TASK ORDER: 5638 O1

PROJECT NUMBER: 50114730

L16 FEATHERSTONE SPS AND FORCE MAIN ASSESSMENT EVALUATION

Featherstone Sewage Pumping Station Rehabilitation Program

OCTOBER 2023

Dewberry

FINAL

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1. INTRODUCTION

1.1 Background

In 1978, the Featherstone Sewage Pump Station (SPS), also referred to as L16, was constructed to take the Featherstone Sewage Treatment Plant offline. In 1999, the pump station was rehabilitated to replace aging equipment. The SPS continues to have major equipment failures including the pumps, VFD, and main disconnect switch requiring replacement under maintenance projects. There are several major drivers for the Featherstone SPS replacement, including:

- The existing SPS is not delivering the original firm design capacity
- There are fundamental issues with the SPS that were discussed in the L16 Featherstone SPS Short Term Solution Preliminary Engineering Report (PER)
- Anticipated growth requires a larger pump station capacity beyond what can be provided as an upgrade to the existing SPS.
- The existing pump station is not designed to handle peak wet weather flows.

Prince William County Service Authority (SA) has contracted Dewberry Engineers Inc. (Dewberry) to evaluate the replacement of the existing SPS.

1.2 Purpose

The purpose of this PER is to evaluate the requirements for a new Featherstone SPS, headworks, and equalization basin.

1.3 Scope

The scope of the project includes the following items:

- Confirm and summarize the basis of design and sizing for the headworks, main pump station, new force main, equalization pumps, and equalization basin.
- Confirm configuration of the headworks, main pump station, and equalization basin.
- Preliminary sizing and selection of main process equipment including pumps and grinders.
- Preliminary sizing of the new force main.
- Preliminary sizing and identification of process mechanical, HVAC, plumbing, structural, electrical, and instrumentation and controls systems required for the proposed facility.
- Preparation of conceptual layouts of the proposed facility.
- Evaluate two site layout alternatives, including expanding the pump station site to the adjacent parcel.
- Complete a desktop environmental evaluation and identify list of anticipated permits needed to construct the pump station.
- Preparation of an opinion of probable cost for the recommended project.
- Preparation of an estimated schedule for the recommended project.

2. EXISTING CONDITIONS

2.1 Pump Station Location

The Featherstone Sewage Pump station is located south of the intersection of Featherstone Road and Farm Creek Drive and is situated on an 0.89 acre parcel, GPIN 8391-92-4578, owned by the Service Authority. The site is accessed through a driveway off Farm Creek Road that is a separate parcel owned by the Service Authority, GPIN 8391-92-0587. Refer to **Figure 2.2** for additional information.

2.1.1 Site Layout

The Featherstone SPS site includes the SPS building, which includes the drywell and electrical room, wet well, influent grinder channel structure, outdoor generator and fuel tank, and a separate abandoned building. In addition, at the time of the site visit, a diesel bypass pump was set up due to one of the pumps being out of service. The site is enclosed by a chain link fence with a swing gate at the entrance.

2.1.2 Property Information

The subject property is developed and mostly cleared. The site is bounded to the north and southwest by Farm Creek Portfolio Owner LLC, to the east by CSX Transportation, and to the west by property owned by Prince William County Service Authority. The topography of the site is generally mild, and it drains towards an existing culvert under the railroad tracks to the north and west of the property. Property information is summarized in **Table 2.1.**

Table 2.1 Property Information

CHARACTERISTIC	VALUE
Address	15023 Farm Creek Dr.
Owner	Prince William County Service Authority
GPIN Number	8391-92-4578
Current Use	Pump Station
Land Area	0.8916 Acres (County Records)
Existing Zoning	M-1 Heavy Industrial (REZ1981-0004)
Magisterial District	Woodbridge
Long Range Land Use	Public Land (PL), T-3
Overlay Districts	Prehistoric Sensitivity Areas Impact Conditions Environmental Resource Protection Overlay 100-yr Flood Hazard Overlay
Surrounding Uses	North: Warehouse (Industrial) East: CSXT South/West: Industrial Light Manufacture West: Vacant

2.1.3 Floodplain and Stormwater Management

The site is located along a side tributary of the Potomac River called Farm Creek. Farm Creek appears to have a separate floodplain analysis, aside from the main floodplain study along the Potomac River. The Featherstone SPS is located with the FEMA flood zone AE, which indicates that the pump station is within the 100-year flood plain. It should be noted that the original FEMA base map does not include the whole area, but a revision added it, see **Attachment A – FEMA Flood Maps** for reference.

The finished floor elevation of the pump station is 8.58 ft and the FEMA 100-year flood plain elevation is 10 ft. Based on information included in the “Featherstone Sewage Pump Station Flood Mitigation Evaluation”, dated October 2013, the pump station has had one significant flood event in September 2011 in which the flood level reached approximately 2 to 3 feet above the finished floor, or a flood elevation of 10.5 to 11.5 ft.

Figure 2.1 Pump Station Flood Protection

Berms constructed of either precast concrete median barriers or sandbags were installed around openings, doors, and electrical equipment as the current mitigation strategy for the pump station finished floor being below the 100-year flood plain elevation as seen in the above photo.

2.1.4 Soil Conditions

The reviewed geologic maps indicate Alluvium (Qal) at the site of the existing PS. The Alluvium at the site joins Alluvium associated with the floodplain of Farm Creek on the east side. Terrace Deposits (Qp2) are mapped on the west side of the Alluvium along Farm Creek. And the Potomac Formation (Kp) is mapped adjacent to the west side of the Terrace Deposits. It is likely that both the Terrace Deposits and Potomac Formation successively underlay the Alluvium at the site.

One test boring was completed near the center of the current pump station prior to construction. A log of the boring is shown on Sheet 2 of 15 of the 1978 Record Drawings. The ground surface elevation at the boring was +6.2'. In summary:

- The boring encountered several layers of fine-grained soils to a depth of 17' (El -10.8'). The layers consisted of sandy silt (Unified Soil Classification ML), clay with some sand (CH), and silt (ML). The consistency of these soils was generally firm to stiff, based on standard penetration test data (blow counts).
- Granular soils consisting of silty sand (SM) and coarse sand (SW) were encountered between depths of 17' and 33.5' (El -27.3'). A note on the log indicates that sand ran into the hole below about 25' (El -18.8'). The relative density of the granular soils was generally medium dense.
- Clay (CH) with layers of sand and gravel was encountered between 33.5' and 48.5' (El -42.3'). The clay appeared to have a hard or very hard consistency, although the blow counts may have been distorted on the high side due to presence of layers of sand and gravel within the clay.
- Groundwater was encountered at a depth of 2' (El +4.2').

Development of the existing pump station and associated structures (e.g., underground piping, screen chamber, flow meter vault, etc.) and subsequent upgrades indicated on the 1999 Record Drawings have altered the subsurface conditions at the site. For example, the Site Plan shown on Drawing No. C1 (Sheet 2 of 23) and Detail 3/C1 on Drawing No. S101 (Sheet 11 of 23) of the 1999 Record Drawings shows where "select structural fill" was to replace existing soils to a depth of 12' along much of the east side of the pump station.

According to the NRCS Soil Survey, the western portion of the site is within Map Unit 54B – Urban land-Udorthents complex, which is minimally described as Urban Land 50%; Udorthents 40%. (Urban land includes areas covered with buildings and paved areas; Udorthents include areas that have been altered by cutting or filling). The NRCS Soil Survey generally covers only the upper 6'-7' of the original soil profile in areas that have not been significantly altered by human activity. Therefore, it is not of use in evaluating deeper subsurface conditions, except in descriptions that provide supplemental or corroborating information, such as noting the parent material from which the soil was derived, depth to the water table, and many other properties and qualities of the shallow soil that might help in evaluating the deeper soils. For example, the eastern part of the existing site is within Map Unit 37A – Marumsco loam, which is described in a typical profile as having several layers consisting of loam, clay, and sandy clay loam to a total depth of 75 inches. The parent material is noted to be marine deposits and the depth to the water table is noted to be about 12 to 18 inches. This information is generally in line with and supports the geologic and test-boring information previously summarized.

It should be noted that the potential alternate pump station site located NNW, just across the access driveway, appears to be within the Soil Survey Map Units 54B and 37A discussed above. Another soil, Map Unit 1A – Aden silt loam, occurs in a relatively small wedge-shaped area next to the paved area around the large building to the west. The Map Unit 1A area appears to extend about 130' north of the southeast corner of the paved area and up to approximately 100' to the east at its greatest extent. The typical profile is described as follows:

- 0 to 8" silt loam
- 8" to 31" clay
- 31" to 58" silty clay loam
- 58" to 78" silt loam
- 78" to 82" bedrock

The parent material is described as Alluvium. The depth to the water table is noted to be about 0 to 12 inches. The depth to restrictive layer is noted to be 74 to 82 inches to paralithic bedrock. The presence of paralithic bedrock suggests that Piedmont type geology may be at shallow depth in the area of Map Unit 1A. Paralithic bedrock is essentially decomposed rock that is more soil-like than rock-like but is usually very dense. It often occurs in the upper part of bedrock. Deeper, the bedrock usually becomes less weathered, very hard rock.

Based on the geologic mapping, it is reasonable to assume for preliminary assessment purposes that the deeper soils at the potential alternate site within the Map Unit 37A and probably within the Map Unit 54B (though with less confidence) should be similar to those as previously discussed for the existing PS site. The subsurface conditions indicated in the area of Map Unit 1A suggest very difficult excavation conditions for deep structures. This soil type is denoted on Figure 2.3 for reference, as it should be avoided for placement of the new pump station.

2.1.5 Existing Storage Building

There is an existing building onsite, located to the southwest of the pump station, which is a single-story building, that is approximately 25'-0" x 25'-0" constructed of CMU block walls, and steel roof joists supporting metal deck and concrete roof. The building is currently not in use and appears to have reached the end of its useful life.

2.1.6 Railroad

The back of the SPS property abuts a property owned by CSX Transportation. The railroad is approximately 50' off the property line and approximately 110' from the main pump station building, with a few miscellaneous appurtenances between the building and the property line.

2.1.7 Easements

There are no easements on the existing SPS parcel, but there are many easements on the adjacent property to the North, which will be evaluated as an alternative site for proposed improvements.

2.2 Sewage Pump Station

The Featherstone SPS was originally constructed in 1974 and consists of a below-grade wet well, a below-grade dry well pump room, and an above-grade motor and control room. In 1999, the station was upgraded, which included three (3) extended shaft dry-pit centrifugal pumps. The station has two (2) duty pumps with 450 HP motors and a design capacity of 8,900 GPM at 147 ft Total Dynamic Head (TDH) and one standby pump with a 500 HP motor and a design capacity of 10,300 GPM at 153 ft TDH. This results in a design firm pumping capacity of 25.6 MGD, with the largest pump out of service. However, recent drawdown testing has confirmed that the pumps are not operating at the original design capacity and the actual firm capacity of the station is much less. The cause of the reduced capacity is evaluated in detail in the L16 Featherstone SPS Short Term Solution Preliminary Engineering Report (PER). In addition, at the time of the site visit for this report, both Pumps 2 and 3 were offline for maintenance and/or replacement and a bypass pumping system was in-place to supplement pump station capacity.

The at-grade floor contains the pump motors, control equipment, and electrical equipment and the dry-well contains the pumps, suction and discharge piping, and valves. Pump shafts extend through the top slab with the motors being at-grade. Pump removal requires the use of a crane truck, which accesses the drywell through a roof hatch that is centered over an access hatch in the top slab.

The station also includes a separate headworks structure with two (2) parallel channels including one hydraulic grinder rated at 14.2 MGD and a manual bar screen. A project to replace the existing grinder with a new Franklin Miller Dimminutor 36T and hydraulic motor with a rated capacity of 20 MGD is currently in progress.

The station includes a 30-inch magnetic flow meter on the discharge force main located in a separate meter vault onsite. A full-size valved bypass is included around the vault for maintenance purposes.

2.2.1 Structural and Architectural

According to the original drawings, both the base slab of the wet well and dry well are 24-inch thick reinforced concrete, but the base slab elevations differ with the wet well being 22'-6" below the motor and control room floor and the dry well being 23'-4" below the motor and control room floor. The perimeter exterior walls of the wet well and dry well are 24-inch thick reinforced concrete. The interior wall separating the wet well from the dry well is 18-inch thick reinforced concrete. The floor of the motor and control room above the wet well is a 9-inch thick reinforced concrete slab. The floor of the motor and control room above the dry well is a 7-inch thick reinforced concrete slab supported by three (3) 30-inch deep by 18-inch wide reinforced concrete beams spanning in the short direction of the dry well.

The motor and control room roof construction consists of steel roof deck supported by open web steel bar joists spanning in the east-west direction. The steel bar joists are supported by load-bearing concrete masonry unit (CMU) walls around the perimeter exterior of the room. The original construction drawings do not indicate any vertical reinforcing bars in the CMU walls. The top of roof steel (deck bearing) is 15'-1" above the motor and control room finished floor. The exterior wall has a brick veneer façade.

2.2.2 Electrical

The Featherstone SPS is serviced by a 1500kVA utility transformer with a 480Vac secondary voltage. The service disconnecting mean is located on the building exterior on the northeast corner of the building utilizing a 2000A Squared D bolt lock switch (BLS). The BLS feeds an Eaton 3000A automatic transfer switch (ATS), which is also fed from a Detroit Diesel Spectrum 2500kW diesel generator. The ATS feeds a 3000A Siemens Switchboard (SW1) which distributes power to the rest of the pump station via circuits directly feeding equipment, a 480Vac power panel and a 120/208V power panel via a 30kVA transformer. The three pumps are each fed from an Allen Bradley 18 pulse variable frequency drive (VFD) with reduced voltage soft start (RVSS) bypass. The VFD for Pump 1 and 2 are rated for 600HP. The VFD for

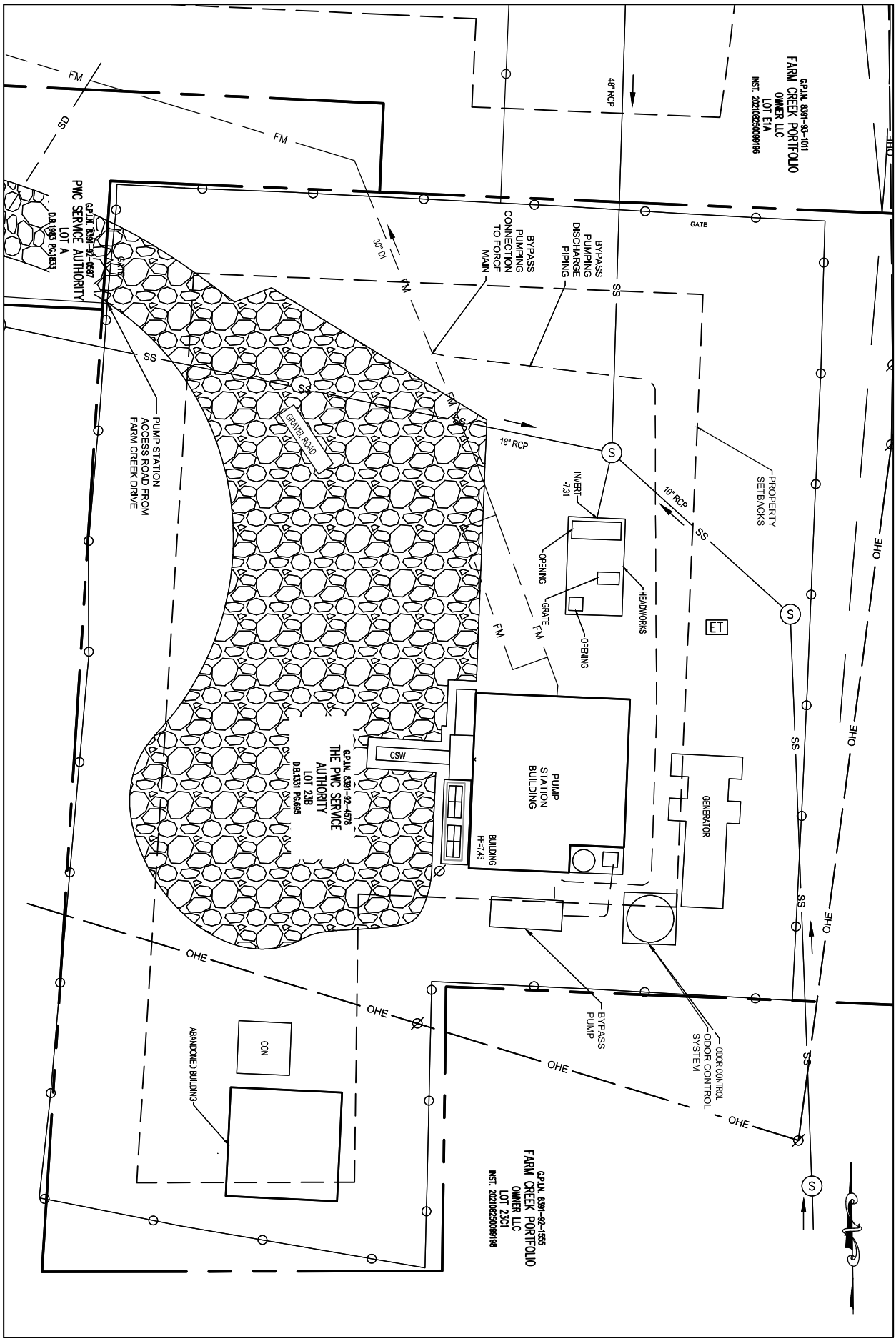
Pump 3 is rated for 500HP. Pumps 1 and 3 are provided with 450HP motors while Pump 2 is provided with a 500HP motor. The system has a remote terminal unit (RTU) with a Schneider Electric M340 PLC and HMI. The RTU connects to the SCADA via a cable modem and provide with a network switching cabinet.

There were several deficiencies noted in the existing electrical infrastructure when on site. The existing fusible service disconnect switch that is mounted to the building exterior has exceeded its anticipated service life and should be replaced as it is showing signs of aging and deterioration. This includes the raceway between the disconnect and the existing utility CT cabinet. Dewberry highly recommends the disconnect switch be replaced as part of this project.

The existing Main Switchboard was installed in 2001 and is approaching its end of service life. It appears to be in good condition however any major improvements should consider the replacement of the switchboard to extend the life of the pump station. In its current condition, it appears that the switchboard can sustain 5-10 additional years of service.

The 30kVA transformer ‘LA’ that is fed from Panel ‘PA’ is showing signs of corrosion and rust from repeated exposure to dripping water, creating a maintenance personnel hazard. Dewberry highly recommends the transformer be replaced as part of this project.

It was also noted on site that the existing receptacles and lighting in the dry well need to be replaced due to damage and improper rating for the location.



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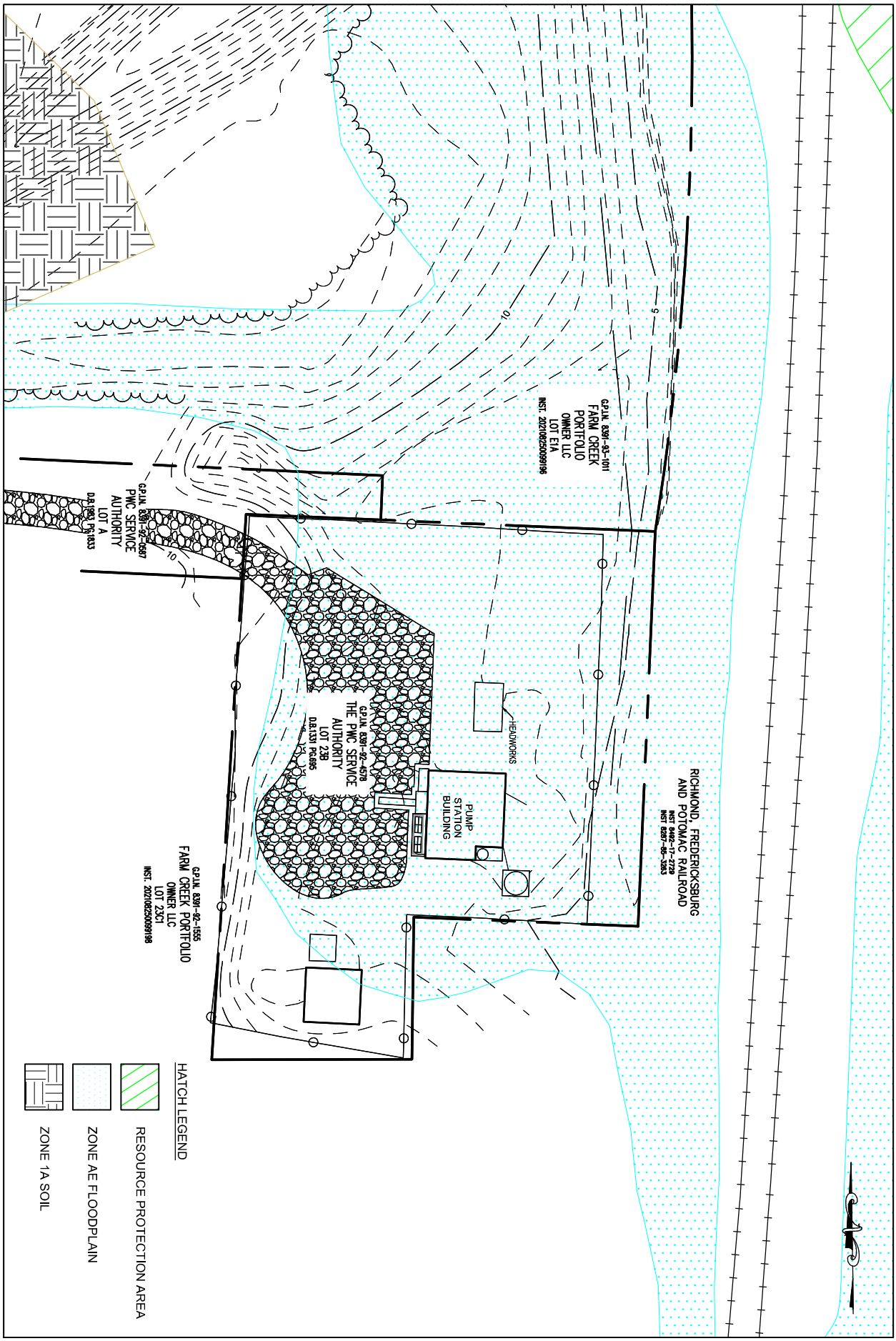
DATE	SCALE	TITLE	FIGURE NO.
07/2023	1" = 20'	EXISTING SITE LAYOUT	2.2
PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



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DATE	SCALE	TITLE	FIGURE NO.
07/2023	1" = 40'	EXISTING SITE - FLOODPLAINS, WETLANDS, AND SOILS	2.3
PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		

3. REGULATORY REQUIREMENTS

The new pump station will be designed in accordance with all regulatory requirements, including the following.

- Prince William County Service Authority Utility Service Manual (PWCSA USM)
- Virginia Sewage Collection and Treatment (SCAT) Regulations
- National Fire Protection Association (NFPA) 820
- Building Code

Additionally, although not a regulatory requirement, the new pump station will be designed in accordance with Hydraulic Institute Standards.

4. SYSTEM COMPONENTS

4.1 Introduction

The proposed Featherstone SPS system components include a new sewage pump station, a new discharge force main, and wet weather equalization storage.

4.2 Featherstone Sewage Pump Station Projected Flows

Pump station flow projections were developed under the Master Plan task order. The SA provided water billing data from winter months. These demands were spatially allocated throughout the model to best represent the current distribution of loadings. The SA then calibrated existing flows to match SCADA data at each pumping station, adding additional flow to represent inflow and infiltration (I&I) specific to each sewer shed. This is considered to be the average day demand (ADD) tributary to the pump station.

Future flows were developed for the Planning Period (Year 2020-2045) based on forecasted water use and population projections. Population data was collected from the 2020 Washington Metropolitan Area Water Supply Study, Demand and Resource Availability Forecast for the Year 2050, dated September 2020 (WMA Study) and the Metropolitan Washington Council of Governments (MWCOG) Round 9.1 Forecasts. Projected flows were calculated by multiplying per capita demand forecasts by the projected population in five-year intervals. The ratio of consumed water demand to generated wastewater flow was assumed to be 1:1.

Peak hour flow (PHF) is calculated using peaking factors specific to each service area. For the East Service Area, which includes the Featherstone SPS, the following peaking factors are applied:

- Sewer Subshed ADD < 0.5 MGD: Peaking factor of 4.
- Sewer Subshed ADD > 0.5 MGD. Peaking factor of 2.5.

The Featherstone sewer subshed ADD is greater than 0.5 MGD and therefore a peak factor of 2.5 is used to determine PHF.

Table 4.1 summarizes the projected ADD and PHF to the Featherstone SPS at each time step during the planning horizon.

Table 4.1 Featherstone SPS Projected ADD and PHF

YEAR	AVERAGE DAILY DEMAND (ADD) GPM	PEAK HOUR FLOW (PHF) GPM
2020	5,115	12,787
2025	5,824	14,559
2030	6,381	15,952
2035	6,735	16,838
2040	7,039	17,597
2045	7,292	18,230

In accordance with the level of service criteria determined under the Master Plan, the future Featherstone SPS will be designed such that 80% of firm pump station capacity is equal to the PHF. Based on the projected 2045 PHF of 18,230 GPM, the proposed Featherstone SPS design firm capacity is 23,000 GPM.

4.3 Force Main

4.3.1 Introduction

Due to the increased pump station capacity and resulting discharge flow rate, a new pump station force main will be required for the project. With the proposed firm pump station capacity of 23,000 GPM, the velocity in the existing 30-inch diameter force main would exceed the 8 fps (feet per second) threshold set by both the PWCSA Utility Service Manual (SA USM) and Virginia Department of Environmental Quality (DEQ) Sewage Collection and Treatment (SCAT) regulations. Therefore, a ~~larger~~ new force main will be required.

For the purposes of this report, it is assumed that the new force main will follow the existing force main alignment and match the existing force main elevations. An alignment evaluation should be completed during the design phase of this project to confirm the final routing, configuration, easements, permits, schedule, and cost to construct the new force main.

4.3.2 Force Main Size

The SCAT regulations and the SA USM allow for a maximum force main velocity of 8.0 fps and a minimum velocity of 2.0 fps.

See L16 FEATHERSTONE FORCE MAIN EVALUATION

The force main pipe size is selected for an ultimate Featherstone Pump Station pumping rate of 23,000 GPM. A 42-inch Class 52 ductile iron pipe (DIP) results in a velocity of 5.06 fps in the force main, meeting both the minimum and maximum velocity requirements. The proposed force main design requirements are summarized in **Table 4.2**.

Table 4.2 Force Main Design Requirements

FORCE MAIN MATERIAL	NOMINAL DIAMETER (IN)	INSIDE DIAMETER (IN)	SPS FIRM CAPACITY (GPM)	FM VELOCITY AT FIRM CAPACITY (FPS)	MAX. SPS CAPACITY AT 8 FT/S (GPM)
DIP (Class 52)	42	43.07	23,000	5.06	36,350

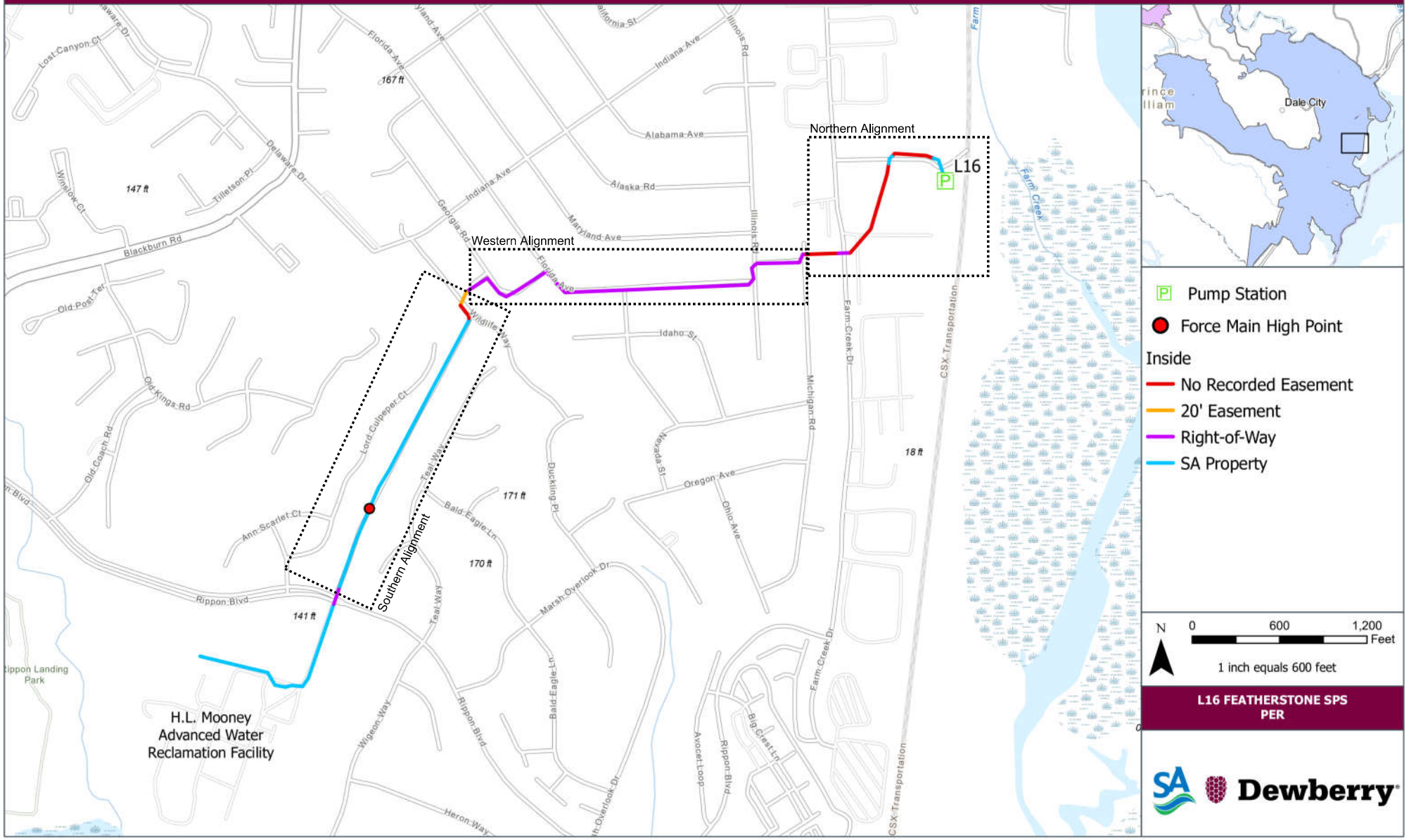
4.3.3 Force Main Easement

Dewberry performed a preliminary assessment to quantify additional easement needed to construct a new forcemain. This assessment includes reviewing the record drawings of the existing force main to determine the extent of existing easements and the feasibility of locating the new force main within any existing easements.

The force main alignment travels generally southwest from the pump station parcel to the HL Mooney Advanced Water Reclamation Facility (AWRF). The alignment encounters a variety of property types including existing easement, right-of-way, SA property and private property. Dewberry generally assumed portions of the alignment located within right-of-way and SA owned property will not require easement. Portions of the alignment located within private property will require a new permanent utility easement. Portions of the alignment located within an existing utility easement may require temporary construction easement or a widening of the existing easement.

