a pump station failure, it is recommended that the design include a manhole with a low elevation lid or an overflow pipe in the influent gravity sewer system.

1.9.1 Equipment Redundancy

Design the following pump station components with redundancy to provide capacity for peak design flows:

- Pumps and motors.

- Motor control center (MCC) components.
- Instrumentation and control for pumps and motors.
- Power supply.

Select pumps and motors to provide one (1) redundant unit that matches the largest pump and motor unit in the pump station. It should handle peak design flows with one of the largest units out of service.

Each pump and motor unit should have a separate electrical supply, motor starter, motor sensor and alarm, electrical components, and instrumentation and control components. Each wet well bay should have an instrumentation and control module for operation of the pumps and alarm conditions as designed.

1.9.2 Emergency Power

Power supply to the pump stations includes the primary electrical feed as well as standby power in the form of a permanent diesel-powered generator. Each generator unit shall contain automatic transfer switches to transfer the electrical feed from the primary to the generator unit when a power failure is detected. Final generator selection shall be approved by the City.

Determining the engine generator's size should depend upon the requirements of starting and operating the installed pumps (both duty and standby) at peak possible load, and any ancillary equipment at the pump station that could operate during a power outage. Permanent engine generators should be located inside a building, or in a weather-tight enclosure. Block heaters are recommended to ensure reliable startup in cold weather.

Fuel storage for the engine generators shall be adequate to operate the pump station for a minimum of twenty-four (24) continuous hours with both pumps operating simultaneously. Above ground fuel storage is required to have liquid containment capability equal to the volume in the tank and should be covered to prevent accumulation of precipitation. The fuel fill tube should be equipped to prevent overfilling of the tank. New belowground fuel storage tanks will not be approved in the City. A fuel gauge can be incorporated into the instrumentation system for remote readings of the fuel supply status.

Air permits issued by the Southwest Clean Air Agency (SWCAA) are required for emergency generators. Emergency generators shall comply with the standards and agreements found in SWCAA regulation 400-072 (Small Unit Notification for Selected Source Categories), Section 5.C – Emergency Services Internal Combustion Engines.

1.9.3 Bypass Capability

Design pump stations to eliminate any bypass due to power outage, mechanical failure or unusual flow regime.

1.9.4 Overflow Storage Capability

The wet well and gravity sewer system shall have a minimum of two (2) hours peak flow detention time.

1.10 Electrical Design

Attention should be given during design to classifying the various enclosed spaces such as the wet well and vaults. Ensure adequate ventilation is provided and the use of explosion-proof electrical equipment where necessary. In most cases, electrical equipment in a raw sewage wet well should meet the requirements of the NEC Area Classification as listed in NFPA 820. Personnel entering the wet well are required to meet the requirements of current State Department of Labor and Industry confined space regulations, contained in Chapter 296-62M WAC.

The pump station electrical design shall consider the following:

- Electrical service to the station shall be 3-phase.
- Provide 4-pole (1750 rpm) pump motors whenever possible.

- Provide sufficient separation between pump power cables and instrumentation wiring to minimize electromagnetic (EM) interference.

1.11 Instrumentation & Control

The minimum pump station instrumentation shall include:

- Flow meters.
- Pressure gauges.
- Motor voltage/ampere meters
- Pump run times.

1.11.1 Control Panel

Design of the control panel shall include:

- City approved canopy cover over an all-weather NEMA 4 rated control enclosure.
- Dual pump hour monitors.
- Pump controls.
- Two (2) additional 110 volt outlets.
- Control panel lighting as required.
- Automatic transfer switch cabinet.
- PUD meter and main power switch.

Physically separate control panels from the wet well and meet NEC requirements. Electrical junction boxes should be easily accessible without entering the wet well. To allow efficient change-out of instrumentation, terminate instruments in wet well at pump disconnect panel, and then to control panel via contact strip. Any necessary seal-offs are OUTSIDE of wet well so they can be cut out without wet well entry.

Provide tiered Hand Off Auto (HOA) controls for the pump. Provide HOA control through the HMI, but also provide a physical HOA swtich for each pump that supercedes the HMI. An OFF or HAND selection on the physical switch would register as NOT READY on the HMI.

1.11.2 Level Measurement

Provide continuous wet well level measurement. The City shall approve the final type (e.g. ultrasonic, radar, or pressure transducer, etc.) and manufacturer of the selected level measurement instrument. Addtionally, provide a full Multitrode stick and relays as a backup. Provide consistent documentation of the level setpoints. Include the following monitoring list with each pump station:

- Multitrode high high alarm.
- Analog high high alarm.
- Multitrode lag pump on.
- Multitrode lead pump on.
- Multitrode lag pump off.
- Multitrode lead pump off.
- Multitrode high wet well.
- Analog high wet well.
- Analog lag pump on.
- Analog lead pump on.
- Analog lag pump off.
- Analog lead pump off.
- Low wet well/zero level/analog failure.

1.11.3 Alarms and Telemetry

Equip pump stations with sensors for key operational conditions. Connect alarm signals to recordable telemetry. The telemetry should send alarm signals to a location that is continuously monitored. The telemetry units generally include radio-controlled units.

Alarms at pump stations should include the following:

- High high level.
- High level.
- Low level.
- Power failure.
- Pump failure.
- Excessive run time.
- Surge control system failure (if applicable).
- Odor control system failure (if applicable).
- Engine generator running.
- Engine generator failure.
- Redundant control (i.e. Multitrode high wet well level).

As determined by the City Engineer:

- Fire alarm.
- Pump station intrusion.
- Sump pump alarm.

1.12 Other Design Considerations

1.12.1 Site Piping

- Avoid installing buried pipes directly underneath each other.
- Minimize pipes crossing one another.
- Maintain appropriate minimum and/or maximum velocities in pipes.
- Provide appropriate restraint or thrust blocking for pressure pipe bends, etc.
- Conform to City requirements for meter service, backflow prevention, etc.
- Provide flexible connections where pipes penetrations vaults and other underground structures.
- Normal pump station installations include one (1) inlet line into the wet well.
- Boot penetrations 4” and larger use Kor-N-Seal connectors with wedge and pipe clamps.
- Seal penetrations smaller than 4” using Link Seal model S-316 modular seal.
- Flanged cement lined Class 52 ductile iron pipes and fittings except where specified.

1.12.2 Flow Measurement

Provide suitable devices for measuring pump station flow when required. Consider strategies that use instrumentation, monitoring, control or process-driven concepts to integrate flow measurement into the overall perspective of the pump station design. Flow measurement shall be submersible.

1.12.3 Access Hatches

Provide H-20 rated lockable access hatches for wet wells and valve vaults that contain integral aluminum safety grates. The minimum access hatch size shall be comply with the following:

- Minimum hatch length: the distance between the guide rail bracket and the front of the pump.
- Minimum hatch width: (number of pumps x pump width) + [(number of pumps – 1) x (minimum pump spacing)]

Hatches in excess of 20 pounds or 4 feet in width must have hydraulic assist. Individual hatch doors not to exceed 5 ft x 5 ft. Provide non-slip coating on hatch covers that meet ADA/OSHA requirements for coefficient of friction. Provide double leaf (wet well) and triple leaf (valve vault) safe hatch with angle style frame with stainless steel door springs, cable, race, recessed padlock clip, slamlock skirt, safety grates and safety chains.

1.12.4 Pig Launch Station

Pump stations that discharge into long force mains in which there is high likelihood of grease buildup or where the force main will have low velocities should be equipped with a pig launch station. Pig launch stations typically include three (3) valves for isolation. The force main terminus design shall include a pig receiving station and the ability to remove materials driven out of the force main by the pig.

1.12.5 Grease and Grit

Grease and grit entering a pump station can can buildup in the wet well and result in clogging and flow restriction. Grease tends to accumulate on mechanical and electrical instrumentation and can interfere with the control system. Grease also contributes to odor. Ultimately, the presence of grease and grit increase the pump station's operations and maintenance problems.

Provisions to limit grease and grit from entering the system, such as regulating the allowable fats, oils and grease by sewer ordinances, pretreatment requirements such as filters and grit collection sumps, or other ways to put the burden for grease and grit limits on the originator, should be considered. Adequate access to the wet well for grease and grit removal using mechanical means, such as vactor truck, blasting using high-pressure water to loosen the material, injecting grease control chemicals by pumping, drip, shock or maintenance dosing, or hand-scraping and removal methods should be provided.

1.12.6 Odor Control

When required, pump stations shall include an odor control system approved by the City. Incorporate planning and construction techniques that consider odor-producing conditions and solutions in the pump station design.

The physical layout of the pump station should allow a variety of accessory systems to be applied that meet whatever odor concern is indicated, either before construction, in the planning/design phase, or after starting operation. Consider both the expected waste load, with associated chemical or unusual physical parameters, and the detention time and hydraulic characteristics of pipes and wet well.

Odor problems are typically related to the presence of hydrogen sulfide (i.e. sulfides). Therefore, the alternatives for odor control are usually aimed at preventing sulfide generation or at removing sulfides through chemical or biological action. Regular inspection and cleaning of existing collection systems can reduce sulfide buildup, significantly minimizing odor problems. Sealing manhole lids and their openings can be used as a temporary solution for reducing odor complaints. Minimize drops or falls when appreciable amounts of dissolved sulfide are present, as the turbulence will release sulfide from the stream, generating odors and potentially deteriorating the structure.

Air permits issued by the Southwest Clean Air Agencdy (SWCAA) are required for odor control systems. Odor control systems shall comply with the standards and agreements found in SWCAA regulation 400-040(4), "Odors".

1.12.7 Noise Control

Incorporate planning and construction techniques that consider noise-producing conditions and solutions in the pump station design.

Noise control depends on location, type, and layout of the pump station components, and local conditions, such as zoning, property use, or other ordinances. Noise control systems shall comply with local and state regulations. The regulations usually are set by local government, development covenants or simply a cooperative

understanding between the station owners and adjoining properties. The WISHA standards also speak to noise and safety considerations, specifically Chapter 296-62 WAC of the General Occupational Health Standards.

Submit a report to the City detailing the need for and method of noise control. The most significant sources of noise are emergency generators, ventilation equipment, and, in some cases, motor or pump operations. Of these, the emergency generator is most significant. Emergency generator engines can produce mechanical, intake air, or exhaust stack noise, which may result in racking, pulsating, whining, humming or other noises. A variety of sound insulation schemes are used to reduce the effects of these noises and are rated by the degree of sound reduction they can achieve. Hospital-grade silencing is recommended as the design standard. Consider manufacturers' recommendations and careful study of the rated noise production values assigned to each component of a pump station in implementing a successful noise-reduction strategy.

1.12.8 Corrosion Control

The design of the wet well shall evaluate and compensate for the potential for hydrogen sulfide in the wet well from sewage. If low initial flows, long travel times, or high sewage temperatures could cause significant concentrations of hydrogen sulfide, it is required that the concrete and steel structure in the wet well be protected from corrosion. Provide protection with a coating (Raven 405 or approved equal) and/or ventilation (refer to NFPA 820 for required ventilation rates).

1.12.9 Temperature and Ventilation

The temperature of the electrical and instrumentation enclosures shall remain within the equipment manufacturer's specifications on the hottest day of the year. Provide ventilation to maintain a temperature within the manufacturer's suggested operating range. Ventilation strategy should prevent insects and outdoor contaminants from entering enclosures and the accumulation or condensation of moisture within the enclosure. The life of solid-state-based equipment, such as programmable logic controllers, variable frequency drives, telemetry equipment, and computers, will be increased if a lower maximum design temperature is used.

1.13 Useful References

American National Standard Institute/Hydraulic Institute (ANSI/HI). Centrifugal Pumps-Nomenclature, Definitions, Application and Operation. 1994.

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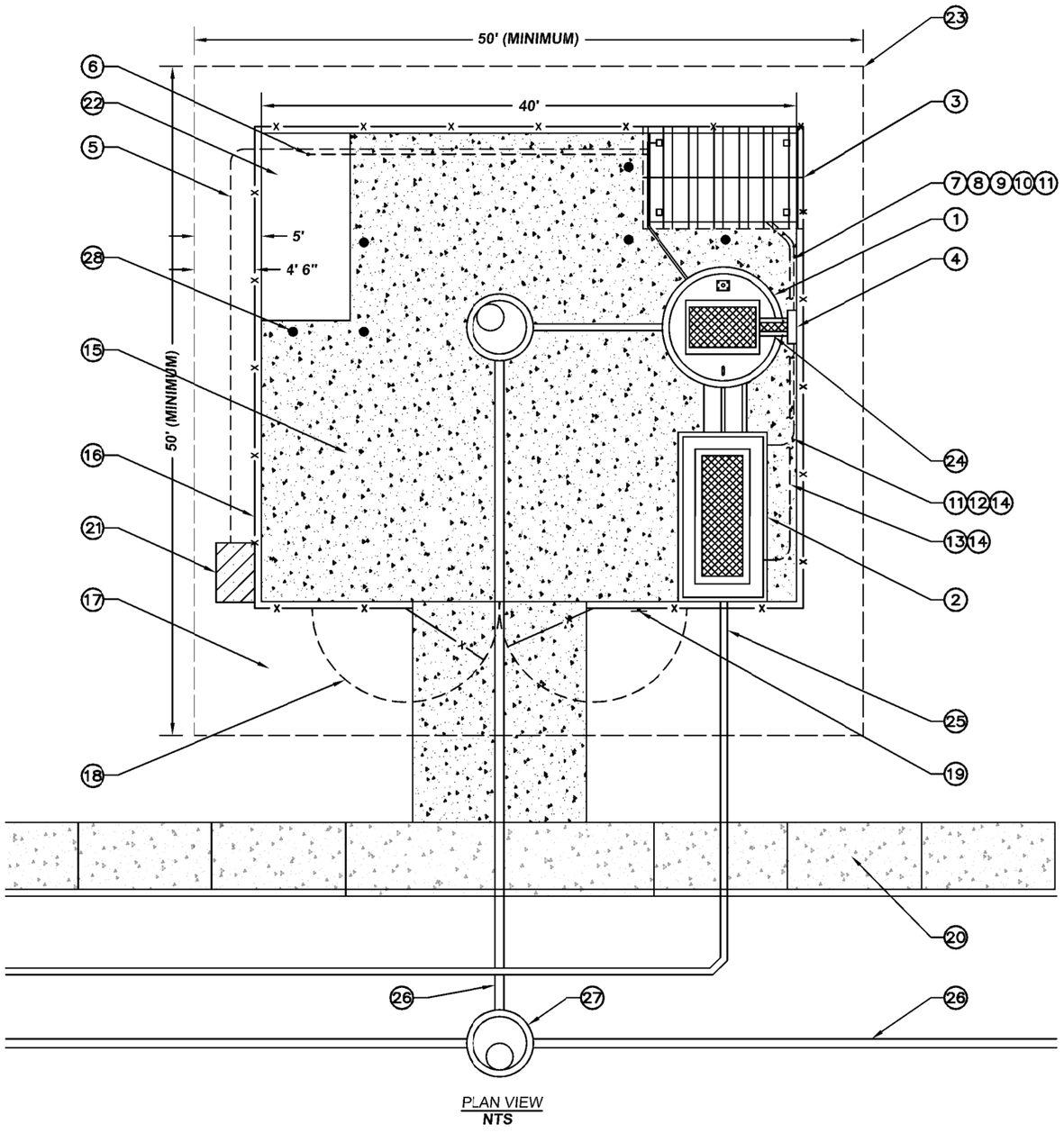

PLAN VIEW
NTS

GENERAL NOTES:

1. PRE-DESIGN LOCATES ARE REQUIRED BEFORE COMMENCING DESIGN WORK. FIELD VERIFICATION OF LOCATION AND ELEVATIONS OF EXISTING FACILITIES IS THE RESPONSIBILITY OF THE DESIGN ENGINEER OR SURVEYOR.
2. WRAP CONDUITS TRANSITIONING FROM PVC UNDERGROUND TO RGS ABOVE GRADE WITH CORROSION RESISTANT TAPE FROM TRANSITION TO A MINIMUM 6" ABOVE GRADE.
3. SEE STANDARD DRAWING #8 FOR EXAMPLE ONE-LINE DIAGRAMS.
4. PROVIDE POSITIVE DRAINAGE AWAY FROM STRUCTURES. PLACE ELASTOMERIC EXPANSION JOINT SEALS PER PROJECT SPECIFICATIONS AROUND THE VALVE VAULT, CONTROL PANEL SHELTER FOUNDATION, WET WELL, AND GENERATOR FOUNDATION. PLACE CONTRACTION JOINTS ALONG GRADE BREAKS AND FLOW LINES. FILL IN FLOW LINES WITH GRAY POURED RUBBER JOINT SEALER PER PROJECT SPECIFICATIONS. SUBMIT SITE SPECIFIC GRADING PLAN NOTING JOINT LOCATIONS FOR APPROVAL BY THE CITY ENGINEER.
5. SEE STANDARD DRAWING #1A FOR TYPICAL AND COMBINED CONDUIT TRENCH DETAILS.
6. LOCATE MAIN CIRCUIT BREAKER AND UTILITY POWER METER OUTSIDE FENCE. PUBLIC UTILITY COMPANY SHALL SECURE CIRCUIT BREAKER.
7. PROVIDE SPACE FOR FLOW METER VAULT, ODOR CONTROL SYSTEM, SURGE PROTECTION AND PIGGING STATION WITHIN FENCE BOUNDARIES WHEN DESIGN REQUIRES.
8. PROVIDE YARD HYDRANT WITH POTABLE WATER SUPPLY.

