Land Surveying Civil Engineering Land Use Planning Landscape Architecture

# CITY OF CAMAS

# GREEN MOUNTAIN ESTATES PH 4
# BOOSTER STATION REPORT

JOB # 9595.01.01



BY: PETER TUCK, P.E.

# Booster Pump Station Report

# Green Mountain Estates
# Phase 4

PROJECT NO. 9595.01.01


June 22, 2021

By Peter Tuck, P.E.

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Vancouver, WA 98660
(360) 695-1385

| REVISION | BY | DATE | COMMENTS |
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# PROJECT REPORT NARRATIVE FOR:

# Green Mountain Estates Phase 4 Booster Station

## A) Background/General Project Information:

The project is to construct a booster pump station to serve 228 lots within the current City of Camas UGA. Checklist from the Water System Design manual used for this report are (Included in Appendix B):

- General Project report Checklist
- Booster Pump Station Checklist with elements from the Hydraulic Analysis Checklist
- Pressure Tank Checklist

Green Mountain Estates Subdivision (GMES) is located within the northern limits of the City of Camas. See Figure 2.1 Service Area from the City's Water System Plan (See Appendix D).

Green Mountain Estates Subdivision (City File # SUB15-02 is a 346-lot single family development on 98.37 combined acres. The property is located north of NE 28th Street and east of NE 222nd Avenue. The subdivision received preliminary land use approval on June 24, 2016. (See Appendix A for a copy of the Notice of Decision.

The portion of GMES above elevation 370 is Phases 4, 5 and 6 and totals 228-lots of the approved 346-lot subdivision. See layout of Phases 4-6 on topographic survey. The options to serve this area with water are with a standalone booster station or with a booster station and a reservoir. The feasibility of installing a reservoir was researched, however it was found to be infeasible based on location, cost of installation, environmental impacts, and maintenance costs.

Camas Water System Plan
In 2016 the GMES went through a public hearing and SEPA review. During the hearing and SEPA review process, a booster station for the upper lots was addressed. As part of the Final Order, Condition 21 states; *Prior to final plat approval of any phase, the applicant shall identify an appropriate lot(s) or approved tract for the developer funded water booster identified in the City's June 2010 WSP Chap 8 to serve lots located above an elevation of 370 feet.*

When the City's WSP was revised in 2019, reference to a booster station on Green Mountain was omitted. To add the booster station to the latest WSP, there are five (5) steps that are required. The following details each step and how they have or will be addressed:

- SEPA Review to be completed addressing the new Booster Pump Station. This was already covered by the SEPA review completed by the GMES.
- Submit Project Report to WSDOE project – Once completed, the project report will be submitted to WSDOE. Since the proposed project is not changing water rights or system capacity, no comment is expected.

- Local Government Consistency – A Local Government Consistency form has been filled out and signed by the relevant official at the City of Camas. A copy of the form is included in Appendix B (To be provided).
- Approval by city council – The proposed Booster Pump Station was submitted to the City Council and was approved on (To be determined). A copy of the approved docket item is included in Appendix B. (To be provided)
- Meeting of consumers – A public review element is required to add the Booster Pump Station to the WSP through addendum. Since the GMES went through a public hearing, this element has already been satisfied.

Since the above elements have been satisfied, the booster pump station will be added to the 2019 WSP as an addendum once the Booster Station Report is approved by WSDOH with this submittal.

Schedule of Construction.

The Schedule for construction of the GMES Phase 4 is the summer of 2021 with the booster station to be constructed during the same period beginning October 2021. The Booster station construction should be completed in 2022.

Cost and Financing.

Total cost of the Booster Pump Station including but not limited to: Building, pumps and fittings, control system, site improvements, generator and pressure tank is approximately $1,100,000 and is being privately funded by the developer of the GMES.

Capacity Analysis.

Since the area to be served is within the UGA, the connections to be served by the Booster Pump Station are already included within the existing WSP. No capacity analysis is required to address this item. A capacity and hydraulic analysis addressing design flows for the Booster Pump Station and the station's ability to supply minimum pressures during peak flows and fire events is covered in Section C.

System Protection.

To prevent vandalism a 6-foot fence is to be installed around the facility. In addition, action sensor lights are being installed around the building. Issues with access through maintenance roof hatches on other facilities has precluded their use on this facility. Instead, an internal gantry and crane system is being installed to enable pumps to be removed for maintenance purposes.

Disinfection Protocol.

The 8-inch ductile iron water main pipes will be installed up through the floor elevation of the booster station and capped with 8 x 2 inch tapped blind flanges to allow disinfection and testing with the rest of the subdivision water main per AWWA standards.

The booster station pump skid and surge tank will be isolated by capping both the inlet and outlet, making it a closed system. It will then be filled with sodium hypochlorite solution and allowed to sit for 24 hours per AWWA standards.

The booster station system will be flushed using a 2-inch hose fitted with dechlorinating diffuser containing dechlorinating tablets. The treated water will be direct to the storm drains or diffused over nearby green space.

Once acceptable bacteria tests are obtained, the booster station system will be connected to the subdivision system using approved AWWA methods.

As part of the Booster Pump Station development, a maintenance and operations manual will be developed detailing pump start up, exercising procedures for fire pumps and generator. All controls will be tied into the City's remote system with all aspects of the station online and remotely accessed. Details of the controls are provided in Section G and H.

Maintenance.
Maintenance and operation of the Booster Pump Station will be by the City of Camas operations Department. This station will be added to the eight Booster Pump Stations they are currently operating.

**B) Booster Station Location**

As previously mentioned, Green Mountain Estates Subdivision (GMES) is located within the northern limits of the City of Camas. See Figure 2.1 Service Area from the City's Water System Plan.

GMES is in the north corner of the City's 544ft pressure zone. Calculations by the City's water system consultant required all lots above elevation 370 to be served by a booster pump station. For this development, all lots above the 370ft elevation are located within Phases 4, 5 and 6.

There are two roads that access the upper lots. One runs up the central ridge and provides direct access to Phase 4 and 5. The other access runs up the west property line and will not be installed until Phase 6. Based on timing and location, the central road is the better option for a booster station. On review of the geotechnical exploration completed for the GMES by Redmond Geotechnical Services dated 3/28/14 they found that there are no ancient or active landslides and that the risks for potential geological hazards are low to moderate based on the Landslide Hazard Map. The report states that improvements required for a subdivision located on the slopes in the north portion of the site can be constructed safely if completed based on the recommendations in the report. Currently all construction documents are based on these recommendations.

Open Space tracts exist along both sides of the road with the first lot approximately 150ft further up the hill from where the booster station will be located. This will provide a buffer between the station and adjacent lots to help mitigate any noise.

Other noise mitigation efforts include:

The Pumps that were originally specified were centrifugal. At the pressure required, 1800rpm pumps had very poor efficiency with large motors. 3600 rpm pumps provided lower motor size and much better efficiency, however due to potential noise concerns, the high rpm pumps were not approved by City staff. To address this issue, the pump type was switched to vertical turbines running at 1800rpm with smaller HP motors.

To reduce electrical harmonics concerns from the large fire flow pumps, they are being designed with soft starts and pump control valves with the ability to exercise them by running in a throttled condition.

The generator is being installed within a sound enclosure to reduce the noise when it is operating.

**C) Booster Station Sizing:**

The GMES Booster Station will eventually be serving 228 residential lots. Completion of the residential lots will be over a 3-year time frame. Construction of Phase 4 with 87 lots will be completed late 2021 with house construction over 2022. Phase 5 will add another 98 lots and will be constructed in 2022 with house construction in 2023. Phase 6 will add the remaining 43 lots in 2023 with house construction in 2024.

In the Water System Design Manual (WSDM) Section 3.1 Demand versus Consumption, the lower limit for the ERU to be used to determine Maximum Daily Demand is 350 gpd unless there are records to support a value that is less. Within the City of Camas approved 2019 WSP, water use per Average Daily Demand ERU has been determined for low, medium, and high projections based on average water use per ERU over the last three years. The historical ERU's per account by customer class were used to project future demands. These ERU per Account values were based on the 75$^{th}$ percentile of the historical data and a water use per ERU value of 315 gpd/ERU to be conservative. (Taken from Section 5.6.1 of the 2019 WSP – See Appendix B for copy of section). Use of this value was confirmed by both Carollo and City Staff.

To obtain the Maximum Daily Demand ERU ($ERU_{MDD}$), the Average Daily Demand ERU ($ERU_{ADD}$) is multiplied by a peaking factor. The peaking factor to be applied to the $ERU_{ADD}$ is 2.95 as detailed in Section 5.6.1 of the 2019 WSP and confirmed by Carollo who developed the plan and City Staff. Based on a 2.95 Peaking Factor, $ERU_{MDD}$ is 929gpd.

Since the booster station is only serving residential lots, Equations 3-1 is being used to calculate the Peak Hour Demand (PHD) per Section 3.4.2 of the WSDM.

$PHD = (ERU_{MDD}/1440)\ [(C)(N) + F] + 18$

Where:

- PHD = Peak Hour Demand, total system (gpm)

- C = Coefficient Associated with Ranges of ERU's
- N = Number of ERU's based on MDD
- F = Factor Associated with Ranges of ERU's
- $ERU_{MDD}$ = Maximum day Demand per ERU (gpm)

From Table 3-1 from the WSDM provides the following values for C and F for 228 residential lots.

- C = 2.0
- F = 75

Based on these values PHD for the system is 361 gpm.

Since all residences within Phases 4, 5 and 6 are required to have Low Flow Life Safety Residential Fire Sprinklers, Fire Flow for this area has been reduced to 500gpm by the Fire Marshall.

The service area of the booster station is considered a closed system with the booster station providing the only point of supply. In addition, no reservoir exists within the proposed service area. Due to this, pump discharge at the booster station is to be MDD + FF. See Section 8.1.2 Closed System Booster Pump Station Sizing Guidelines of the WSDM. For this situation, the total of the two flows is 861gpm.

To meet the flow requirements, three 20HP duty pumps will be installed that are sized to provide 180gpm per pump of flow at 129.1psi. This will provide the required Maximum Hour flow of 360gpm.

In addition to the duty pumps, two 75hp fire pumps (lead + backup configuration) will be installed capable of providing 680gpm per pump of flow. To provide the required 860gpm maximum of flow during a fire event, one fire pump and one duty pump will be operating together. The pumps have been sized to provide a minimum of 30psi at the high point in the system which exceeds the minimum required pressure of 20psi.

**D) Buildout of Booster Station Service Area**

As previously mentioned, the service area of the booster station will be constructed in phases over several years. The impact on the booster station is that the PHD for the station will not be reached for at least 4 years. This will result in low flows when the booster station is first brought online. Projected flows required at the booster station are as follows:

- Phase 4 – 87 lots total – 2021 to end of 2022 – Up to Peak hour Flow of 181gpm.
- Phase 5 – 185 lots total – 2022 to end of 2023 – Up to Peak Hour Flow of 305gpm.
- Phase 6 – 228 lots total – End 2024 Full Buildout. – Up to Peak Hour Flow of 361gpm.

The surge analysis by Carollo (See Appendix C) requires installation of a 3,000gal hydro-pneumatic tank. The active volume within the tank provides low flow volume preventing the

need for a jockey pump for low nighttime flows. Since the initial flow requirements are for a peak flow of 181gpm, only two of the duty pumps are needed, however all three duty pumps will be installed with the construction of the BPS.

**E) Hydraulic Analysis.**

The suction side of the booster station is within the City's 544ft pressure zone. See Figure 9.1 Service Areas from the City's 2019 WSP in Appendix D. Since the booster station is at the extreme end of the 544ft zone, Carollo completed a pressure analysis of the system using their Hydraulic Model of the Camas Water System. See Carollo Project Memorandum – Green Mountain Estates Phase 3 Development BPS – Hydraulic Modelling Results in Appendix C. This analysis determined the range of pressures on the suction side of the pumps.

Based on this analysis, the following pressures at the proposed booster station site were determined:

| Scenario | Pressure at Proposed BPS Location |
|---|---|
| 2025 ADD | 74psi |
| 2025 PHD | 41psi |
| 2025 MDD + FF at BPS Location | 40psi |
| 2025 MDD + FF at Other Location | 31psi |
| 2035 MDD + FF at BPS Location | 51psi |

Carollo Hydraulic Model Results.

The proposed BPS is located at elevation 370ft. The elevation of the highest point to be serviced by the BPS is 550ft and is approximately 2,700ft from the station. For the duty point pumps it is assumed that the working pressure at the high point will be 50psi. For the fire pumps, it is assumed that the working pressure can drop to 30psi.

The water system between the BPS and the high point in the system consists of a single run of 8" Ductile Iron Class 52 pipe that is approximately 700ft long followed by a looped system consisting of multiple loops of 8" Ductile Iron Class 52 pipe that conveys the water the remaining 2,000ft. To calculate the losses in the pipes, the Hazen-Williams Equation was used with the following assumptions:

- C for DIP ranges from 145 for new to 130 for old. A value of 130 was used.
- 8" Ductile Iron Class 52 pipe has an outside diameter of 9.05" and wall thickness of 0.33". Inside diameter is 8.39".
- Maximum Daily Flow at farthest limit of the system will be considerably lower than 360gpm, however that value was used and will result in slightly higher calculated loss than actually occurs. Since losses for maximum day flow are minimal, this does not impact the pump design.
- Fire Flow + Maximum Daily Flow assumed as 860gpm. As with above, maximum daily flow will be less than in this calculation, however resultant impact on head loss is

minimal. Resultant pressure at fire flow in top end of system will be slightly higher than 30psi.

Based on the above assumptions, the calculated head loss in the pipe from the BPS to the highpoint results and the associated total head at the BPS for each flow is as follows:

| | | With 50psi at High Point | | With 30psi at High Point | |
|---|---|---|---|---|---|
| Flow (GPM) | Head Loss (FT) | Total Head (FT) | Total Head (psi) | Total Head (FT) | Total Head (psi) |
| 0 | 0.0 | 295.5 | 127.9 | 249.3 | 107.9 |
| 50 | 0.1 | 295.6 | 128.0 | 249.4 | 108.0 |
| 100 | 0.3 | 295.8 | 128.0 | 249.6 | 108.0 |
| 150 | 0.5 | 296.0 | 128.2 | 249.8 | 108.2 |
| 180 | 0.8 | 296.3 | 128.3 | 250.1 | 108.3 |
| 200 | 0.9 | 296.4 | 128.3 | 250.2 | 108.3 |
| 250 | 1.4 | 296.9 | 128.5 | 250.7 | 108.5 |
| 300 | 2.0 | 297.5 | 128.8 | 251.3 | 108.8 |
| 350 | 2.6 | 298.1 | 129.1 | 251.9 | 109.1 |
| 360 | 2.8 | 298.3 | 129.1 | 252.1 | 109.1 |
| 400 | 3.4 | 298.9 | 129.4 | 252.7 | 109.4 |
| 450 | 4.2 | 299.7 | 129.7 | 253.5 | 109.7 |
| 500 | 5.1 | 300.6 | 130.1 | 254.4 | 110.1 |
| 550 | 6.0 | 301.5 | 130.5 | 255.3 | 110.5 |
| 600 | 7.1 | 302.6 | 131.0 | 256.4 | 111.0 |
| 650 | 8.2 | 303.7 | 131.5 | 257.5 | 111.5 |
| 700 | 9.4 | 304.9 | 132.0 | 258.7 | 112.0 |
| 750 | 10.7 | 306.2 | 132.6 | 260.0 | 112.6 |
| 800 | 12.1 | 307.6 | 133.2 | 261.4 | 113.2 |
| 850 | 13.5 | 309.0 | 133.8 | 262.8 | 113.8 |
| 860 | 13.8 | 309.3 | 133.9 | 263.1 | 113.9 |
| 900 | 15.0 | 310.5 | 134.4 | 264.3 | 114.4 |

Pressures at BPS based on 50psi and 30psi at high point in system.

The surge system includes a hydro-pneumatic tank and a PRV. The PRV is designed to discharge water from the discharge line to the suction line in the BPS. Since this is within the closed system, there is no external discharge from the system.

### F) Electrical Power

During construction of the initial three phases of GMES, 480V 3 Phase power was run to the edge of Phase 4. Clark Public Utilities (CPU) is designing the extension of this line to the BPS. In talking to CPU, power reliability in the Green Mountain area is high with an average of only 1.4 outages per year.

Due to the location of the booster station and the fact that it is the sole source for GMES Phases 4 to 6, a generator will be installed as part of the station. The booster pump station electrical system is designed to support all connected loads however the actual usage will be less because only one high service pump will only be used in emergencies. The generator is sized to support one 75hp pump, one 20hp pump, one 5hp air compressor and station ancillary loads, suitable to meet the operating needs defined in this report. Startup of motors following a loss in power is controlled by the pump station automation system which sequences motors online following standby generator startup of the lighting loads and provides any required load shedding. The prescriptive sequence starts the lead 20hp pump, then the air compressor if needed followed by the 75hp high service pump if needed. If two 20hp VFDs are in operation and the 75hp pump is required, the automation system will first drop power to the lag 20hp pump and then energize the lead high service pump starter. Maximum use will be 90% of the generator capacity during the high service pump start cycle with a 16% voltage drop. Once started under its maximum design load, the generator uses 70% of available kW capacity. The automation system monitors connected loads and provides algorithms to prevent overloading the generator. Detailed Sizing Calculations are provided in Appendix C.

**G) Automated Control System**

The Station is automatically controlled to meet flow and pressure requirements by a programmable logic controller (PLC) based automation system. The automation system is designed to communicate with the City of Camas' central Supervisory Control and Data Acquisition (SCADA) computer system located at the City Shops for remote monitoring and management functions via a cellular connection. The cellular connection is fully encrypted for the highest level of security.

The PLC based automation system contains input/output modules to provide control and monitoring for the site. Pressures and flows are transmitted to the SCADA system along with status of the generator, ATS, doors, valves, and pneumatic tank.

The PLC controls the pump motors by means of Process Field network (Profinet) connections that provide a complete array of energy and performance parameters to the automation system. Using setpoints entered by the operator on either the station's graphical user interface screen or from the SCADA computers, pump speeds will modulate to meet pressure setpoint requirements. The network connections to the PLC provide all information pertinent to the operation and alarm status of each connected motor starter unit.

The station's operator interface panel has all these values displayed on a color graphic screen. In addition, the unit is programmed to display trends of all analog values to facilitate tuning of the process and provide date/time stamped diagnostic information for historical events and alarms. The graphic unit has multiple screens including a process overview screen showing the reservoirs and pumps with levels, flow, pressures, and pump status simultaneously. Detailed information is shown in 'daughter' screens that includes 1 - Power information, 2 - pump

controller parameters, 3 - settings for alarms and shutdown conditions, 4- trending for all analog variables, 5- system overview information showing 544' supply reservoir level, 6 - RTU/PLC communication data, 7- intrusion system entry/exit setup, 8 - detailed information on each motor, status, alarms, etc. The PLC programming has features to detect various abnormal operating conditions and take corrective action. Alarms detected at the station may be viewed locally on a graphic panel or viewed at the headquarters location. Average update from the station to the central SCADA requires about 6 seconds.

The central station location includes graphical user interface computers for system-wide monitoring and control. Pump status, control settings, alarm setpoints and station alarms and status are all viewed from this computer. Trending and data archiving are also accomplished with this computer. Off-duty alarm notification is provided for the station's alarm conditions via Win911 alarm software and sent to operators via SMS messages.

### *H) Booster Pump Control*

Up to three variable speed duty pumps and one high service pump are designed into the control algorithm to boost water to the 695' distribution zone from the 554' zone when operating on utility power. When operating under standby power the pump operation is limited to one duty pump and one high service pump as described previously. The 75hp pumps are configured as primary and standby, with a maximum of one high service pump operating at any time. A failure of the selected primary 75hp pump is met immediately by the automation system changing primary/standby assignments and starting the replacement pump. The maximum hour daily flows are met by two 20hp pumps and fire flow met by one 75hp fire pump and one 20hp duty pump. The additional 20hp and 75hp pumps are standby units that provide resiliency. Pumps may be selected to alternate by runtime or duty cycle.

Flow demand in the 695' zone manifests itself in the form of zone pressure drop and discharge pressure is the main variable for the station control algorithm. Two pressure transmitters are used for resiliency purposes to ensure this critical measurement is provided. The discharge setpoint can be adjusted at the Pump Station and the automation logic will sequence between pumps with increasing or decreasing demand periods, adjusting speeds as necessary to maintain a steady pressure with varying flows. The system is sensitive to the suction side pressure and will take corrective action to decrease the pump output should it drop below a critical threshold that would damage the pumping units by cavitation. Pump operation is automatically reset upon suction pressure recovery. Pump motor power usage is monitored for determining pumping efficiency.

Low to moderate flow rates are met by the lead 20hp booster pump and capacity within the hydro-pneumatic tank. Moderate to maximum hour flows are met by lead + lag 20hp pump operation. Flow is measured by the 4" discharge flowmeter. The meter accuracy is excellent with flows greater than 20gpm and functional down to about 8gpm. Very low flows are satisfied by the hydro-pneumatic tank capacity. When the tank level drops to the start setting,

a 20hp pump will cycle up to meet demand plus refill the tank before stopping when pressure is satisfied, and tank level rises to the stop level setting. The air compressor is used to add air to the tank as the volume slowly decreases when the pumps are off. The air vent solenoid opens when the pressure setting is satisfied, but the tank level is below the stop level. This tank exercise is intended for very low flow time periods and is also important for water quality purposes to change over water inside the tank daily. The lag 20hp pump is configured to work with the lead 20hp pump for flows that exceed the lead pump maximum capacity. The 20hp motors work with alternation such that a failure of a selected pump immediately alternates to a functional replacement 20hp pump.

When two 20hp pumps are unable to maintain the pressure setpoint and are running at full operating speed, the selected primary high service pump is called to operate to meet high service flows. One duty pump may remain online to meet the anticipated fire flow plus domestic flow requirement. As flows decrease to a flow range that can be met by the 20hp pumps, the high service pump will be commanded to close and the 20hp pumps started. The pump control valves on the discharge side of the 75hp pumps are configured to modulate slowly to the fully closed position to allow the pressure to transition smoothly between the large, fixed speed and variable speed duty pumps.

The large pump control logic includes the ability to cycle the pump on a scheduled exercise basis to keep the motor and pump bearings regularly used. During the cycle, the pump will run against its closed pump control valve for one minute and the valve allowed to briefly start opening to refresh the pump line water before returning closed and the motor stopping.

### I) Surge Control

As described above the pump start controls are designed to cycle pumps on and off smoothly without pressure surges. In addition to pump start up and shut down, the potential for a surge exists during a power outage prior to when the generator turns on or when a valve is shut incorrectly. To address these potential issues a transient (surge) analysis to assess potential for damaging transient pressure waves has been performed by Carollo for the GME Phase 4 BPS and is included in Appendix C. The analysis determined that a 3,000gal hydro-pneumatic surge tank was required to address the impact of potential transients and mitigate the impacts of potential surges.

### J) Hydro-pneumatic Tank.

A 3,000gal hydro-pneumatic steel pressure tank is being installed with the project to mitigate the impacts of potential surges. The tank will be externally located and is proposed to be 5ft diameter and 23ft long.

The proposed tank to have the following:

- Manway at one end.
- Tank water level sensor and transmitter providing 4-20mA signal

- Tank Pressure sensor and transmitter providing 4-20mA signal
- Visual liquid level gauge
- 1/2" NPT safety valve per ASME Section VIII.
- Two 1/2" NPT air-line solenoid valves
- 1/2" NPT ball and check valves for air flow control
- 4 ½" DIA dial pressure gauge
- Air bleed muffler.

The tank is manufactured with support saddles that sit on 2.5ft x 6.0ft reinforced concrete pads. Exact depth of pads will be designed to provide the required anchorage.

A 5hp oil-less air compressor system with its own integral control / motor starter panel to be installed in the BPS building. A 5hp dual stage compressor associated with the control system is being installed in the building as needed to provide the pressure operation for the hydro-pneumatic tank. The system for controlling the compressor is addressed in Section H above. Intake for compressor to be protected by an air filter.

# Table of Contents

## Project Report



## Technical Appendices

# Technical Appendix

## Appendix A

- Green Mountain Estates Subdivision – Final Order

## Appendix B

- City of Camas Water System Plan (WSP) – Water System Design Criteria
- Water System Design Manual Checklists
- Local Government Consistency Form
- City Council Meeting Minutes.

## Appendix C

- Carollo Hydraulic Modelling Results – Booster Station Suction Pressures.
- Carollo Surge Analysis
- Generator Detailed Sizing

## Appendix D

- City of Camas Service Area. WSP Fig. 2.1
- City of Camas Physical Environment. WSP Fig. 2.2
- City of Camas Comprehensive Plan. WSP Fig. 5.6
- City of Camas Water Service Area. WSP Fig. 9.1

## Appendix E

- Booster Station Site Plan
- Booster Station Building Plans
- Booster Station Skid Layout

RECEIVED
JUN 27 2016

City of Camas WASHINGTON

# NOTICE of DECISION
## Green Mountain Estates Subdivision (file# SUB15-02)

Effective Date of Decision: **June 24, 2016**

Applicant: Green Mountain Estates, LLC
2300 East 3rd Loop, Suite 100
Vancouver, WA 98661

**THIS IS TO SERVE AS NOTICE** that a decision of **APPROVAL** with conditions has been rendered for Green Mountain Estates Subdivision (SUB15-02), a 346-lot single-family development on 98.37 combined acres. The property is located north of NE 28th Street and east of NE 222nd Avenue, which is also described as Tax Parcels: 173158-000, 173193-00, 173212-000, 173213-000, 173214-000 & 173215-000.

The final order of the Hearings Examiner is attached to this notice.

**RECONSIDERATION PROCEDURES:**

Any party of record believing that a decision of the hearings examiner is based on erroneous procedures, errors of law or fact, or the discovery of new evidence which could not be reasonably available at the public hearing, may make a written request to the examiner, filed with the city clerk (**Municipal Center, 616 NE 4th Ave., Camas**), to be accompanied by an appeal fee of $350, for reconsideration by the examiner.

A. Time Frame. The request for reconsideration shall be filed within fourteen calendar days of the date the decision was rendered. **Deadline for filing a reconsideration request is July 1, at 5:00 p.m.**

B. Content. The request for reconsideration shall contain the following:

1. The case number designated by the city and the name of the applicant;

2. The name and signature of each petitioner;

3. The specific aspect(s) of the decision being appealed, the reasons why each aspect is in error as a matter of fact or law and the evidence relied on to prove the error. If the petitioner wants to introduce new evidence in support of the appeal, the written appeal must explain why such evidence should be considered.

C. The hearings examiner may, after review of the materials submitted in conjunction with the reconsideration request, and review of the open record hearing transcript, take further action as he or she deems proper; including, but not limited to, denying the request, modifying the decision, or affirming the decision.

D. The hearings examiner shall issue a decision on a request for reconsideration within forty-five (45) days of the filing of the request for reconsideration. When a request for reconsideration has been timely filed, any appeal to Clark County Superior Court under the Land Use Petition Act shall be filed within twenty-one (21) days after a hearings examiner issues its decision on the request for reconsideration.

**QUESTIONS:** For further information regarding this specific application, Hearing Examiner action in this matter, or planning issues in general, please contact Sarah Fox, Senior Planner, by email at communitydevelopment@cityofcamas.us, or by phone at (360) 817-1568 ext. 4269.

**BEFORE THE LAND USE HEARING EXAMINER**
**FOR THE CITY OF CAMAS, WASHINGTON**

Regarding an application by Green Mountain Estates LLC ) **FINAL ORDER**
for approval of a preliminary plat to divide 98.37 acres into )
346 lots in the R-6 & R-10 zones north of NE 28th Street and) **Casefile No. SUB15-02**
east of NE 222nd Avenue, in the City of Camas, Washington ) **(Green Mountain Estates)**

## A. SUMMARY

1. The applicant, Green Mountain Estates LLC, requests approval to divide the 98.37-acre site into 346 lots and stormwater and open space tracts. The applicant proposed to develop the site in five phases. The site is located at the northeast corner of the intersection of NE 222nd Avenue and NE 28th Street. The legal description of the site is tax parcels 173158-000, 173193-000, 173212-000, 173213-000 & 173214-000, Section 21, Township 2 North, Range 3 East, Willamette Meridian (WM), Camas, Washington (the "site").

a. The southwest portion of the site and abutting properties to the west are zoned R-6 (Single Family Residential, 6,000 square foot average lot size). The southeast corner and northern portion of the site, and abutting properties to the east of the southern portion of the site, are zoned R-10 (Single Family Residential, 10,000 square foot average lot size). Properties to the southwest, across NE 28th Street, are zoned R-7.5 (Single Family Residential, 7,500 square foot average lot size). All other abutting properties are located in unincorporated Clark County. Properties to the east and west of the northern portion of the site are zoned FR-40 (Forest, 40-acre minimum lot size). Properties abutting the northern portion of the site and to the north and southeast are zoned AG-20 (Agriculture, 20-acre minimum lot size). Properties to the south, across NE 28th Street, are zoned R-12 (Residential, 12-units per acre)

b. The site is currently developed with three single-family residences and associated accessory structures. The applicant proposed to remove all but one of the existing structures on the site. The applicant will retain an existing residence in the southeast corner of the site, on proposed Lot 25. The applicant will construct a new single-family detached dwelling on each of the remaining proposed lots. All proposed lots will comply with the minimum dimensional standards for the applicable zone as modified by the density transfer ordinance.

c. Domestic water and sanitary sewer service will be supplied by the City of Camas. The applicant will collect stormwater from impervious areas on the site and convey it to proposed stormwater facilities in the southwest corner of the site for treatment, detention, and discharge into the onsite wetlands.

