MUSCATINE CITY COUNCIL
IN-DEPTH MEETING
Tuesday, January 13, 2026

Brad Bark, Mayor

Don Lampe, 1st Ward	Angie Lewis, At Large
Jeff Osborne, 2nd Ward	Matt Conard, At Large
Peggy Gordon, 3rd Ward	Matt Mardesen, City Administrator
Nadine Brockert, 4th Ward	Cinda Hilger, City Clerk
John Jindrich, 5th Ward	Brent Hinders, City Attorney

City Council meetings are held at 5:30 pm on the 1st and 3rd Tuesday of each month, In-depth sessions will be held as needed at 5:30 pm on the 2nd Tuesday of each month. All meetings are available for review on the City of Muscatine YouTube page.

AGENDA

1. **CALL TO ORDER**

2. **ROLL CALL**

3. **PLEDGE OF ALLEGIANCE**

4. **COUNCIL DISCUSSION ITEMS**

   A. Papoose Sewer Pump Station and Future Projects Related to Sewer Separation.

      This item is for informational purposes. However, staff will be requesting consensus from the council on how they would like to proceed.

   B. Discussion of the County Wide Emergency Plan - Emergency Management Director, Chris Jasper

5. **STAFF, COUNCIL AND MAYOR REPORTS**

6. **ADJOURNMENT**

City of Muscatine

ITEM NUMBER 2025-992

IN-DEPTH ITEM - CITY COUNCIL

DATE: 1/13/2026

STAFF

Brian Stineman, Public Works Director
Jon Koch, Water Pollution Control Plant Director
Kevin Coon, City Engineer

SUBJECT FOR DISCUSSION

Papoose Sewer Pump Station and Future Projects Related to Sewer Separation.

EXECUTIVE SUMMARY

This will be a presentation from City Staff and Stanley Consultants providing a summary of the recently completed Papoose Creek Pump Station Study.

GENERAL DIRECTION SOUGHT AND SPECIFIC QUESTIONS TO BE ANSWERED

The main goal of the presentation will be to provide an overview of the need for the study, the recommendations as determined by the study, staff recommendations for procedure, and a request for consensus on how to proceed.

BACKGROUND/DISCUSSION

The Papoose Creek Pump station is one of the final aspects of the West Hill Sewer Separation Project. Until the majority of the combined sanitary and storm sewer in the West Hill area was separated, we could not be sure about how the pump station would react to the separation and what if any improvements or modifications would be necessary. As we neared the end of the separation project, the City of Muscatine hired Stanley Consultants to study the Papoose Creek Pump Station and the surrounding watershed to determine the viability of the existing pump station, the effects that separation of the storm and sanitary sewer would have on flow through it, how stormwater and heavy rainfall events are handled by it, and to assess its current condition.

The study is attached to this document. Staff from the City and Stanley Consultants will explain the study and the findings. There are some decisions that will need to be made to move this project forward and complete the separation.

Question 1: Do we attempt to rehabilitate the current pump station or build a new station at a new location?

Question 2: Do we construct a permanent stormwater pumping station with stationary pumps or plan a sump location where temporary pumps can be installed to pump stormwater during or after heavy rainfall events?

Recommendations from Staff:
Construct a new pump station on the "town side" of Mississippi Drive.

Construct a "temporary" stormwater pumping system.

Staff will discuss the reasoning behind these recommendations and go over the preliminary cost estimates during the presentation.

ATTACHMENTS

1. 20260106_City of Muscatine Papoose Creek Pump Station Study_Final

Stanley Consultants INC.

Connect. Create. Contribute.

Papoose Creek Pump Station Study

Feasibility Study Report

City of Muscatine, Iowa

Final

January 6, 2026

Deliverable: Final Feasibility Study Report
Project: Papoose Creek Pump Station Study
Client: City of Muscatine
Location: Muscatine, Iowa

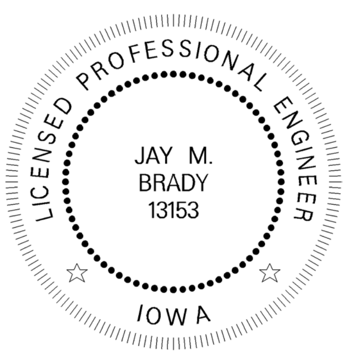
Submittal: Final
Date: January 6, 2026

Prepared by: Candice Bark, P.E.
Reviewed and Approved by: Jay Brady, P.E.

I hereby certify that this report was prepared by me or under my direct personal supervision and that I am duly registered under the laws of the State of Iowa.

Jay Brady, P.E.	Jay M. Brady	
Name	Signature	
January 6, 2026	P13153	December 31, 2026
Date	Registration Number	Expiration Date

Professional Seal:



Stanley Consultants

Executive Summary

ES.1 Introduction

The Papoose Creek watershed is one of four major watersheds in the City of Muscatine, with a combined sanitary and storm sewer system flowing to the Papoose Creek Pump Station. The pump station, constructed in 1963, is experiencing issues due to age and deferred maintenance. Its performance is evolving as the City's sewer separation program nears completion. The City's long-term program to separate sewers in the West Hill area will be completed by 2028, affecting the pump station's function and performance. The existing pump station faces several infrastructure challenges, including mismatched pump capacities, surcharging during wet weather events, deteriorating interceptors, and street flooding in the downtown area.

The study aims to evaluate the Papoose Creek Pump Station's capacity, storm water pumping, and determine the best course of action for the existing pump station. The scope includes:

- Evaluate and estimate post-separated design sanitary sewer flows based on populations and sewer shed areas.
- Develop concepts for providing access ways to the east and west interceptor sewers within Papoose Creek tunnel and replacement of deteriorating lining.
- Evaluate existing sanitary wet well size and pump size and determine preliminary design size based on estimated post-separated sanitary sewer flows.
- Perform a high-level evaluation and estimation of post-separated design storm flows from Papoose Creek.
- Develop design concepts and costs for rehabilitating the existing pump station, building a new sanitary pump station, and building a stormwater pump station.

ES.2 Service Area and Infrastructure Description

Two sanitary sewer interceptors serve the Papoose Creek sewershed, located parallel to Papoose Creek Sewer, both internal and external to PCS. The 24-inch west interceptor conveys flow from the Upper and Lower West Branch Sanitary Sewers, while the 30-inch east interceptor conveys sanitary flows east of Cedar Street. The internal interceptors are asphalt-lined corrugated steel pipe encased in concrete, with the interior asphalt lining deteriorating and sloughing off, requiring replacement, relocation, or lining.

A site visit was conducted on April 24, 2025, by Stanley Consultant's engineering/architectural team to document the pump station condition and identify necessary modifications and updates. Observations were made across various disciplines, including structural, architectural, process mechanical, HVAC mechanical, and electrical.

- Structural Observations: The pump station substructure is in good/fair condition, but experiences extensive flowing leakage through the substructure concrete walls during flood conditions. The superstructure is in good condition, but exterior concrete stairs are severely deteriorated/spalled and need replacement. Precast wall panels are bowed, and connection plates are severely corroded, recommending removal and/or replacement.

- Architectural Observations (Exterior): The roof leaks, and flashings should be replaced. Precast panels are bowing out or deteriorating and should be replaced or reviewed for renewal with other types of panel systems. The building is uninsulated, and occupancy and energy code requirements should be verified.
- Architectural Observations (Interior): The overhead door appears to have surface rust and needs to be cleaned and resealed. Holes in the floor with no fall protection in the screen room pose a safety risk. Restrooms do not meet ADA requirements.
- Process Mechanical: The capacity rating for the pump access hatches is unknown and should be replaced with safety railing and fall protection. An electrical hoist should be installed in the control room to safely remove each pump. The process piping in the dry well contains asbestos, which needs to be abated before being replaced.
- HVAC Mechanical: The electrical room should have air conditioning to prevent overheating of electrical equipment. The diversion chamber room and bar screen room do not have a separate exhaust, and ventilation needs to be isolated from the electrical room.
- Electrical: The utility service is mounted on an aged wood structure that should be replaced. The motor control center (MCC) has damaged buckets and is beyond its useful life, recommending replacement. The panelboard in the space utilizes duct tape and electrical tape to hold breakers in specific positions and appears to be beyond its serviceable life.

ES.3 Stormwater Analysis

To gain insight into how storm water runoff is collected and conveyed through the Papoose Creek Tunnel, a computerized hydraulic model was developed. The hydraulic model is also used to develop a better understanding of hydraulic performance of the Papoose Creek storm sewer system (PCS) including the PCS under various storm events. Initially, Stanley Consultants evaluated a new stormwater pump station to handle the entirety of the flow coming through downtown on the surface as well as in the PCS. The proposed stormwater pumps sized to control this magnitude of runoff were infeasibly large. The downtown area became the focus of flow evaluations to determine sizes for the proposed storm water pump station where the existing stormwater system experiences surcharging and street flooding during heavy rainfall events, particularly when the Mississippi River is at flood elevation.

At the normal river pool elevation of 538.54 feet (NAVD88), the model shows storm sewer surcharging and slight downtown street flooding at the 100-year storm event. Junctions MH203-S and MH204-S experienced flooding, with total flood volumes of 2.71 MG and 0.24 MG, respectively.

At the Mississippi River flood elevation of 555.65 feet (NAVD88), the downtown storm sewer system experiences surcharging for 5 through 100-year storm events. Significant flooding was observed at MH203-S for each event, with total flood volumes ranging from 32017.75 MG to 79541.41 MG. The need for a separate stormwater pump station for local downtown drainage was identified to alleviate flooding on Sycamore Street.

ES.4 Stormwater Pump Station Alternatives

The study presents two alternatives for the stormwater pump station: building a permanent pump station or building a system for mobile pumps. A permanent stormwater pump station was sized to handle peak runoff flows for the 10-year storm event from the downtown sub-catchments shown in Figure ES-1.

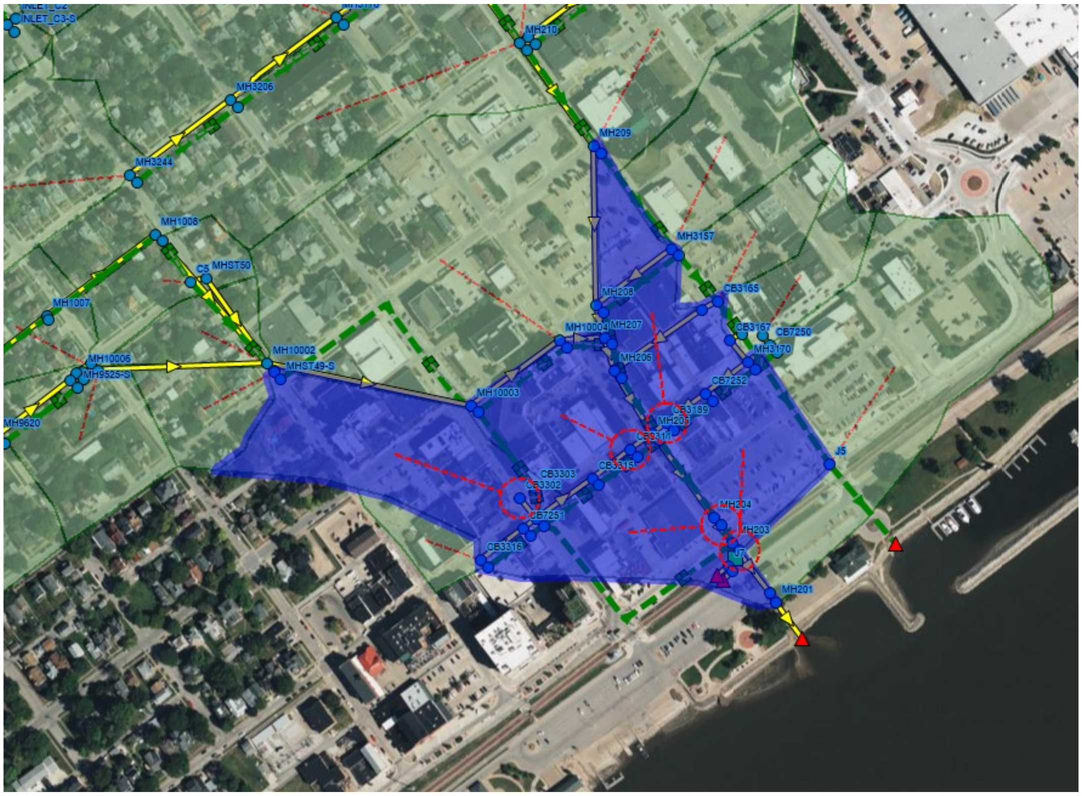


Figure ES-1: Downtown Muscatine Sub-Catchments

The pump station comprises one 60 horsepower (HP) solids-handling centrifugal pump with 4,728 gpm capacity and two 240 HP submersible column pumps with variable speed drives (VFDs) each with 20,230 gpm capacity.

The proposed stormwater pump station would be in the parking lot along Sycamore Street and Mississippi Drive as shown in Figure ES-2. This preferred location is near the lowest elevation point in the downtown area to which water drains. This location is also north of the temporary floodwall that the City installs along Mississippi Drive when the Mississippi River floods, allowing the pump station to be accessed during flooding conditions. To convey surface runoff to the pump station, additional storm sewer piping and inlets will be needed along Sycamore Street. Additional analysis will be needed to determine this conveyance system design. In addition to storm sewer, shutoff valves should also be placed in the manholes shown in Figure ES-2, to isolate the system south of the temporary flood wall.

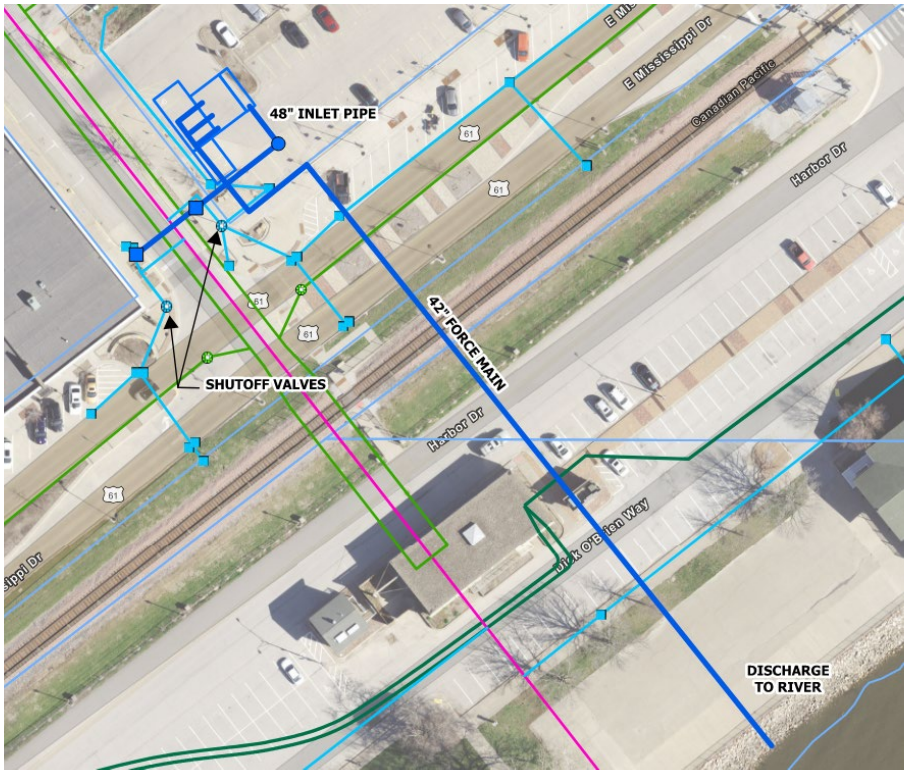


Figure ES-2: Proposed Stormwater Pump Station Location

The pump station's wet well was sized with dimensions of 24.4 feet by 24 feet, and 21 feet deep. The pump station structure will be designed to be compatible with the historic downtown Second Street district. The valve vault and wet well will be cast-in-place reinforced concrete structures. The mechanical systems will include exhaust fans, makeup air unit(s), and electric unit heaters. The electrical system will provide a new MCC, 480V Panel, step-down transformer, and 120/208V Panel, with a backup generator for power outages. The instrumentation and control system will include a PLC control panel with a touchscreen HMI, radar level transmitter, and magnetic flow meter.

Having a stormwater pump station shows a significant decrease in street flooding in the downtown area for all storm events from the 5-year to the 100-year. Flooding on Sycamore Street was reduced to less than 2 hours for both the 5-year and 10-year storm events.

The mobile pump alternative involves modifying the stormwater pipe network with valves or gates to isolate the piping south of the floodwall. Two new large sump structures will be constructed on the north side of the temporary floodwall to facilitate the use of portable pumps during flood-fighting events. Additional storm sewer piping and inlets will be needed along Sycamore Street to convey water to the sumps.

ES.5 Sanitary Analysis

ES.5.1 Interceptor Analysis and Rehabilitation

The East Side Interceptor Sewer receives sanitary flow from residential areas and a food manufacturing plant, Kraft Heinz. The analysis indicates the 36-inch pipe runs about 26 percent full with a velocity of 7.61

ft/s under free flow conditions. The computed capacity of the 30-inch East Side Interceptor Sewer is 22 mgd (34 cfs). The West Side Interceptor receives sanitary flow from the West Hill basin residential area. Under free flow conditions, the 24-inch pipe runs about 58 percent full with a velocity of 6.93 ft/s. The reported capacity of the 24-inch West Side Interceptor Sewer is 12.2 mgd (18.9 cfs).

Both interceptors are aging and in deteriorated condition, with issues such as asphalt interior liner sloughing off. Two rehabilitation alternatives are considered: constructing access points and relining the interceptors or abandoning the existing interceptors and installing new piping external to the tunnel. Installing new piping external to the tunnel is preferred.

ES.5.2 Papoose Pump Station Analysis

The existing pump arrangement consists of one 2,800 gpm pump and two 8,600 gpm pumps. The wet well volume is adequately sized for the small pump but is undersized for the large pumps. The force main hydraulics study identifies issues with high head loss and reduced pump capacity. The reduced pumping capacity at Papoose Creek Pump Station can cause water levels in the wet well to rise, leading to manhole surcharging. Hydraulic modeling results show head loss between the wet well and Mississippi Drive manholes, causing surcharging during high wet well levels.

ES.5.3 Proposed Pump Size and Configuration

A sanitary sewer hydraulic trunk sewer model is used to determine design flows for Papoose Creek Pump Station sanitary pump sizing. A three-pump equal size configuration is recommended, which can achieve the maximum flow at high head conditions and the required turndown for low-flow conditions. The 215 horsepower pumps have a combined pumping capacity of 9,138 gpm with one pump on standby.

ES.5.4 Sanitary Pump Station Alternatives

The study presents two alternatives for the Papoose Creek Pump Station: modifying the existing pump station and building a new one outside the regulated floodway. The existing pump station's renovation is limited by its location in the floodway, while a new pump station offers improved safety and reliability.

ES.5.5 Existing Pump Station Renovation

ES.5.5.1 Process Mechanical

The stormwater diversion chamber sump will be filled with concrete to facilitate sediment sweeping out through flap gates. A new mechanical bar screen will be added in the wet well, with a wash press for dewatering screenings. The wet well will be expanded to increase volume, and a mixer will be installed to prevent solids settling. Three shafted pumps will be replaced with three 4,500 gpm dry-pit submersible pumps operating on VFDs. All piping within the dry well will be replaced except for the bypass piping back to the wet well. 16-inch piping connected to the Mad Creek force main will be increased to 24-inch to reduce hydraulic bottlenecking.

ES.5.5.2 Architectural

Precast curtainwall panels, doors, guardrails, and roofing will be replaced to improve energy efficiency and safety. Options for new panels include insulated metal panels or translucent panels.

ES.5.5.3 Structural

The wet well substructure will be extended to the north. Roof beams will be strengthened to support a monorail hoist. Fall protection will be added around the existing floor opening in the Bar Screen Room and the new floor hatch in the Control Room.