KEYED NOTES:

1. SEE STANDARD DRAWING #2 FOR WET WELL.
2. SEE STANDARD DRAWING #4 FOR VALVE VAULT.
3. SEE STANDARD DRAWING #5 FOR CONTROL PANEL SHELTER.
4. SEE STANDARD DRAWING #7 FOR PUMP DISCONNECT PANEL.
5. ONE (1), 2" SERVICE CONDUIT FROM TRANSFORMER TO METERBASE. VERIFY TRENCH DEPTH AND COVERING FOR INCOMING SERVICE CONDUIT WITH PUBLIC UTILITY.
6. ONE (1), 2" POWER CONDUIT, (1) 1" CONTROL CONDUIT FROM AUTOMATIC TRANSFER SWITCH TO GENERATOR. VERIFY STUB-UP LOCATIONS WITH GENERATOR MANUFACTURER.
7. TWO (2), 1" PUMP POWER CONDUITS FROM CONTROL PANEL TO DISCONNECT PANEL.
8. ONE (1), 1" [120V] CONTROL CONDUIT FROM CONTROL PANEL TO DISCONNECT PANEL.
9. ONE (1), 1" [DC] CONTROL CONDUIT FROM CONTROL PANEL TO DISCONNECT PANEL.
10. ONE (1), 1" LEVEL TRANSDUCER CONDUIT FROM CONTROL PANEL TO DISCONNECT PANEL.
11. PROVIDE CONTINUOUS SECTION OF RGS CONDUIT FROM TRANSITION UNDERGROUND TO DISCONNECT PANEL REFERENCE NEC ARTICLE 501.15 (B2) EXCEPTION NO 1.
12. ONE (1), 1" CONTROL CONDUIT FROM VALVE VAULT TO DISCONNECT PANEL.
13. TWO (2), 1" FLOWMETER CONDUITS FROM VALVE VAULT TO CONTROL PANEL.
14. PROVIDE CONTNUOUS RGS CONDUITS ENTERING VALVE VAULT FROM OUTSIDE VAULT TO A SEAL-OFF LOCATED INSIDE VAULT. WRAP RGS CONDUIT WITH CORROSION RESISTANT TAPE FROM PVC TRANSITION TO SEAL-OFF CONNECTION INSIDE VAULT. REFERENCE NEC ARTICLE 501.15 (B). ROUTE RGS ALONG PIPING AND USE NM FLEXIBLE CONDUIT FOR FINAL CONNECTIONS TO EQUIPMENT.
15. HOT MIX ASPHALT. SEE STANDARD DRAWING #1A FOR TYPICAL SECTION.
16. 6' BLACK TYPE 3 CHAIN LINK FENCE WSDOT STANDARD PLAN L-20,10-00.
17. LANDSCAPE BUFFER. SEE STANDARD DRAWING #9.
18. 14' DOUBLE GATE W/ SECURITY TOP. SEE WSDOT STANDARD PLAN L-30.10-00.
19. MOUNT SIGN ON FENCE. SEE STANDARD DRAWING #1A.
20. TYPE A CEMENT CONCRETE DRIVEWAY APPROACH PER WSDOT STANDARD PLAN F-80 10-02.
21. TRANSFORMER LOCATION.
22. GENERATOR LOCATION. SUBMIT GENERATOR DESIGN FOR APPROVAL.
23. PUMP STATION TRACT
24. CABLE TRENCH FROM PUMP DISCONNECT PANEL TO WET WELL.
25. SANITARY SEWER FORCE MAIN.
26. SANITARY SEWER GRAVITY MAIN.
27. SANITARY SEWER MANHOLE.
28. REMOVABLE BOLLARDS (TYP.). SEE STANDARD DRAWING #10.

TYPICAL CONDUIT SIZING TABLE

ITEM	CONDUIT	FROM	TO	NOTES
1	1"	CONTROL PANEL	PUMP DISCONNECT PANEL	PUMP #1
2	1"	CONTROL PANEL	PUMP DISCONNECT PANEL	PUMP #2
3	1"	CONTROL PANEL	PUMP DISCONNECT PANEL	HI ALARM LEVELS / SEAL FAIL / TEMPS / CVLS
4	1"	CONTROL PANEL	PUMP DISCONNECT PANEL	LEVEL MFR CABLE
5	1"	CONTROL PANEL	PUMP DISCONNECT PANEL	DISCHARGE PRESSURE
6	1"	CONTROL PANEL	CHEMICAL FEED	FUTURE CHEMICAL FEED LEVEL
7	1"	CONTROL PANEL	CHEMICAL FEED	FUTURE CHEMICAL FEED POWER
8	3/4"	CONTROL PANEL	LIGHT SWITCH	COVER LIGHT SWITCH
9	1"	CONTROL PANEL	VALVE VAULT	FLOWMETER MFR SIGNAL CABLE
10	1"	CONTROL PANEL	VALVE VAULT	FLOWMETER MFR ELECTRODE CABLE
11	1"	AUTO TRANSFER SWITCH	GENERATOR	START/STOP CONTROL / BATTERY VOLT SIGNAL
12	2"	GENERATOR	AUTO TRANSFER SWITCH	POWER FEED / BATTERY CHGR / BLOCK HTR
13	2"	METER BASE	TRANSFORMER	SERVICE FEED
14	2"	ODOR CONTROL	LOCAL PANEL / CONTROL PANEL	ODOR CONNECTION

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TYPICAL PUMP STATION SITE PLAN

STANDARD DRAWING

1

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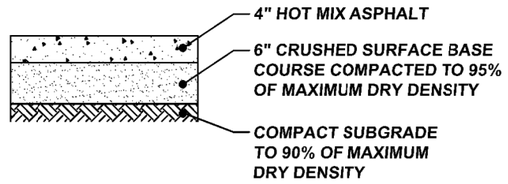
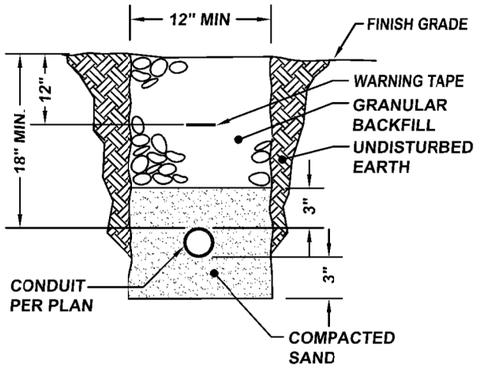


TYPICAL HOT MIX ASPHALT SECTION
NTS



TYPICAL CONDUIT TRENCH
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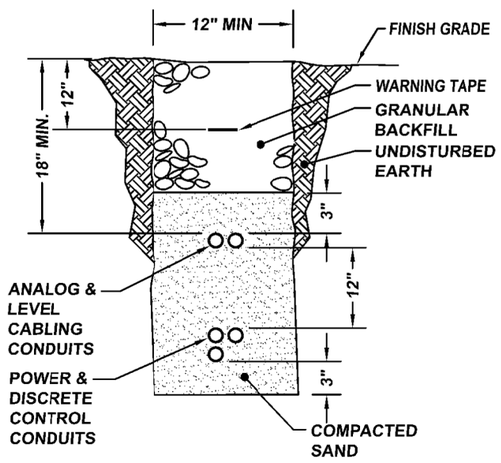

COMBINED CONDUIT TRENCH
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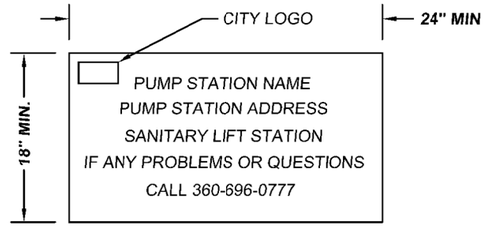

PUMP STATION SIGN
NTS

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PUMP STATION SITE PLAN - DETAILS

STANDARD DRAWING

1A

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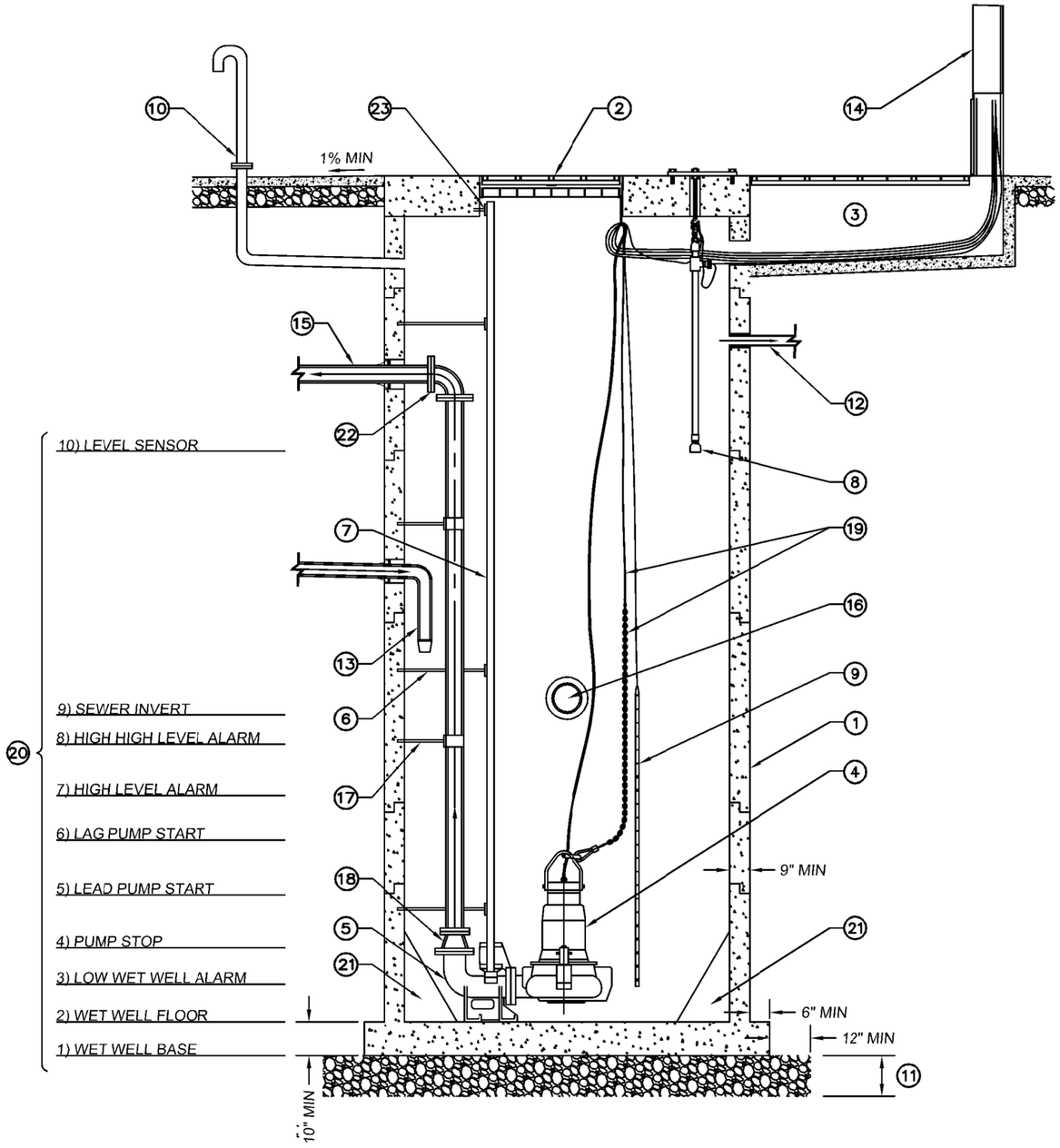


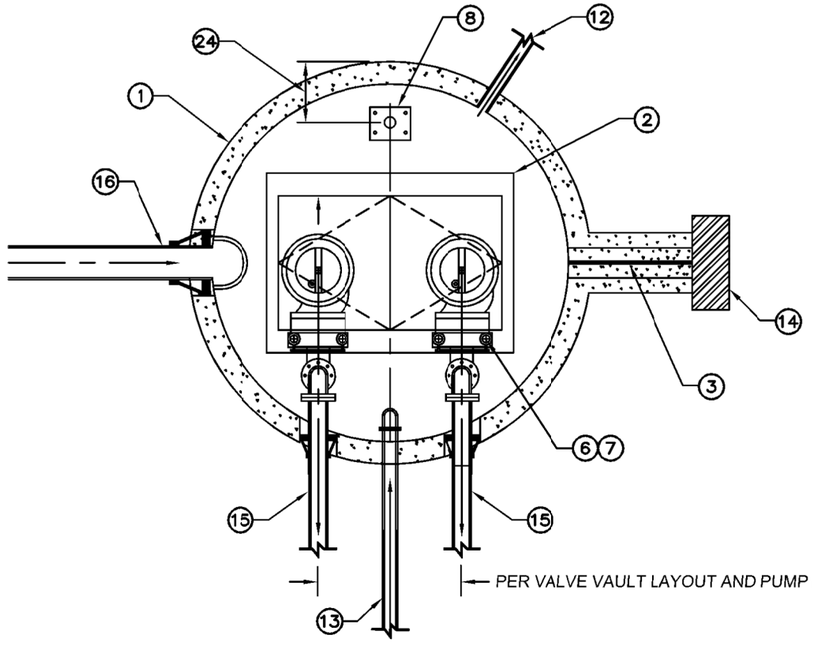
WET WELL SECTION VIEW
NTS

GENERAL NOTES:

1. PROVIDE 316 STAINLESS STEEL WET WELL HARDWARE.
2. SEE SECTION 1.12.1 OF DESIGN MANUAL FOR CORE SEALING REQUIREMENTS.
3. COORDINATE WET WELL CORING WITH REFERENCE TABLE ON STANDARD DRAWING #4A.

KEYED NOTES:

1. REINFORCED CONCRETE WET WELL.
2. COORDINATE HATCH CLEAR OPENING DIMENSIONS AND PLACEMENT WITH PUMP LAYOUT.
3. CABLE TRENCH FOR POWER AND CONTROL CABLES. PROVIDE REMOVABLE COVER FOR ACCESSING CABLES. DESIGN COVER TO MINIMIZE INFILTRATION OF WATER, LEAVES AND OTHER DEBRIS. PROVIDE METAL (ALUMINUM) TO SEPARATE POWER AND CONTROL CABLES IN TRENCH TO MINIMIZE ELECTROMAGNETIC INTERFERENCE. ROUTE SIGNAL AND CONTROL CABLES TO INTRINSICALLY SAFE SIDE OF PUMP DISCONNECT PANEL.
4. SUBMERSIBLE PUMPS.
5. QUICK DISCONNECT PUMP DISCHARGE ELBOW BY PUMP MANUFACTURER..
6. GUIDE RAIL BRACKETS BY PUMP MANUFACTURER.
7. GUIDE RAILS BY PUMP MANUFACTURERS RECOMMENDATION. TWO (2) GUIDE RAILS PER PUMP.
8. ULTRASONIC / RADAR LEVEL TRANSDUCER.
9. MULTI-POINT LEVEL PROBE.
10. MAKEUP AIR VENT WITH GOOSENECK, BUG SCREEN AND FRP BUTTERFLY DAMPER FOR ODOR CONTROL SYSTEM.
11. MINIMUM 12" OF CRUSHED SURFACING BASE COURSE COMPACTED TO 95% DENSITY.
12. PVC CONDUIT FOR ODOR CONTROL.
13. 3" DRAIN PIPE FROM VALVE VAULT FLOOR DRAIN. SLOPE AT 2% MINIMUM GRADE AND TERMINATE W/ SLIP-ON STYLE DUCKBILL CHECK VALVE.
14. SEE STANDARD DRAWING #7 FOR DISCONNECT PANEL.
15. MINIMUM 4" DIAMETER DISCHARGE LINES TO VALVE VAULT.
16. SANITARY SEWER LINE INTO WET WELL WITH DROP BOWL ASSEMBLY.
17. DISCHARGE PIPE SUPPORT BRACKETS (TYP.).
18. FLANGE REDUCER.
19. STAINLESS STEEL CABLE W/ 3' SLACK ATTACHED TO 6' LENGTH OF CHAIN.
20. ELEVATIONS ON AS-BUILT DRAWINGS.
21. WET WELL BASIN SIDE SLOPES (MINIMUM 45 DEGREE SLOPE).
22. FLANGED JOINTS IN WET WELL (TYP.).
23. MOUNT TOP BRACKET FOR PUMP GUIDE RAILS TO FACE OF VALVE VAULT OPENING.
24. DIMENSIONS FOR LEVEL TRANSDUCER BASED ON DEPTH OF WET WELL, BOTTOM OF TRANSDUCER AND OBSTRUCTIONS IN WET WELL.