2. The City issued a Mitigated Determination of Nonsignificance ("MDNS") for the subdivision pursuant to the State Environmental Policy Act ("SEPA") on March 15, 2016. The SEPA determination was not appealed and is now final.

3. City of Camas Land Use Hearing Examiner Joe Turner held a duly noticed public hearing to receive public testimony and evidence regarding the application. City staff recommended the examiner approve the preliminary plat subject to conditions. See the City of Camas Staff Report to the Hearing Examiner dated March 23, 2016 (the "Staff Report"). The applicant accepted those findings and conditions, as amended at the hearing and during the open record period, with certain exceptions. Two persons testified orally in opposition to the application. Other persons testified in writing. Contested issues in the case include:

a. Whether the applicant is required to provide larger lots along the boundaries of the site;

b. Whether the proposed development will be adversely impacted by air traffic from the Grove Field airport;

c. Whether an exception to the off-street parking requirements of CMC 17.19.040.B(10)(c) is warranted;

d. Whether the applicant is required to retain the existing driveway apron at the southeast corner of the site to facilitate access to the adjacent property;

e. Whether the applicant is required to dedicate right-of-way for a bike lane on the south side of NE 28th Street;

f. Whether traffic from the proposed development, as mitigated, will exceed the capacity of area streets or create or exacerbate a hazard.

4. Based on the findings provided or incorporated herein, the examiner approves the preliminary plat subject to the conditions at the end of this final order.

## B. HEARING AND RECORD HIGHLIGHTS

1. The examiner received testimony at a public hearing about this application on March 30, 2016. All exhibits and records of testimony are filed at the City of Camas. At the beginning of the hearing, the examiner described how the hearing would be conducted and how interested persons could participate. The examiner disclaimed any *ex parte* contacts, bias or conflicts of interest. The following is a summary by the examiner of selected testimony and evidence offered at the public hearing.

2. City planner Sarah Fox summarized the Staff Report and the exhibits received since the Staff Report was issued.

a. The site is zoned R-6 and R-10. The R-6 zone allows lot sizes between 4,200 and 7,200 square feet. The R-10 zone allows lot sizes between 7,000 and 12,000 square feet.

b. The City supports the applicant's proposal for off-street parking, Exhibit 26. However some adjustments may be needed during final review.

c. The applicant will need to provide a separate tract for the water booster pump station that Mr. Adams noted will be needed to supply water to lots above 370 feet in elevation.

e. The Grove Field airport is located southeast of the site. Although the airport is outside of the City limits, the flight pattern for the airport extends over the site. The applicant should be required to notify the future residents of the site about the potential for noise and other impacts from airplanes using this airport and to provide an aviation easement allowing air traffic at 500 feet above the site.

f. She requested the examiner adopt certain amendments to the findings and conditions in the Staff Report.

i. A condition is warranted requiring Oregon white oak trees planted to mitigate trees removed from the site be two-inch caliper trees spaced ten feet apart, consistent with the recommendation of Washington Department of Fish and Wildlife ("WDFW").

ii. Staff supports a condition requiring the applicant install a fence along the southeastern boundary of the site, where the site abuts larger lots in the Country Estates development.

iii. The City supports the additional conditions proposed by Mr. Printz in Exhibit 31 regarding sewer and water.

3. City utilities manager Sam Adams noted that the applicant is required to replace the existing 8-inch diameter water main in Goodman Road with a 12-inch diameter main between the bridge crossing Lacamas Creek and NE Ingle Road. The applicant must install a 24-inch diameter water main in Goodman from the Ingle Road intersection through the site. In addition, the applicant will be required to install a booster station to serve areas of the site above 370 feet in elevation.

a. The applicant proposed to provide four stormwater treatment and detention facilities in the flatter, southern, portion of the site. The applicant requested exceptions to the 30-foot setback requirement from the right-of-way for three of the four facilities. City staff support the proposed exception.

b. There is no existing public sanitary sewer service in this area. The City's General Sewer Plan Amendment of April 2010 (Sewer Plan) provides a plan on how the North Urban Growth Area ("NUGA") will be served. The NUGA is divided into six basins served by multiple regional pump stations and major force main and gravity piping systems. The Sewer Plan, calls for traditional gravity sewer flows (including solids) from all six basins to be directed south and east along the north side of Lacamas Lake. Sewer service for the NUGA is currently in the design phase and construction should be completed in early 2018. The applicant will pay a proportionate share of the planned sanitary sewer improvements for the area, the NUGA Sewer Transmission System ("NUGA-STS"). The applicant will also be required to construct gravity sewer improvements that are necessary to connect to the proposed subdivision to the planned pump system and to provide for future upstream connections to the north and east. The applicant will size the facilities to serve properties upstream and downstream of the site. There is a STEP force main southwest of the site. The applicant may be able to utilize this existing system for interim sanitary sewer service. The applicant will be required to pay for all improvements needed to utilize the STEP system and demonstrate that adequate capacity exists to serve this site. The applicant will be required to connect to the NUGA-STS once it is completed.

c. He requested the examiner modify condition 3 to require construction of the 24-inch diameter water main in 28th Street prior to final plat approval for any lots abutting NE 28th Street.

4. City engineer James Carouthers responded to Mr. Printz's traffic comments on behalf of the Green Mountain PRD development, Exhibit 31. He agreed that the Green Mountain PRD is vested for full buildout, 1,365 pm peak hour trips. The applicant's traffic study should have considered all of the projected vehicle trips generated by full buildout of the approved Green Mountain PRD development.

5. City project manager Wes Heigh testified that the applicant will be required to construct left-turn pockets as part of the initial construction of the site access to NE 28th Street, prior to occupancy of any homes on the site. A center turn lane will replace the left turn pockets when NE 28th Street is fully improved. He noted that the north-south section of Tract E, the private road providing access to Lots 1-4, should be improved with a minimum 20-foot paved width and the east-west portion should be improved with a minimum 25-foot paved width to allow vehicles to maneuver in and out of the proposed lots. Condition of approval 17 should be modified to that effect.

a. He requested the examiner modify condition 5 to require proper abandonment of existing septic systems as well as groundwater wells on the site.

b. Condition of approval 29 should be modified to allow gates in the fence along the north boundary of the site to allow public access to the abutting County property. Private access from individual lots should be prohibited.

c. Condition 36 should be modified to require fire sprinklers for homes on lots served by dead-end streets longer than 400 feet.

6. Planner Andrew Gunther, attorney Jamie Howsley, and Dean Kirkland, chairman of Kirkland Development, testified on behalf of the applicant, Green Mountain Estates, LLC.

a. Mr. Gunther summarized the proposed development and responded to the issues raised in oral and written testimony.

i. The applicant is working with the developer of the adjacent property regarding sharing the cost of improvements necessary to access the existing STEP sewer system and sharing the capacity of that system.

ii. The applicant should not be required to construct a bike lane on the south side of NE 28th Street. There is no nexus between this off-site improvement and the impacts of the development. This condition would create an isolated section of bike lane along the site's frontage with no connection to other bike lanes to the east or west. The remainder of NE 28th Street is a narrow County road with no shoulders. A bike lane in this area is unlikely to be extended and connect to other sections for many years. Lands to the west of the site are zoned Urban Holding and lands to the east are zoned Rural. In addition, construction of a bike lane on the south side of NE 28th Street would likely impact fences, ditches, driveways and other existing improvements. The Code only requires half-width street improvements. In addition, improvements to NE 28th Street between Camas Meadows Drive and 232nd Avenue are included in the City's six-year capital improvement plan. Condition 12 should be modified to require a 38-foot paved width with a single five-foot bike lane along the site's frontage.

iii. The applicant submitted a modified plan that includes off-street parking required by the Code. However the applicant continues to request approval of an exception to the parking requirement. The proposed development will provide significant opportunities for on-street parking throughout the development. The development will provide more than 5,000 lineal feet of curb line with no abutting lots or driveways, where roads abut open space tracts, and unrestricted on-street parking will be available on one side of these street sections. Although the requirement to preserve open space is not exceptional, the amount of curb line available for parking on this site is exceptional. In addition, the proposed lots are only slightly smaller than the 7,400 square foot standard where no off-street parking is required. There are smaller, 50-foot wide, lots in the southern portion of the site, south of the wetland. Only five of the remaining 300 lots are smaller than 60 feet in width. Many lots exceed 70 feet in width, which provide substantial opportunities for on-street parking and room for three-car garages and driveways.

iv. He requested the examiner modify condition 21 to allow the applicant to locate the booster pump station on a tract rather than a lot, provided the applicant demonstrates no reduction in the amount of open space on the site.

v. The applicant will revise the setbacks to comply with Code requirements.

vi. The applicant may eliminate Tract N. Therefore condition 35 should be modified to require access for maintenance only if this Tract is included in the final plat.

vii. The existing driveway serving the residence in the southeast corner of the site, in combination with Mr. Gilmore's adjacent driveway, creates a wider driveway apron that may make it more convenient for Mr. Gilmore to maneuver large trucks and trailers onto his property. However the applicant is required to construct sidewalk and other improvements along the site's entire frontage on NE 28th Street, which will eliminate the existing on-site driveway and reduce the effective driveway apron used by Mr. Gilmore. Mr. Gilmore does not have an easement or other legal right to use the existing driveway on the site. However Mr. Gilmore will still have full access to his existing driveway and the center left turn planned for NE 28th Street will facilitate access to Mr. Gilmore's driveway.

viii. The applicant is not required to provide larger lots abutting the Country Estates development. The beveling standard of CMC 18.09.080.B only applies to residential lots. The Country Estates development is located in the rural area and zoned AG-20 (Agriculture, 20-acre minimum lot size). Clark County approved the Country Estates development as a cluster subdivision.

ix. The applicant will construct a center turn lane on the section of NE 28th Street abutting the site and left-turn lanes on Goodwin at NE Ingle Road, which will mitigate some of the traffic concerns raised by area residents.

x. He agreed to the conditions proposed by staff regarding potential impacts from the airport. The applicant will put a note on the plat informing future residents about potential noise and other impacts from airport traffic. The applicant is also willing to provide an aviation easement allowing air traffic at 500 feet above the site.

xi. The applicant is willing to review the potential to preserve trees along the boundary of the site. However the applicant will not preserve trees that pose a potential hazard to the future residents based on tree health, wind throw potential, grading and infrastructure needs, and similar issues.

xii. He agreed to a condition of approval requiring a fence on the south boundary of Lots 139-148, abutting the Country Estates development prior to final occupancy of the first home in that series of lots.

xiii. He agreed to the additional conditions proposed by Mr. Printz regarding sanitary sewer improvements and a potential future water reservoir on the site.

b. Mr. Kirkland argued that the applicant was aware of this development and could have sought approval of a latecomers agreement for sewer improvements earlier. The applicant can negotiate an agreement with Green Mountain PRD regarding the traffic from this development during the open record period.

c. Mr. Howsley requested the examiner hold the record open to allow all parties an opportunity to address the issues raised at the hearing.

4. Area resident Ken Miles argued that the applicant should be required to provide 12,000 square foot lots, the maximum size allowed by the R-10 zone, along the boundary of the site abutting the Country Estates development in order to comply with section LU-4 of the comprehensive plan and CMC 18.09.080.B and be compatible with the existing one-acre lots in the Country Estates development.

a. He testified that there have been numerous accidents at the intersection of NE 232nd Avenue and NE 28th Street. Many accidents, especially single vehicle accidents, go unreported and therefore are not included in the WSDOT database noted in the applicant's traffic study. Traffic generated by the proposed development will increase this existing hazard.

b. He objected to any access between the site and the Country Estates development.

5. Attorney Randy Printz appeared on behalf of the Green Mountain PRD development and summarized his memorandum, Exhibit 31. The Green Mountain PRD is a 1,300 lot master planned development, including 8.8 acres of commercial development and a variety of single- and multi-family residential development.

a. The Green Mountain PRD developer is required to contribute funds to the City to fund a portion of the planned sanitary sewer improvements for the NUGA. The applicant for this development, Green Mountain Estates, should be required to pay a pro-rata share of the NUGA improvements.

b. The Green Mountain PRD will build interim sanitary sewer improvements that will allow use of the City's existing STEP sewer system. The capacity of the STEP system is limited to approximately 350 Equivalent Residential Units ("ERUs"). The development agreement with the City reserves 201 ERUs of the capacity for Green Mountain PRD. If this development utilizes the STEP sewer improvements in excess of the 201 ERUs reserved to Green Mountain PRD, it should be required to reimburse Green Mountain PRD for its share of the cost of the interim improvements through a latecomers agreement.

c. Traffic from the Green Mountain PRD development is vested at full buildout and for all mitigation improvements required to support that full buildout. In addition, the development agreement requires the Green Mountain PRD developer to monitor certain intersections and provide additional mitigation if they reach a specified level of service. However the applicant's traffic study did not include all traffic from the Green Mountain PRD development. Therefore, traffic from this development, in combination with approved traffic from the Green Mountain PRD, could cause intersections to fail or to require mitigation that would not be required, or would not be required as soon, without traffic from this development.

d. The applicant should be subject to a condition of approval regarding the potential need for a water reservoir on the site, similar to the condition imposed on the Green Mountain PRD.

6. At the conclusion of the public hearing, the hearings officer ordered the record held open for one week, until April 8, 2016, for new evidence from all parties regarding the traffic impacts of this development; for a second week, until April 15, 2016, for a response to that new evidence from all parties; and for a third week, until April 22, 2016, for a closing argument by the applicant. By Orders dated April 18 and May 9, 2016 the examiner extended the initial open record period until May 19, 2016, the response period until May 23 and the applicant's closing argument until May 30, 2016. The record in this case closed at 5:00 p.m. on May 31, 2016, due to a holiday on the 30th.

## C. DISCUSSION

1. City staff recommended approval of the preliminary subdivision plat, based on the affirmative findings and subject to conditions of approval in the Staff Report, as modified at the hearing and during the open record period. The applicant accepted those findings and conditions, as modified, with certain exceptions.

2. The examiner concludes that the affirmative findings in the Staff Report, as modified, show that the proposed preliminary plat does or can comply with the applicable standards of the Camas Municipal Code (the "CMC") and Revised Code of Washington, provided that the applicant complies with recommended conditions of approval as modified herein. The examiner adopts the affirmative findings in the Staff Report as his own, except to the extent they are inconsistent with the following findings.

3. The City cannot require the applicant to develop the site with larger lots. The proposed lots comply with the dimensional requirements for the R-6 and R-10 zoning that applies to the site, as modified by the density transfer provisions of CMC 18.090.060.

a. CMC 18.09.080.B requires that lots on the perimeter of a subdivision must be the maximum lot size allowed by the applicable zoning where adjacent to a greater density residential zone.

i. The northern portion of the site is zoned R-10. There is additional R-10 zoned land to the south of this portion of the site. CMC 18.09.080.B does not apply to this zoning boundary, because the properties are in the same zone. Properties abutting the south of the eastern end of the R-10 zoned portion of the site, the Country Estates subdivision, and properties abutting the north boundary are zoned AG-20 (Agriculture, 20-acre minimum lot size). Properties abutting the northwest and east boundaries are zoned FR-40 (Forest, 40-acre minimum lot size). The AG-20 and the FR-40 zones are not "residential" zones. Therefore CMC 18.09.080.B is inapplicable to lots abutting those boundaries of the site.

ii. The southwest corner of the site is zoned R-6. Abutting properties to the west are also zoned R-6. Properties to the southwest, across NE 28th Street, are zoned R-7.5 and R-12. However they do "abut" the site. They are separated by a public right-of-way.

iii. The R-6 zoned portion of the site abuts R-10 zoning to the north and west. The northern zoning boundary is located within the development site. Therefore CMC 18.09.080.B is inapplicable. The R-10 zoned properties to the east are not included in this development. Therefore CMC 18.09.080.B requires that lots abutting this boundary must be developed with 7,200 square foot lots, the maximum lot size allowed in the R-6 zone. With the exception of proposed Lot 26, all of the lots on this boundary are 7,200 square feet. Lot 26 is 7,163 square feet. The applicant should be required to modify this lot to provide 7,200 square feet as required by CMC 18.09.080.B. A condition of approval is warranted to that effect.

b. As Mr. Miles noted, Land Use Policy LU-4 of the Camas Comprehensive Plan provides, "Maintain compatible use and design with the surrounding built and natural environment when considering new development or redevelopment." The examiner finds that CMC 18.09.080.B implements this policy by requiring larger lots along the boundaries of different residential zones. This Policy does not expand the scope of CMC 18.09.080.B to require larger lots abutting agricultural zoned lands. Although the proposed lots are smaller than adjacent lots, the uses are not incompatible. The applicant is proposing to provide single-family detached residences adjacent to existing single-family development. Even if the proposed subdivision will have an adverse impact on property value --- and there is no substantial evidence to that effect in the record --- protection of property value is not relevant to the applicable State or City standards. The examiner must base the decision on the laws of the City of Camas and Washington State.

c. The applicant agreed to provide a fence along the southern boundary of the lots abutting the Country Estates subdivision, proposed lots 139-148. The applicant also agreed to preserve existing trees within ten feet of the southern boundary of these lots, provided the trees are healthy, wind-firm, and will not be impacted by planned grading on the site. The proposed fence and tree retention will provide separation and a

buffer between the existing and proposed lots. Conditions of approval are warranted to that effect.

4. The site is located within the flight pattern for the Grove Field airport. The applicant agreed to include a plat note advising future homeowners of the potential for noise and other impacts from air traffic. The applicant also agreed to a condition of approval requiring dedication of an air navigation easement 500 feet above the site. Conditions of approval are warranted to that effect.

5. The applicant requested an exception to the off-street parking requirements of CMC 17.19.040.B(10)(c).

a. CMC 17.19.040.B(10)(c) provides:

> When the proposed development's average lot size is seven thousand four hundred square feet or less, one additional off-street parking space shall be required for every five units, notwithstanding the requirements of CMC Chapter 18.11. These spaces are intended to be located within a common tract.

The average lot size proposed on this site is 7,065 square feet. Therefore CMC 17.19.040.B(10)(c) requires the applicant provide 69 off-street parking spaces.

b. CMC 17.23.010.A(1) authorizes exceptions where an applicant demonstrates that strict compliance with the Code will create an "undue hardship" and:

a. There are special physical circumstances or conditions affecting the property, such that the strict application of the provisions of this code would deprive the applicant of the reasonable use or development of his land;

b. The exception is necessary to insure such property rights and privileges as are enjoyed by other properties in the vicinity and under similar circumstances; and

c. The granting of the exception will not be detrimental to the public welfare or injurious to other property in the vicinity.

c. The applicant argued that there is no need for off-street parking on this site. The wider lots and extensive open space areas on the site provide substantial opportunities for on-street parking throughout the site. That may be true, but it is not relevant to the applicable standards for an exception. The examiner finds that the applicant failed to demonstrate compliance with the approval criteria in CMC 17.23.010.A(1). There is no evidence that compliance with the off-street parking requirements will create an undue hardship for the applicant. The applicant demonstrated

in Exhibit 26 that it is feasible to comply with this requirement. In addition, the applicant failed to demonstrate compliance with the remaining criteria in CMC 17.23.010.A(1)(a) and (b).

i. The applicant failed to identify any special physical circumstances or conditions affecting the property. CMC 17.23.010.A(1)(a). The site contains sensitive lands (wetlands and steep slopes). However such conditions are not unique to this site. Many developments in the City are subject to similar constraints. There is no evidence that these development constraints will deprive the applicant of the reasonable use or development of its land. To the contrary, Exhibit 26 demonstrates that it is feasible to develop the site in compliance with this requirement.

ii. The applicant failed to demonstrate that the exception is necessary to insure such property rights and privileges as are enjoyed by other properties in the vicinity and under similar circumstances. CMC 17.23.010.A(1)(b). As noted above, the existence of sensitive lands on this site is not unique. Other properties in the City are subject to the same constraints. Compliance with the off-street parking requirement will not preclude the applicant from developing the site consistent with applicable zoning or otherwise deprive the applicant of rights and privileges as are enjoyed by other properties in the vicinity.

iii. The examiner finds that the granting of the exception will not be detrimental to the public welfare or injurious to other property in the vicinity. CMC 17.23.010.A(1)(c). As the applicant noted, the proposed development will provide ample opportunities for on-street parking. The 5,000 lineal feet of unrestricted curb line will allow up to 250 on-street parking spaces, assuming 20 lineal feet per parking space. In addition, the larger and wider lots in the northern portion of the site provide additional opportunities for on- and off-street parking. However the Code does not require a minimum amount of on- and/or off-street parking. The Code requires off-street parking based on the average lot size proposed and the applicant failed to demonstrate compliance with the remaining approval criteria for an exception to the off-street parking requirement. Therefore the applicant must be required to provide 69 off-street parking spaces on this site.

6. Mr. Gilmore objected to the elimination of the driveway serving the existing residence in the southeast corner of the site. The examiner understands that this existing driveway, in combination with Mr. Gilmore's adjacent driveway, makes it easier for Mr. Gilmore to maneuver his large vehicle and trailer in and out of his property. However there is no evidence that Mr. Gilmore has an easement or legal right to continue using this existing driveway. The applicant is required to remove the portion of the driveway access located on the site and construct frontage improvements along the site's entire 28th Street frontage. Mr. Gilmore can expand his own driveway on his property to provide a wider driveway apron if he feels it is necessary to maintain safe access to his property. In addition, right-of-way and frontage improvements provided by this development will provide a wider paved section and may provide adequate pavement width to allow

striping of a center left turn lane along the site's frontage, which may facilitate access to Mr. Gilmore's property, allowing him to maneuver his vehicle out of the through traffic lane while waiting to turn left into his property.

7. The applicant objected to the requirement to provide a five-foot bike lane on the south side of NE 28th Avenue, arguing that there is no essential nexus between the impact of this development and the need for this bike lane. However, based on the conditions proposed by staff and the requirements of CMC 17.9.040.B(1), the applicant is only required to dedicate and improve half-width improvements. The applicant is not required to construct a bike lane or other improvements on the south side of NE 28th Street. Condition of approval 12 should be modified to clarify that requirement.

8. The examiner finds that traffic from this development will not exceed the capacity of area streets or cause or exacerbate a hazard, provided the applicant provides certain mitigation measures identified by the City in Exhibit 57.

a. The applicant's traffic study analyzed the crash history as obtained from WSDOT. The crash rates for all identified intersections are well below 1 accident per million entering vehicles, the City's action rate for accidents. The action rate is based on reported accidents. As noted in the testimony and Exhibit 45, some accidents are not reported. Therefore the accident history may not reflect all of the accidents in the area. However the action rate of 1 accident per million entering vehicles is generally based on reported accidents. There is no substantial evidence that this location experiences an unusually high number of unreported accidents. Mr. Miles submitted evidence of numerous 911 calls regarding accidents in the area. However the 911 records do not provide sufficient information to determine the cause of the majority of accidents reported. The applicant can only be required to address accidents caused by engineering and road conditions. The applicant cannot mitigate for accidents caused by distracted or impaired drivers, excessive speed, and similar causes. The examiner finds that the WSDOT accident history is the best evidence available regarding the accident history for this area.

i. The applicant will provide left turn pockets at both of the proposed intersections on NE 28th Street and the NE Goodwin/Ingle Road intersection, which will allow drivers waiting to turn left at these intersection to move out of the eastbound through lane, reducing the potential for rear-end collisions. In addition, the applicant will be required to modify the intersection of NE 28th Street and NE 232nd Avenue to maintain LOS D and install turn lanes and a traffic signal at the NE Goodwin/Ingle Road intersection prior to construction of the 181st home on the site.

b. The applicant proposed alternatives to the conditions recommended by the City (Exhibit 54). However, as noted by the City, the examiner has no authority to impose additional conditions on the previously approved Green Mountain PRD or require the City to enter into a covenant or other agreement with the applicant. In addition, there is no evidence that the mitigation specific measures proposed by the applicant at certain

intersections will prevent the expected failure of these intersections. In order to approve this development, the examiner must find that all affected intersections will operate at acceptable levels of service. Therefore conditions of approval are warranted that ensure mitigation necessary to maintain acceptable levels of service will be provided. The applicant may be able to reach agreements with the City and other developers regarding cost sharing and timing of the required mitigation measures. This application cannot be approved unless the applicant is conditioned to provide all necessary mitigation.

## D. CONCLUSION

Based on the above findings and discussion, the examiner concludes that FILE# SUB15-02 (Green Mountain Estates) should be approved, because it does or can comply with the applicable standards of the Camas Municipal Code and the Revised Code of the State of Washington, subject to conditions of approval necessary to ensure the final plat and resulting development will comply with the Code.

## E. DECISION

Based on the findings, discussion, and conclusions provided or incorporated herein and the public record in this case, the examiner hereby approves FILE# SUB15-02 (Green Mountain Estates), subject to the following conditions of approval. Unless waived or modified in this decision, the development must comply with the minimum requirements of the Camas Municipal Code.

CONDITIONS OF APPROVAL

Engineering Division

1. Prior to final engineering plan approval for any phase that includes segments of Road A and/or Road D, the applicant shall include and install acceptable traffic calming elements in the number, type and location deemed necessary by the City Engineer.
2. Prior to final plat approval for any phase, if not already completed by others, the applicant shall be conditioned to install a 12-inch diameter waterline on Goodwin Road from Lacamas Creek to Ingle Road.
3. Prior to final plat approval for any lots abutting NE 28th Street, the applicant shall be conditioned to design and construct the 24-inch diameter transmission main in Goodwin Road/NE 28th Street (T-7) per the Camas Water System Plan. Construction of the transmission main shall be completed prior to final plat approval of the phase(s) the main is located in, or adjacent to.
4. Prior to final plat approval of any phase that includes a lot sited above the 370-foot elevation, the applicant shall be conditioned to construct a booster pump station to meet minimum domestic and fire flow requirements.
5. Existing water wells and on-site septic systems shall be properly abandoned in accordance with State and County guidelines prior to final plat approval for the

particular phase that it will be located in. Additionally, any water rights associated with the abandoned water wells shall be transferred to the City.

6. Prior to final engineering plan approval for any phase, the applicant shall provide enhanced landscaping, screening and fencing acceptable to the city for the detention/wetpond facility in the southern portion of Tract D, the large detention facility located in the northwest corner of Tract D and the detention facility proposed in Tract A.
7. Prior to final engineering plan approval, the applicant shall design the proposed stormwater detention facility located in the northeastern portion of Tract D to meet the minimum 30-foot setback requirement of CMC 17.19.030 (F6).
8. Prior to final engineering approval, the applicant shall place the stormwater facilities in separate tracts from critical areas, and provide fencing around the perimeter of each facility. Fencing shall be installed as part of the construction of the facility.
9. Prior to building permit issuance, the Applicant is conditioned to provide a proportionate share payment of the NUGA-STS necessary to serve the site.
10. Prior to final engineering plan approval, the Applicant is conditioned to provide calculations confirming the off-site gravity sewer facilities on NE 28th Street and Goodwin Road from the easterly edge of the subdivision to Pump Station No. 1 are sized appropriately to serve properties upstream and downstream of the Applicant's subdivision. Prior to final plat approval of any phase, the Applicant shall be required to construct all on- and off-site sanitary sewer improvements necessary to serve that phase.
11. The applicant intends (but is not required) to construct interim sewer improvements to provide service to the Property until such time that the city completes Phase B permanent improvements ("Phase A Interim Improvements"). The approximate capacity of the Phase A Interim Improvements is 350 Equivalent Residential Dwelling Units ("ERUs"), of which 201 ERUs are vested to the Green Mountain PRD development. The City agrees that the Owner may enter into a Latecomers to utilize the remaining actual capacity above 201 ERUs until such time that the permanent Phase B improvements are completed.

    If Additional Phase A Improvements are constructed by the Owner, and the City allows such capacity to be used to serve property other than Owners Property, the Owner may request and apply to the City for a Latecomer Agreement which would obligate the City to collect from the Latecomer a latecomers fee that is equal to the pro rata share of the cost of the design, permitting and construction of the Additional Phase A Improvements based upon the percentage of capacity of the Additional Phase A improvements utilized by the Latecomer. Should the Owner apply for a Latecomer Agreement, it will be considered separately by the City from this decision.

    In this scenario, the applicant is conditioned to design, construct, permit and abandon/decommission all temporary improvements associated with STEP system once the permanent NUGA-STS improvements are completed, including on-site

individual or community solids storage septic tanks. Prior to final engineering plan approval of any phase the applicant is conditioned to submit tank sizing and anti-buoyance calculations and appropriate odor control designs acceptable to the city. The entire temporary system shall be designed and constructed such that the individual septic tanks or large community STEF tank(s) may be abandoned or removed by the developer once the subdivision can be served via a conventional gravity system. Because the solids storage system will provide only a temporary service, the applicant is conditioned to maintain all tanks according to the manufacturer's recommendations and City standards.