ES.5.5.4 Mechanical

Ventilation systems in the dry and wet wells will be upgraded to meet NFPA code requirements. Supplemental electric unit heaters will be provided in the dry well, and a natural gas-fired makeup air unit will be installed in the wet well.

ES.5.5.5 Electrical

The electrical room will be isolated from classified spaces. The existing MCC will be replaced with a new one, and new lighting, receptacles, and HVAC power will be provided.

ES.5.5.6 Instrumentation & Control

A local control panel with PLC, radar level transmitter, and magnetic flow meter will be implemented for autonomous operation. The pump station will be designed for unmanned operation, with monitoring and control logic programmed in the local PLC.

ES.5.6 New Sanitary Pump Station

Figure ES-3 shows a proposed site location for the new sanitary pump station. If the stormwater pump station were also to be built, the stormwater structure would be positioned to the east of the sanitary pump station.

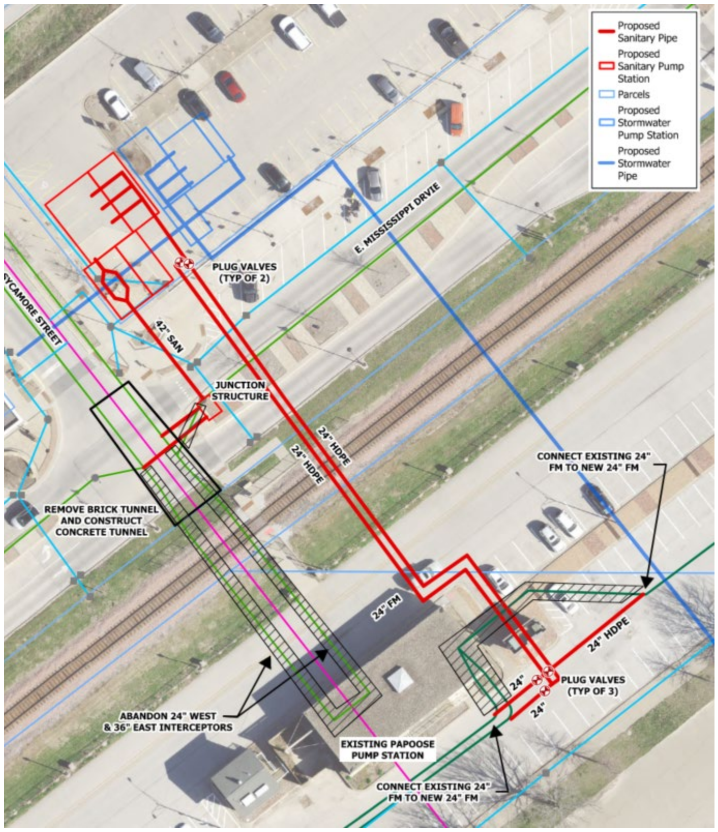


Figure ES-3: Proposed Sanitary Pump Station Location

ES.5.6.1 Process Mechanical

A new pump station will be designed with a bar screen room, wet well, and valve vault, featuring three 4,500 gpm submersible pumps. The dual force main will be jack and bored under the railroad tracks. Odor control is not included in the cost estimate but may be considered by the City.

ES.5.6.2 Architectural

Exterior material options include precast concrete structural panels, masonry, metal panels, and glass panels. The roof structure will be precast panels with an EPDM roofing system.

ES.5.6.3 Structural

The valve vault, wet well, and bar screen structures will be cast-in-place reinforced concrete structures. The building structure will be above grade, partially supported on the bar screen structure and partially on shallow concrete foundations.

ES.5.6.4 Mechanical

Mechanical systems will consist of exhaust fans, makeup air units, and electric unit heaters to meet NFPA 820 requirements.

ES.5.6.5 Electrical

Electrical systems will be housed in a room isolated from classified spaces, with a new MCC, 480V panel, step-down transformer, and 120/208V panel.

A backup generator will be provided on a raised platform.

ES.5.6.6 Instrumentation and Control

The instrumentation and control system will be similar to the existing pump station renovation, with a local control panel and SCADA integration for autonomous operation.

ES.6 Cost Estimates

The cost estimates are based on 2025 dollars and include construction contingency, market inflation, overhead, and profit. The actual cost may vary depending on the selected alternative and design choices made during the project.

Modifying the existing pump station Opinion of Probable Construction Cost (OPCC) is $6,060,000. The cost to modify Papoose Creek Pump Station includes:

- Replacement of three shafted pumps with three dry pit submersible pumps with associated piping and valves.
- Expansion of wet well.
- Addition of a second mechanical bar screen and washer compactor.
- Replacement of MCC, VFDs, exterior lighting, electrical service and controls.
- Addition of an emergency generator.
- Replacement of MAU and exhaust fans.
- Replacement of all doors, windows, roof, stairs and precast wall panels.
- Replacement of guardrails and floor hatches.
- Addition of monorail, structural beam support and pump hatches.
- Modifications to the stormwater diversion chamber.
- Keeping the pump station in operation during construction.

Building a New Sanitary Pump Station OPCC is $8,960,000. The cost of building a new sanitary pump station includes:

- Papoose tunnel modifications and junction structure.
- Bar screen room with two mechanical bar screens and two washer compactors.
- Wet well with three submersible pumps and pump hatches.
- Valve vault with associated piping, valves and hatches.
- Electrical equipment including MCC, VFDs, lighting, electrical service and controls.

- Emergency generator.
- MAU and exhaust fans.
- Modifications to the stormwater diversion chamber.
- Decommissioning of Papoose Pump Station.
- 24-inch force main from new sanitary pump station to riverfront with connections to existing force mains.

Building a Stormwater Pump Station OPCC is $7,250,000. The cost of building a stormwater pump station includes:

- Catchment and piping modifications at Sycamore and E. Mississippi Drive to convey runoff to the new pump station and isolate the local catchments from the Papoose tunnel.
- Adding catchments along Sycamore Street between E. 2nd Street and E. Mississippi Drive.
- Wet well with three submersible axial pumps and pump hatches.
- Valve vault with associated piping, valves and hatches.
- Electrical equipment including MCC, VFDs, lighting, electrical service and controls.
- Emergency generator.
- MAU and exhaust fans.
- 42-inch force main from new stormwater pump station to river including horizontal directional drilling under the railroad tracks.

Modifying Existing Catchments OPCC is $750,000. The cost of modifying the local stormwater catchments to accommodate portable pumping includes:

- Two 5 feet x 5 feet x 6 feet deep sumps to house the portable pumps.
- Installation of five buried gate valves to isolate the local catchments from the Papoose tunnel.
- Catchment and piping modifications at Sycamore and E. Mississippi Drive to convey runoff to the two sumps.

ES.7 Conclusions and Recommendations

ES.7.1 Sanitary Pump Station

The existing sanitary pump station is over 60 years old and requires significant upgrades to meet safety and efficiency standards. Modifying the existing pump station is not recommended due to its location in the floodway and the need for staff to access it during flooding. Building a new sanitary pump station is the recommended option, providing improved safety, efficiency, and a longer lifespan. The new pump station should be designed according to Hydraulic Institute standards to ensure optimal performance.

The new sanitary pump station will be designed to handle both dry weather and wet weather flows effectively. The design includes a wet well expansion to improve hydraulics and prevent solids deposition. A second mechanical bar screen will provide redundancy for maintenance purposes. The wet well will be designed to allow even, uniform laminar flow to the pump intake, and will be deep enough to prevent sanitary interceptors from experiencing surcharge conditions regularly. The pumps will be submersible to avoid maintenance in a dry pit, and pump hatches will allow crane access for pump removal.

ES.7.2 Stormwater Pump Station

Building a stormwater pump station is recommended to manage local runoff and reduce street flooding. The pump station will be designed to handle the 10-year peak flow, reducing flooding along Sycamore Street and East 2nd Street. Alternative solutions, such as a sump system for portable pumps, are also considered. The City should continue to pursue distributed storm runoff mitigation techniques, including detention basins, bioswales, and green roofs, to minimize peak runoff flows.

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Figures

Section 1 Introduction

1.1 Background

Papoose Creek is one of four major watersheds and sanitary service areas within the City of Muscatine. The sewers tributary to the Papoose Creek watershed are a combined sanitary and storm sewer system. The City's long-term program to separate sewers in the West Hill area will be completed by 2028. Sewage, rainwater, and creek water from the Papoose Creek area flow by gravity to the Papoose Creek Pump Station. The station is on the Mississippi riverfront at the foot of Sycamore Street. The pump station was constructed in 1963 and was designed to serve the combined sewer system. The function and performance of the Papoose Creek Pump Station is evolving as sanitary sewage and storm flows are separated and the separation program nears completion.

The City's Papoose Creek watershed has several infrastructure challenges that require review and improvement.

- The Papoose Creek Pump Station pump numbers and capacities do not match up with future separate sanitary low, normal, and peak flows.
- The sanitary sewer system in the vicinity of the pump station and in Sycamore Street between Mississippi Drive and 2nd Street experiences surcharging during wet weather events.
- The East and West Sanitary Sewers located inside Papoose Creek Sewer and upstream of Papoose Creek Pump Station are deteriorating from the inside and need to be repaired or replaced.
- Street flooding in the downtown occurs during heavy rainfall. The downtown area is at the bottom of the watershed. When high intensity rainfall events occur, storm runoff quickly concentrates and overwhelms street intakes, resulting in street flooding at intersections located in low lying areas. Sycamore Street, at the lowest part of the watershed, is prone to street flooding during these high intensity events. Backwater during high Mississippi River levels into Papoose Creek Sewer intensifies the storm water problem.
- The Papoose Creek Pump Station has many mechanical, electrical and structural problems due to age and deferred maintenance that will require investment to maintain the viability of the pump station.

1.2 Scope

The purpose of this study is to evaluate Papoose Creek Pump Station capacity, evaluate storm water pumping and sizes, and analyze whether to modify and renovate the pump station or construct a new pump station in the vicinity of Mississippi Drive and Sycamore Street. The Papoose Creek Pump Station study scope includes the following:

1. Evaluate and estimate post-separated design sanitary sewer flows based on populations and sewer shed areas.
2. Develop concepts for providing access ways to the east and west interceptor sewers within Papoose Creek tunnel and replacement of deteriorating lining.
3. Evaluate sanitary wet well size and determine preliminary design size based on estimated post-separated sanitary sewer flows.

4. Evaluate sanitary pump sizes and configurations with consideration of revised design flows and the multiple pump station force main system.
    a. Existing – one (1) small pump; two (2) large pumps
    b. Three (3) pumps of same size
    c. Four (4) pumps – two (2) small pumps, two (2) large pumps
5. Perform a high-level evaluation and estimation of post-separated design storm flows including:
    a. Review of prior storm flow analysis and West Hill Sewer Plan by Rob McDonald that includes stormwater flows.
    b. Update prior storm flow analysis with best available information on subbasins, storm sewer routings, detention and flows. Subbasin delineations will be reviewed and updated.
    c. Estimate 1-, 25-, 50- and 100-year peak storm flows from subbasins using standard hydraulic and hydrologic methods.
    d. Create an existing conditions hydrologic and hydraulic (H&H) stormwater model to route storm runoff from subbasins through the storm network to Papoose Creek Pump Station. This uncalibrated model will provide insight into the system's operation and peak flows.
    e. An existing conditions gravity condition model (no pumps operating) will be developed from the existing conditions H&H model as a verification to available historic and anecdotal information.
    f. Utilize the models to determine the critical storm duration that develops the largest flow.
    g. Utilize the models to determine the critical storm duration that develops the largest flow.
    h. Utilize the evaluation to determine available system storage in the tunnel and impact on peak flow requirements.
    i. Create a proposed conditions model to determine preliminary pump station peak design flows for 1-, 25-, 50- and 100-year events.
    j. Make recommendations for flow meters and level sensors to gather appropriate data over time to allow future calibration of the hydraulic model needed to finalize storm pumping design flows.
6. Develop design concepts for the following alternatives:
    a. Reconfiguring Papoose Creek Pump Station with expanded sanitary wet well, storm water pumping and gates, pump station rehabilitation, and new generator structure.
    b. New sanitary and storm pump station north of Mississippi Drive with consideration of:
        i. Connection of sanitary sewers and Papoose Creek tunnel to sanitary and storm pumping wells, including provisions for passing sand and debris past the sanitary sewers crossing the tunnel.
        ii. Storm pumping discharge and conveyance.
        iii. Connection of sanitary pumps to existing force main system south of the railroad tracks.
        iv. Connection of Mad Creek force main to new sanitary wet well.
        v. Sanitary and storm pump types and arrangements.
        vi. Storm sand/grit trap concept.

vii. Sanitary wet well gate to bring stream water into the wet well to enhance Water and Resource Recovery Facility flows.

viii. Storm water gates and conceptual arrangement.

ix. Electrical utility connection, electrical room and conceptual one-line.

x. Preliminary emergency generator sizing and configuration.

xi. HVAC (ventilation) concepts.

xii. Odor control concepts.

xiii. Maintenance access considerations.

7. Conduct site visit to identify and/or confirm field conditions of subbasins, storm sewer, pump station, etc.
8. Analyze two concepts for construction cost and non-monetary factors.

Section 2 Service Area and Infrastructure Description

2.1 Papoose Creek Watershed and Papoose Tunnel

The Papoose Creek drainage area upstream of the Papoose Creek Pump Station is over 1,800 acres. The drainage area extends to Mulberry Avenue on the north; Oak Street on the east; Lucas Street on the south; and extends past Houser Street on the west. The Papoose Creek Sewer (PCS), also referred to as Papoose Tunnel, begins where the natural drainageway for this area, Papoose Creek, enters PCS north of Fulliam Avenue and west of Cedar Street. At the entrance, PCS is a 7-ft by 8-ft concrete box. PCS is the main combined truck sewer serving the drainage area and receives flow contributions from combined sewers, storm sewers and sanitary sewers. Efforts have been underway for decades to separate the sanitary and storm flow streams that contribute to Papoose Creek Sewer. The West Hill Sewer Separation program has been going on since the 2010 West Hill Concept Design report by Stanley Consultants. It is about separating sewers in the West Hill Area upstream of PCS. That program includes nine separate construction contracts which are scheduled to be completed by 2028.

Two major storm sewers contribute to PCS. A major focus of the West Hill Separation program is separating the combined flows contributing to these two trunk sewers. The Upper West Branch Sewer (UWBS) extends from Logan Street to East 11th Street and Sycamore Street where it connects into the PCS. The Lower West Branch Sewer (LWBS) begins at Lucas Street and connects to PCS near 3rd and Sycamore Street.

Papoose Creek Sewer outlets to the Mississippi River through a 24-foot-wide by 8-foot-tall concrete box with two flap gates located within the pump station diversion chamber. High river levels back up water into the PCS and restrict the function of the flap gates.

Sanitary sewage is collected into two interceptor sewers that were installed inside of the tunnel on the east and west sides of the structure. The sanitary interceptor sewers convey collected sewage into a dedicated sanitary wet well at Papoose Creek Pump Station for pumping to the wastewater treatment plant.

The pump station is equipped with a 48-inch by 36-inch sluice gate that separates the diversion chamber/tunnel from the sanitary wet well before the West Hill sewer separation program started, this gate was partly open to collect dry weather combined sewage flow from the tunnel diversion chamber preventing dry weather combined sewer discharges to the river. During large rain events, storm water and combined sewage in PCS exceeds the capacity of the sanitary wet well and overflows through the flap gates into the river. As separation progressed, and the sewage in the tunnel became more diluted, the sluice gate opening has been reduced, minimizing the amount of wet weather flow into the sanitary system.

2.2 Sanitary Sewer Interceptors

Two sanitary sewer interceptors serve the Papoose Creek sewershed. These interceptors are located parallel to Papoose Creek Sewer, both internal and external to PCS. The 24-inch west interceptor conveys flow from the Upper and Lower West Branch Sanitary Sewers. The 30-inch east interceptor conveys sanitary flows east of Cedar Street. In 1975, two interceptors were put in the Papoose Creek Sewer tunnel from Alley #2, between 3rd and 2nd Streets. They brought separate sanitary flows to the Papoose Pump Station sanitary wet well. In 1987, the east interceptor was extended inside the tunnel from Alley #2 to 4th Street and Cedar Street. The internal interceptors are located on each side of tunnel at the base and are encased in concrete.

The internal section of the West Interceptor is approximately 700 feet long. The West Side Interceptor continues outside the tunnel from Alley #2 to the mouth of Papoose Creek Sewer north of Fulliam Avenue where the creek enters the sewer. The internal section of the east interceptor is approximately 1,300 feet long.

The 30-inch East Side Interceptor continues externally to the tunnel at 4th and Cedar Street, and at 8th Street, the interceptor changes to a 24-inch pipe which extends to East 10th Street. All service connections to the interceptors enter the tunnel high and have a vertical connection down to the interceptor. Neither internal interceptor has access points along the alignment to visually inspect its condition. The interior interceptors are asphalt-lined corrugated steel pipe encased in concrete and anchored to the walls and floor of PCS. The interior asphalt lining has been sloughing off the pipe wall and reaching the sanitary wet well at the Papoose Creek Pump Station. Due to deterioration of the liner and the lack of access to the internal interceptors, replacement, relocation or lining the interceptors should be considered.

2.3 Papoose Creek Pump Station Condition Assessment

Stanley Consultant's engineering/architectural team completed a site visit of the Papoose Creek Pump Station on Thursday, April 24, 2025. The site visit's purpose was to document the pump station condition and to understand the modifications and updates needed for the facility to meet code and safety requirements and to eliminate high maintenance practices. The following are observations made by each discipline that attended the site visit. In addition to the listed observations, each discipline noted the hazard for staff maintaining a facility located in a flood prone area. Photos from the site visit noting the team's observations are shown in Figures 2-1 through 2-10.

2.3.1 Structural Observations

- Pump station substructure is cast-in-place concrete with below-grade wet well and dry well. It appears to be in good/fair condition with no obvious deterioration of visible areas.
- Superstructure is above-grade cast-in-place concrete columns/beams/roof slab and appears to be in good condition with no obvious deterioration of visible areas.
- Exterior concrete stairs are severely deteriorated/spalled, with exposed/corroded rebar, and need replaced (typical at three locations).
- Precast wall panels are removeable by three bolts each at the top and bottom of each panel. Precast wall panels are bowed, and connection plates are severely corroded in bar screen and wet well rooms. Recommend removing and replacing precast panels and steel connection elements.
- Precast wall panels can be replaced with new precast panels or concrete masonry units (CMU) infill. Concrete curbs could be added at wall openings to protect against higher water levels.
- Steel floor hatch load rating in the electrical room is unknown. Steel eye bolt above floor hatch load rating is also unknown.
- City would like to have fall protection around the floor hatch, as well as a hoist beam above the floor hatch.

- 3-ton bridge crane in wet well room is newer (~2010) and is in good/fair condition (mild corrosion on support framing).
- Exterior hoist beam is moderately corroded but is still usable. Could be cleaned/repainted to extend life.
- Upon reviewing the City's safety audit, which applies to all pump stations, several concerns were identified regarding lack of fall protection related to ladders, platforms, hatches, access openings and confined spaces. Each area of concern, if applicable to Papoose Creek Pump Station, could be addressed with new OSHA-compliant ladders, guardrail and tie-off/anchor points, as needed. Load-bearing access covers with unknown load capacity could be replaced.
- City has communicated that the dry-well substructure walls leak during flood conditions. They noted that there is significant flow of exterior water coming into the dry-well from the exterior walls during the high water conditions. This was not observed during the site visit but is noted for further investigation.