WET WELL PLAN VIEW
NTS

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WET WELL

STANDARD DRAWING

2

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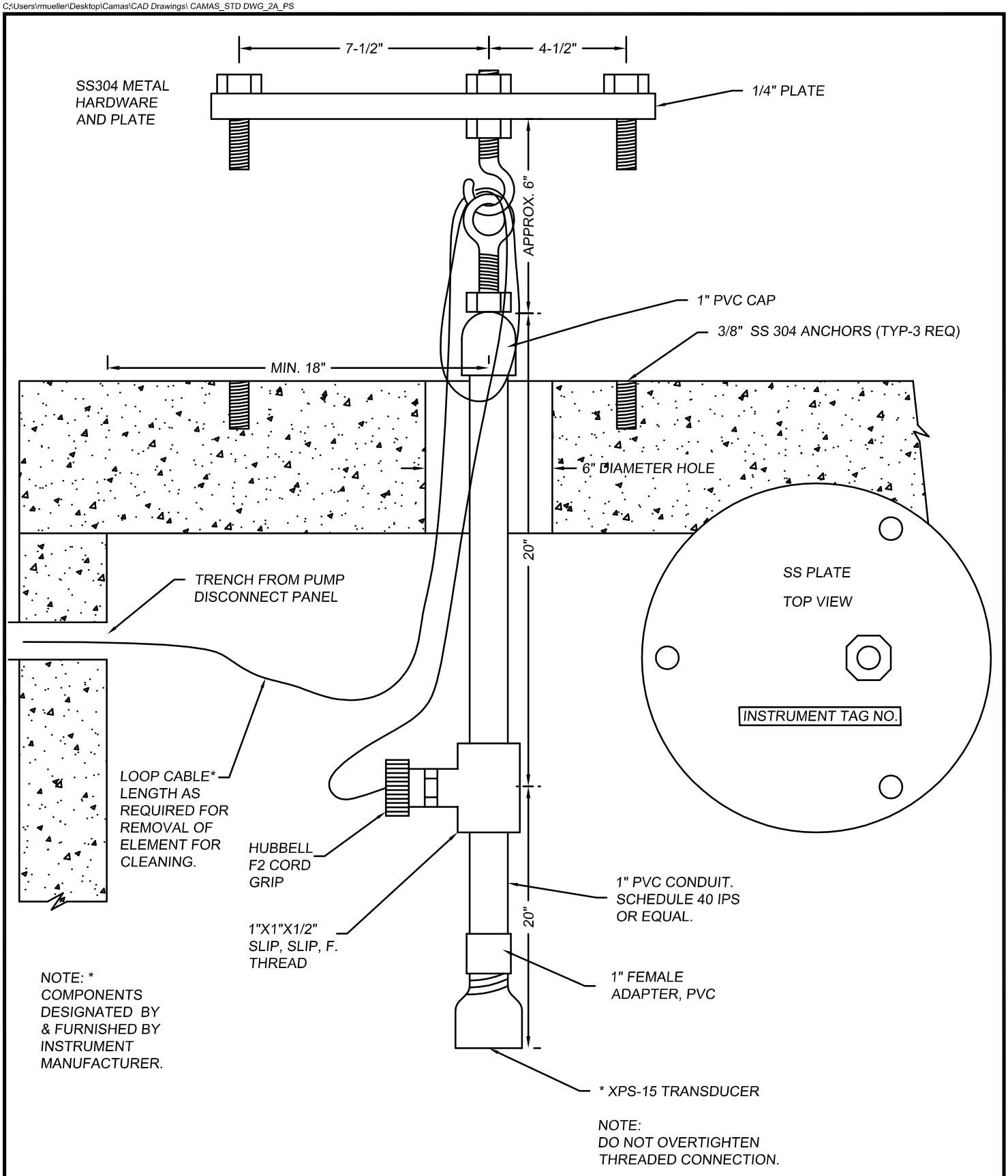

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ULTRASONIC TRANSDUCER

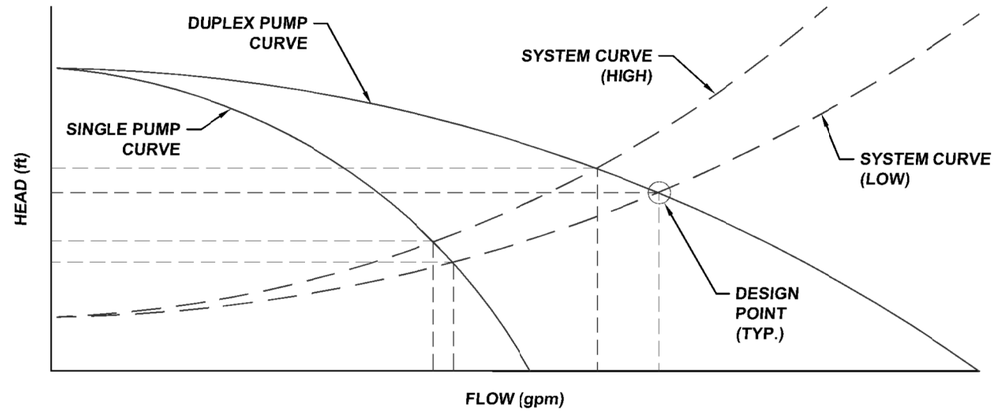
STANDARD DRAWING

2A

DESIGN DATA SUMMARY TABLE

ITEM DESCRIPTION	DESIGN INFORMATION
PUMP STATION TYPE	DUPLEX SUBMERSIBLE
PUMP TYPE	FLYGT NP 3102
DESIGN FLOW	500 GPM
DESIGN HEAD	50 FT
PUMP HP	15 HP
ELECTRICAL SERVICE TYPE	480V, 100 AMP
LEVEL CONTROL TYPE	ULTRASONIC TRANSDUCER
OVERFLOW POINT ELEVATION	100 FT
OVERFLOW DISCHARGE	WETWELL RIM
AVE. TIME TO OVERFLOW	90 MIN
AUXILIARY POWER TYPE	GENERATOR
TRANSFER SWITCH	AUTOMATIC
ALARM TELEMETRY TYPE	RADIO SCADA
EPA RELIABILITY	CLASS I
FORCE MAIN LENGTH / DIAMETER	1200 LF / 8" PVC
FORCE MAIN PROFILE	CONTINUOUSLY ASCENDING
DISCHARGE MANHOLE / LOCATION	MH #27 / 1725 NE STREET NAME
AIR RELEASE VALVES	NONE
AVE. DETENTION TIME, EXISTING FLOWS	200 MIN
SULFIDE CONTROL SYSTEM	CHEMICAL INJECTION IN WETWELL

NOTE: EXAMPLE INFORMATION PROVIDED. PROJECT SPECIFIC INFORMATION TO BE INCLUDED BY DESIGN ENGINEER AND SHOWN ON APPROVED DRAWING.



TYPICAL PUMP CURVE

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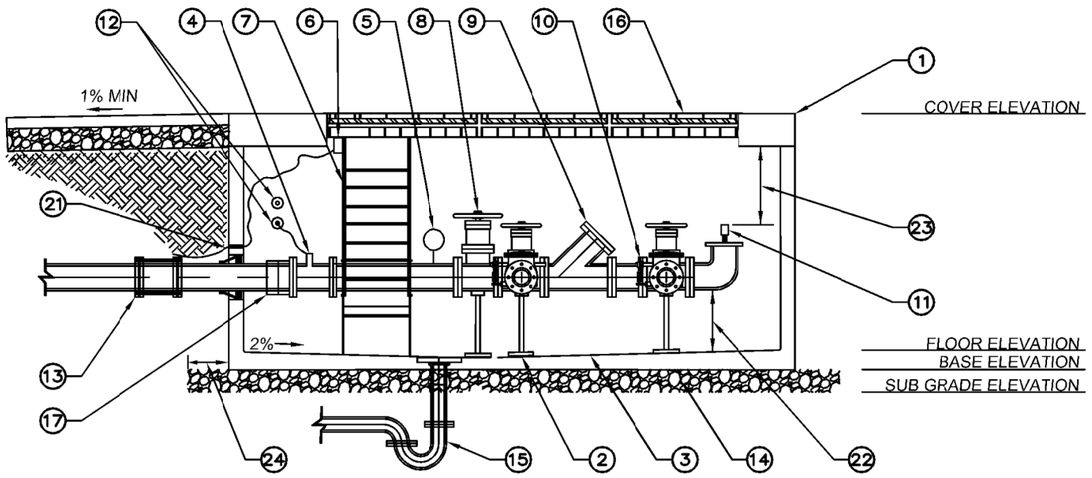
TYPICAL PUMP STATION DESIGN CRITERIA

STANDARD DRAWING

3



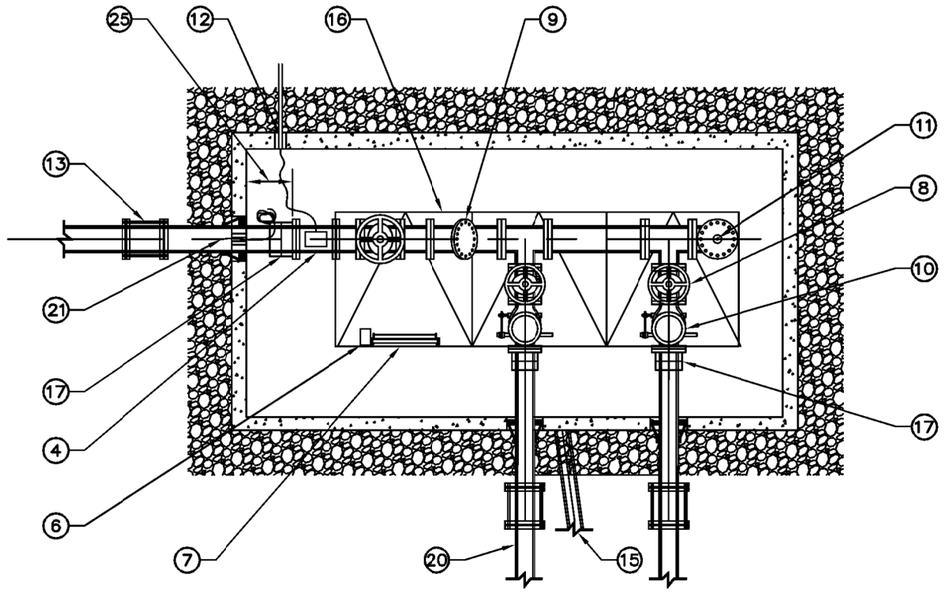
VALVE VAULT ELEVATION VIEW SIDE INLET
NTS

GENERAL NOTES:

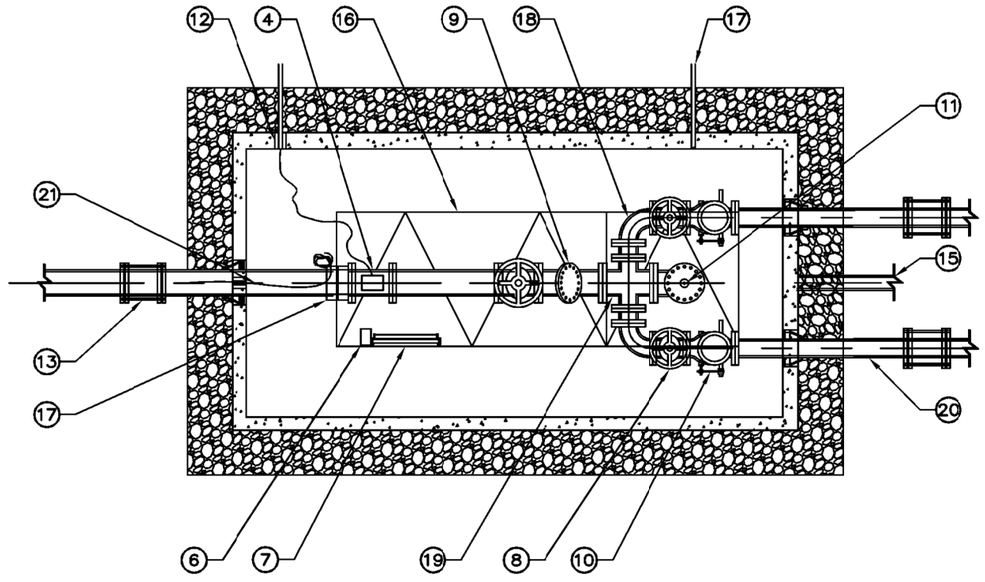
1. PROVIDE 316 STAINLESS STEEL HARDWARE.
2. FLANGE CEMENT LINED CLASS 52 DUCTILE IRON PIPES & FITTINGS EXCEPT WHERE SPECIFIED.
3. SEE STANDARD DRAWING #4A FOR CORE DRILL PENETRATIONS. SEE SECTION 1.12.1 OF DESIGN MANUAL FOR CORE SEALING REQUIREMENTS.
3. COORDINATE WET WELL CORING WITH REFERENCE TABLE ON STANDARD DRAWING #4A.
4. GENERIC PIPE SIZING SHOWN. ACTUAL PIPE SIZE TO BE SPECIFIED ON PLAN.
5. PROVIDE RECOMMENDED UPSTREAM AND DOWNSTREAM STRAIGHT PIPE LENGTHS PER FLOW METER MANUFACTURERS RECOMMENDATION.
6. PROVIDE PRESSURE ELEMENT/TRANSMITTER ON DISCHARGE LINE. WIRE BACK TO CONTROL PANEL.

KEYED NOTES:

1. PRE-CAST VALVE VAULT.
2. ADJUSTABLE VALVE AND PIPE SUPPORTS (TYP.).
3. SLOPE VALVE VAULT FLOOR MINIMUM 2% TO 3" BRASS FLOOR DRAIN.
4. SUBMERSIBLE MAGNETIC FLOW METER.
5. PRESSURE GAUGE WITH ISOLATION VALVE AND NIPPLE.
6. FLANGE FINK (FIVE LEAD) LOCATOR STATION. ATTACH FLANGE FINK TO THE TOP OF LADDER OUTSIDE OF RUNGS.
7. GALVANIZED STEEL PERSONAL LADDER WITH ALUMINUM EXTENSION.
8. ECCENTRIC FULL BORE PLUG VALVE WITH VALVE STAND (3 REQ'D).
9. WYE WITH BLIND FLANGE PROVIDED FOR PIG INSTALLATION PORT AND BYPASS CONNECTION.
10. FLANGED EXTERNAL ARM SWING CHECK VALVE (2 REQ'D).
11. TAP AND THREAD BLIND FLANGE ON 90 DEGREE BEND WITH NIPPLE & QUICK CONNECT CAM LOCK HOSE CONNECTION.
12. 1" CONDUITS TO CONTROL PANEL.
13. RESTRAINED MECHANICAL JOINT (3 REQ'D).
14. 6" MINIMUM COMPACTED DEPTH CRUSHED SURFACING BASE COURSE @ 95% OF MAX DENSITY.
15. 3" DRAIN TO WET WELL WITH P-TRAP.
16. LOCKING COVER WITH SAFETY GRATE OR APPROVED EQUAL.
17. FLANGE ADAPTOR.
18. FLANGED LONG SWEEP 90 DEGREE BENDS (2 REQ'D).
19. FLANGED 4-WAY CROSS WITH PIPE SUPPORT.
20. MINIMUM 4" DISCHARGE PIPE FROM WET WELL (2 REQ'D).
21. 12GA FORCE MAIN TRACER WIRE (6' COIL MINIMUM). BRING TRACER WIRE INTO VAULT THROUGH $\frac{1}{2}$" CONDUIT SLEEVE. SEAL WIRE W/ 2-PART EPOXY.
22. TWO TIMES PIPE DIAMETER (MINIMUM 12" CLEARANCE).
23. MINIMUM 3' VERTICAL CLEARANCE.
24. MINIMUM 12" CLEARANCE.