12. Prior to Final Plat Approval, the Applicant is conditioned to dedicate right-of-way (ROW) along NE 28th Street of sufficient width to provide for a minimum 37 foot half-width right-of-way.
13. Final platting of an accumulation of more than 200 lots shall not occur until such time as a left turn refuge is installed on NE Goodwin Road/NE 28th Street east of NE Ingle Road.
14. Prior to final acceptance of any phase, the applicant is conditioned to install eastbound left turn lanes in NE 28th Street
15. Half width street improvements across the applicant's entire frontage on NE 28th Street shall be completed prior to final platting of an accumulation of 150 lots or more.
16. The applicant shall provide a minimum of 69 off-street parking spots located in a common tract maintained by the HOA at locations acceptable to the city.
17. The applicant shall pave the entire width of Joint Access Tract E (20 feet of paved width on the north-south section and 25-feet of paved width on the east-west section) and shall install residential fire sprinklers systems in accordance with the requirements of NFPA 13D or 13R in all lots accessed by this tract and shall install an acceptable address monument signage where Tract E leaves the public street.
18. Lots 7 & 8 shall be rear-loaded lots and prohibited from accessing Road K.
19. The applicant shall pave the entire 20-foot width of Joint Access Tract F and shall install residential fire sprinkler systems in accordance with the requirement of NFPA 13D or 13R in lots 5, 6, 7 and 8 that are accessed by Tract F and shall install acceptable address monument signage where Tract F leaves the public street.
20. Prior to final engineering plan approval for any phase the applicant is conditioned to complete a landscaping plan that details the location, number, plant species proposed, planting notes, fencing notes and associated details.
21. Prior to final plat approval of any phase, the applicant shall identify an appropriate lot(s) or approved tract for the developer funded water booster station identified in the city's June, 2010 Water System Plan at Chapter 8 to serve lots located above an elevation of 370 feet.

a. Should it later be determined that a water booster station has previously been installed by other developers or is no longer needed to provide adequate domestic and fire flows to lots above the 370 foot elevation, this area could be converted back to a residential lot.

b. The booster station shall require Site Plan and Design Review permits. The design of the booster station shall be similar to that of the adjacent residential structures in style (exterior materials, roofing, roof pitch, windows) and landscaping.

c. Any tract needed for the booster station shall not reduce the available open space on the site.

22. Prior to construction of the 181st house, or upon documented failure of the Goodwin and Ingle intersection based on GML's monitoring, whichever is earlier, the applicant shall identify, design and construct □corrective measures to mitigate the following intersections to Level of Service (LOS) D or better and receive concurrence from the City of Camas and Clark County, as applicable:

    a. NE Goodwin & Camas Meadows Drive

    b. NE Goodwin & Alexandra Lane

    c. NE 28th Street & NE 232nd Avenue

23. The traffic signal at NE Goodwin Road and NE Ingle Road shall be installed prior to construction of the 181st lot. If at any time monitoring of the intersection indicates that signal warrants are met prior to the construction of the 181st house, the applicant shall construct the signal at that time.

24. The applicant shall pay to the City of Vancouver a proportionate share contribution towards the construction of a northbound right turn lane on NE 192nd Avenue and a westbound right turn lane on 13th Avenue. The timing of payments shall be determined with the City of Vancouver prior to final plat approval of any phase.

25. Prior to final engineering the City and the applicant will determine the sizing and location of water facilities and any needed land for dedication for a reservoir.

**Planning Division**

26. Five (5) phases are approved with this decision. Modifications to the phasing plan will require approval of a modification pursuant to CMC§18.55.270-Plat amendments and plat alterations.

27. The applicant shall revise the preliminary plat to ensure that side lot lines are at right angles to the street (or radial to a curve) as practical per CMC§17.19.030 (D)(2) and (3).

28. The applicant will revise lot areas to meet the dimensional requirements of the respective zoning unless specifically modified in these conditions. An exception is not granted to exceed the dimensional standards of the zone for Lots 110 to 115, or Lots 44 to 56. Lot 26 shall be modified to provide 7,200 square feet of area as required by CMC 17.19.040.B(10)(c)

29. Proposed Lot 25 has an existing home that will remain. The lot exceeds the dimensional standards for the R-6 zone, which is permitted, as it is consistent with CMC§18.09.040, Table 2, Note 4.
    a. Any future division of Lot 25, five years after final platting, will comply with R-6 zoning.
    b. Setbacks from NE 28th Street and to the lots west of Lot 25 will be a minimum of 20-feet.
    c. Future homes will be oriented with fronts toward NE 28th Street if lot(s) are adjacent.
30. The applicant shall revise and remove double-frontage lots throughout the subdivision, specifically Lots 28, 29, and Lots 218 to 226. The city will accept the revisions as suggested in this report, or a substantially similar remedy. Revisions must be approved by the City prior to engineering construction plan approval of first phase.
31. A single sales office in a model home for purposes of selling lots within the development may be located within each phase, and remain until 50% of lots are sold in that phase or two years after Certificate of Occupancy is issued for the model home or trailer, whichever is less. After such time, the sales office in the home or the trailer must be removed.
32. If a sales office is proposed in a trailer, then a site plan must be approved by the City, including landscaping along the street frontage and base of trailer, and off-street parking per CMC 18.11 Parking.
33. The applicant shall construct a permanent physical barrier consisting of a six-foot high fence that adequately prevents human entry into the Clark County owned conservations lands and priority habitat areas known as Green Mountain along the entire north side of the Green Mountain Estates Subdivision. Gate or openings may be provided at approved public access points, i.e., the vehicle access at the northeast corner of the site and approved public trails. The fence shall be constructed prior to occupancy of individual home sites. Entrance into Clark County's conservation lands from individual lots shall be strictly prohibited without first obtaining an access agreement from Clark County.
34. Signs shall be posted and maintained along Clark County's conservation lands property boundary at an interval of one (1) per lot and shall read substantially as follows: "Conservation Area - Please retain in a natural state."
35. Wetlands, streams and associated buffers shall be clearly marked on the final plat.
36. Tree retention zones within Tracts I and J shall be clearly marked on the final plat. Tree topping is not permitted, nor removal of more than 20 percent of a tree's canopy. A note to this effect shall be added to the plat.
37. The location of the T-29 trail shall be clearly labeled on the final plat.
38. Prior to final plat approval of any phase, the applicant shall provide a copy of the private covenants intended to be recorded with the plat, which will include provisions for maintenance of all required improvements, such as storm or sewage facilities,

open space areas, access tracts, private parking enforcement provisions acceptable to the fire marshal, etc.

39. The applicant shall provide access acceptable to the city for maintenance of all tracts included in the final plat. Access could include a road, access tract, or recorded agreement with owners to the south. Annual maintenance of all tracts shall be included with the HOA CC&R's, for removal of invasive species.

40. The final tree mitigation plan shall include the dimensions of all Oregon White Oak trees (retained and removed) and an analysis of the health of the trees.

41. Oregon White Oak mitigation trees must be planted every 10 feet from each other, which will be shown on mitigation construction plans.

42. The applicant shall record an avigation (aviation) easement that runs with the property, which provides a right-of-way for the unrestricted passage and flight of aircraft above 500- feet ground level.

43. The applicant shall install uniform, continuous fencing at the rear of Lots 139-148 (abutting lots in the Country Estates development) prior to issuance of a certificate of occupancy for the first home in this series.

44. The applicant shall analyze the health of the trees within 10 feet of the rear of Lots 139-150. If trees are deemed healthy by the project's arborist, and the trees will not be impacted by site grading, then the trees will not be removed. Trees shall remain within subject lots until occupancy.

**Fire Department**

45. Low Flow Life Safety Residential Fire Sprinklers (NFPA 13D) required in all new dwellings served by dead end roads longer than 400 feet. CMC (Camas Municipal Code) 17.19.040.14, CMC 17.19.030.D.5.d

46. Low Flow Life Safety Residential Fire Sprinklers are required where structure(s) are accessed by a flag lot, access tract, or private road. CMC 17.19.030.D.5.c, 17.19.040.A.7

47. Low Flow Life Safety Residential Fire Sprinklers that comply with 13D or 13R are required in all buildings abutting a street designed and constructed with less than 36 feet of pavement width. CMC Table 17.19.040-2

48. If a lot is not required to have residential sprinklers, any new single-family residence or duplex to **be used as a model home or home sales office** shall have Low Flow Life Safety Residential Fire Sprinklers installed. CMC 15.17.050

49. The distance from a required fire hydrant may be doubled when Low Flow Life Safety Residential Fire Sprinklers are installed throughout a fully sprinklered subdivision. CMC 17.19.040.C.4.a.

50. Establishing Hydrant Flow Tests per NFPA 24 (National Fire Protection Association) utilizing a Washington State Licensed Fire Sprinkler Contractor may be waived when Low Flow Life Safety Residential Fire Sprinklers are installed throughout a fully sprinklered subdivision. 17.15.030.D.C

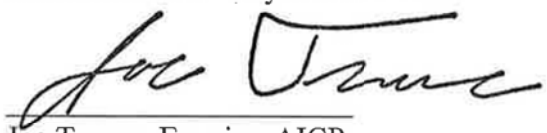
51. Low Flow Life Safety Residential Fire Sprinklers are required where minimum hydrant water flow from the closest hydrant is not met. CMC 17.19.040.C.4.a, CMC 15.04.010.D (IFC Appendix B, Fire Flow) A Washington State Licensed Fire Sprinkler Contractor meeting NFPA 24 Fire Flow guidelines may be hired to establish the gallons per minute (fire flow). A permit is required with the fire marshal's office prior to the flow test.
52. An approved address sign, in accordance with the Camas Municipal Code, must be posted for each residence where the flag lot leaves the public road or access tract prior to final plat approval of each phase. CMC 17.19.030.D.5.d
53. When access grades exceed those specified in CMC 17.19.040.12.b, Low Flow Life Safety Residential Fire Sprinklers are required to be installed. CMC 17.19.040.12.b.iii.
54. Underground oil tank removal requires a permit with the fire marshal's office following IFC (International Fire Code) 3404.2.14
55. Any existing structures that are scheduled to be torn down may be considered for fire department training.
56. Any blasting that may be needed for this location is required to follow the CMC Blasting Code and requires a permit with the fire marshal's office. CMC 15.40
57. Any gates serving two or more homes is required to follow the gate code CMC 12.36
58. Gated access to two or more homes is required to have Low Flow Life Safety Residential Fire Sprinklers installed CMC 12.36.040.J
59. Private Streets require a plan for access obstruction per CMC, 17.19.040.A.9
60. All new street signage shall include the hundred block designation.

**Final Plat Notes [SEPA15-05 also included plat notes]**

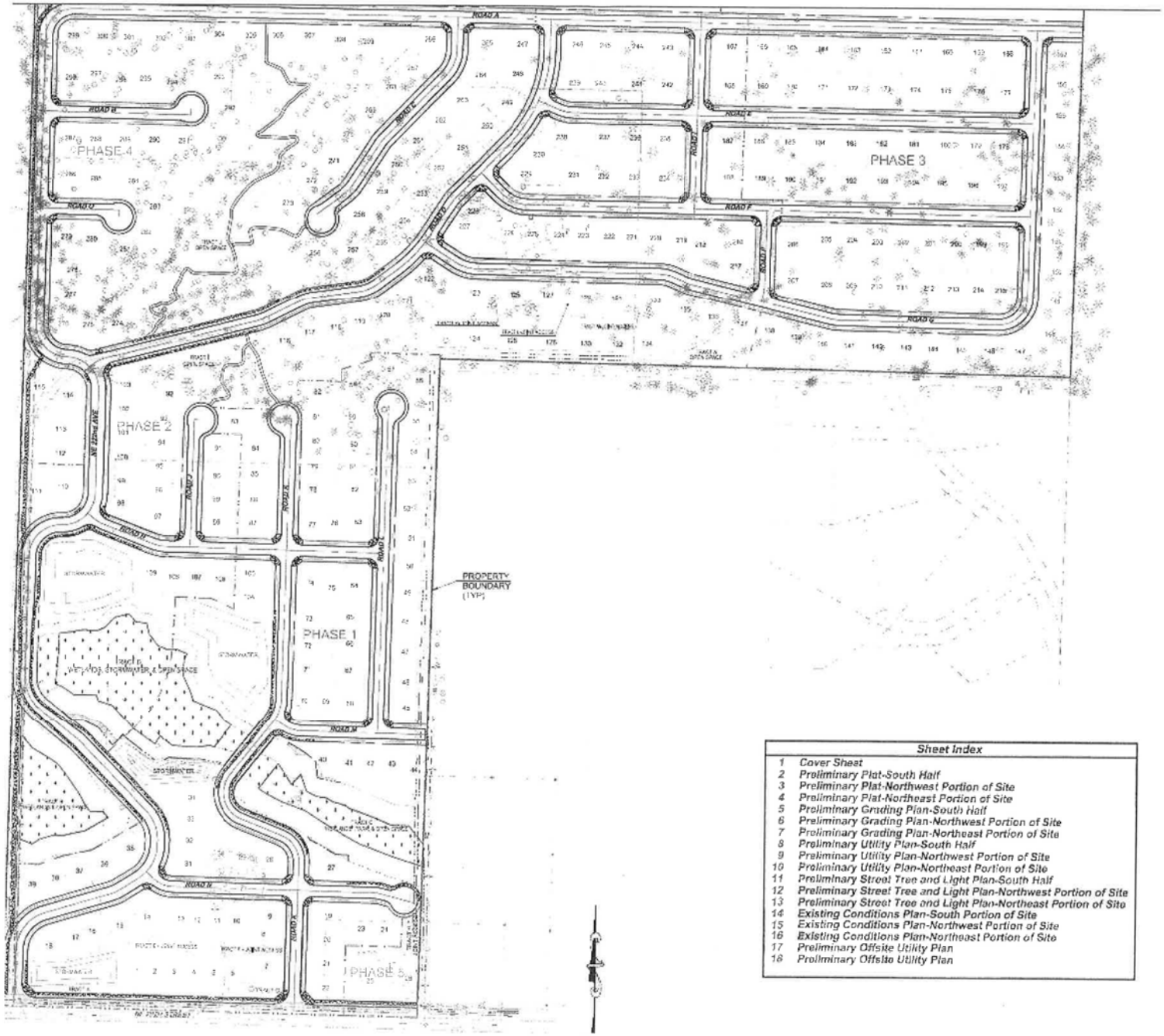
1. A homeowners association (HOA) will be required for this development. Copies of the C.C. & R's shall be submitted and on file with the City of Camas.
2. Building permits will not be issued by the Building Department until all subdivision improvements are completed and Final Acceptance has been issued by the City.
3. This plat is located adjacent to Clark County conservation land managed for sustainable forestry on which a variety of forestry operations may occur that may not be compatible with residential development for certain periods of limited duration. Potential discomforts or inconveniences may include, but are not limited to: noise, odors, fumes, dust or operation of machinery during any twenty-four (24) hour period.
4. Entrance into Clark County's conservation lands from individual lots shall be strictly prohibited without first obtaining an access agreement from Clark County.

5. Maximum building lot coverage for this subdivision is 40%.
6. The lots in this subdivision are subject to traffic impact fees, school impact fees, fire impact fees and park/open space impact fees. Each new dwelling will be subject to the payment of appropriate impact fees at the time of building permit issuance.
7. Wetlands, streams and associated buffers shall be maintained in their natural state as described in the Final Wetland Mitigation Plan (Note: add date after approval) that is recorded with this plat by the HOA. Any modifications to critical areas and buffers must be approved in writing by the City after submittal of a revised critical area report.
8. Tree topping is not permitted within this development, nor removal of more than 20 percent of a tree's canopy. Trees that are determined to be hazardous by a licensed arborist may be removed after approval by the City. Required street trees and backyard trees shall be promptly replaced with an approved species.
9. The Green Meadows subdivision is under a flight corridor for Grove Airfield; aircraft noise is to be expected.

DATED this 24th day of June 2016.



Joe Turner, Esquire, AICP
City of Camas Land Use Hearing Examiner

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| 3 | Preliminary Plat-Northwest Portion of Site |
| 4 | Preliminary Plat-Northeast Portion of Site |
| 5 | Preliminary Grading Plan-South Half |
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| 7 | Preliminary Grading Plan-Northeast Portion of Site |
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## 5.6 PROJECTED WATER DEMAND

Projecting future water demand is one of the key elements of the water system planning process. Identification of system improvements such as supply, pumping, storage, and piping requirements are all related to demand projections. This section summarizes the ERU, ADD, and MDD projections, as well as the potential range in future demands associated with various factors, such as water use per ERU, DSL, and demographic growth rate.

### 5.6.1 Potential Range in Future Water Demand

Numerous factors and assumptions affect the accuracy of projected future water demands. Recognizing that certain assumptions built into the demand projections will vary in the future, the projections were developed for low, medium, and high demand scenarios to provide a range in demands that may be experienced in the future.

The variables considered in developing the range of demand projections are summarized in Table 5.8 and are discussed below.

- **Future Water Accounts:** The future water accounts are presented in Table 5.7 and were used for their corresponding demand scenario (low, medium, and high).
- **Water Use per ERU:** Water use per ERU for the low and medium demand projections are based on the average water use per ERU over the last three years (2013 to 2015), 260 gallons per day per equivalent residential unit (gpd/ERU), and reflect the City's conservation goals. The high demand projection was based on 75th percentile of the historical data presented in Table 5.3, which equals 315 gpd/ERU.
- **ERUs per Account:** The historical ERUs per account by customer class presented in Table 5.3 were used to project the future demands. These ERU per Account values were based on the 75th percentile of the historical data and a water use per ERU value of 315 gpd/ERU to be conservative.
- **Distribution System Leakage:** DSL varied between 5.6 and 13.3 percent of the City's total production between 2008 and 2015. For the low and medium demand scenarios, a DSL of 10 percent was selected to represent the City's conservation goals. For the high demand scenario, the average DSL observed from 2008 to 2015 of 10.3 percent was used.
- **Maximum Day/Average Day Peaking Factor:** Due to the high projected demands for the City's largest water users (described in the following section), and the lack of summer peaking of industrial users (which comprise most Large Users), the MDD/ADD peaking factor was not applied to Large Users to avoid overly conservative demand projections. Therefore, MDD/ADD peaking factors were developed for all customers excluding the largest users from the historical data to be used for the

demand projections herein. The MDD/ADD peaking factor for all customers excluding Large Users varied from 2.48 to 3.58 between 2008 and 2015. For the low demand projection, the average peaking factor over the most recent three year period (2013 to 2015) of 2.74 was used. For the medium demand projection, the average peaking factor observed from 2008 to 2015, 2.95, was used. For the high demand projection, the 75th percentile peaking factor from 2008 to 2015, 3.43, was used.

Large Users were based on individual demand projections that are presented in the following sections.

**Table 5.8 Demand Projection Parameters Water System Plan Update City of Camas**

| Demand Scenario | Demographic Growth Scenario | Water Use per ERU (gpd/ERU) | Distribution System Leakage (%) | Maximum Day Peaking Factor |
|---|---|---|---|---|
| **Low** | Low | 260 | 10.0% | 2.74 |
| **Medium** | Average of High and Low | 260 | 10.0% | 2.95 |
| **High** | High | 315 | 10.3% | 3.43 |

### 5.6.2 Large Users Demand Forecast

The City's top 10 water users, or Large Users, were identified by the City as presented in Section 5.1.1. Low, medium, and high demand forecasts were created for each Large User based on historical water use data from 2008 through 2015.

The low demand scenario projections assume that each Large User's annual water demand is held constant over the entire planning period at the maximum demand observed by the user during the 2008 to 2015 period. The Large Users high demand scenario projections assume that each user's demands increased at a constant rate equal to that user's average rate of annual increase in demand over the most recent three year period (2013 to 2015). The medium demand scenario is an average of the low and high demand projections.

Notably, demand projections for some Large Users were developed differently. Wafertech Industries and Linear Technologies are not expected to expand and subsequently increase demand, per City staff. Similarly, recent budget cuts applied to the City of Camas and Camas School District limit the amount of water to be used for irrigation purposes in the future. Consequently, the demand projections for these four Large Users calculated under the low demand scenario were used for all demand scenarios, as significant increases in water demand are not expected over the planning period. Additionally, SE Incorporated did not contribute any water demand until 2013, so limited data is available for establishing demand projections. In this case, annual increases in water demand were assumed to match the annual rate of increase in demand over the most recent three year period (2013

## Appendix A.3.1 General Project Report Checklist

Include the following information in the project report, as applicable to the project and water system's planning status. See Chapter 2, including the project development flowcharts therein, and WAC 246-290-110 and -120 for further design guidance and requirements.

- ☐ The signed and dated stamp of a Washington state-licensed professional engineer. Federal facilities can have a PE from any state, but still must have a PE stamp.
- ☐ Narrative discussion that establishes the need for the project. It should include a construction schedule for the recommended alternative, project cost, and method of financing. Also, indicate the relationship of the project to the currently approved water system plan or one in the process of being prepared or updated.
- ☐ Alternatives analysis and rationale for selecting the proposed project. It should include an evaluation of life cycle costs, including initial capital costs and on-going operations and maintenance costs.
- ☐ Appropriate planning elements: Cite appropriate reference in an approved water system plan, prepare an amended water system plan, or include as part of the project report.
- ☐ Capacity analysis if seeking a change in the number of approved service connections. Include rationale and calculations to justify total number of service connections and equivalent residential units (ERUs). The analysis should identify the number of residential, industrial, commercial, and municipal connections the water system now serves. If the water system seeks to increase its approved number of connections through construction of new facilities, document water system plan approval status.
- ☐ *Water Right Self-Assessment Form* must be completed for new sources and all projects that increase the approved number of connections.
- ☐ Hydraulic analysis that demonstrates the ability of the project to supply minimum pressure requirements during peak flows and fire events. The analysis should include a narrative discussion that describes the hydraulic analysis method, explains critical assumptions, and summarizes the effect of the proposed expansion on the existing water system.
- ☐ Measures to protect against vandalism.
- ☐ Disinfection procedures according to AWWA or APWA/WSDOT standards and a narrative discussion on how the project will be disinfected and tested prior to use.
- ☐ Provisions to discharge water to waste including description of how wastewater is disposed, and documentation that procedures are acceptable to the Department of Ecology and local authorities.
- ☐ Routine and preventive operations and maintenance tasks and their frequency, and the role of a certified operator in completing them.

## Appendix A.3.6 Booster Pump Station Checklist

Address these design elements in booster pump station project report and construction document submittals. Refer to Chapter 8 and WAC 246-290-230 for further guidance and requirements.

### Project Report

- ☐ Sizing analysis, including pumping system discharge capacity requirements, and fire-flow requirements, if any.
- ☐ Flow and pressure control.
- ☐ Alarm conditions.
- ☐ Hydraulic analysis that demonstrates the ability of the project to meet minimum pressure requirements during peak hourly demands and maximum day demands plus fire flow. The analysis should include a narrative description of the hydraulic analysis method, explain critical assumptions, and summarize the effect of the proposed demands on the existing system (see Checklist A. 3.4 Hydraulic Analysis for details).
- ☐ Service area map for the zone(s) to be served.
- ☐ Site feasibility considerations:
  - Location and site considerations (see Section 8.2).
  - Natural hazards analysis (see Section 8.2.1).
  - Noise from the pumps and equipment, and any need for noise mitigation.
- ☐ Assess capacity of each reservoir overflow to safely discharge the total possible flow to the reservoir (all sources, booster pump station discharges and flow through PRVs) to ensure the structural integrity of each reservoir in the event of control system failure.
- ☐ Assess potential for damaging transient pressure wave during pump start up and abrupt pump station shutdown.
- ☐ Electrical power issues including:
  - Supply: voltage, quality, and desired phase configuration.
  - Reliability: frequency of power outages.
  - Assessing the need for backup power.

### Construction Documents

- ☐ Map of the site and vicinity drawn to scale, including the pump station structure, water lines, site topography, roadways, and all above and underground utilities.

- ☐ Pump station details including security measures, slab elevation, ventilation, and electrical connections allowing the use of emergency power.
- ☐ Building equipment and instrument layout demonstrating adequate clearance to safely enter, operate, and maintain all pump station components.
- ☐ Pumping equipment specifications including:
  - Horsepower, flow rate (gpm), head, pump controls, and alarm system.
  - The specific pump curve used and operation range of head and flow conditions.
- ☐ Flow and pressure control and instrumentation specifications.
- ☐ Site piping plans including:
  - Sample tap(s).
  - Isolation valves on the suction and discharge sides.
  - Flexible couplings.
  - Check valves on the discharge side.
  - Surge anticipation valves, as needed.
  - Suction side pressure gauge(s).
- ☐ Pump station start-up task including:
  - Field-testing pumps for output, efficiency and vibration.
  - Disinfecting piping.
  - Pressure, leakage, and bacteriological testing.
- ☐ General facility considerations including:
  - Security measures.
  - Special anchoring or support requirements for equipment and piping.
  - Heating, cooling and humidity control for equipment protection and operator comfort.

## Appendix A.3.7 Pressure Tank Checklist

Address these design elements in pressure tank project report and construction document submittals. Refer to Chapter 9 (Pressure Tanks), Appendix B.2 (Cycle Control Valves), and Appendix B.3 (Variable Frequency Drives) for further design guidance.

### Project Report

- ☐ Sizing analysis, pump protection, and pump discharge control.
- ☐ Pressure settings. Include a narrative justification of water system hydraulics and operating pressure range.

### Construction Documents

- ☐ Pressure relief valves:
  - Specify an ASME Section VIII pressure-relief valve installed between a pressure tank greater than 37.5 gallons gross volume and the tank isolation valve.
  - Specify a properly sized pressure relief valve manufactured according to a recognized national standard installed between a pressure tank equal to or smaller than 37.5 gallons gross volume and the tank isolation valve.
  - Pressure relief valve capacity.
  - See DOH 331-429
- ☐ Isolation valve for each pressure tank.
- ☐ Site piping plans including location, size, type, and class of pipe.
- ☐ Clearance provided around each tank adequate for operations and maintenance.
- ☐ Bladder tanks only:
  - Pre-charged pressure
- ☐ Hydropneumatic tanks only:
  - Confirmation of oil-less or food-grade oil lubricated air compressor.
  - Air filter.
  - Access hatch with minimum 5-foot clearance.
  - Level control.
  - Sight glass.
  - Structural support and earthquake resiliency or bracing.

PROJECT MEMORANDUM

# ON-CALL TASK ORDER 8 – GREEN MOUNTAIN ESTATES PHASE 3 DEVELOPMENT BPS

**Date:** January 25, 2021
**Project No.:** 11151J00

City of Camas

| | |
|---|---|
| **Prepared By:** | Natalie Reilly, PE (WA pending) |
| **Reviewed By:** | Matt Huang, PE |
| **Subject:** | Hydraulic Modeling Results |

## Purpose

The purpose of this Task Order is to provide hydraulic criteria for the design of the Green Mountain Estates Phase 3 Development booster pump station (BPS) in the northwest corner of the Camas Water System.

The Green Mountain Estates Phase 3 Development will require a BPS to serve customers at high elevations. The Developer will design and construct the BPS based on City criteria and standards. The purpose of this task order is to provide a range of suction pressures at the BPS under multiple conditions, including fire flows, using the City's hydraulic model.

## Model Updates

The City's most recent InfoWater Pro hydraulic model was updated as part of Task Order 9 to include the latest capital improvement program (CIP) projects, including the new 544 Zone 2-MG Reservoir (18th Avenue Reservoir). This updated model was used to perform Task Order 8.

The hydraulic model was also updated to match the pipes for the Green Mountain Estates Development per the following drawings:

- "8938.e.design final.Ph2 A-F": received via email from Olson Engineering on December 9, 2020.
- "GME 1-3 Cover Page Water layout": received via email from Olson Engineering on December 9, 2020.

The Green Mountain Estates Development pipelines are shown on Figure 1.

Demands were allocated to the Green Mountain Estates Development based on the total number of lots in the development per the drawings (734 lot) and the assumed average day demand (ADD) of 500 gallons per day (gpd) per lot. To convert from ADD to maximum day demand (MDD), the MDD/ADD peaking factor of 2.95 was applied. This factor was developed as part of the 2016 Water System Plan. The diurnal curve developed as part of the 2016 Water System Plan was used to determine the peak hour demands (PHD).

In addition to these changes, the diameter for the pipe on Goodwin Rd from Lacamas Creek to Ingle Rd in the model was updated from 8-inch to 12-inch, per confirmation from the City.

## Hydraulic Model Scenarios

To determine the system pressures at the proposed BPS to the Green Mountain Estates Phase 3 Development, the following model scenarios were run:

- Scenario A: 2025 ADD:
  - The reservoirs were assumed to be at the bottom of the operational level.
- Scenario B: 2025 PHD:
  - The reservoirs were assumed to be at the bottom of the equalizing level.
- Scenario C: 2025 MDD plus Fire Flow at BPS Location:
  - This scenario was run with a fire flow requirement of 500 gpm at the BPS location. The reservoirs were assumed to be at the bottom of the fire pool.
- Scenario D: 2025 MDD plus Fire Flow at Other Location:
  - This scenario was run with a fire flow requirement of 1,000 gpm at a different location in the Green Mountain Estates Development (north end of N Woodland St). The reservoirs were assumed to be at the bottom of the fire pool.
- Scenario E: 2035 MDD plus Fire Flow at BPS Location:
  - This scenario was run with a fire flow requirement of 500 gpm at the BPS location. The reservoirs were assumed to be at the bottom of the fire pool. The additional looping in the North Shore was assumed to be online.

The assumed BPS ground elevation is 367 feet based on the information provided by Olson Engineering.

## Hydraulic Model Results

Table 1 summarizes the pressure at the proposed BPS location for the five scenarios run. These results represent the range of pressures at the BPS under multiple conditions.

Table 1 Hydraulic Model Results

| Scenario | Pressure at Proposed BPS Location |
|---|---|
| Scenario A: 2025 ADD | 74 psi |
| Scenario B: 2025 PHD | 41 psi |
| Scenario C: 2025 MDD Plus FF at BPS Location | 40 psi |
| Scenario D: 2025 MDD Plus FF at Other Location | 31 psi |
| Scenario E: 2035 MDD Plus FF at BPS Location | 51 psi |

## Conclusion

Based on the hydraulic modeling, the expected range of pressures at the BPS location will range between 31 psi and 74 psi.