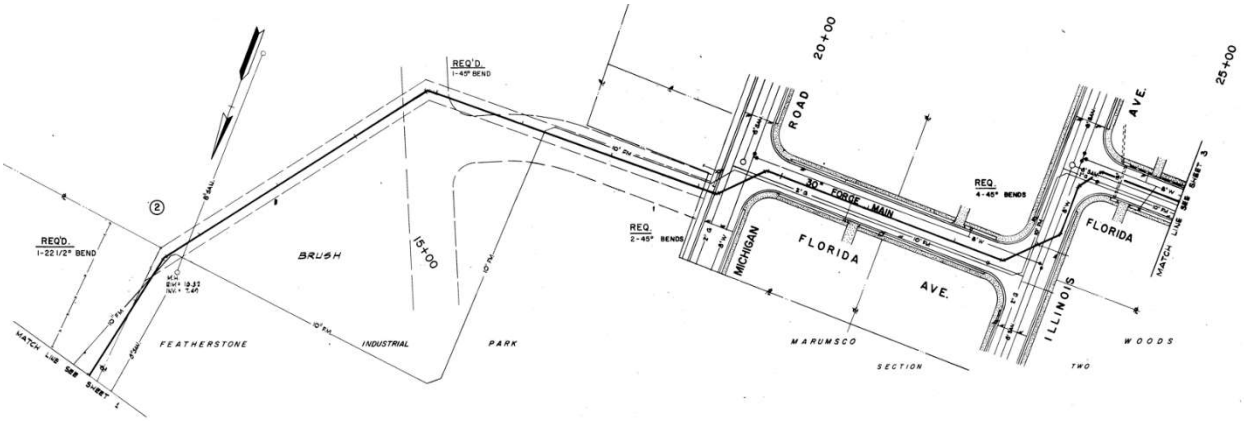
The force main alignment is shown in **Figure 4.1.**

FIGURE 4.1 - FEATHERSTONE FORCE MAIN ALIGNMENT



Beginning at the pump station, the first portion of the force main alignment travels west along the access road on parcel GPIN 8391-93-1011 before turning south through industrial property on parcel GPINs 8391-92-1555 and 8391-92-1206. The alignment then turns west to cross Farm Creek Drive and through parcel GPIN 8391-82-5821 before reaching Florida Ave. where a 20-foot easement is assumed. The record drawings along this portion of the alignment show dashed lines surrounding the force main with an approximate width of 20 ft. However, as shown in **Figure 4.2,** this area is not specifically designated as an easement. Therefore, Dewberry is not able to access the constructibility within this portion of the existing easement without conducting additional land records research.

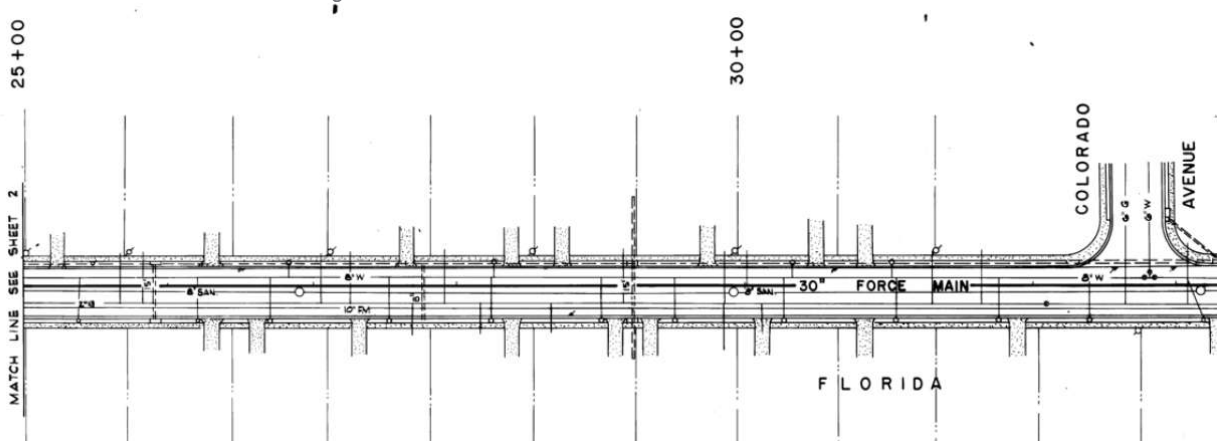
Figure 4.2 Northern Force Main Alignment



It should be noted that at the time of construction, portions of this section of the alignment were located at the former Featherstone Sewage Treatment Plant. This area has since been subdivided and redeveloped in to multiple industrial property (GPINs 8391-92-1555 and 8391-92-1206). To avoid conflicts with the industrial complex, the proposed force main could be installed in the shoulder adjacent to the pump station entrance road to Farm Creek Drive and travel south along Farm Creek Drive, re-joining the existing alignment near Florida Ave.

The alignment then travels west along Florida Ave., Georgia Rd., and Georgia Ct. This section of the alignment is within the right-of-way. There are several utilities within the right-of-way along this section of the alignment including water, gas, and gravity sewer as shown in **Figure 4.3.** Due to these existing utilities, the construction of a parallel force main within the limits of pavement will be difficult. While it is not anticipated that the force main will need to be located outside of the right-of-way, additional utility relocation may be needed to accommodate the parallel force main.

Figure 4.3 Western Force Main Alignment

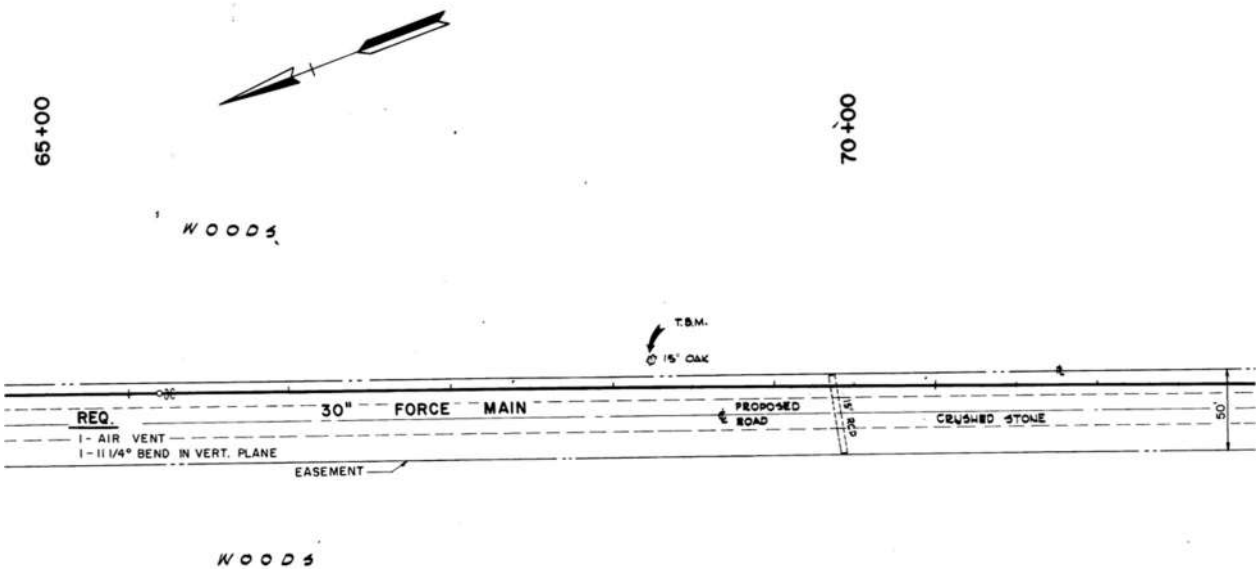


South of Georgia Rd., the alignment travels south through parcels GPIN 8391-61-0994 and 8391-61-1985 before reaching parcel GPIN 8391-51-7302, which is owned by the Service Authority. The alignment follows this parcel south before crossing Rippon Blvd. and entering the HL Mooney AWRF.

A 20-foot easement is recorded on parcel GPIN 8391-61-0994. The existing force main is generally located in the center of this easement; therefore, the easement will need to be widened to accommodate a parallel force main. Record drawings show that this easement ends, and no easement is recorded on the southeasterly oriented section of the alignment on parcel GPIN 8391-61-1985. Therefore, at this stage, it is assumed that no easement exists. The existence of an easement needs to be verified with subsequent plat studies, which are beyond the scope of this work.

The section of the alignment extending south to the HL Mooney AWRF runs through parcel GPIN 8391-51-7302, which is owned by the Service Authority. As shown in **Figure 4.4,** this area is shown as being located within a 50-foot-wide easement in the record drawings. The record drawings do include an annotation that the area is a proposed road, however, no road was constructed in this area. The force main is generally located to the west of the property and there appears to be adequate space to construct a parallel force main within the limits of the property without obtaining an easement.

Figure 4.4 Southern Force Main Alignment



The total length of the alignment is approximately 8,000 LF. Based on this review, it is anticipated that approximately 1,650 LF of the alignment from the existing station to Florida Ave. does not have a recorded easement on the record drawings. It is assumed that a new easement will be required for this section of the alignment. An additional approximately 100 LF of the alignment directly south of Georgia Ct. is located within an existing 20-foot easement. This easement will need to be widened to accommodate a parallel force main.

Approximately 2,700 LF of the alignment along Florida Ave, Georgia Rd. and Georgia Ct. is within public right-of-way. Although this section contains multiple existing utilities, it is not anticipated that additional easement will be required. Approximately 3,550 LF of the alignment between Georgia Ct. and the HL Mooney AWRF is located within SA property with adequate space to construct a parallel force main.

Dewberry recommends completing a desktop alignment analysis to confirm these assumptions and review two potential alignments for the force main.

4.4 Equalization Storage

As part of the Master Plan task order, Dewberry conducted a sewer equalization study for the East End Sewer System. The study identified equalization system needs to facilitate wet-weather flow management at facilities within the service area. Dewberry developed a wet-weather hydrograph for each facility. Storm flows were calibrated during the SA1911 System Wide Master Plan Technical Memorandum 4: Sewage Collection System – Future Collection System Improvements Identification.

The required equalization storage resulting from 2-year, 5-year and 10-year, 24-hour design storms represents the volume of flow that exceeds the Featherstone SPS firm capacity. **Table 4.3** summarizes the calculated storage needed for each 24-hour design storm at each timestep in the planning period.

Table 4.3 Required Flow Equalization Storage Volume

DESIGN STORM	2020 STORAGE (GAL)	2025 STORAGE (GAL)	2030 STORAGE (GAL)	2035 STORAGE (GAL)	2040 STORAGE (GAL)	2045 STORAGE (GAL)
2-Year, 24-hour	1,116	41,759	95,873	136,215	176,512	211,552
5-Year, 24-hour	247,602	360,913	462,629	532,507	590,723	646,254
10-Year, 24-hour	595,114	749,295	877,599	967,621	1,043,738	1,111,258

An equalization storage volume needed to contain a 10-year, 24-hour storm was selected as the basis of design for this report. This will maximize the potential onsite storage while complying with the anticipated site constraints.

The 2045 10-year storm will require flow equalization storage of 1.11 million gallons at Featherstone SPS.

The anticipated peak pump station influent flow rate during a 10-year wet weather event is 29,900 GPM. Based on the pump station firm capacity of 23,000 GPM, the peak flow rate into the equalization basin is 6,900 GPM.

Refer to **Section 7** for additional information on the equalization storage design and the associated pumping facilities.

5. FEATHERSTONE PUMP STATION DESIGN COMPONENTS

5.1 Main Pumping Configuration

The pump station configuration must consider the number of pumps installed in the SPS. The SA USM requires the pump station design include a two-chamber wet well.

Two pump configuration alternatives were identified as summarized in **Table 5.1**.

Table 5.1 SPS Pump Configuration Alternatives

NUMBER OF PUMPS	PUMPS PER WET WELL CHAMBER (SIDE A / SIDE B)
3 total (2 Duty, 1 Standby)	2 / 1
4 total (3 Duty, 1 Standby	2 / 2

To simplify the pump station, provide better redundancy, and operational flexibility, it is preferable that each wet well chamber have the same number of pumps. Therefore, it was decided that the station should be designed with four (4) main pumps total. With this configuration, each pump will have a design

capacity of 7,670 GPM, which will provide a firm pump station capacity of 23,000 GPM, with one pump out of service.

See L16 FEATHERSTONE FORCE MAIN EVALUATION

5.2 Pump Station Hydraulic Analysis

Dewberry developed a hydraulic model utilizing Bentley WaterGEMS for the Featherstone SPS for the purpose of developing system curves to evaluate the future system hydraulics and determine proposed conditions for future SPS upgrades. The model was developed based on the following assumptions:

- New 42-inch diameter DIP discharge force main, Class 52
- New force main will be installed parallel to the existing force main, with matching elevations
- Minor losses are not included

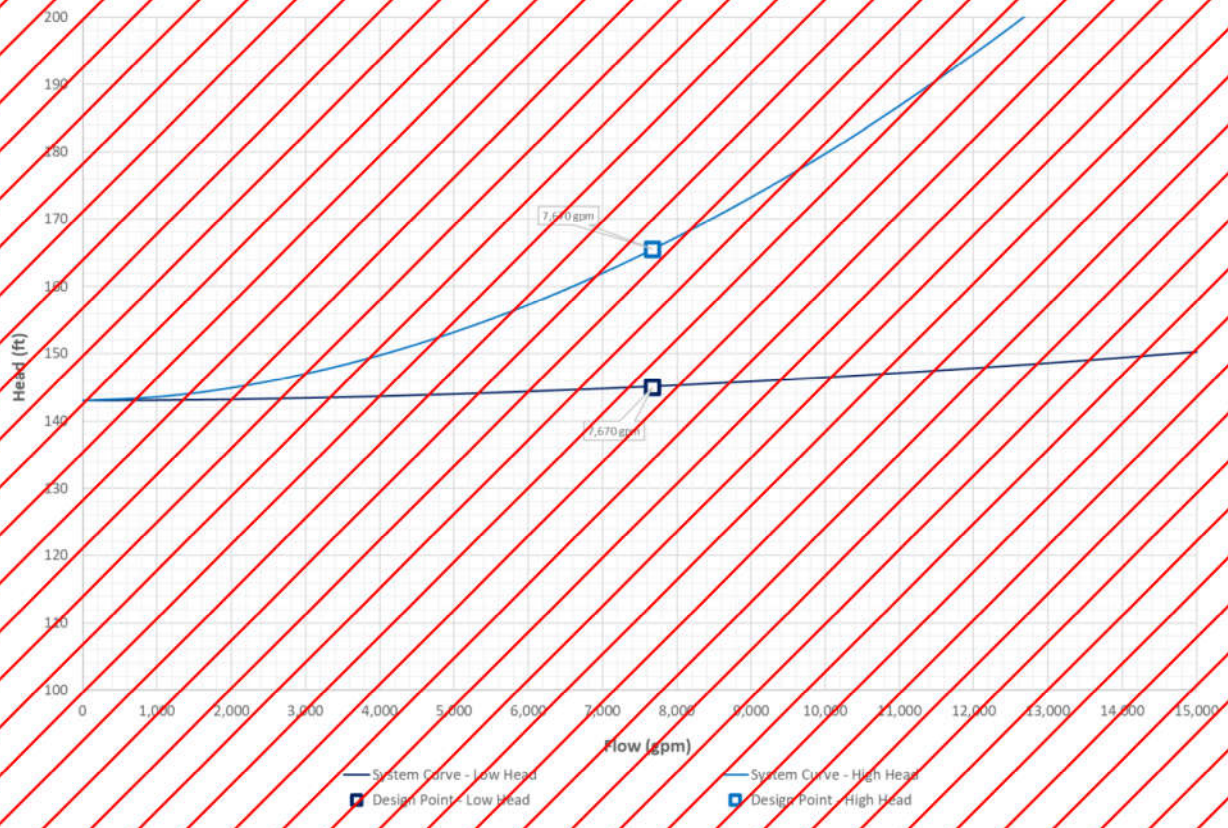
To evaluate the full range of hydraulic conditions over the life of the facility, two operating scenarios were analyzed for the Featherstone SPS. A high head scenario assumes three (3) pumps are operating and the 42-inch force main has a Hazen Williams C value of 100. The low head scenario assumes a single pump operating and the force main has a C value of 120. The operating conditions for each scenario are summarized in **Table 5.2**.

Table 5.2 Hydraulic Analysis Scenarios

SCENARIO	C-FACTOR	NO. OF ACTIVE PUMPS
High Head	100	3
Low Head	120	1

The resulting system curves and design points are shown in Figure 5.1.

Figure 5.1 L16 Featherstone Proposed Design Points



Based on the system curves, the pumps should be selected to meet the high head condition of 7,670 GPM at 166 ft TDH and can operate at a reduced speed to meet the low head condition of 7,670 GPM at 145 ft TDH.

5.3 Pump Selection

A preliminary pump selection was obtained to identify the pump station design requirements including pump motor horsepower, pump efficiency, and the pump station mechanical layout. The preliminary selection is based on a Flygt dry-pit submersible pumps and are summarized in the **Table 5.3**.

Table 5.3 Preliminary Main Pump Selection

PARAMETER	MAIN PUMPS	
	HIGH HEAD	LOW HEAD
Model	Flygt NT 3312	
Operating Point	7680 GPM @ 170' TDH	9,500 GPM @ 146' TDH
Efficiency	75.9%	72%
Impeller Diameter	565 mm	
Motor Size	470 HP	
NPSHr	24.6 ft	38 ft

5.4 Headworks

5.4.1 Introduction

The Featherstone SPS will include a headworks with mechanical equipment to remove or grind larger debris before wastewater is discharged to the wet well. The headworks equipment helps protect the pumping units and prevents sending large debris downstream.

5.4.2 Design Capacity

Headworks equipment will be designed to pass the 10-year storm peak influent flow rate of 29,900 GPM. The headworks will be designed with full redundancy to pass this flow rate with the largest unit out of service. An alternative would be to size the headworks to pass the full design flow and provide a manual bar rack for redundancy. The benefit to designing the headworks to pass the full flow with one unit out of service is that it prevents the operations staff from having to regularly enter the wet well during periods where a grinder or screen is out of service. This will save operational costs and reduce health and safety risks for operations staff.

5.4.3 Equipment Evaluation

Mechanical screens and grinders are identified as the two headworks equipment alternatives. The evaluation of the two alternatives includes a description of the equipment, preliminary equipment selection, general layout, debris disposal requirements, operator familiarity and equipment capital cost.

5.4.3.1 Mechanical Screens

Mechanical screens vary in design and operation, however, generally rely upon either perforated plates or bars/plates that are at a set spacing/opening sizes to prevent solid debris from passing through the screens. Debris collected on the screens is removed from the wastewater flow, collected, and disposed of offsite. The design differences between different screens impacts the head loss, capture efficiency, and operation and maintenance.

The preliminary equipment selection is based on two (2) Fairfield catenary mechanical bar screens each with a rated capacity of 29,900 GPM, to meet the expected peak wet weather flow with one screen out of service. **Table 5.4** summarizes the mechanical bar screen basis of design selection. Refer to **Attachment E** for additional information on the preliminary mechanical bar screen selection.

Table 5.4 Mechanical Screen Summary	
PARAMETER	**DESIGN**
Number of Screens	2
Make and Model	Fairfield CAT-03
Peak Design Flow Rate (per screen)	29,900 GPM
Opening Size	6 mm
Headloss	7.3 in
Upstream Water Depth	12.5 ft
Channel Width	6 ft

Refer to **Figure 5.2** for a preliminary layout of the pump station headworks with mechanical screening equipment.

The primary benefit of mechanical screens is that the debris is removed from the sewage flow before passing into the wet well. This will minimize the need to clean out the wetwell and equalization basin and will eliminate the need for a solids flushing system in the equalization basin. The screenings that are removed are required to be washed and compacted and then disposed of offsite, which requires additional equipment, additional disposal costs, and are an additional source of odor.

Based upon preliminary calculations, a significant volume of screenings will be produced. Although screens are designed to pass a peak flow rate, the screenings volume estimation is based on average annual flows and maximum monthly flows. An average flow of 10.5 MGD was assumed, with a peak factor of 1.5 equating to a flow rate of 15.75 MGD for a typical maximum day.

Table 5.5 Screenings Production Estimates	
FLOW RATE	**SCREENINGS* (CUBIC YARDS/DAY)**
10.5 MGD (Average Day)	1.3 – 2.3
15.75 MGD (Maximum Day)	1.9 – 3.5
*Screenings estimate is based on values for 3 mm screens and assumes a 50% volume reduction in washer and compactor. (Reference: WEF Manual of Practice 8 Design of Wastewater Resource Recovery Facilities)	

Screenings will be conveyed to a dumpster for disposal. **Table 5.6** provides summary of anticipated dumpster capacity based on the average day flow.

Table 5.6 Dumpster Capacity			
30 YARD DUMPSTER (DAYS)	**20 YARD DUMPSTER (DAYS)**	**15 YARD DUMPSTER (DAYS)**	**10 YARD DUMPSTER (DAYS)**
13 - 23	8 - 15	6 - 12	4 - 8

Based upon the potential odor from the screenings dumpster, it is recommended to place the screens, conveyors, and dumpster inside of a building with odor control.

Although the headloss through the screen is not significant, screen installations require deeper channels that grinders to prevent excessive velocities from pushing solids through the screen. The channel depth will be impactful to the cost of construction.

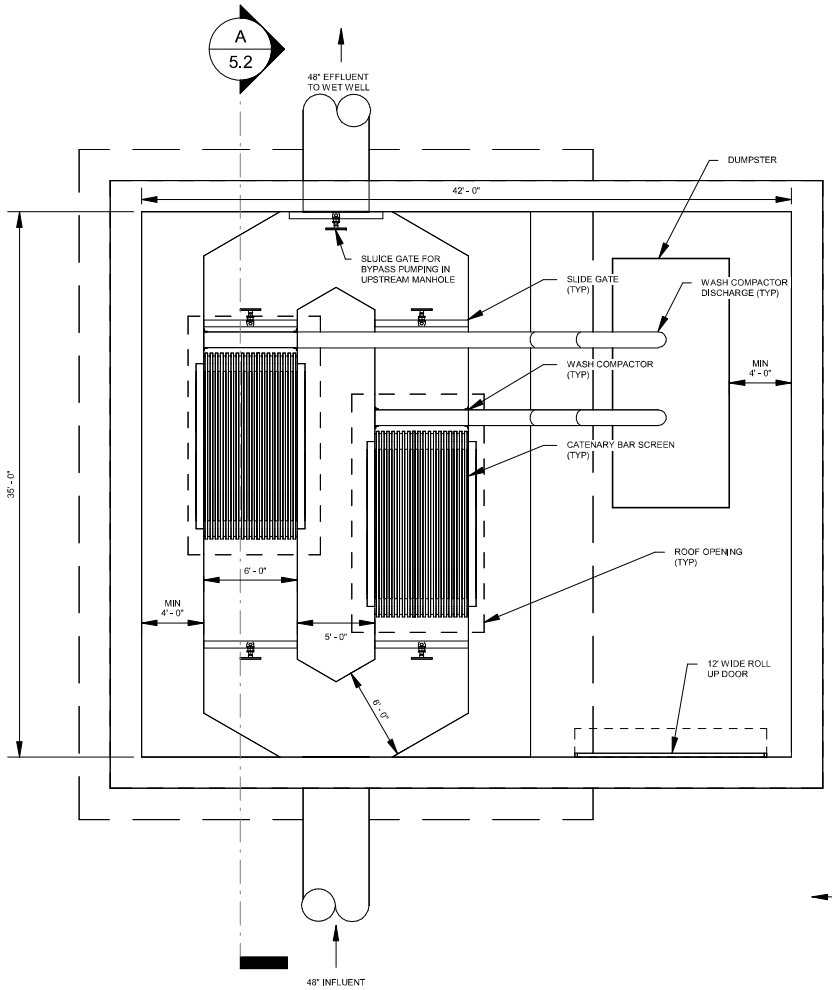
PWCSA does not currently have mechanical bar screens installed at any of the collection system pump stations. The installation of mechanical screens will require operator training for operation, maintenance, and troubleshooting of the new equipment.

5.4.3.1.1 Mechanical Screens Advantages

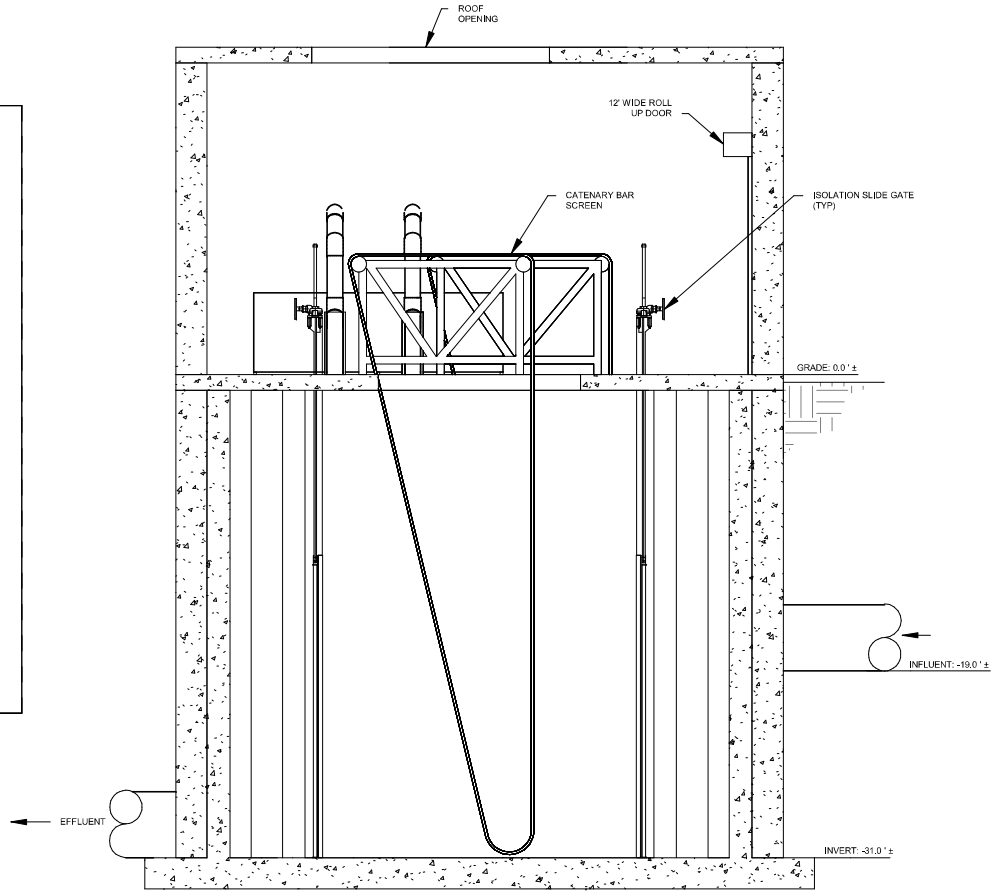
- Debris removed from sewage
- Reduced debris load at WWTP
- Eliminates need for flushing system at EQ tank
- Reduces need for cleaning wetwell
- Reduces chance of pumps clogging due to wipes and other stringy material

5.4.3.1.2 Mechanical Screens Disadvantages

- More complex
- Requires disposal of screenings
- Requires a building to house the screens, washer and compactor, and dumpster
- Deeper channel
- Operations staff unfamiliarity



1 SCREEN PLAN
Scale: 1/8" = 1'-0"



A SCREEN SECTION
Scale: 1/8" = 1'-0"

NOTE:
1. ALL ELEVATIONS ARE APPROXIMATE

FIGURE NO. 5.2

TITLE PRELIMINARY SCREENS LAYOUT

SCALE 1/8" = 1' - 0"

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5.4.3.2 Grinders

In lieu of removing the solids from the sewage flow, grinders shred solids into smaller pieces so that they can be handled by the wastewater pumps. Grinders are typically equipped with rotating cutter stacks that cut up the debris as the flow passes through the grinder.

Preliminary equipment selections are based on a total headworks design capacity of 29,900 GPM with one grinder out of service. Two preliminary grinder selections were obtained from JWC to determine the optimal number of grinders. Refer to **Table 5.7** for a summary of design flow for each option.

Table 5.7 Grinder Option Summary

NO. OF GRINDERS	REQ. CAPACITY, TOTAL (GPM)	REQ. CAPACITY PER GRINDER (GPM)
3	29,900	14,950
2	29,900	29,900

Similar to the mechanical screen design, it was assumed that the grinders would provide the required capacity with one grinder out of service. Based upon the increase in capacity of the JWC channel grinders, if two grinders are installed each rated for 100% of the flow, the provided firm capacity with one unit out of service is 11,000 GPM over the required capacity, and the provided total capacity is 51,900 GPM over the required capacity. This is approximately 37% and 75% overdesigned. However, if three grinders are installed each rated for 50% of the design flow, they match the design flow much closer.

The cutter stacks for grinders that operate significantly under capacity tend to corrode faster while operating grinder closer to the design point typically leads to more efficient operation. Therefore, it is recommended that three grinders be utilized for the headworks. **Table 5.8** summarizes the grinder basis of design selection. See **Attachment E** for additional information on the preliminary grinder selection.

Table 5.8 Grinder Summary

PARAMETER	DESIGN
Number of Grinders	3
Grinder Make and Model	JWC Model CDD4020
Peak Design Flow Rate	15,100 GPM per grinder; 30,200 GPM firm capacity
Headloss	44 in
Upstream Water Depth	44 in
Channel Width	54 in

Refer to **Figure 5.3** and **Figure 5.4** for conceptual layouts of the headworks with grinders.

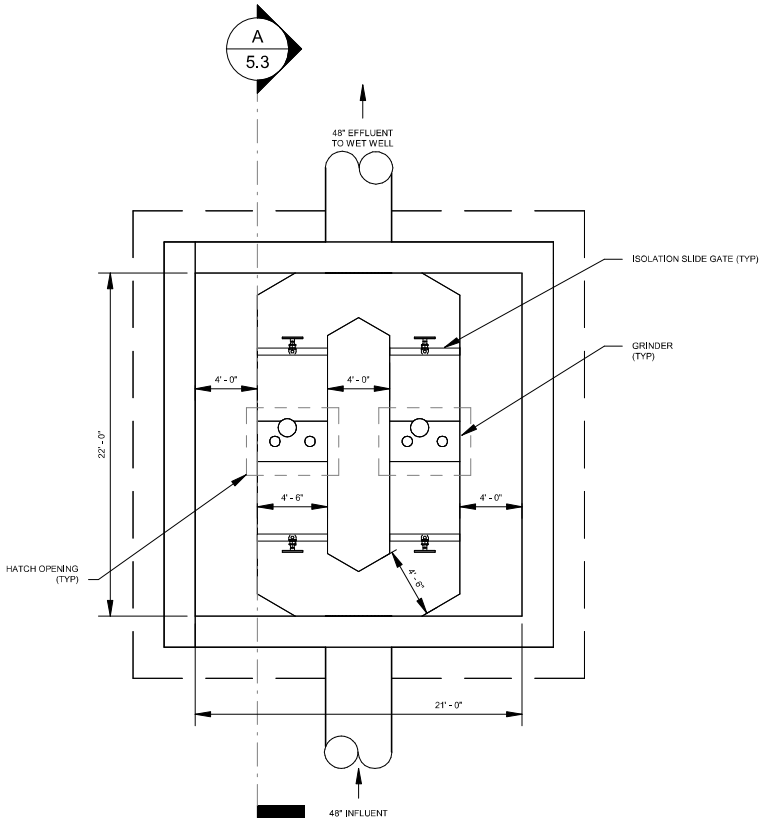
The key benefit to grinders is that collection and disposal of screenings is not required. The grindings are not removed from the sewage stream but instead passed along to the wastewater treatment plant where they will then be removed. Since solids are not removed, this does require special attention in the design of the pump station wet well and equalization basin. Currently, many of the SA sewage pump stations are equipped with grinders. Therefore, the operators have significantly more experience performing maintenance, troubleshooting, and operating grinders.