VALVE VAULT PLAN VIEW SIDE INLET
NTS



VALVE VAULT LAYOUT PLAN VIEW END INLET - ALTERNATE
NTS

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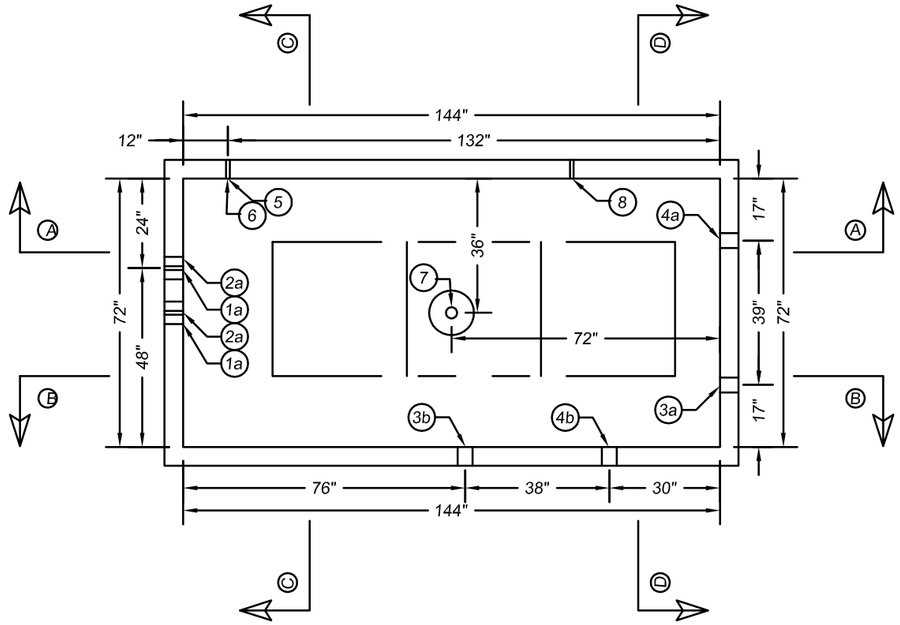
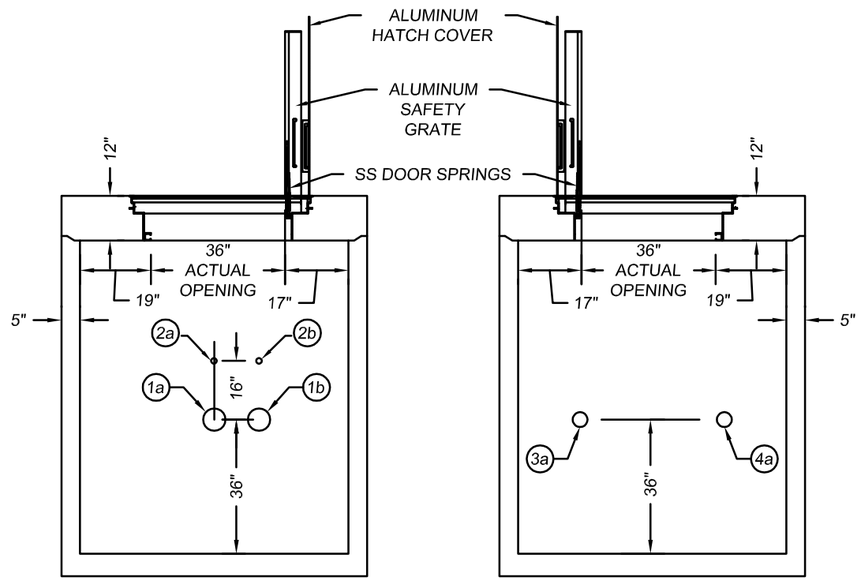
VALVE VAULT

STANDARD DRAWING

4

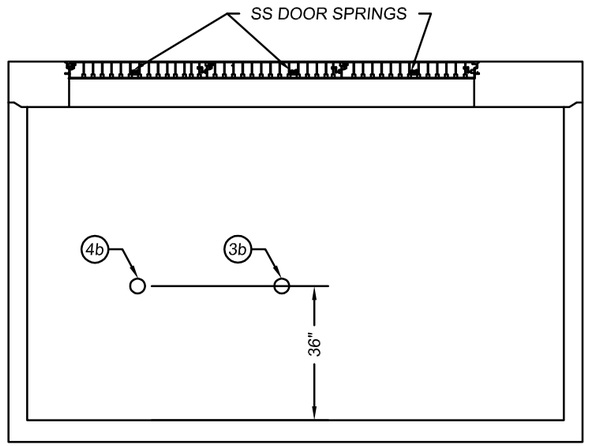


VALVE VAULT CORING PLAN VIEW
NTS

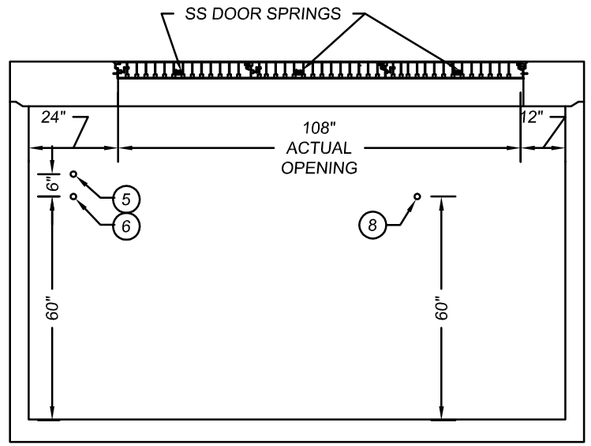


CROSS SECTION C-C
NTS

CROSS SECTION D-D
NTS



CROSS SECTION B-B
NTS



CROSS SECTION A-A
NTS

CORE REFERENCE TABLE

1. CORE FOR BOOTED 6" DIP - TO FM
2. CAST IN PLACE 1" CONDUIT SLEEVE
3. CORE FOR BOOTED 4" DIP - FROM WET WELL
4. CORE FOR BOOTED 4" DIP - FROM WET WELL
5. CORE FOR LINK SEALED 1" CONDUIT TO PANEL
6. CORE FOR LINK SEALED 1" CONDUIT TO PANEL
7. CORE FOR BOOTED 3" DIP TO WET WELL
8. CORE FOR LINK SEALED 1" CONDUIT TO PANEL

NOTE:
a - END INLET VAULT LAYOUT (PREFERRED)
b - SIDE INLET VAULT LAYOUT

** DIMENSIONS MAY VARY ON ACTUAL DESIGN. LAYOUT AND DIMENSIONS SHOWN ARE FOR GUIDANCE PURPOSES ONLY AND MAY VARY BY PUMP STATION.

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VALVE VAULT CORING PLAN

STANDARD DRAWING

4A

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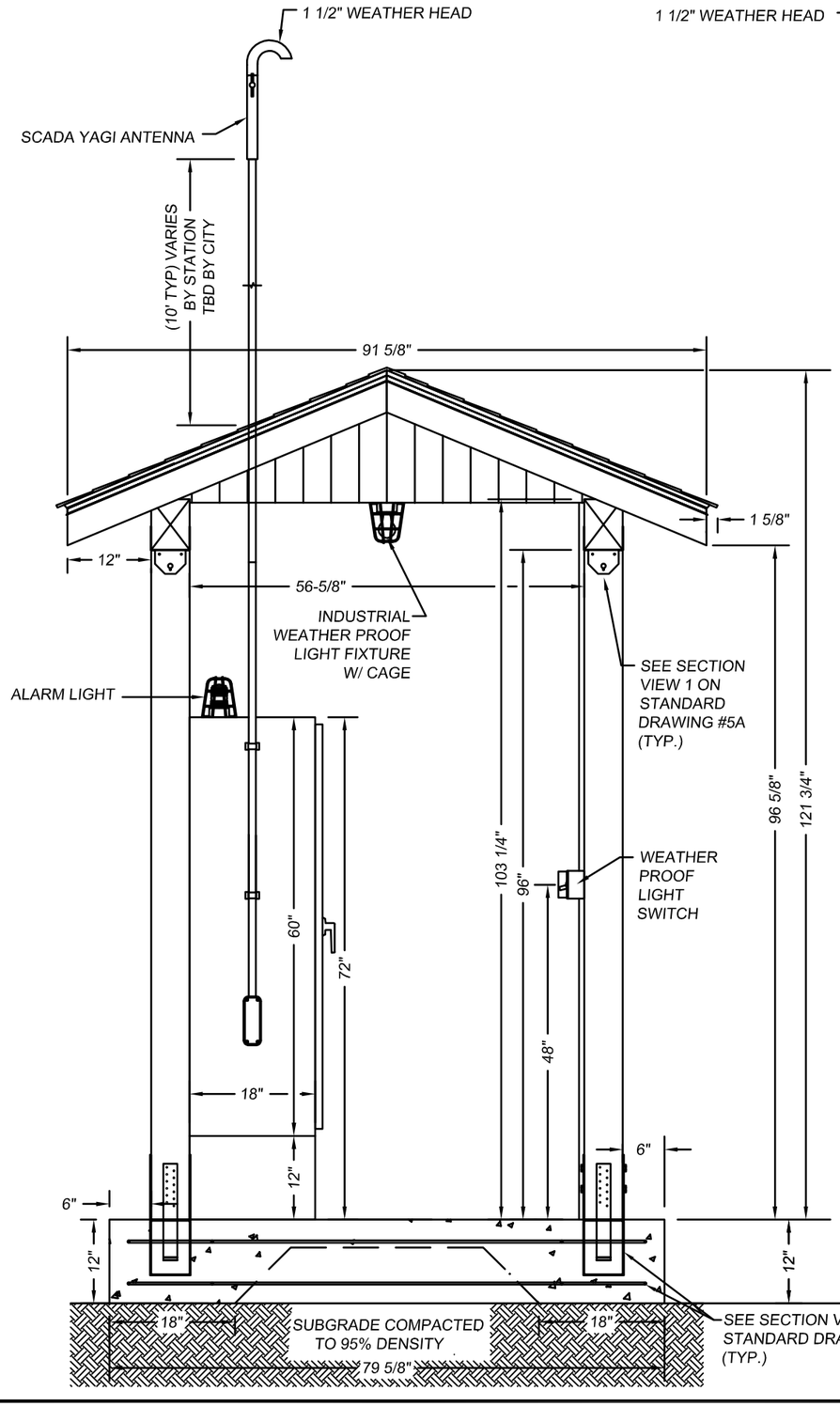

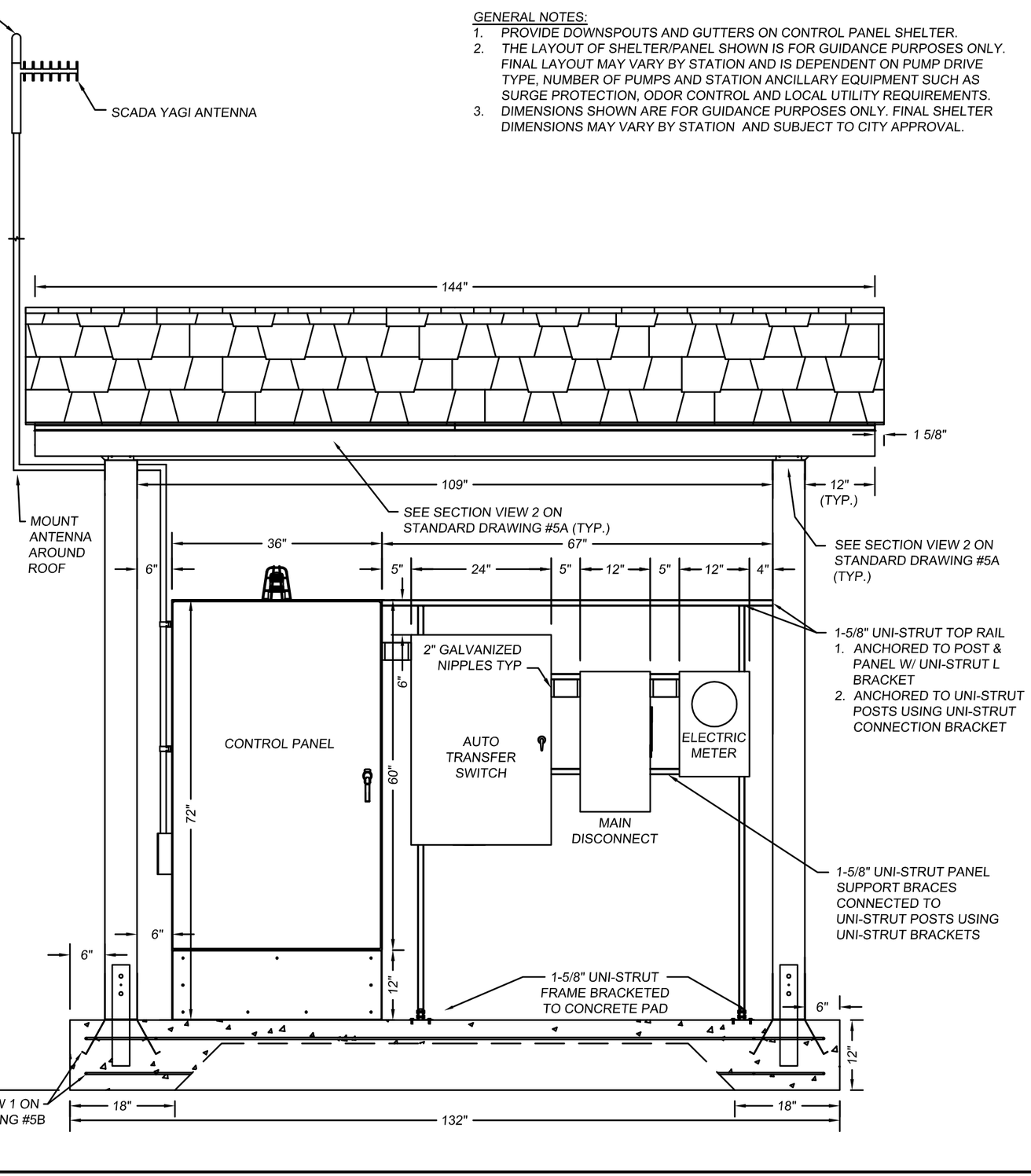

GENERAL NOTES:

1. PROVIDE DOWNSPOUTS AND GUTTERS ON CONTROL PANEL SHELTER.
2. THE LAYOUT OF SHELTER/PANEL SHOWN IS FOR GUIDANCE PURPOSES ONLY. FINAL LAYOUT MAY VARY BY STATION AND IS DEPENDENT ON PUMP DRIVE TYPE, NUMBER OF PUMPS AND STATION ANCILLARY EQUIPMENT SUCH AS SURGE PROTECTION, ODOR CONTROL AND LOCAL UTILITY REQUIREMENTS.
3. DIMENSIONS SHOWN ARE FOR GUIDANCE PURPOSES ONLY. FINAL SHELTER DIMENSIONS MAY VARY BY STATION AND SUBJECT TO CITY APPROVAL.

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CONTROL PANEL SHELTER / PANEL LAYOUT

STANDARD DRAWING

5

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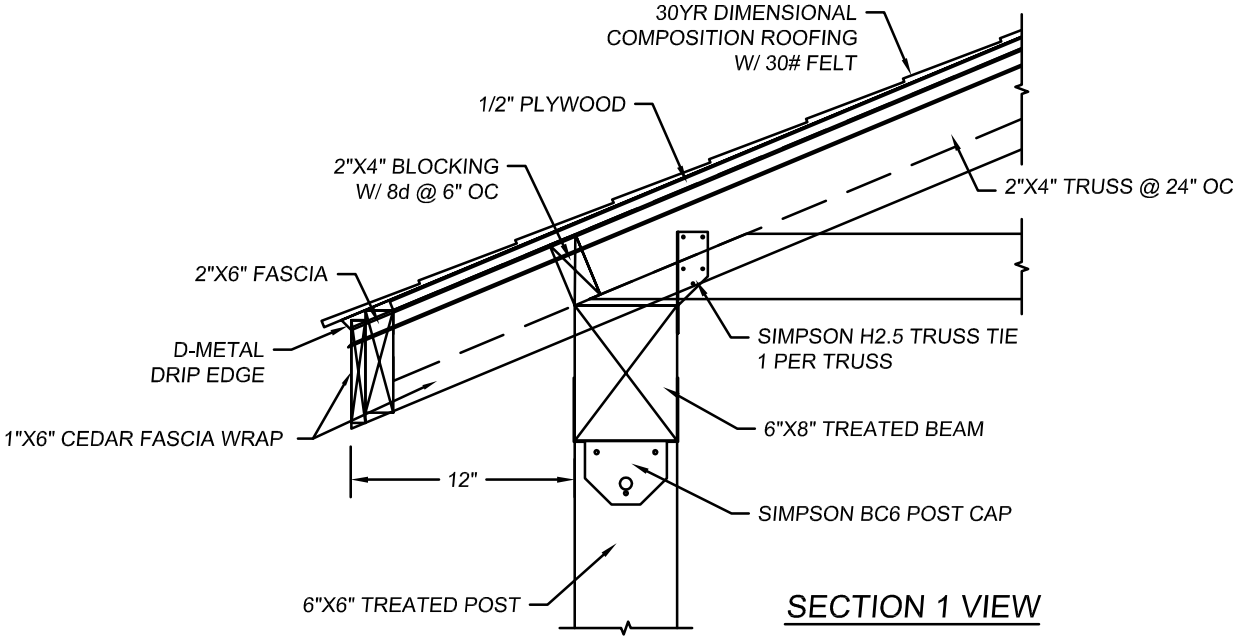
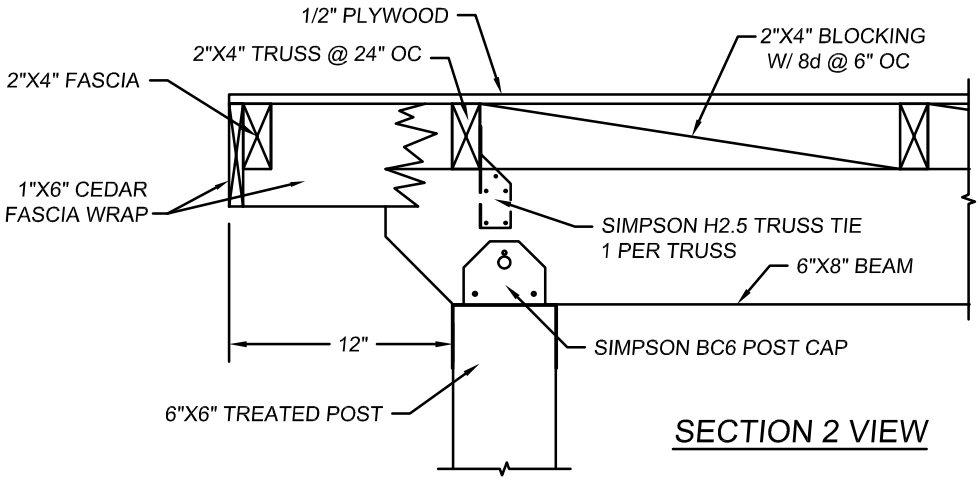
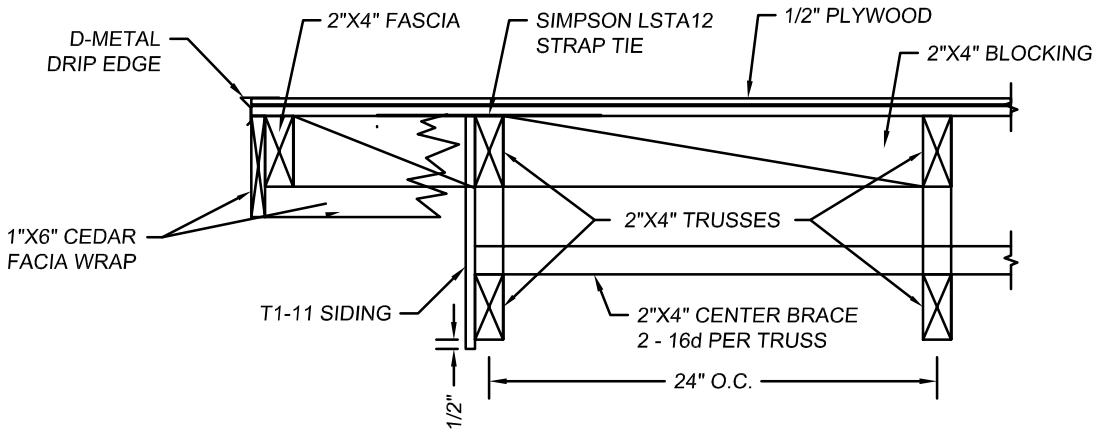