2.3.2 Architectural Observations (Exterior)

- Roof leaks - the roofing and flashings should be replaced.
- The precast panels are bowing out or deteriorating. They should be replaced with new panels or renewed with other types of panel systems.
- Seals around panels either have gaps or are deteriorating.
- The building is uninsulated; verify occupancy and the energy code requirements.
- The windows have been damaged and need to be replaced.
- Exterior stairs need to be replaced, and hand/guard rails replaced or added.
- Exterior doors
  - Doors to restrooms do not meet American with Disabilities Act (ADA) access requirements.
  - Door to women's restroom opens into an egress path for diversion chamber room.
  - Doors added on north face need fall protection added as no platform or stairs lead to grade.
  - The door exiting from the diversion chamber room is partially blocked by floor grating.
  - Doors do not have the proper egress hardware

2.3.3 Architectural Observations (Interior)

- The overhead door appears to have surface rust and needs to be cleaned and resealed to protect it from further damage.
- A newer doorway was added from the screen room to the control room. It appears to provide an exit from the screen room after the overhead door was installed to replace double swing doors. This doorway has no visible lintel and combines two rooms with different hazard classifications (See Figure 2-7).
- Holes in floor with no fall protection in screen room.
- The guardrail in the diversion chamber room has had the top rail removed and needs to be replaced.

- Restrooms do not meet ADA requirements.
- It appears wood is in the construction of the ceiling above the restrooms and janitors' room and needs to be reviewed in the occupancy classification of the building.
- All egress paths need to be clear; some paths are blocked as viewed in photos.
- Missing fall protection on main level; verify locations.

2.3.4 Process Mechanical

- The capacity rating for the pump access hatches is unknown and should be replaced with safety railing and fall protection.
- An electrical hoist should be installed in the control room to safely remove each pump.
- The doorway between the screen room and control room provides access to two different classified spaces. The doorway should be removed to keep the classified areas separate (see Figure 2-7).
- The clearance in front of the control/electrical panels is not adequate.
- The process piping in the dry well contains asbestos which needs to be abated before being replaced. Much of the ductile iron in the dry well is corroded (see Figure 2-9) and given the length of service and probable internal grit abrasive wear, should be replaced. The 90-degree elbow support for each pump does not physically support the process piping any more due to corrosion (See Figure 10).
- The 24-inch force main from Mad Creek Pump Station connects to a 16-inch tee which causes a hydraulic bottleneck to the 24-inch interceptor on the riverfront.
- Two of the three pumps are oversized for sanitary flows.
- The screening room has one mechanical bar screen with no redundancy or bypass screen.
- No gas monitoring system, as required by current codes, is in place to know if it is safe to enter the facility.
- The entrance of Papoose Creek Sewer into the pump station diversion chamber is not fully accessible with the bucket crane to remove sand deposits. Sand builds up in the diversion chamber and in the mechanical bar screen and can only be removed by hand.

2.3.5 HVAC Mechanical

- The wall connecting the electrical room and bar screen room has openings for a fan. These spaces should be permanently separated for National Fire Protection Association (NFPA) classification purposes.
- The electrical room should have air conditioning to prevent overheating of electrical equipment.
- Three small electric unit heaters supply heat to the electrical room. Capacity appears to be too small for ventilation air being brought in by exhaust fans.
- The diversion chamber and bar screen room do not have a separate exhaust other than the fan transferring air from the electrical room to the bar screen room. Exhaust needs to be increased in these spaces to meet NFPA requirements and spaces and ventilation isolated from the electrical room.

2.3.6 Electrical

- Exterior Utility Service (Figure 2-3): The utility service is mounted on a wood structure to keep it above the flood line. This structure appears aged and should be replaced.
- Electrical Room
  - Motor control center (see Figure 2-1): The MCC has damaged buckets (see Figure 2-2) and is beyond its useful life. It appears the pump starters had been replaced and retrofitted in the past. It is recommended to replace the MCC in its entirety.
  - Debris and mechanical parts on the electrical room floor make unsafe conditions to work on the electrical equipment (see Figures 2-4 & 2-5). The hatch for basement pump access has broken off in recent months and had to be welded back together. All of this creates unsafe working conditions.
  - The panelboard in the space utilizes duct tape and electrical tape to hold breakers in specific potions (see Figure 2-6). The panelboard also appears to be beyond its serviceable life and a new panel is recommended.
  - The structure of the electrical room is not sound, and air gaps to the outside are visible. There are also a leaking roof and pipes. This creates unsafe conditions for the electrical room.
- The bar screen room should be a hazardous classified space and is designed as such with seal offs and explosion-proof enclosures, but there is a door connecting the bar screen room to the electrical room (see Figure 2-7).

Figure 2-1: Motor Control Center

Figure 2-2: Broken Breaker Handle

Figure 2-3: Utility Transformer Structure

Figure 2-4: Electrical Room

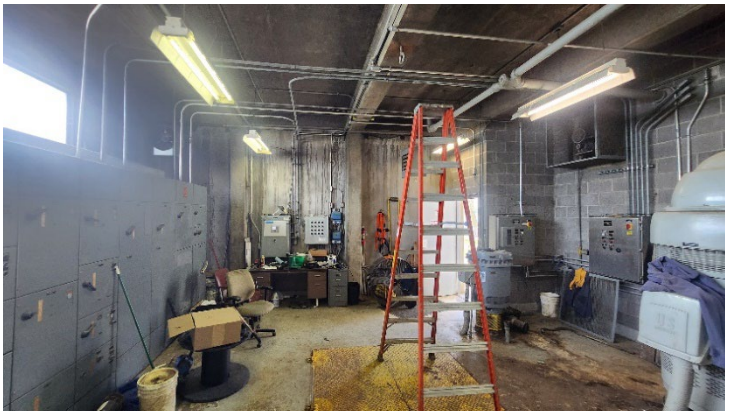

Figure 2-5: Electrical Room

Figure 2-6: Panelboard

Figure 2-7: Bar Screen Room

Figure 2-8: Diversion Chamber Room

Figure 2-9: Process Pump and Piping

Figure 2-10: Process Pump Support

Section 3 Stormwater Analysis

3.1 Existing Conditions

3.1.1 Model Development

The Papoose Creek Sewer system is still in the process of being fully separated into dedicated sanitary and storm systems. Currently, both storm and sanitary flow are routed to the Papoose Creek Pump Station. The pump station has a sluice gate that divides the PCS from the sanitary wet well which receives segregated sanitary sewage. When the gate is partially open, the sanitary wet well receives low-flow, dilute combined sewage during dry weather flows. During major storm events, some dilute sewage and stormwater can enter the sanitary wet well, but most of the combined stormwater and dilute sewage discharges to the river. Flow entering the sanitary wet well is pumped to the treatment plant. Stanley Consultants was tasked to perform further analysis on the separated storm water system to size a pump station exclusively for stormwater to alleviate this issue.

To gain insight into how storm water runoff is collected and conveyed through the Papoose Creek Tunnel, a computerized hydraulic model was developed. The stormwater hydraulic model was developed from the City of Muscatine's GIS data and storm sewer improvement plans prepared by Stanley Consultants. The data was evaluated for accuracy of current combined sewer separation progress and for containing sufficient information such as pipe size, inverts, and lengths. Stormwater elements were then transferred to PC SWMM hydraulic modeling software. PC SWWMM 2023 version 7.6.3695 was utilized in this analysis.

Drainage areas were mapped out based on contours. The overall boundary followed the limits of evaluation of the 2010 West Hill Area Sewer Separation, as shown in Figure 3-1. Curve numbers from the Statewide Urban Design and Specifications (SUDAS) were assigned to areas for various conditions. The web soil survey shows that the City of Muscatine mainly has type C soils. However, the 2010 West Hill Area Sewer Separation report used curves for type B soils. For consistency, type B soil curves were used for this hydraulic study. Good condition (grass cover >75%), Curve #61, was designated for areas northwest of downtown where the condition applies. Forested areas in poor condition, Curve #66, was assigned to applicable areas in the watershed. For downtown areas, urban districts: commercial and business, Curve #92, was determined to be the most applicable.

In PC SWMM, a dual drainage system was added to allow runoff to be routed through the storm sewer and the street. Overland flow paths were included to allow surface flow for storm sewers outside of street conveyance. In the model, underground conduits are expressed as yellow solid lines. The streets are represented as dotted green lines. Based off light detection and ranging (LIDAR) data, storage areas were modeled to account for the attenuation of flow in natural ravines and channels. The extent of the hydraulic model can be observed in Figure 3-2.

The hydraulic model is used to develop a better understanding of hydraulic performance of the Papoose Creek storm sewer system including the PCS under various storm events. The model is useful in determining pumping rates needed for the various storm conditions.

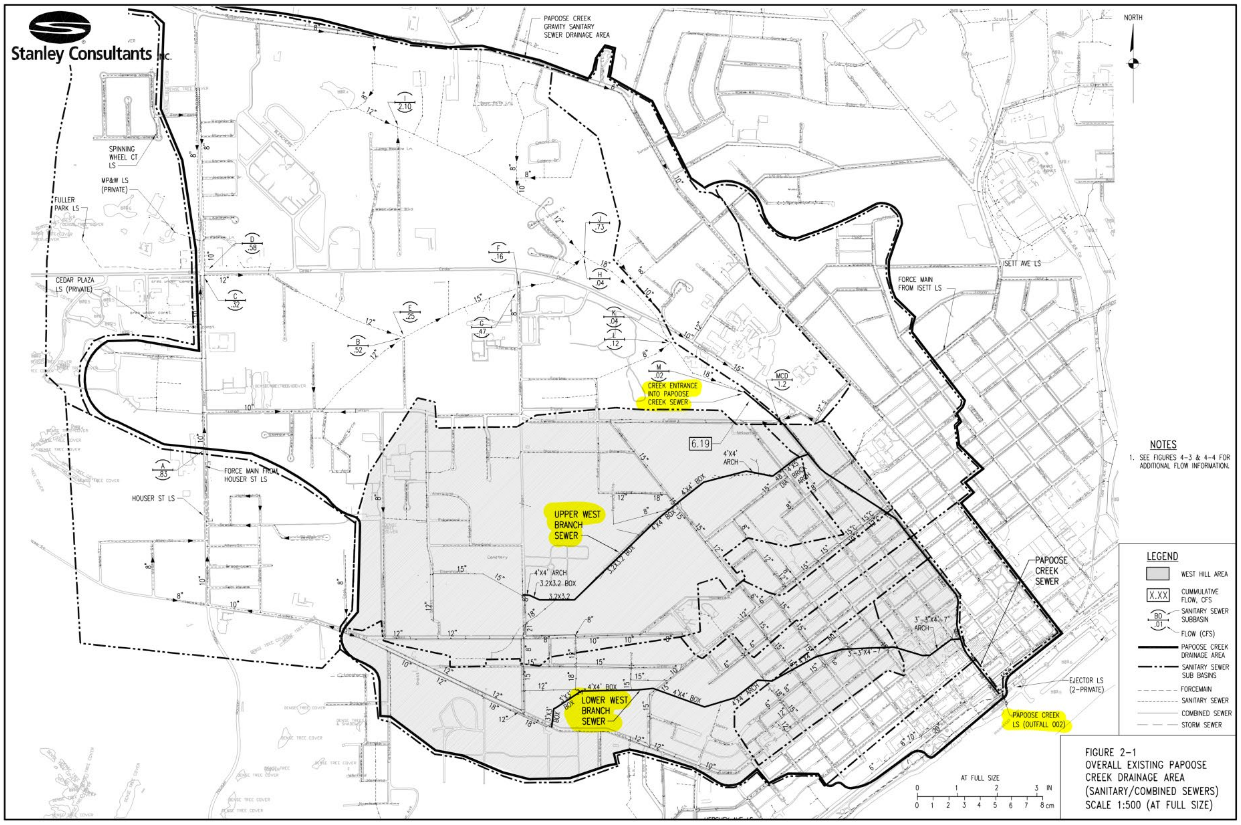

Figure 3-1: Overall Papoose Creek Drainage Area (2010 West Hill Area Sewer Separation Report)

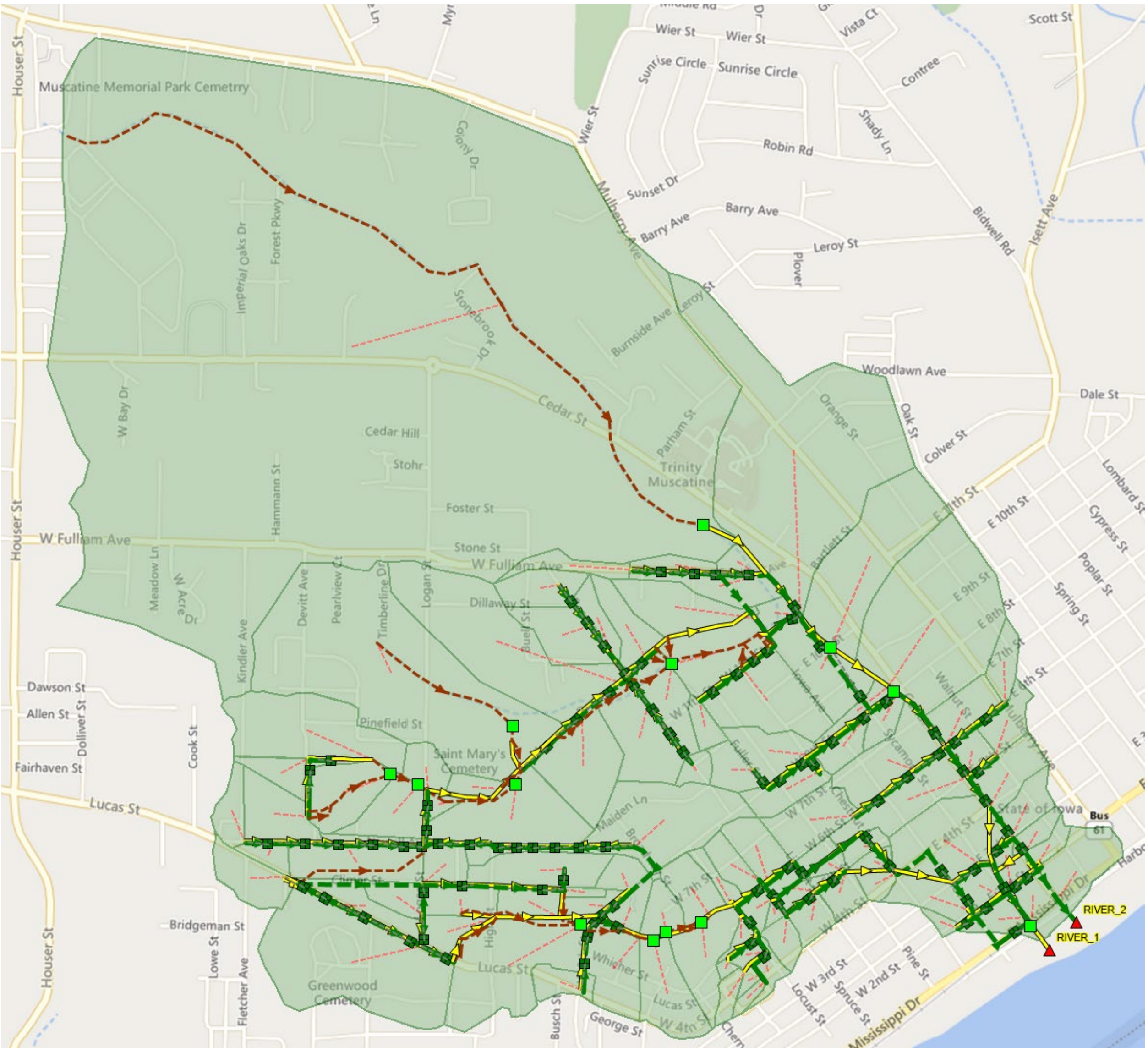

Figure 3-2: Stormwater Model Network Extent

3.1.2 Results

Initially, Stanley Consultants evaluated a new stormwater pump station to handle the entirety of the flow coming through downtown on the surface as well as in the PCS. As seen below in Table 3-2, the maximum flow in the tunnel during the 100-year event is 2,208 cubic feet per second (cfs) at normal river pool elevation, 538.54 (NAVD88). As a result, the proposed stormwater pumps sized to control this magnitude of runoff were infeasibly large.

Multiple scenarios to reduce flow were considered. The detention basins from the study by the University of Iowa were modeled throughout the watershed. Another scenario was installing underground detention systems beneath two parking lots downtown. Neither scenario made a significant impact in reducing pump sizes. The City of Muscatine agreed with Stanley's suggestion to improve stormwater management in the downtown area. This will help reduce street flooding during rain events when the Mississippi River is at a flood height of 555.65 (NAVD88).d elevation of 555.65 (NAVD88). During river flood events, the City plugs CB9946, CB9941, and CB9942 on Sycamore Street. In the hydraulic model, these catch basins are represented as MH203-S and MH204-S. To model this scenario accurately, MH204-S and MH203-S were plugged, cutting them off from the PCS tunnel. The STREET_OUTFLOW node serves as the 4-foot temporary floodwall the city installs on Sycamore Street during river flooding events.

The downtown area became the focus of flow evaluations to determine sizes for the proposed storm water pump station. The model was run for the 5-, 10-, 25-, 50-, and 100-year events in addition to evaluating the river at normal elevation and flood elevation. Stage data was obtained from the United States Army Corps of Engineers (USACE) River Gage Mississippi River at Muscatine, IA in the vertical datum mean sea level (MSL) of 1912. Gage zero is 530.74 feet in MSL 1912. The average normal stage from the USACE River Gage was determined to be 8.5 feet. The record high stage observed was 25.61 feet. Elevations were converted from MSL 1912 to National Geodetic Vertical Datum (NGVD) 1929 to North American Vertical Datum (NAVD) of 1988. From these conversions and calculations, the normal river elevation was determined to be 538.54 feet (NAVD88) and the flood river elevation of 555.65 feet (NAVD88). The flood river elevation was verified with the 1% annual-chance flood water surface elevation from the Federal Emergency Management Agency (FEMA) flood insurance study number 19139CV000D.

The results presented in this report are for type B soils as discussed in Section 3.1.1 Model Development. If the model were updated to type C soils the runoff from each sub catchment would increase. This would cause an increase in the flow through the tunnel. For scenarios where the tunnel is at full capacity, for example when the river is flooded, the increase in runoff would cause an increase in flooding and street flow. This is expected to be the most significant in the downtown area, which already experiences the most significant flooding. For more detailed results further analysis is required.

3.1.3 Normal River Elevation Condition

At the normal river pool elevation of 538.54 feet (NAVD88), the model shows storm sewer or tunnel surcharging and slight downtown street flooding at the 100-year storm event. In this condition, the floodwall is not up, and MH204-S and MH203-S are not plugged in the hydraulic model. Figure 3-3 displays the layout of the storm sewer for normal river elevation. Table 3-1 shows junctions with surcharging and flooding. The maximum surcharge is the hydraulic grade line elevation above the crown of the pipe. Figure 3-4 displays which junctions are flooding at the peak hour. Only the junctions that are along the dotted green line representing above ground street flow were reported in Table 3-1. If the associated street junctions, i.e. MH203 to MH203-S, are not flooding then the water has not traveled out of the gutter. Table 3-2 shows the max depth and flow of pipes in the downtown area. Conduit MH201 – RIVER_1 is the outfall pipe flow that was evaluated in the pump station analysis.

Figure 3-3: Hydraulic Model Downtown Layout at Normal River Elevation

Figure 3-4: Flooding Junctions at Normal River Elevation

Table 3-1: Summary of Surcharging and Flooding Junctions for the 100-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH203-S	0.22	0.8	0.2	2.71
MH204-S	0.22	0.8	0.2	0.24
CB3165	0.18	0.15	0	0

Source: Stanley Consultants, Inc.

Table 3-2: Summary of Depth and Flow in Conduits for the 100-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.34	0
MH205-S – MH204-S	0.84	87.78
MH204-S – MH203-S	1	66.21
MH205 – MH204	0.54	2118.15
MH204 – MH203	0.5	2155.43
MH203 – MH202	0.87	2206.66
MH202 – MH201	0.84	2207.11
MH201 – RIVER_1	0.76	2207.79

Source: Stanley Consultants, Inc.