5.4.3.2.1 Grinder Advantages

- Screenings removal is not required
- A building to house collection and disposal equipment is not necessary
- Requires shallower channel, resulting in a lower construction cost
- Operations staff familiarity

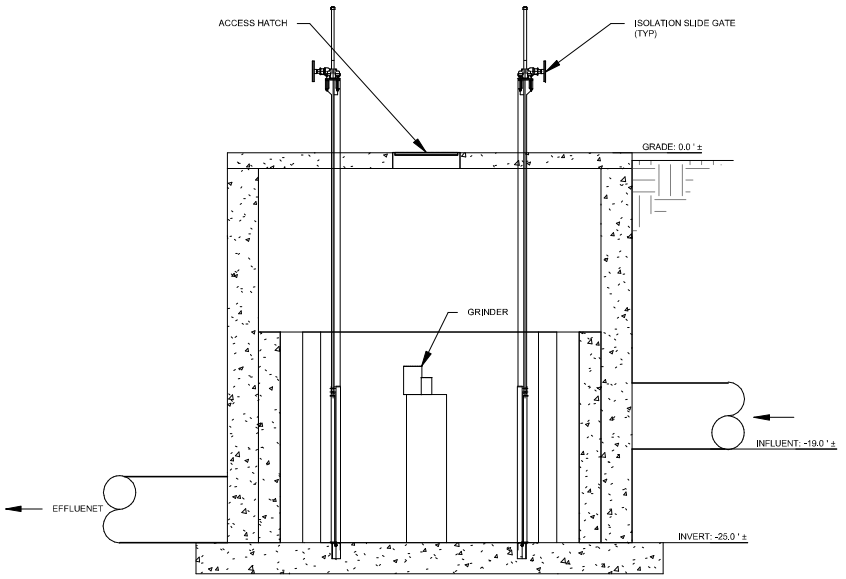
5.4.3.2.2 Grinder Disadvantages

- Solids are not removed from the wastewater stream
- Solids require design accommodations for the wet well, equalization tank, and pumping system



1 TWO GRINDER OPTION PLAN

Scale: 1/8" = 1'-0"



A TWO GRINDER OPTION SECTION

Scale: 1/8" = 1'-0"

NOTE:
1. ALL ELEVATIONS ARE APPROXIMATE

FIGURE NO. 5.3

TITLE PRELIMINARY GRINDER LAYOUT - TWO GRINDERS

SCALE 1/8" = 1'- 0"

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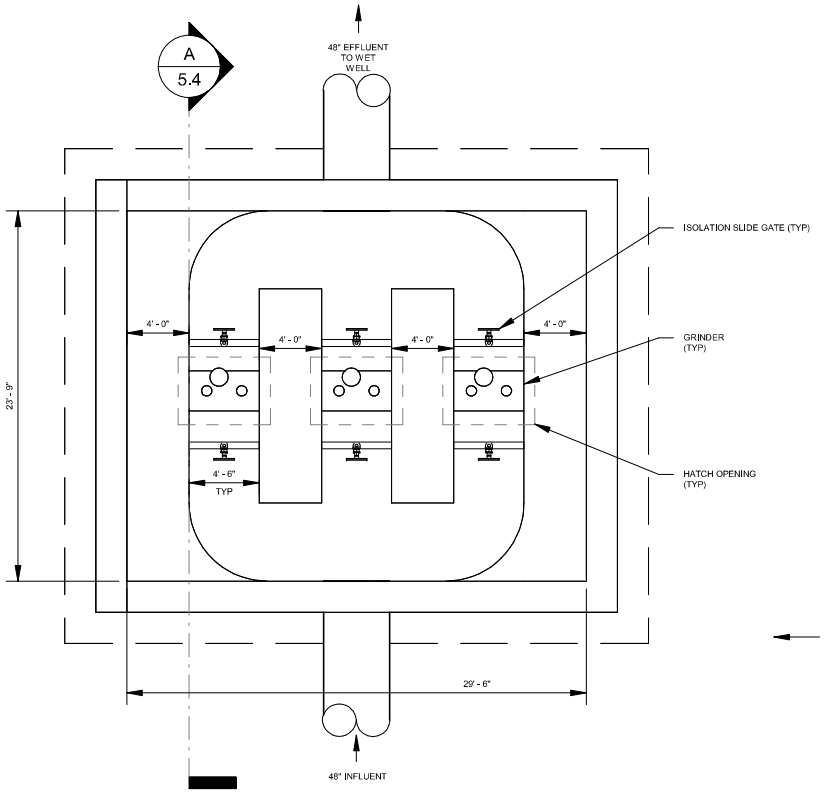

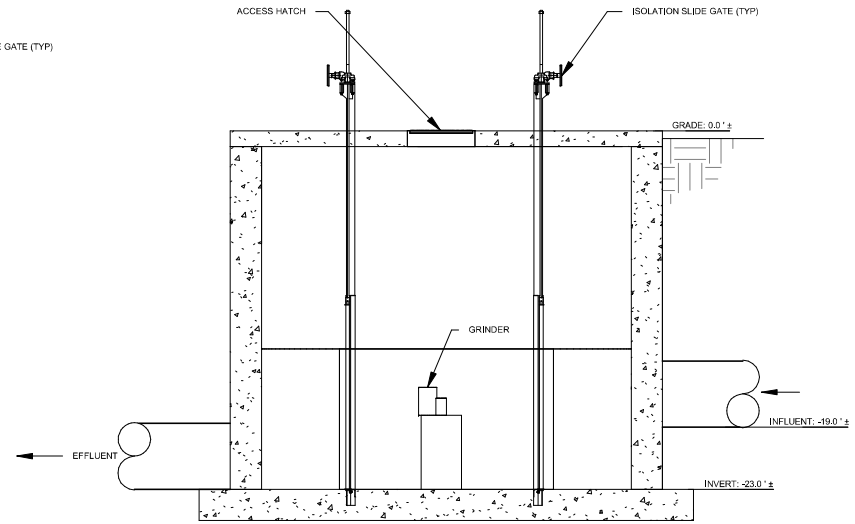

1 THREE GRINDER OPTION PLAN
Scale: 1/8" = 1'-0"

A THREE GRINDER OPTION SECTION
Scale: 1/8" = 1'-0"

NOTE:
1. ALL ELEVATIONS ARE APPROXIMATE

FIGURE NO. 5.4

TITLE PRELIMINARY GRINDER LAYOUT - THREE GRINDERS

SCALE 1/8" = 1' - 0"

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5.4.3.3 Summary and Conclusions

Both mechanical screens and grinders are feasible for the headworks; however, grinder are recommended for the following reasons:

- The grinders are a simpler technology, and do not require additional screenings washing, compacting, conveying or disposal equipment.
- The odor concerns related to collected screenings and dumpster disposal are not an issue for the grinders
- The mechanical screens would require deeper channels and a building, which would increase the capital cost.
- The grinder equipment will not require the routine disposal of solids.
- This pump station is upstream of the Mooney Water Reclamation Facility, where screenings are currently removed.
- PWCSA pump station operators are familiar with the operation and maintenance requirements and troubleshooting of grinder equipment and grinders are typical and wastewater collection system pump stations.

The primary drawback to the grinders is that the solids will remain in the flow stream and will flow into the equalization basin during peak events. This may result in odors and additional maintenance requirements for the equalization basin. Refer to **Section 7** for a discussion on the equalization basin flushing requirements.

Three (3) grinders in parallel channels will be assumed as the basis of design for the Featherstone SPS.

5.5 Wet Well

The SA USM requires new sewage pump stations to be designed with a split wet well that is separated by a normally open sluice gate so that half of the wet well can be taken offline while maintaining function of the pump station.

Several wet well styles are commonly used in wastewater pump station design, including:

- Self-Cleaning Trench Style
- Circular Style
- Rectangular

Trench style or self-cleaning wet wells, as illustrated in **Figure 5.5** are characterized by a long narrow channel, which contains a significant change in elevation. This change in elevation causes a distinct hydraulic jump, which helps to prevent both solids accumulation and scum. However, the trench style is not practical for split wet wells and therefore it eliminated from consideration to allow for the wetwell to meet USM standards.

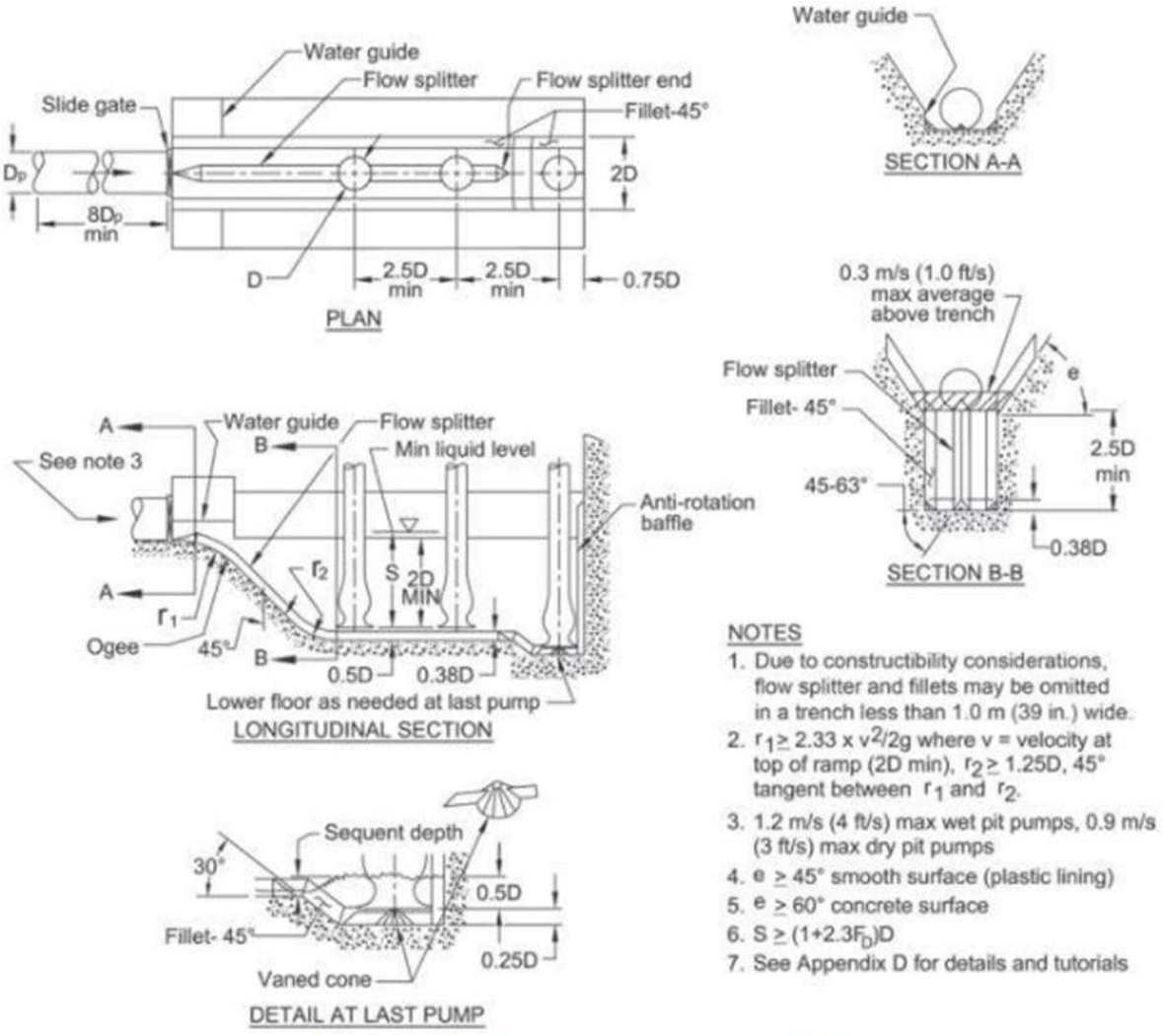
Circular style wet wells are ideal for smaller capacity pump stations, making use of a precast circular structure. Given the required depth of the wet well and anticipated pump station layout, a precast wet well will not be possible for Featherstone SPS, and therefore the circular style wet well was eliminated.

For larger pump stations, rectangular wet wells are most common. Cast-in-place rectangular wet wells provide an opportunity to tailoring the layout, size, depth and structural features to best meet the project requirements.

To allow for a split wet well design, a rectangular wet well is chosen. The wet well will be designed in accordance with Figure 9.8.4.4.4 Confined Wet Well of HI Standard 9.8. This wet well layout is characterized by steep sloped or vertical sides and a deep submergence. Additional considerations are

given to anti-rotation baffles, concrete fillets, and dividing walls. HI Standard 9.8 also provides recommendations of working volumes of wet wells.

Figure 5.5 Hydraulic Institute Figure 9.8.4.1.4 - Open Trench-Type Wet Well



5.6 Piping and Valves

The pump station interior piping will be Class 53 flanged ductile iron pipe and fittings. The pipe and fittings will be rigidly supported from the slab or wall. Individual pump suction piping will be 24” diameter to limit the velocity to less than 6 fps. Individual pump discharge piping will be 20” diameter to limit the velocity to less than 8 fps. The pump station discharge header will be ~~42”~~ 30" diameter to match the force main size.

Each pump will have a plug valve on the suction pipe and one on the discharge pipe to allow for isolation. A check valve will be installed on the pump discharge piping to prevent reverse flow through the pump. The discharge header will be equipped with surge relief valves of a size and design to be determined during preliminary design. Two surge relief valves are utilized in order to reduce the valve sizing and provide redundancy for maintenance. Combination air release valves will be provided as necessary at high points.

To simplify the dry well layout and ensure accessibility, the effluent flow meter will be located in a concrete vault on the exterior of the pump station building. Isolation plug valves will be provided for the magnetic flow meter.

5.7 Heating, Ventilation and Air Conditioning

5.7.1 Introduction

Heating, ventilation and cooling (HVAC) requirements will vary based on the pump station area:

- Wet Well
- Dry Well
- Electrical Room

The major design factors that need to be evaluated for each alternative are as follows:

- NFPA 820 requirements
    - Class 1 Division 1
    - Class 1 Division 2
    - Unclassified
- OSHA Standards
- Corrosion protection
- Electrical heat loads
- Odor Control

5.7.2 Wet Well

The wet well will be ventilated to provide continuous air change to prevent the accumulation of corrosive gases and provide odor control. This air change rate will be confirmed based upon the anticipated corrosive gas load during preliminary design; a preliminary air change rate of 3 air changes per hour was assumed. Hydrogen sulfide gas concentrations can be measured in the existing wet well and a safety factor can be applied to determine the anticipated concentrations; based upon the anticipated concentrations, the air change rate per hour may be increased to provide a more robust design. The air vacated from the wet well should be sent through an air phase odor control system to remove odors and prevent them from becoming a nuisance problem.

5.7.3 Dry Well

The dry well will be declassified from Class 1 Division 2 to unclassified, which requires continuous ventilation at 6 air changes per hour and additional monitoring and alarms. The dry well will also require unit heaters to prevent freezing.

5.7.4 Electrical Room

Based upon the heat load from the electrical equipment, the electrical room will require a cooling system.

5.8 Electrical System

The estimated pump station loads are summarized as shown in **Table 5.9**. The total load was calculated with the assumption that all 6 pumps were operating simultaneously.

Table 5.9 Proposed Electrical Loads	
DESCRIPTION	REQUIRED CAPACITY
Four (4) 470HP Main Pumps and Two (2) 135HP EQ Pumps	2,682A
Additional Auxiliary Load	350A
Total at 480V	3032A

Based on the anticipated loads, the Featherstone SPS will require 4000A service entrance rated equipment. A service disconnecting means will be mounted on the pump station exterior next to the utility CT cabinet.

The pump station electrical room will house the automatic transfer switch (ATS), main switchboard, low voltage infrastructure, pump control panels and variable frequency drives (VFDs).

The main pumps and equalization pumps will operate on VFDs. The basis of design is an 18-Pulse VFD with Reduced Voltage Soft Starter (RVSS) Bypass, which matches the VFDs currently installed at the existing Featherstone SPS. Active Front End VFDs should be evaluated during the design phase because they fulfill the requirements of the facility from a power quality standpoint but will also have a decreased heat output and necessitate a smaller physical footprint. Active front end VFDs are also less costly compared to the 18-Pulse alternative.

To serve this facility, a 3,000kVA transformer and 2,750kW standby diesel generator are recommended. The transformer and generator are conservatively sized to allow for all pumps to run simultaneously and accommodate future pump station expansions and upgrades. The generator will require a sound attenuated enclosure and a skid mounted fuel tank with fuel storage to maintain 100% facility load for 24 hours.

The utility transformer, generator and associated accessories will be located on the pump station site and will require concrete pads for mounting and underground electrical duct bank between equipment locations and the pump station electrical infrastructure.

5.9 Instrumentation and Controls

The control room will be provided with a new PLC and backup HMI with redundant power supplies, operator interface terminal (OIT), and full redundant back up controls and instrumentation complying with the latest version of PWCSA's SCADA Design & Configuration Standards. A separate Communications Rack will also be provided and will house the UPS and 24-port, Power over Ethernet, managed ethernet switch, and cellular router. Each cellular router will be provided with two Omni-directional antennas to be mounted a minimum 12" above the highest point on the building. The site will be provided with both a WAN and VLAN network for local and remote communications. The WAN will support the PLC, access control, operation video, and system management sub-networks.

5.9.1 Site Access Control and Security

Access control and security will be provided for the pump station. Access control will consist of a card reader at the designated primary entrance, intrusion switches at each door or hatch used for maintenance access, door exit controls, and a horn to sound during unauthorized intrusion. REX push buttons shall be provided for personnel exiting the building or site and shall be wired directly to the card reader. The building and site will also be provided with security cameras that will monitor electrical gear, access doors and hatches, and major equipment control panels. The security cameras will be backed by always-on lighting to allow for clear visibility.

Smoke detectors will be installed inside the pump station and will be directly monitored by the PLC. Smoke detectors shall be industrial grade and rated for its area classification.

5.10 Structural Requirements

The pump station will consist of a conventional one-story building above grade with an approximately 40 foot deep dry and wet well vault. The dry well portion will generally be located directly under the one-story building footprint.

The one-story above grade building will primarily house the electrical room. The building will have load bearing exterior walls with a truss bearing elevation of approximately 12'-0". Exterior walls will have split face block veneer with concrete masonry unit (CMU) backup. The roof structure will consist of pre-engineered cold-formed steel trusses.

The pump station dry well will contain six dry-pit pumps and associated piping and appurtenances. A drain channel along the dry well floor will be provided at the wet well/dry well divider wall which will flow to a sump.

The wet well will be subdivided into two sections by an interior concrete wall. A headworks including sewage grinder concrete channels with an invert at a higher elevation than the wet well will be located directly adjacent to the wet well. A suspended concrete top slab and grating will cover the channel grinder. The building footprint will not extend over the below grade wet well or headworks. Access hatches will be provided to access equipment.

Stairs and landings will be provided in both the dry well and wet well as required for access to the lower levels.

A bridge crane will be located in the dry well for lifting of the dry pit pumps to the place them under the access hatch. Miscellaneous structural slab-on-grades will be required to support process mechanical, electrical, and HVAC mechanical equipment located at grade.

5.11 Architectural Requirements

Architectural requirements will be coordinated with the Prince William County Planning Department and the PWCSA. Construction will generally match the existing construction of a block building with a split face block veneer or brick veneer. A Public Facilities Review (PFR) may be required in Prince William County, based on the Public Facilities Review determination request; refer to **Section 11** for details.

6. Pump Station Layout

The pump station will generally consist of a headworks, wet well, dry well, electrical room, and separate equalization basin. A summary of the pump station components and layout options is presented in this section.

6.1 Headworks

The headworks will generally consist of three parallel channels each with a grinder rated for 50% of the peak influent flow. A slide gate will be installed on either side of each grinder channel to allow for isolation. Each grinder will have an access hatch to facilitate the removal of the grinder for repair or replacement. The headworks will be accessed by a stairway.

6.2 Wet Well

As previously discussed, the wet well will be a two-compartment design in accordance with Hydraulic Institute Standard 9.8 Figure 9.8.4.4.4. Each half of the wet well will have a sluice gate for isolation, and there will be an additional sluice gate to allow the wet wells to be hydraulically connected during normal operation. The wet well will be accessible by access hatches in the wet well top.

Figure 6.1 Hydraulic Institute Figure 9.8.4.4.4 – Confined Wet Well

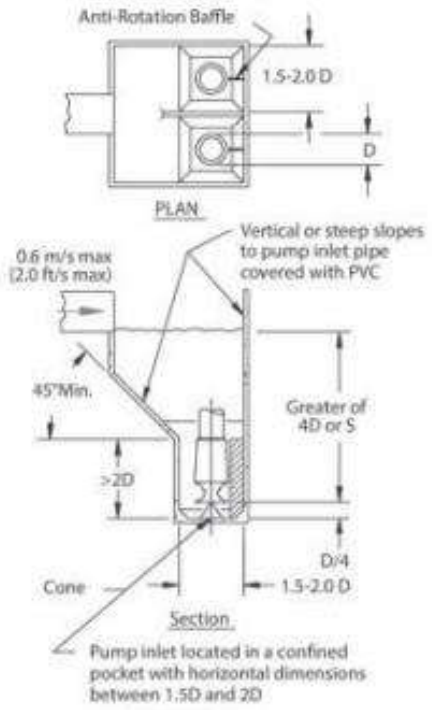


Figure 9.8.4.4.4 Confined wet-well design

6.3 Dry Well

The dry well will contain the dry-pit pumps, isolation valves, check valves, and surge relief valves. This space will be accessible via a dedicated stairwell with an exterior entrance.

A traveling bridge crane will be installed in the dry well to lift and move pumps, valves and appurtenances to an area underneath an access hatch. The access hatch will open at grade level. This will allow a crane truck to remove the equipment through the hatch.

Two dry well layouts were evaluated to compare building footprint, spacing requirements, equipment access, and constructability. The layouts assumed the wet well and dry well were independent of the headworks for visualization purposes, and the recommended layout will have the proposed headworks incorporated in.

6.3.1 Design Criteria

For both alternative layouts, the following design criteria was used:

- Wet well dimension and layout per HI Standards
- Provide minimum four (4) pipe diameters between the wet well isolation plug valve to the pump inlet elbow
- Provide minimum one (1) pipe diameter from the pump suction reducer to the pump inlet elbow
- Provide four (4) to five (5) pipe diameters from the pump discharge to the effluent check valve
- Provide minimum three foot six inches working room around all pumps and equipment

6.3.2 Layout Alternative 1 - Discharge Manifold Over Suction Pipes

Alternative 1 aligns the station discharge header along the shared wall with the wet well. This alternative requires that the header be installed above the pump suction lines.

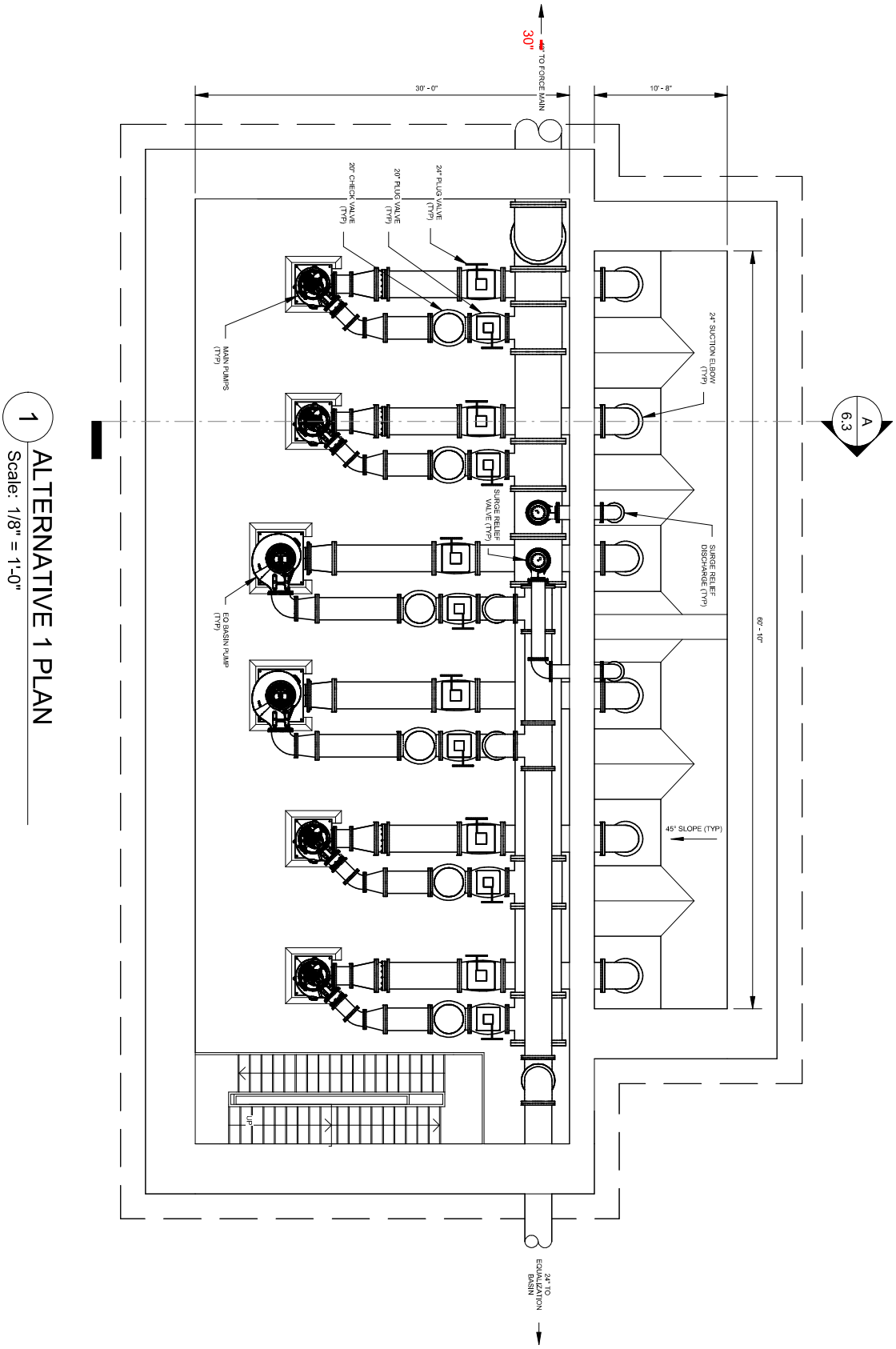
Refer to **Figure 6.2** and **Figure 6.3** for a plan and section of this layout alternative.

6.3.2.1 Dry Well Layout Alternative 1 Advantages

- Decreased length of dry well perpendicular to the wet well.

6.3.2.2 Dry Well Layout Alternative 1 Disadvantages

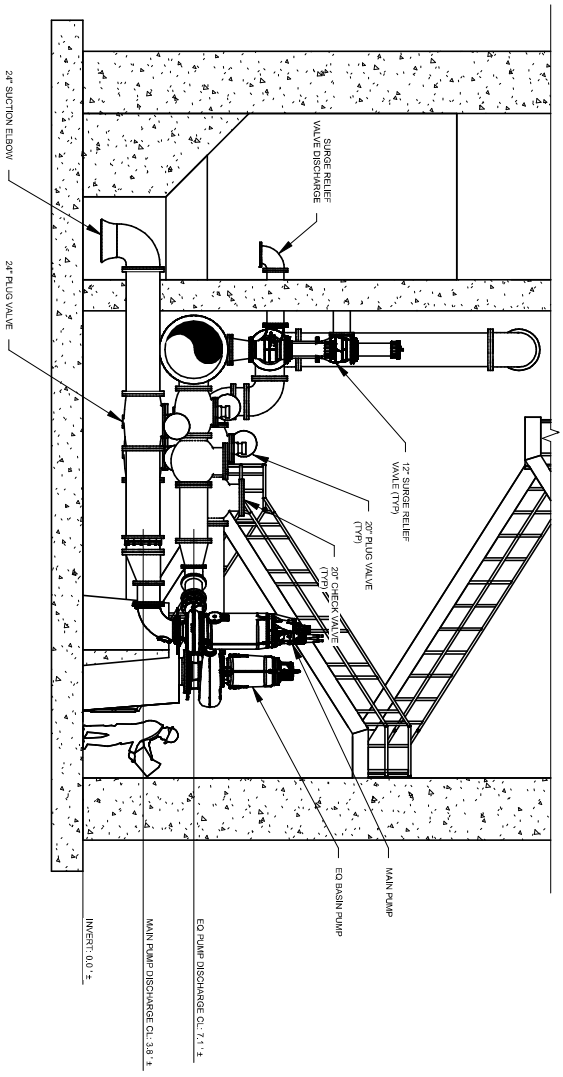
- Discharge piping and valves are elevated approximately 6 to 12 feet, which results in the following drawbacks:
    - Difficulty performing maintenance and inspection of valves
    - Difficulty and complexity supporting large diameter piping and associated thrust forces
    - Low headroom in several locations
- Although this layout reduces the drywell length, it increases the width and results in the overall size of the drywell being marginally larger.



1 ALTERNATIVE 1 PLAN

Scale: 1/8" = 1'-0"

Dewberry Dewberry Engineers Inc. 4805 Lake Brook Drive, Suite 200 Glen Allen, VA 23060 Phone: 804.290.7957 Fax: 804.290.7928	DATE 07/2023	SCALE 1/8" = 1' - 0"	TITLE LAYOUT ALTERNATIVE 1 - DISCHARGE MANIFOLD OVER SUCTION PLAN	FIGURE NO. 6.2
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



A ALTERNATIVE 1 SECTION

Scale: 1/8" = 1'-0"

Dewberry Dewberry Engineers Inc. 4805 Lake Brook Drive, Suite 200 Glen Allen, VA 23060 Phone: 804.290.7957 Fax: 804.290.7928	DATE 07/2023	SCALE 1/8" = 1' - 0"	TITLE LAYOUT ALTERNATIVE 1 - DISCHARGE MANIFOLD OVER SUCTION SECTION	FIGURE NO. 6.3
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		

6.3.3 Layout Alternative 2 - Discharge Header Opposite of Wet Well

Alternative 2 aligns the station discharge header along the wall opposite the wet well. This alternative requires that the individual pump suction lines be located in a pipe gallery accessible by removable grating. The intent of this layout was to reduce the width of the pump station and to maintain all piping as close to the slab as possible for ease of access and support.

Refer to **Figure 6.4** and **Figure 6.5** for a plan and sections of this layout alternative.

6.3.3.1 Dry Well Alternative 2 Advantages

- All valves are close to the floor for accessible maintenance and operation
- All piping is close to the floor for ease of supporting weight and thrust forces of piping
- Marginally smaller overall footprint

6.3.3.2 Dry Well Alternative 2 Disadvantages

- Increase length of dry well perpendicular to the wet well
- Multiple level slab construction

6.3.4 Summary and Conclusion

Based on the two alternative dry well piping layouts, Alternative 2 is the recommended alternative. The manifolded discharge header aligned along the wall opposite the wet well results in the following benefits:

- Compliance with HI standards
- Piping layout results in a marginally smaller footprint
- Valves and pumps are easily accessible for operation, maintenance, and inspection
- Large diameter piping can be supported from the floor

6.4 Electrical Room

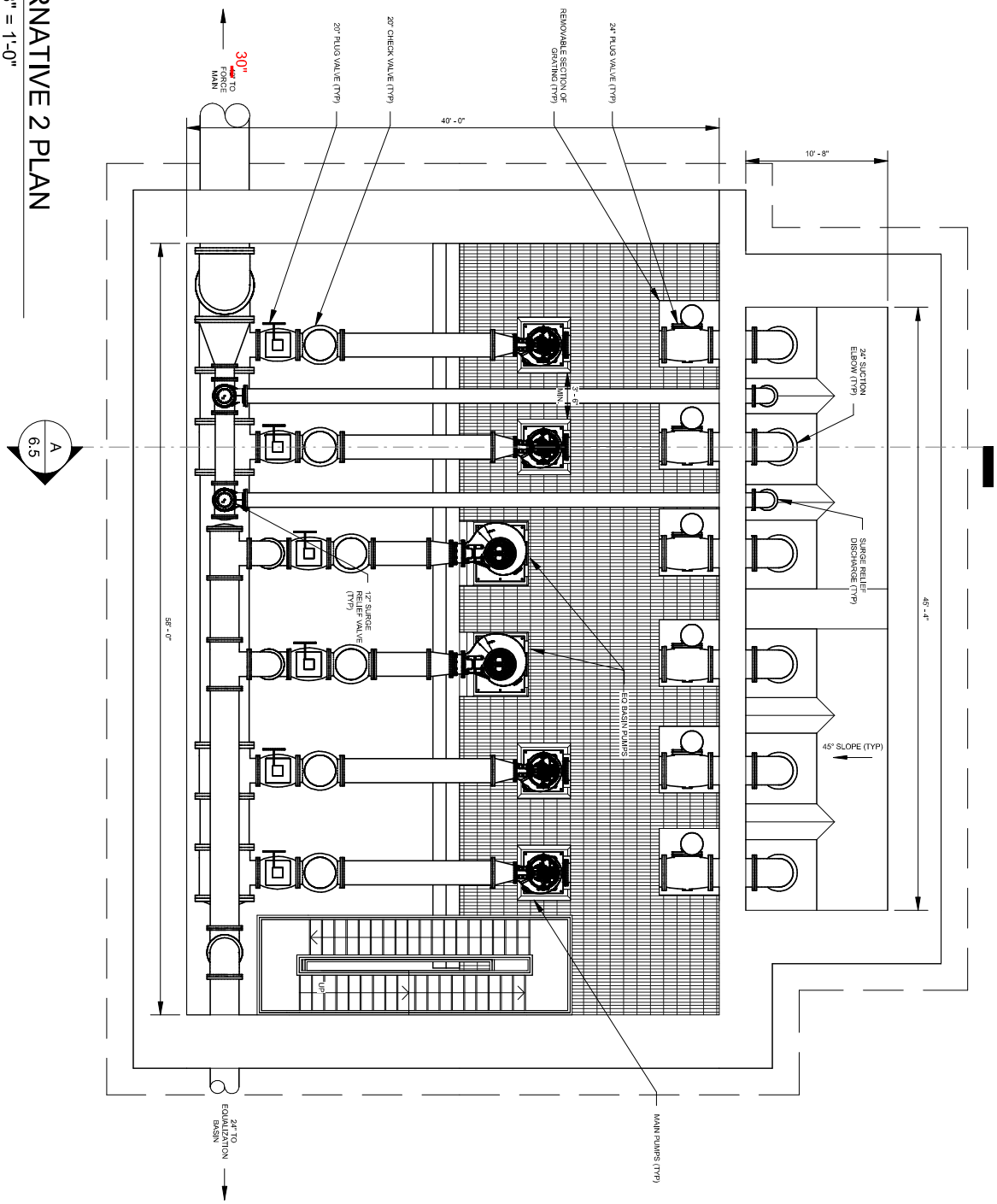
The electrical room will be located at the pump station grade level. The electrical room will be accessed from the station exterior to reduce the risk of hazardous or corrosive gases from migrating from the wet well or dry well. The room will house all of the major electrical equipment including the main incoming service equipment, variable frequency drives, transfer switch, pump control panels and low voltage infrastructure.