**Reviewed by:**

Matthew M. Huang, PE

NR:kh

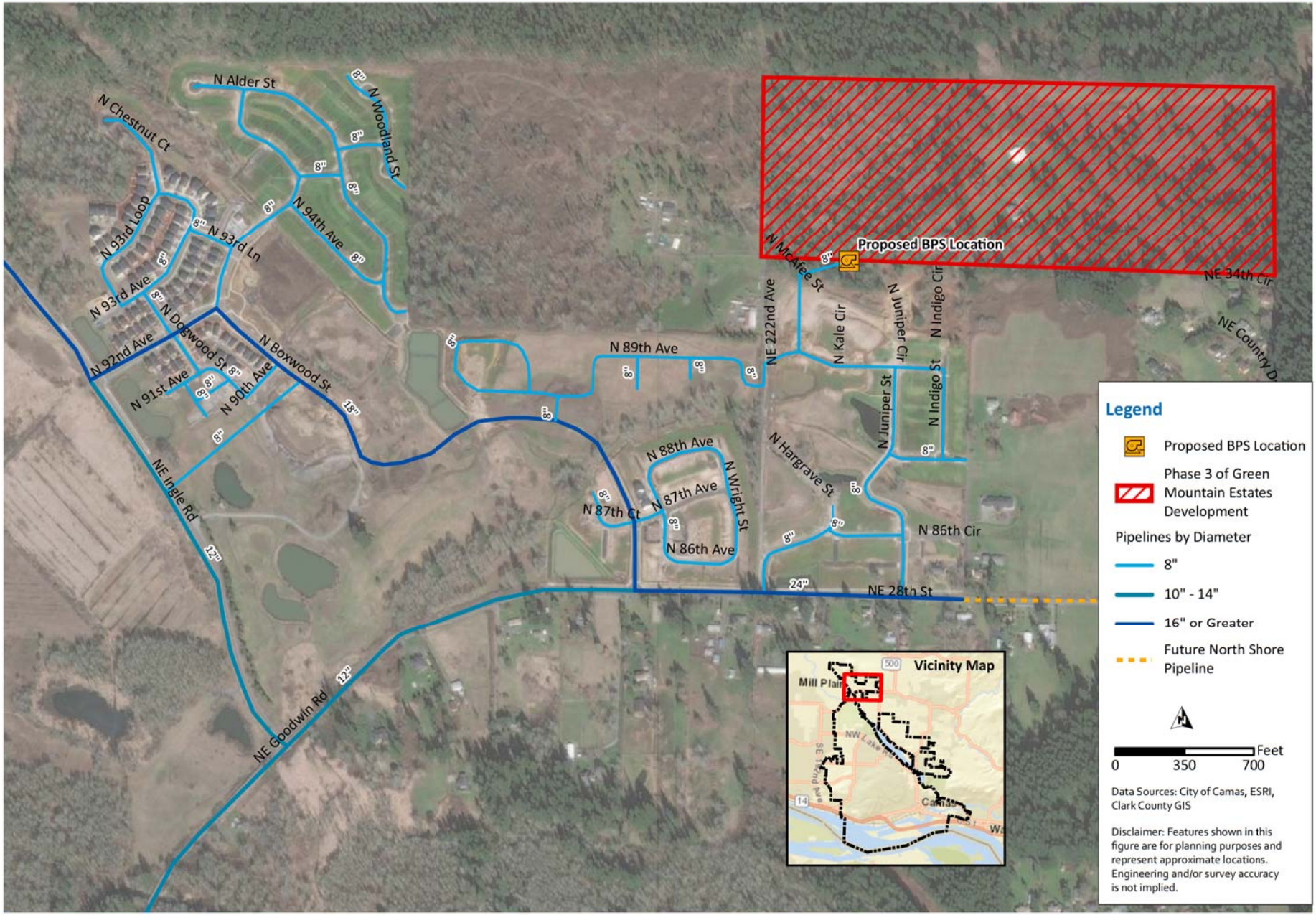


Figure 1 Green Mountain Estates Development

City of Camas
Green Mountain Estates Phase 4 Booster Pump Station

# Technical Memorandum
# SURGE ANALYSIS

FINAL | August 2021

City of Camas
Green Mountain Estates Phase 4 Booster Pump Station

# Technical Memorandum
# SURGE ANALYSIS

FINAL | August 2021

Digitally signed by Matthew M. Huang
Contact Info: Carollo Engineers, Inc.
Date: 2021.08.24 10:54:04-07'00'

# Contents

## Technical Memorandum - Surge Analysis



# Tables

# Figures

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# Abbreviations

| | |
|---|---|
| DIP | ductile iron pipe |
| ft | feet |
| ft/s | feet per second |
| gpm | gallons per minute |
| hp | horsepower |
| $lbs/ft^2$ | pounds per square foot |
| psi | pounds per square inch |
| rpm | revolutions per minute |
| TDH | total dynamic head |
| WSDM | Washington Water System Design Manual |

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Technical Memorandum

# SURGE ANALYSIS

## 1.1 Background

A developer plans to construct an inline Green Mountain Estates Booster Pump Station for the City of Camas along the 8-inch diameter water pipeline which serves Green Mountain Estates Phases 4, 5 and 6. Green Mountain Estates Pump Station will serve 228 lots in the northeast corner of the Camas water system which are at high elevations.

The surge analysis was conducted to determine the maximum and minimum surge pressures that could occur in the 8-inch diameter pipeline at Green Mountain Estates, and to recommend surge mitigation measures to prevent undesirable surge pressures. This report documents the results for the surge analysis and is intended to meet the requirements of Washington Water System Design Manual (WSDM) Section 6.1, requiring a hydraulic model evaluation of hydraulic transients (water hammer). This report is divided into the following sections:

1. Introduction.
2. Green Mountain Estates Pump Station Delivery System Description – Provides a physical description of the system that was modeled.
3. Hydraulic Transient Phenomenon – Explains various causes of hydraulic transient events in this pipeline system.
4. Surge Vessel as Surge Protection – Provides a general description of the surge protection devices considered for this study.
5. Hydraulic Modeling Approach - Describes the model setup and the acceptance criteria used for this analysis.
6. Model Scenarios Description and Results - Describes the scenarios simulated for this analysis.
7. Simulation Results Summary - Summarizes model-predicted results for the scenarios.
8. Recommendations – Provides recommendations for the study.

## 1.2 Green Mountain Estates Pump Station Delivery System Description

This section describes the physical characteristics of Green Mountain Estates water system. Green Mountain Estates are located at the northeast corner of city of Camas with high elevations ranging from 340 feet (ft) to 549 ft. There will be 228 lots within Green Mountain Estates with a peak hour demand of 361 gallons per minute (gpm) in accordance with information provided by Olson Engineering and the Washington WSDM Equation 3-1. A maximum day demand of 207 gpm was calculated using a peak hour demand to maximum day demand factor of 1.74 based on the diurnal pattern in the Infowater hydraulic model.

Green Mountain transmission mains are 8-inch diameter pipes. The 8-inch diameter pipe on NE 22nd Ave connects the existing Camas water distribution system with Green Mountain Estates pipelines. Two tanks in the City of Camas' 544 pressure zone, approximately 7 to 9 miles from Green Mountain Estates, function as discharge site supplying water to Green Mountain Estates Phases 4 to 6.

In order to meet the water demand in Green Mountain Estates Phases 4 to 6, an inline booster station named Green Mountain Estates Pump Station was proposed to lift water from the existing water system to satisfy the pressure criteria within Green Mountain Estates. The Green Mountain Estates Pump Station is located at the east of NE 22nd Ave. The pipeline configuration in Green Mountain Estates is a loop, however, the pipeline far end located west of NE 22nd Ave is closed in operation. The Green Mountain Estates Pump Station includes two 75 horsepower (hp) fire pumps with a design flow of 680 gpm for each, and three 20 hp duty pumps (two duty, one standby) with a design flow of 180 gpm for each. Figure 1 represents a plan view of the Green Mountain Pump Station delivery system.

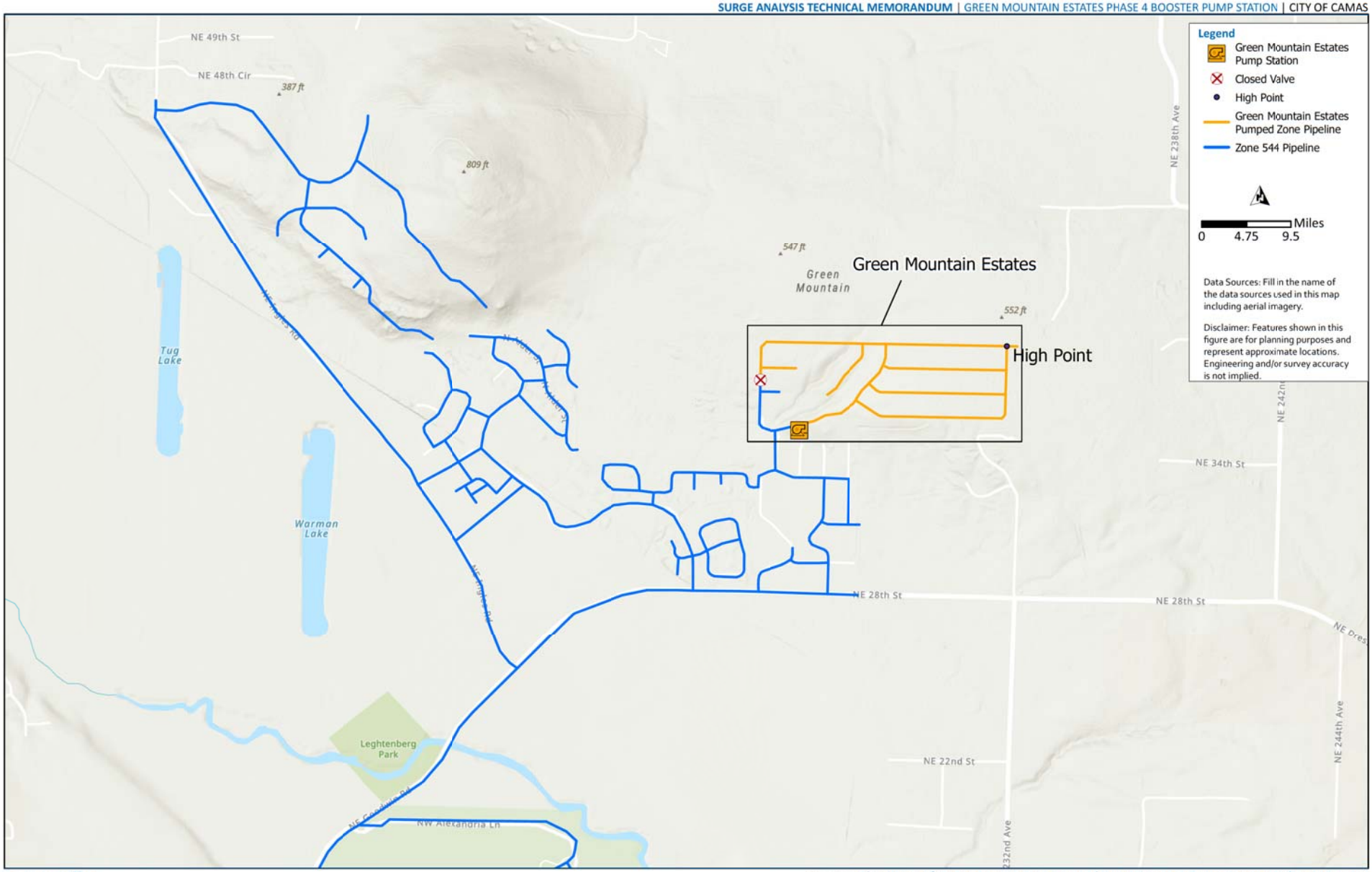


Figure 1 Plan View of Green Mountain Estates Phase 4 Booster Pump Station Delivery System

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The Camas Green Mountain Estates Surge Analysis InfoWater Pro Model was used to determine the elevation profile of the Green Mountain Estates 8-inch diameter pipeline. Figure 2 represents a profile view of the transmission from the Green Mountain Estates Pump Station to the far end located west of NE 232nd Ave. The high point is located at northeast corner of Green Mountain Estates, around 2,961 ft downstream of the pump station. The 8-inch diameter pipe material is ductile iron pipe (DIP). Therefore, 4,287 feet per second (ft/s) was calculated as the 8-inch diameter pipe wave speed.

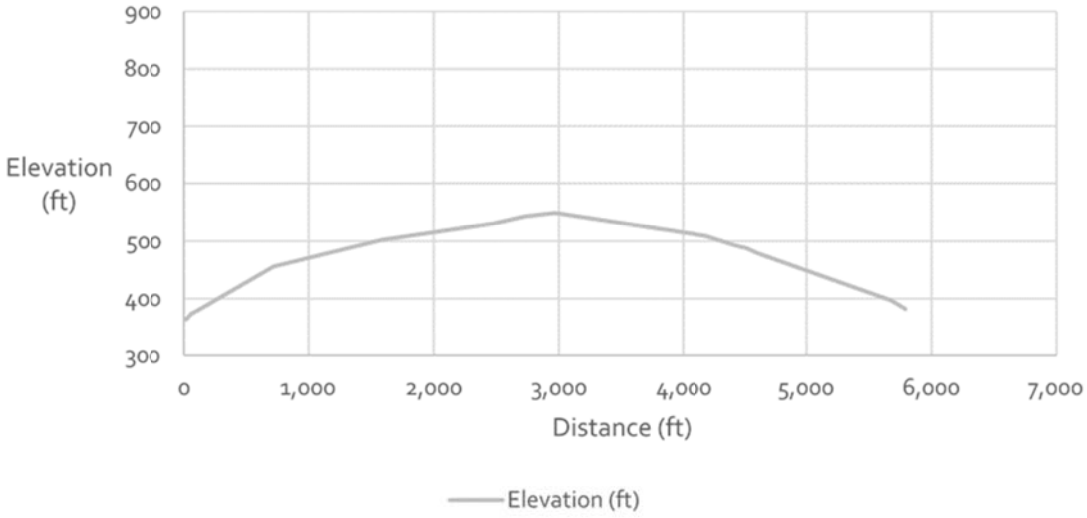



Figure 2 Transmission Main Profile from the Green Mountain Estates Pump Station to the Far End

The fire pump and duty pump curves were provided to describe the Green Mountain Estates pump characteristics. In the surge simulations, two duty pumps are operating during peak hour demand, while one duty pump and one fire pump are operating during maximum day demand plus 500 gpm fire flow. Table 1 presents the design parameters of the duty pumps and fire pumps in Green Mountain Estates Pump Station.

Table 1 Green Mountain Pump Station Duty and Fire Pump Characteristics

| Pump Type | Numbers | Pump Design Flow Rate (gpm) | TDH (ft) | Rating (hp) | Speed (rpm) | Moment of Inertia ($lb/ft^2$) | Stages |
|---|---|---|---|---|---|---|---|
| Duty Pump | 3 | 180 | 290 | 20 | 1,750 | 4,803 | 9 |
| Fire Pump | 2 | 680 | 290 | 75 | 1,760 | 25,283 | 4 |

Notes:
(1) Abbreviations: pounds per square foot ($lb/ft^2$), revolutions per minute (rpm); total dynamic head (TDH)

## 1.3 Hydraulic Transient Phenomenon

Undesirable surge pressures are caused by sudden changes in water velocity in a pipeline. These changes in velocity are most commonly caused by pump station power failure events. Following a pump station power failure, a low-pressure wave begins at the pump station and travels down the pipeline to the end of the pipeline. This low-pressure wave works to dissipate the forward momentum of the water in the pipeline. Then a high-pressure wave travels back from the end of the pipeline to the pump station, causing high pressures. This pressure wave travels back and forth along the pipeline for several cycles until the energy in the system is dissipated.

Undesirable surge pressures can also be caused by vapor cavity formation and collapse, also referred to as column separation. When the initial low-pressure wave travels down the pipeline, pressures can become negative and even drop to vapor pressure. At an intermediate break in the grade of the pipe, or at an intermediate high point, the forward momentum of the water in the pipeline downstream of the high point is great enough that low pressures down to vapor pressure are not sufficient to stop the water column and water column separation occurs. The pressure at the intermediate high point or break in grade remains at vapor pressure while the water column is separated. The downstream water column slows down and then reverses because of the differential hydraulic grade line between the end of the pipeline and vapor pressure at the intermediate high point. The water column then moves toward the vapor cavity. At the instant the cavity collapses, the water column must come to an abrupt stop, which results in a sudden, high-pressure spike that travels along the pipeline.

Pressures down to vapor pressure are commonly predicted in transmission mains following pump failure events. However, just because pressures drop to vapor pressure does not automatically mean that column separation will occur with the resulting high-pressure spikes. Column separation occurs when the forward momentum of the water column is great enough that the water column cannot be stopped merely because the pressure drops to vapor pressure. The risk associated with column separation is due to high pressures that occur when the vapor cavity collapses. The repeated rapid change in pressure caused by a cavity collapsing can, over time, contribute to wear on pipe (and/or associated linings), gaskets, and joints. As a definitive computation of high pressures associated with the vapor cavity collapse can be uncertain, it is common practice to eliminate the potential of vapor pressure to mitigate the risk altogether.

Surge events including column separation are governed by the laws of physics, specifically the momentum and continuity equations. Computer models can predict the magnitude of surge pressures and are useful to design pipelines and pump stations to withstand pressures as predicted by the model. The model can also be used to iteratively select surge protection devices to obtain solutions that are appropriate for each pipeline. Models tend to be conservative in their predictions because the models use steady-state energy equations (Hazen-Williams, Darcy-Weisbach) to predict energy dissipation in a pipeline during a surge event. However, the rate of energy dissipation during a transient event is usually greater than these equations predict. For this reason, models often show more pressure wave cycles than occur in the physical system.

## 1.4 Surge Vessel as Surge Protection

A surge vessel provides surge protection by gradually slowing down water velocities in pipelines following a pump trip or other surge-causing event. This is done by allowing water in the surge vessel to enter the pipeline following a down surge caused by a pump trip. Pressures at the surge

vessel decrease gradually, causing the water column in the pipeline to slow down gradually. When the water column reverses, water begins to fill the tank, which increases the pressure at a gradual rate and slows down the water column moving back towards the surge vessel. These oscillations continue for several cycles until the energy in the system is dissipated.

## 1.5 Hydraulic Modeling Approach

### 1.5.1 Model Setup

Bentley's OpenFlows HAMMER modeling software was used to perform this surge analysis. A hydraulic InfoWater Pro model of the Camas water system was adapted for this study. The surge model includes Green Mountain Estates water system and Zone 544 water system. Table 2 presents the steady-state conditions established in the model.

Table 2 Steady-State Flow and Pressure Conditions at the Green Mountain Estates Pump Station

| Green Mountain Estates Delivery Pipeline Diameter (inch) | Demand Condition | Green Mountain Estates Pump Station Flow (gpm) | Green Mountain Estates Pump Station Discharge Pressure (psi) | Green Mountain Estates Pump Station Suction Pressure (psi) |
|---|---|---|---|---|
| 8 | Peak Hour Demand | 361 | 174 | 47 |
| 8 | Maximum Day Demand Plus 500 gpm Fire Flow | 707 | 184 | 51 |

Notes:
(1) Abbreviation: pounds per square inch (psi).

### 1.5.2 Acceptance Criteria

Surge pressures were evaluated against the following criteria:

1. Pressures throughout the transmission main must be within the pipe maximum allowable pressure. For Class 200 DIP pipe, the maximum operating pressure needs to be less than 200 psi plus 100-psi surge allowance.
2. Vapor pressure should be prevented from occurring along the transmission main where possible.

## 1.6 Model Scenarios Description and Results

Surge events are most commonly caused by pump station power failure, pump start-up, or rapid valve opening or closing events.

The following water hammer inducing events were simulated for the analysis:

- During peak hour demand, two duty pumps trip followed by start-up at the pump station, with and without surge protection.
- During maximum day demand plus fire flow, fire hydrant abrupt closure, with and without surge protection.

Table 3 presents the detailed settings of simulations runs.

Table 3 Simulation Run Settings

| Run No. | Water Demand | Transient Event | Surge protection | Surge Vessel size (gallons) | Surge Vessel Inlet Diameter (inch) |
|---|---|---|---|---|---|
| 1 | Peak Hour | Two duty pumps trip followed by start-up | None | N/A | N/A |
| 2 | Peak Hour | Two duty pumps trip followed by start-up | With surge vessel | 5,000 | 4 |
| 3 | Peak Hour | Two duty pumps trip followed by start-up | With surge vessel | 3,000 | 4 |
| 4 | Peak Hour | Two duty pumps trip followed by start-up | With surge vessel | 2,000 | 4 |
| 5 | Max Day Plus 500 gpm Fire Flow | Fire hydrant abrupt closure | None | N/A | N/A |
| 6 | Max Day Plus 500 gpm Fire Flow | Fire hydrant abrupt closure | With surge vessel | 3,000 | 4 |

## 1.7 Model Scenarios Description and Results

A surge vessel was modeled downstream of Green Mountain Estates Pump Station. In this study, three different surge vessel sizes, 5,000 gallon, 3,000 gallon and 2,000 gallon surge vessels were evaluated. Surge vessel connection diameter was set as 4-inch.

### 1.7.1 Run 1: Two duty pumps trip followed by start-up – no surge vessel, peak hour demand

The purpose of Run 1 is to determine the undesirable surge pressures that may occur with no surge protection, so that the need for surge mitigation measures can be established. In this simulation, during peak hour demand, two duty pumps trip followed by start-up without any surge protection. Following the power failure event, a low-pressure wave travels down the transmission main, and the forward momentum of the water column decreases. The pressure-waves travel back and forth until the pumps start back up. The check valve downstream of each pump closes rapidly upon flow reversal. Figure 3 and Figure 4 show the time graph of the model-predicted discharge and suction pressures at the Green Mountain Estates Pump Station. The model predicts the maximum pump discharge pressure is 182 psi, and the maximum suction pressure is 99 psi. Figure 5 shows the time graph of the high point pressures in Green Mountain Estates. The surge pressures at the high point are close to steady state pressure, which are around 93 psi.

Figure 6 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. Figure 7 shows the vapor cavity volume along the transmission main for the duration of the simulation. The model predicts vapor pressure conditions occurring along the transmission main. Vapor cavities are predicted at intermediate high points.

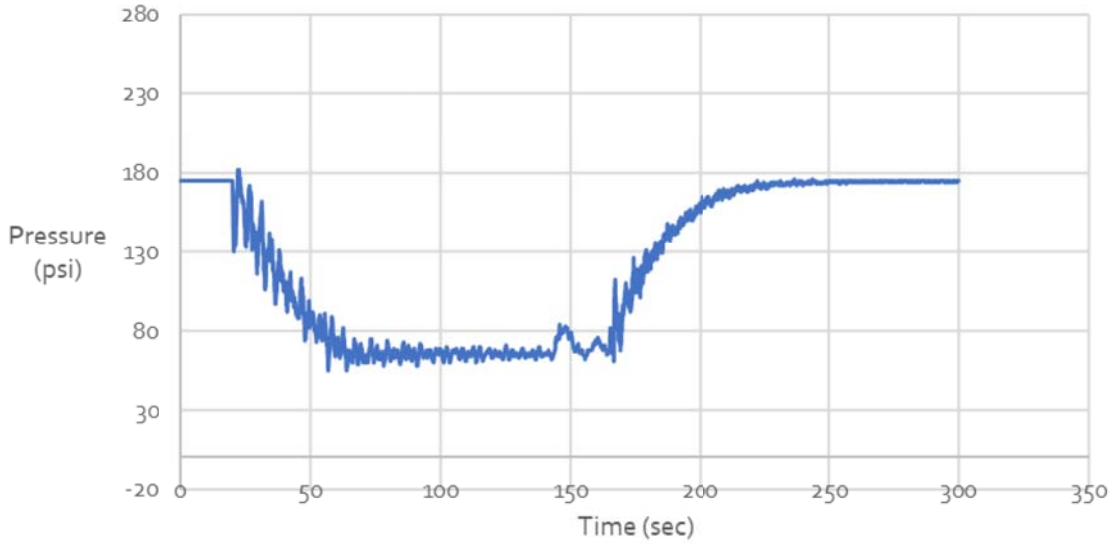



Figure 3 Run 1: Green Mountain Estates Pump Station Discharge Pressure

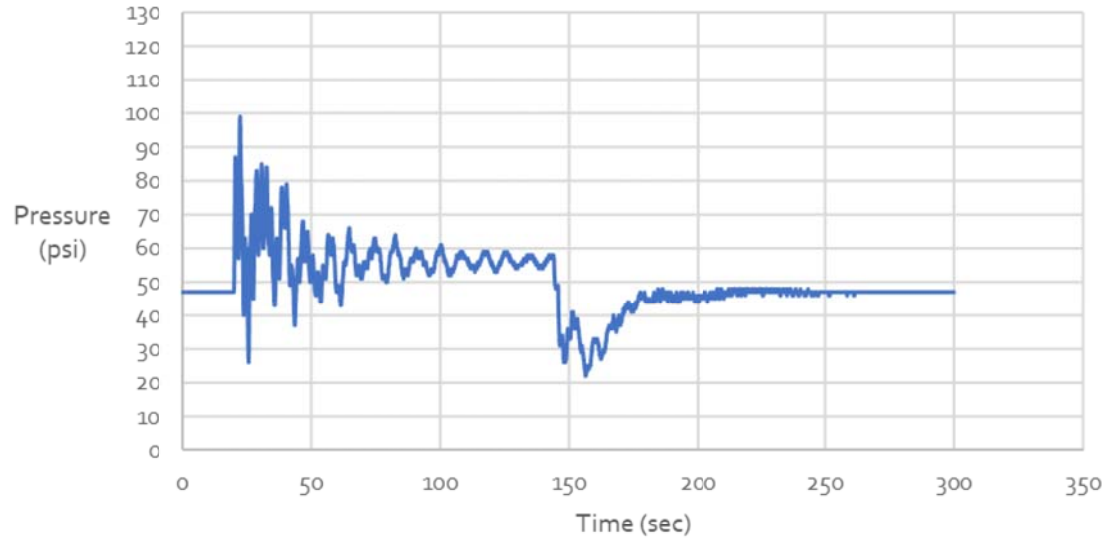



Figure 4 Run 1: Green Mountain Estates Pump Station Suction Pressure

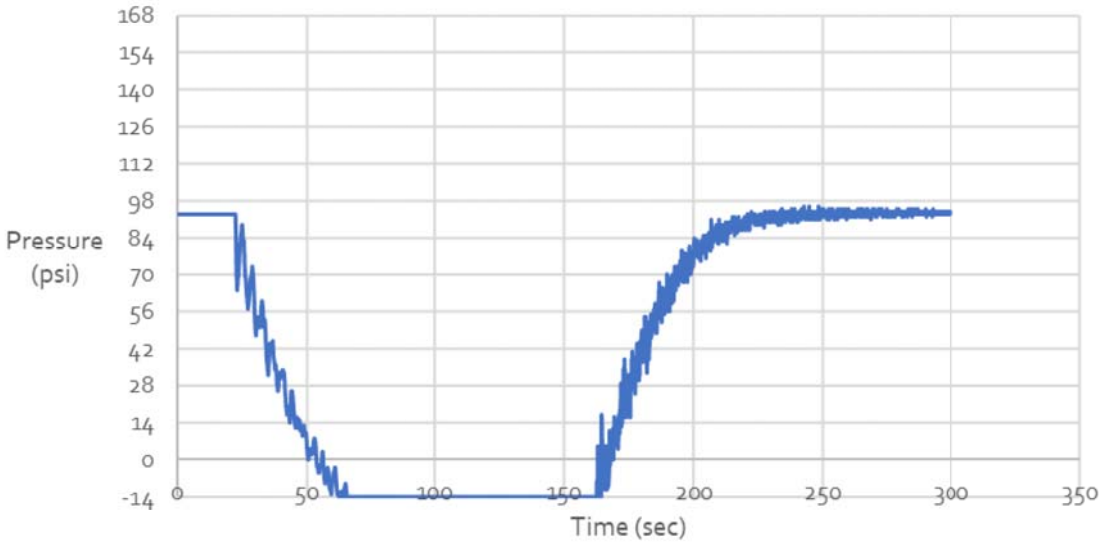



Figure 5 Run 1: Green Mountain Estates High Point Pressure

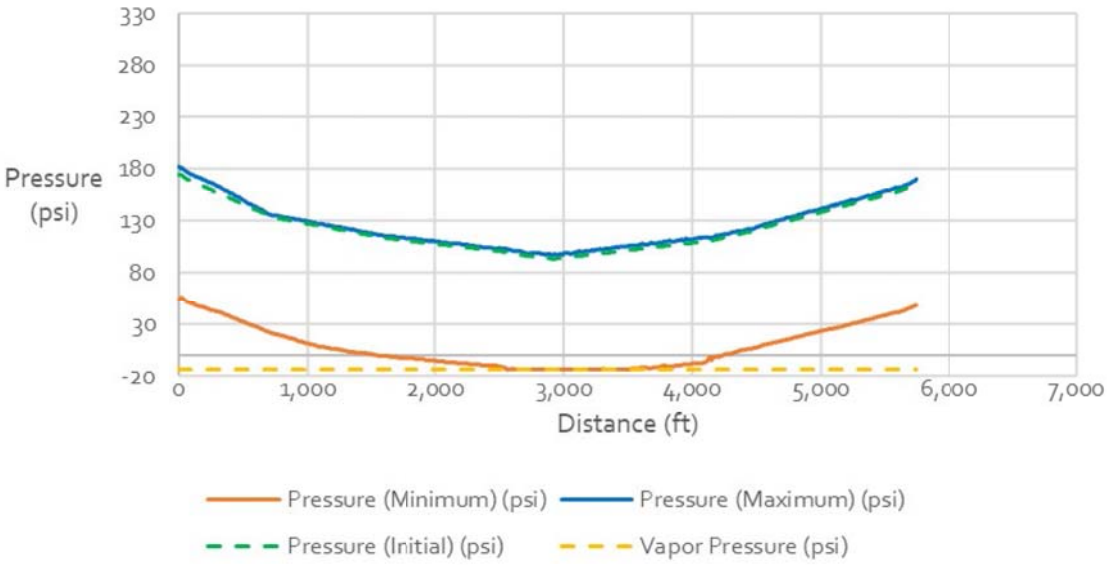



Figure 6 Run 1: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

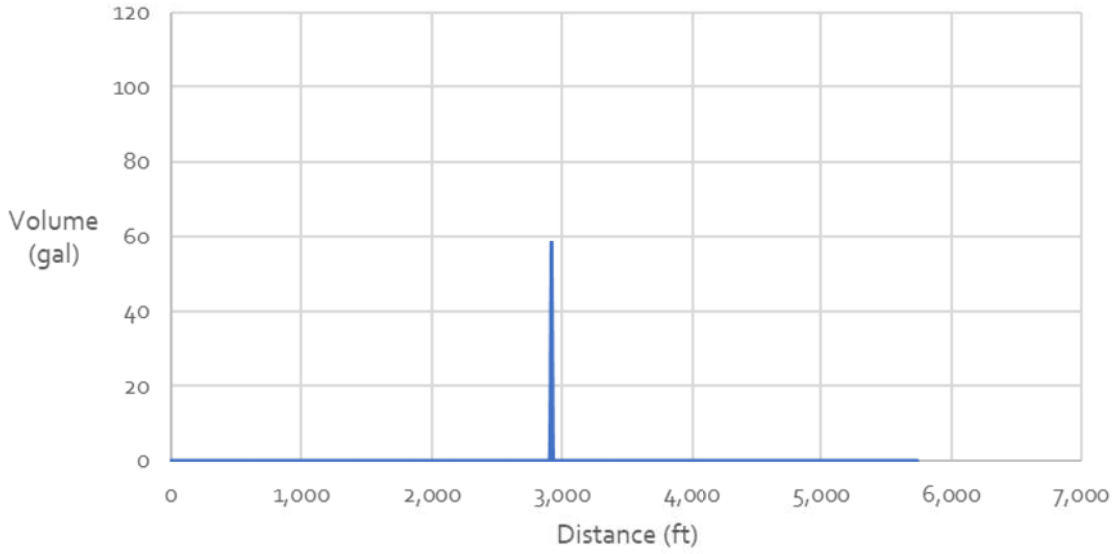



Figure 7 Run 1: Vapor Cavity Volume Along the 8-inch Diameter Transmission Main From the Green Mountain Estates Pump Station

### 1.7.2 Run 2: Two duty pumps trip followed by start-up – 5,000 gallon surge vessel, peak hour demand

This run includes a 5,000 gallon surge vessel at Green Mountain Estates Pump Station. In this simulation, during peak hour demand, two duty pumps trip followed by start-up with a 5,000 gallon surge vessel. Following the power failure event, a low-pressure wave travels down the transmission main, the water from the surge vessel enters the pipeline and the pressure at the pump station decreases gradually. When the water column reverses, water fills the tank causing the pressure to increase at a gradual rate. Figure 8 and Figure 9 show the time graph of the model-predicted discharge and suction pressures at the Green Mountain Estates Pump Station. The model predicts the maximum pump discharge pressure is 207 psi, and the maximum suction pressure is 104 psi. Figure 10 shows the time graph of the high point pressures in Green Mountain Estates. After the pump station power failure, the high point pressure drops to 51 psi instead of vapor pressure with a 5,000 gallon surge vessel.