3.1.4 River Flood Condition

At the Mississippi River flood of record elevation of 555.65 feet (NAVD88), the downtown storm sewer system experiences surcharging for the 5 through 100-year storm events. In this scenario, MH204-S and MH203-S are plugged, cutting them off from the PCS tunnel. The STREET_OUTFLOW node serves as the 4-foot temporary floodwall the city installs on Sycamore Street during flooding events. This scenario layout can be observed in Figure 3-5. Tables 3-3, 3-5, 3-7, 3-9, and 3-11 show the surcharging and flooding of junctions during the 5 through 100-year storm events. Between MH201 and MH202, there is surcharging observed in each storm event. Figure 3-6 displays the junctions that are flooding at the peak hour. As in the normal elevation analysis, only the junctions that are along the dotted green line in representing above ground street flow were reported. Tables 3-4, 3-6, 3-8, 3-10, and 3-12 show the max depth and flow of pipes in the downtown area.

Figure 3-5: Hydraulic Model Downtown Layout at Flood River Elevation

Figure 3-6: Flooding Junctions at Flood River Elevation

Table 3-3: Summary of Surcharging and Flooding Junctions for the 5-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH201	48	5.24	48	5681.18
MH202	48	6.14	0.01	0.1
MH203-S	36.62	0.8	36.41	32017.75
MH204-S	36.62	0.8	12.66	0.38
MH206-S	0.01	0.8	0.01	0.03

Source: Stanley Consultants, Inc.

Table 3-4: Summary of Depth and Flow in Conduits for the 5-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.7	127.3
MH205-S – MH204-S	0.76	37.2
MH204-S – MH203-S	1	13.7
MH203-S – STREET_OUTFLOW	1	11.7
MH205 – MH204	1	2506.4
MH204 – MH203	0.98	3224.3
MH203 – MH202	1	2915.1
MH202 – MH201	1	4233.4
MH201 – RIVER_1	1	4384.9

Source: Stanley Consultants, Inc.

Table 3-5: Summary of Surcharging and Flooding Junctions for the 10-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH201	48	5.24	48	5699.60
MH202	48	6.14	0.01	0.1
MH203-S	37.13	0.8	36.82	36772.64
MH204-S	37.13	0.8	13.16	0.56
MH206-S	0.01	0.8	0.01	0.03

Source: Stanley Consultants, Inc.

Table 3-6: Summary of Depth and Flow in Conduits for the 10-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.7	127.3
MH205-S – MH204-S	0.79	44.7
MH204-S – MH203-S	1	13.7
MH203-S – STREET_OUTFLOW	1	11.7
MH205 – MH204	1	2506.4
MH204 – MH203	0.98	3224.3
MH203 – MH202	1	2915.1
MH202 – MH201	1	4233.4
MH201 – RIVER_1	1	4384.9

Source: Stanley Consultants, Inc.

Table 3-7: Summary of Surcharging and Flooding Junctions for the 25-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH201	48	5.24	48	5729.92
MH202	48	6.14	0.01	0.1
MH203-S	37.97	0.8	37.56	50896.4
MH204-S	37.97	0.8	14.01	0.81
MH206-S	0.01	0.8	0.01	0.03

Source: Stanley Consultants, Inc.

Table 3-8: Summary of Surcharging and Flooding Junctions for the 25-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.7	127.3
MH205-S – MH204-S	0.81	60.4
MH204-S – MH203-S	1	13.7
MH203-S – STREET_OUTFLOW	1	11.7
MH205 – MH204	1	2506.4
MH204 – MH203	0.98	3224.3
MH203 – MH202	1	2915.1
MH202 – MH201	1	4233.4
MH201 – RIVER_1	1	4384.9

Source: Stanley Consultants, Inc.

Table 3-9: Summary of Surcharging and Flooding Junctions for the 50-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH201	48	5.24	48	5754.89
MH202	48	6.14	0.01	0.1
MH203-S	38.68	0.8	38.21	62355.53
MH204-S	38.68	0.8	14.73	1.02
MH206-S	0.01	0.8	0.01	0.03
CB3165	0.08	0.04	0	0

Source: Stanley Consultants, Inc.

Table 3-10: Summary of Surcharging and Flooding Junctions for the 50-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.7	127.3
MH205-S – MH204-S	0.83	73.6
MH204-S – MH203-S	1	13.7
MH203-S – STREET_OUTFLOW	1	11.7
MH205 – MH204	1	2506.4
MH204 – MH203	0.98	3224.3
MH203 – MH202	1	2915.1
MH202 – MH201	1	4233.4
MH201 – RIVER_1	1	4384.9

Source: Stanley Consultants, Inc.

Table 3-11: Summary of Surcharging and Flooding Junctions for the 100-Year Event

Junction	Time Surcharging (hours)	Max Surcharge (ft)	Time Flooding (hours)	Total Flood Volume (MG)
MH201	48	5.24	48	5781.67
MH202	48	6.14	0.01	0.1
MH203-S	39.34	0.8	38.86	79541.41
MH204-S	39.34	0.8	15.44	1.27
MH206-S	0.01	0.8	0.01	0.03
CB3165	0.18	0.18	0	0

Source: Stanley Consultants, Inc.

Table 3-12: Summary of Depth and Flow in Conduits for the 100-Year Event

Pipe	Max/Full Depth (ft)	Max Flow (cfs)
MH206-S – MH205-S	0.7	127.3
MH205-S – MH204-S	0.85	95.8
MH204-S – MH203-S	1	13.7
MH203-S – STREET_OUTFLOW	1	11.7
MH205 – MH204	1	2506.4
MH204 – MH203	0.98	3224.3
MH203 – MH202	1	2915.1
MH202 – MH201	1	4233.4
MH201 – RIVER_1	1	4384.9

Source: Stanley Consultants, Inc.

While the Mississippi River is at the major flood elevation of 555.65 ft (NAVD88), the PCS experiences surcharging and flooding in the tunnel beyond the pump station as well as upstream of the pump station on Sycamore Street before 2nd Street.

On Sycamore Street, there is a significant volume of flooding observed at MH203-S for each event in this condition. This junction is right before the temporary 4-foot floodwall. One option to reduce the volume of storm water accumulated on Sycamore Street is to add a separate storm water pump station for local downtown drainage.

Section 4 Stormwater Pump Station Alternatives

Based on the stormwater analysis for existing conditions shown in Section 3, different stormwater pump station concepts were explored. Initially, a design to pump Papoose Creek watershed's 100-year storm that drains into the Papoose Creek Tunnel was explored with a peak flow of 2,210 cfs, or 1,189 MGD. This design included four pumps: one 21,000 GPM pump, one 70,000 GPM pump, and two 390,000 GPM pumps. The 21,000 GPM pump was selected to handle smaller rain events including the 1-year, 24-hour[1] storm and "nuisance flows" such as snowmelt. The 70,000 GPM pump is intended to handle slightly larger events such as the 5-year and 10-year storms. The two large pumps would handle the biggest events ranging from the 25-year to the 100-year storms. Upon analysis and review with the City, it was determined that a stormwater pump station this large would be very costly and infeasible to implement.

Above- and below- ground storage options within the watershed were also considered to help decrease the peak flow into the pump station, but ultimately a stormwater pump station for the entire watershed was determined infeasible. The City and Stanley agreed to an alternate approach of a stormwater pump station to pump only local storm runoff rather than the entire watershed.

The Papoose Creek Sewer storm system functions well under most conditions without pumping. The City has been working diligently to eliminate direct connections between local downtown buildings and the tunnel to eliminate basement flooding when water levels in the tunnel rise. The brick arch tunnel between 2nd Street and Alley 1 was lined with steel reinforced gunite after surcharging during the historic 1993 flooding. Given that the system functions fairly well under most conditions at normal and river flood levels without pumping, the need for adding a sizable pumping system to maintain levels within the tunnel appears unnecessary.

A stormwater pump station that only pumps stormwater runoff collected from the downtown area, which experiences the worst flooding during rainfall events, was explored. Figure 4-1 shows the downtown sub-catchments that drain to the stormwater pump station. Downtown storm drainage is normally designed for 5- to 10-year return frequency storm events. The City concurred that the 5-year and the 10-year events were reasonable storms for the analysis. The extent of flooding, including water depth and area, for the 25-, 50-, and 100-year storms were considered throughout the analysis.

Two options for downtown storm water pumping were considered: a permanent pump station and a mobile pump sump layout. The following sections describe the two options.

4.1 Permanent Stormwater Pump Station

A permanent stormwater pump station was sized to handle peak runoff flows for the 10-year storm event from the downtown sub-catchments shown in Figure 4-1. The pump station comprises one 60 horsepower (HP) solids-handling centrifugal pump and two 240 HP submersible column pumps with variable speed drives (VFDs). The smaller 60 HP pump is sized to handle surface runoff from a 1-year storm event, which has a peak flow of 4,613 gallons per minute (GPM). This smaller pump handles small flows resulting from

[1] All storm events are 24-hour duration.

light rainfall. The two larger pumps are sized to run in parallel to handle surface runoff from the 10-year storm event, which has a peak flow of 38,662 GPM. These pumps can also run independently to handle rainfall events between the 1-year and 10-year storm events.

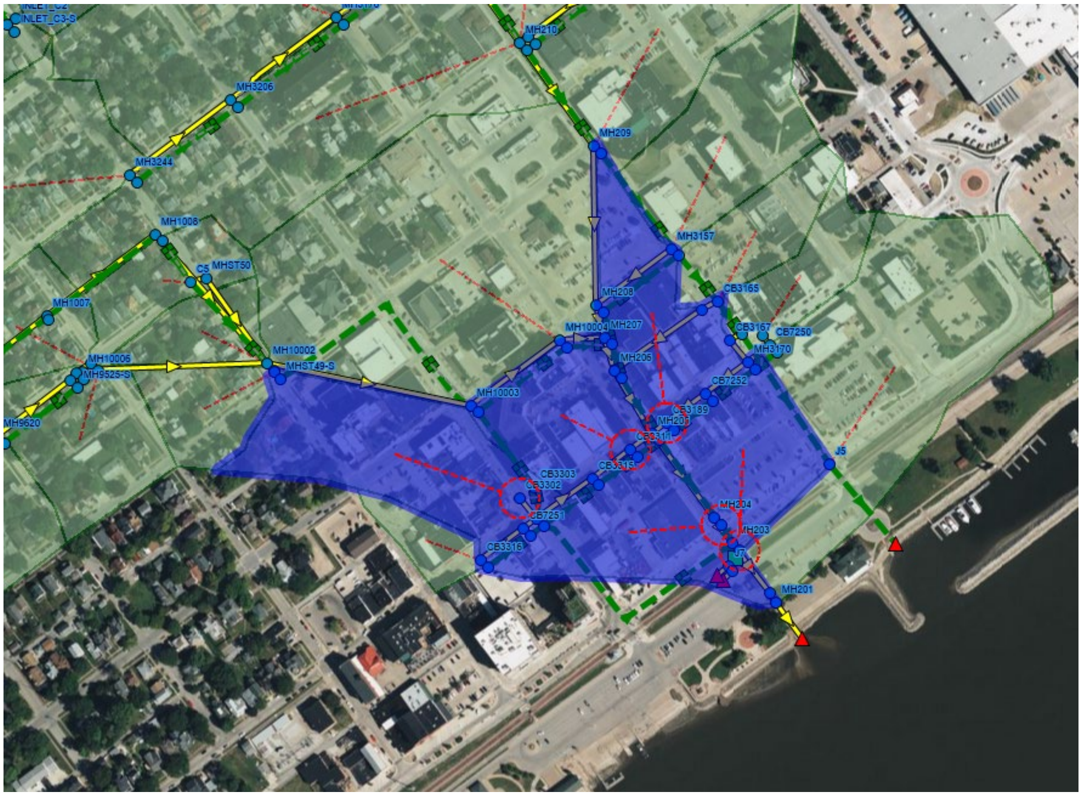

Figure 4-1: Downtown Muscatine Sub-Catchments

4.1.1 Process Mechanical

The design team reached out to pump vendor, Electric Pump, for preliminary sizing and cost estimates. For the 60 HP pump, Electric Pump provided estimates for a centrifugal pump with a design flow of 4,728 GPM and a total dynamic head of 34.24 feet. For the two larger pumps, Electric Pump provided estimates for two submersible mixed-flow pumps each with a design flow of 20,230 GPM and a total dynamic head of 36.37 feet. When the two pumps are running in parallel, the design flow is 40,461 GPM at 36.37 feet of total dynamic head. Table 4-1 presents the preliminary pump selection. Appendix A has the pump information provided by Electric Pump.

Table 4-1: Preliminary Pump Selection for Permanent Stormwater Pump Station

Flygt Pump Model	NP 3202 LT 3~ 615	LL 3602/835 3~ 1240
Discharge size, inch	12	24
Impeller Diameter, mm	342	630
Horsepower	60	240
Flow @ 60 Hz, gpm (1 pump)	4,728	20,230
Pump Efficiency	82%	83.11%
Flow @ 60 Hz, gpm (2 pumps)	n/a	40,461
Pump Efficiency	n/a	83.2%

Figures 4-2, 4-3, and 4-4 show the configuration of the proposed stormwater pump station. A wet well was sized for the three pumps with dimensions of 24.4 feet by 24 feet, and 21 feet deep. Flow from the local downtown drainage area enters the pump station through a 48-inch pipe, parallel with the line of pumps. The manhole at the entrance to the pump station includes a sand trap to remove sediment and debris from stormwater entering the wet well. An overflow-underflow weir distributes flow across the wet well, dissipating and minimizing turbulence. The flow is directed towards three pump bays, each sized for their designated pump.

The two 240 HP pumps include formed suction intakes (FSI), that create quiescent flow conditions at the pump inlet. The intake structures help condition the incoming flow into a uniform profile, achieving better hydraulic performance compared to standard inlets. The small pump outlets to a 12-inch force main and the two large pumps outlet to 24-inch force mains. The three force mains meet at a 42-inch header that conveys the stormwater to the river. Each pump force main includes isolation and check valves. The isolation valve allows for a pump to be taken offline, and the check valve prevents backflow from the force main. The valves are in a 16-feet by 34-feet valve vault adjacent to the wet well.

The 42-inch force main leaving the storm water station will discharge into the river as shown in Figure 4-5. Prior to discharging to the river, the 42-inch force main will change to a 6-foot by 5-foot box culvert with a new stormwater discharge to the river. This transition prevents high velocity flow from discharging directly into the river.

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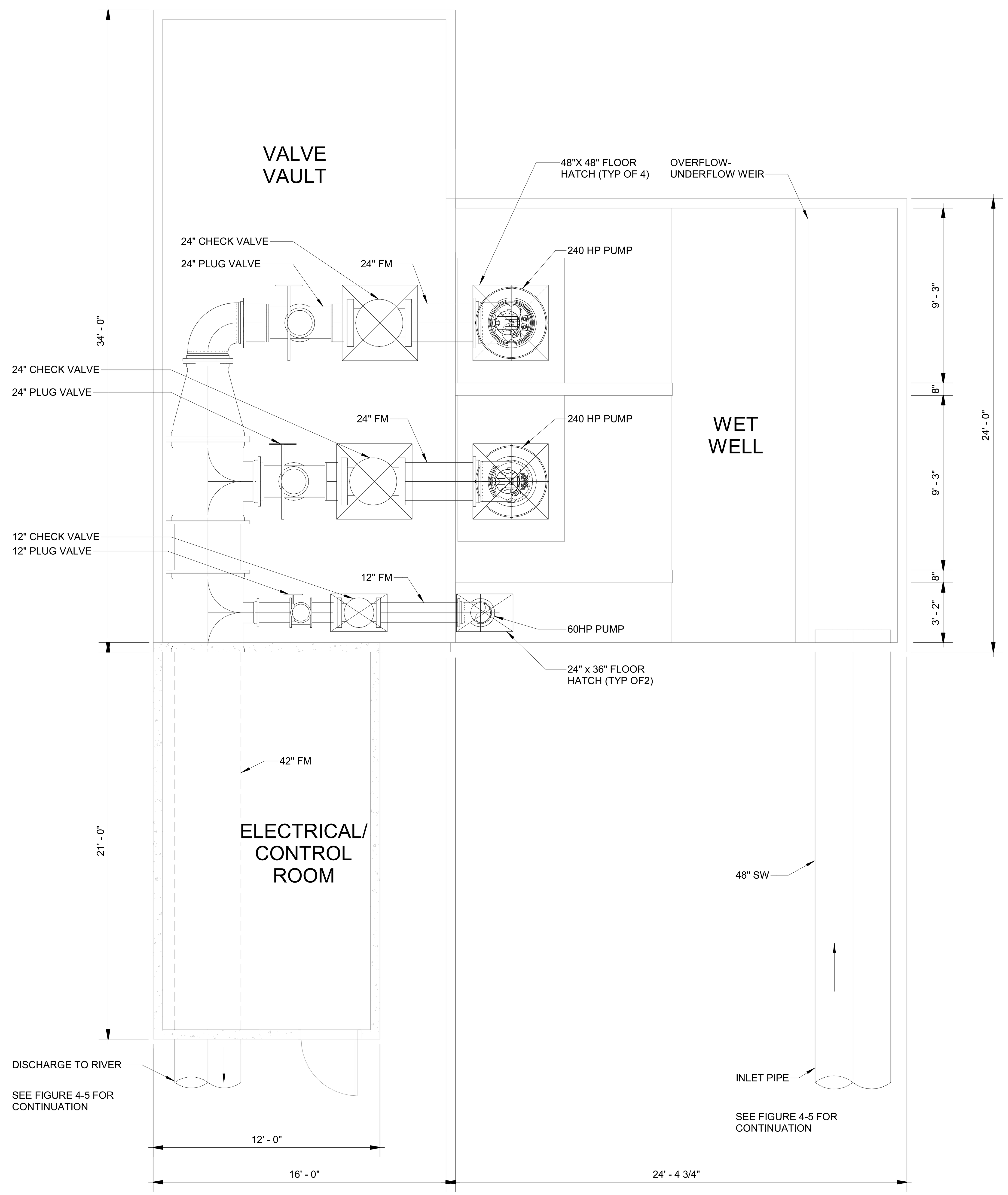


FIGURE 4-2

STORMWATER PUMP STATION PLAN

CADD 04-R3

Stanley Consultants INC.

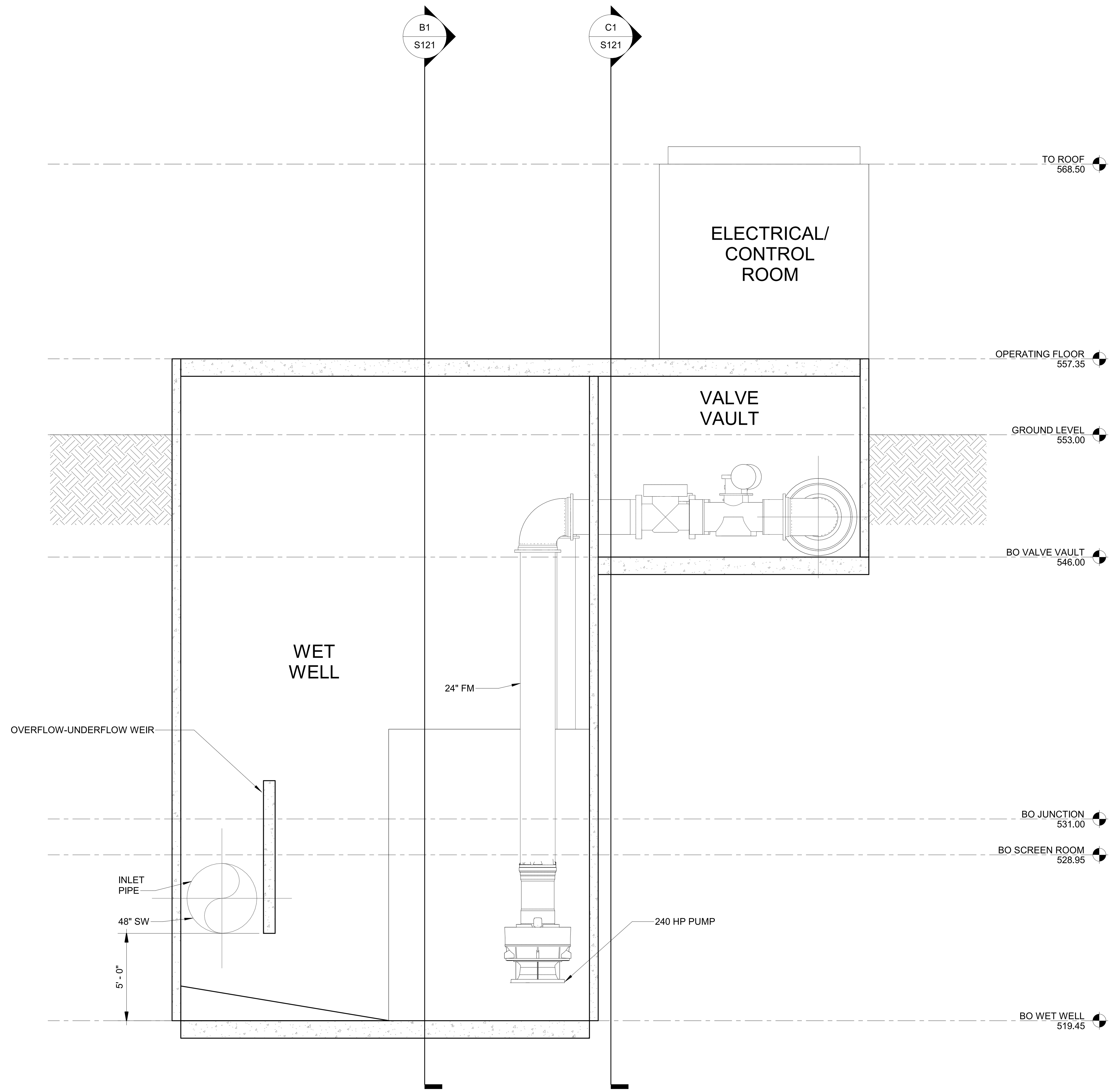


FIGURE 4-3

STORMWATER PUMP STATION SECTION

CADD 04-R3

Stanley Consultants INC.