6.5 Pump Station Layout – Preliminary Drawings

The recommended headworks, wet well, and dry well are compiled into preliminary layouts that include access stairs, access hatches and the electrical room. Refer to **Attachment C – Preliminary Recommended Layout** for details.

1 ALTERNATIVE 2 PLAN

Scale: 1/8" = 1'-0"



A 6.5

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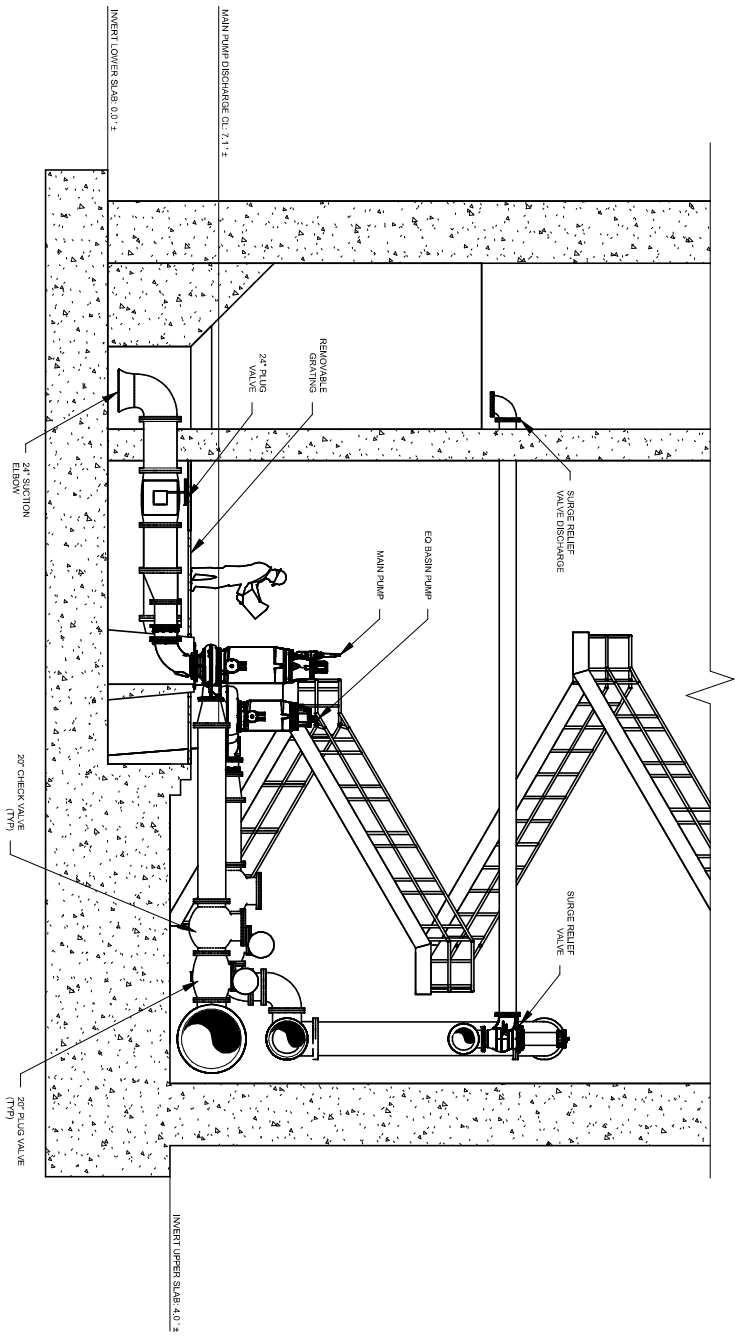
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



A ALTERNATIVE 2 SECTION

Scale: 1/8" = 1'-0"

NOTE:
1. ALL ELEVATIONS ARE APPROXIMATE

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	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		

7. EQUALIZATION BASIN DESIGN COMPONENTS

7.1 Design Criteria

As discussed in **Section 4.3.3**, approximately 1.2 million gallons of storage is required to equalize peak flows resulting from a projected 24-hour, 10-year storm in 2045.

7.2 Equalization Basin Configuration Alternatives

Two equalization basin configuration alternatives were evaluated:

- Inline Equalization – All influent wastewater flows through the equalization basin and discharges to the wet well. Basin is filled and drained by gravity.
- Offline Equalization – Basin is filled by pumping wastewater from the wet well and drained by gravity back to the wet well.

7.2.1 Inline Equalization

For the inline equalization storage alternative, all influent wastewater passes through the basin before discharging to the wet well refer to **Figure 7.1.**

The invert of the basin is set to the same elevation as the wet well normal high water level. Equalization storage is provided by both the wet well and the separate basin, whose storage volume is defined by the difference between the influent sewer invert elevation and the basin invert elevation. See **Figure 7.2** for reference.

Figure 7.1 Inline Equalization Process Flow

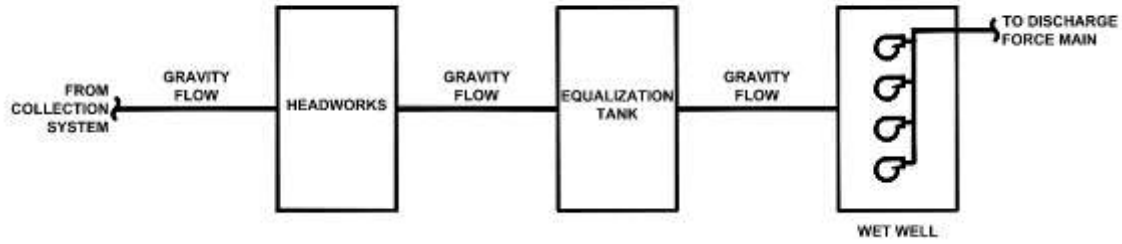
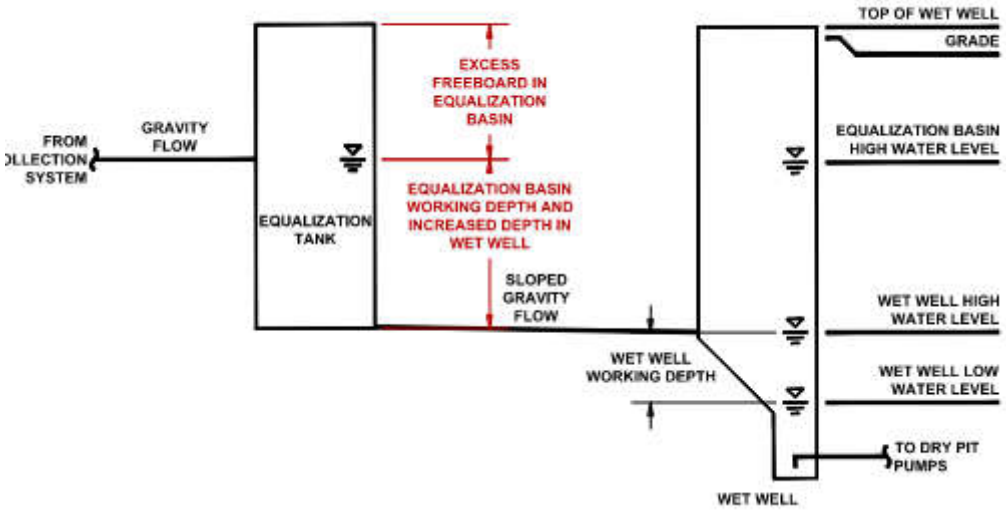


Figure 7.2 Inline Equalization Schematic Section



Based on site space constraints, it is assumed that the equalization basin will have approximate footprint of 8,100 sq ft, which results in a side water depth of approximately 20 feet. Due to the inline basin filling and draining by gravity, the basin must be buried, requiring an excavation of approximately 34 feet deep, equating over 10,000 cubic yards of excavation, with significant sheeting and dewatering expected.

7.2.1.1 Inline Equalization Basin Advantages

- Simple operation as it does not require mechanical equipment to fill or drain basin.

7.2.1.2 Inline Equalization Basin Disadvantages

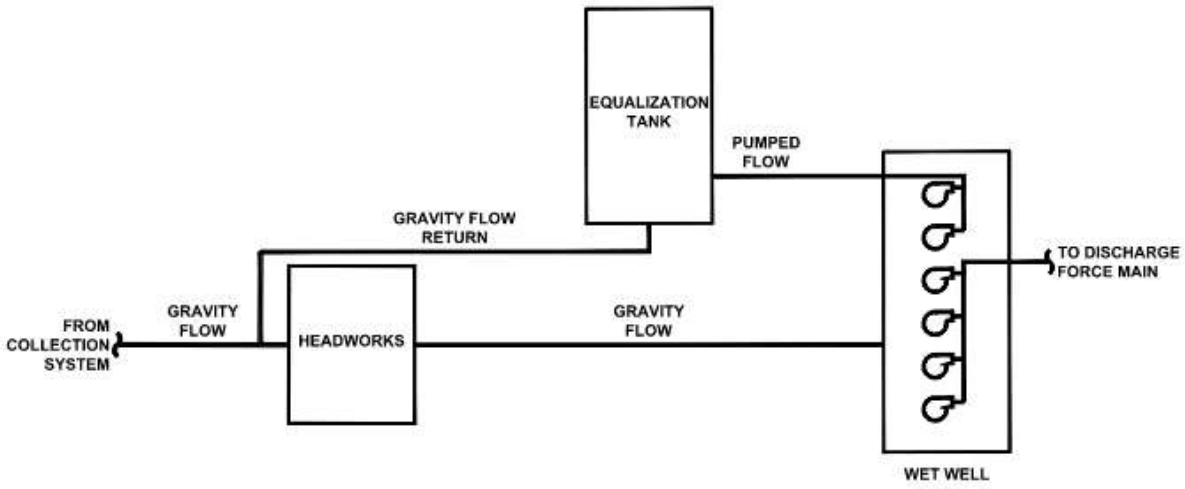
- Costly excavation due to basin depth and large footprint.
- Pump station wet well must be constructed deeper to accommodate the equalization basin working volume.

7.2.2 Offline Equalization

In the offline equalization storage alternative, the basin is filled by dedicated equalization basin pumps located in the pump station that transfer wastewater from the wet well during a peak flow event and discharge to the basin. When the main Featherstone SPS pumps are unable to keep up with incoming wastewater flowrate and the wet well level continues to rise to a predetermined elevation, the equalization pumps will be activated to divert flow to the equalization basin.

The basin will hold the wastewater until the main pumps can handle the incoming flow and the level in the wet well drops. Wastewater held in the basin will drain by gravity through a pipe discharging back into the wet well utilizing a motorized valve to control the rate of flow.

Figure 7.3 Offline Equalization Process Flow



Based on site space constraints, it is assumed that the equalization basin will have approximate footprint of 8,100 sq ft, which results in a side water depth of approximately 20 feet. Due to the basin fill controlled by pumps, the basin can be constructed at grade, thereby eliminating costly excavation associated with buried storage.

7.2.2.1 Offline Equalization Advantages

- Basin may be placed at or near grade, avoiding costly excavation
- The rate of flow from the basin to the wet well can be controlled
- The footprint, side water depth, and basin location on the pump station site can be tailored to

comply with the site constraints

- Greater flexibility in operation, as basin is not always in the path of flow and can be taken offline for cleaning or maintenance.

7.2.2.2 Offline Equalization Disadvantages

- Requires mechanical equipment (pumps) to fill the basin, and motorized valves to drain the basin

7.2.3 Summary and Conclusion

Based on the two equalization basin alternatives, offline equalization is the recommended alternative. Offline equalization offers the following benefits:

- Offline storage allows for the equalization basin to be constructed at grade, limiting costly excavation.
- Operators have the flexibility to control when to drain the basin, and the rate of flow.
- Design flexibility to determine the basin dimensions and location on the site that best meets the project requirements.
- Greater flexibility in operation, as basin is not always in the path of flow and can be taken offline for cleaning or maintenance.

7.3 Additional Equalization Basin Considerations

7.3.1 Odor Control

The equalization tank will be covered, to prevent the escape of odors off site. The airspace inside of the equalization basin will be tied into the air phase odor control system.

7.3.2 Flushing System

The equalization basin will require a flushing system to remove debris and sediment to prevent odors. Automated removal of the debris and sediment immediately following the draining of the basin will significantly reduce the potential for odors and corrosive gases. Two common types of flushing systems are summarized in the following sections.

7.3.2.1 Tipping Buckets

Tipping buckets require a cylindrical vessel suspended above the back wall of the basin. When a cleaning cycle is activated, the tipping buckets will slowly fill with water, until they are full at which point, they will tip and send a large volume of water across the basin. Specially designed concrete fillets along the basin floor will form the water into a wave which passes across the equalization basin, pushing any debris into the sump trench where it can be routed back to the wet well. To enhance the cleaning, the basin will be divided into 30’ wide flush ways which help to concentrate the cleaning force of the tipping buckets. Flush ways will be separated from each other with a short knee wall, and each flush way will have a dedicated tipping bucket.

It is recommended to provide a means of filling the buckets with clean water. Use of stored wastewater for the tipping buckets would require a separate pump system to fill the buckets at the top of the basin wall.

7.3.2.2 Flushing Gates

A flushing gate system includes stainless steel gates with a hydraulic opening system. The flushing gates are mounted in a wall that separates a flush water reservoir from the individual flushways in the equalization basin. Flushways in the basin are created by adding a short curb wall. Each flushway requires a floor slope of approximately 2 percent towards the collection sump.

To clean the basin, the flushing gates open which causes a flushing wave with a high sweeping force to move solids and debris. Flush water is collected in a sump at the far end of the basin, which drains by gravity to the pump station wet well. To achieve the most effective cleaning, the length of each flushing

gate is sized relative to the flushway width so that the flushing velocity is greater than 6 feet per second. The collection sump is designed to capture the flush volume without allowing splash back into the basin and depositing debris. The sump volume is approximately 1.5 times the flushing volume.

The flush water reservoir fills as the basin fills, and therefore the first cleaning flush is with wastewater. It is recommended that clean water be used for subsequent flushes to reduce the risk of odor formation and the potential for corrosive gases to generate inside the basin. Typically, 3 to 4 flushes are recommended, however this is dependent on the incoming wastewater characteristics, residence time and volume stored.

7.3.2.3 Summary and Conclusion

Both tipping buckets and flushing gates will effectively clean the equalization basin and prevent solids from building up. For cost estimating purposes, it was assumed that tipping buckets would be used with a covered equalization basin since that will increase the tank height and result in a conservative cost. The type of flushing system will be confirmed during preliminary design based on the final equalization basin configuration, whether the basin is covered or not, and cost.

7.3.3 Equalization Basin Construction Type

Two alternatives have been identified for the equalization basin construction: cast-in-place concrete and precast post-tensioned concrete. Refer to **Table 7.1** for a comparison of both alternatives.

Table 7.1 EQ Basin Construction Type Summary

CAST IN PLACE CONCRETE	PRECAST POST TENSIONED TANKS
Benefits: • Easy modifications post construction • Easy to support piping and appurtenances off of structure • Allows for more flexible/unique geometry	Benefits: • Fast onsite Construction • Factory QA/QC of individual concrete panels • Consistent casting and curing environment • Less risk of weather delay • More Cost Effective
Drawbacks: • Time consuming construction • Weather dependent construction • More Expensive	Drawbacks: • Requires coordination with manufacturer for modifications post construction • Requirements for larger crane during construction • Limited size and geometry by delivery method

7.4 Equalization Basin Pumps

Dedicated equalization basin pumps located inside the Featherstone SPS will pump excess peak wastewater from the pump station wet well to the basin. Based on the influent flow projections, the 10-year storm peak influent flow rate is 29,900 GPM. The pump station design firm capacity is 23,000 GPM. Therefore, the equalization basin pumps must have a firm pumping capacity of 6,900 GPM.

The PWCSA USM requires the pump station design include a two-chamber wet well. To simplify the pump station and to provide better redundancy and operational flexibility, it is preferable each wet well chamber have one equalization basin pump. Therefore, it was decided that the station be designed for two (2) pumps total, one duty pump and one standby pump.

A preliminary pump selection was obtained to identify the preliminary pump selection criteria and pump station design requirements including pump motor horsepower, pump efficiency, and the pump station mechanical layout. Preliminary selections were based on a Flygt dry-pit submersible pump. The preliminary pump selection is summarized in **Table 7.2**.

Table 7.2 Preliminary Equalization Pump Selection	
PARAMETER	**EQUALIZATION BASIN PUMPS**
Make and Model	Flygt NT3400
Design Point	6,900 GPM @ 53' TDH
Efficiency	83%
Impeller Diameter	560 mm
Motor Size	135 Horsepower

8. SITE LAYOUT

8.1 Introduction

Two site layout alternatives were evaluated for the pump station. One alternative evaluated the use of the existing pump station parcel to house the new pump station and equalization basin while the second alternative evaluated a new pump station on an adjacent parcel. The site constraints were evaluated for each alternative, including, but not limited to, flood plain and property setbacks.

8.2 Site and Environmental Constraints

8.2.1 Flood Plain Assessment

A floodplain assessment is needed to determine the extent of the proposed impacts (new structures and grading) will have on the hydraulic model and the base flood elevation. If proposed improvements don't pose any impacts to the floodplain elevation, a No-Rise Certification for Floodways shall be prepared by the engineer and submitted to FEMA. Accompanying this certification shall be supporting technical data that should be based on the standard step-backwater computer model used to develop the 100-year floodway shown on the Flood Insurance Rate Map (FIRM) or Flood Boundary and Floodway Map (FBFM). If the proposed improvements do impact the FEMA floodplain, a Conditional Letter of Map Revision (CLOMR) will need to be prepared and submitted to FEMA to show proposed changes to the mapped floodplain and any increase in anticipated flood heights. Once the project is completed, a Letter of Map Revision (LOMR) will need to be prepared and submitted. The LOMR will consider what was built onsite and the FEMA map will be updated based on the constructed improvements.

8.2.2 Stormwater Management

The project will be considered redevelopment and subject to the Virginia Stormwater Management Regulations that went into effect on July 1, 2014. SWM is expected to be met with sheet flow conditions draining to the existing floodplain. BMP is expected to be met with simple disconnection of proposed impervious areas and with off-site nutrient credits as needed.

8.2.3 Zoning Ordinance

Public Facilities are permitted within all zoning districts in Prince William County. The site is in the M-1, Heavy Industrial district and it is subject to the development standards of said district in accordance with the zoning ordinance. The zoning ordinance requirements are summarized in **Table 8.1**.

Table 8.1 Zoning Ordinance Requirements	
CHARACTERISTIC	**VALUE**
Lot Size	No Minimum
Lot Coverage	85%
Open Space	15%
Maximum Floor Area Ratio (FAR)	0.5
Maximum Height	75 feet
ROW Setback	20 feet
Side/Rear Setback	20 feet
(Commercial/Office)	50 feet

As part of this preliminary report, it was evaluated to acquire a portion of the lot to the North of the existing parcel, in order to place some of the improvements on the adjacent site based upon site layout and space considerations.

8.2.4 CSX Transportation

The site is adjacent to the Richmond, Fredericksburg and Potomac Railroad (RF&P) right-of-way, which is now owned by CSX Transportation. Additionally, the DC to Richmond High Speed Rail project is anticipating the construction of new railroad lines on the east side of the railroad tracks. All improvements necessary for the completion of the recommendations in this report are anticipated to be outside of the CSX ROW.

8.2.5 Demolition and Asbestos Inspection

As part of the demolition activities associated with the removal of the abandoned building, existing pump station, and miscellaneous demolition on the property, a Demolition Checklist is likely to be required with the submission of the Building Permit. The code official will require certification that the affected building has been inspected for the presence of asbestos by an individual licensed to perform such inspections pursuant to 54.1-503 of the Code of Virginia and that no asbestos containing materials were found or that appropriate action be undertaken. The Demolition Checklist will also require a written release from each utility connected to the structure stating that their respective service connections and equipment have been removed or sealed and plugged in a safe manner.

8.2.6 Virginia Department of Historic Resources

A review of the Virginia Department of Historic Resources (DHR) Virginia Cultural Resources Information System (VCRIS) database noted that the CSX railroad property is eligible for listing on the National Register of Historic places. Since all improvements will be outside of the CSX property, the proposed project will not be affected by this.

As part of the requirements of any Federal wetlands permits, Section 106 of the National Historic Preservation Act coordination is required to be vetted during the U.S. Army Corps of Engineers wetlands permit process to determine if the project has an adverse impact on cultural and historic properties or resources. See **Section 8.2.4** that discusses CSX site restrictions.

At the time of this report, no additional cultural or historic resources were identified during the desktop analysis performed for the subject property. Data is regularly updated and should be reexamined prior to permitting.

8.2.7 Waters of the U.S. and State including Wetlands

The pump station site is adjacent to areas that may contain tidal and non-tidal jurisdictional Waters of the U.S. and State (WOUS), and their associated wetlands. A Waters of the U.S. Delineation will be required to determine the limits of jurisdictional areas and tidal limits and will support the regulatory permit applications to define project impacts to WOUS.

Once limits of disturbance are finalized for the construction, Clean Water Act Section 404/401 permits will need to be acquired through the U.S. Army Corps of Engineers (USACE) and the Virginia Department of Environmental Quality (DEQ). Impact to tidal waters/wetlands will require coordination and possible permit acquisition through the Virginia Marine Resources Commission (VMRC). Coordination with the United States Coast Guard (USCG) may be required for any project aspects affecting navigable waters.

Due to the project occurring within areas containing tidal influence, a DEQ Coastal Zone Management Act Consistency Determination may also be required and will be determined during design.

8.2.8 Threatened & Endangered Species

Federally listed species identified during preliminary review of the State and Federal Threatened and

Endangered Species Databases included the Federally Endangered Northern Long-eared Bat (*Myotis septentrionalis*) as well as the Monarch Butterfly (*Danaus plexippus*), which is currently listed as a candidate species.

Federal and state wetland impact permits require compliance with Section 7 of the Endangered Species Act and coordination with the U.S. Fish & Wildlife Service (FWS) will likely be required for the project. A Time of Year Restrictions between April 1st to November 15th for tree clearing is likely to be incorporated into federal and state permits to protect bats and migratory bird nesting.

The Monarch Butterfly is a candidate species and there are no official current protections for the butterfly, however the species is currently under study. Should the status of the species change to threatened or endangered, project aspects may need to be altered to prevent impact to the species.

Three Bald Eagle (*Haliaeetus leucocephalus*) nests are located within 5 miles of the project area. Eagles and particularly their nests are protected under the Bald and Golden Eagle Protection Act. Construction encroachments near the nests could impact the eagle nesting success. Coordination with FWS will likely be required. Blasting, pile driving, and other loud construction methods could result in the need to acquire a FWS incidental take permit and/or Time of Year Restrictions for certain aspects of construction within certain buffers around active nests.

Nest locations can move from year to year and a review of the latest data should be conducted during project permitting. Reviews of the State and Federal Threatened and Endangered Species Databases are only valid for 90 days and will need to be updated as design advances. The information contained in this section is based on the findings at the time of this report (June 2023).

Due to the project occurring within areas containing tidal influence, coordination with the National Oceanic and Atmospheric Administration (NOAA) Fisheries may also be required to address certain aquatic threatened and endangered species and fisheries protections/restrictions.

8.2.9 Parks & Preservation Areas

The pump station site is located adjacent to the Featherstone National Wildlife Refuge. Should any project aspects involve access or construction within the limits of the refuge, Special Use Permits will likely be required.

The pump station site is located in the Chesapeake Bay Preservation Overlay District and is in close proximity to associated Resource Protection Areas (RPA). Although public utility lines are typically exempted under Section 32, Article V, Part 504 of the Prince William County Code of Ordinances, specifically noted under Part 504.14, a Water Quality Impact Assessment (WQIA) and a Preservation Area Site Assessment (PASA) submittal per the County DCSM may be required if a structure such as a pump station is placed in an RPA.

8.2.10 Hazardous Materials

Should the project require acquisition of permanent or temporary right-of-way, a Phase I Environmental Assessment may be required to be obtained.

A review of the DEQ Data Mapper noted several active underground storage tanks adjacent to the project vicinity. Coordination with DEQ may be necessary to ensure no impacts to existing tank facilities.

8.3 Site Alternative 1 - Pump Station and Equalization Basin On Existing Site

This alternative consists of constructing the new pump station and equalization basin on the existing site as shown in **Figure 8.1**. Although this option would eliminate the need for additional property acquisition, a majority of the existing site is within the flood plain and we would need to be raised. Additionally, the site is small; therefore, constructability would be a challenge and the final site layout would be tight with the addition of an equalization basin. The project would also likely require a variance since the proposed structures are likely to encroach in the existing property setbacks.

8.3.1 Site Alternative 1 Advantages

- Will not require additional property acquisition

8.3.2 Site Alternative 2 Disadvantages

- Will require significant shoring and sheet piling due to tight site and close proximity to existing pump station.
- The new facilities will encroach into the property setbacks and would require a variance.
- Difficult access for operations during construction and may require additional bypass pumping.
- The new pump station would remain inside of the flood plain, which will require bringing in fill to raise the elevation of the access road and site to prevent flooding in the future. This will require a Conditional Letter of Map Revision (CLMOR) and Letter of Map Revision (LMOR).

8.4 Site Alternative 2 – Pump Station On Adjacent Site and Equalization Basin On Original Site

The alternative to place the pump station on an adjacent site and equalization basin on the existing site is shown in **Figure 8.3**. Although this alternative requires the purchase of additional property, it provides more room for construction and operation. Based on site constraints, the equalization basin would be constructed in the flood plain, which will require additional grading and permitting, but since the basin will be constructed at grade and the top will be significantly higher than the existing flood plain, this should not be an issue.

8.4.1 Site Alternative 2 Advantages

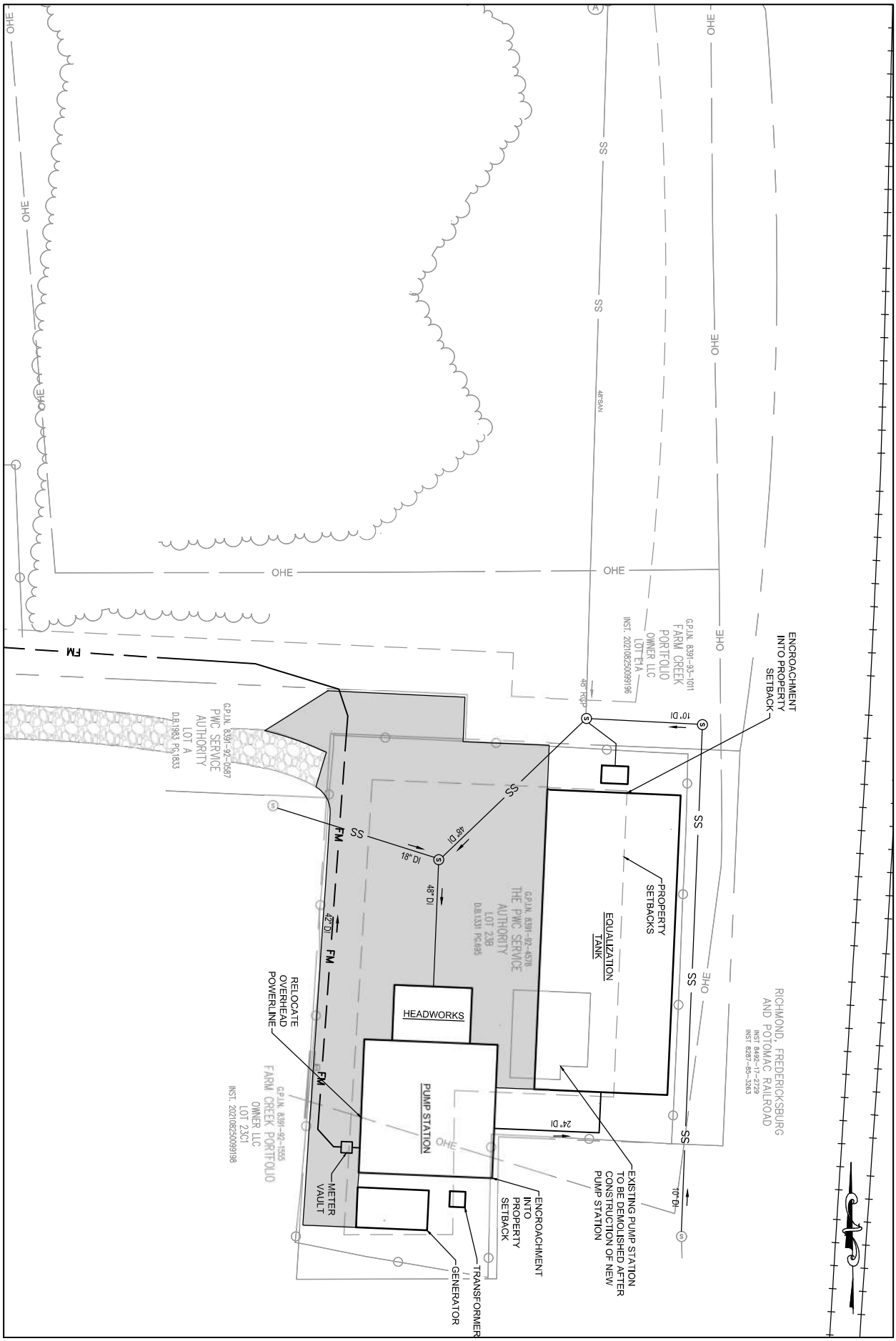
- Minimizes impact on the existing pump station during construction
- Reduces infrastructure in flood zone
- Eases construction by having larger separation between existing infrastructure and new construction
- Maintains access to site and equalization basin
- Better horizontal separation of the shallow foot foundation of the equalization tank adjacent to the deep structure of the pump station
- The main pump station can be placed outside of the floodplain, with just the equalization basin tank and site grading inside of the floodplain. This will still require a Conditional Letter of Map Revision (CLMOR) and Letter of Map Revision (LMOR), but it will be less expansive than if the pump station was on the existing site.

8.4.2 Site Alternative 2 Disadvantages

- Additional property acquisition
- Easement modifications will be required, including:
    - Storm Water Drainage Easement
    - Detention Pond Access Easement
- The equalization basin would be constructed inside of the flood plain, which will require a Conditional Letter of Map Revision (CLMOR) and Letter of Map Revision (LMOR).