SECTION 1 VIEW



SECTION 2 VIEW



SECTION 3 VIEW

City of Camas WASHINGTON
616 NE 4TH AVENUE
CAMAS, WA 98607
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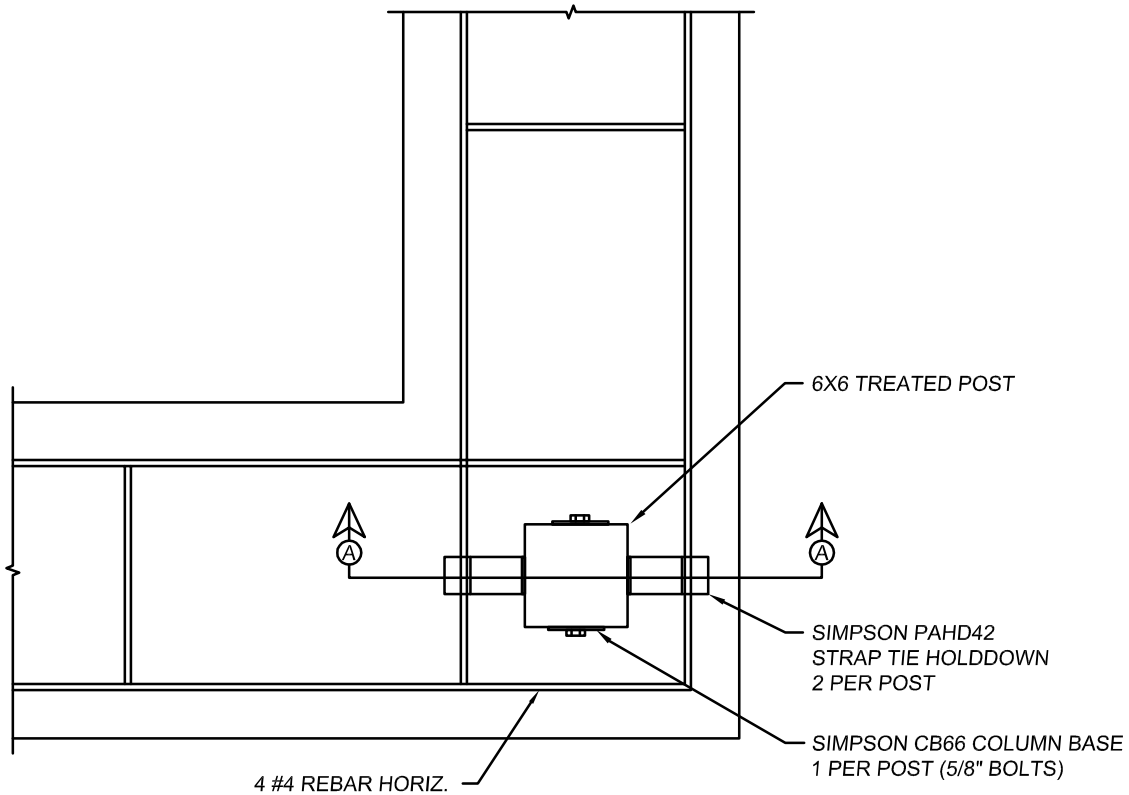
CONTROL PANEL COVER CROSS SECTIONS

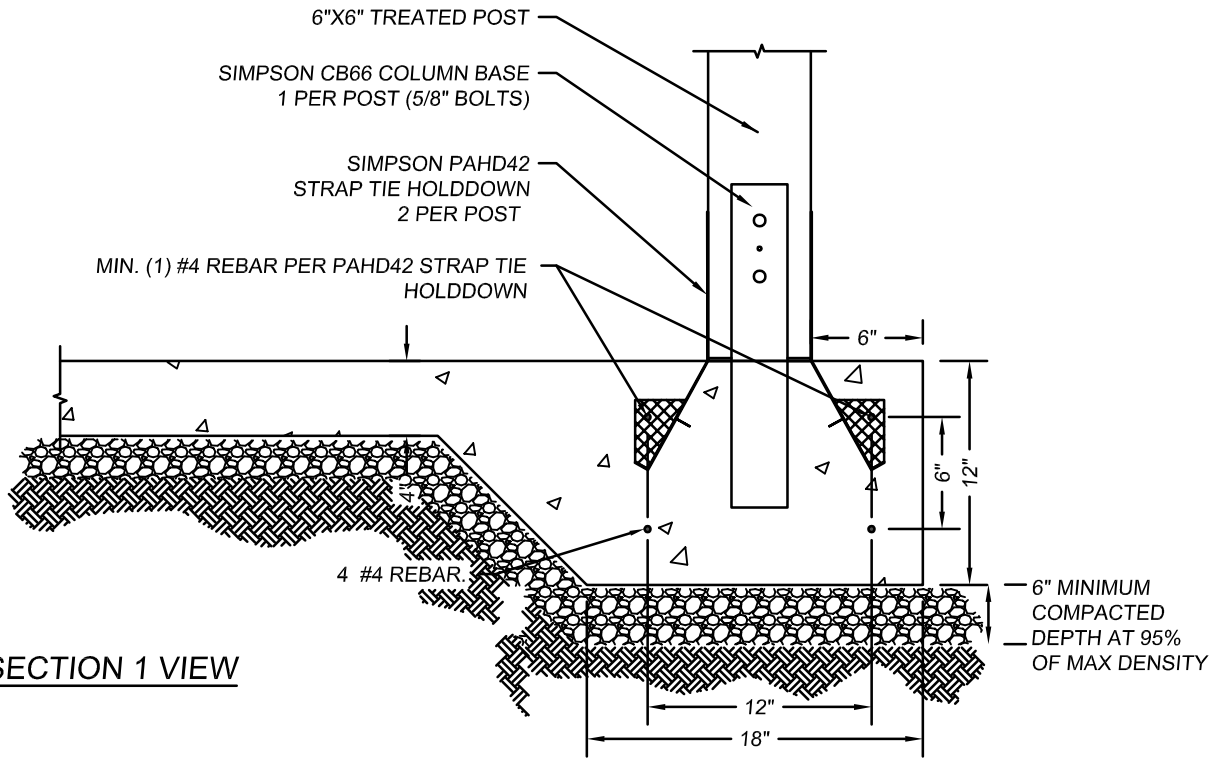
STANDARD DRAWING

5A

Plotted on Dec 31, 2018 - 12:22pm, Modified 12-06-18
C:\Users\rmueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_5B_PS



PLAN 1 VIEW



SECTION 1 VIEW

City of Camas WASHINGTON
616 NE 4TH AVENUE
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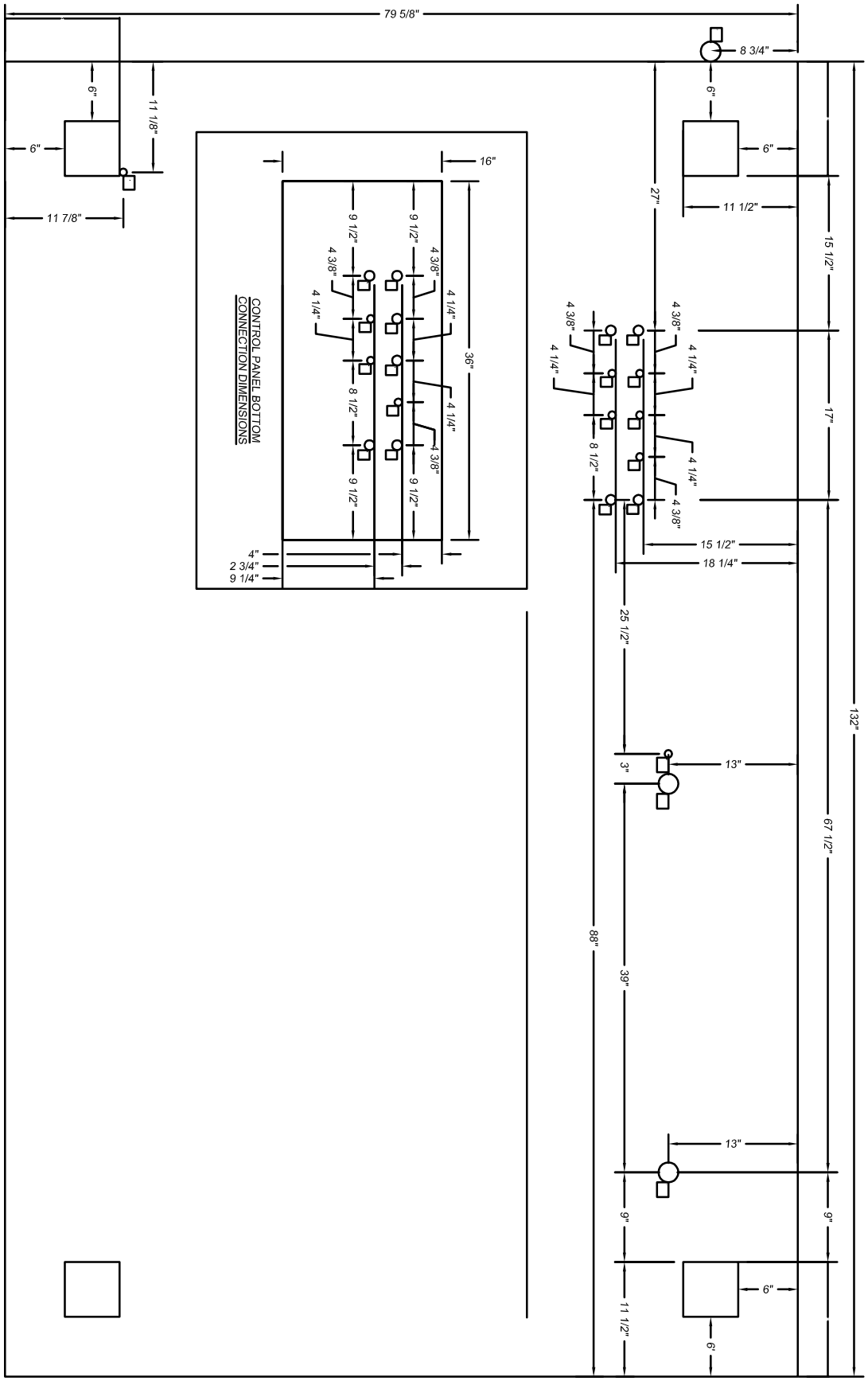
CONTROL PANEL COVER FOOTING / POST CONNECTION

STANDARD DRAWING

5B

Plotted on Dec 31, 2018 - 12:24pm, Modified 11-26-18
C:\Users\rmueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_5C_PS



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CONTROL PANEL CONDUIT LAYOUT

STANDARD DRAWING

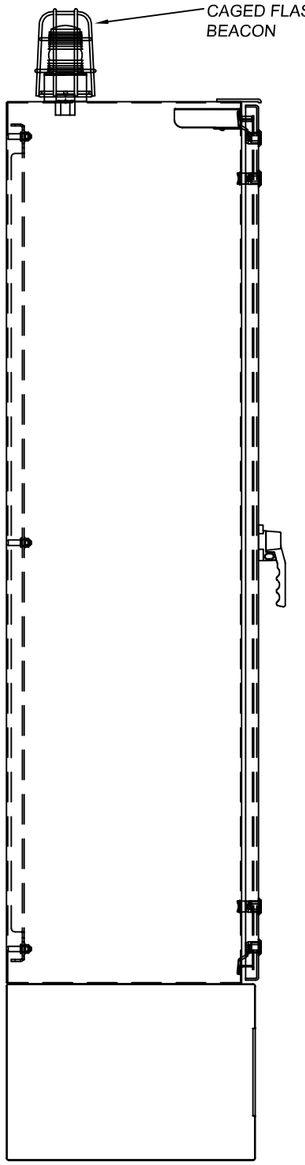
5C

GENERAI NOTES:

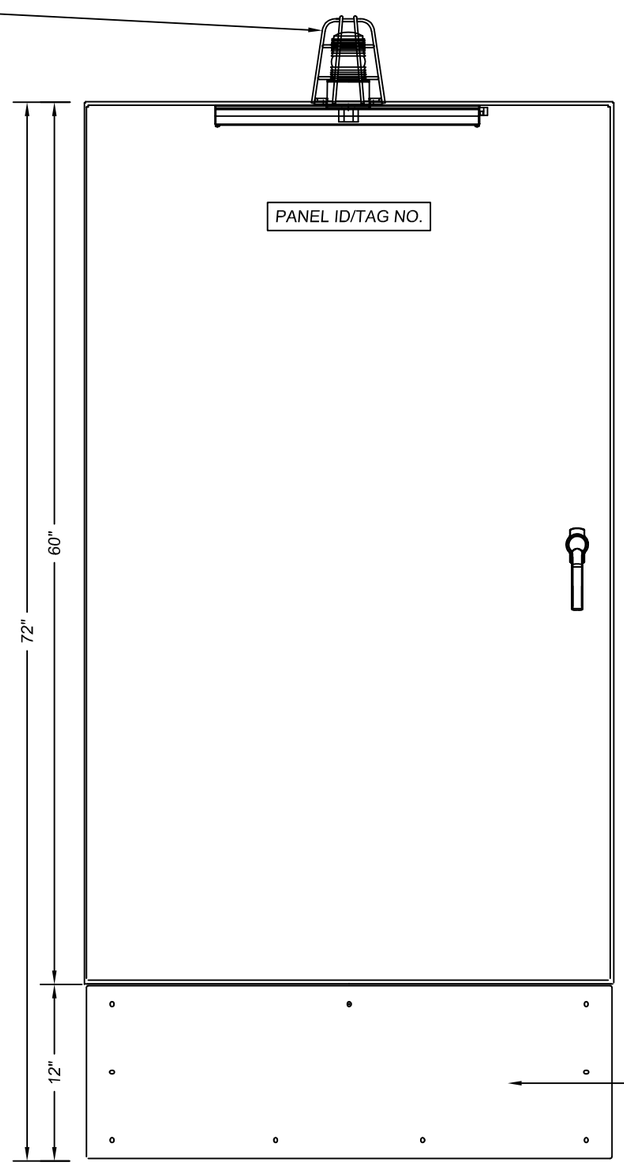
1. MINIMUM 60"H X 36"W X 16"D HOFFMAN NEMA 4 ENCLOSURE MODEL #A60H3616FLP3PT OR APPROVED EQUAL CONTAINING THE FOLLOWING:

   - LIGHT WITH MANUAL SWITCH HOFFMAN LF120V18 OR APPROVED EQUAL
   - ONE (1), 1/4 TURN OUTER DOOR HANDLE THAT CAN BE PADLOCKED.
   - DOCUMENT SLEEVE ON INSIDE PANEL DOOR CONTAINING WIRING LAMINATED SCHEMATIC AND DIAGRAM

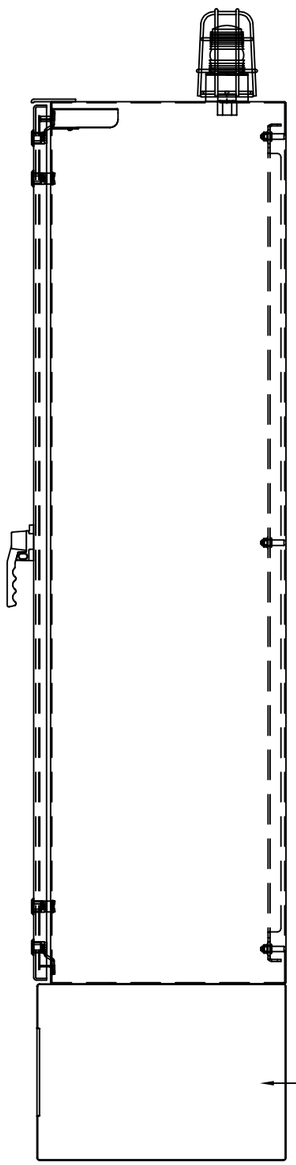
2. SEE STANDARD DRAWINGS #6A, #6B, AND #6C FOR CONTROL PANEL LAYOUT AND WIRING.