Figure 11 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. The model predicts that the 5,000-gallon surge vessel prevents vapor pressure from occurring along the entire length of the transmission main. The surge vessel air volume is shown on Figure 12.

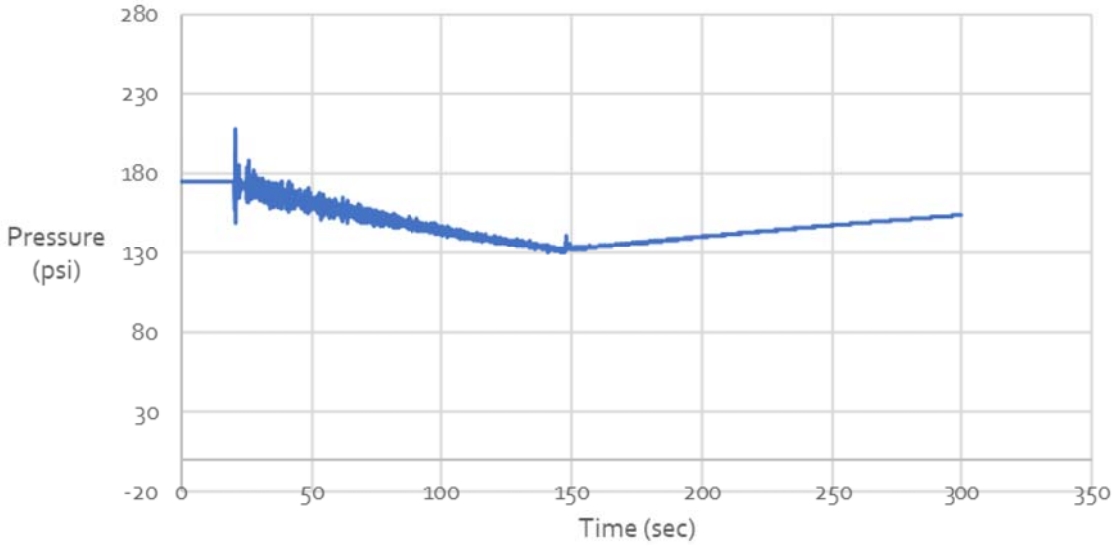



Figure 8 Run 2: Green Mountain Estates Pump Station Discharge Pressure

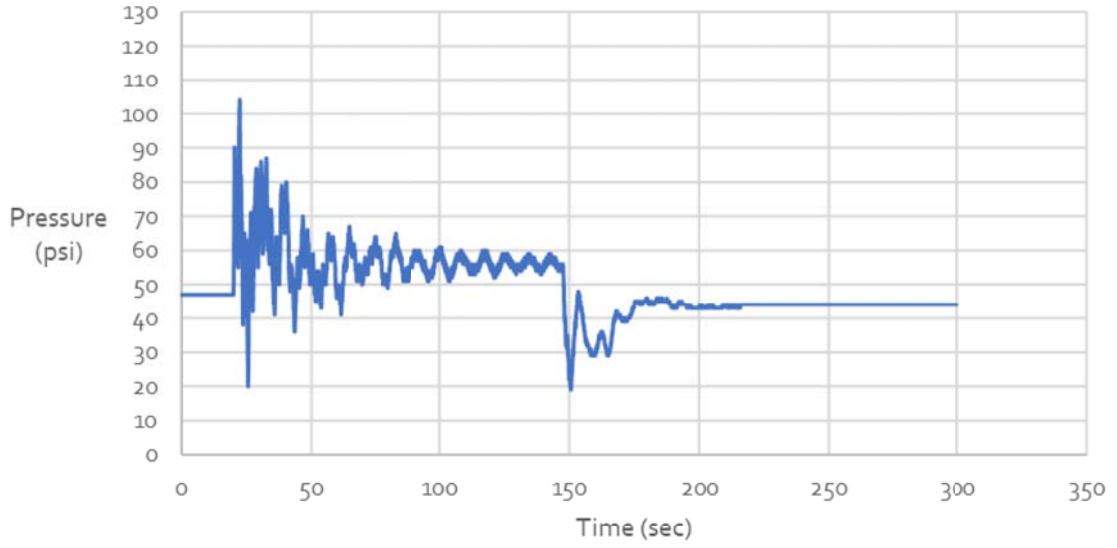



Figure 9 Run 2: Green Mountain Estates Pump Station Suction Pressure

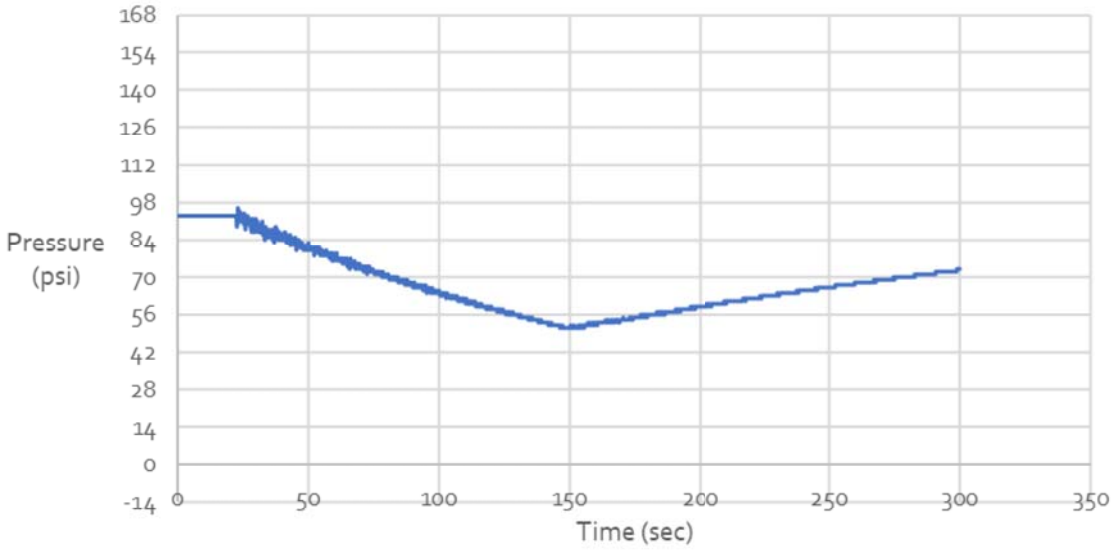



Figure 10 Run 2: Green Mountain Estates High Point Pressure

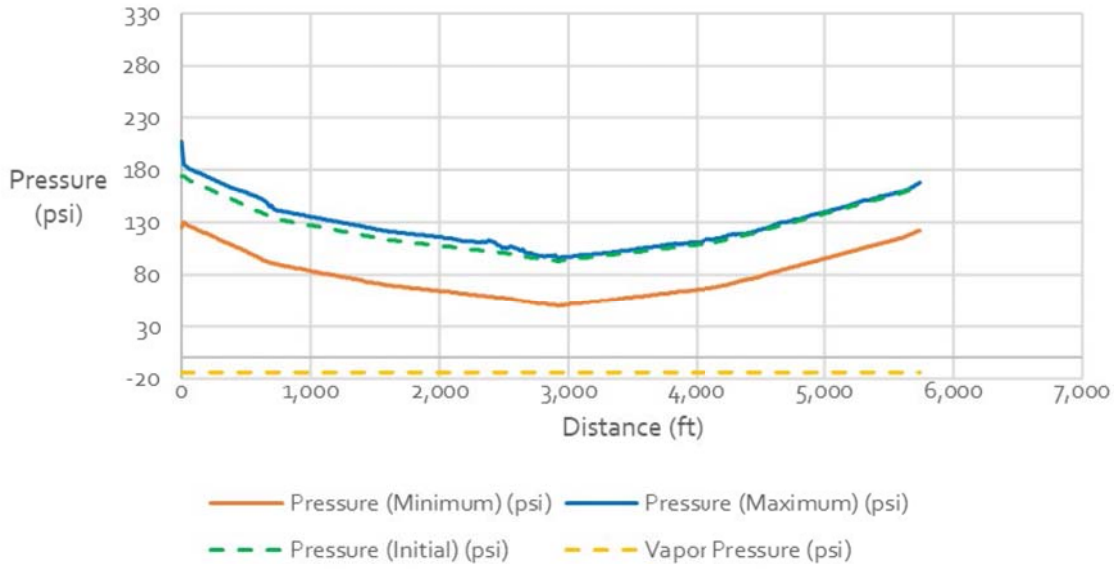



Figure 11 Run 2: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

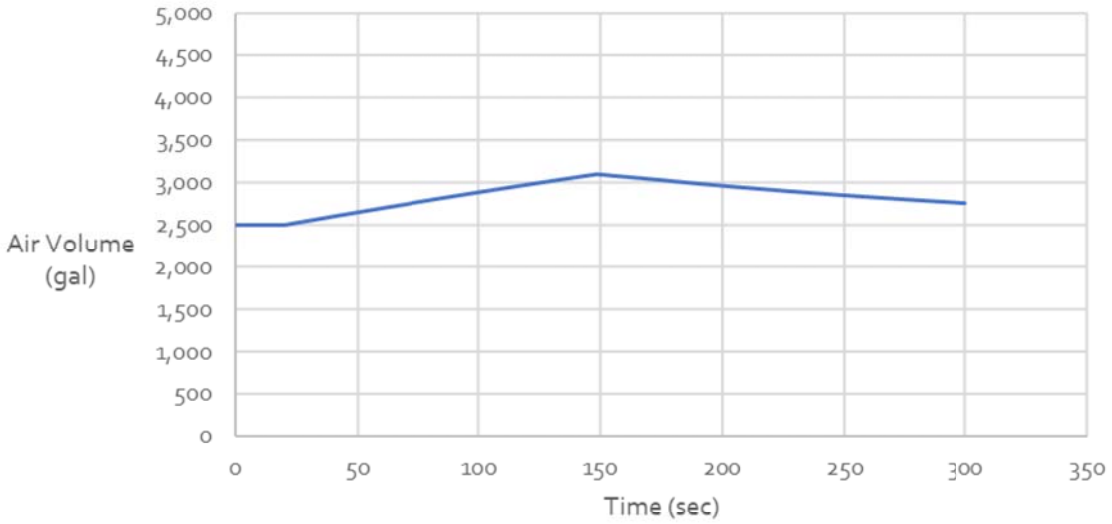



Figure 12 Run 2: Surge Vessel Air Volume

### 1.7.3 Run 3: Two duty pumps trip followed by start-up – 3,000 gallon surge vessel, peak hour demand

This run includes a 3,000-gallon surge vessel at Green Mountain Estates Pump Station. In this simulation, during peak hour demand, two duty pumps trip followed by start-up with a 3,000 gallon surge vessel. Figure 13 and Figure 14 show the time graph of the model-predicted discharge and suction pressures at Green Mountain Estates Pump Station. The model predicts the maximum pump discharge surge pressure is 207 psi, and the maximum suction pressure is 104 psi. Figure 15 shows the time graph of the high point pressures in Green Mountain Estates. After the pump station power failure, the high point pressure drops to 35 psi.

Figure 16 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. The model predicts that the 3,000-gallon surge vessel is sufficient to prevent vapor pressure from occurring along the entire length of the transmission main. The surge vessel air volume is shown on Figure 17.

A surge vessel will also be used to minimize pump cycling during low demand times. A surge vessel is normally filled 50% full under normal pumping conditions. If the surge vessel water volume can vary between 40% and 60% full, then the pump cycle times can be calculated under minimum demand conditions of 46 gpm at night. Each duty pump has a design flow of 180 gpm. Therefore, the duty pump will need to turn on 5 to 7 times/ hour.

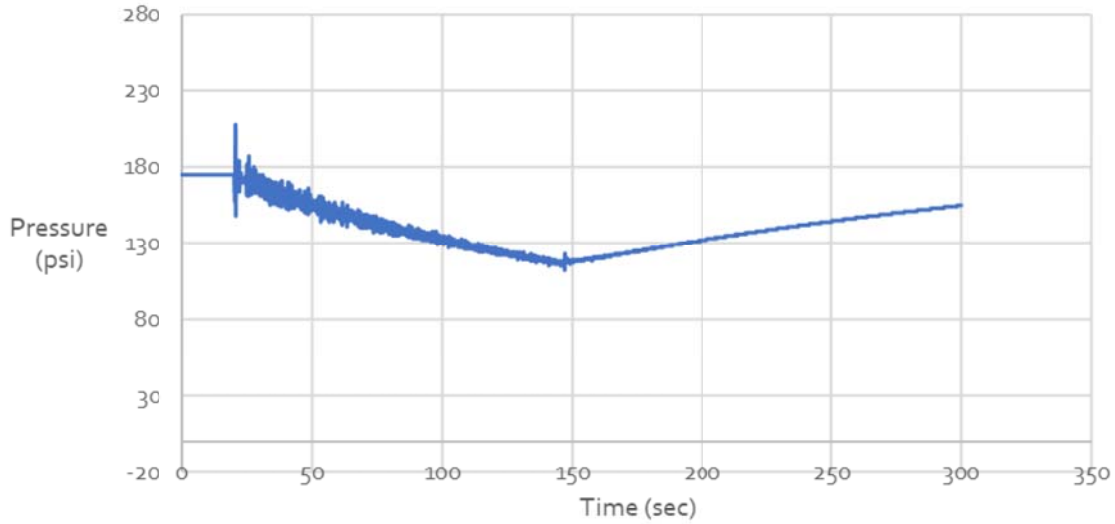



Figure 13 Run 3: Green Mountain Estates Pump Station Discharge Pressure

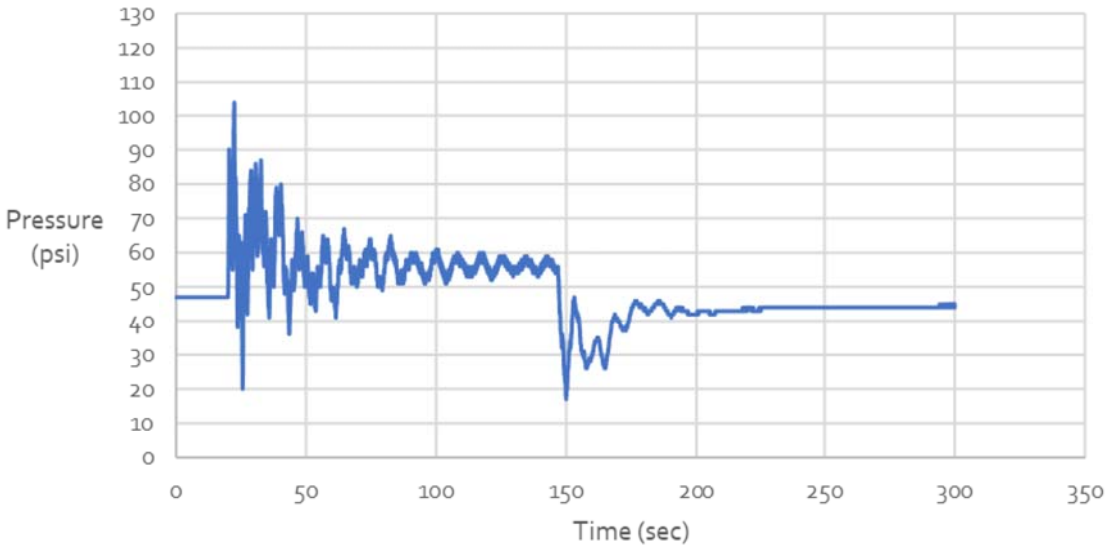



Figure 14 Run 3: Green Mountain Estates Pump Station Suction Pressure

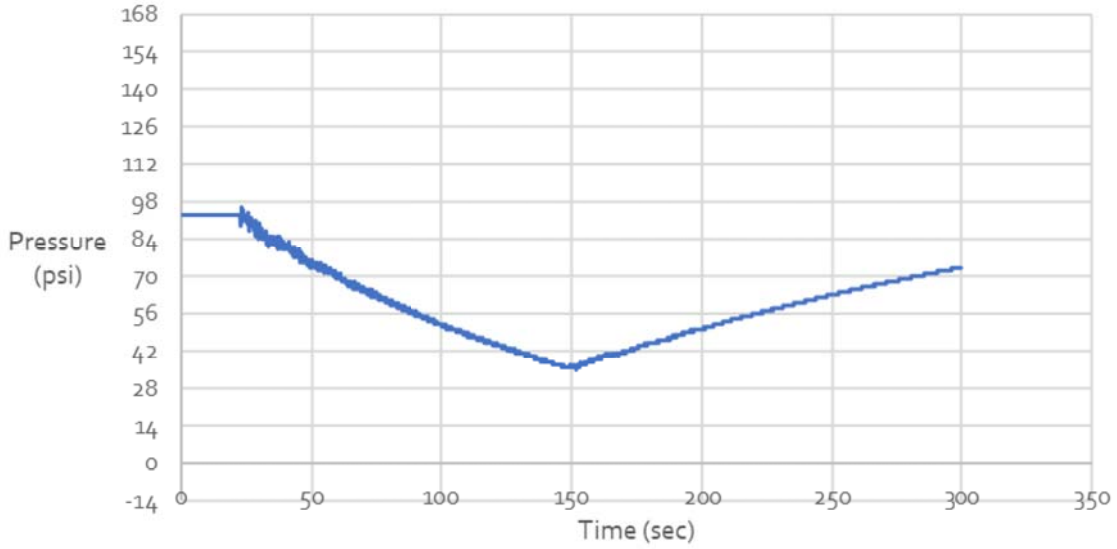



Figure 15 Run 3: Green Mountain Estates High Point Pressure

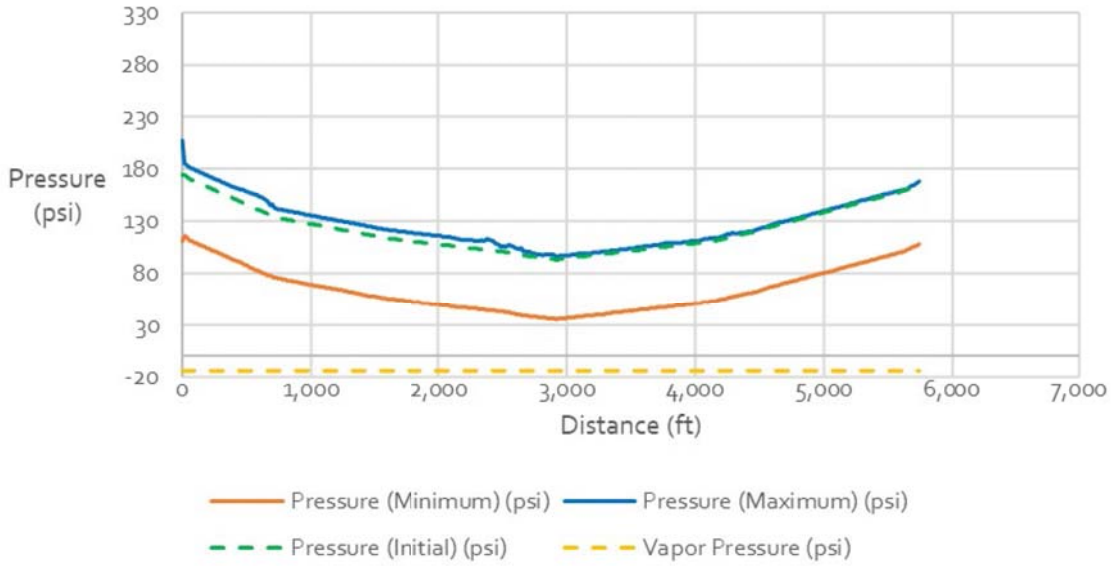



Figure 16 Run 3: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

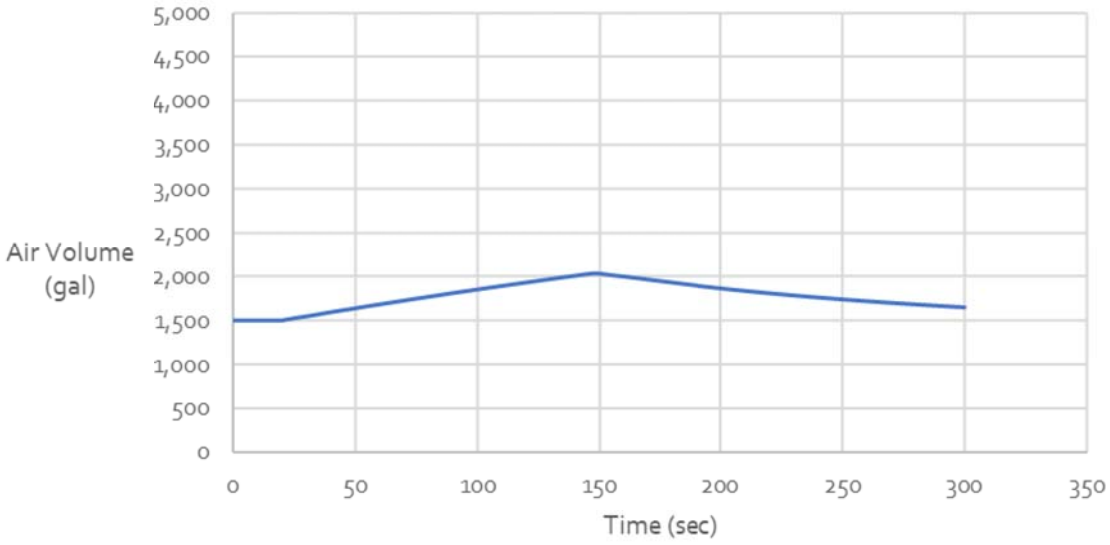



Figure 17 Run 3: Surge Vessel Air Volume

### 1.7.4 Run 4: Two duty pumps trip followed by start-up – 2,000 gallon surge vessel, peak hour demand

This run includes a 2,000-gallon surge vessel at Green Mountain Estates Pump Station. In this simulation, during peak hour demand, two duty pumps trip followed by start-up with a 2,000 gallon surge vessel. Figure 18 and Figure 19 show the time graph of the model-predicted discharge and suction pressures at Green Mountain Estates Pump Station. The model predicts the maximum pump discharge pressure is 207 psi, and the maximum suction pressure is 104 psi. Figure 20 shows the time graph of the high point pressures in Green Mountain Estates. After the pump station power failure. the high point pressure drops to 23 psi.

Figure 21 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. The surge vessel air volume is shown on Figure 22. The model predicts that the 2,000-gallon surge vessel is able to prevent vapor pressure from occurring along the entire length of the transmission main, but provide less cushion than 3,000 gallon surge vessel.

A surge vessel will also be used to minimize pump cycling during low demand times. A surge vessel is normally filled 50% full under normal pumping conditions. If the surge vessel water volume can vary between 40% and 60% full, then the pump cycle times can be calculated under minimum demand conditions of 46 gpm at night. Each duty pump has a design flow of 180 gpm. Therefore, the duty pump will need to turn on 7 to 10 times/ hour.