8.5 Summary And Conclusion

It was determined that placing the pump station on the adjacent site and the equalization basin on the existing site is the preferred option based upon the benefits it brings to the table. It should be noted that both layouts will require some infrastructure and grading in the flood plain which will trigger Conditional Letter of Map Revision (CLMOR) and Letter of Map Revision (LMOR).



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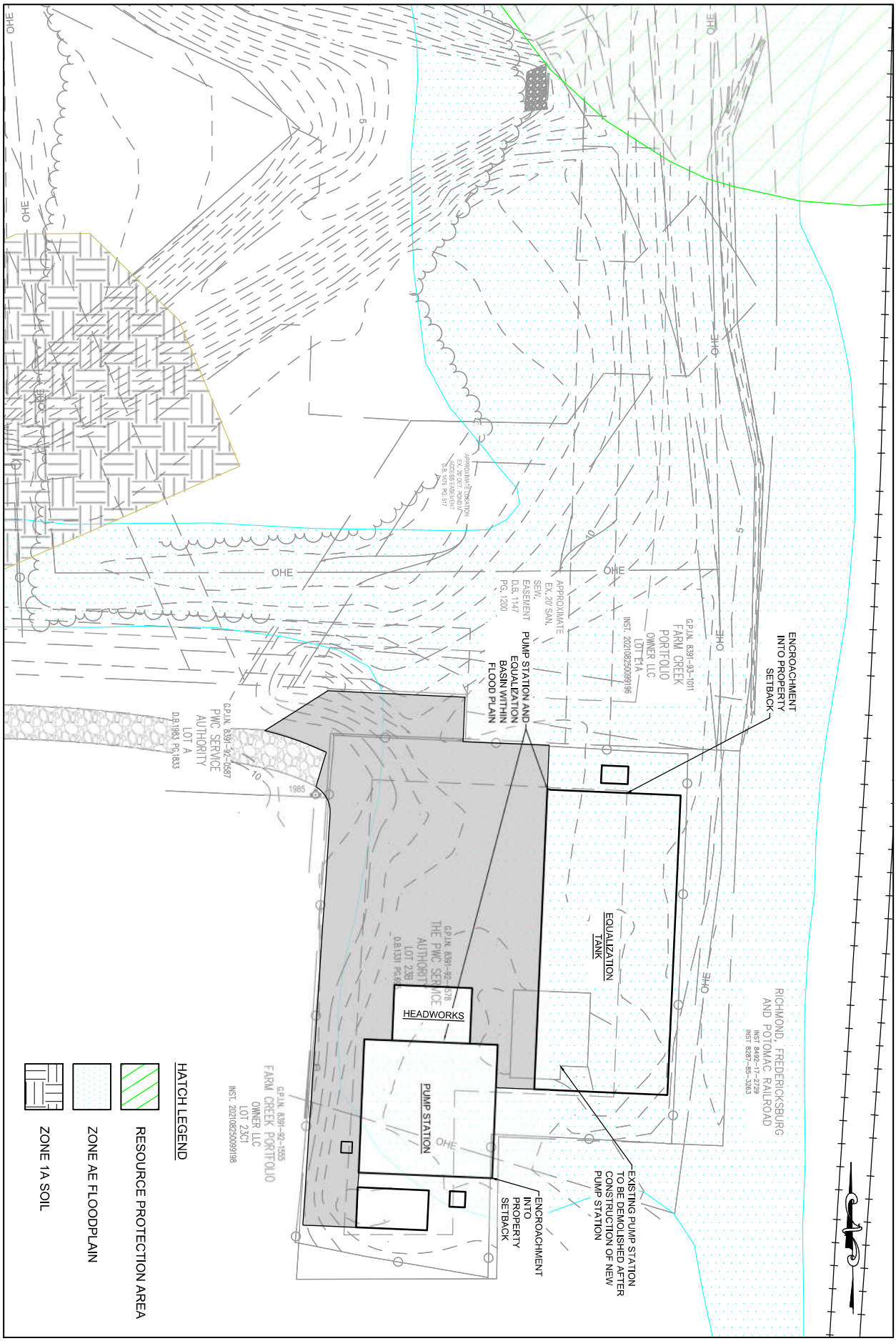
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



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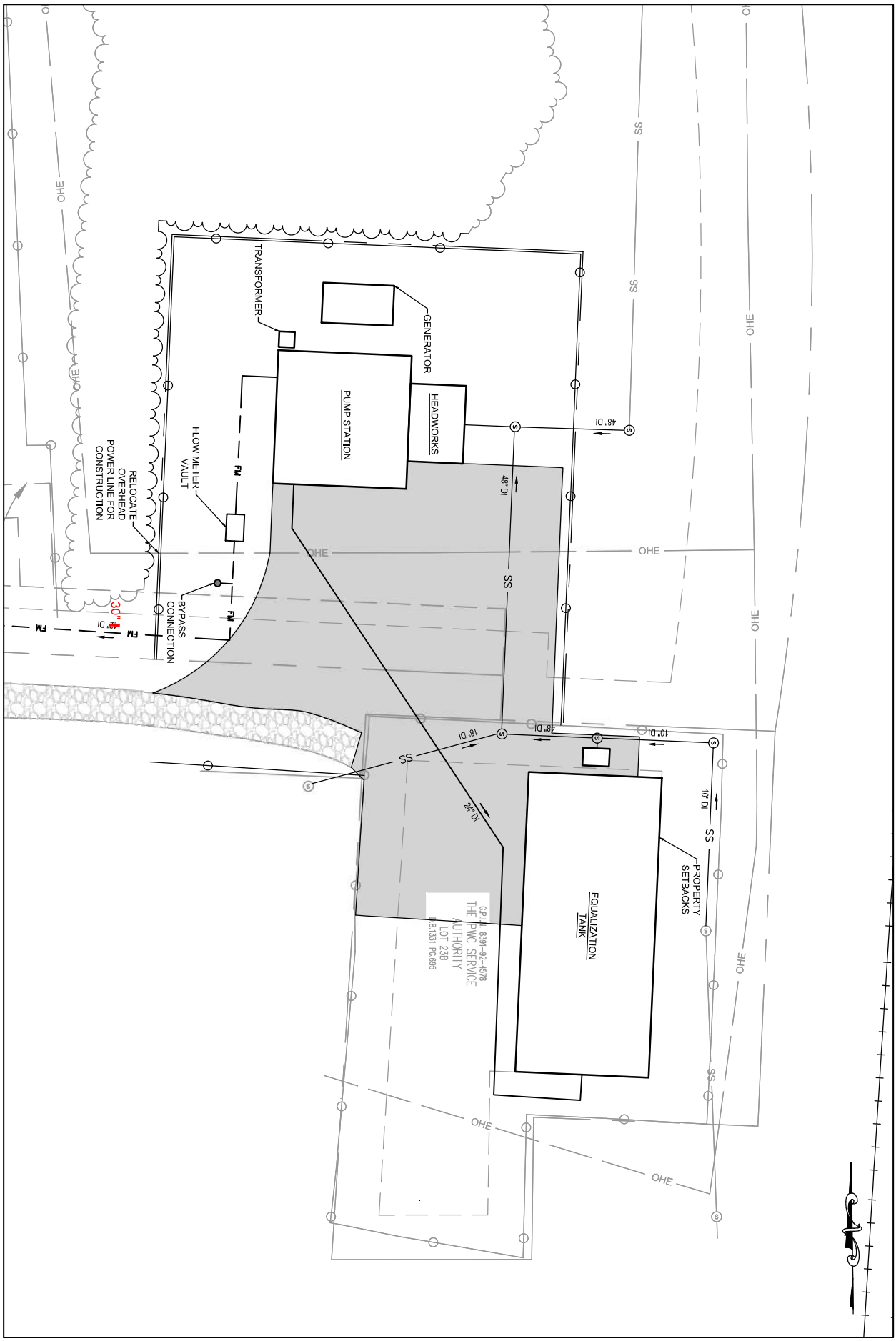
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



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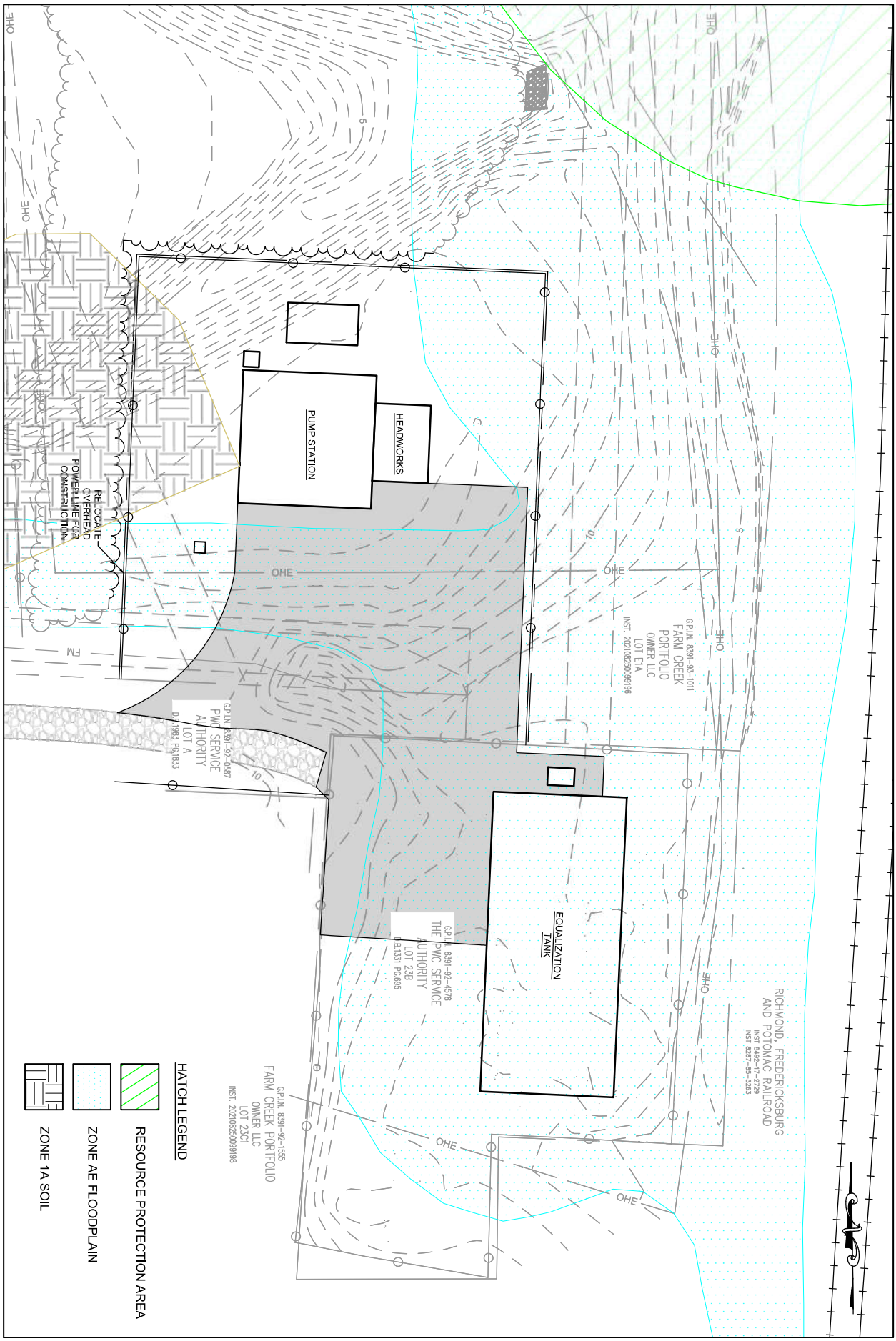
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		



Dewberry Dewberry Engineers Inc. 4805 Lake Brook Drive, Suite 200 Glen Allen, VA 23060 Phone: 804.290.7957 Fax: 804.290.7928	DATE 07/2023	SCALE 1" = 40'	TITLE SITE ALTERNATIVE 2 - FLOOD PLAINS AND WETLANDS	FIGURE NO. 8.4
	PROJ. NO. 50114730	PROJECT FEATHERSTONE SPS PROGRAM PER		

9. SUMMARY OF PROJECT RECOMMENDATIONS

9.1 Overall

The proposed replacement Featherstone SPS project will include a new pump station, a new discharge force main, and an equalization basin. See **Table 9.1** for a summary of the project facilities.

Table 9.1 Proposed Project Design Summary

DESCRIPTION	DESIGN
Featherstone Sewage Pump Station Firm Capacity	23,000 GPM
Equalization Pump Firm Capacity	6,900 GPM
Headworks (Grinders) Firm Capacity	29,900 GPM
Proposed Featherstone Force Main Diameter	30" ~~42~~ in
Equalization Storage Volume	1.2 MG

9.2 Featherstone SPS

The pump station will include the following major mechanical equipment a summarized in **Table 9.2**.

Table 9.2 Featherstone SPS Mechanical Equipment Summary

DESCRIPTION	DESIGN CAPACITY
Four (4) Main Pumps	7,670 GPM each
Two (2) Equalization Pumps	6,900 GPM each
Three (3) Grinders	14,950 GPM each

9.3 Featherstone Equalization Basin

The equalization basin will be designed to be an offline equalization basin with a storage volume of 1.2 million gallons.

10. OPINION OF PROBABLE CONSTRUCTION COST

An opinion of probable construction cost (OPCC) was prepared for the proposed SPS upgrades. The total OPCC was $56,831,000 and includes engineering, easement acquisition, and construction costs. The estimate class is based on the AACE International cost estimate classification system. The estimate class for this OPCC is Class 5. A Class 5 OPCC is typically associated with concept screening and has an expected low accuracy variation of -20% to -50% and a high accuracy variation of +30% to +100%. For this estimate, a low accuracy variation of -20% and a high accuracy variation of +30%. Detailed cost estimates are included in **Attachment B – Cost Estimates.**

A detailed OPCC was not prepared for the new 42-inch force main. As a placeholder, the PWCSA should budget approximately $14.4 to $28.8 million for this project as estimated in the Comprehensive Master Plan. The OPCC for the new force main project will be updated during design once the alignment is confirmed.

11. PERMITTING

11.1 Permit Summary

Based on available information, the following permits are anticipated to be required for the recommended project:

- Building Permit
- Land Disturbance Permit
- Erosion and Sediment Control Permit
- VSMP Permit

- Public Facilities Review Determination Request and Public Facilities Review
- Site Plan Application
- Utility Permit
- Wetlands Permit, if wetlands are disturbed
- VDOT Entrance Permit, if modifications are completed to the entrance
- VDEQ Certificate to Construct (CTC)
- VDEQ Certificate to Operate (CTO)

Additional information is provided for the various permits in the following sections.

11.2 Public Facilities Review

A Public Facilities Review (PFR) will likely be required in Prince William County since the pump station upgrades are not currently incorporated in the County's Comprehensive Plan. The first step in the process is for PWCSA to submit a Public Facility Determination Request form which will verify if a PFR is officially required. If one is needed, a pre-application meeting will be set up to discuss specifics of the project and process and then a PFR Application Package will need to be prepared and submitted to Prince William County for review. This will also require completing two additional forms: 1) Application for Deferral of Traffic Impact Analysis and 2) Cultural Resources Assessment and Record Check for Pending Development Applications.

All projects subject to a PFR are required to comply with all relevant Zoning Ordinances and the Prince William County Design and Construction Standards Manual (DCSM). As part of the PFR process, A public hearing will be required prior to the Planning Commission's approval. The estimated timeframe for a PFR review is summarized in **Table 11.1**.

Table 11.1 Public Facilities Review Schedule

TASK	DESCRIPTION	DURATION
1	Prepare and Submit Public Facilities Review Determination Request	1 Week
2	County Reviews Determination and send letter that PFR is required	4 Weeks
3	Prepare and submit PFR package to PWC (Pre-Application Meeting required prior to submission)	16 Weeks
4	Planning Commission Approval of PFR	1 Week
	Total Estimated Time to Approval:	**22 Weeks**

There are a few instances where a project is exempt from a PFR, however, based on the nature of the work outlined in this report and current information available, it does not appear that this project would qualify for an exemption from a PFR.

11.3 Site Plan Approval

A site plan is required to be submitted to Prince William County for review of the new buildings, grading, and the demolition of the abandoned on-site building. The site plan will need to address any necessary Erosion and Sediment Control and Stormwater Management and Best Management practices. The estimated timeframe for a major site plan review is summarized in **Table 11.2**.

Table 11.2 Site Plan Review Schedule		
TASK	**DESCRIPTION**	**DURATION**
1	Draft Site Plan Application	6 Weeks
2	QC Submission to PWC and Acceptance	3 Weeks
3	1st Submission Review by PWC	8 Weeks
4	Respond to review agency 1st Submission comments and re-submit to PWC	3 Week
5	2nd Submission Review by PWC	4 Weeks
6	Respond to review agency 2nd Submission comments and re-submit to PWC (*Geotech Submittal approval needed)	2 Weeks
7	PWC issues Signature Submission Letter	1 Week
8	Prepare Signature Submission Plan Set & Forms	1 Week
9	County Deed/ Plat Review and Approval	3 Weeks
10	PWC Issues Approved Stamped Site Plan Set and Letter	1 Week
	Total Estimated Time to Approval:	**32 Weeks**

It should be noted that the Site Plan review timeframes are estimates based upon recent experience of preparing and processing Site Plans in Prince William County. Timeframes assume a development program has been established and will not change through the process. Timeframes assume no waivers or variances of the county code are required. Note that time frames are subject to change due to workload and volume of plan intake at Prince William County.

11.3.1 DEQ Certificate to Construct and Certificate to Operate:

Under the Sewage Collection and Treatment (SCAT) Regulations 9 VAC 25-790, this project will require obtaining a Certificate to Construct (CTC) and Certificate to Operate (CTO) through the DEQ. The CTC application process does not require the submittal of the design plans, specifications, or design calculations, but does require that all applicable DEQ regulations are followed.

12. SCHEDULE

Refer to **Table 12.1** for the preliminary project schedule. Please note that depending upon the chosen alternatives, this schedule could be modified.

Table 12.1 Schedule		
DESCRIPTION	**DURATION (MONTHS)**	**CUMULATIVE DURATION (MONTHS)**
30% Design	6	6
PWCSA Review	1	7
60% Design	4	11
PWCSA Review	1	12
90% Design	5	17
PWCSA Review	1	18
Final 100% Design	2	20
PWCSA Review	1	21
Bidding	2	24
Construction	24	48

13. SUMMARY AND CONCLUSIONS

For the long-term solution, it is recommended to proceed with the project as summarized in **Section 9.** This project generally consists of a new wet-pit/dry-pit pump station on the adjacent site with a two compartment wetwell including four main pumps and a headworks with three grinders. The pump station

will also include two equalization basin pumps, which will divert flow during high flow events to an equalization basin located on the existing site. Since the new pump station will be located on the adjacent site, it is anticipated that the existing pump station can remain operational during construction and will allow for easier phasing of construction and additional site space for future maintenance activities.

A new ~~42-~~30" inch force main will be required for the pump station upgrade. For purposes of sizing the new pump station, it was assumed that the force main would be installed parallel to the existing 30-inch force main. A separate study will need to be completed for this force main to confirm alignment, appurtenances, permitting, and easement acquisition requirements, schedule, and cost.

14. ATTACHMENTS

Attachment A – FEMA Flood Maps
Attachment B – Cost Estimates
Attachment C – Preliminary Recommended Layout
Attachment D – Permit Register
Attachment E – Proposed Equipment Cut Sheets

ATTACHMENT A

FEMA Flood Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Virginia State Plane North zone. The **horizontal datum** was NAD 83/HARN, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench** marks shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was provided by the Commonwealth of Virginia through the Virginia Base Mapping Program (VBMP). The orthophotos were flown in 2009 at scales of 1:100 and 1:200.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

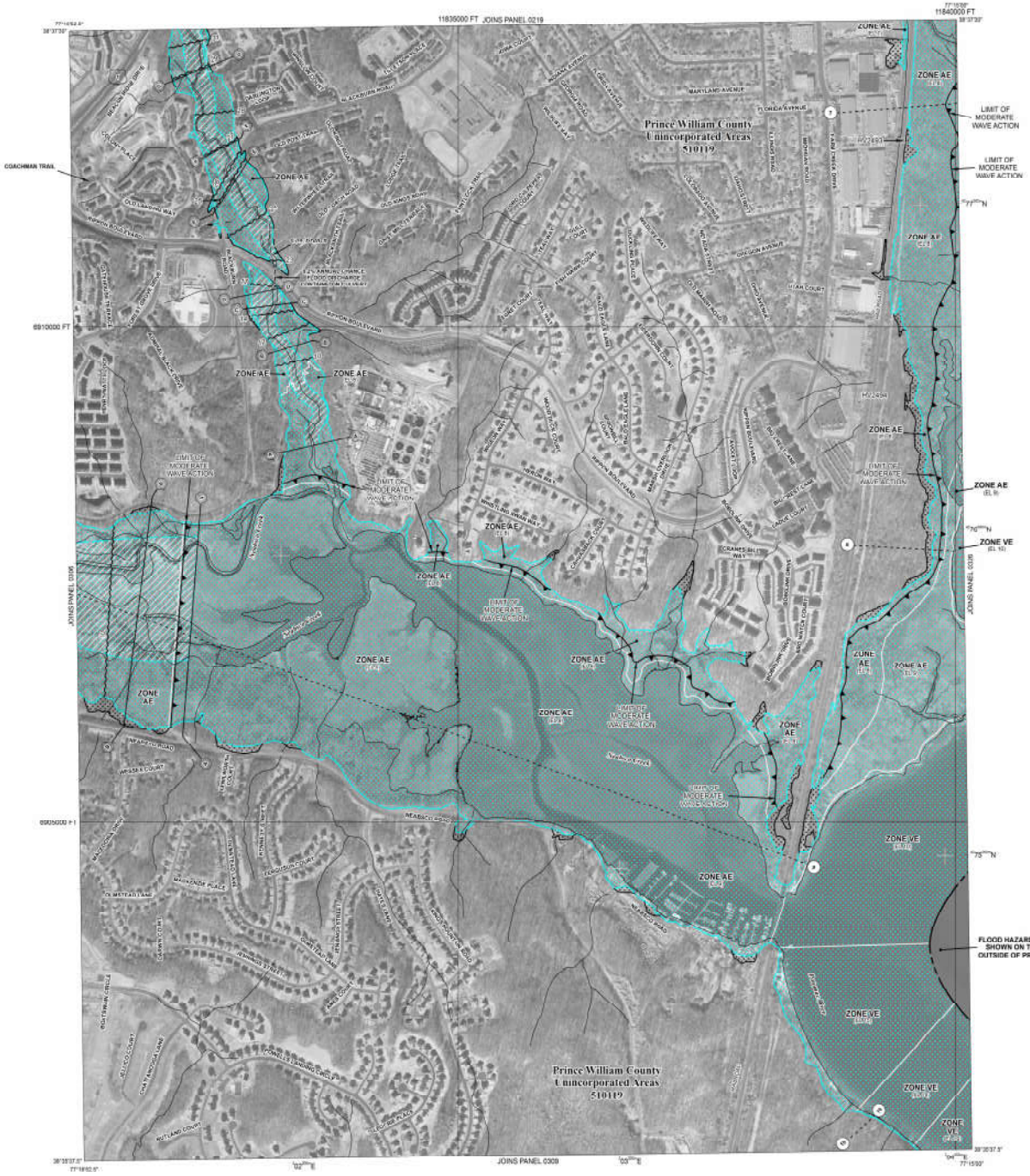
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de - annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

The AE Zone category has been divided by a **Limit of Moderate Wave Action (LiMWA)**. The LiMWA represents the approximate landward limit of the 1.5 - foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Contact the **FEMA Map Information eXchange** at 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The FEMA Map Information eXchange may also be reached by Fax at 1-800-358-9620 and their website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, AR/A, AR/AE, AR/AH, AR/AO, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- Limit of Moderate Wave Action
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

- Cross section line
- Transect line
- Culvert, Flume, Penstock or Aqueduct
- Road or Railroad Bridge
- Pedestrian
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4276000 FT — 1000-meter Universal Transverse Mercator grid values, zone 18N
- 600000 FT — 3000-foot grid values: Virginia State Plane coordinate system, North zone (FIPSZONE 4501), Lambert Conformal Conic projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
January 5, 1995

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
August 3, 2015 - to change Base Flood Elevations, to change Special Flood Hazard Areas, to update the effects of wave action, to incorporate Primary Frontal Dune analysis, to incorporate previously issued Letters of Map Revision, to reflect revised shoreline, and to reflect the effects of coastal erosion.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

500 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0307E

FIRM
FLOOD INSURANCE RATE MAP

PRINCE WILLIAM COUNTY, VIRGINIA
AND INCORPORATED AREAS

PANEL 307 OF 328

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PRINCE WILLIAM COUNTY	510119	0307	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
51153C0307E

MAP REVISED
AUGUST 3, 2015

Federal Emergency Management Agency

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Prince William County Virginia (Unincorporated Areas)	NO PROJECT	UPDATE FLOODWAY
	COMMUNITY NO.: 510119		
IDENTIFIER	Farm Creek at 14870 Persistence Drive	APPROXIMATE LATITUDE AND LONGITUDE: 38.626, -77.252 SOURCE: USGS QUADRANGLE DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 51153C0219E DATE: August 3, 2015 TYPE: FIRM* NO.: 51153C0307E DATE: August 3, 2015	NO REVISION TO THE FLOOD INSURANCE STUDY REPORT

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map

FLOODING SOURCE AND REVISED REACH See Page 2 for Additional Flooding Sources

Farm Creek - from just upstream of Railroad to approximately 150 feet downstream of Featherstone Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Farm Creek	Floodway	Floodway	YES	YES
	BFEs*	BFEs	YES	NONE
	Zone AE	Zone AE	YES	YES
	Zone X (shaded)	Zone X (shaded)	YES	NONE

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304. Additional Information about the NFIP is available on our Web site at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE AND REVISED REACH

Marumsco Creek Tributary B - on the right overbank on the upstream side of the Railroad in the vicinity of Saxon Street

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Marumsco Creek Tributary B	Zone X (shaded)	Zone X (shaded)	YES	NONE

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304. Additional Information about the NFIP is available on our Web site at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304. Additional Information about the NFIP is available on our Web site at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Eugene K. Gruber
Director, Mitigation Division
Federal Emergency Management Agency, Region III
One Independence Mall, Sixth Floor
615 Chestnut Street
Philadelphia, PA 19106-4404
(215) 931-5512

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panels warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304. Additional Information about the NFIP is available on our Web site at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

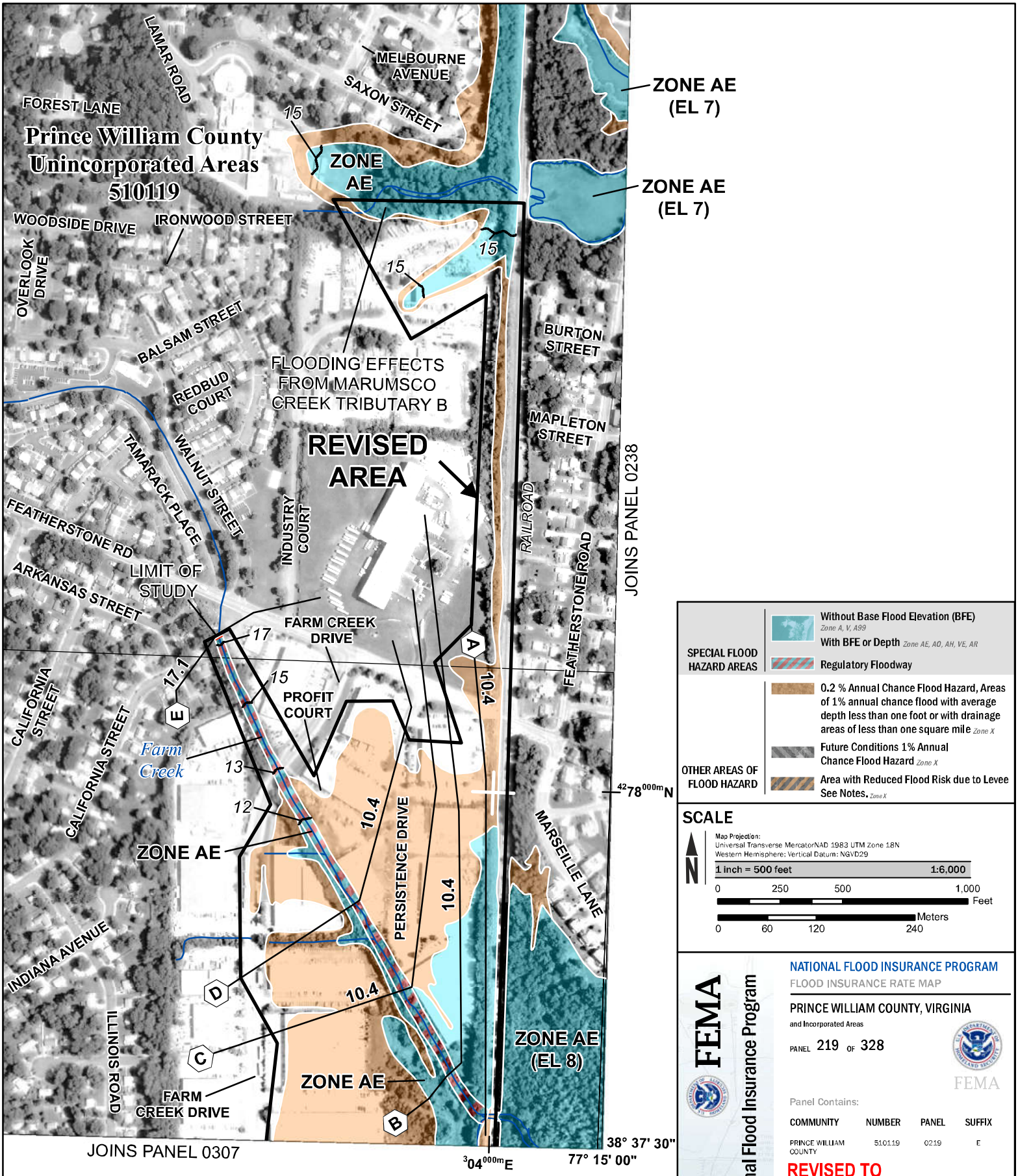
A notice of changes will be published in the Federal Register. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping Web site at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Prince William Times*
Dates: February 24, 2016 and March 2, 2016

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304. Additional Information about the NFIP is available on our Web site at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration



SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2 % Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*

SCALE

Map Projection:
Universal Transverse MercatorNAD 1983 UTM Zone 18N
Western Hemisphere; Vertical Datum: NGVD29

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 60 120 240 Meters

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

PRINCE WILLIAM COUNTY, VIRGINIA

and Incorporated Areas

PANEL 219 OF 328

FEMA

Panel Contains:

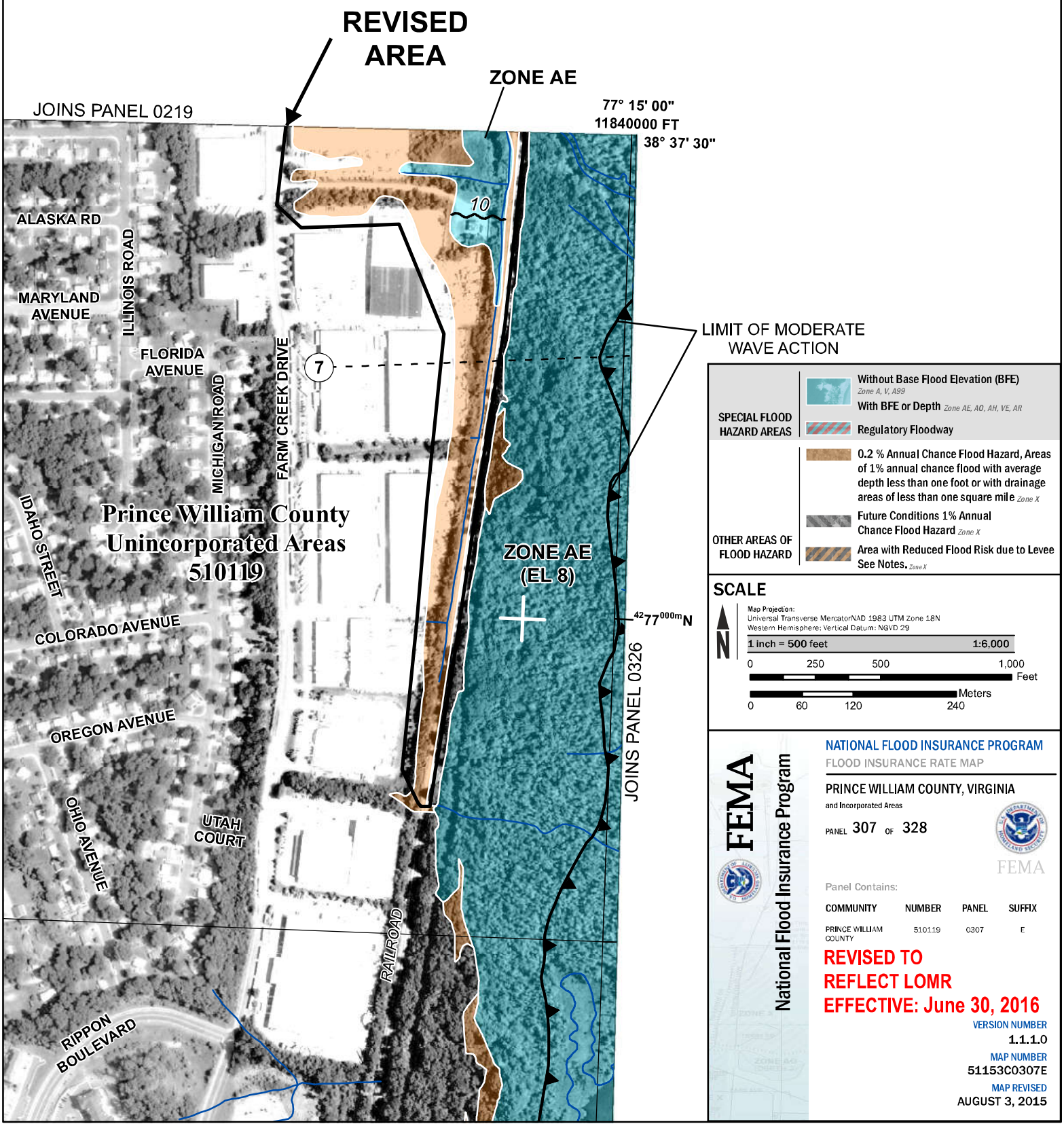
COMMUNITY	NUMBER	PANEL	SUFFIX
PRINCE WILLIAM COUNTY	510119	0219	E

REVISED TO REFLECT LOMR EFFECTIVE: June 30, 2016

VERSION NUMBER
1.1.1.0

MAP NUMBER
51153C0219E

MAP REVISED
AUGUST 3, 2015


REVISED AREA
ZONE AE
JOINS PANEL 0219
77° 15' 00"
11840000 FT
38° 37' 30"
10
ALASKA RD
ILLINOIS ROAD
MARYLAND AVENUE
FLORIDA AVENUE
MICHIGAN ROAD
FARM CREEK DRIVE
7
LIMIT OF MODERATE WAVE ACTION
IDAHO STREET
Prince William County
Unincorporated Areas
510119
ZONE AE
(EL 8)
4277000mN
COLORADO AVENUE
OREGON AVENUE
OHIO AVENUE
UTAH COURT
RAILROAD
RIPPON BOULEVARD
JOINS PANEL 0326
SPECIAL FLOOD HAZARD AREAS
Without Base Flood Elevation (BFE) Zone A, V, A99
With BFE or Depth Zone AE, AO, AH, VE, AR
Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD
0.2 % Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
Future Conditions 1% Annual Chance Flood Hazard Zone X
Area with Reduced Flood Risk due to Levee See Notes. Zone X
SCALE
N
Map Projection:
Universal Transverse MercatorNAD 1983 UTM Zone 18N
Western Hemisphere; Vertical Datum: NGVD 29
1 inch = 500 feet
1:6,000
0 250 500 1,000 Feet
0 60 120 240 Meters
FEMA
National Flood Insurance Program
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP
PRINCE WILLIAM COUNTY, VIRGINIA
and Incorporated Areas
PANEL 307 OF 328
FEMA
Panel Contains:
COMMUNITY NUMBER PANEL SUFFIX
PRINCE WILLIAM COUNTY 510119 0307 E
REVISED TO REFLECT LOMR
EFFECTIVE: June 30, 2016
VERSION NUMBER
1.1.1.0
MAP NUMBER
51153C0307E
MAP REVISED
AUGUST 3, 2015

ATTACHMENT B

Opinion of Probable Construction Cost

L16 Featherston SPS and Force Main Replacement
Prince William County Service Authority
Opinion of Probable Construction Cost[1]

Long Term Solution

Description	Quantity	Unit	Unit Cost	Extension
General				
Mobilization (5%)	1	LS	$ 1,525,000	$ 1,525,000
General Conditions (5%)	1	LS	$ 1,525,000	$ 1,525,000
Permits and Fees (2%)	1	LS	$ 610,000	$ 610,000
Bonds and Insurance (2%)	1	LS	$ 610,000	$ 610,000
Start up and Testing	1	LS	$ 610,000	$ 610,000
Bypass Operation				
Bypass Pumping	2	Months	$ 65,000	$ 130,000
Temporary Floats	2	Months	$ 1,500	$ 3,000
Temporary Sewer plug	2	Months	$ 5,000	$ 10,000
Labor/Equipment	1	LS	$ 110,000	$ 110,000
Site Work	1	LS	$ 450,000	$ 450,000
Demolition	1	LS	$ 750,000	$ 750,000
Excavation, Sheet Piling, and Dewatering	1	LS	$ 1,200,000	$ 1,200,000
Pumps, Piping, Etc.				
Grinders	3	EA	$ 141,500	$ 425,000
Slide Gates	6	EA	$ 20,000	$ 120,000
Main Pumps	4	EA	$ 325,000	$ 1,300,000
Equalization Basin Pumps	2	EA	$ 265,000	$ 530,000
Piping and Valves	1	LS	$ 1,880,000	$ 1,880,000
Labor and Equipment To Install	1	LS	$ 2,555,000	$ 2,555,000
Piping and Equipment Coating	1	LS	$ 350,000	$ 350,000
HVAC and Plumbing	1	LS	$ 807,000	$ 807,000
Wet-Pit/Dry-Pit Structure and Building	1	LS	$ 10,445,000	$ 10,445,000
Equalization Tank				
Tank	1	LS	$ 2,500,000	$ 2,500,000
Piping, Equipment and Appurtenances	1	LS	$ 375,000	$ 375,000
Labor and Equipment To Install	1	LS	$ 375,000	$ 375,000
Rigging				
Bridge Crane	1	LS	$ 278,500	$ 279,000
Bridge Crane Support	1	LS	$ 120,000	$ 120,000
Odor Control and Appurtenances	1	LS	$ 750,000	$ 750,000
Electrical	1	LS	$ 4,353,000	$ 4,353,000
Instrumentation and Controls	1	LS	$ 610,000	$ 610,000
Subtotal				*$35,307,000.00*
Contractor Overhead & Profit	15	%		$ 5,297,000
Contingency	25	%		$ 10,151,000
Engineering	10	%		$ 5,076,000
Site Acquisition				$ 1,000,000
Total Budget Estimate				**$56,831,000.00**

(1) This estimate represents project costs as discussed in Section 10.

L16 Featherston SPS and Force Main Replacement
Prince William County Service Authority
Opinion of Probable Construction Cost (1)

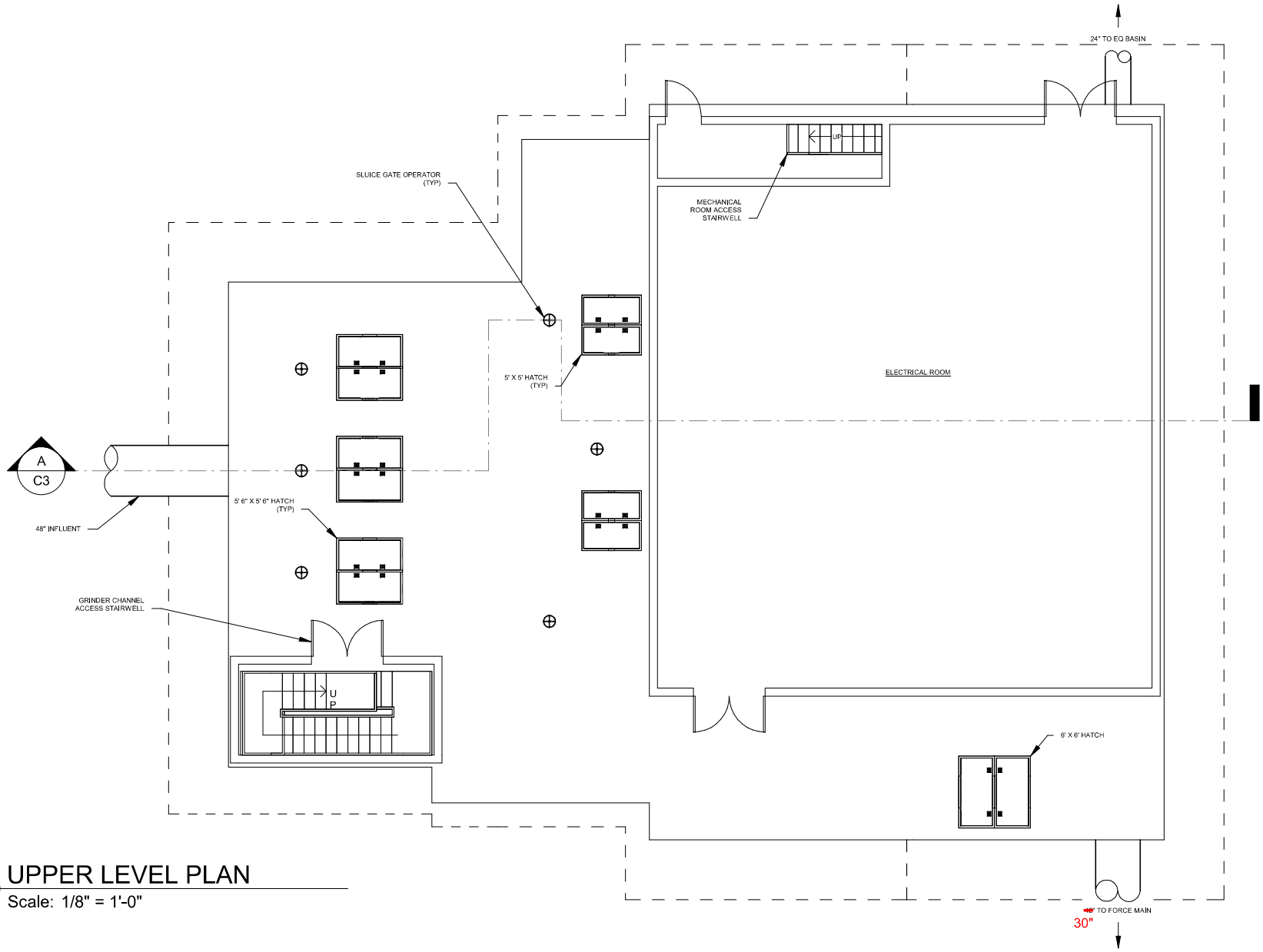
Long Term Solution Sequencing Summary

Description	Engineering	Phase 1 Construction	Phase 2 Construction
Force Main	$1,440,000	$14,400,000	
Pump Station	$4,207,300	$42,073,000	
Equalization Basin	$1,112,500		$11,125,000
Total	**$6,759,800**	**$56,473,000**	**$11,125,000**

(1) This estimate represents phased project costs as discussed in executive summary Section 3.

ATTACHMENT C

Preliminary Recommended Layout



1 UPPER LEVEL PLAN
Scale: 1/8" = 1'-0"

FIGURE NO. C1

TITLE MECHANICAL LAYOUT - UPPER LEVEL PLAN

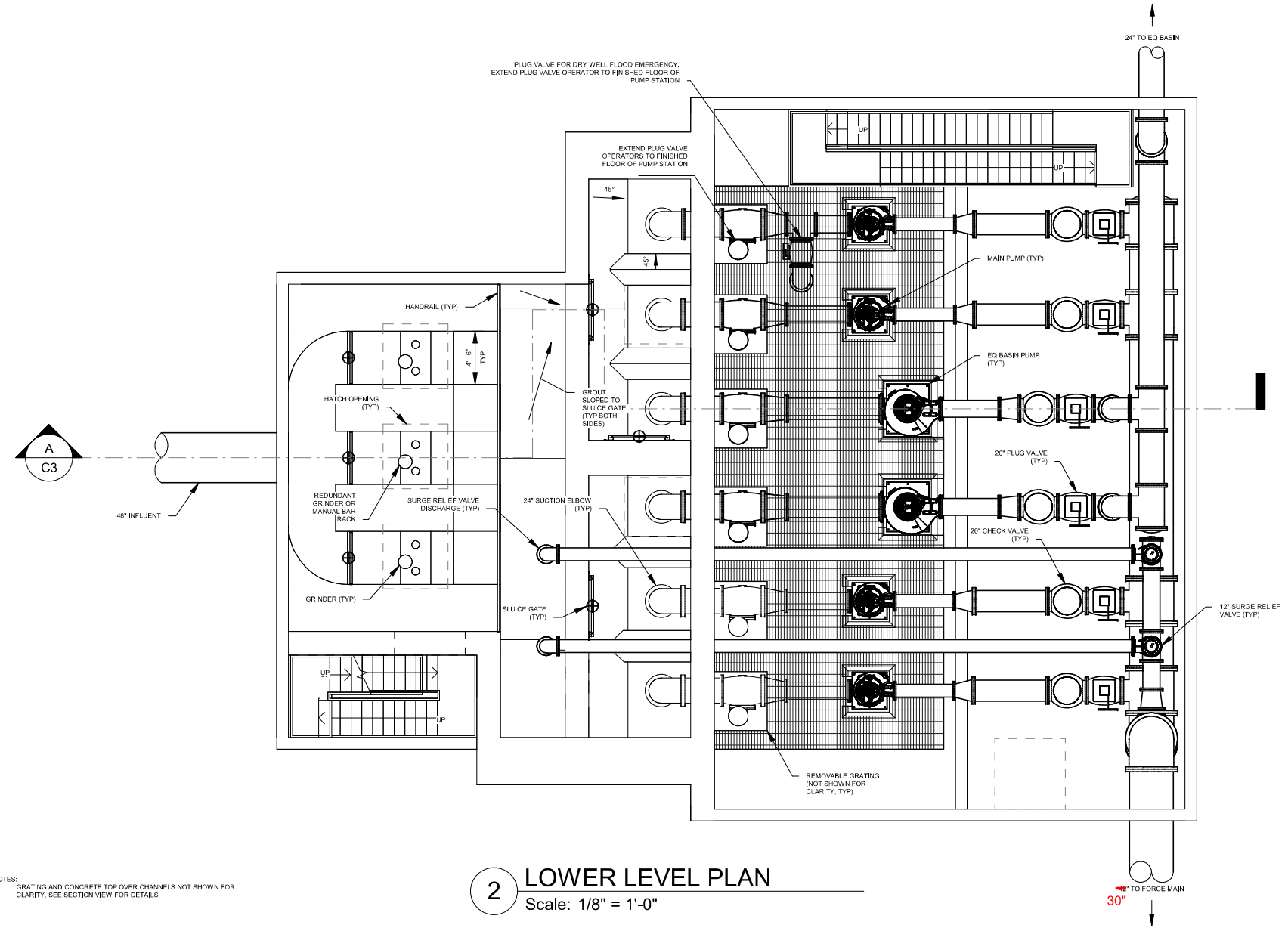
SCALE 1/8" = 1'-0"

PROJECT FEATHERSTONE SPS PROGRAM PER

DATE 07/2023

PROJ. NO. 50114730

Dewberry
Dewberry Engineers Inc.
4805 Lake Brook Drive, Suite 200
Glen Allen, VA 23060
Phone: 804.290.7957
Fax: 804.290.7928



NOTES:
1. GRATING AND CONCRETE TOP OVER CHANNELS NOT SHOWN FOR CLARITY, SEE SECTION VIEW FOR DETAILS

2 LOWER LEVEL PLAN
Scale: 1/8" = 1'-0"

FIGURE NO. C2

TITLE MECHANICAL LAYOUT - LOWER LEVEL PLAN

SCALE 1/8" = 1'-0"

PROJECT FEATHERSTONE SPS PROGRAM PER

DATE 07/2023

PROJ. NO. 50114730

Dewberry
Dewberry Engineers Inc.
4805 Lake Brook Drive, Suite 200
Glen Allen, VA 23060
Phone: 804.290.7957
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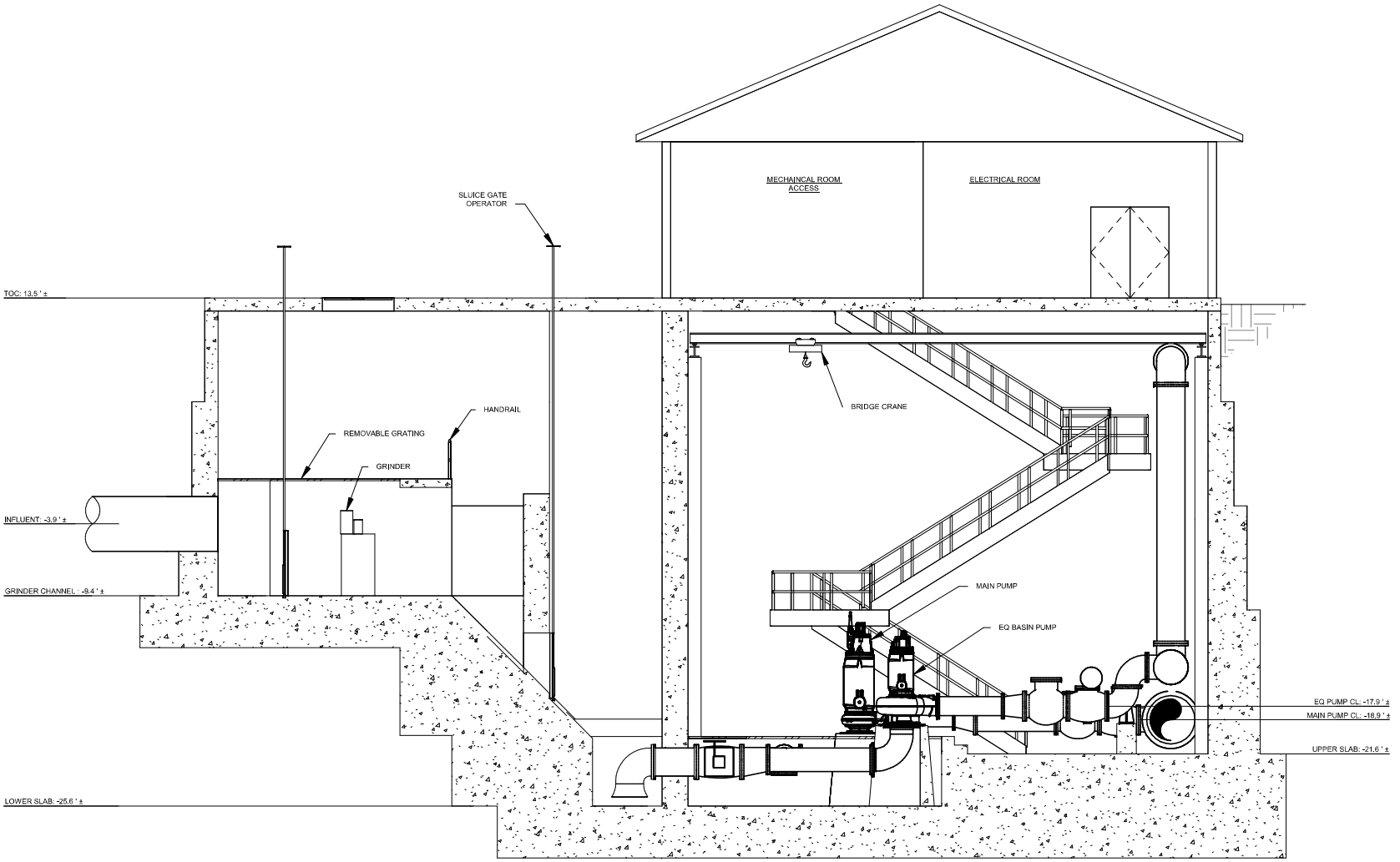


A SECTION
Scale: 1/8" = 1'-0"

FIGURE NO. C3

TITLE FINAL MECHANICAL LAYOUT - SECTION

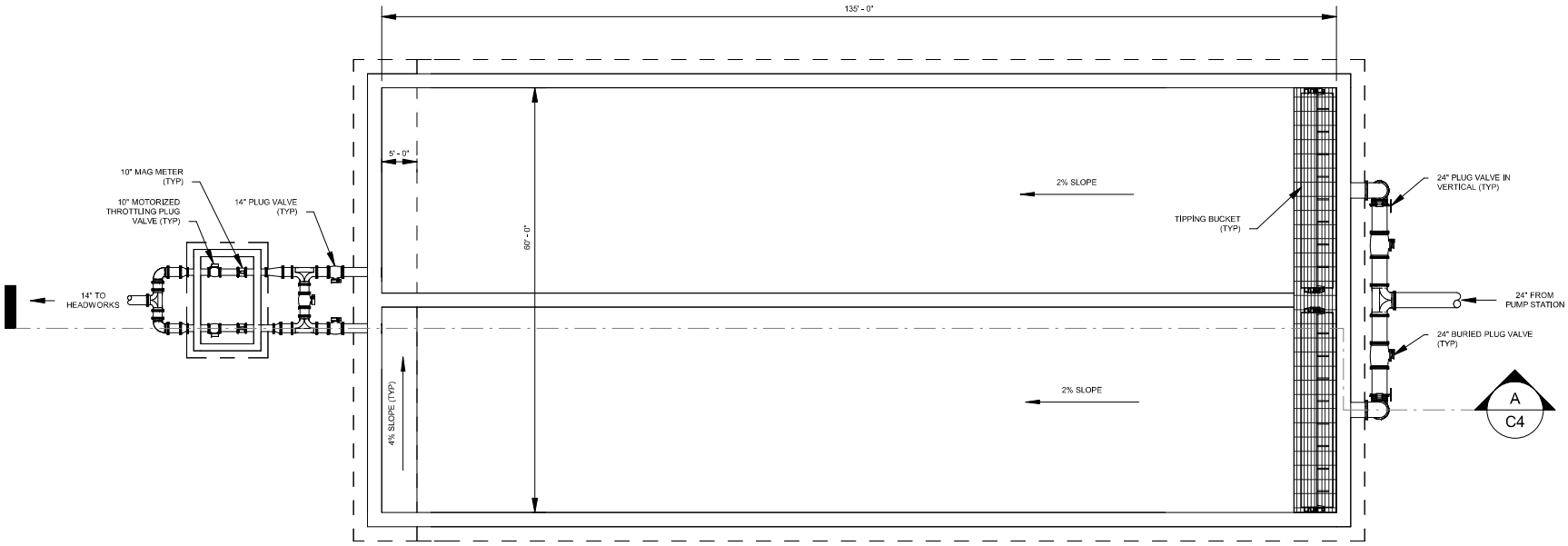
SCALE 1/8" = 1' - 0"

PROJECT FEATHERSTONE SPS PROGRAM PER

DATE 07/2023

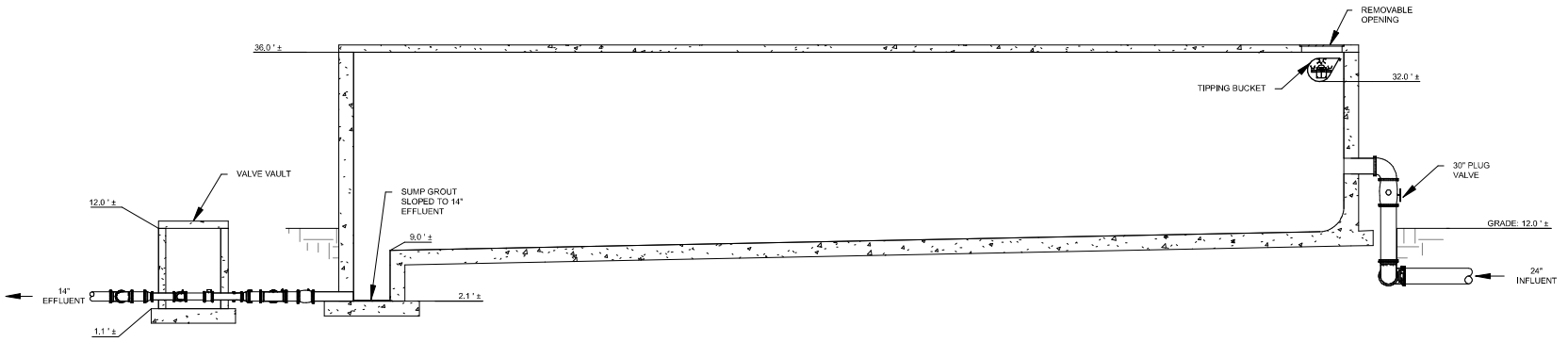
PROJ. NO. 50114730

Dewberry
Dewberry Engineers Inc.
4805 Lake Brook Drive, Suite 200
Glen Allen, VA 23060
Phone: 804.290.7957
Fax: 804.290.7928



1 EQ BASIN PLAN

Scale: 1/16" = 1'-0"



A EQ BASIN SECTION

Scale: 1/16" = 1'-0"

FIGURE NO.	C4
TITLE	MECHANICAL LAYOUT - EQ BASIN
SCALE	1/16" = 1' - 0"
PROJECT	FEATHERSTONE SPS PROGRAM PER
DATE	07/2023
PROJ. NO.	50114730

Dewberry
Dewberry Engineers Inc.
4805 Lake Brook Drive, Suite 200
Glen Allen, VA 23060
Phone: 804.290.7957
Fax: 804.290.7928

ATTACHMENT D

Permit Register

Agency	Permit Type	Regulatory Citation	Project Requirement	Action/Report/Application	Design Phase Necessary to Make a Determination	Production/ Length	Agency Review
U.S. Army Corps of Engineers (USACE)	Jurisdictional Determination (JD) Section 404	33 U.S.C. §1344	Yes to identify waters / wetlands and RPA's	Field Delineation/Wetland Delineation Report	Kick Off	1 Month	4-6 Weeks
U.S. Army Corps of Engineers (USACE)	Nationwide Permits (Nontidal Wetlands Section 404)	33 U. S. C. §1344	Yes; applicability determined on project impacts to WOUS/wetlands	Determine detailed impacts; narrative, and Joint Permit Application (JPA). Application filed jointly with the USACE, and VMRC	60%	1 Month	45-60 Days
VA Department of Environmental Quality (DEQ)	Virginia Water Protection Permit (401 Water Quality Certificate)	9 VAC 25-260-10 9 VAC 25-210-10 et seq 9 VAC 25-680-10 et seq	Yes; applicability dependent on project impacts to WOUS/wetlands	Determine detailed impacts; narrative, and Joint Permit Application (JPA). Application filed jointly with the USACE, and VMRC	60-90%	1 week	
VA Department of Environmental Quality (DEQ)	Air Quality Permit for Generator Emission	9 VAC 5-80-1100	Yes, depending on size of generator, below is exempted from a permit requirement by size, anything over will need a permit	File permit application if necessary, upon determination of size requirement & fuel type	60%-90%	1 week	3-4 months
VA Department of Environmental Quality (DEQ)	Certificate to Construct	9 VAC 25-790-50 through 90	Yes	File application 180 days prior to construction	Plan Approval- Prior to Construction		
VA Department of Environmental Quality (DEQ)	Certificate to Operate	9 VAC 25-790	Yes	File application 30 days prior to operation	Plan Approval -Prior to Operation		
VA Department of Environmental Quality (DEQ)	VPDES General Permit (VAG-83) discharges from groundwater remediation of contaminated sites, dewatering activities of contaminated sites, and hydrostatic tests	9 VAC25-120-15	Unknown	Determine applicability	Construction stage		
Virginia Marine Resource Commission (VMRC)	Subaqueous Individual Permit to construct in Virginia Tidal Wetlands and Subaqueous bottoms.	Code of VA § 28.2-1200 through 28.2-1400	Yes; applicable if crossing or impacting tidal waters and waters with over a 5 square mile drainage area.	Direct or indirect impacts to streams with > 5 square miles of drainage are Determine detailed impacts; narrative, and Joint Permit Application (JPA). Application filed jointly with the USACE, and VMRC	60%	1 Month	3 Months
Prince William County	Chesapeake Bay Preservation Area Site Assessment & Exemption Approval	9 VAC-10-20-070 Code of VA, Chesapeake Bay Preservation Act, Sections 10.1-2100 Prince William DCSM Section 742; Section 32-504	Yes, portions of the project site are located within mapped RPA. Dependent on design	Plan Approval – Perennial Flow Determination PASA/WQIA	90% (Submit at 100%)	3 Months	60-90 Days
Prince William County Wetlands Board	Tidal wetlands involvement up to 1.5ft. above MHW.	28.2-1300 Code of Virginia	Unknown, public utilities typically exempt	Concurrent with Joint Permit Application submittal		3 months	
Prince William County	Erosion and Sediment Control & Grading Permit	VA Code 1950 10-1-506 PWC Section 750-752	E&S Reviewed with grading plans		100%		

Prince William County & DEQ	Virginia Stormwater Management Program (VSMP) Permit	Prince William County Stormwater Management Code 23.2-30 Section 750-752	Yes	VSMP Registration/SWPPP	100%	2 Weeks	30 Days
Prince William County	Public Facility Determination Request		Yes, for Pumping Stations	Public Facility Determination Request Application	30%	1 week	30 Days
Prince William County	Flood Hazard Use Permit (FHUP)		May be required if working in the flood hazard area. Applicability based on final site plan.	Flood Hazard Use Permit Application	100%	1 week	30-60 Days
Prince William County	Building Permit		Unknown	Building Permit Application	Construction Contractor		
Prince William County	Electrical Permit		Unknown	Electrical Permit Application	Construction Contractor		
Prince William County	Plumbing Permit		Unknown currently, need design	Plumbing Permit Application	Construction Contractor		
Prince William County	Mechanical Permit		Unknown currently, need design	Mechanical Permit Application	Construction Contractor		
Prince William County	Site Development		Unknown currently, need design	Site Development Permit Application	Plan Approval – Prior to Construction	2 weeks	2 weeks
Prince William County	Fire Inspection/Permit		Unknown currently, need design	On-site diesel fuel tank inspection and new building construction	Construction Contractor		
Prince William County	Stormwater Management Regulations		Unknown currently, need design	Stormwater Management Waiver Application	60%	2 weeks	30 Days
Prince William County	Demolition Permit		Unknown currently, need design	Demolition Checklist & Permit	100%	2-4 weeks	2-4 weeks
Prince William County	Retaining Wall Permit		Unknown currently, need design	Building Permit Application for each wall	Plan Approval – Prior to Construction		

ATTACHMENT E

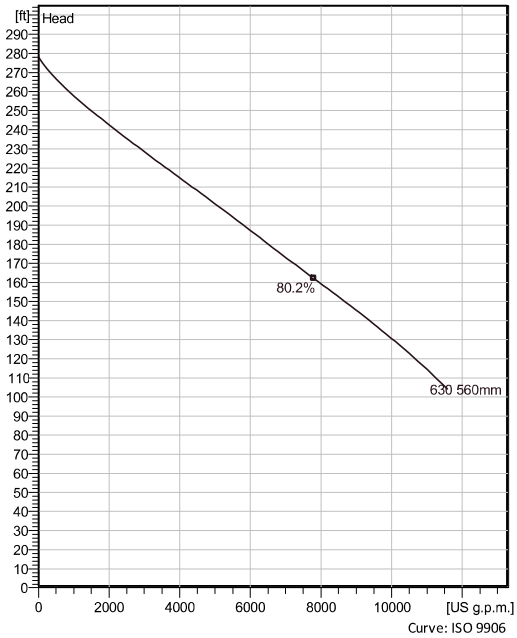
Proposed Equipment Cut Sheets

CT 3312/865 3~ 630

Shrouded single or multi-channel impeller pumps with large throughlets and single volute pump casing for liquids containing solids and fibres. Cast iron design with double sealing technology. Some models available as stainless steel versions.