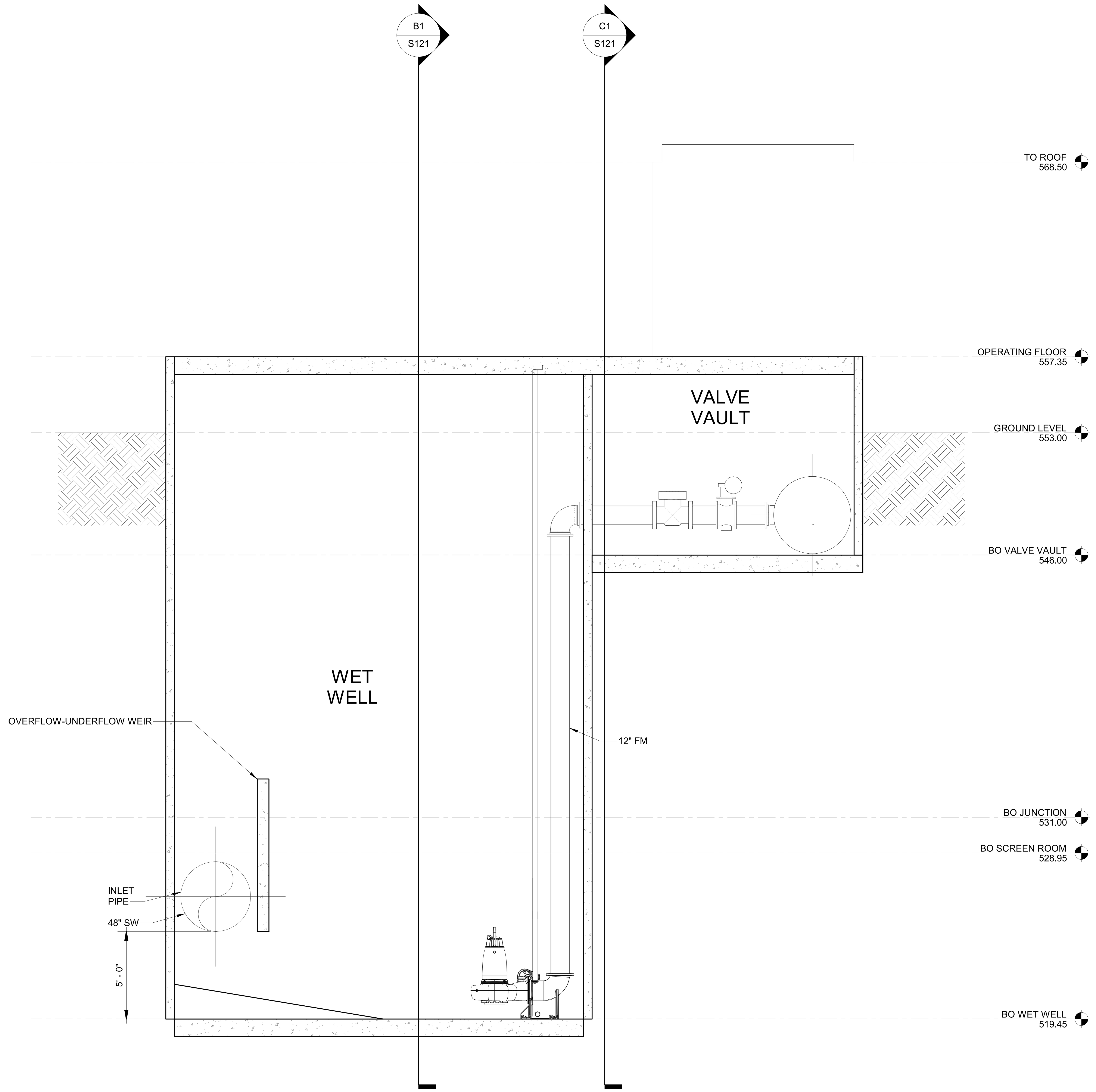
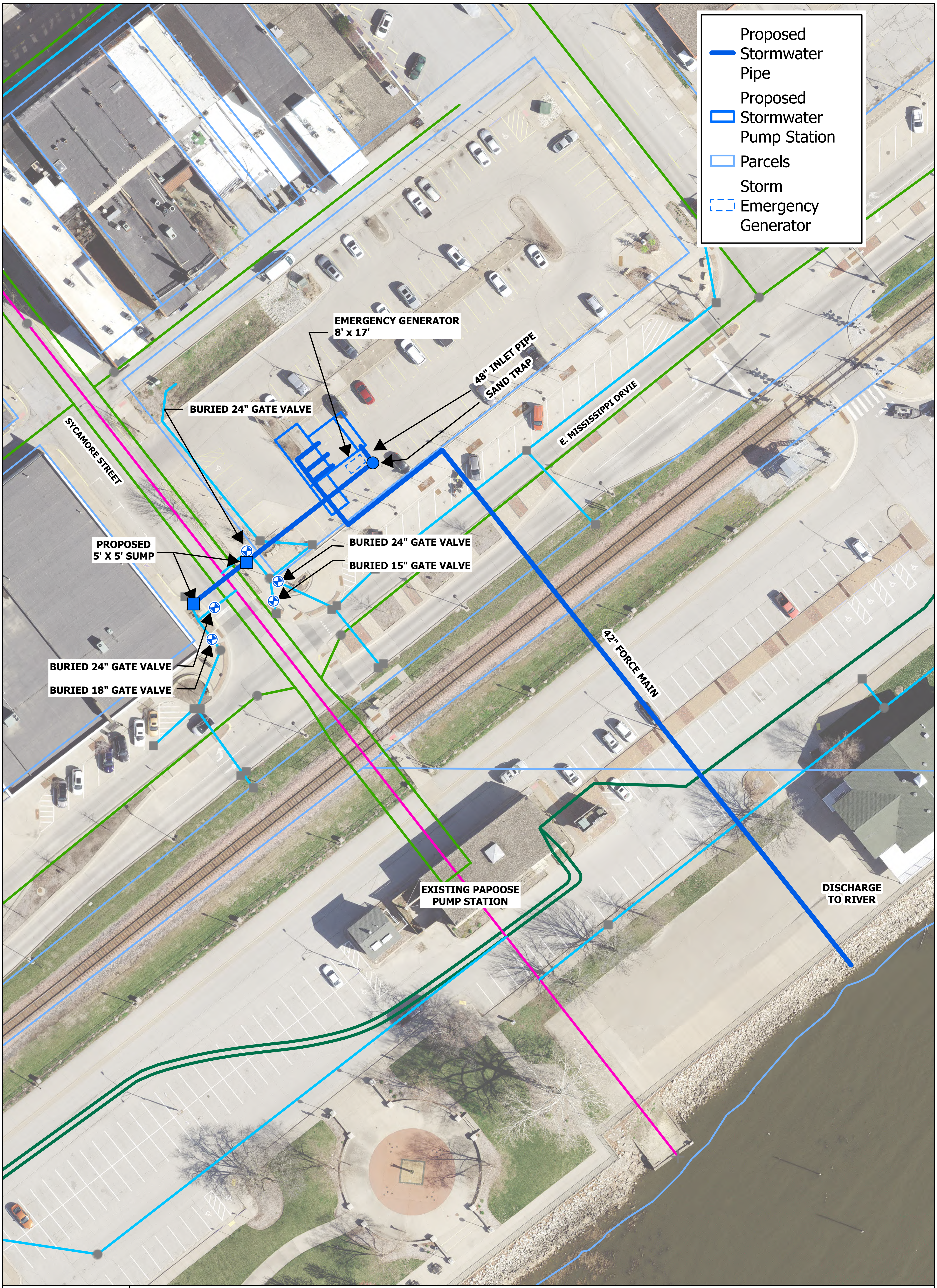


FIGURE 4-4

STORMWATER PUMP STATION SECTION

CADD 04-R3

The proposed stormwater pump station would be in the parking lot along Sycamore Street and Mississippi Drive as shown in Figure 4-5. This preferred location is near the lowest elevation point in the downtown area to which water drains. This location is also north of the temporary floodwall that the City installs along Mississippi Drive when the Mississippi River floods, allowing the pump station to be accessed during flooding conditions. To convey surface runoff to the pump station, additional storm sewer piping and inlets will be needed along Sycamore Street. Additional analysis will be needed to determine this conveyance system design. In addition to storm sewer, shutoff valves should also be placed in the manholes shown in Figure 4-5, to isolate the system south of the temporary flood wall.



Stanley Consultants

PapooseCreekFieldData.aprx

MUSCATINE PAPOOSE CREEK PUMP STUDY

PROPOSED STORMWATER PUMP STATION

FIGURE 4-5

N

0 12.5 25 50 US Feet

4.1.2 Architectural

Possible exterior material options for a new pump station structure include precast concrete structural panels with insulation and air space, masonry, metal panels and glass panels.

The roof structure will be precast panels with an EPDM roofing system with tapered insulation and roof drainage with scuppers and downspouts.

The architectural styling and materials should be selected for compatibility with the overall historic downtown Second Street district.

4.1.3 Structural

The valve vault and wet well will be cast-in-place reinforced concrete structures. The walls will be mostly below grade and will be supported on mat slab foundations. The top slabs will be above grade. The building structure will be above grade, supported by shallow concrete foundations, unless geotechnical investigation determines that piles are required. The building structure (load-bearing elements and roof) will be a durable material, such as precast concrete, cast-in-place concrete or CMU.

4.1.4 Mechanical

Mechanical systems serving the new pump station dry well and wet well will consist of exhaust fans, makeup air unit(s) and electric unit heaters. NFPA 820 required air change rates will be provided for a partially below grade stormwater pumping station. Spaces will be considered unclassified or Class 1 / Division 2 and equipment will be rated according to the space it is serving.

4.1.5 Electrical

Electrical systems serving the new pump station will be provided in an electrical room sealed off from any Class 1 Div 2 spaces to keep the electrical systems from being required to be designed for a classified space. The electrical system will provide a new MCC, 480V Panel, step-down transformer, and 120/208V Panel. Lighting and receptacle layouts will also be provided. Any conduits leaving the electrical room will include seal offs to be rated for the classified areas. A backup generator will be provided to provide power to the pumps during power outages. A utility service location will have to be identified during design.

4.1.6 Instrumentation and Control

The instrumentation and control system for the Papoose Pump Station will include a local control panel designed in consideration of existing City utility control system infrastructure and Supervisory Control and Data Acquisition (SCADA) network architecture. Existing fiber optic cable to the site will be reused.

Major components include a programmable logic controller (PLC) control panel with a touchscreen human machine interface (HMI), radar level transmitter, float switches (backup control), pressure transmitter and gauges, and a magnetic flow meter.

Major components of the pump station control system include:

- Lift stations will be designed for unmanned, autonomous operation. Monitoring and control logic will be programmed in the local, main PLC.
- Standard remote monitoring (typical of all City lift stations) will be included in the design.
- Remote control from City SCADA fiber optic network will include setpoint adjustment and fault reset.

4.2 Permanent Stormwater Pump Station – Model Results

The stormwater pump station was modeled using PC SWMM to review the impacts on flooding in the downtown area compared to existing conditions without the pump station. Figure 4-6 shows the PC SWMM model links and nodes. The nodes denoted with an "S" are street junctions. Existing conditions represent the system when the catch basins on the intersection of Sycamore Street and Mississippi Drive are typically plugged during flood-fighting, and the temporary flood wall is installed. The portable pumps the City currently uses to address flooding were not modeled. The model was run for the 5-, 10-, 25-, 50-, and 100-year events and the following results were observed.

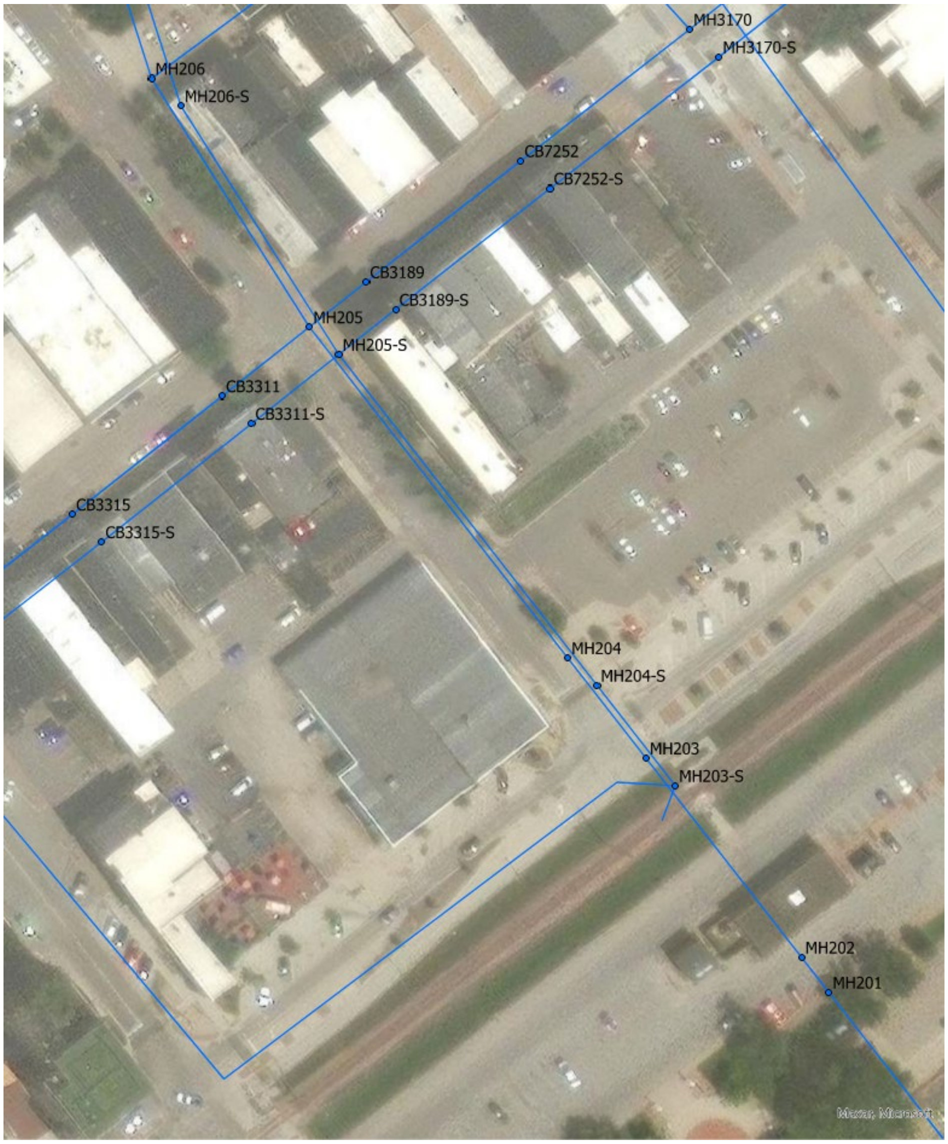


Figure 4-6: PC SWMM Links and Nodes

For the 5- and 10-year storm events, street flooding was decreased with the addition of the pump station as seen in Table 4-2 and Table 4-3. Flooding occurs when the water depth on the street exceeds 0.44 feet (5.3 inches), which is the maximum depth associated with the allowable spread and curb height. The flooding on Sycamore Street was reduced to less than 2 hours for both storm events. Additional storm sewer needed to convey water to the pump station was not modeled and could have an impact on the duration and depth of street flooding.

Table 4-2: Summary of Flooding for the 5-Year Event

Street	Link (inlet node – outlet node)	Existing Conditions		Proposed Conditions	
		Time Flooding (hours)	Max Depth (ft)	Time Flooding (hours)	Max Depth (ft)
Sycamore Street	MH205-S - MH204-S	38	0.92	0.45	0.86
Sycamore Street	MH204-S - MH203-S	39.86	1.2	1.2	1.02
Sycamore Street	MH203-S - STREET_OUTFLOW	41.12	1.2	0.44	1.08

Source: Stanley Consultants, Inc.

Table 4-3: Summary of Flooding for the 10-Year Event

Street	Link (inlet node – outlet node)	Existing Conditions		Proposed Conditions	
		Time Flooding (hours)	Max Depth (ft)	Time Flooding (hours)	Max Depth (ft)
Sycamore Street	MH205-S - MH204-S	38.5	0.94	0.47	0.87
Sycamore Street	MH204-S - MH203-S	41.45	1.2	1.2	0.91
Sycamore Street	MH203-S - STREET_OUTFLOW	40	1.2	0.53	0.77
Second Street	CB3311-S - MH205-S	0.38	0.63	0.6	0.63

Source: Stanley Consultants, Inc.

For the 25-year through the 100-year storm events, similar results to the 5-year and 10-year events were found regarding flooding and street flow. There is a significant reduction in street flooding as shown in Table 4-4 for the 100-year event. The most severe flooding in the downtown area, at the intersection of Sycamore Street and Mississippi Drive, was addressed within 4 hours of the peak.

Table 4-4: Summary of Flooding for the 100-Year Event

Street	Link (inlet node – outlet node)	Existing Conditions		Proposed Conditions	
		Time Flooding (hours)	Max Depth (ft)	Time Flooding (hours)	Max Depth (ft)
Sycamore Street	MH205-S - MH204-S	40.63	1.02	0.9	1.02
Sycamore Street	MH204-S - MH203-S	38.78	1.2	3.5	1.2
Sycamore Street	MH203-S - STREET_OUTFLOW	43.26	1.2	1.03	1.2
Second Street	CB3315-S - CB3311-S	0.37	0.62	0.37	0.62
Second Street	CB3311-S - MH205-S	0.62	0.75	0.58	0.75
Second Street	CB3189-S - MH205-S	0.28	0.63	0.27	0.63

Source: Stanley Consultants, Inc.

Overall, the addition of a permanent stormwater pump station showed a significant decrease in street flooding in the downtown area for all storm events from the 5-year to the 100-year. Flow in the tunnel and downstream of the flood wall is not significantly impacted by the pump station.

4.3 Mobile Pumps

The purpose of this alternative is to facilitate the temporary pumping of storm and seep water that the City does during deployment of the temporary flood wall. The stormwater pipe network would be modified with valves or gates to isolate the piping south of the floodwall as in the permanent pump station alternative. This alternative provides permanent sumps or structures for temporary mobile pumps to be placed on the north side of the temporary floodwall to allow for pumping water over the floodwall. The sumps provide a means for pumping runoff that may be collected on Sycamore Street in the situation where a rain event occurs during a flood-fighting event. The sumps also provide a place for any leakage from the temporary floodwall to be collected and pumped away from the dry side of the wall.