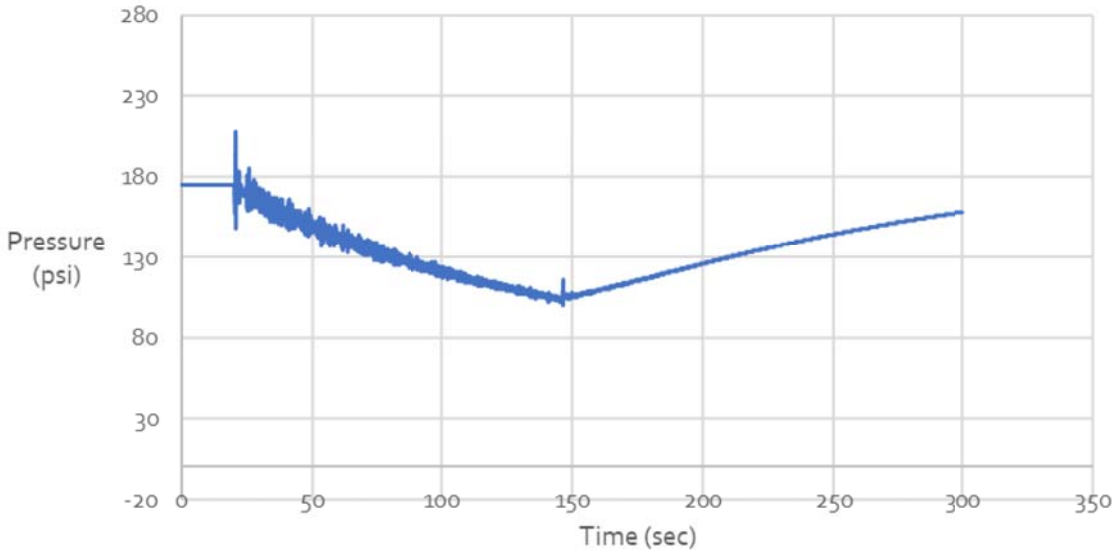



Figure 18 Run 4: Green Mountain Estates Pump Station Discharge Pressure

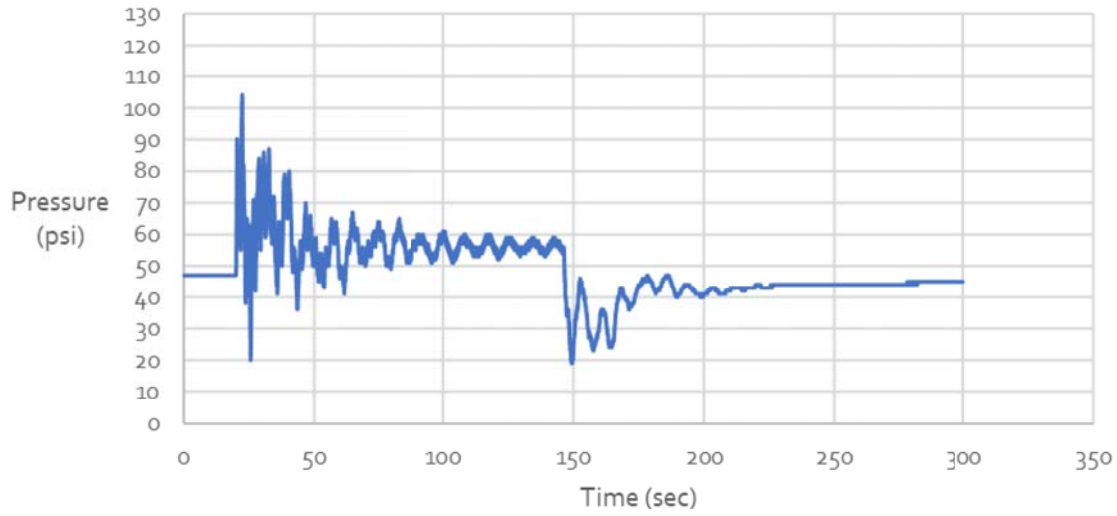



Figure 19 Run 4: Green Mountain Estates Pump Station Suction Pressure

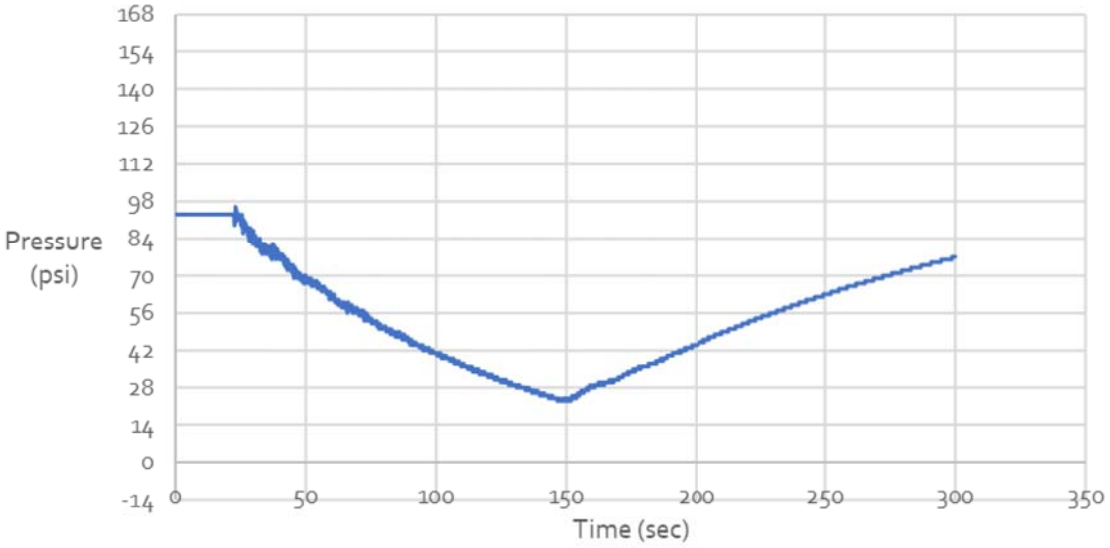



Figure 20 Run 4: Green Mountain Estates High Point Pressure

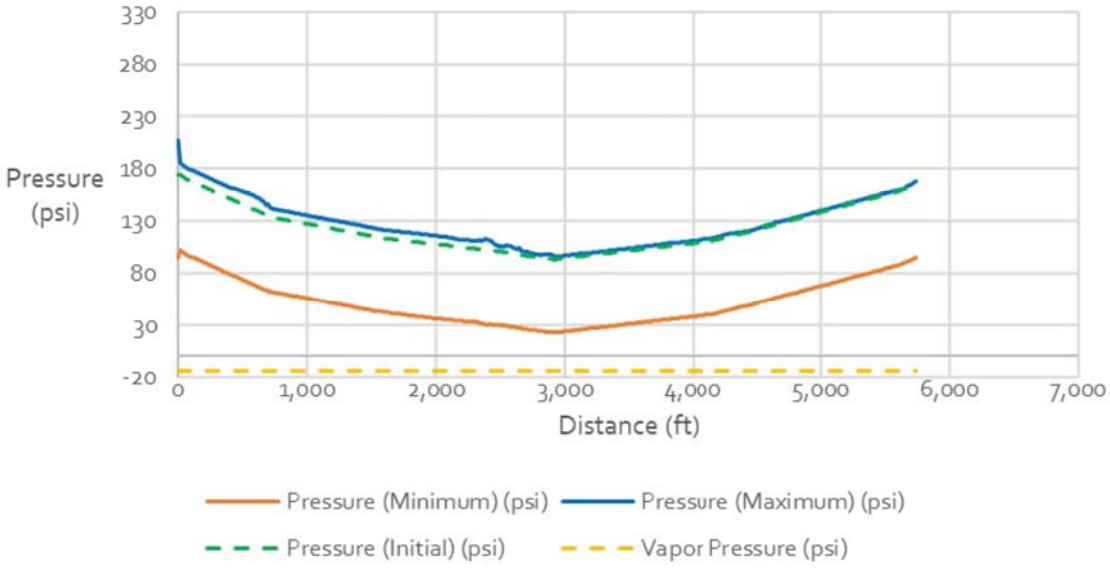



Figure 21 Run 4: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

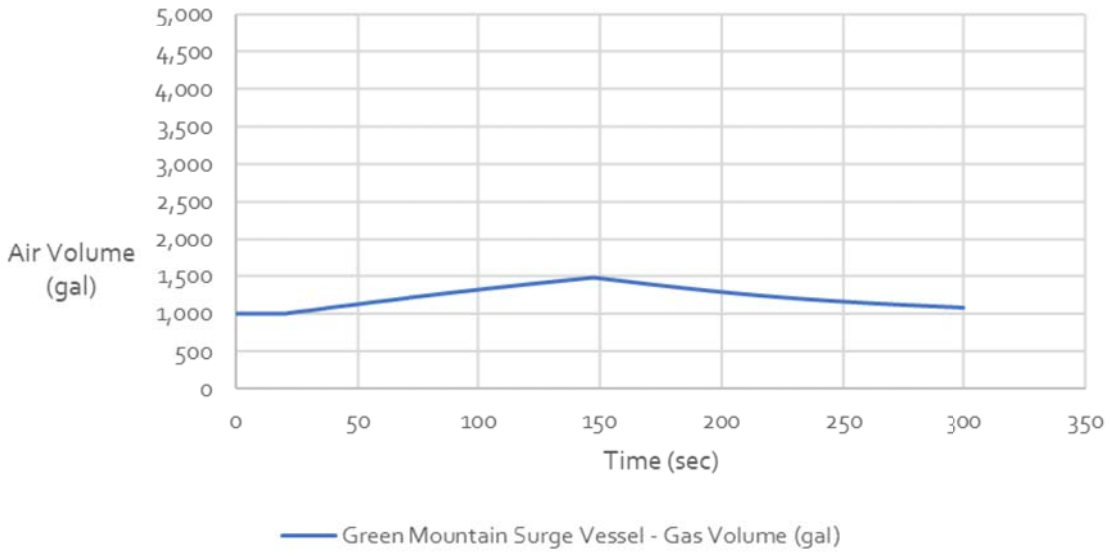



Figure 22 Run 4: Surge Vessel Air Volume

### 1.7.5 Run 5: Fire hydrant abrupt closure – no surge vessel, maximum day demand plus 500 gpm fire flow

The purpose of this run is to determine the undesirable surge pressures that may occur with no surge protection when fire hydrant closes abruptly, so that appropriate surge mitigation measures can be established. In this simulation, during maximum day demand plus 500 gpm fire flow, one duty pump and one fire pump are operating. When the fire hydrant located at the high point closes abruptly, the fire pump shuts down after filling in the hydropneumatic tank for some time. Figure 23 and Figure 24 show the time graph of the model-predicted discharge and suction pressures at Green Mountain Estates Pump Station. The model predicts the maximum pump discharge pressure is 200 psi, and the maximum suction pressure is 84 psi. Figure 25 shows the time graph of the high point pressures in Green Mountain Estates. The pressures at the high point range from 58 psi to 130 psi.

Figure 26 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. The model predicts that minimum pressures along the entire length of the transmission main are above 0 psi, and the maximum pressure is 208 psi.

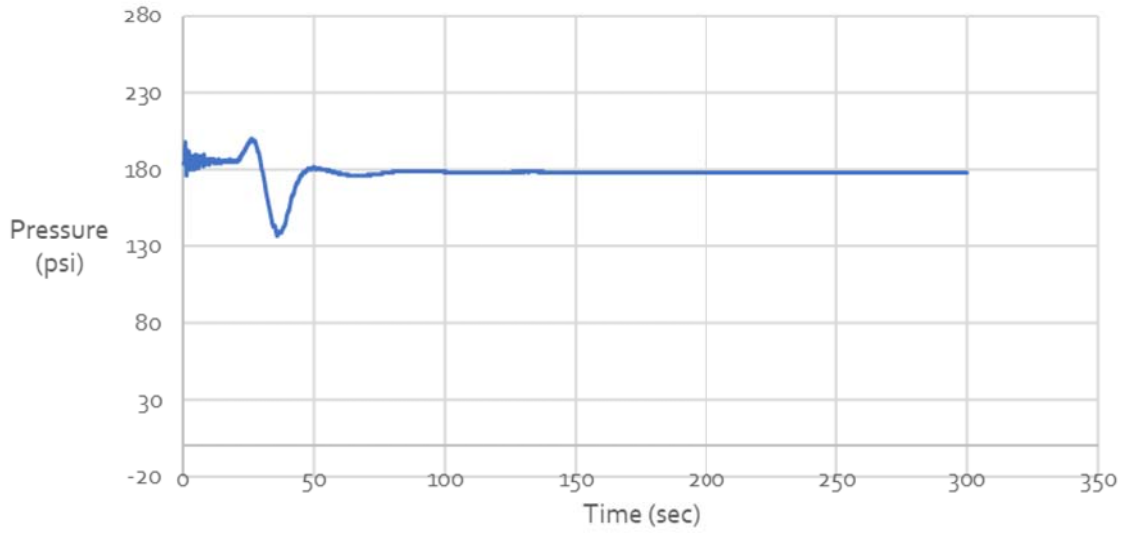



Figure 23 Run 5: Green Mountain Estates Pump Station Discharge Pressure

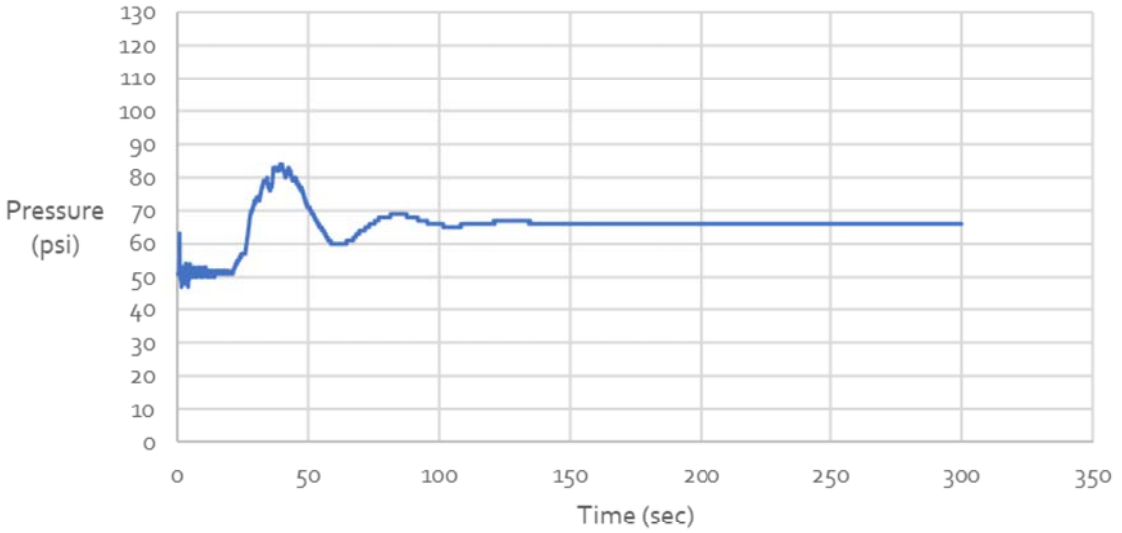



Figure 24 Run 5: Green Mountain Estates Pump Station Suction Pressure

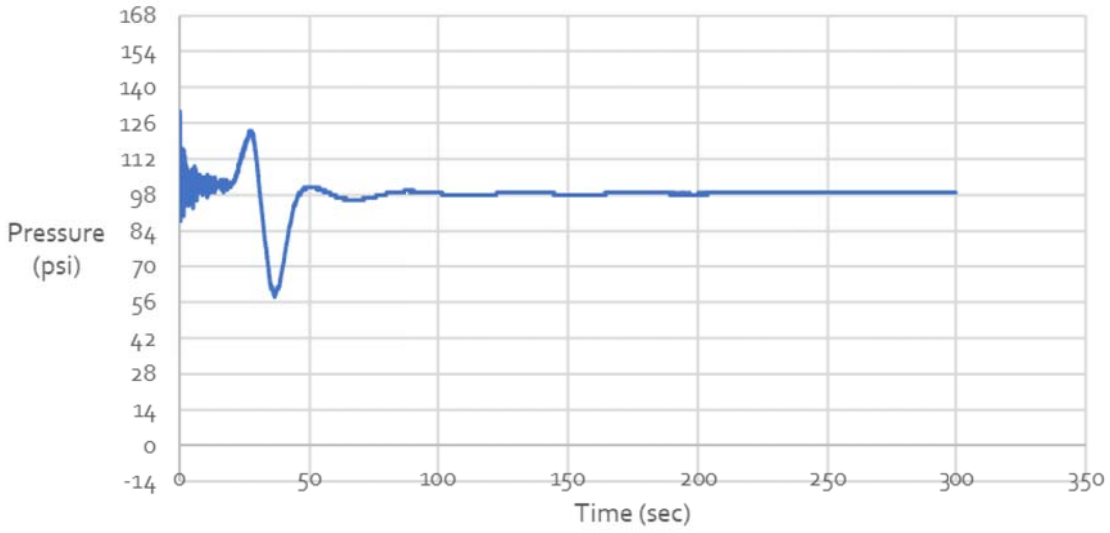



Figure 25 Run 5: Green Mountain Estates High Point Pressure

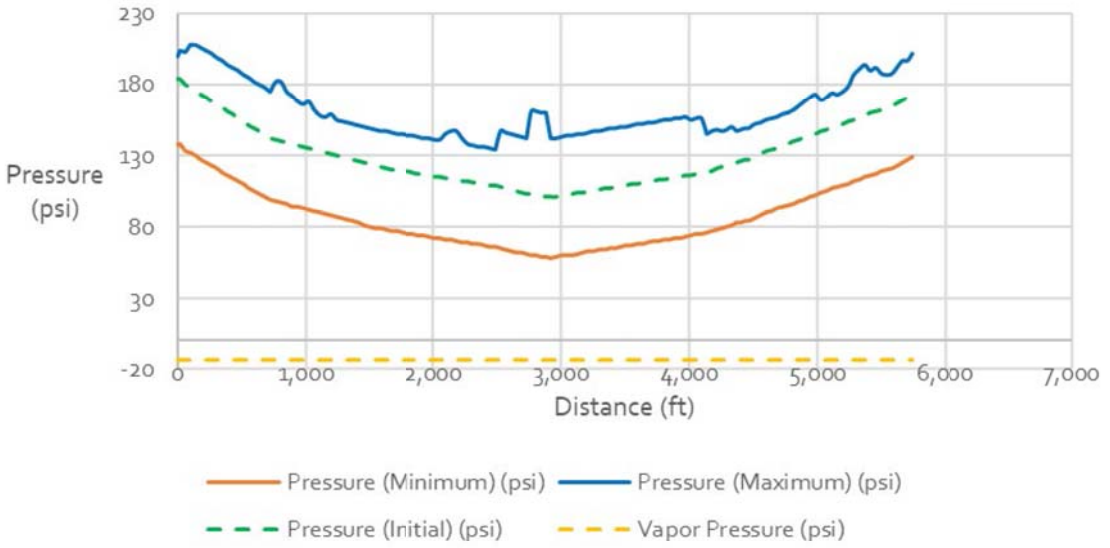



Figure 26 Run 5: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

### 1.7.6 Run 6: Fire hydrant abrupt closure – 3,000 gallon surge vessel, maximum day demand plus 500 gpm fire flow

For the transient condition of fire hydrant abrupt closure, various sizes of surge vessel were evaluated, including 2,000 gallon, 3,000 gallon, and 5,000 gallon surge vessels. The model results show all these three size surge vessels have similar surge results. Along the 8-inch diameter transmission main, the surge pressures range between 70 psi and 219 psi. All these three size surge vessels have little effect in mitigating surge maximum pressures.

Considering 3,000 gallon is sufficient and the most economic efficient among these three sizes regarding surge protection during a peak hour demand pump trip, only 3,000 gallon surge vessel analysis is reported here for fire hydrant abrupt closure scenario. In this simulation, during

maximum day demand plus 500 gpm fire flow, the fire hydrant closes abruptly with 3,000 gallon surge protection. Figure 27 and Figure 28 show the time graph of the model-predicted discharge and suction pressures at Green Mountain Estates Pump Station. The model predicts the maximum pump discharge pressure is 191 psi, and the maximum suction pressure is 90 psi. Figure 29 shows the time graph of the high point pressures in Green Mountain Estates. The high point minimum pressure is 130 psi.

Figure 30 shows the steady state, maximum, minimum, and vapor pressure along the pipeline starting at the Green Mountain Estates Pump Station. The model predicts pressures as high as 206 psi along the transmission main. The surge vessel air volume is shown on Figure 31.

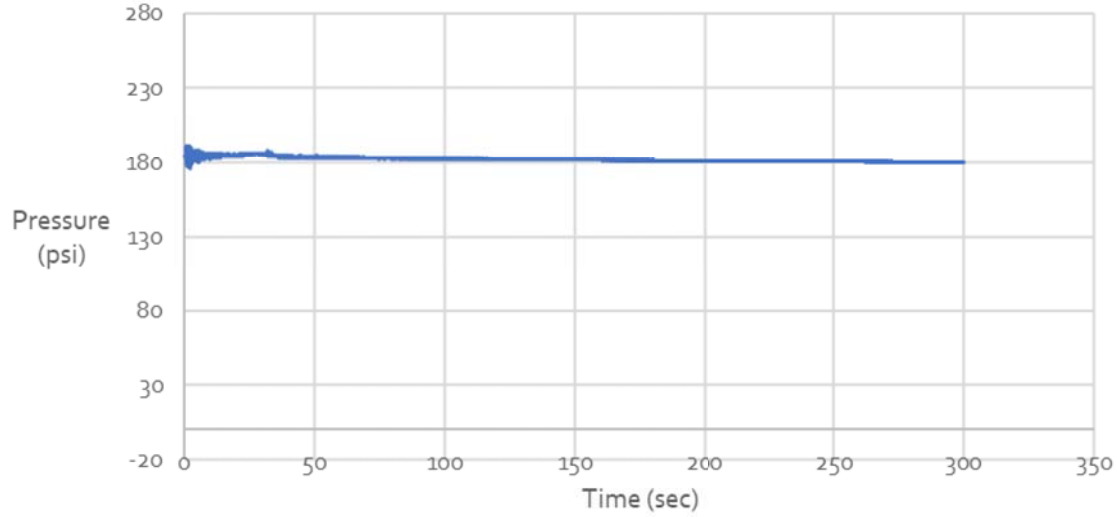



Figure 27 Run 6: Green Mountain Estates Pump Station Discharge Pressure

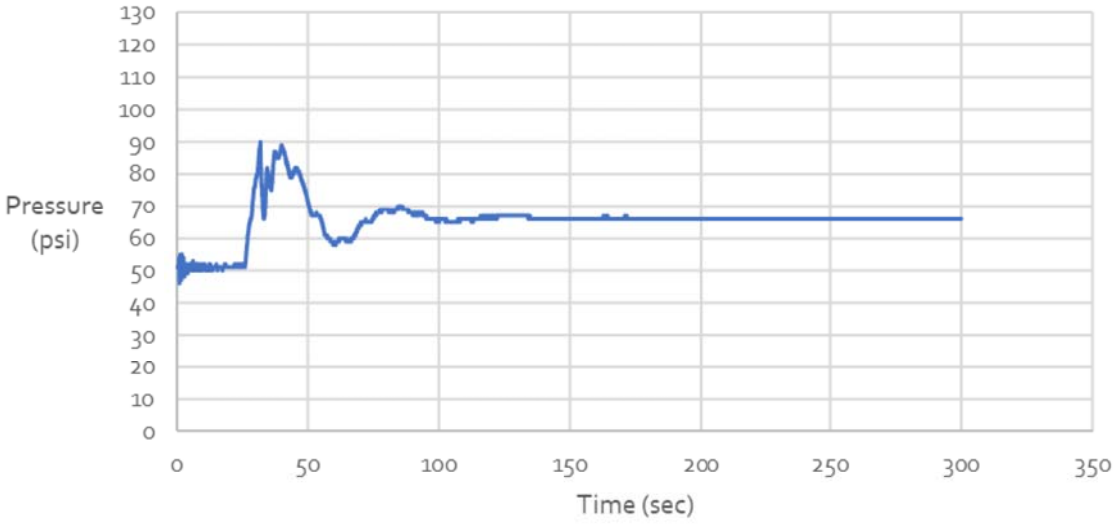



Figure 28 Run 6: Green Mountain Estates Pump Station Suction Pressure

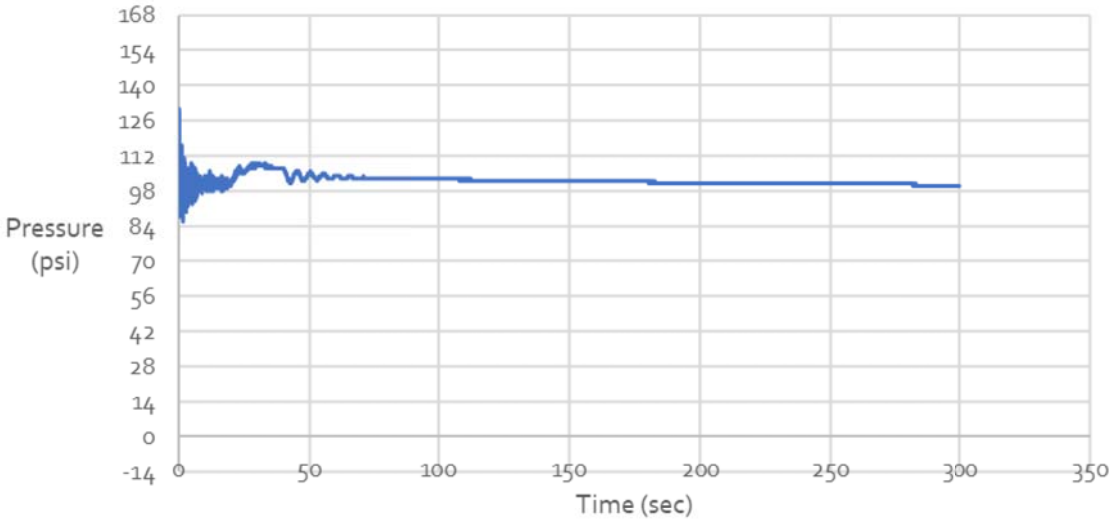



Figure 29 Run 6: Green Mountain Estates High Point Pressure

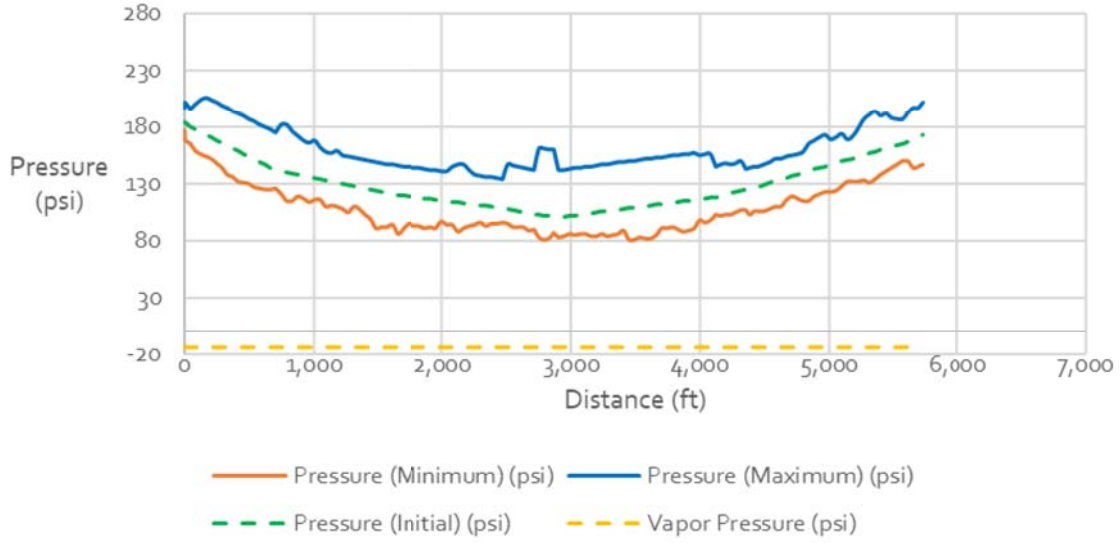



Figure 30 Run 6: Pressure Profile Along the 8-inch Diameter Transmission Main Starting From the Green Mountain Estates Pump Station

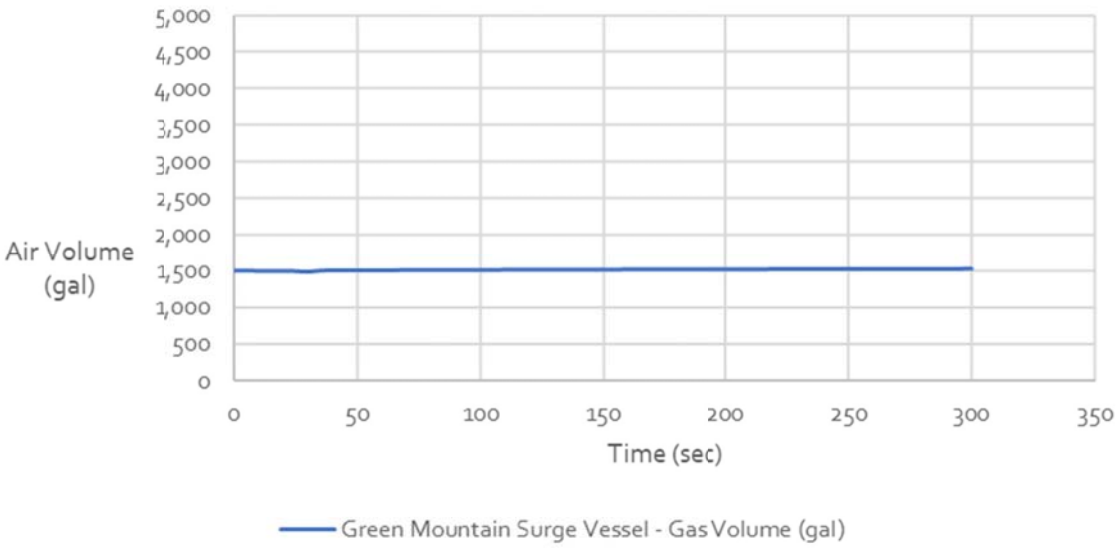



Figure 31 Run 6: Surge Vessel Air Volume

## 1.8 Summary of Simulation Results

Table 4 summarizes the model-predicted maximum and minimum pressures along the transmission main, maximum discharge pressure and maximum suction pressure at the Green Mountain Estates Pump Station.

Table 4 Model Simulation Summary

| Run No. | Demand | Description | Surge Protection Device | Pressure Along the Transmission Main | | Maximum Discharge Pressure at Green Mountain Estates Pump Station (psi) | Maximum Suction Pressure at Green Mountain Estates Pump Station (psi) |
|---|---|---|---|---|---|---|---|
| | | | | Maximum Pressure (psi) | Minimum Pressure (psi) | | |
| 1 | Peak Hour | Two duty pumps trip followed by start-up | None | 182 | Vapor Pressure | 182 | 99 |
| 2 | Peak Hour | Two duty pumps trip followed by start-up | 5,000-gallon surge vessel | 207 | 50 | 207 | 104 |
| 3 | Peak Hour | Two duty pumps trip followed by start-up | 3,000-gallon surge vessel | 207 | 35 | 207 | 104 |

| Run No. | Demand | Description | Surge Protection Device | Pressure Along the Transmission Main | | Maximum Discharge Pressure at Green Mountain Estates Pump Station (psi) | Maximum Suction Pressure at Green Mountain Estates Pump Station (psi) |
|---|---|---|---|---|---|---|---|
| | | | | Maximum Pressure (psi) | Minimum Pressure (psi) | | |
| 4 | Peak Hour | Two duty pumps trip followed by start-up | 2,000-gallon surge vessel | 207 | 23 | 207 | 104 |
| 5 | Maximum Day Plus 500 gpm Fire Flow | Fire hydrant abrupt closure | None | 208 | 58 | 200 | 84 |
| 6 | Maximum Day Plus 500 gpm Fire Flow | Fire hydrant abrupt closure | 3,000-gallon surge vessel | 206 | 81 | 191 | 90 |

## 1.9 Recommendations

Both 2,000 gallon and 3,000 gallon surge vessels are able to eliminate vapor pressure and vapor cavity along the 8-inch diameter transmission main. During the minimum demand in the day, extra pump flow out of the demand would discharge to surge vessel as storage. With a 40 to 60 percent water volume 2,000 gallon surge vessel, the pump station needs approximately 7 to 10 cycle times per hour to not overflow the surge vessel. With a 40 to 60 percent water volume 3,000 gallon surge vessel, the pump station needs approximately 5 to 7 cycle times per hour. According to Washington WSDM Section 7.1.1.1, the maximum pump cycle times is 6 times per hour. The 3,000 gallon surge vessel meets the pump cycle times requirements. Therefore, a 3,000 gallon surge vessel at the Green Mountain Estates Pump Station is recommended. Table 5 provides details of the proposed surge vessel.