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.43 lb/ft³,1.6888E-5 ft²/s



Curve: ISO 9906

Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Configuration

Motor number
C0865.000 54-66-6AA-D 470hp

Installation type
T - Vertical Permanent, Dry

Impeller diameter
560 mm

Discharge diameter
12 inch

Configuration

Pump information

Impeller diameter
560 mm

Discharge diameter
12 inch

Inlet diameter
350 mm

Maximum operating speed
1190 rpm

Number of blades
3

Throughlet diameter
4 1/16 inch

Max. fluid temperature
40 °C

Material

Impeller
Grey cast iron

Project	Xylect-20777380	**Created by**	Jon Casarotti		
Block	0	**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

Technical specification

Motor - General

Motor number C0865.000 54-66-6AA-D 470hp	**Phases** 3~	**Rated speed** 1190 rpm	**Rated power** 470 hp
ATEX approved No	**Number of poles** 6	**Rated current** 555 A	**Stator variant** 1
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 000	**Direct media cooling system**		

Motor - Technical

Power factor - 1/1 Load 0.84	**Motor efficiency - 1/1 Load** 94.9 %	**Total moment of inertia** 284 lb ft²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.80	**Motor efficiency - 3/4 Load** 94.7 %	**Starting current, direct starting** 3410 A	
Power factor - 1/2 Load 0.71	**Motor efficiency - 1/2 Load** 93.6 %	**Starting current, star-delta** 1140 A	

Project	Xylect-20777380	**Created by**	Jon Casarotti		
Block	0	**Created on**	6/27/2023	**Last update**	6/27/2023

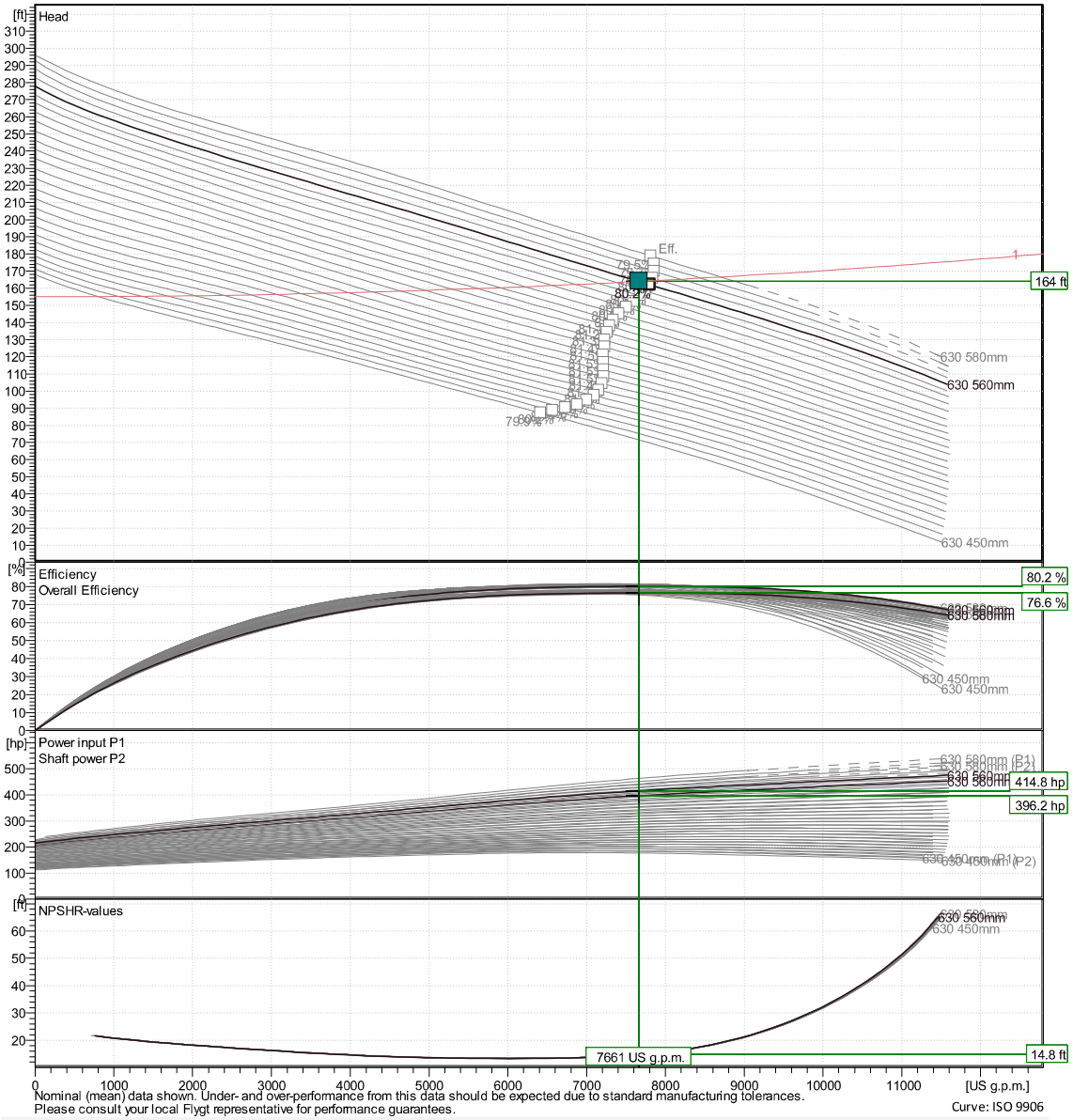
CT 3312/865 3~ 630

Performance curve

Duty point

Flow	Head
7670 US g.p.m.	164 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.43 lb/ft³,1.6888E-5 ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

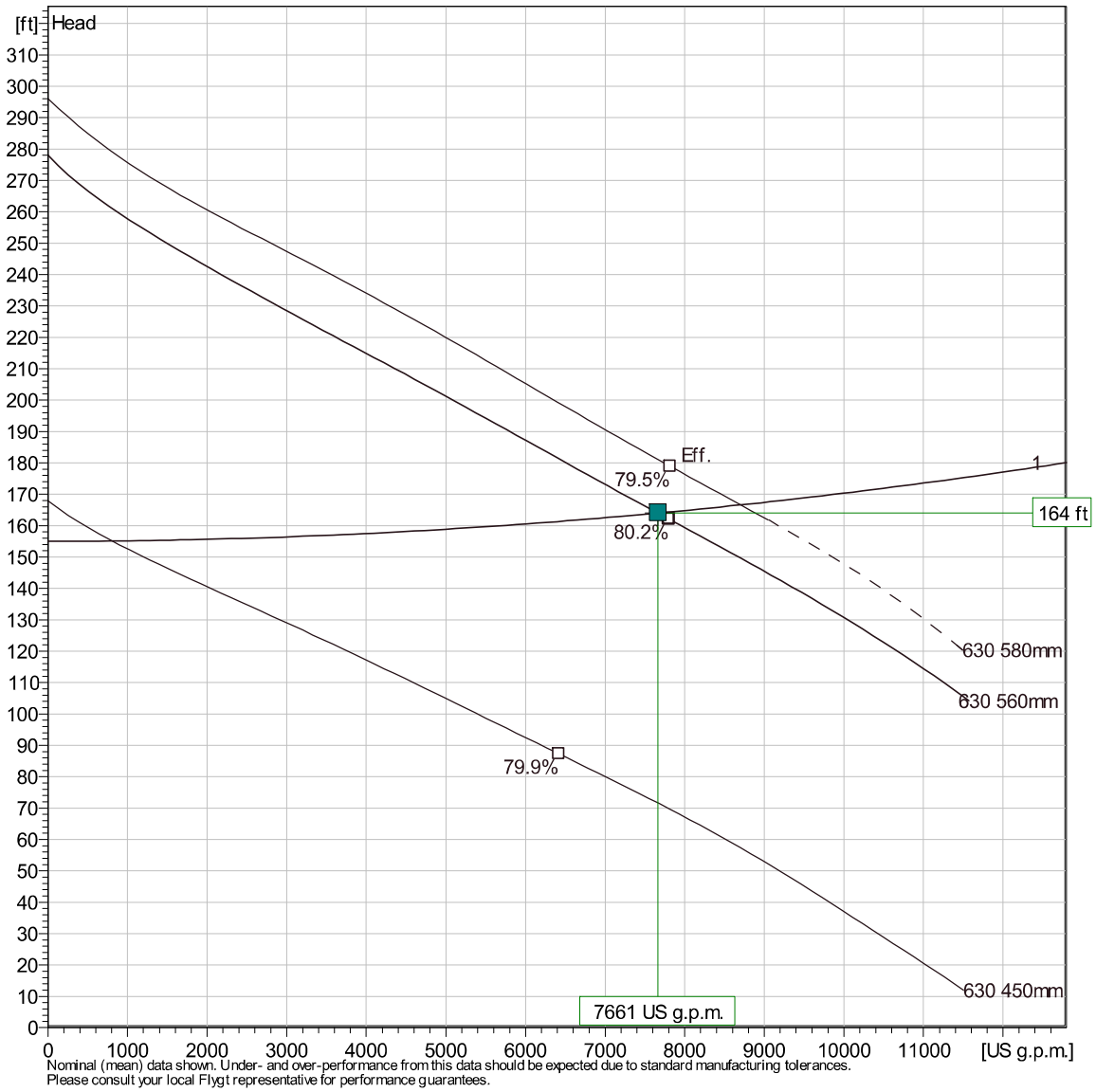
Curve: ISO 9906

Xylect-20777380			Jon Casarotti		
0		**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.43lb/ft³; 1.6888E-5ft²/s



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Operating characteristics

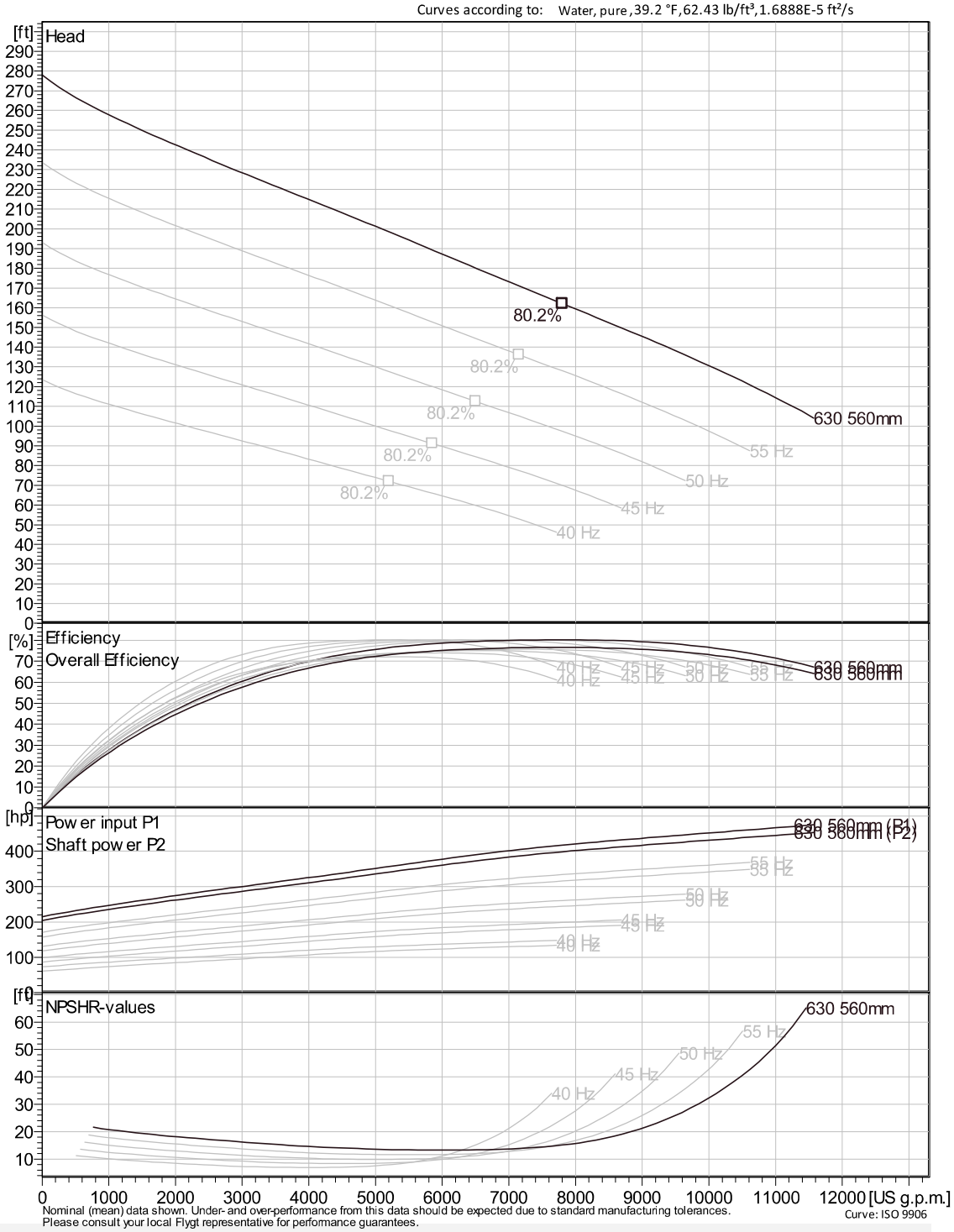
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	7670	164	396	7670	164	396	80.2 %	672	14.8

Project		**Created by**	Jon Casarotti		
Block	Xylect-20777380	**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

VFD Curve

Curves according to: Water, pure, 39.2 °F, 62.43 lb/ft³, 1.6888E-5 ft²/s



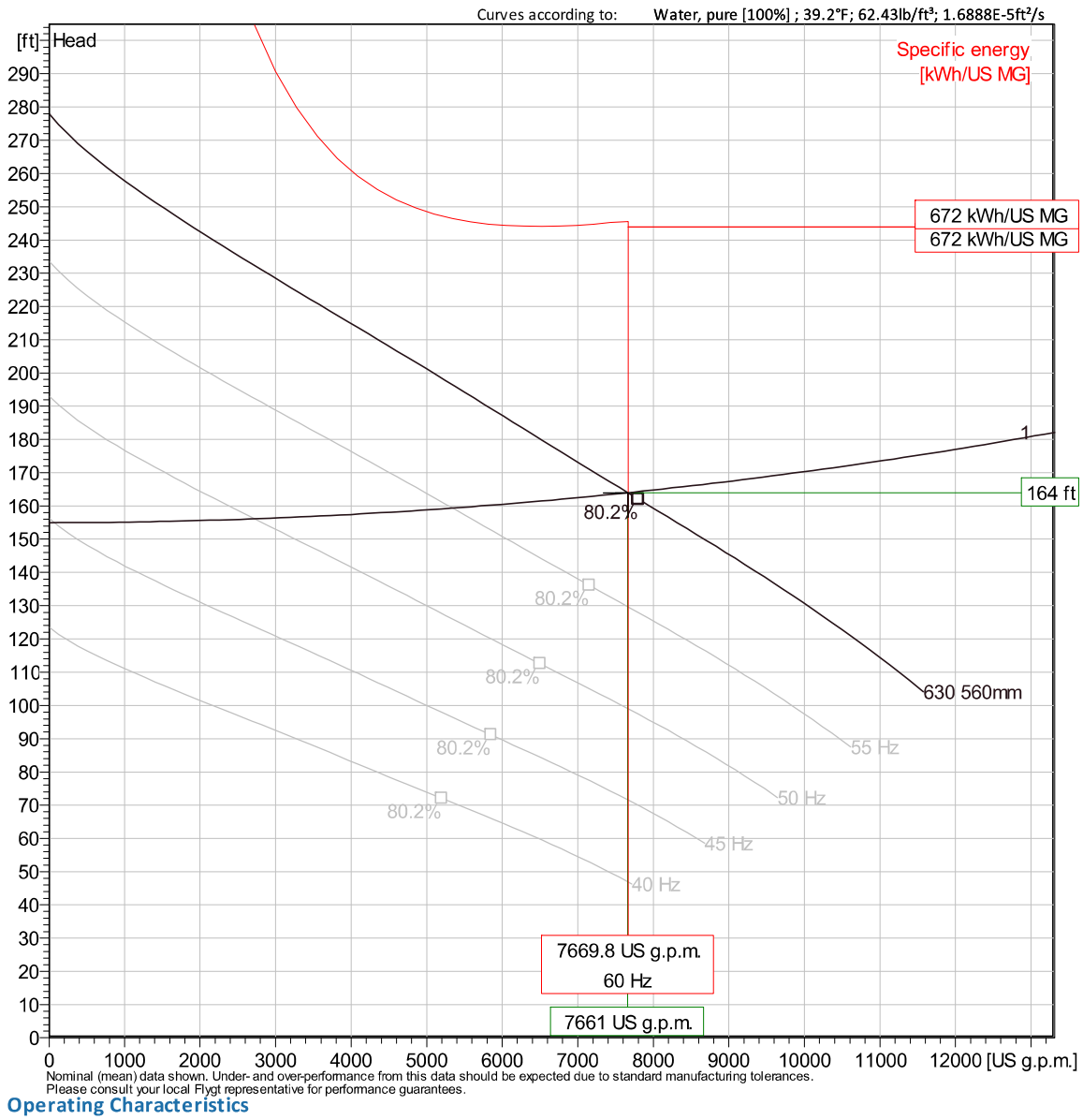
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

Curve: ISO 9906

Project	Xylect-20777380	**Created by**	Jon Casarotti		
Block	0	**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

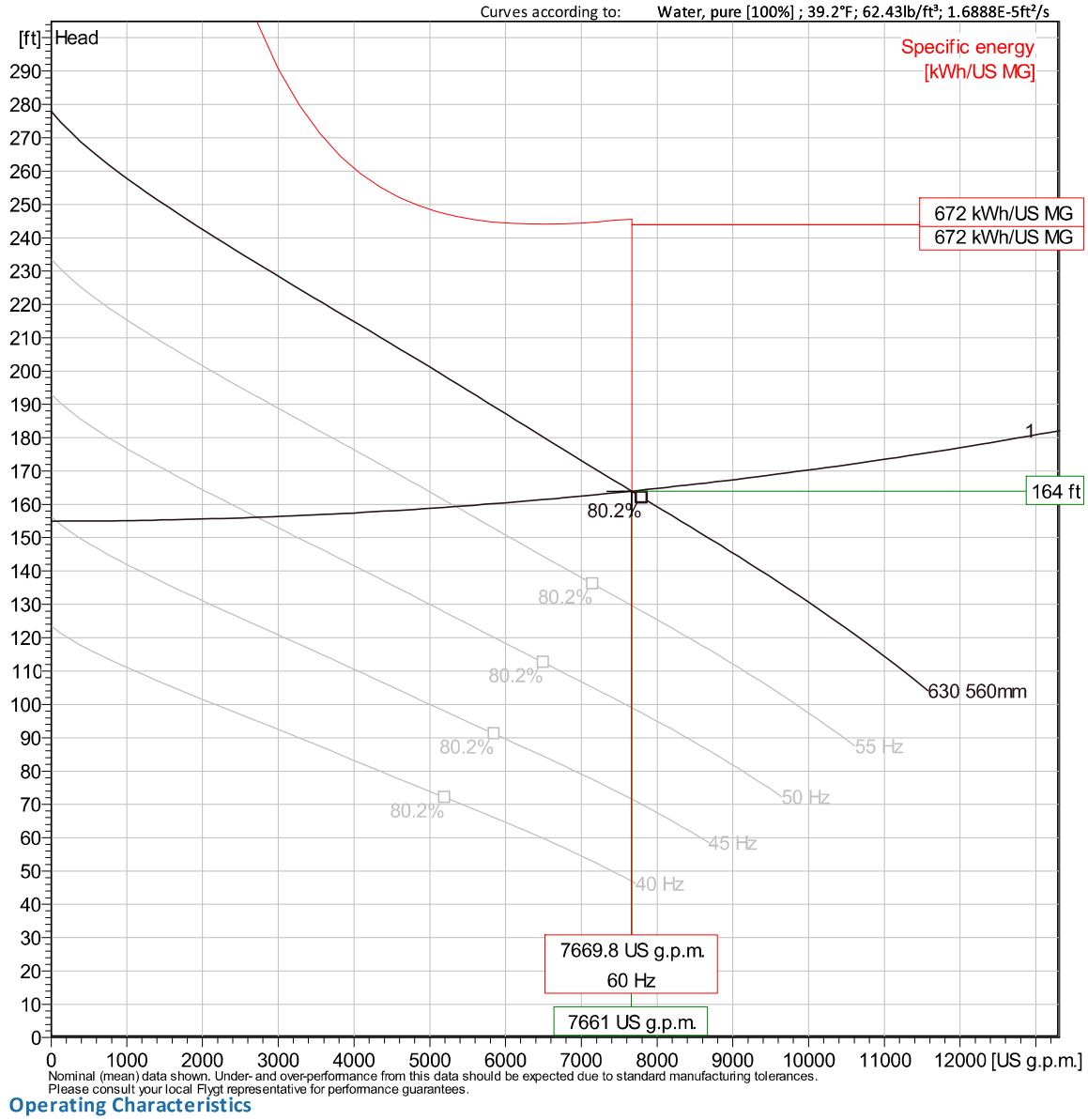
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	60 Hz	7670	164	396	7670	164	396	80.2 %	672	14.8
1	55 Hz	5340	159	275	5340	159	275	78.3 %	679	11.6
1	50 Hz	2720	156	170	2720	156	170	63.3 %	840	11.8
1	45 Hz	70.6	155	87.6	70.6	155	87.6	3.12 %	17700	

Project	Xylect-20777380	**Created by**	Jon Casarotti		
Block	0	**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

VFD Analysis



Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances.
Please consult your local Flygt representative for performance guarantees.

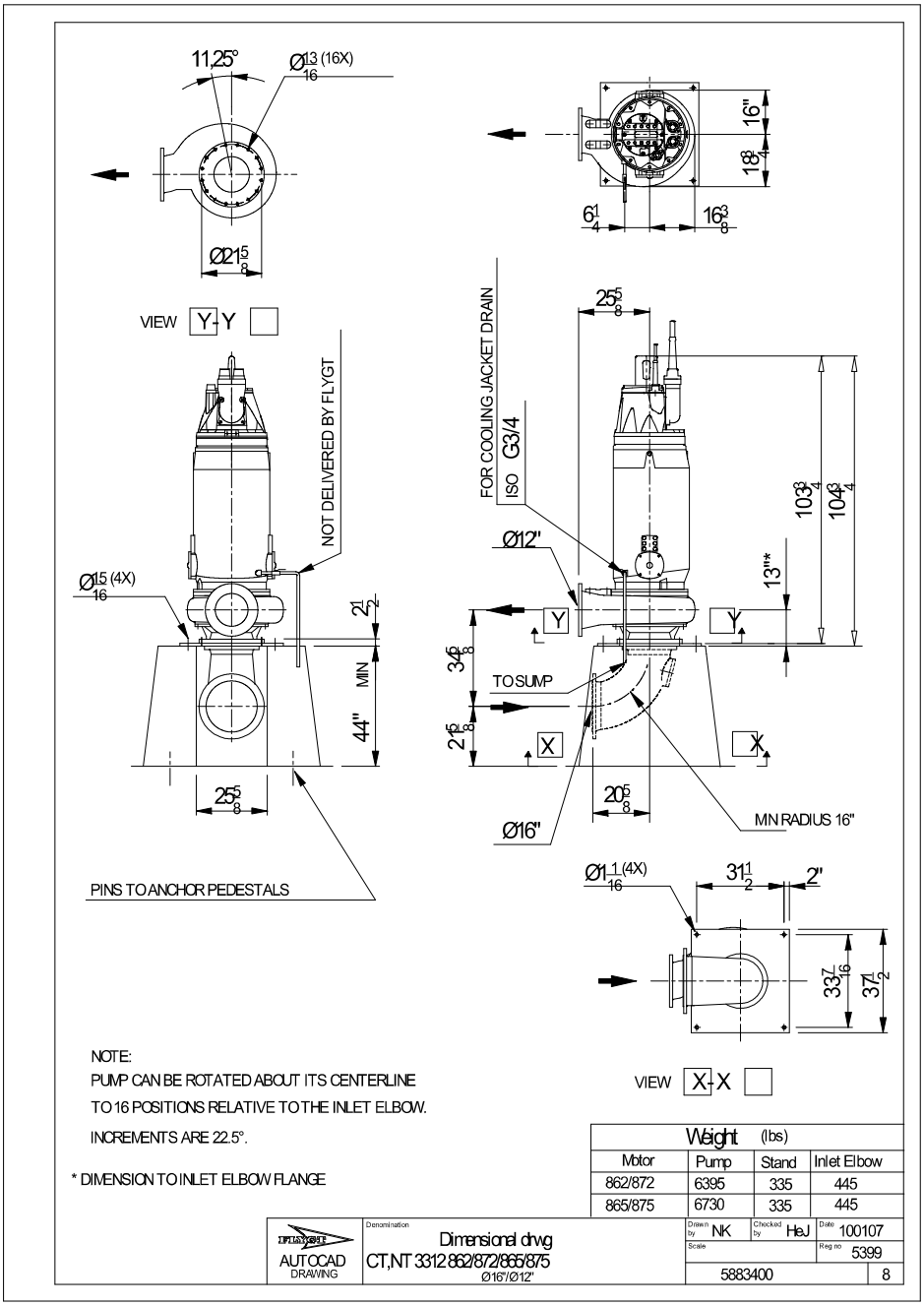
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	40 Hz									

Project	Xylect-20777380	**Created by**	Jon Casarotti		
Block	0	**Created on**	6/27/2023	**Last update**	6/27/2023

CT 3312/865 3~ 630

Dimensional drawing



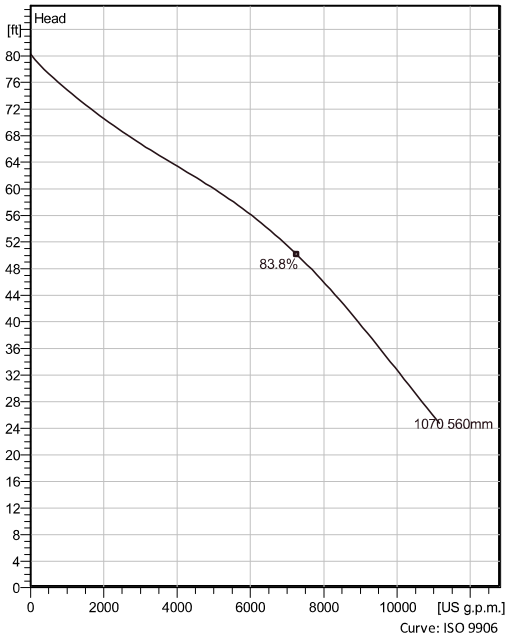
Project	Xylect-20777380	**Created by**	Jon Casarotti
Block	0	**Created on**	6/27/2023 **Last update** 6/27/2023

NT 3400/735 3~ 1070

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.

Technical specification

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s



Curve: ISO 9906

Configuration

Motor number
N0735.000 43-44-10FA-D 135hp

Installation type
T - Vertical Permanent, Dry

Impeller diameter
560 mm

Discharge diameter
16 inch

Pump information

Impeller diameter
560 mm

Discharge diameter
16 inch

Inlet diameter
500 mm

Maximum operating speed
710 rpm

Number of blades
3

Max. fluid temperature
40 °C

Configuration

Material

Impeller
Hard-Iron ™

Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

Technical specification

Motor - General

Motor number N0735.000 43-44-10FA-D 135hp	**Phases** 3~	**Rated speed** 710 rpm	**Rated power** 135 hp
ATEX approved No	**Number of poles** 10	**Rated current** 211 A	**Stator variant** 1
Frequency 60 Hz	**Rated voltage** 460 V	**Insulation class** H	**Type of Duty** S1
Version code 000	**Direct media cooling system**		

Motor - Technical

Power factor - 1/1 Load 0.66	**Motor efficiency - 1/1 Load** 90.6 %	**Total moment of inertia** 118 lb ft²	**Starts per hour max.** 15
Power factor - 3/4 Load 0.59	**Motor efficiency - 3/4 Load** 90.1 %	**Starting current, direct starting** 960 A	
Power factor - 1/2 Load 0.48	**Motor efficiency - 1/2 Load** 87.9 %	**Starting current, star-delta** 320 A	

Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

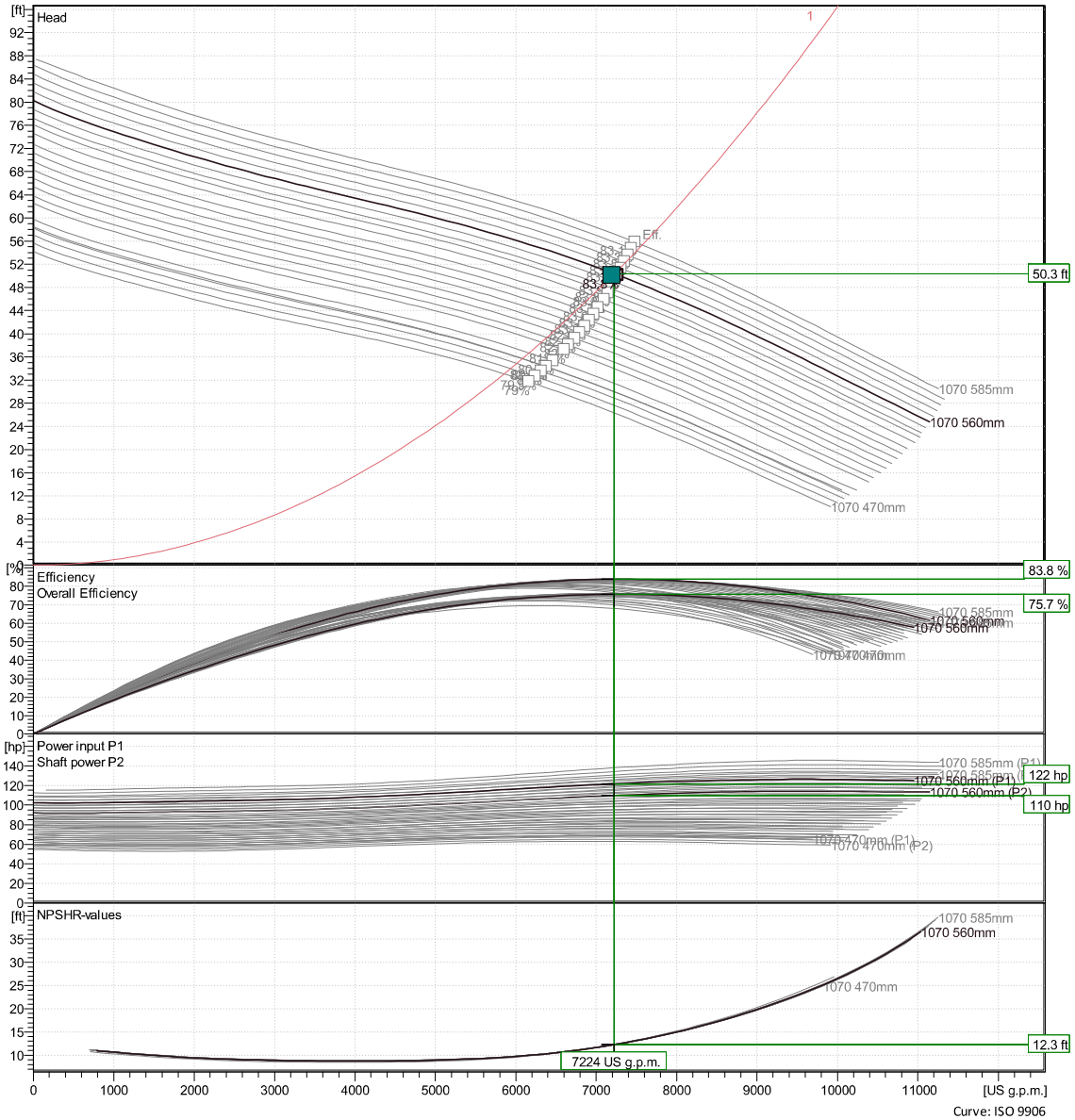
NT 3400/735 3~ 1070

Performance curve

Duty point

Flow	Head
7220 US g.p.m.	50.3 ft

Curves according to: Water, pure Water, pure [100%],39.2 °F,62.42 lb/ft³,1.6891E-5 ft²/s