Figure 4-5 shows the proposed upgrades to the storm sewer. The upgrades comprise of two new large sump structures located on the town side of the temporary floodwall which allows portable pumps to be easily installed and used. The two sump structures include shut-off gates and curb inlets on either side of Sycamore Street. The shutoff gates would be closed during normal non-flood conditions. When Mississippi River flood fighting is anticipated, the structure gates would be opened in preparation for pumping. To accommodate this configuration, curb inlets and additional conveyance down Sycamore Street will be needed to convey water to the sumps for pumping. Additional analysis is needed to size this upgraded conveyance if this alternative is selected.

It is also recommended to add shutoff gate valves in the manholes and on existing storm sewer piping shown in Figure 4-5 to isolate the piping that crosses the temporary flood wall to the PCS tunnel. This storm sewer conveys water from the flooded side of the temporary wall to the tunnel potentially causing more flooding in the downtown area. Placing shut off valves in the manholes will isolate the storm sewer south of the wall from the rest of the system (PCS and street intakes) during flooding conditions. Additional storm sewer and shutoff valve will also be needed connecting the inlets from the parking lot east of Sycamore Street to the new sump structures. With the new pipe shutoff valves disconnecting the storm sewer south of the floodwall from the rest of the system, these inlets on the town side of the floodwall would also be isolated. A storm sewer pipe connecting the new town side inlets to the sump during flooding conditions will resolve the issue.

Section 5 Sanitary Analysis

This sanitary system analysis reviews the peak flows to Papoose Creek Pump Station and determines if the interceptors and wet well are adequately sized for the design peak flow. During heavy rain events, the City's sewer system has experienced several backups and surcharging of sanitary manholes upstream of Papoose Creek Pump Station at Mississippi Drive and East 2nd Street.

Various references were reviewed to determine peak design flow conditions in each interceptor. The City's 2000 draft West Hill Sewer Separation Master Plan by Rob McDonald, Assistant City Engineer, provided peak flow calculations of the collection system contributing to Papoose Creek Sewer. In the 2000 report, sanitary flows were calculated by counting the current number of households in the sewer shed plus estimated future households, using 3.1 persons per house, and an average dry weather sewage flow rate of 100 gallons/day/capita multiplied by a peaking factor of 3.0. The inflow and infiltration allowance was 60,000 gallons/day/sewer mile.

In 2010, Stanley Consultants completed the West Hill Area Sewer Separation Concept Design report focused on planning for separating sewers upstream of the Papoose Creek Pump Station and calculating sanitary sewage flows contributing to the West Side Interceptor. The 2010 report used the same design criteria as the 2000 report but with a higher peaking factor of 4.0 and included an allowance of 300 gallons per day per business. After the 2010 report, a series of construction projects were executed to separate the West Hill combined sewers. Construction of the West Hill Sewer Separation program began in 2011 and will continue until 2028. The West Hill sewer record drawings and design flows were consulted as part of this analysis.

5.1 East Side Interceptor Sewer

The East Side Interceptor Sewer receives sanitary flow from residential areas and a food manufacturing plant, Kraft Heinz. Kraft Heinz flow enters the East Side Interceptor via the Isett Avenue Pump Station. Isett Avenue Pump Station force main connects into the East Side Interceptor Sewer at the intersection of East 10th and Cedar Street at MH 4321. Isett Avenue Pump Station typically uses one pump with a capacity of 3,900 gpm (8.69 cfs) to convey collected flows. The original Isett Avenue Pump Station design capacity is 14.4 mgd (22.3 cfs). The East Side Interceptor Sewer consists of 24-inch, 30-inch, and 36-inch pipe segments.

At the Papoose Creek Pump Station, a 35-feet segment of 36-inch pipe discharges to the wet well. The 30-inch segment extends from the 36-inch pipe at the Papoose Creek Pump Station to the intersection of East 8th and Cedar streets where the interceptor changes to a 24-inch pipe. The East Side Interceptor Sewer is located inside of PCS from the Papoose Creek Pump Station to East 4th Street and Cedar Street.

For this analysis, a peak flow of 10.5 cfs is used to analyze the 30-inch pipe's capacity. An additional 0.38 cfs from the service line along Mississippi Drive contributes to the East Side Interceptor Sewer. A total peak flow of 10.88 cfs is used to analyze the 36-inch pipe's capacity.

The interceptor was first evaluated under free flow conditions, assuming that the wet well water elevation is below the invert of the 36-inch discharge pipe at 534.62 feet. The analysis indicates that the 36-inch pipe runs about 26 percent full with a velocity of 7.61 ft/s. The analysis indicates that the 30-inch pipe runs 36 percent full with a velocity of 6.51 ft/s.

The interceptors usually do not have free flow conditions into the Papoose Creek Pump Station wet well. The first pump does not turn ON until wet well levels reach 538.22 feet causing the sanitary interceptors to be fully submerged with a discharge water depth of 3.6 feet. Analysis shows that the 30-inch pipe at peak flow surcharges at Mississippi Drive and is 77 percent full between 2nd and 3rd Street.

When the second pump turns ON, the interceptor has a discharge water depth of 5 feet. Under this condition, the 30-inch pipe is under slightly higher surcharge conditions at Mississippi Drive, but between 2nd and 3rd Street the 30-inch is still 77 percent full. Surcharge conditions at Mississippi Drive do not exceed manhole rim elevation for either scenario.

The computed capacity of the 30-inch East Side Interceptor Sewer with an average slope of 0.67 percent is 22 MGD(34 cfs).

5.2 West Side Interceptor Sewer

The West Side Interceptor receives sanitary flow from a West Hill basin residential area that extends from Sycamore Street west to Kindler Avenue. A peak flow of 13.14 cfs is used to analyze capacity of the 24-inch West Side Interceptor Sewer. The analysis indicates that under free flow conditions the 24-inch pipe runs about 58 percent full with a velocity of 6.93 ft/s. This is based on the wet well water elevation below 534.62 feet.

When the first pump turns ON, the West Side Interceptor Sewer has a discharge water depth of 3.6 feet, and the 24-inch pipe is 100 percent full between 2nd and 3rd Street. When the second pump turns ON, the interceptor pipe has a discharge water depth of 5 feet, and the 24-inch pipe is under surcharge conditions. Surcharge conditions do not exceed manhole rim elevations in Mississippi Drive for either scenario.

The reported capacity of the 24-inch West Side Interceptor Sewer with an average slope of 0.67 percent is 12.2 mgd (18.9 cfs).

5.3 Interceptor Rehabilitation

Both interceptors are aging and are in deteriorated condition. The interceptor pipes internal to PCS have an asphalt interior liner that has been sloughing off, flowing downstream, and depositing at the Papoose Creek Pump Station bar screen. The extent of interceptor pipe deterioration is unknown. The steel interceptors are concrete encased inside the bottom of Papoose Creek tunnel on each side with limited access provided for pipe televising to observe pipe condition. Access to the internal West Side Interceptor Sewer can be through MH 8800 on the external interceptor in Sycamore Street near City Hall. The next surface access point is over 750-feet away at the Papoose Creek Pump Station. External access to the East Side Interceptor is at East 4th Street and Cedar Street via MH 6903 with the next access point over 1,350 feet away at Papoose Creek Pump Station. The distance between access points and pipe flow conditions make televising the interceptors nearly impossible.

Interceptor repair or replacement alternatives were evaluated and are summarized as follows:

One interceptor rehabilitation alternative is to construct access points and reline the interceptors. Access manholes along the interceptors could be installed by cutting through the tunnel and concrete encasement to tee into the pipe with a bolted blind flanged connection. These access points would allow a contractor to internally line the interceptors. The interior of the pipe would be scoured clean and stripped of the asphalt lining before the cure-in-place lining is installed. The City has reservations about lining the interceptors because a contractor would have to work in a confined space and bypass pumping is required while the lining work occurs. The interceptor lining is anticipated to extend internal interceptor life by 50 years.

A second interceptor alternative is to abandon the interceptors inside the tunnel and install new piping external to the tunnel conceptually described as follows:

Space is available west of the tunnel along Sycamore Street between Mississippi Drive and 2nd Street to open-cut install a new replacement sewer between the tunnel and the buildings on the west side of the street.

Figure 5-1: Rerouting of West Interceptor

The tunnel runs underneath a building foundation at 2nd and Sycamore streets, making it infeasible to install a new replacement sewer next to the tunnel on the east. The tunnel is also situated closer to the buildings on the east side of Sycamore Street, preventing open-cut trench installation without impacting the tunnel structure.

One alignment option for the East Side Interceptor Sewer replacement is to continue running sewer down Cedar Street from 4th Street to East Mississippi Drive. Figure 5-2 illustrates the rerouting of the East Side Interceptor Sewer in orange.

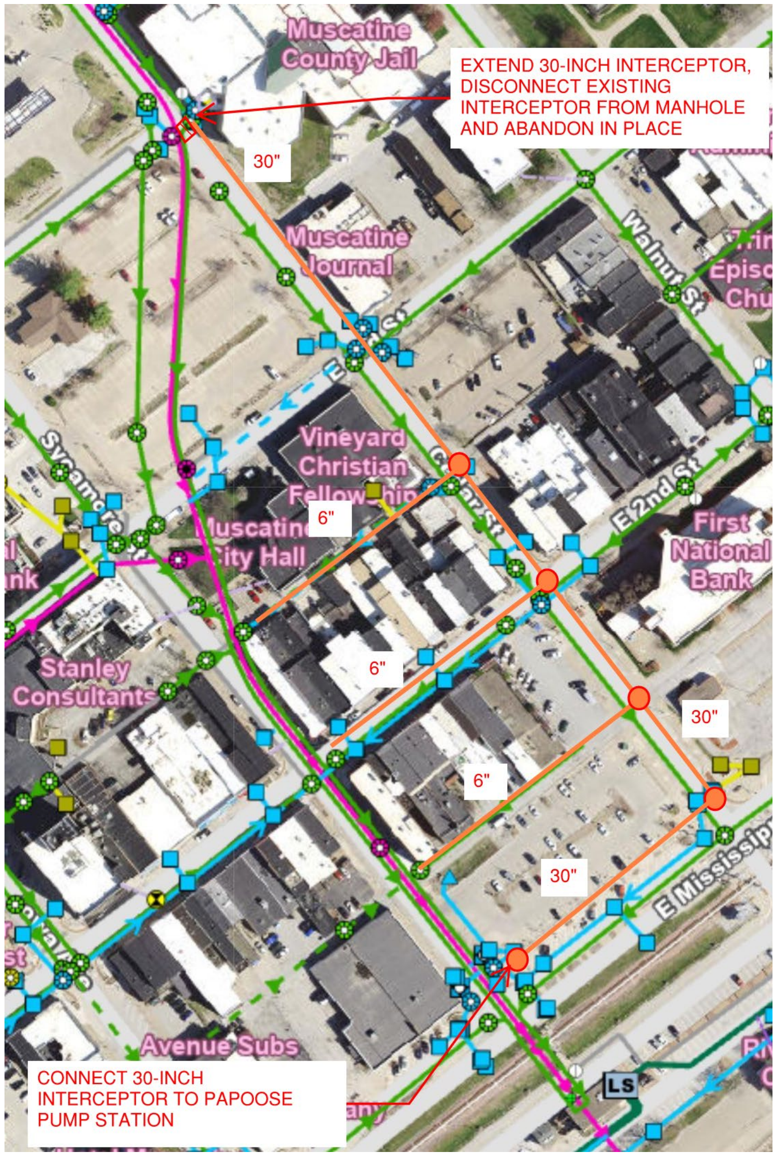


Figure 5-2: New Alignment for East Side Interceptor

The East Side Interceptor would run under the sidewalk along East Mississippi Drive from Cedar Street to Sycamore Street to avoid replacing the pavement and landscaped median installed in 2018. The flow would combine with the sanitary flow from the 12-inch sewer running under Mississippi Drive before being conveyed to Papoose Pump Station. The new East Interceptor alignment would require rerouting the 6-inch sewer lines that service 2nd Street, Alley #1 and Alley #2.

To avoid costly rerouting of the sanitary laterals, the east interceptor inside the tunnel could still be used to house a smaller pipe. The installation would be much simpler and faster than a cure-in-place liner. Figure 5-3 illustrates the rerouting of the West Side Interceptor Sewer in orange and the access point locations to slip line a new 12-inch pipe inside the East Side Interceptor Sewer to only serve the downtown area.

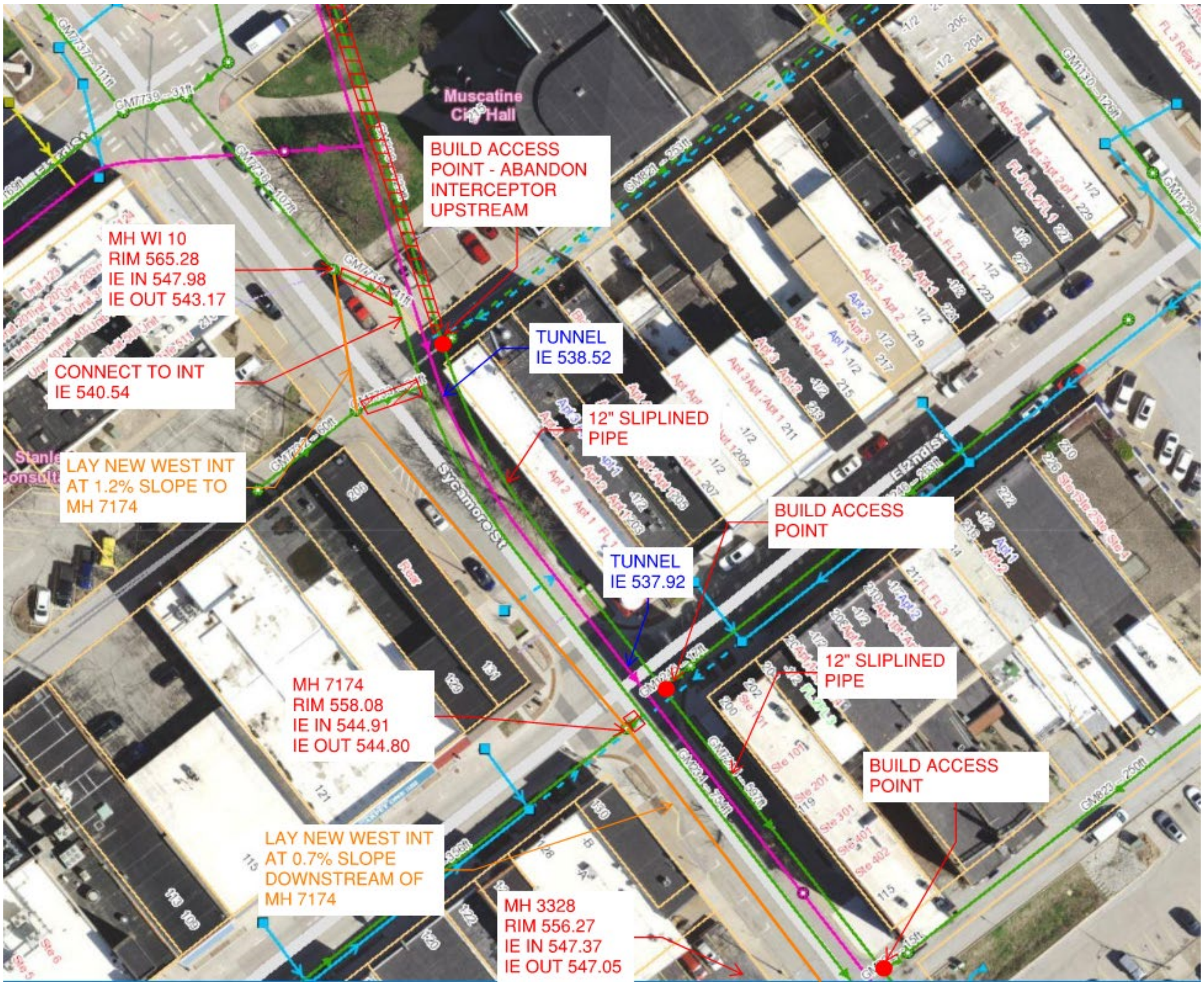


Figure 5-3: Rerouting of Sanitary Interceptors

The new West Side Interceptor Sewer would pick up the laterals on 2nd Street, E. Mississippi Drive and the alleys. Existing service laterals interior to the tunnel connecting to the existing interceptor would require interception outside the tunnel on the west side. The sewer lateral connections would be plugged at the tunnel.

The new west and east interceptors would extend to the pump station, leaving the existing interceptors to either be abandoned in place or removed. The 12-inch slip lined pipe would combine with the rerouted East Side Interceptor. If the new pump station is located to the east of Papoose Creek Tunnel, the west interceptor would need to run underneath the tunnel to reach the new pump station. The opposite is true if the new pump station is located to the west of the tunnel. Both interceptors would combine before reaching the new pump station. If the existing pump station remains in operation, both interceptors will either continue outside of the tunnel and be jack and bored under the railroad tracks, or the interceptors could enter inside the tunnel before crossing the railroad tracks, replacing the existing interceptors from E. Mississippi Drive to the existing pump station.

5.4 Papoose Pump Station Analysis

5.4.1 Wet Well

The pump arrangement consists of one 2,800 gallon per minute (gpm) pump and two 8,600 gpm pumps. The 8,600 gpm pumps only discharge 5,850 gpm due to the downstream force main hydraulics. A review of the wet well volume indicates that it is adequately sized for operation of the 2,800 gpm pump, but the wet well is undersized for the large pumps. Historically, the pump station used the combined sewer tunnel as part of the wet well storage. The two pumps operate when wet well levels are between 8 feet deep and 3.8 feet deep. Operation points cannot be raised to increase the working volume because the two interceptors already surcharge under normal operating levels. The only way that the volume of the wet well can increase without impacting upstream sewer capacity is by increasing the wet well footprint.

5.4.2 Force Main Hydraulics

The flow through the Papoose force main was analyzed to understand the system's total dynamic head and compare to the pumps' rated head. Two force mains exit the Papoose Creek Pump Station. On one segment of force main, a short segment of 16-inch exits the station before turning into 24-inch pipe. The Papoose force main consists of dual 24-inch-high density polyethylene pipe (HDPE) DR11 pipes (ID 19.63-inch). At Oregon Street near Musser Park, the two pipes connect into a single 24-inch HDPE DR17 pipe (ID 21.01-inch) that runs 1,000 feet, followed by a single 26-inch HDPE DR17 pipe (ID 22.76-inch) that runs another 1,000 feet to the WRRF. In 2017 – 2018, the segment from Oregon Street to the Water and Resource Recovery facility (WRRF) was rehabilitated with a smaller HDPE liner.

Six pump stations, including Papoose, either have a direct connection to the east side or west side gravity interceptors or they feed into a force main that connects into the two gravity interceptors:

- Canon Avenue Pump Station
- Mad Creek Pump Station
- Papoose Creek Pump Station
- Hershey Avenue Pump Station
- Bond Street Pump Station
- Schley Avenue Pump Station

Figure 5-4 illustrates how all the pump stations are connected.