Table 5 Surge Vessel Details Recommendations

| Surge Vessel at Green Mountain Estates Pump Station | Recommendations |
|---|---|
| Surge Vessel Type | Hydropneumatic tank, with a compressor to maintain the desired air volume in the tank |
| Tank Volume (gallons) | 3,000 |
| Initial Air Volume (gallons) | 1,500 |
| Tank Dimension | Not critical, so use a standard size |
| Orientation | Horizontal is preferred |
| Pressure Rating (psi) | 200 psi (plus 100 psi surge allowance) |
| Pipe Inlet/Outlet Size (inch) | 4 |
| Pump Discharge Valve | Check valve with the ability to close quickly upon reverse flow |

KOHLER Power Systems

# Sizing Report

## Project information

Project name: green mountian estates
Customer's name: Rotschy
Customer contact: Daniel Massie

## Site requirements

| | |
|---|---|
| Voltage: | 277/480 |
| Phase: | 3 |
| Frequency: | 60Hz |
| Alt. Temp. Rise Duty: | 130°C Standby @40C |
| Qty of Gensets: | 1 |
| Fuel type: | Diesel |
| Country : | United States |

| | |
|---|---|
| Application: | Construction |
| Emissions Requirement: | Stationary emergency (US EPA) |
| Altitude: | 500 Feet |
| Max. Ambient Temp.: | 77 Degrees F |
| Min. Genset Loading : | 25 % |
| Max. Genset Loading : | 90 % |

## Site load requirements summary

| | |
|---|---|
| Running kW: | 89.65 |
| Running kVA: | 100.77 |
| Running P.F.: | 0.89 |

| | |
|---|---|
| Max. Starting kW: | 58.91 in step 2 |
| Max. Starting kVA: | 178.50 in step 2 |

## Generator selection

| | |
|---|---|
| Genset Model: | 125REOZJG |
| Engine: | 4045HF285 |
| Emission level: | EPA Tier 3 |
| BHP: | 197.00 |
| Displacement: | 276.00 |
| RPM: | 1800 |

| | |
|---|---|
| Alternator: | 4R13X |
| Alternator Leads: | 12 |
| Alt. Starting kVA at 35% V dip: | 540.00 |
| Cal Alt Temp rise with site loads: | 80C |
| Excitation System : | PMG |

| | |
|---|---|
| Rated kW : | 128.00 |
| Site Alt / Temp De-Rated kW : | 128.00 |
| Seismic Certified | |
| UL 2200 Certified | |

## Generator Performance Summary

| | |
|---|---|
| Voltage Dip Limit: | 30.00 % |
| Frequency Dip Limit: | 10.00 % |
| Harmonic Distortion Limit: | 10.00 % |

| | |
|---|---|
| Calculated Voltage Dip: | 14.97 % |
| Calculated Frequency Dip: | 4.14 % |
| Calculated Harmonic Distortion: | 2.81 % |
| Calculated Genset % Loaded: | 70.04 % |

Report prepared by: vincent biggart



Software version: 1.0041.7.5

Thursday, June 17, 2021

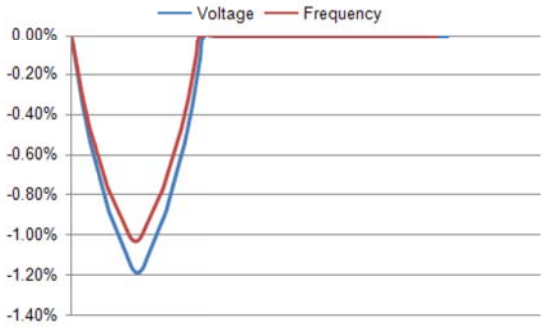
KOHLER Power Systems

# Sizing Report

Model : 125REOZJG, Alternator : 4R13X

## Load Profile

| Step # 1 | Qty | Run | | | Start | | | Volt Dip % | Freq Dip % | Volt. Dist. % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | kW | kVA | PF | kW | kVA | PF | | | |
| **Lighting**<br>Evenly distributed Incandescent | 1 | 10.00 | 10.00 | 1.00 | 10.00 | 10.00 | 1.00 | | | |
| **Step Total** | | 10.00 | 10.00 | 1.00 | 10.00 | 10.00 | 1.00 | 1.19 | 1.03 | 0.00 |
| **Cum.Total** | | 10.00 | 10.00 | 1.00 | | | | | | |



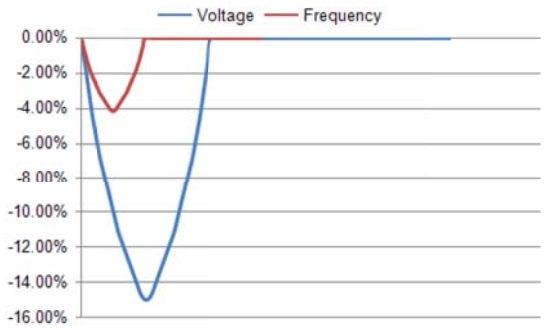

Report prepared by: vincent biggart

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

KOHLER Power Systems

# Sizing Report

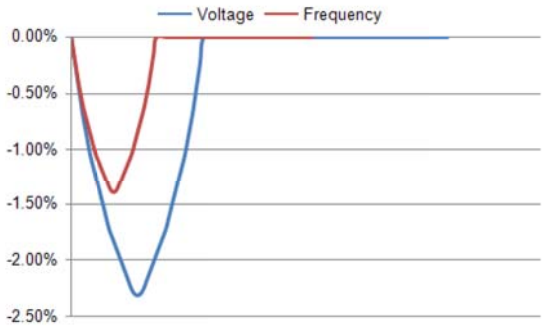
| Step # 2 | Qty | Run | | | Start | | | Volt Dip % | Freq Dip % | Volt. Dist. % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | kW | kVA | PF | kW | kVA | PF | | | |
| **Motor**<br>**pump 4**<br>75.00 HP<br>3 Phase<br>Motor code : G<br>Loaded<br>NEMA Design<br>soft start with ramp | 1 | 60.82 | 71.13 | 0.86 | 58.91 | 178.50 | 0.33 | | | |
| **Step Total** | | 60.82 | 71.13 | 0.86 | 58.91 | 178.50 | 0.33 | 14.97 | 4.14 | 0.00 |
| **Cum.Total** | | 70.82 | 79.85 | 0.89 | | | | | | |



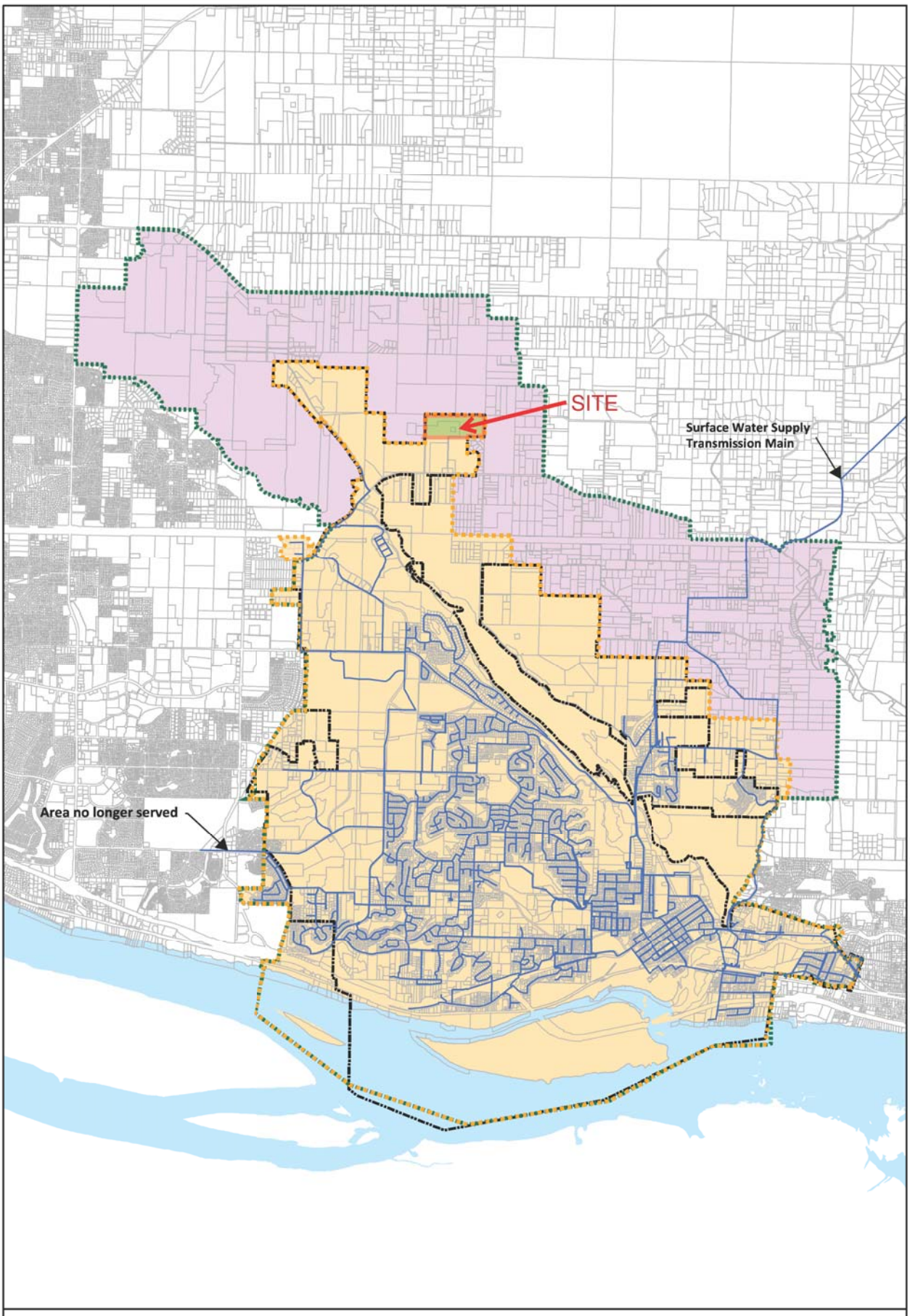

Report prepared by: vincent biggart

TOTAL SYSTEM INTEGRATION
GENERATORS | TRANSFER SWITCHES | SWITCHGEAR | CONTROLS

| Step # 3 | Qty | Run | | | Start | | | Volt Dip % | Freq Dip % | Volt. Dist. % |
|---|---|---|---|---|---|---|---|---|---|---|
| | | kW | kVA | PF | kW | kVA | PF | | | |
| **Motor pump 2**<br>20.00 HP<br>3 Phase<br>Motor code : G<br>Loaded<br>NEMA Design<br>VFD | 1 | 18.84 | 20.93 | 0.90 | 18.84 | 20.93 | 0.90 | | | |
| **Step Total** | | 18.84 | 20.93 | 0.90 | 18.84 | 20.93 | 0.90 | 2.31 | 1.39 | 2.81 |
| **Cum.Total** | | 89.65 | 100.77 | 0.89 | | | | | | |
| **Grand Total** | | 89.65 | 100.77 | 0.89 | | | | 14.97 | 4.14 | 2.81 |



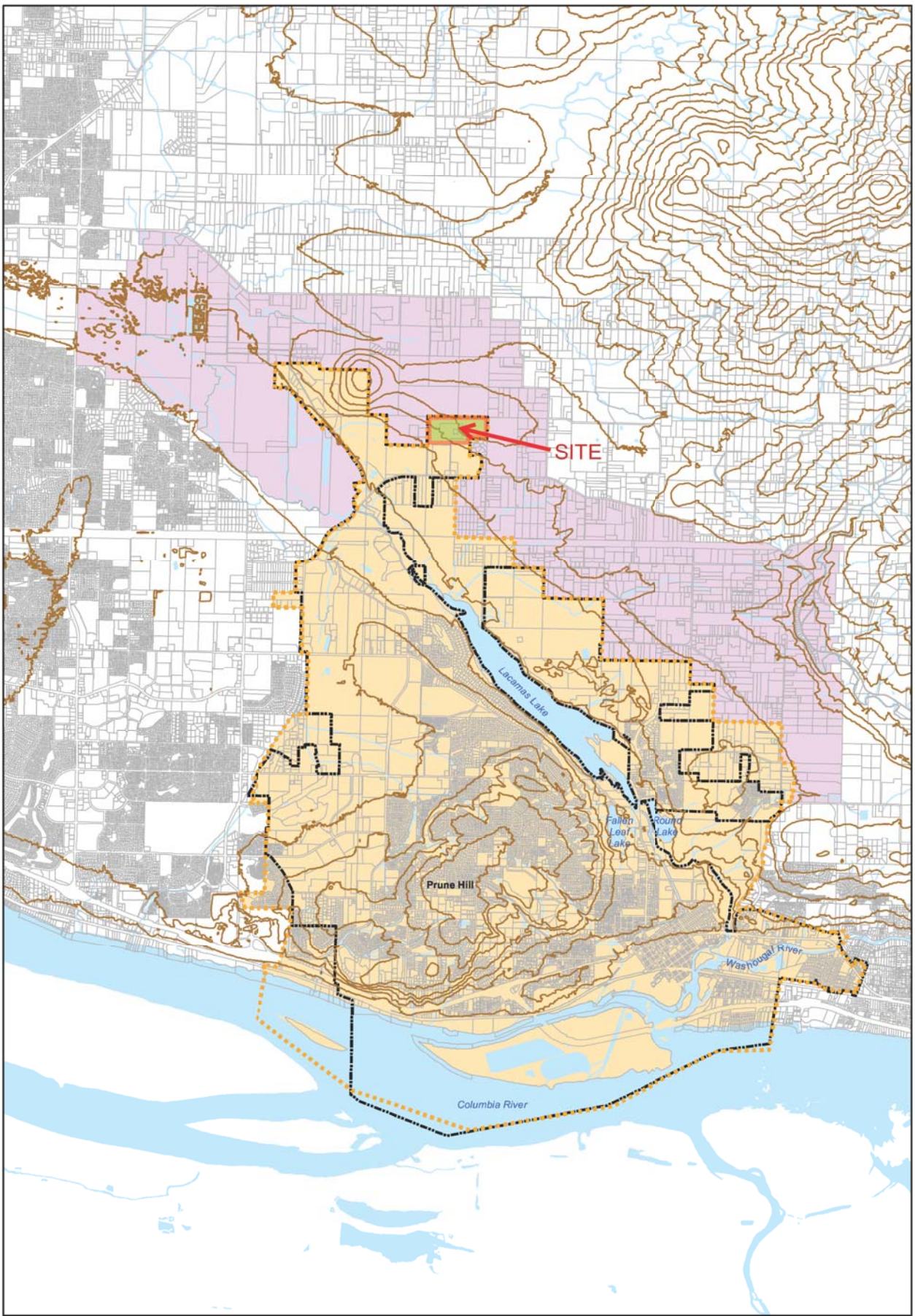

Report prepared by: vincent biggart




**SERVICE AREA**

FIGURE 2.1

CITY OF CAMAS
*WATER SYSTEM PLAN UPDATE*




**Legend**

- Hundred Foot Contours
- Retail Water Service Boundary
- Future Water Service Boudary
- City Limits
- ugabnd
- Parcels
- Waterbody

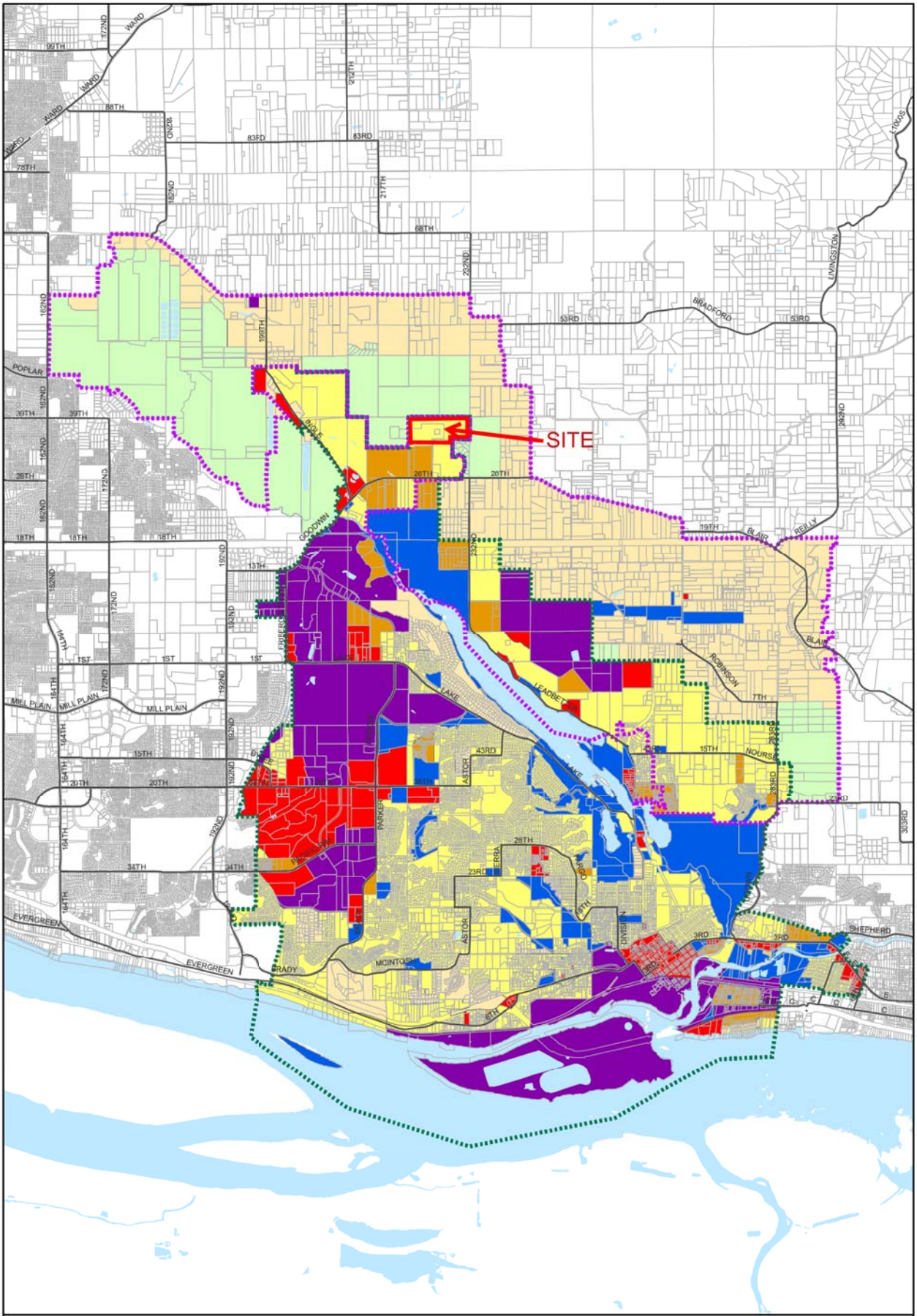
0 0.5 1 Miles

carollo

**PHYSICAL ENVIRONMENT**

FIGURE 2.2

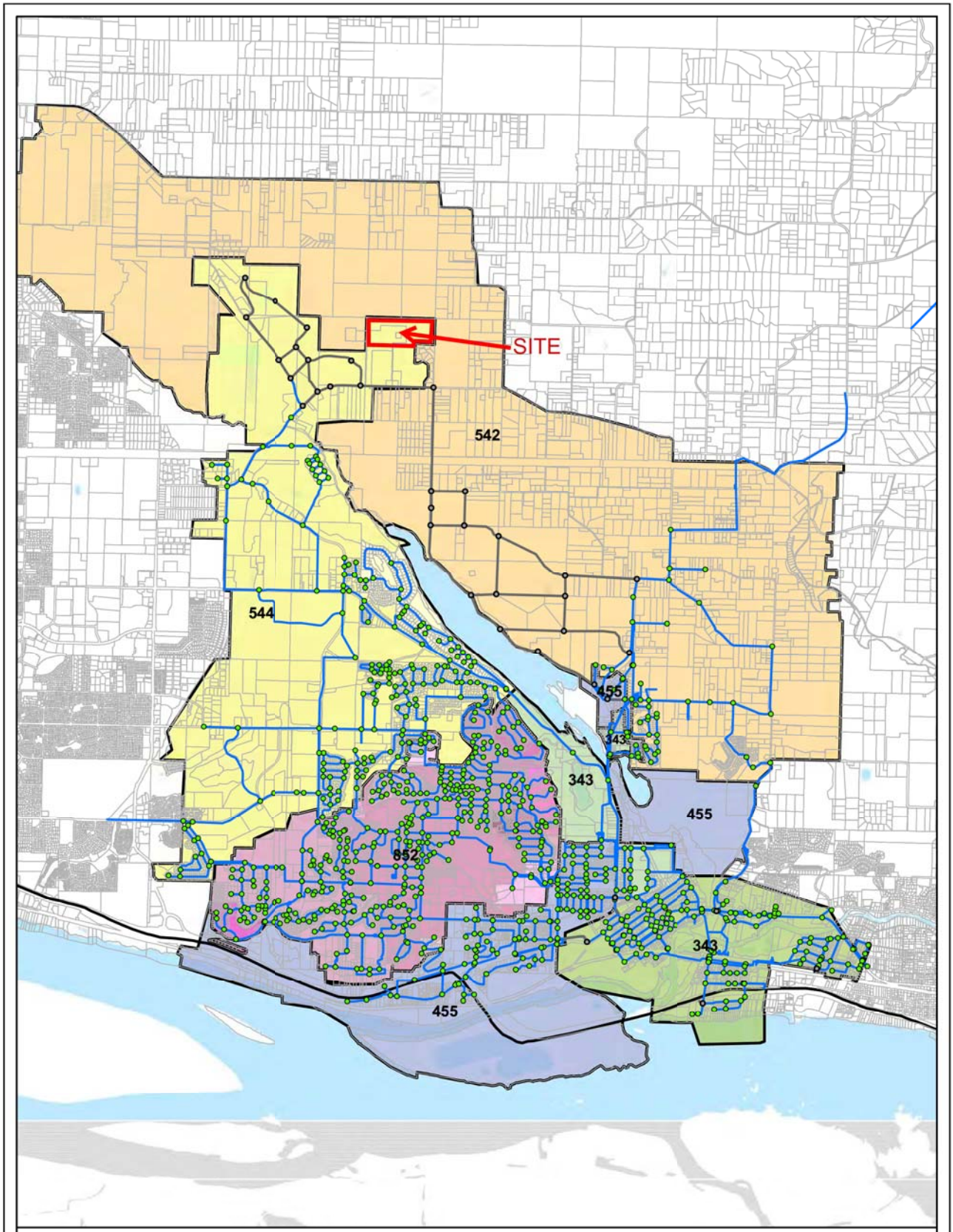
CITY OF CAMAS
*WATER SYSTEM PLAN UPDATE*




**FUTURE LAND USE PER COMPREHENSIVE PLAN**

FIGURE 5.6

CITY OF CAMAS
*WATER SYSTEM PLAN UPDATE*




**Legend**

- Highway 14
- Parcels
- Waterbody
- Existing Water Main
- Future Pipelines
- Existing Junction
- Future Junctions
- Service Area

Pressure Zones

- 343
- 455
- 542
- 544
- 852

0 0.25 0.5 Miles

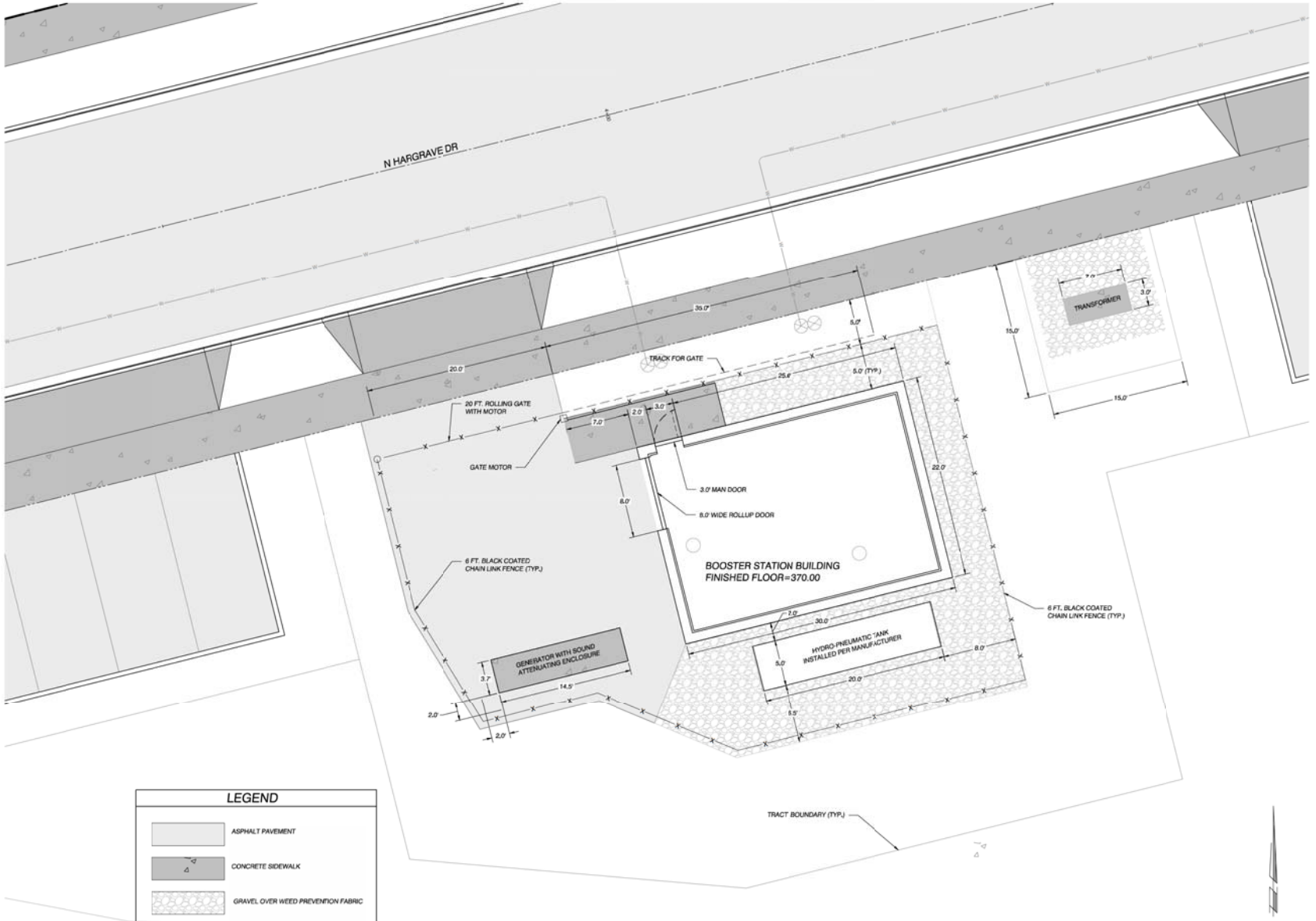
**SERVICE AREAS**

FIGURE 9.1

CITY OF CAMAS
*WATER SYSTEM PLAN UPDATE*

carollo

Document Path: E:\KRC D DRIVE\CAMAS\Fire Flow Analysis\FireFlowServiceAreas.mxd

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STABLET.STB


CLIENT:

CLIENT NAME
P.O. BOX XXXX
CITY, ST 91000X

PH: (360) 321-7654
FX: (360) XXX-XXXX
CONTACT: CONTACT NAME
EMAIL: email@somewhere.com


SITE PLAN FOR:

# GREEN MOUNTAIN ESTATES
## BOOSTER STATION


CLSON LAND SURVEYORS
ENGINEERS
ENGINEERING INC. 222 E. EVERGREEN, VANCOUVER, WA 98660
360-695-1385
503-223-3928




PETER A. TUCK
STATE OF WASHINGTON
21817
REGISTERED
PROFESSIONAL ENGINEER

PRELIMINARY

06/18/2021

CHANGES / REVISIONS

| DESCRIPTION: | DATE: |
|---|---|

DESIGNED: GCO

DRAWN: GCO/TAS

CHECKED: PAT

DATE: AUGUST 2021

SCALE: H: 1"= 5'
V: N/A

GREEN MOUNTAIN ESTATES
BOOSTER STATION

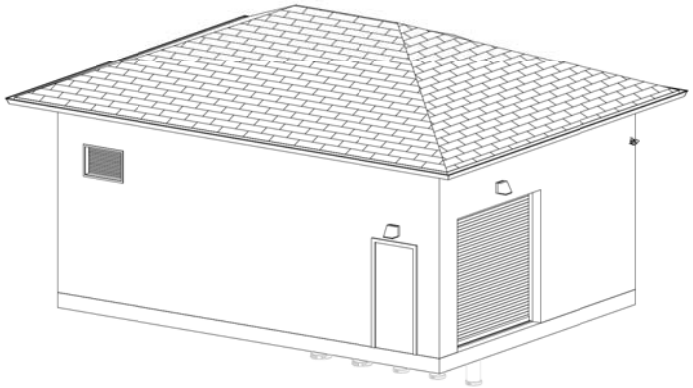
JOB NO.: 9595.01.01

SHEET

C2.0

# GREEN MOUNTAIN ESTATES PHASE 4

## BOOSTER PUMP STATION BUILDING




VICINITY MAP

| SHEET INDEX | |
|---|---|
| SHEET NO. | SHEET TITLE |
| A1 | COVER |
| A2 | FLOOR PLAN |
| A3 | ELEVATIONS |
| A4 | SECTIONS |
| A5 | INTERIOR ELEVATIONS |
| S1 | STRUCTURAL NOTES |
| S2 | FOUND/FRAM'G PLAN |
| S3 | FOUND/FRAM'G DETAILS |
| S4 | CRANE PLAN & DETAILS |