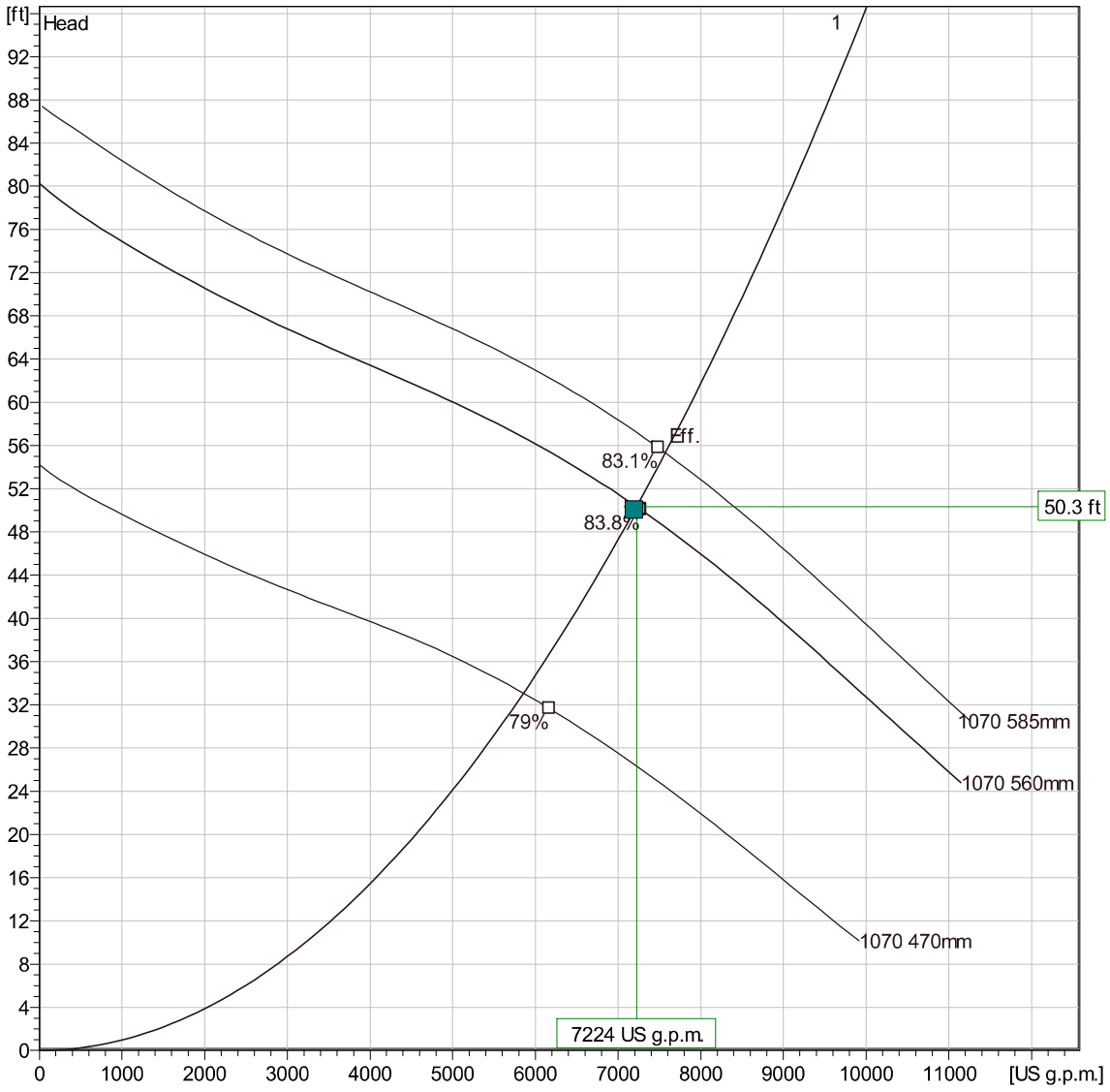


Xylect-20278133		Jon Casarotti	
Created on	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

Duty Analysis

Curves according to: Water, pure [100%] ; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Operating characteristics

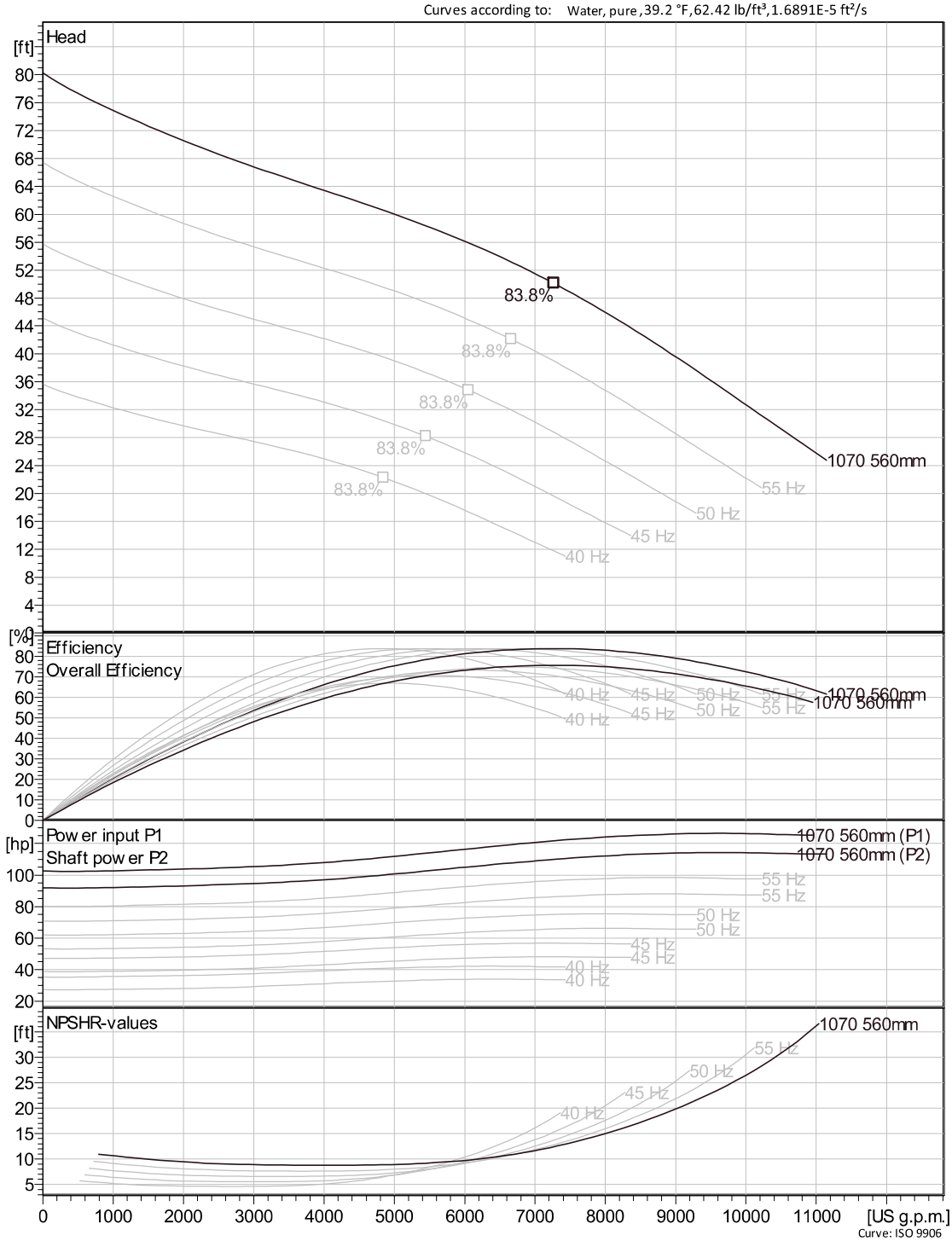
Pumps / Systems	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Spec. Energy	NPSHre
	US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	7220	50.3	110	7220	50.3	110	83.8 %	209	12.3

Project		**Created by**	Jon Casarotti		
Block	Xylect-20278133	**Created on**	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

VFD Curve

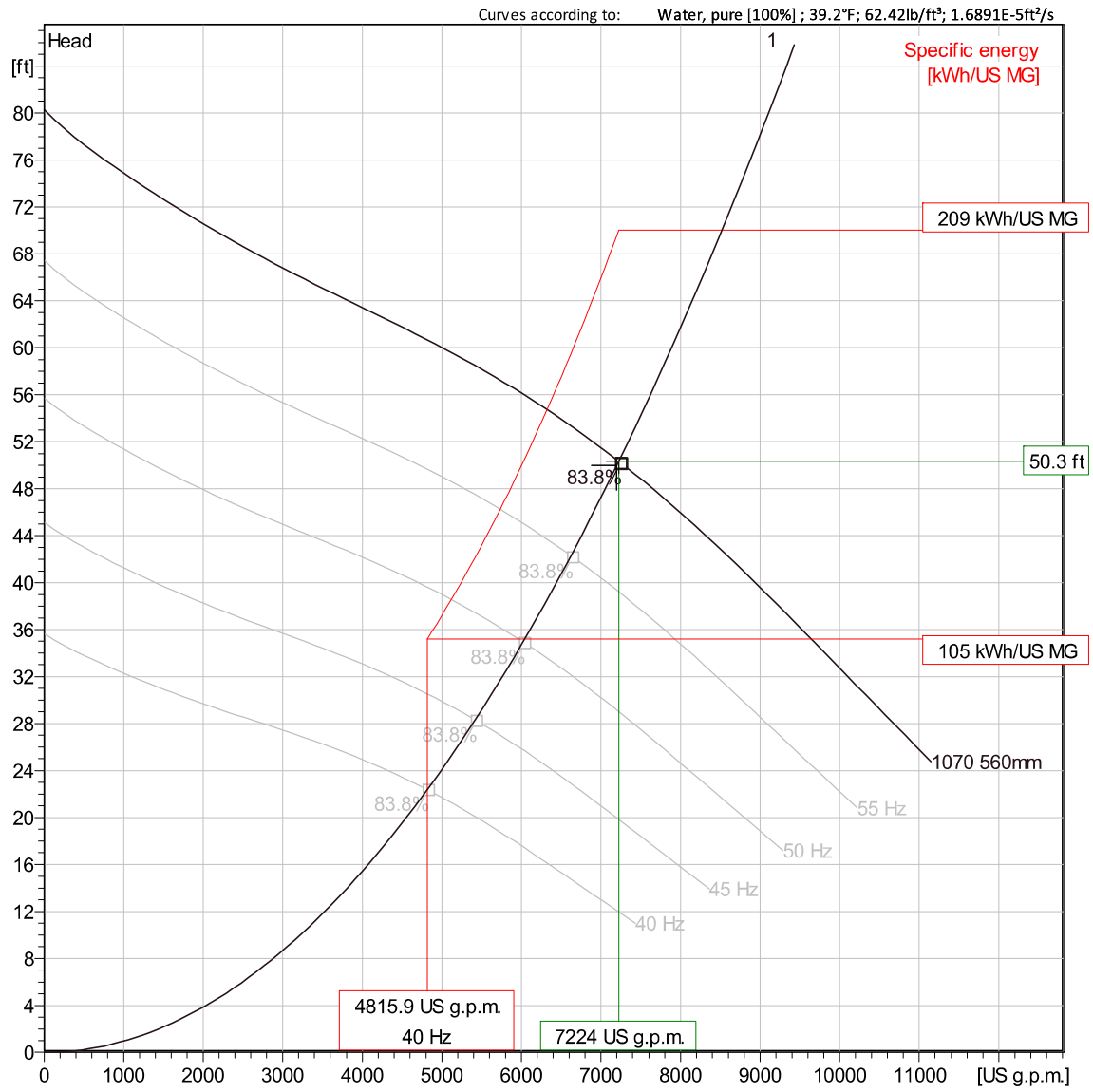
Curves according to: Water, pure, 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

VFD Analysis



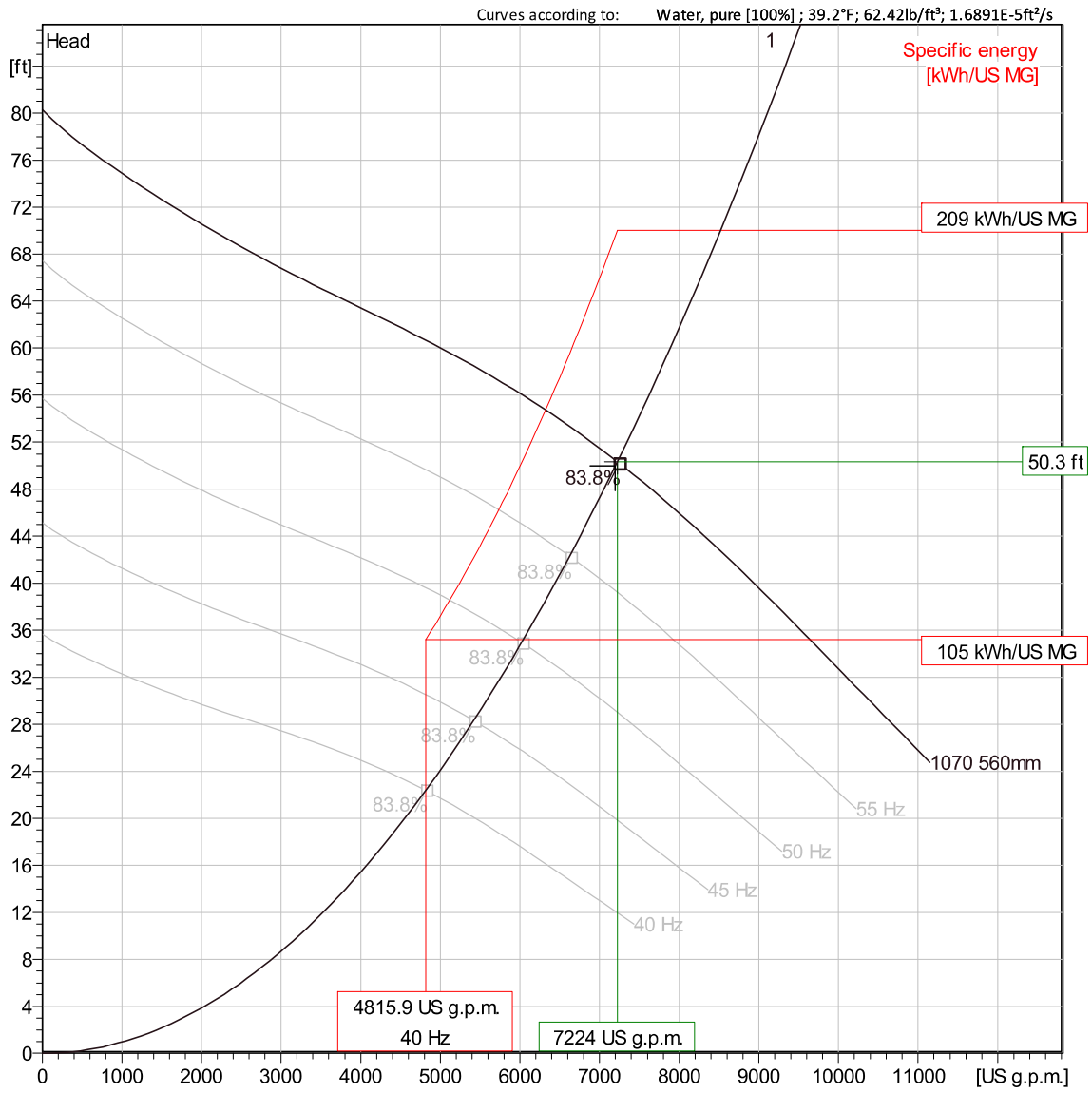
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	60 Hz	7220	50.3	110	7220	50.3	110	83.8 %	209	12.3
1	55 Hz	6620	42.3	84.6	6620	42.3	84.6	83.8 %	178	10.7
1	50 Hz	6020	35	63.5	6020	35	63.5	83.8 %	150	9.17
1	45 Hz	5420	28.3	46.3	5420	28.3	46.3	83.8 %	126	7.74

Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

VFD Analysis



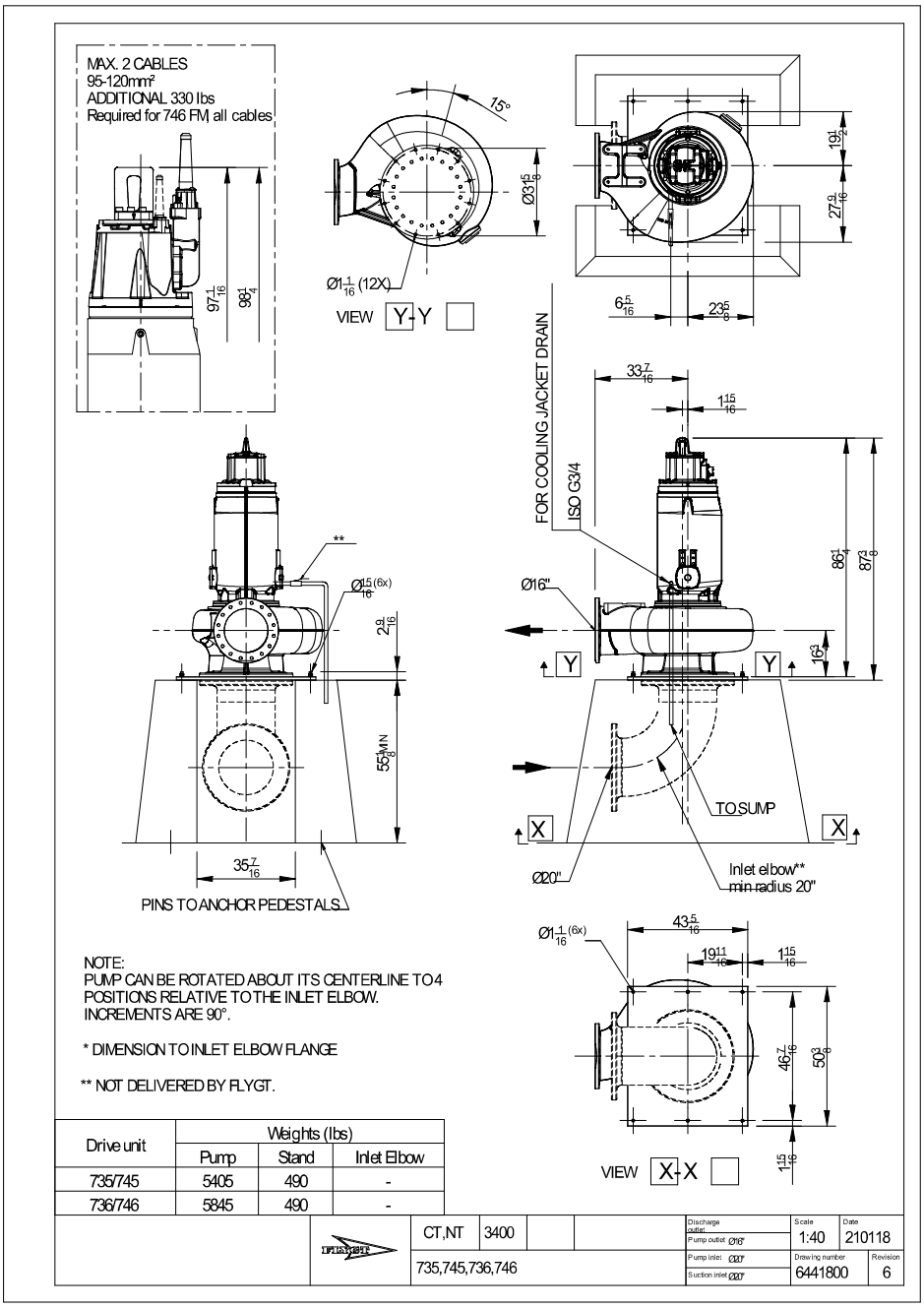
Operating Characteristics

Pumps / Systems	Frequency	Flow	Head	Shaft power	Flow	Head	Shaft power	Hydr.eff.	Specific energy	NPSHre
		US g.p.m.	ft	hp	US g.p.m.	ft	hp		kWh/US MG	ft
1	40 Hz	4820	22.4	32.5	4820	22.4	32.5	83.8 %	105	6.41

Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

NT 3400/735 3~ 1070

Dimensional drawing



NOTE:
PUMP CAN BE ROTATED ABOUT ITS CENTERLINE TO 4 POSITIONS RELATIVE TO THE INLET ELBOW. INCREMENTS ARE 90°.

* DIMENSION TO INLET ELBOW FLANGE

** NOT DELIVERED BY FLYGT.

Drive unit	Weights (lbs)		
	Pump	Stand	Inlet Elbow
735/745	5405	490	-
736/746	5845	490	-

	CT,NT	3400		Discharge outlet: Pump outlet Ø16"	Scale 1:40	Date 210118
	735,745,736,746			Pump inlet: Ø20" Suction inlet Ø20"	Drawing number 6441800	Revision 6

Project	Xylect-20278133	**Created by**	Jon Casarotti		
Block		**Created on**	3/13/2023	**Last update**	3/13/2023

JWC Environmental®
Trust Monster Quality™

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fax (949) 833-8858
jwce@jwce.com

CDD 2.0 CHANNEL MONSTER BUDGET DESIGN INFORMATION

REVISION 3

DATE: 11/29/2021 **EXPIRES:** 5/10/2023

PROJECT: Featherstone PS - Prince William County SA

TO: Mark Wolff / Watermark Environmental

Thank you for choosing JWC's equipment. Enclosed you will find a specification and drawing based on the design parameters listed below. Please let us know if any of the information below changes.

Number of units:	3	
Model:	CDD-4020-XDS2.0	
Flow:	21.8 MGD	**Unrestricted free fall condition / Refer to JWC flow curves**
Channel width	54 inches	
Channel depth	60 inches	
Weight	4580 lbs. each	

CDD4020-XDS2.0 Channel Monster with 11 tooth cam cutters

15 HP Hydraulic Power pack with stand and 40' x 3/4" hose pair with QD connectors at motor end

304 S/S custom channel frame

PC2240 NEMA 4X FRP control panel

BUDGET PRICE FOR ALL THREE UNITS **$424,429**

(Freight and one startup service included)

Not to be used for construction

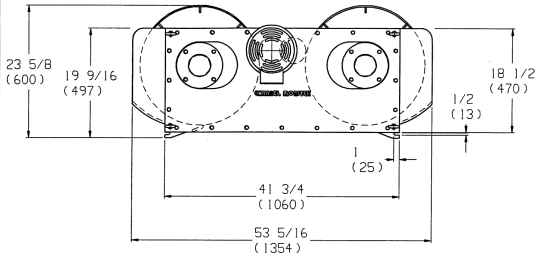
Please contact JWC if you have any questions.

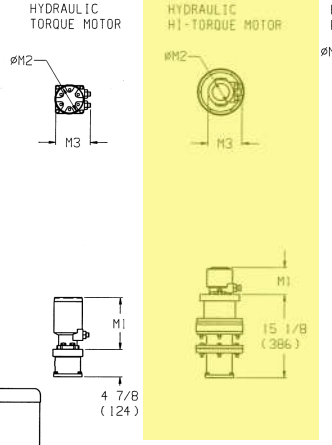
DRAWING NO. CDD0020-020-XDS-CD

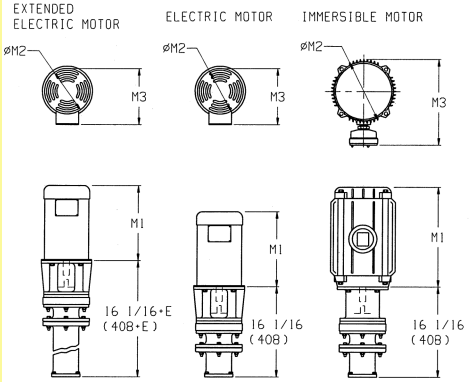
NOTES: UNLESS OTHERWISE SPECIFIED

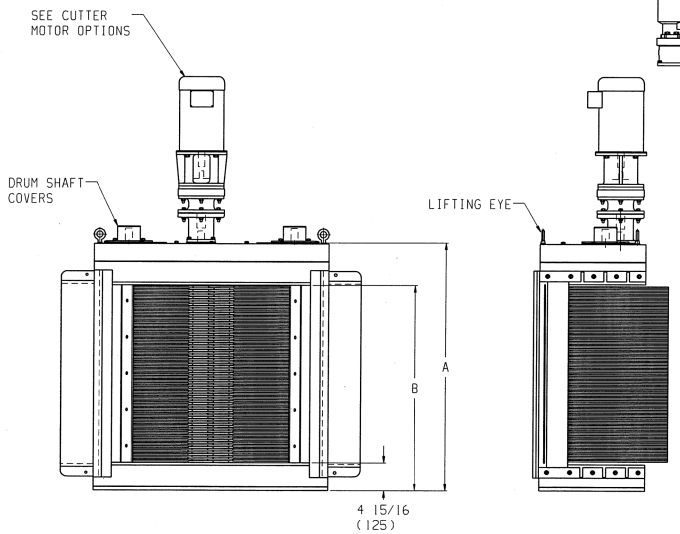
1. WEIGHT OF UNITS EQUIPPED WITH TEFC ELECTRIC MOTORS.

REVISIONS					
ZONE	LTR	DESCRIPTION	ECO NO.	DATE	APPROVED (CT/D, PE, DMM, QC)
A6.7	A	INITIAL RELEASE	CM-0626	5-25-05	PM RS MU MC
A7.8	B	ADDED 2.0 TO SUFFIX, ADDED 4020	CM-0718	5-25-06	CG RS VO MC
A6.7	C	ADDED 50,60 SPECIAL APPLICATIONS	CM-0734	12-12-06	









CUTTER MOTOR OPTIONS			
ELECTRIC	M1	M2	M3
5 HP			
TEFC	14 (356)	8 7/8 (225)	11 1/4 (286)
SUPER-E	13 3/8 (340)	9 (229)	12 (305)
XPFC	16 1/4 (413)	9 (229)	12 (305)
CHEM PRCS EXTRM SRVC	14 1/4 (362)	10 1/4 (260)	12 1/4 (311)
IMMERSIBLE	15 3/4 (400)	11 7/16 (291)	17 1/4 (438)
HYDRAULIC			
STANDARD	9 1/4 (235)	5 1/8 (130)	6 1/8 (156)
HI-TORQUE	4 3/4 (121)	4 1/2 (114)	5 1/2 (140)

Uncontrolled Copy

STANDARD APPLICATION HEIGHTS			
MODEL	A	B	WEIGHT 1
CDD3220-XDS2.0	44 (1118)	36 3/4 (933)	2220. (1007)
CDD4020-XDS2.0	51 7/8 (1318)	44 1/2 (1130)	2295 (1041)

SPECIAL APPLICATION HEIGHTS			
MODEL	A	B	WEIGHT 1
CDD5020-XDS2.0	61 7/8 (1572)	54 1/2 (1384)	2470 (1121)
CDD6020-XDS2.0	72 1/4 (1835)	64 7/8 (1648)	2620 (1188)

EXTENDED SHAFT LENGTHS (E)																		
12 (305)	18 (457)	24 (610)	30 (762)	36 (914)	42 (1069)	48 (1219)	54 (1372)	60 (1524)	66 (1676)	72 (1829)	78 (1981)	84 (2134)	90 (2286)	96 (2438)	102 (2591)	108 (2743)	114 (2896)	120 (3048)

CONTROLLED

ITEM NO.	QTY. REQD	PART NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION OR MATERIAL
PARTS LIST				

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± 1/8 DECIMALS .XX ± .XXX ± ANGLES °

MATERIAL

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS		DATE
DRAWN	R. SABOL	5-25-05
CHECKED	P. MAI	6-09-05
MANUF.	M. UPTON	6-09-05
QUALITY	M. COCKRELL	6-14-05

JWC ENVIRONMENTAL
2600 South Garnsey, Santa Ana, California 92707

CHANNEL MONSTER 20"-XDS
CHANNEL MONSTER-MODEL CDDXX20-XDS
2" SINGLE DRIVE CONFIGURATION

SIZE	CODE IDENT NO.	DRAWING NO.	REVISION
D	53242	CDD0020-020-XDS-CD	C

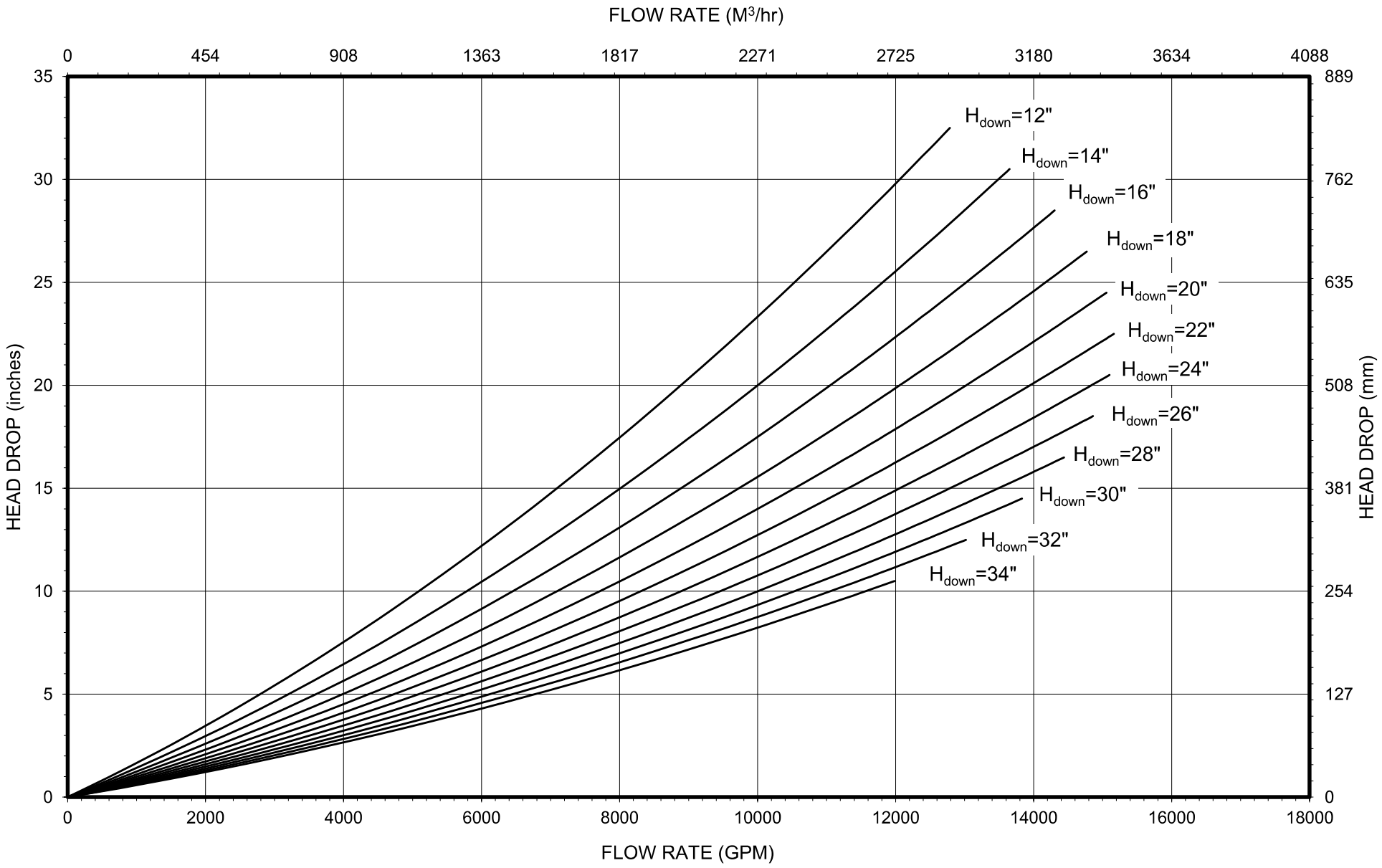
SCALE 3/32 SHEET 1 OF 1

HEAD DROP

MODEL CDD4020-XD2.0

Ø1/2" PERFORATED STAINLESS STEEL DRUM

3-13-15



UNRESTRICTED DISCHARGE

MODEL CDDXX20-XD2.0 CHANNEL MONSTER

Ø1/2" PERFORATED STAINLESS STEEL DRUM

3-13-15