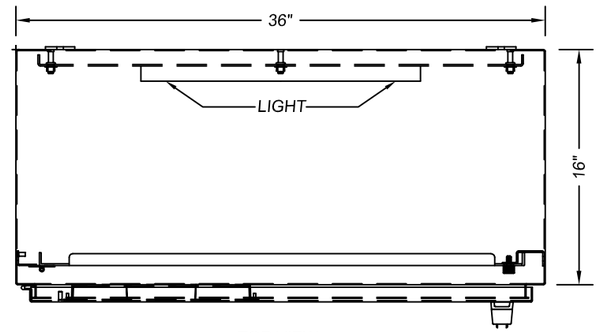
LEFT SIDE
NTS



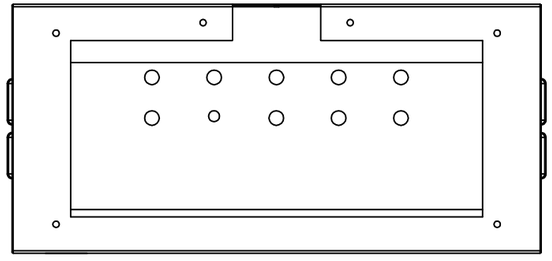
ELEVATION
NTS



RIGHT SIDE
NTS



TOP VIEW
NTS



BOTTOM
NTS

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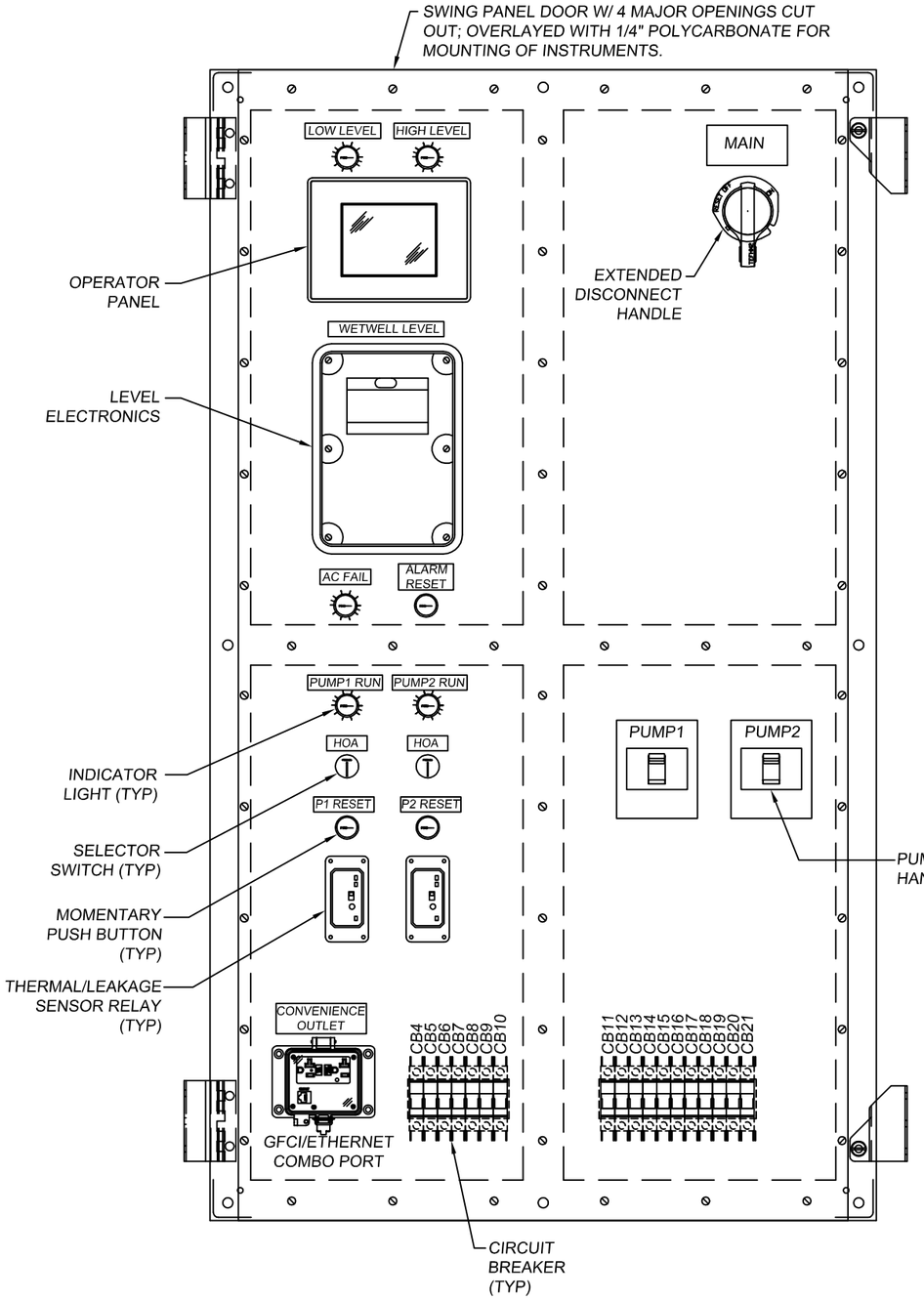
CONTROL PANEL ENCLOSURE

STANDARD DRAWING

6

Plotted on Dec 31, 2018 - 12:28pm, Modified 12-06-18
C:\Users\mueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_6_PS

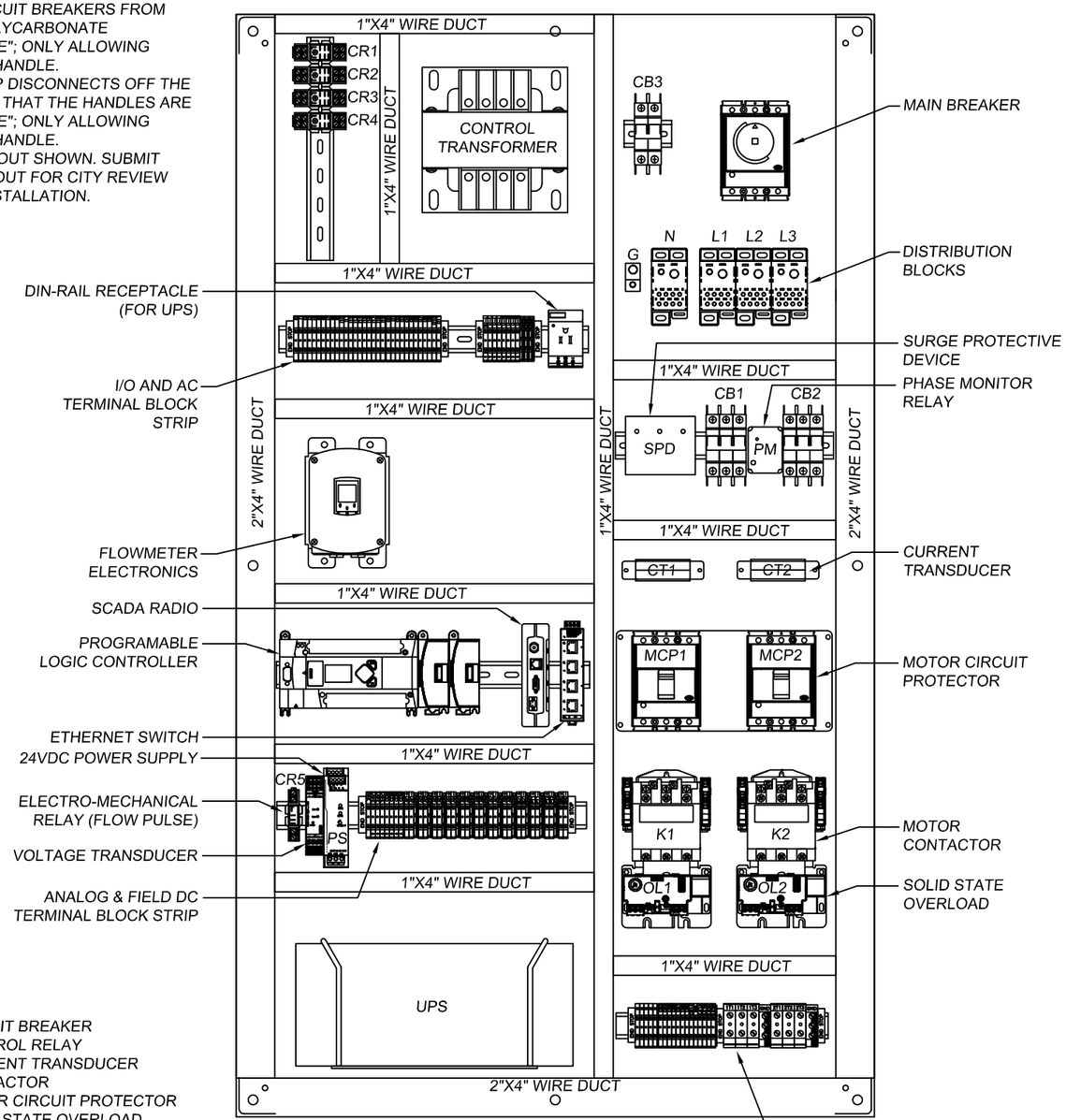


SWING PANEL FRONT VIEW

NTS

GENERAL NOTES:

1. SEE STANDARD DRAWINGS #6B AND #6C FOR CONTROL PANEL WIRING.
2. INSTALL CIRCUIT BREAKERS FROM REAR OF POLYCARBONATE "FINGER-SAFE"; ONLY ALLOWING ACCESS TO HANDLE.
3. MOUNT PUMP DISCONNECTS OFF THE BACKPAN SO THAT THE HANDLES ARE "FINGER-SAFE"; ONLY ALLOWING ACCESS TO HANDLE.
4. TYPICAL LAYOUT SHOWN. SUBMIT ACTUAL LAYOUT FOR CITY REVIEW PRIOR TO INSTALLATION.



SUB PANEL FRONT VIEW

NTS

LEGEND:

- CB- CIRCUIT BREAKER
- CR- CONTROL RELAY
- CT- CURRENT TRANSDUCER
- K- CONTACTOR
- MCP- MOTOR CIRCUIT PROTECTOR
- OL- SOLID STATE OVERLOAD
- PM- PHASE MONITOR
- PS- POWER SUPPLY
- SPD- SURGE PROTECTOR

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CONTROL PANEL - SWING / SUB PANEL

STANDARD DRAWING

6A

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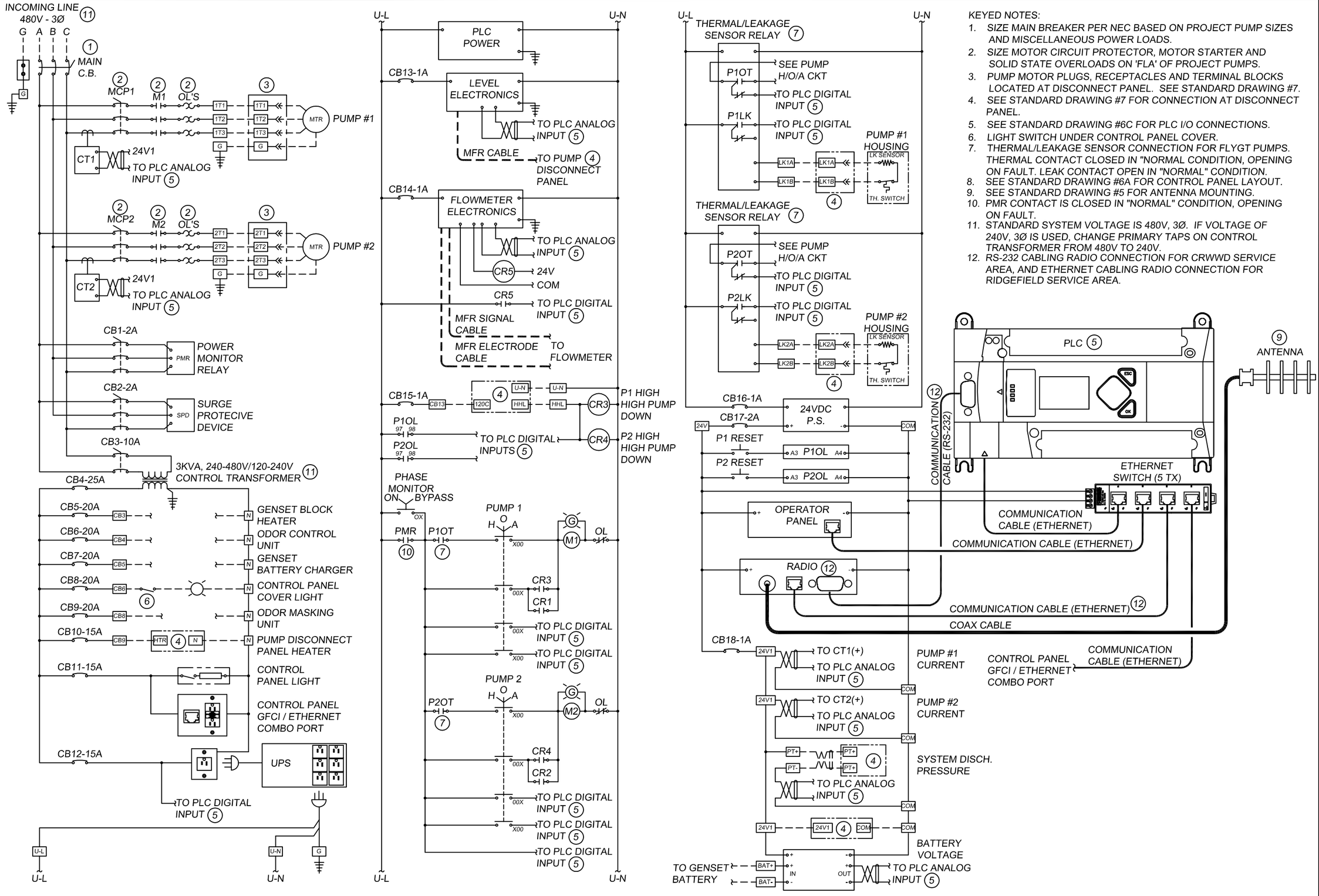
C:\Users\mmueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_6A_PS



KEYED NOTES:

1. SIZE MAIN BREAKER PER NEC BASED ON PROJECT PUMP SIZES AND MISCELLANEOUS POWER LOADS.
2. SIZE MOTOR CIRCUIT PROTECTOR, MOTOR STARTER AND SOLID STATE OVERLOADS ON 'FLA' OF PROJECT PUMPS.
3. PUMP MOTOR PLUGS, RECEPTACLES AND TERMINAL BLOCKS LOCATED AT DISCONNECT PANEL. SEE STANDARD DRAWING #7.
4. SEE STANDARD DRAWING #7 FOR CONNECTION AT DISCONNECT PANEL.
5. SEE STANDARD DRAWING #6C FOR PLC I/O CONNECTIONS.
6. LIGHT SWITCH UNDER CONTROL PANEL COVER.
7. THERMAL/LEAKAGE SENSOR CONNECTION FOR FLYGT PUMPS. THERMAL CONTACT CLOSED IN "NORMAL CONDITION, OPENING ON FAULT. LEAK CONTACT OPEN IN "NORMAL" CONDITION.
8. SEE STANDARD DRAWING #6A FOR CONTROL PANEL LAYOUT.
9. SEE STANDARD DRAWING #5 FOR ANTENNA MOUNTING.
10. PMR CONTACT IS CLOSED IN "NORMAL" CONDITION, OPENING ON FAULT.
11. STANDARD SYSTEM VOLTAGE IS 480V, 3Ø. IF VOLTAGE OF 240V, 3Ø IS USED, CHANGE PRIMARY TAPS ON CONTROL TRANSFORMER FROM 480V TO 240V.
12. RS-232 CABLING RADIO CONNECTION FOR CRWWD SERVICE AREA, AND ETHERNET CABLING RADIO CONNECTION FOR RIDGEFIELD SERVICE AREA.