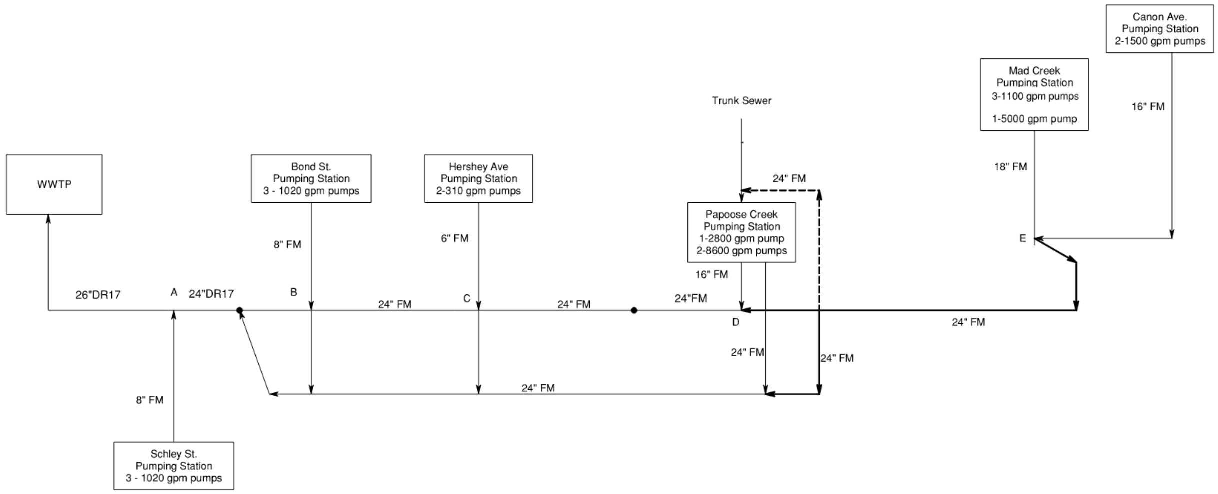


Figure 5-4: Papoose Force Main Schematic

Papoose Creek, Mad Creek, and Hershey Avenue pump stations are located near Mississippi Drive. Canon Avenue Pump Station is at the intersection of Canon Avenue and River Road. Canon and Mad Creek pump stations receive sanitary flows from the Mad Creek basin. Canon pumps into Mad Creek's 24-inch force main. The Mad Creek force main connects into Papoose Creek's 16-inch and 24-inch force mains. The piping configuration also allows for Mad Creek and Canon Pump Station flows to divert to the Papoose Creek wet well if Mad Creek pumps cannot overcome the force main pressure. The Hershey Avenue Pump Station connects directly to each of the two 24-inch force mains.

The Bond Street Pump Station is on Bond Street and the eastern tip of Muscatine Slough. The Bond Pump Station force main connects directly to the two 24-inch force mains. The two 24-inch force mains combine into a single force main. The single force main was originally a 30-inch ductile iron pipe but was lined with a 24-inch and 26-inch HDPE DR 17 pipe repairing the broken 30-inch pipe.

The Schley Avenue Pump Station is at the intersection of Schley Avenue and Nebraska Street. The Schley Avenue Pump Station connects to the single 24-inch force main at the intersection of Nebraska Street and Birch Drive. The City has plans to construct two new force mains on a different alignment, replacing the repaired segment to provide full force main redundancy to the WRRF.

Table 5-1 presents the rated total pumping capacity for each of the pump stations.

Table 5-1: Rated Pumping Capacity for Each Pump Station

Pump Station	Pump Capacity [gpm]	Number of Pumps	Head [ft]	Total Capacity [gpm]	Comments
Papoose Creek	2,800	1	70	2,800	
Papoose Creek	8,600	2	72	8,600	Operating at ~68% (5,850 gpm, 33 feet TDH)

Pump Station	Pump Capacity [gpm]	Number of Pumps	Head [ft]	Total Capacity [gpm]	Comments
Canon Avenue	1,500	2	95	1,500	-
Mad Creek	1,100	3	135	2,200	1-5,000 gpm pump for wet weather flow but does not operate.
Hershey Avenue	310	2	69	310	-
Bond Street	1,020	3	40	1,020	Force main is too small. Pumps do not pump at rated capacity (actual may be closer to ~800 gpm)
Schley Avenue	1,020	3	40	1,020	Force main is too small. Pumps do not pump at rated capacity (actual may be closer to ~800 gpm)

A hydraulic spreadsheet analysis tool was updated from a previous study to reflect current hydraulic conditions and to evaluate conditions with new dual force mains. All flow running through the single 24-inch force main results in high velocities and high head loss. High head loss can cause the pumps to run at reduced capacity or run off their curve and exceed their shutoff head. Various flow conditions were evaluated to understand how the pumps at each pump station would operate. The results show that:

- All pump stations at full capacity have trouble operating together at once except for Mad Creek Pump Station.
- If all pump stations are at full capacity, except Papoose Pump Station only has the small pump running, all pumps can operate but at reduced capacity except Bond and Schley.
- If the small and large pumps at Papoose Pump Station are the only pumps operating, they both cannot pump at their rated capacity.
- If one pump at Canon, two pumps at Mad Creek, and the two pumps at Papoose are operating at the same time, the large and small pumps at Papoose cannot operate at the same time.
- Bond and Schley pump stations typically run at reduced capacity when other stations are not pumping into the combined force main. If Papoose, Canon and Mad Creek are pumping Bond and Schley cannot operate.

The 24-inch HDPE pipe lining of the 30-inch DI pipe as emergency repair work creates additional headloss that reduces the output from the Papoose Pump Station large pump. The condition worsens when other pump stations are discharging at the same time, contributing additional head loss to the force mains.

5.4.3 Historic Manhole Surcharging

The reduced pumping capacity at Papoose Creek Pump Station can result in water levels in the wet well to rise. The sanitary manhole on Mississippi Drive connected to the west interceptor, MH 2986, has occasionally surcharged. The cause of this occurrence is due to high sanitary wet well levels raising the hydraulic grade line within the east and west interceptors. MH 2986 has one of the lowest rim elevations along Mississippi Drive at 551.91 feet. Hydraulic modeling results show 12 inches of head loss between the wet well and MH2986 causing the hydraulic grade line to reach the manhole rim elevation when the wet well water level reaches 550.16 feet (20.54 feet deep). If papoose pumps cannot keep up with the influent flow, and the sluice gate is not open to the Papoose Creek Pump Station diversion chamber to relieve the wet well, the wet well water level will continue to rise until water finds pressure relief at the rim of MH2986.

Another manhole that has seen surcharged conditions is MH 9950, connected to the east interceptor along Mississippi Drive. Rim elevation of MH 9950 is 552.56 feet. Hydraulic model results show that when the wet well water level reaches 550.16 feet (20.54 feet deep), the hydraulic grade line at MH9950 is 551.18 feet. The manhole does not surcharge; however, the east interceptor is surcharged and may cause basement backups if service lines are directly connected to the interceptor. The hydraulic grade line will reach the rim elevation of MH9950 when the wet well level rises to 551.54 feet (21.92 feet deep).

5.4.3.1 Historical Rain Event

A 2.4-inch rain event occurred on May 20, 2025, that caused enough flow to Papoose Creek Pump Station that two pumps could not keep up with the influent flow. The wet well level rose to 22 feet deep and three manholes on Mississippi Drive surcharged, causing the manhole rims to blow off (Figure 5-5):

- MH 9970 at Walnut St. and Mississippi Drive (Rim 551.56 ft)
- MH 9950 at Sycamore St. and Mississippi Drive (Rim 552.56 ft)
- MH 2986 at Sycamore St. and Mississippi Drive (Rim 551.91 ft)

Figure 5-5: Manhole Surcharge Locations

The rain event caused sanitary sewer backups along East and West Mississippi Drive, Sycamore Street, and East 2nd Street. The wet well level would most likely have risen higher than 22 feet but there is an 18-inch x 18-inch opening in the wall that allows water to pass between the wet well and the Papoose Pump Station diversion chamber at 22 feet. For this rain event, the opening served as an emergency bypass for the wet well.

The Mississippi River elevation was below normal water level at 538.35 feet (MSL 1912). Assuming that the head loss in Papoose Creek Sewer is 12 inches higher at Mississippi Drive than at the river, the water depth in Papoose Creek Sewer was less than four feet deep. The sluice gate between the sanitary wet well and Papoose Creek Sewer was in the closed position, so no stormwater from Papoose Creek Sewer contributed to the total flow to the wet well.

Level measurements at Mad Creek, Canon, and Hershey indicate that all three pump stations were running simultaneously with Papoose Creek Pump Station.

5.5 Proposed Pump Size and Configuration

5.5.1 Sanitary Sewer Model

A sanitary sewer hydraulic trunk sewer model was utilized to determine design flows for Papoose Creek Pump Station sanitary pump sizing. The peak sanitary interceptor flows from the past studies are the peak flows from each branch sewer added together in a row to estimate the peak flow downstream. East interceptor flow estimate is 10.88 cfs and the west interceptor flow estimate is 13.14 cfs for a total sanitary flow of 24.02 cfs to Papoose Creek Pump Station. Flow meter data within the collection system or at the pump station is not available to validate calculated flows with actual flows. This analysis uses the calculated peak flows for each branch as inputs into a hydraulic model to mimic the flow path through the collection system and incorporate a flow attenuation in the pipe network. Utilizing a hydraulic model, the computed peak flow on the downstream end at the Pump Station will be less than totaling the branch sewer peak flows.

A skeleton of the sanitary sewer interceptors was modeled using SewerCAD encompassing the Lower West Branch Sewer, the Upper West Branch Sewer, and the Mulberry Avenue sewer. Where the flow for one of these points was greater than 1 cfs, the mainline branching off the trunk line was developed, and the total flow to that point was then divided equally along the branch manholes. For the 2nd Street branch, however, due to its proximity to the lift station, flow was divided proportionally among the nodes instead, using the McDonald report estimates as a reference. The model represents all the sewer separation that has been completed to date.

For each peak flow input into the model, a typical residential diurnal curve reflecting higher daily flows in the morning and in the late afternoon was used. Flows are lowest in the early morning hours.

For the Isett Avenue Pump Station that contributes to the East Interceptor Sewer at 10th Street and Cedar Street, a flow pattern was developed based off data from the pump station. This flow pattern shows the pump turning on for 15 minutes and turning off for 15 minutes. This pattern is continuous for over 24 hours.

The Papoose Pump Station discharge force main is not modeled in SewerCAD. The pump station discharge is shown as pumping to an outfall, so that the hydraulic conditions in the wet well do not affect the hydraulics upstream in the interceptors.

The model calculated the flow entering the wet well over a wet weather 24-hour period.

Below is a hydrograph illustrating the 24-hr flow pattern entering Papoose Creek Pump Station (Figure 5-6). The hydrograph follows the diurnal pattern implemented at each point source but accounting for a lag time. The pumping activity from Isett Avenue Pump Station also blends with the diurnal flow from the residential areas.

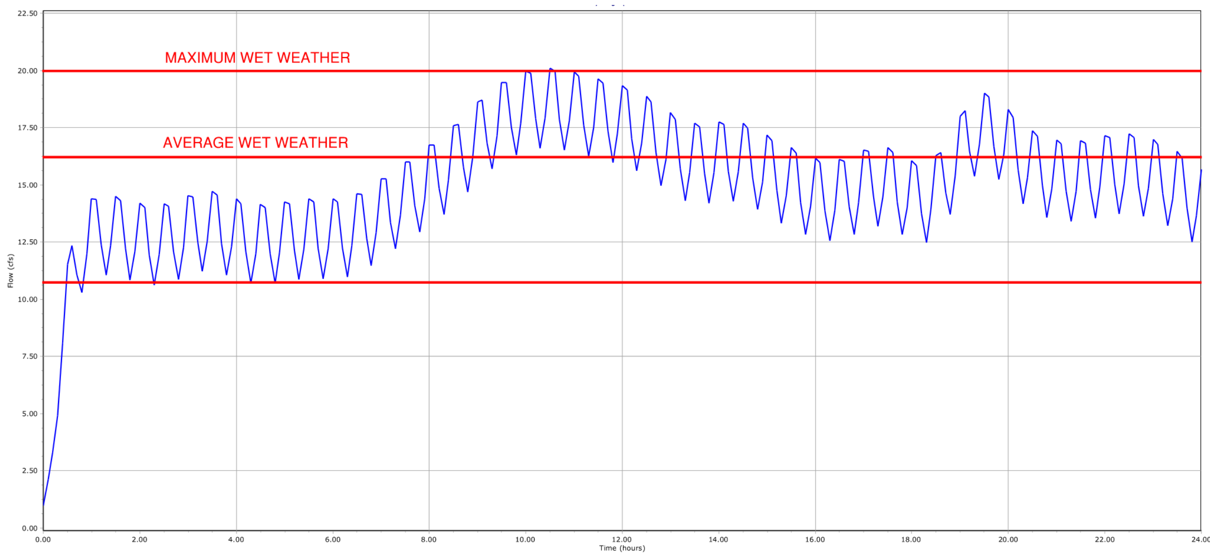


Figure 5-6: 24-Hour Plow Pattern Entering Papoose Pump Station

The model results show a peak flow into the wet well of 19.95 cfs, which is lower than the previously estimated flow of 24.02 cfs from prior studies. Isett Avenue Pump Station causes a flow variation of about 4 cfs. Accounting for the peak flow with Isett pumps on and the low flow with Isett pumps off, the average wet weather flow with Isett pumps on is approximately 16 cfs. Dry weather conditions can be estimated by dividing modeled values by 3. Table 5-2 presents dry and wet weather flow estimates to Papoose Creek Pump Station.

Table 5-2: Flow Estimates to Papoose Creek Pump Station

	Flow (cfs)	Flow (gpm)
Maximum Wet Weather	20.0	8,968
Average Wet Weather	16.1	7,212
Average Flow	5.4	2,401
Dry Weather Flow	3.5	1,570

Source: Stanley Consultants, Inc.

The pump station design capacity should be 9,000 gpm. Pumps will run on VDFs to turn down and meet at least average flow conditions.

Pumps should be designed to handle two different conditions: dry weather conditions with only Papoose Creek Pump Station operating and wet weather conditions with all pump stations operating. To meet conditions where only Papoose Creek Pump Station is contributing flows to the force main, the pumps need to produce a head of 58 feet at maximum flow. To meet conditions when all pump stations are contributing flows to the force main, the pumps need to produce a head of 99 feet at maximum flow.

5.5.2 Pump Configuration

Multiple pump configurations were reviewed to optimize efficiency including: three pumps with one small and two big, four-pumps of equal size, and three-pumps of equal size. The basis of pump selection is from Flygt pumps.

Under the one small pump and two large pump configuration, the small pump would act as a low flow pump for the dry weather flows and the large pump would handle the wet weather flow. The low flow pump would have a 2,800 gpm capacity and the large pumps would have a 6,200 gpm capacity. This is a similar pump configuration to the existing pump station. However, there is not a low flow pump available that can maintain the desired flow at the high head conditions needed. The head demand is too much for the low flow pump to overcome and it would not be productive when run in the high head scenario. The only viable option to provide full redundancy is to have a stand-alone low-flow pump rated for 2,800 gpm and 25 feet TDH and two pumps rated at 9,000 gpm and 99 feet TDH. The combined pump motor horsepower would be 845 hp. Other pump configurations can provide lower combined horsepower to reduce capital cost.

A four-pump configuration requires three 3,000 gpm pumps to run in parallel to achieve 9,000 gpm at 99 feet TDH. The system curve is relatively steep, so finding pumps that can all operate along the system curve efficiently is difficult. Putting more pumps online can push the operating point further left of the best efficiency point (BEP) resulting in the third pump not being very efficient. If a pump is selected closer to the BEP, the first pump in the system can have severe cavitation issues running too far right on the curve.

A three- pump configuration using 4,500 gpm pumps can achieve the maximum flow at high head conditions and achieve the turn down required for the low-flow condition. Table 5-3 presents the preliminary pump selection for a three-pump configuration.

Table 5-3: Pump Selection for Three-Pump Configuration

Flygt Pump Model	NT/NP 3306-745-670
Discharge size, inch	12
Impeller Diameter, mm	440
Horsepower	215
Flow @ 60 Hz, gpm (2 pumps)	9138
Pump Efficiency @ 60 Hz	76%
Flow @ 32 Hz, gpm (1 pump)	2800
Pump Efficiency @ 32 Hz	78%

Source: Stanley Consultants

Two 4,500 gpm pumps can operate in parallel to achieve 9,000 gpm at 99 feet TDH. For 9,000 gpm at 58 ft TDH, the two pumps can run in parallel at 48-50 Hz which is right on the BEP shown on the performance curve in Appendix A. One pump can turn down to 2,800 gpm at 32 Hz to meet dry weather conditions. The three-pump configuration is recommended as the preferred configuration.

Section 6 Sanitary Pump Station Alternatives

Two sanitary pump station alternatives were developed to meet the City's safety concerns and to improve pump performance and reliability during wet weather events. The first alternative is to modify the existing pump station. A majority of the City's concerns with the existing pump station can be rectified with limitations. However, the existing structure is in the regulated floodway. The City will have to continue to boat or wade out into the Mississippi River to maintain pumps during a flood event. The second alternative is to build a brand-new pump station north of the railroad tracks and Mississippi Drive outside of the regulated floodway.

6.1 Pump Station Renovation

Figures 6-1 through 6-4 illustrate the major modifications needed to meet safety standards and bring the facility up to building code.

6.1.1 Process Mechanical

Within the Papoose Creek Sewer Tunnel / pump station stormwater diversion chamber, the sump will be filled with concrete so the invert elevation of the tunnel is flush with the flap gate outlets. Eliminating the sump will facilitate sweeping sediment out through the flap gates rather than being captured in the diversion chamber. The sluice gate between the diversion chamber and the wastewater influent channel will be replaced with a smaller gate raised above the new floor elevation. This modification gives the City the option to bleed stormwater into the wastewater stream to improve treatment performance at the plant.

A second mechanical bar screening will be added in the wet well. The bar screen has a channel width of 6 feet. The new bar screen width is restricted to 4 feet because of the concrete beams running underneath the bar screen room. A multi-rake screen would be a good fit as it is robust and it removes large amounts of debris with continuous screening. Both screens will have a wash press that will dewater the screenings and dispose of them in a dumpster. The dumpster will be a bagged system to allow easy removal for maintenance staff.

The wet well will be expanded to the north underneath the riverfront parking lot to increase volume. Ideally, the wet well storage volume would be increased by allowing a greater operating depth. However, the current depth already causes tailwater conditions on the East and West Side Interceptors and increasing the wet well operating depth would increase the risk of surcharging and basement flooding upstream. Making the wet well longer will cause solids to settle. A mixer could be installed in the wet well addition to keep solids in suspension. The wet well will likely need to be cleaned periodically and consideration needs to be given to providing isolation chambers to facilitate the cleaning.

The three shafted pumps will be replaced with three 4,500 gpm dry-pit submersible pumps. Pumps will operate on VFDs. A 36-inch x 48-inch access hatch will be cut above each pump to lift the pumps out of the dry well for servicing. All piping within the dry well will be replaced except for the bypass piping back to the wet well. All 16-inch piping that is connected to the Mad Creek force main within the Papoose Creek Pump Station will be increased to 24-inch to reduce hydraulic bottlenecking.