Rotschy Inc.
7408 NE 113TH CIR,
Vancouver, WA
98662
(360) 334-3100

BOOSTER PUMP STATION BUILDING

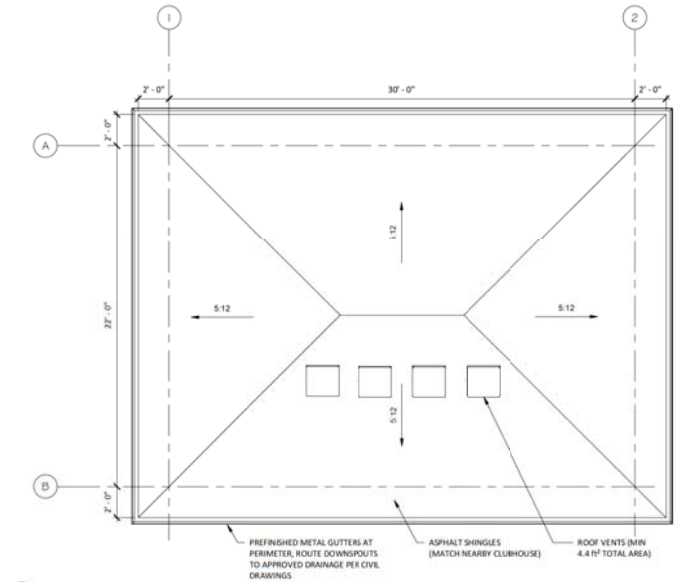
GREEN MOUNTAIN ESTATES PH. 4
CAMAS, WA

PROJECT NO: 2112
DATE: 8/13/2021
DESIGN: SAH
DRAWN: MEH

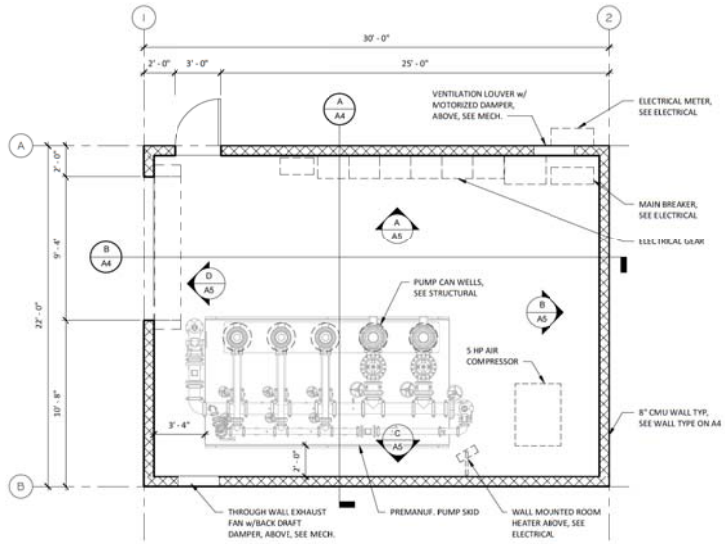
REVISION SCHEDULE
No. Description Date

COVER

A1




B ROOF PLAN
1/4" = 1'-0"




A FLOOR PLAN
1/4" = 1'-0"

**CODE SUMMARY**

2018 INTERNATIONAL BUILDING CODE WITH WASHINGTON STATE AMENDMENTS

CONSTRUCTION TYPE.....VB
OCCUPANCY CLASSIFICATION.....U

PROPOSED BUILDING AREA.....660 SQ FT
PROPOSED MAX BUILDING HEIGHT....17'-11"

**WASHINGTON STATE ENERGY CODE NOTES:**

**C103.6.3 COMPLIANCE DOCUMENTATION.** ALL ENERGY CODE COMPLIANCE FORMS AND CALCULATIONS SHALL BE DELIVERED IN ONE DOCUMENT TO THE BUILDING OWNER AS PART OF THE PROJECT RECORD DOCUMENTS OR MANUALS, OR AS A STANDALONE DOCUMENT. THIS DOCUMENT SHALL INCLUDE THE SPECIFIC ENERGY CODE YEAR UTILIZED FOR COMPLIANCE DETERMINATION FOR EACH SYSTEM, NFRC CERTIFICATES FOR THE INSTALLED WINDOWS, LIST OF TOTAL AREA FOR EACH NFRC CERTIFICATE, THE INTERIOR LIGHTING POWER COMPLIANCE PATH (BUILDING AREA, SPACE-BY-SPACE) USED TO CALCULATE THE LIGHTING POWER ALLOWANCE.

FOR PROJECTS COMPLYING WITH SECTION C401.2 ITEM 1, THE DOCUMENTATION SHALL INCLUDE:
1. THE ENVELOPE INSULATION COMPLIANCE PATH (PRESCRIPTIVE OR COMPONENT PERFORMANCE)
2. ALL COMPLETED CODE COMPLIANCE FORMS, AND ALL COMPLIANCE CALCULATIONS INCLUDING, BUT NOT LIMITED TO, THOSE REQUIRED BY SECTIONS C402.1.5, C403.2.12.1, C405.4 AND C405.5

**C103.6.4 SYSTEMS OPERATION TRAINING.** TRAINING OF THE MAINTENANCE STAFF FOR EQUIPMENT INCLUDED IN THE MANUALS REQUIRED BY SECTION C103.6.2 SHALL INCLUDE AT A MINIMUM:
1. REVIEW OF MANUALS AND PERMANENT CERTIFICATE
2. HANDS-ON DEMONSTRATION OF ALL NORMAL MAINTENANCE PROCEDURES, NORMAL OPERATING MODES, AND ALL EMERGENCY SHUTDOWN AND START-UP PROCEDURES
3. TRAINING COMPLETION REPORT

**C402.5.1.2 BUILDING TEST.** THE COMPLETED BUILDING SHALL BE TESTED AND THE AIR LEAKAGE RATE OF THE BUILDING ENVELOPE SHALL NOT EXCEED 0.25 CFM/SQFT AT A PRESSURE DIFFERENTIAL OF 0.3 INCHES WATER GAUGE (2.0 L/S X SQM AT 75 PA) AT THE UPPER 95 PERCENT CONFIDENCE INTERVAL IN ACCORDANCE WITH ASTM E 779 OR EQUIVALENT METHOD APPROVED BY THE CODE OFFICIAL. A REPORT THAT INCLUDES THE TESTED SURFACE AREA, FLOOR AREA, AIR BY VOLUME, STORIES ABOVE GRADE, AND LEAKAGE RATES SHALL BE SUBMITTED TO THE BUILDING OWNER AND THE CODE DIFFICIAL. IF THE TESTED RATE EXCEEDS THAT DEFINED HERE BY UP TO 0.15 CFM/SQFT, A VISUAL INSPECTION OF THE AIR BARRIER SHALL BE CONDUCTED AND ANY LEAKS NOTED SHALL BE SEALED TO THE EXTENT PRACTICABLE. AN ADDITIONAL REPORT IDENTIFYING THE CORRECTIVE ACTIONS TAKEN TO SEAL AIR LEAKS SHALL BE SUBMITTED TO THE BUILDING OWNER AND THE CODE OFFICIAL AND ANY FURTHER REQUIREMENT TO MEET THE LEAKAGE AIR RATE WILL BE WAIVED. IF THE TESTED RATE EXCEEDS 0.40 CFM/SQFT, CORRECTIVE ACTIONS MUST BE MADE AND THE TEST COMPLETED AGAIN. A TEST ABOVE 0.40 CFM/SQFT WILL NOT BE ACCEPTED.
1. TEST SHALL BE ACCOMPLISHED USING EITHER (1) BOTH PRESSURIZATION AND DEPRESSURIZATION OR (2) PRESSURIZATION ALONE, BUT NOT DREPRESSURIZATION ALONE. THE TEST RESULTS SHALL BE PLOTTED AGAINST THE CORRECT P FOR PRESSURIZATION IN ACCORDANCE WITH SECTION 9.4 OF ASTM E779
2. THE TEST PRESSURE RANGE SHALL BE FROM 25 PA TO 80 PA PER SECTION 8.10 OF ASTM E779, BUT THE UPPER LIMIT SHALL NOT BE LESS THAN 50 PA, AND THE DIFFERENCE BETWEEN THE UPPER AND LOWER LIMIT SHALL NOT BE LESS THAN 25 PA
3. IF THE PRESSURE EXPONENT N IS LESS THAN 0.45 OR GREATER THAN 0.85 PER SECTION 9.6.4 OF ASTM E779, THE TEST SHALL BE RERUN WITH ADDITIONAL READINGS OVER A LONGER TIME INTERVAL

Rotschy Inc.
7408 NE 113TH CIR,
Vancouver, WA
98662
(360) 334-3100

# BOOSTER PUMP STATION BUILDING

GREEN MOUNTAIN ESTATES PH. 4
CAMAS, WA

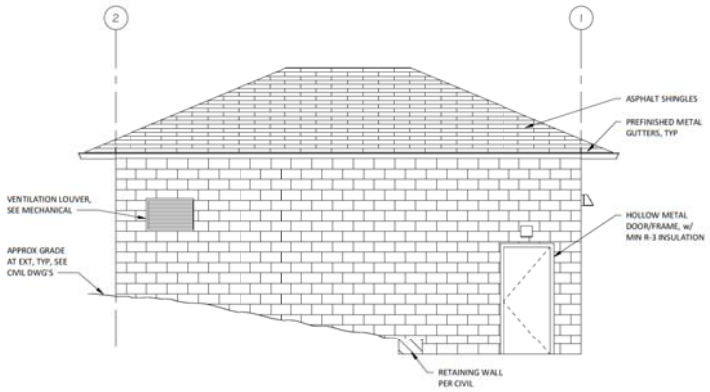
PROJECT NO: 2112
DATE: 8/13/2021
DESIGN: SAH
DRAWN: MEH

REVISION SCHEDULE

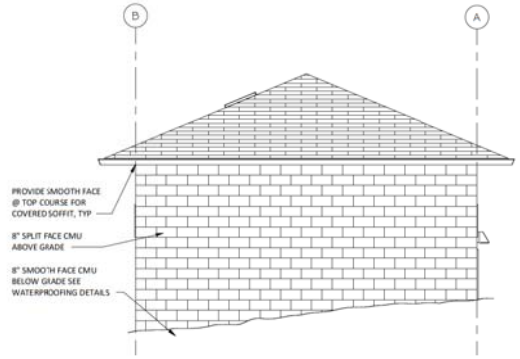
| No. | Description | Date |
|---|---|---|

FLOOR PLAN

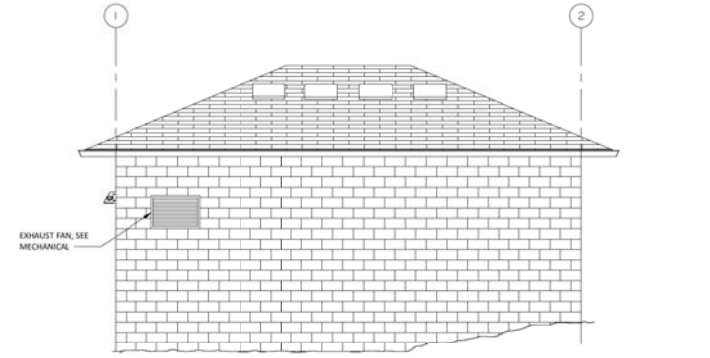
A2




A NORTH ELEVATION
1/4" = 1'-0"




B EAST ELEVATION
1/4" = 1'-0"




C SOUTH ELEVATION
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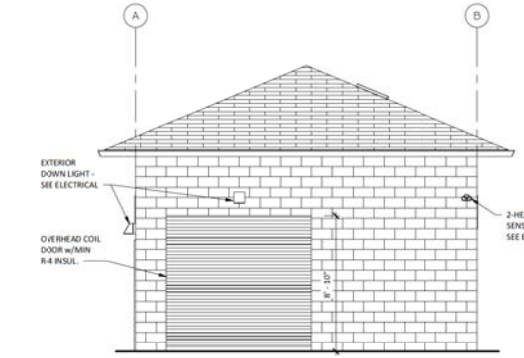



D WEST ELEVATION
1/4" = 1'-0"

Rotschy Inc.
7408 NE 113TH CIR,
Vancouver, WA
98662
(360) 334-3100

# BOOSTER PUMP STATION BUILDING

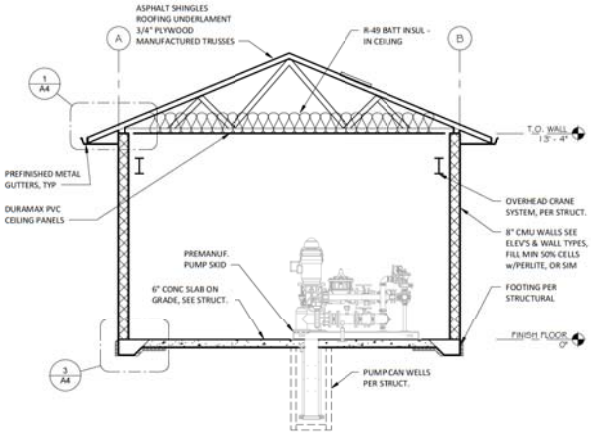
GREEN MOUNTAIN ESTATES PH. 4
CAMAS, WA

PROJECT NO: 2112
DATE: 8/13/2021
DESIGN: SAH
DRAWN: MEH

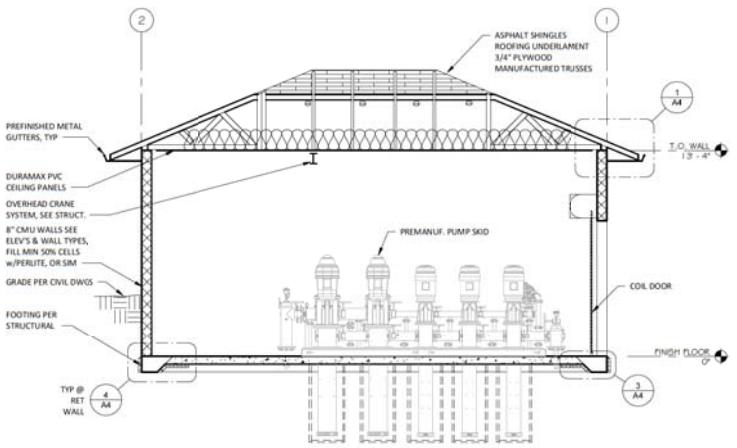
REVISION SCHEDULE
No. | Description | Date

ELEVATIONS

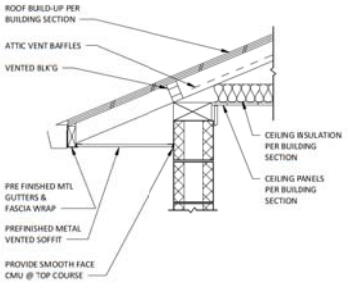
A3



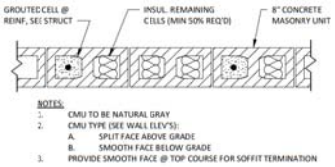

A SECTION 1
1/4" = 1'-0"




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

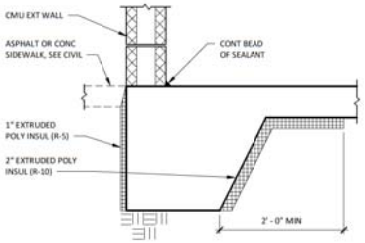



1 SOFFIT/EAVE DETAIL
1" = 1'-0"

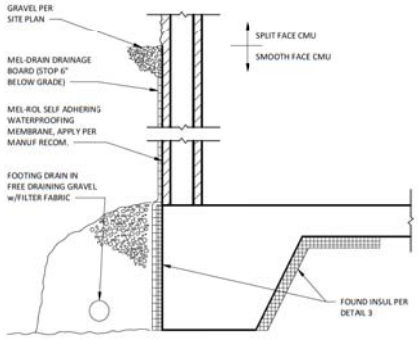



NOTES:
1. CMU TO BE NATURAL GRAY
2. CMU TYPE (SEE WALL ELEV'S):
   A. SPLIT FACE ABOVE GRADE
   B. SMOOTH FACE BELOW GRADE
3. PROVIDE SMOOTH FACE @ TOP COURSE FOR SOFFIT TERMINATION

2 TYP EXT WALL TYPE
1" = 1'-0"




3 SLAB EDGE INSUL DETAIL
1" = 1'-0"




4 CMU WALL WATERPROOFING DETAIL
1" = 1'-0"

Rotschy Inc.
7408 NE 113TH CIR,
Vancouver, WA
98662
(360) 334-3100

# BOOSTER PUMP STATION BUILDING

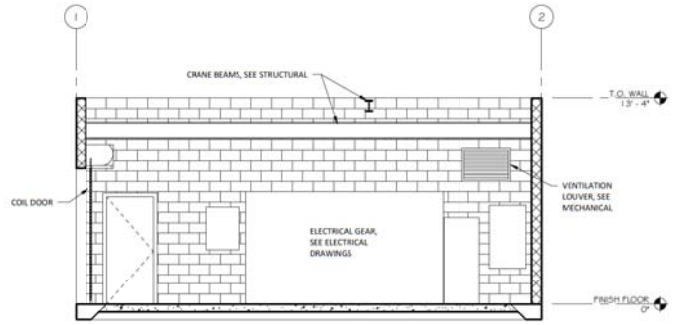
GREEN MOUNTAIN ESTATES PH. 4
CAMAS, WA

PROJECT NO: 2112
DATE: 8/13/2021
DESIGN: SAH
DRAWN: MEH

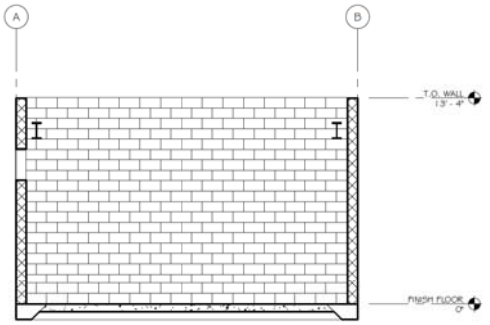
REVISION SCHEDULE
No. Description Date

SECTIONS

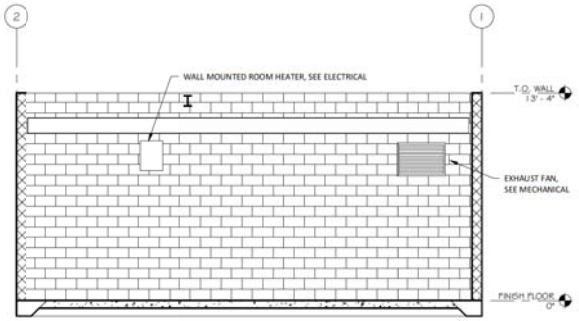
A4



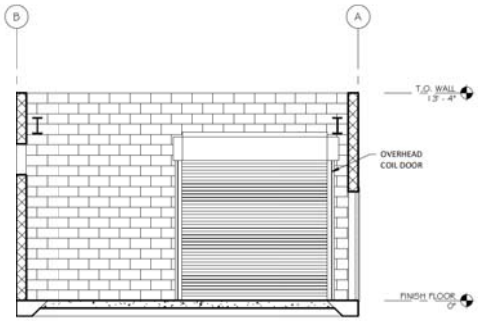

A NORTH INTERIOR
1/4" = 1'-0"




B EAST INTERIOR
1/4" = 1'-0"




C SOUTH INTERIOR
1/4" = 1'-0"




D WEST INTERIOR
1/4" = 1'-0"

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# BOOSTER PUMP STATION BUILDING

GREEN MOUNTAIN ESTATES PH. 4
CAMAS, WA

PROJECT NO: 2112
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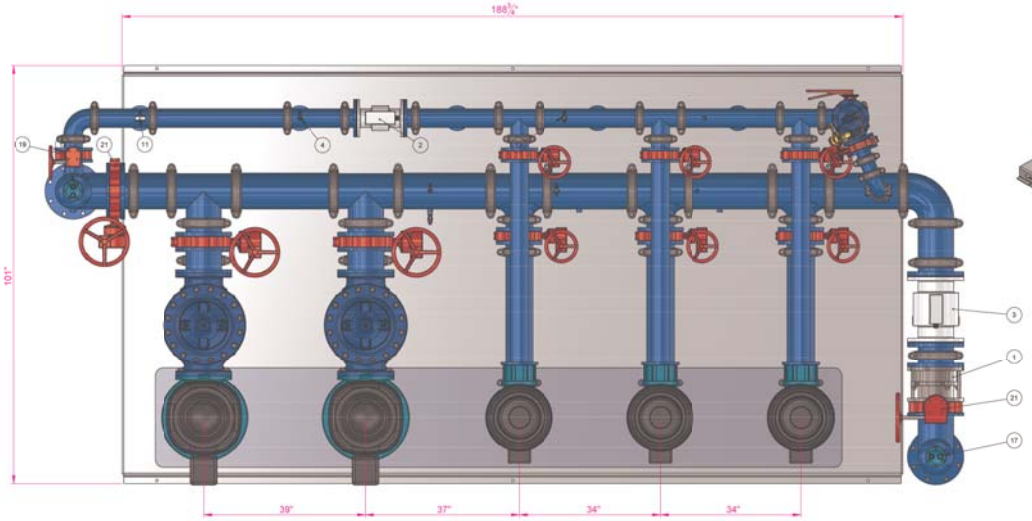
DESIGN: SAH
DRAWN: MEH

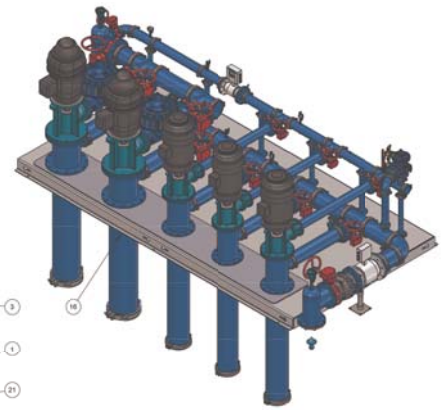
REVISION SCHEDULE

| No. | Description | Date |
|---|---|---|

INTERIOR ELEVATIONS

A5



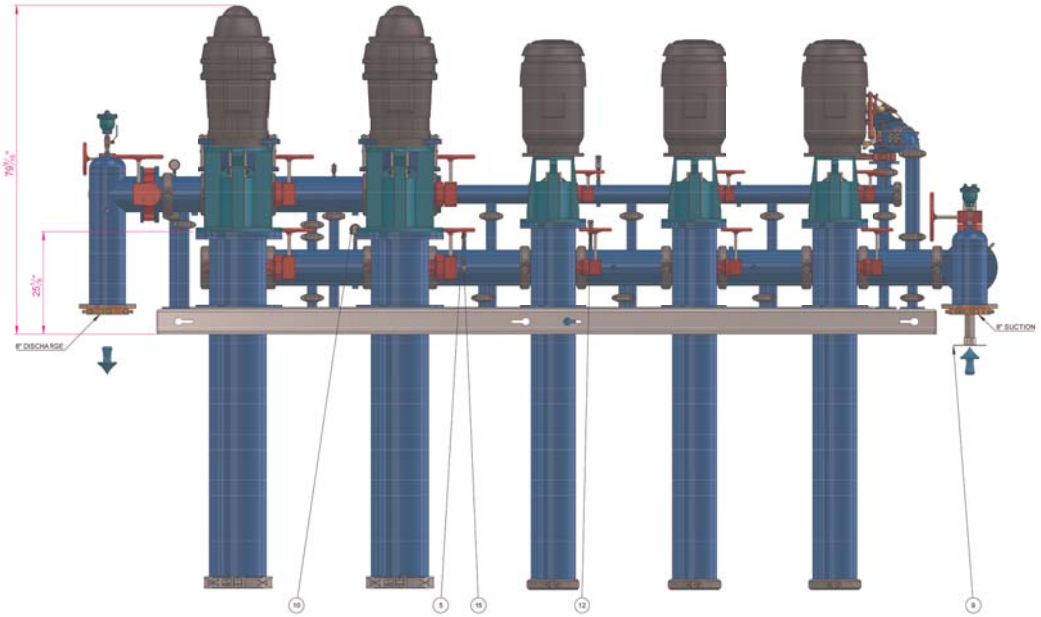



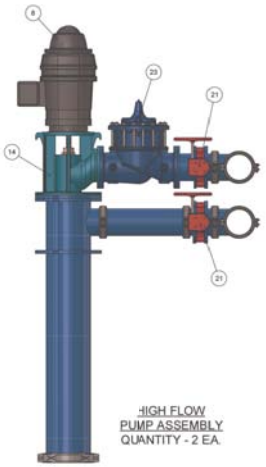
PRESSURE RELIEF ASSEMBLY
QUANTITY - 1 EA.

## DESIGN SPECIFICATIONS

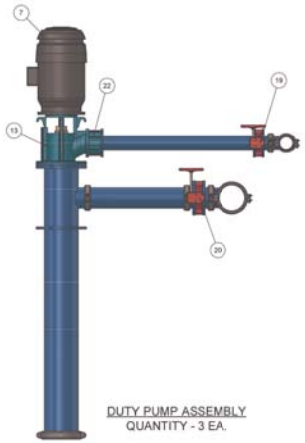
| | | | |
|---|---|---|---|
| Design Point 1: | 300 GPM | @ 127 PSI | |
| Design Point 2: | 1300 GPM | @ 127 PSI | |
| Intake Pressure: | 31 PSI | | |
| Duty Pump Details: | 20 HP/Pump | 150 GPM | @ 290 TDH |
| PM Pump Details: | 7.5HP/Pump | 40 GPM | @ 290 TDH |
| High Flow Pump Details: | 75 HP/Pump | 650 GPM | @ 290 TDH |
| Minimum Power: | 480 Volt / 3 Phase | | |
| Model # | T##C2CT020D00300-127XXXB483IAS-8 | | |

| ITEM NO. | DESCRIPTION | Size | QTY. |
|---|---|---|---|
| 1 | DISMANTLING JOINT | 8" | 1 |
| 2 | FLOW METER, BADGER | 4" | 1 |
| 3 | FLOW METER, BADGER | 8" | 1 |
| 4 | HIGH PRESSURE SWITCH | 1/4" | 1 |
| 5 | LOW PRESSURE SWITCH | 1/4" | 1 |
| 6 | NOT USED | N/A | N/A |
| 7 | MOTOR | 20 HP | 3 |
| 8 | MOTOR | 75 HP | 2 |
| 9 | PIPE SADDLE SUPPORT, 10" | 10" | 1 |
| 10 | PRESSURE GAUGE, 30PSI | 2-1/2" | 1 |
| 11 | PRESSURE GAUGE, 100PSI | 2-1/2" | 1 |
| 12 | PRESSURE TRANSDUCER, -14.5_145PSI, NSF | 1/4" | 2 |
| 13 | PUMP, TURBINE, DI HEAD | 4" | 3 |
| 14 | PUMP, VERTICAL TURBINE, DI | 6" | 2 |
| 15 | SAMPLE TAP | 3/4" | 1 |
| 16 | SKID, BENT | 72"x188" | 1 |
| 17 | VALVE, AIR RELIEF | 3/4" | 2 |
| 18 | VALVE, BUTTERFLY, LUG, LEVER, 175 PSI | 3" | 2 |
| 19 | VALVE, BUTTERFLY, LUG, 175 PSI | 4" | 4 |
| 20 | VALVE, BUTTERFLY, LUG, 175 PSI | 6" | 3 |
| 21 | VALVE, BUTTERFLY, LUG, 175 PSI | 8" | 6 |
| 22 | VALVE, CHECK, SILENT | 4" | 3 |
| 23 | VALVE, CONTROL, 60-11 | 8" | 2 |
| 24 | VALVE, PRESSURE RELIEF, ANGLED | 3" | 1 |



HIGH FLOW
PUMP ASSEMBLY
QUANTITY - 2 EA.



DUTY PUMP ASSEMBLY
QUANTITY - 3 EA.

POTABLE
NOT FOR FABRICATION

| REV. | DESCRIPTION | DATE | APVD |
|---|---|---|---|

REVISIONS

PPS
PRECISION PUMPING SYSTEMS
4313 BUSINESS WAY
BOISE, IDAHO 83714
208-323-3300
www.gopps.us

MATERIAL
Piping: STEEL A53
Skid: GALVANIZED

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES
TWO PLACE DECIMAL ± .01"
THREE PLACE DECIMAL ± .005"
TWO PLACE DECIMAL ± .05
DO NOT SCALE DRAWING

DRAWN: SBM | DATE: 6/3/2021

TITLE: BOOSTER SYSTEM PUMP STATION
PROJECT: GREEN MOUNTAIN ESTATES
LEVEL: 90% Final
PART NO.: 2T-8-NJ-2HF-NF-FM-NI-PT
JOB: | SIZE: D | SCALE: NTS | SHEET: 1 OF 1 | REV: -