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CONTROL PANEL WIRING DIAGRAM

STANDARD DRAWING

6B

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C:\Users\mueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_6B_PS

Plotted on Dec 31, 2018 - 12:40pm, Modified 12-06-18
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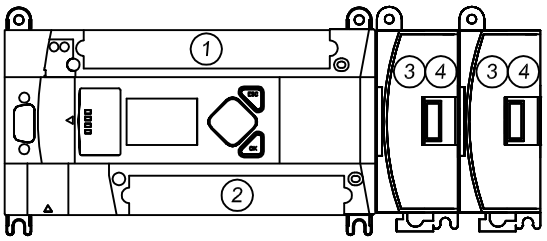
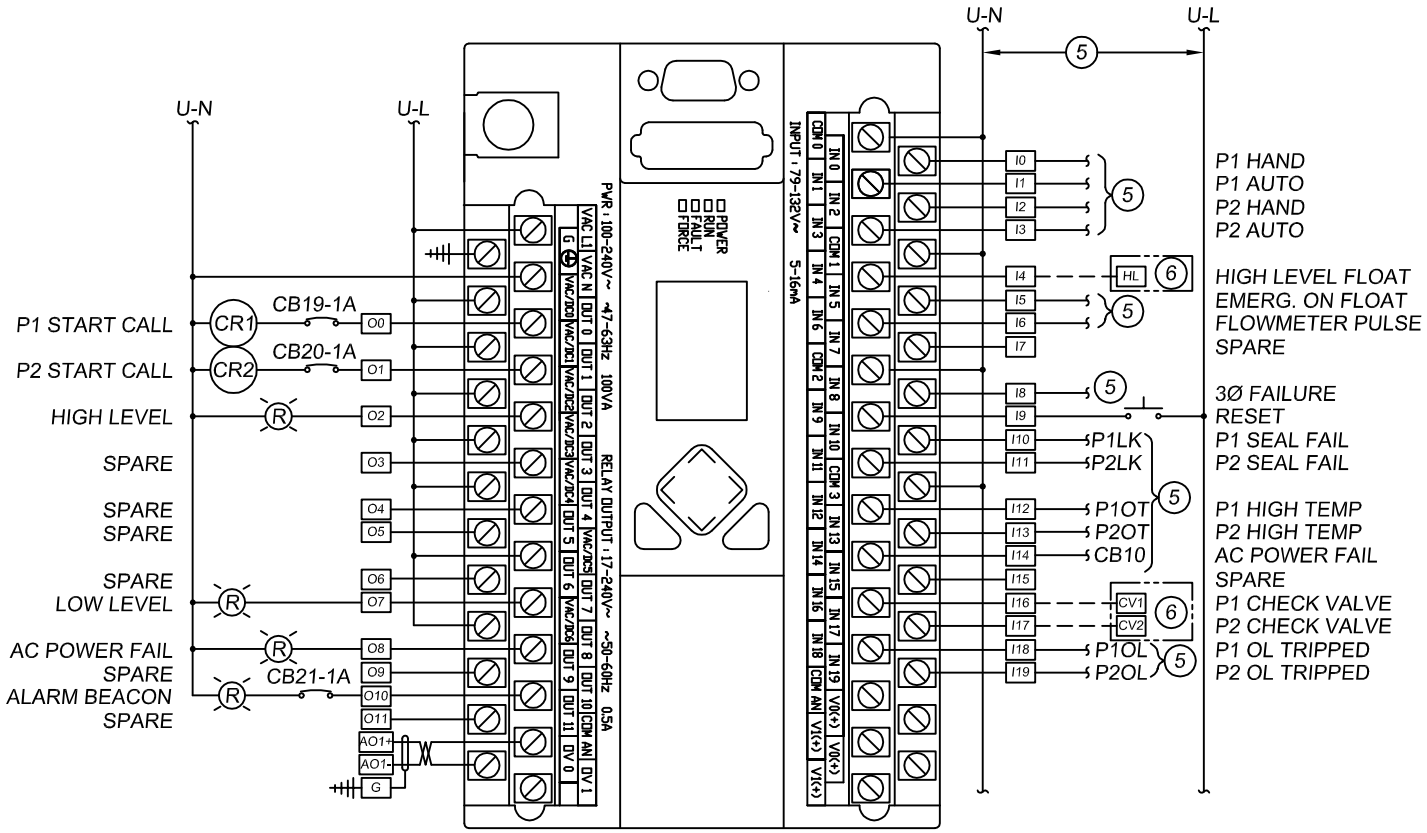
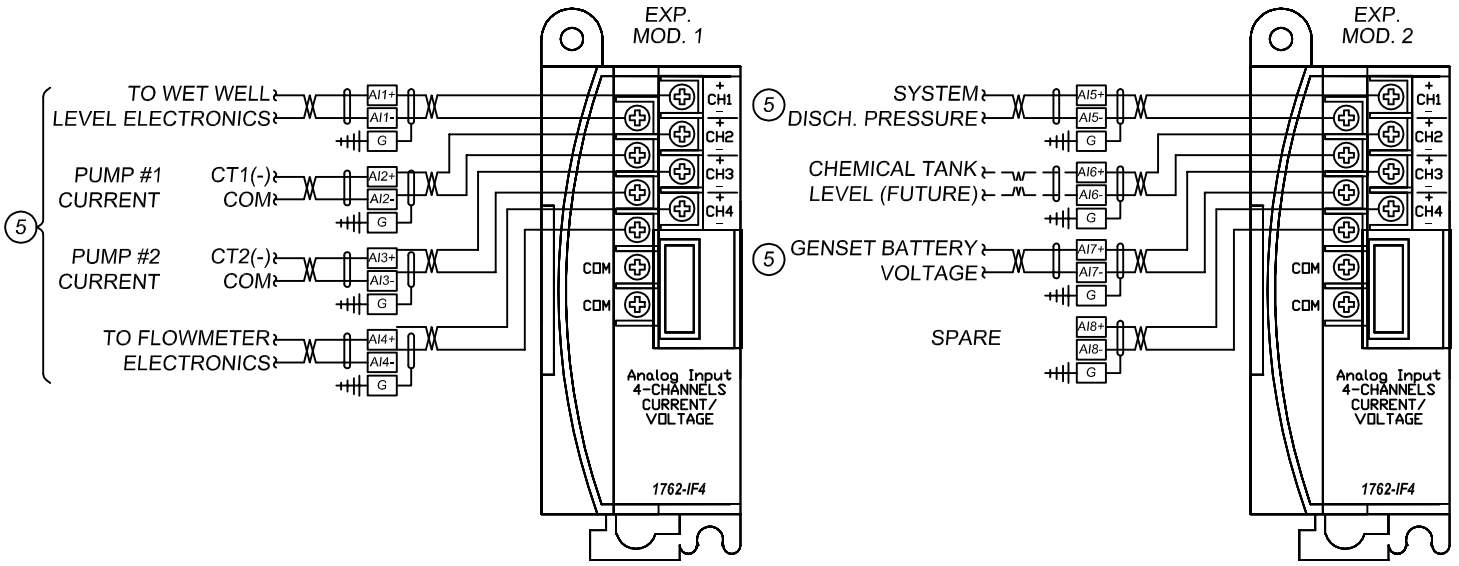


GENERAL NOTES:
1. DISCRETE INPUTS; SEE WIRING BELOW.
2. DISCRETE OUTPUTS; SEE WIRING BELOW.
3. EXPANSION ANALOG INPUT MODULES; SEE WIRING BELOW.
4. SET DIP SWITCHES TO CURRENT SETTING.

KEYED NOTES:
5. SEE STANDARD DRAWING #6B.
6. SEE STANDARD DRAWING #7.





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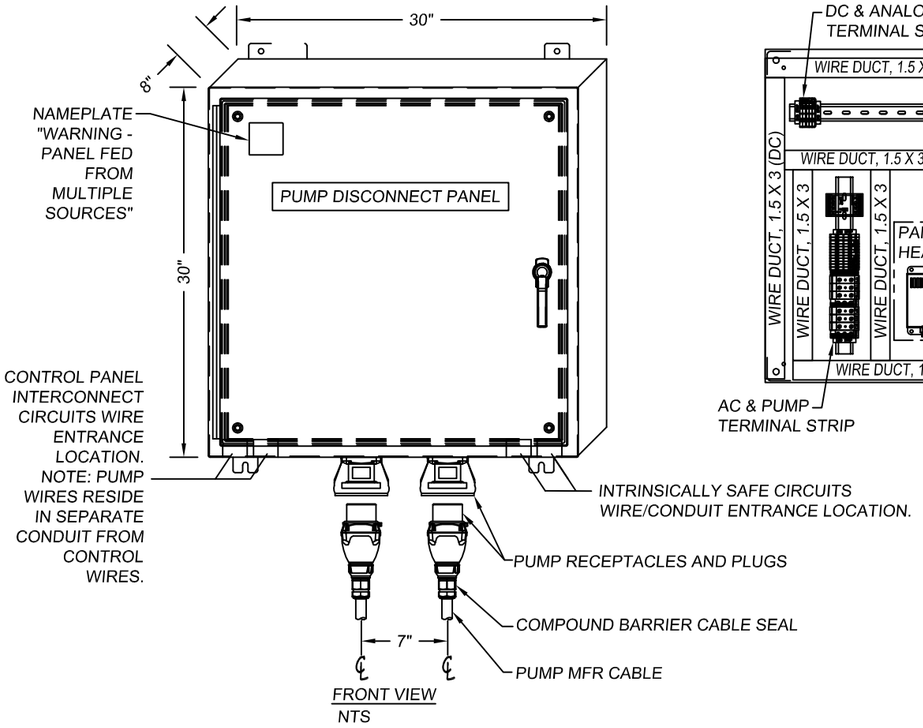
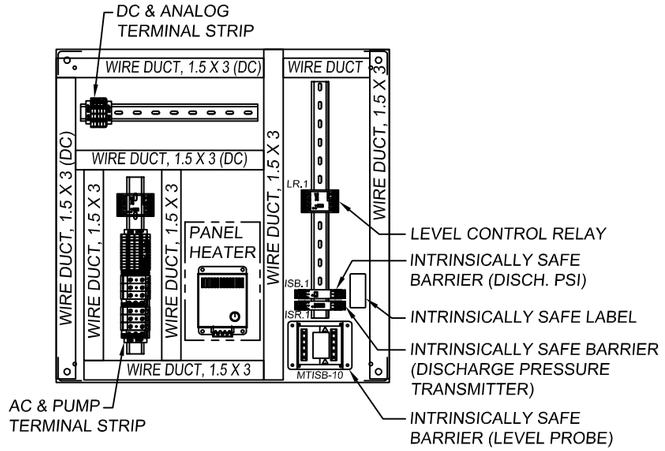
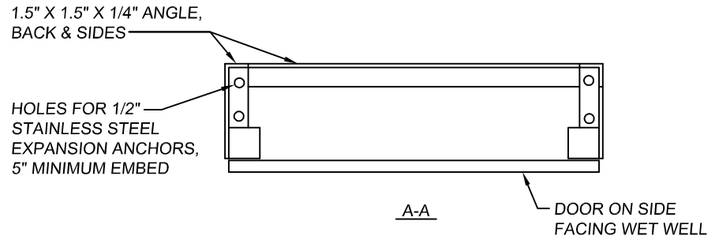
CONTROL PANEL I/O WIRING DIAGRAM

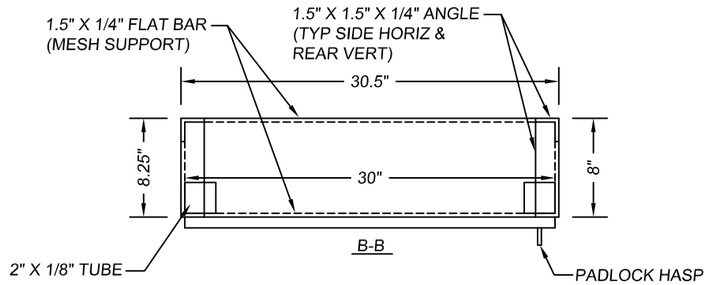
STANDARD DRAWING

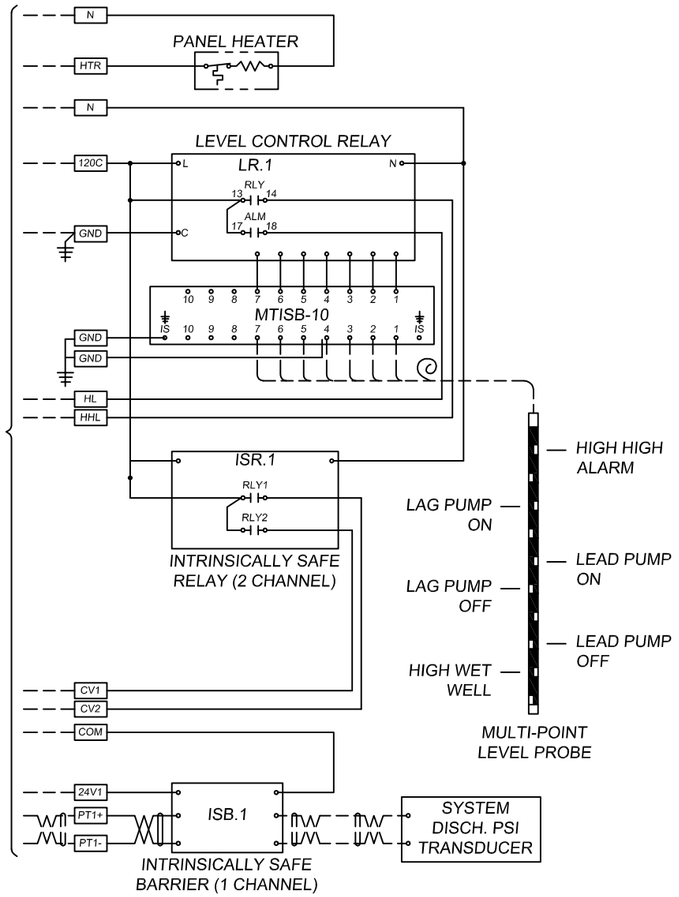
6C

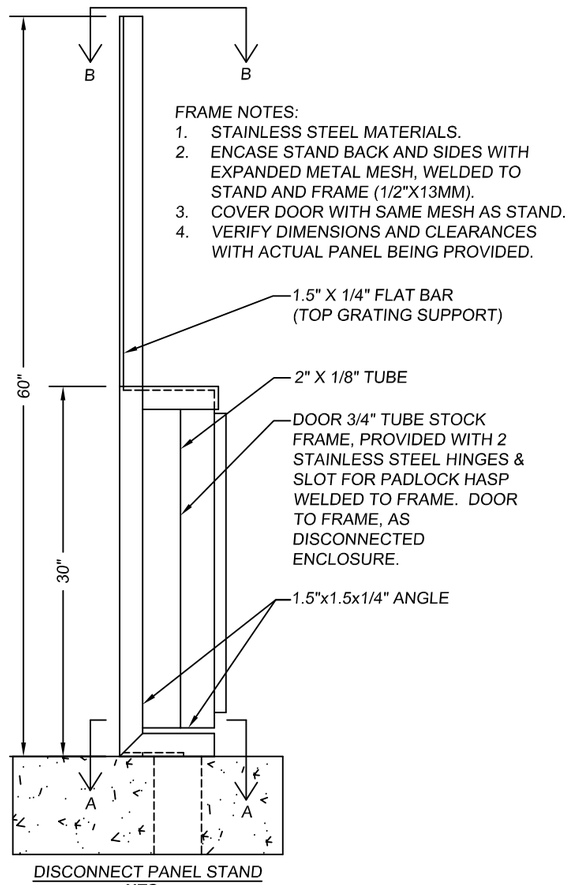




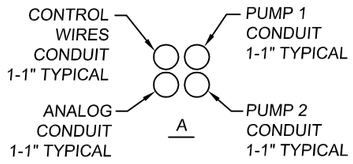




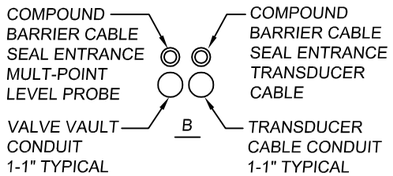


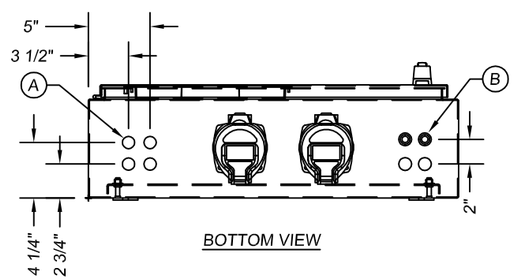


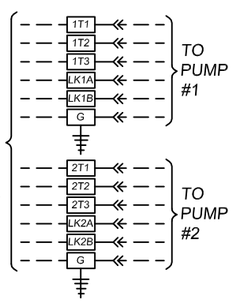
CONDUIT ENTRANCE LOCATION FROM MAIN CONTROL PANEL



INTRINSIC WIRING ENTRANCE LOCATION







WIRING TO CONTROL PANEL. SEE STANDARD DRAWINGS #6B AND #6C.

NOTE: CONTINUOUS RGS CONDUITS CONTINUOUS RGS FROM BELOW GRADE TO CONTROL PANEL. REFERENCE NEC ARTICLE 501.15 (B2) EXCEPTION NO 1.

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PUMP DISCONNECT PANEL

STANDARD DRAWING

7

GENERAL NOTES:

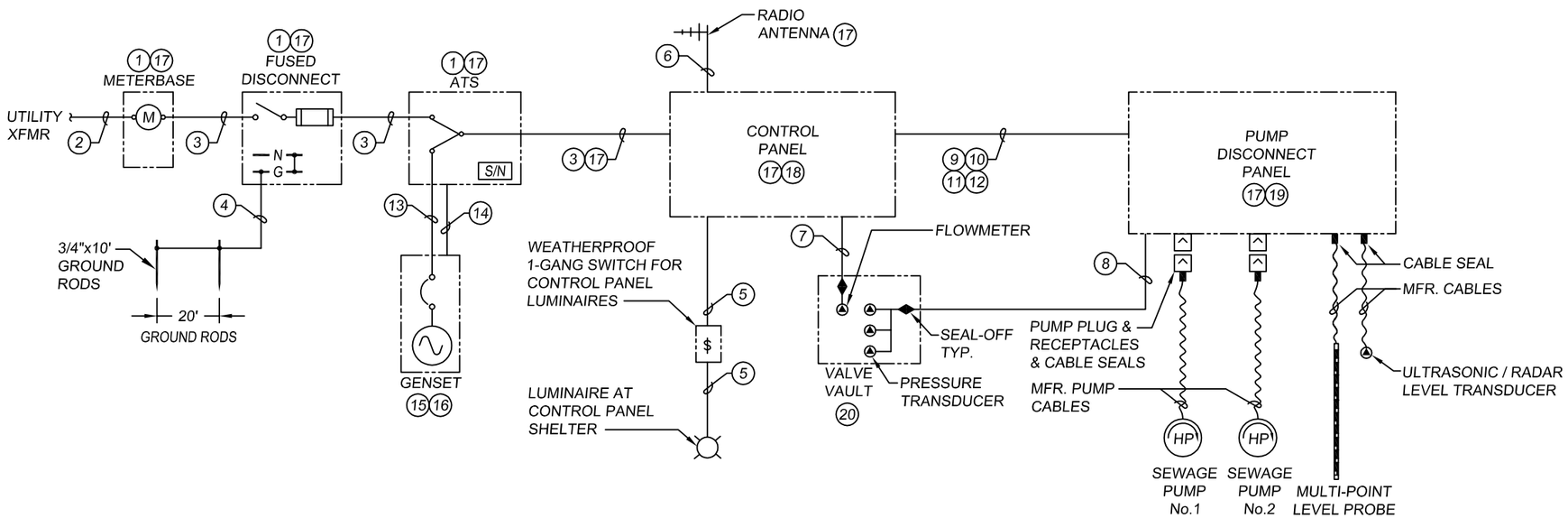
1. SEE STANDARD DRAWING #1 FOR SITE PLAN CONDUIT ROUTING.
2. THIS DRAWING IS AN EXAMPLE OF A TYPICAL PUMP STATION DESIGN. SOME ITEMS MAY VARY DEPENDING ON PROJECT DESIGN.

KEYED NOTES:

1. SIZE METERBASE , FUSED DISCONNECT, AND TRANSFER SWITCH FOR SPECIFIC PROJECT LOADS. SEE LOAD SUMMARY EXAMPLE; THIS SHEET.
2. 2" SERVICE CONDUIT FROM TRANSFORMER TO METERBASE. SIZE CONDUCTORS FOR PUMP STATION LOAD AS REQUIRED. SEE LOAD SUMMARY EXAMPLE; THIS SHEET.
3. 2" CONDUIT WITH CONDUCTORS SIZED FOR PUMP STATION LOAD AND, IF USED, CONDUCTORS FOR GENERATOR BATTERY CHARGER AND BLOCK HEATER CONNECTIONS.
4. SERVICE GROUND CONDUCTOR SIZED PER NEC ARTICLE 250.
5. 3/4" CONDUIT WITH (1) #12 AWG POWER, (1) #12 AWG, NEUTRAL AND (1) #12 AWG GROUND CONDUCTOR.
6. 1.5" CONDUIT W/ ANTENNA CABLING. SEE SPECIFICATION FOR CABLING.
7. 1" CONDUIT WITH FLOWMETER MANUFACTURER SIGNAL AND ELECTRODE CABLE. USE SEAL-OFF FOR CONDUIT INSIDE VALVE VAULT.
8. 1" CONDUIT WITH (1) #18 AWG, TSP, (4) #14 AWG CONTROL CONDUCTORS AND (2) #14 AWG SPARES. USE SEAL-OFF FOR CONDUIT INSIDE VALVE VAULT.
9. 1" PUMP POWER CONDUIT WITH CONDUCTORS SIZED FOR PROJECT PUMP MOTOR.
10. 1" (AC) CONTROL CONDUIT W/ (2) #12 AWG POWER, (2) #12 AWG NEUTRAL, (1) #12 AWG GROUND, (4) #14 AWG CONTROL CONDUCTORS AND (4) #14 AWG SPARES.
11. 1" (DC) CONTROL CONDUIT W/ (1) #18 AWG TSP AND (2) #14 AWG CONTROL CONDUCTORS.
12. 1" LEVEL TRANSDUCER CONDUIT W/ MFR CABLING.
13. 2" CONDUIT WITH CONDUCTORS SIZED FOR PUMP STATION LOAD AND CONDUCTORS FOR GENERATOR CONTROL, BATTERY CHARGER AND BLOCK HEATER.
14. 1" CONDUIT WITH #18 AWG TSP FOR BATTERY VOLTAGE CONNECTION.
15. GENERATOR TO BE SIZED FOR SPECIFIC PROJECT LOADS. SEE SPECIFICATIONS FOR GENERATOR INFORMATION.
16. REMOVE NEUTRAL/GROUND BOND FROM GENERATOR. SYSTEM IS SOLIDLY GROUNDED THROUGH ATS AND IS NOT A SEPARATELY DERIVED SYSTEM.
17. SEE STANDARD DRAWING #5 FOR ELEVATION DETAIL OF EQUIPMENT AND ANTENNA MOUNTING INFORMATION.
18. SEE STANDARD DRAWINGS #6, #6A, #6B, AND #6C FOR CONTROL PANEL INFORMATION.
19. SEE STANDARD DRAWING #7 FOR PUMP DISCONNECT PANEL INFORMATION.
20. SEE STANDARD DRAWING #4 FOR VALVE VAULT INFORMATION.

ITEM	DESCRIPTION	LOAD		
1	SEWAGE PUMP NO. 1 (15HP)	17.5	KVA	
2	SEWAGE PUMP NO. 2 (15HP)	17.5	KVA	
3	FUTURE ODOR CONTROL UNIT	0.1	KVA	
4	FUTURE ODOR MASKING	0.1	KVA	
5	MISC	3.0	KVA	
SUBTOTAL		38.2	KVA	
LARGEST MOTOR X 25%		4.4	KVA	
NON-MOTOR LOADS X 25%		0.8	KVA	
TOTAL:		43.4	KVA	52.2 AMPS
REQUIRED SERVICE SIZE @ 480V, 3-PH:				100 AMPS

LOAD SUMMARY EXAMPLE
NTS



TYPICAL ONE-LINE DIAGRAM W/ GENERATOR
NTS

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EXAMPLE ONE-LINE DIAGRAMS

STANDARD DRAWING

8

Plotted on Dec 31, 2018 - 1:27pm, Modified 12-06-18
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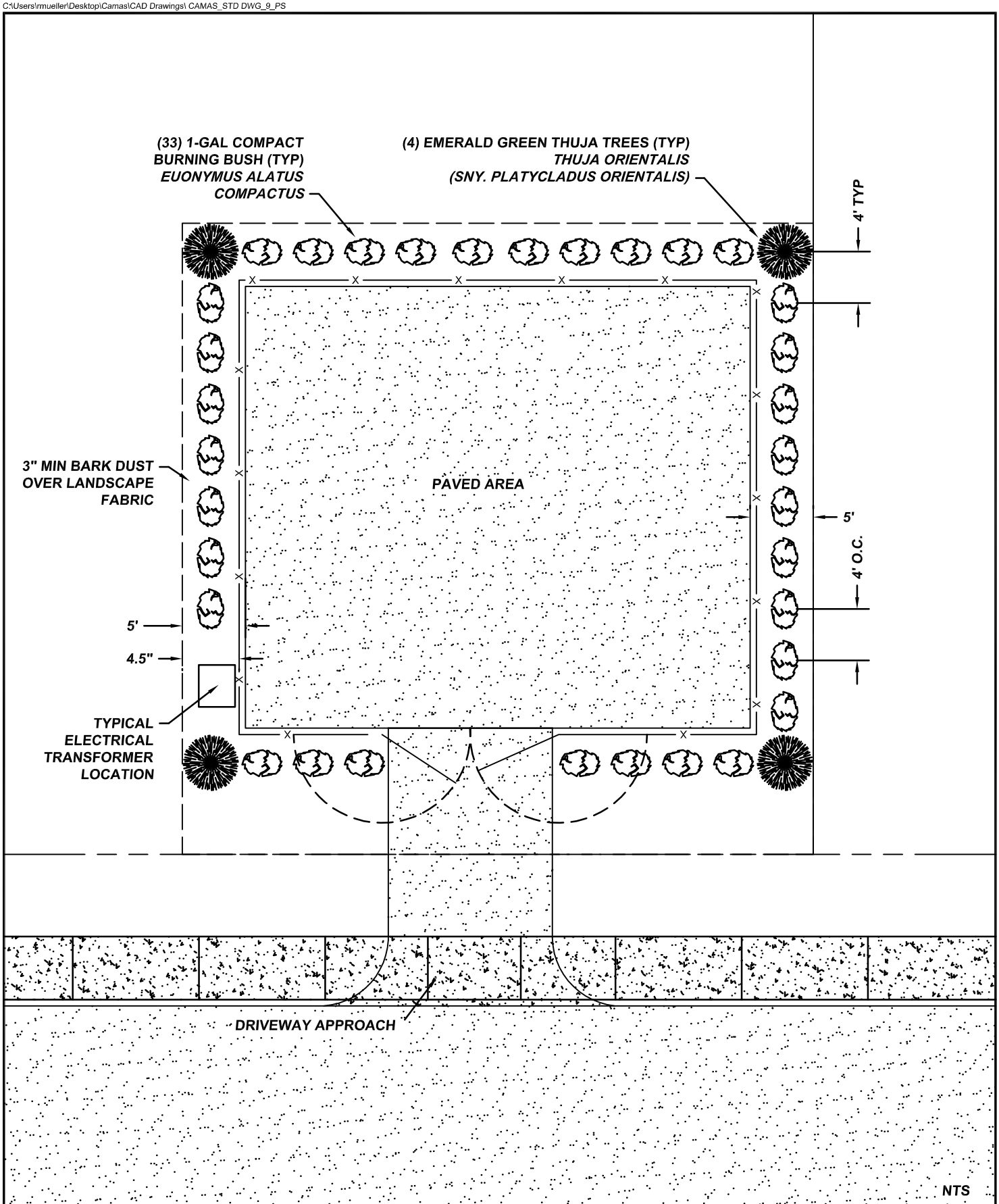
Plotted on Dec 31, 2018 - 1:41pm, Modified 11-26-18
C:\Users\rmueller\Desktop\Camas\CAD Drawings\ CAMAS_STD DWG_9_PS



TYPICAL PUMP STATION LANDSCAPE PLAN

STANDARD DRAWING

9

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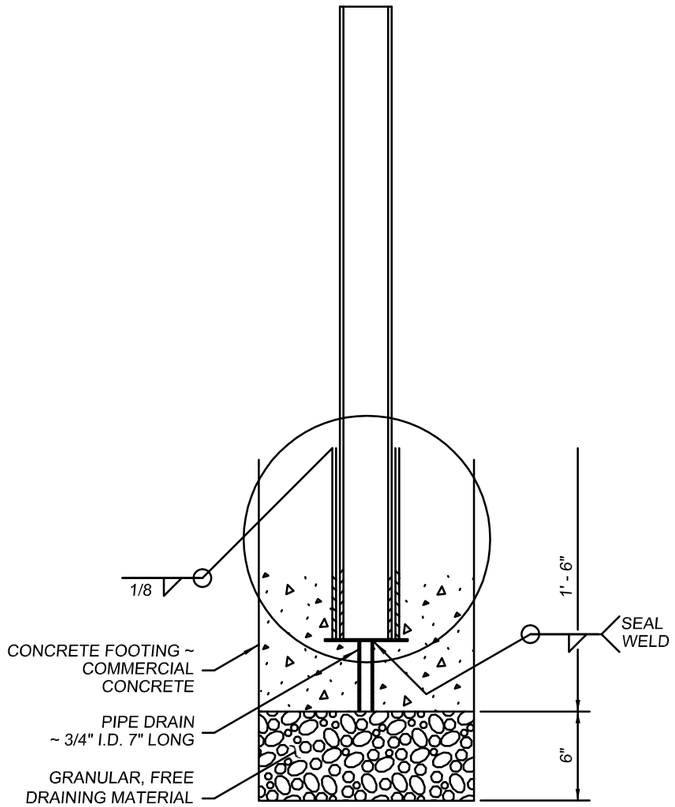
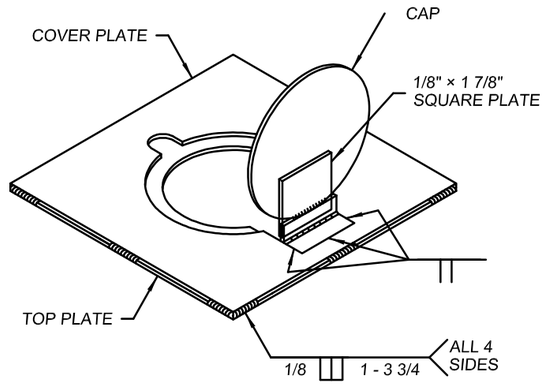
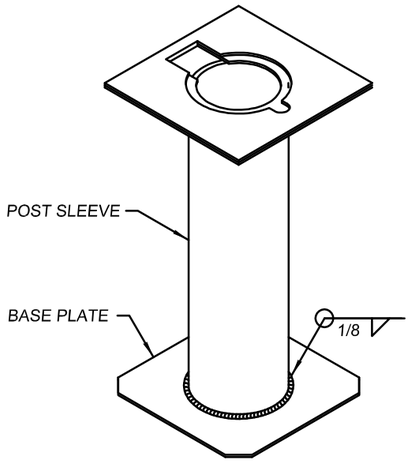
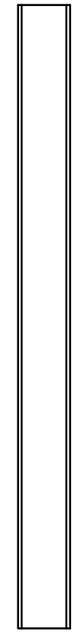


SECTION





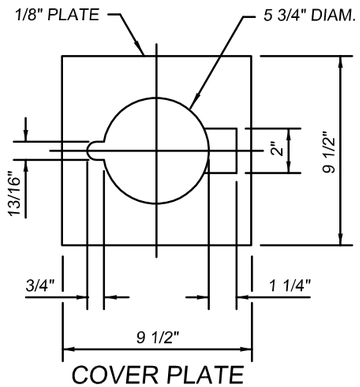
① BASE ASSEMBLY



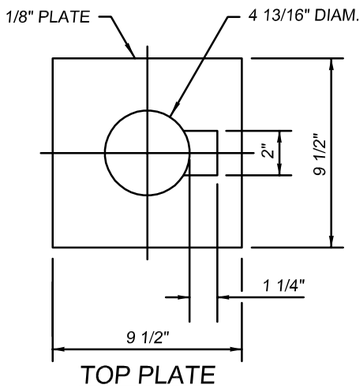
POST

NOTE

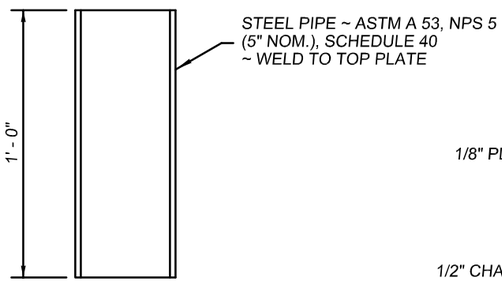
This bollard does not have an effective breakaway design feature and cannot be installed within the Design Clear Zone.



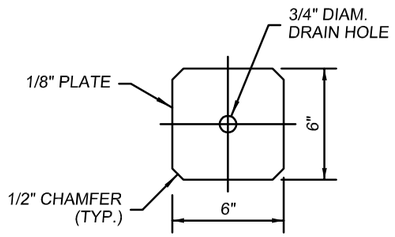
COVER PLATE



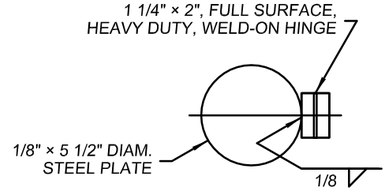
TOP PLATE



POST SLEEVE



BASE PLATE



CAP AND HINGE

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4" REMOVABLE BOLLARD DETAIL

STANDARD DRAWING

10

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