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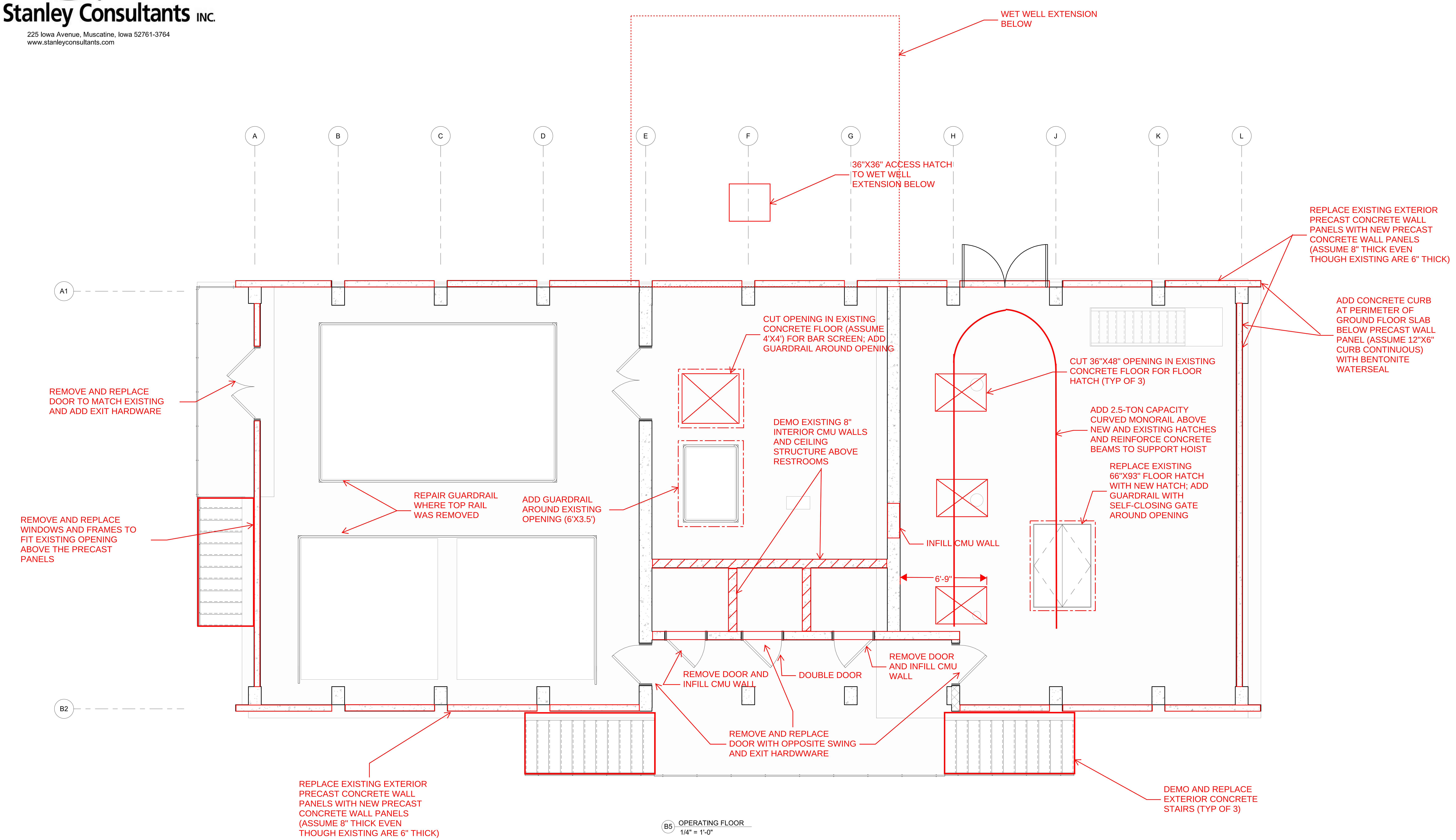

AT FULL SIZE

0 1 2 3 IN

0 1 2 3 4 5 6 7 8 cm

EXISTING PAPOOSE PUMP STATION
PROPOSED MODIFICATIONS

FIGURE 6-1

CADD 03-R4

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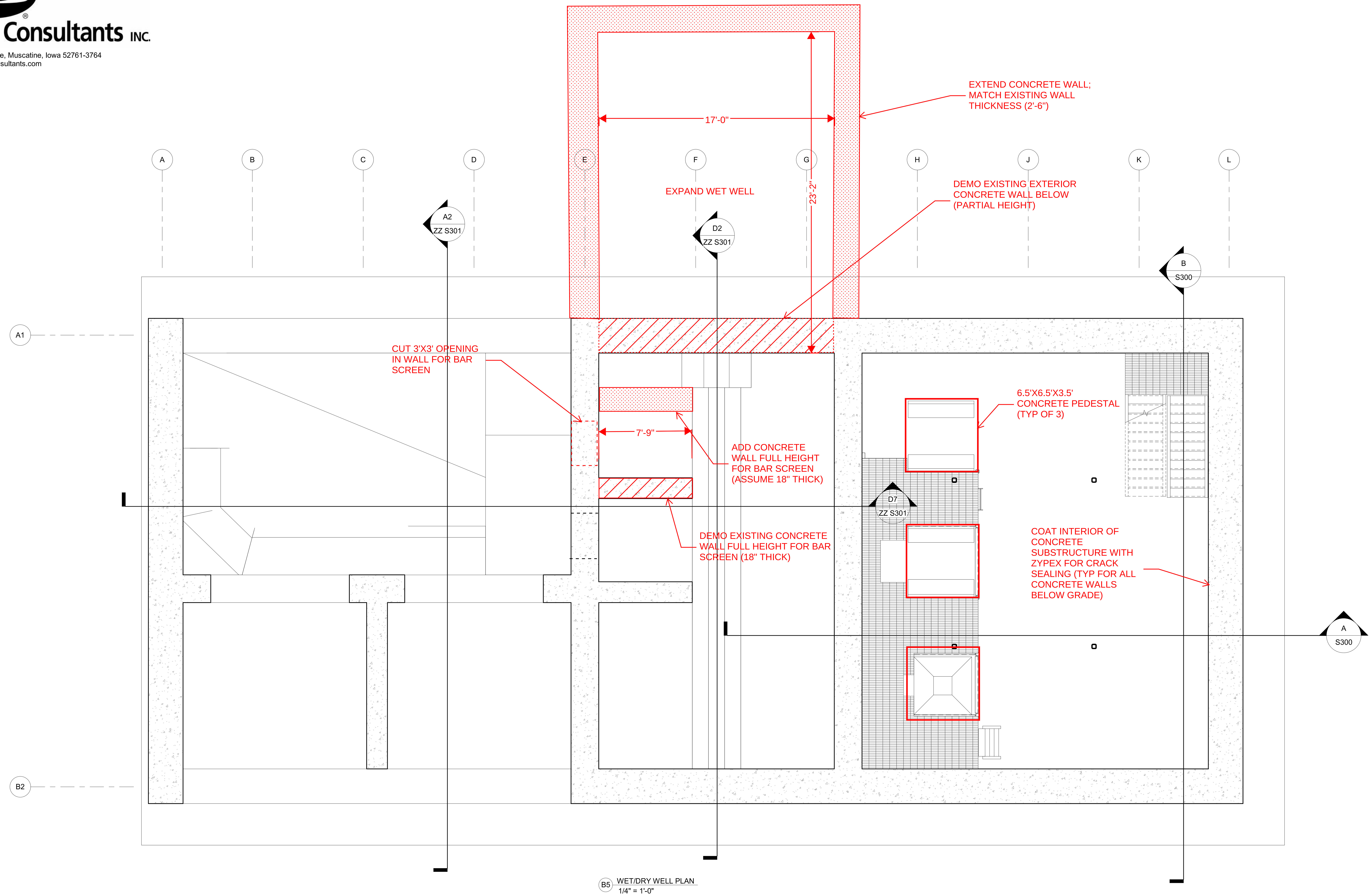

AT FULL SIZE
0 1 2 3 IN
0 1 2 3 4 5 6 7 8 cm

EXISTING PAPOOSE PUMP STATION
PROPOSED MODIFICATIONS

FIGURE 6-2

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AT FULL SIZE
0 1 2 3 IN
0 1 2 3 4 5 6 7 8 cm

EXISTING PAPOOSE PUMP STATION
PROPOSED MODIFICATIONS

FIGURE 6-3

EXISTING PAPOOSE PUMP STATION
PROPOSED MODIFICATIONS

FIGURE 6-4

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6.1.2 Architectural

The pump station facility needs to be further reviewed as to how to repair the building. The precast curtainwall panels will be replaced. Options are to replace panels with similar precast panels but add insulation to the panels to increase the energy efficiency of the building. Other options are insulated metal panels or translucent panels that will increase energy efficiency and provide additional natural light into the structure. Doors will be replaced with new doors to meet ADA and International Building Code (IBC) exiting requirements. All guardrails will be replaced to meet code and improved fall protection. Roofing will be replaced and insulation added for improved energy efficiency and water infiltration. Exterior stairs and guard/ handrails will be replaced for improved safety and access to the structure.

6.1.3 Structural

The existing structural system (beams/columns/slabs) is in good/fair condition with no obvious deterioration and no major repairs planned. The structural modifications planned will include installing new openings in walls and slabs to accommodate the proposed gates and hatches, as well as the addition/removal of interior walls to accommodate the proposed process needs. The below-grade concrete wet well substructure will be extended to the north. The concrete walls and slabs for the extension will match the existing wall/slab thicknesses. The interior of the concrete substructure will be coated with Zypex for crack sealing. Dry-well walls may need additional crack repair to keep the dry-well dry during flood conditions.

A curved monorail hoist system will be supported from the existing roof structure in the Control Room for lifting of pumps from below. The existing concrete roof beams were not designed to support concentrated loads and will need to be strengthened to support the hoist load. Strengthening may include steel plates wrapping the existing beams, or extensions of the existing beams with additional concrete. Use of the hoist will be limited to when the roof is unloaded (no live load or snow load). The new pumps will have new concrete pedestals. The existing floor hatch in the Control Room will be replaced and fall protection will be added around it. Fall protection will also be added to the existing floor opening in the Bar Screen Room. A concrete curb can be added to the operating floor level at the perimeter of the building to raise the flood protection elevation if desired.

An exterior generator will be supported on raised concrete pedestals and will have a raised steel platform with stairs for access.

6.1.4 Mechanical

The mechanical systems serving the pump station do not meet the latest NFPA code requirements. The renovation will include upgrades to both the dry well and wet well spaces within the building. The dry well and wet well will both be provided with properly sized supply and exhaust fans to meet the minimum code required air changes. The dry well will be provided with supplemental electric unit heaters to keep the space above freezing during the winter months. Similarly, the wet well will require heating, likely in the form of a natural gas fired makeup air unit due to a larger airflow requirement.

6.1.5 Electrical

The electrical room has a doorway into the bar screen room that was added after initial construction. This doorway opens up the electrical room to a classified space which is not compatible with electrical equipment. The new design would isolate the electrical room from the Class 1 Div 1 area. The MCC is beyond its serviceable life. The new design would place a new MCC ~4 feet in front of the existing. A new service to the MCC will be run in parallel to the existing MCC to allow for transitioning the existing loads to the new MCC with minimal disruption to the pumping operation. New lighting, receptacles, HVAC power, and emergency egress lighting will be provided with the electrical design. A hazardous design shall be provided between the electrical room and hazardous areas. This will include seal-offs and hazardous-rated boxes and connections.

6.1.6 Instrumentation & Control

The Papoose Pump Station will have a local control panel that will be designed to work with the City's current control system and SCADA network. Existing fiber optic cable to the site will be reused.

Major components include PLC control panel with touchscreen HMI, radar level transmitter, float switches (backup control), pressure transmitter and gauges, and a magnetic flow meter.

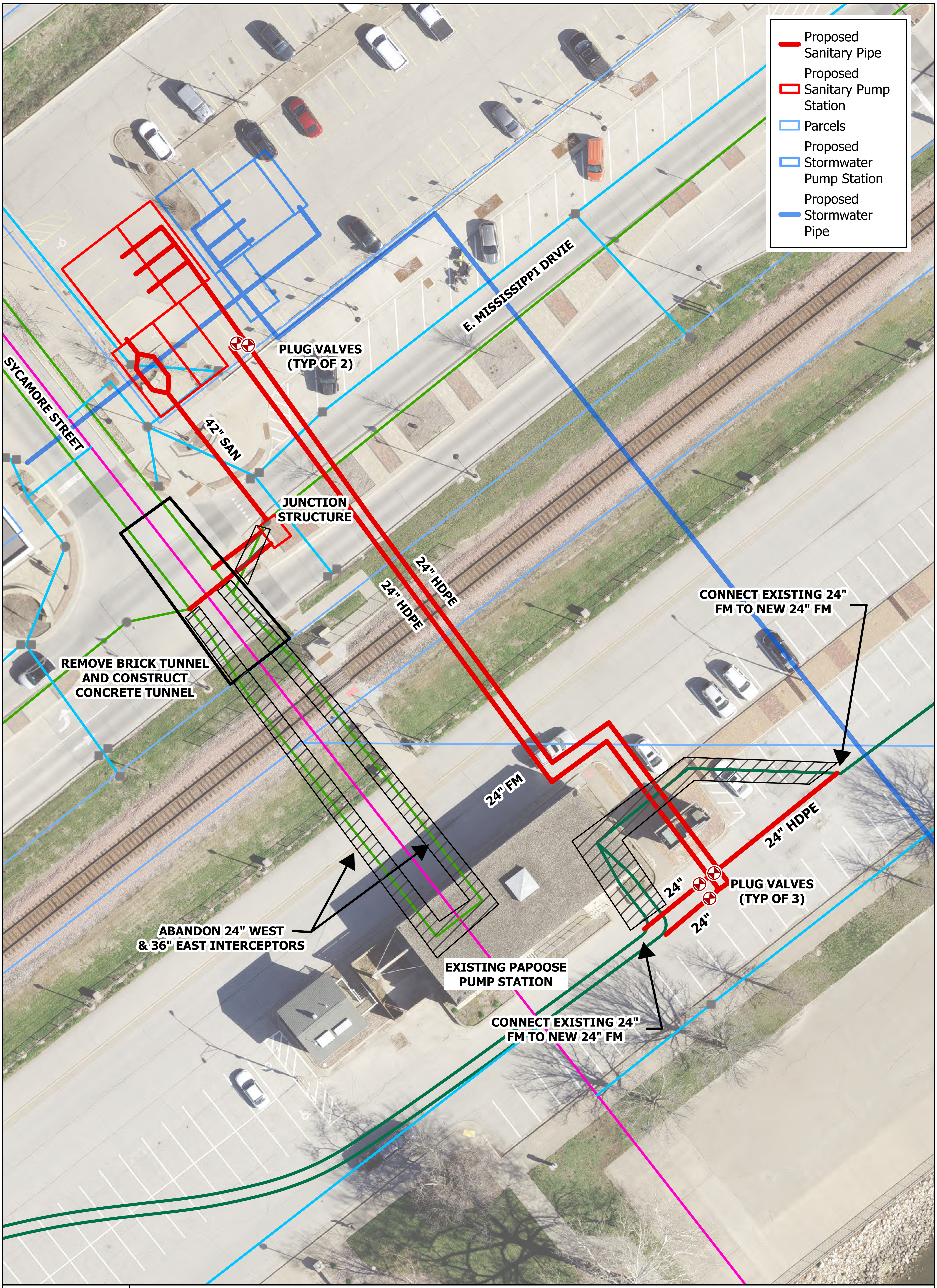
Major components of the pump station control narrative include:

- Pump station will be designed for unmanned, autonomous operation. Monitoring and control logic will be programmed in the local, main PLC.
- Standard remote monitoring (typical of all City pump stations) will be included in the design.
- Remote control from City SCADA fiber optic network will include setpoint adjustment and fault reset.

6.2 New Sanitary Pump Station

Building a new sanitary pump station will allow the City to locate the structure outside of the floodway. For the study, the new pump station is located in the city parking lot across the railroad tracks and Mississippi Drive from the existing pump station but the location is flexible. Figure 6-5 shows a proposed site location for the new sanitary pump station. If the stormwater pump station were also to be built, the stormwater structure would be positioned to the east of the sanitary pump station.

With the new sanitary pump station on the east side of Papoose Creek Sewer (PCS) tunnel, the West Interceptor Sewer will need to run under the PCS tunnel to connect to a new pump station. The tunnel rests on piles that are staggered every couple of feet. Getting the interceptor underneath the tunnel would require the tunnel to be opened and the piles to be cut down. Modifying the brick arch tunnel risks lose of its structural integrity. An alternative option would be to build a new concrete structure in place of the brick arch in the location of the interceptor sewer crossing. The tunnel is a 12-foot by 15-foot brick arch along Sycamore Street up until the railroad property line where it transitions to an 8-foot high by 24-foot-wide concrete box tunnel. The concrete tunnel can extend upstream through East Mississippi Drive to accommodate the interceptor crossing. The last of the sewer services tie into the interceptors at this intersection and extending the concrete tunnel will only require one tie-in back into the brick arch sewer. A new junction structure will be placed in the median of East Mississippi Drive to combine flows from the East and West Interceptor Sewers, and the 12-inch sanitary sewer running west down E. Mississippi Drive. Figures 6-6 through 6-8 illustrate the concept design for the new sanitary pump station.



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PapooseCreekFieldData.aprx

MUSCATINE PAPOOSE CREEK PUMP STUDY

PROPOSED SANITARY PUMP STATION

FIGURE 6-5

FIGURE 6-6

SANITARY PUMP STATION PLAN

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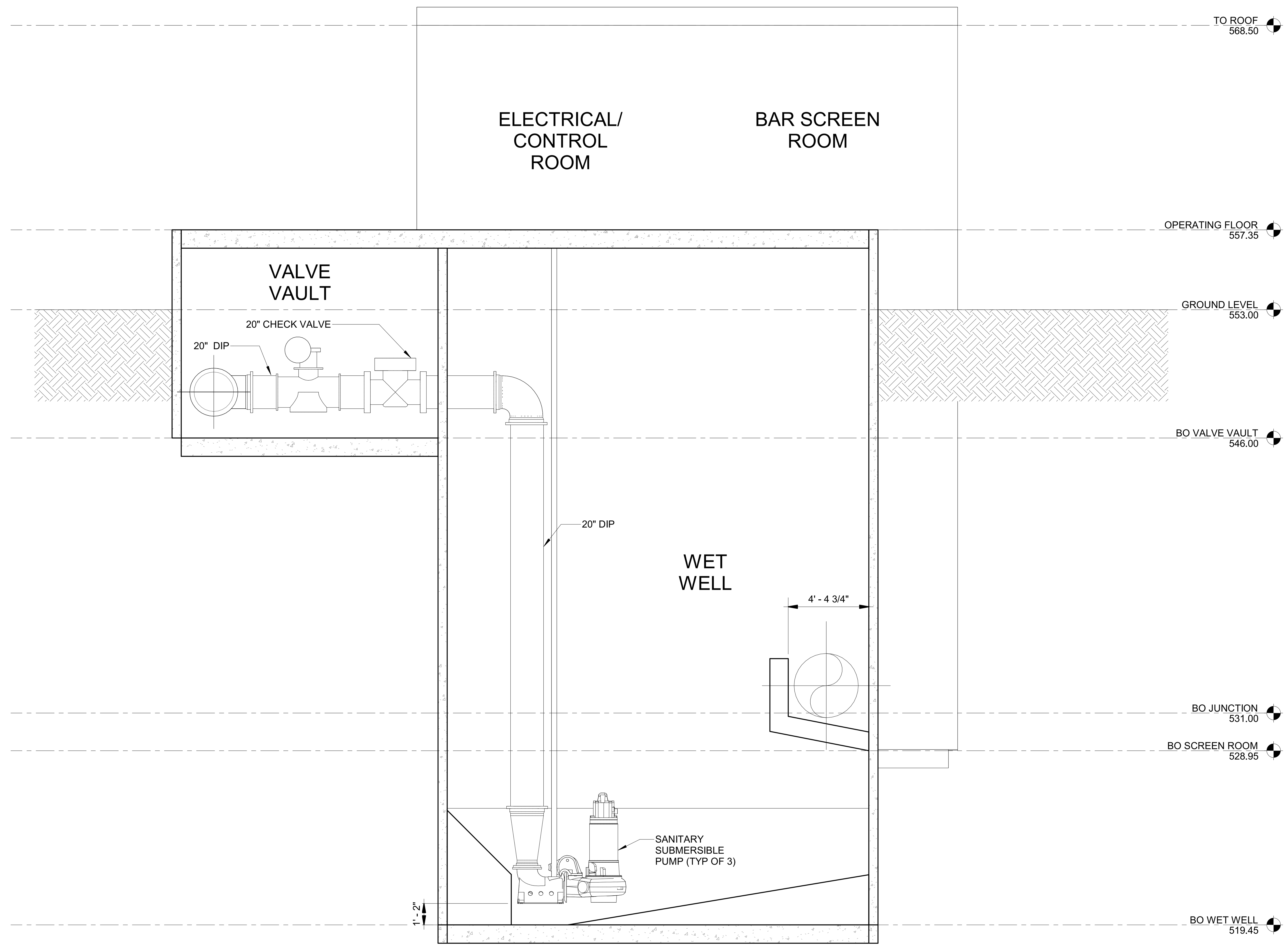

FIGURE 6-7

SANITARY PUMP STATION SECTION

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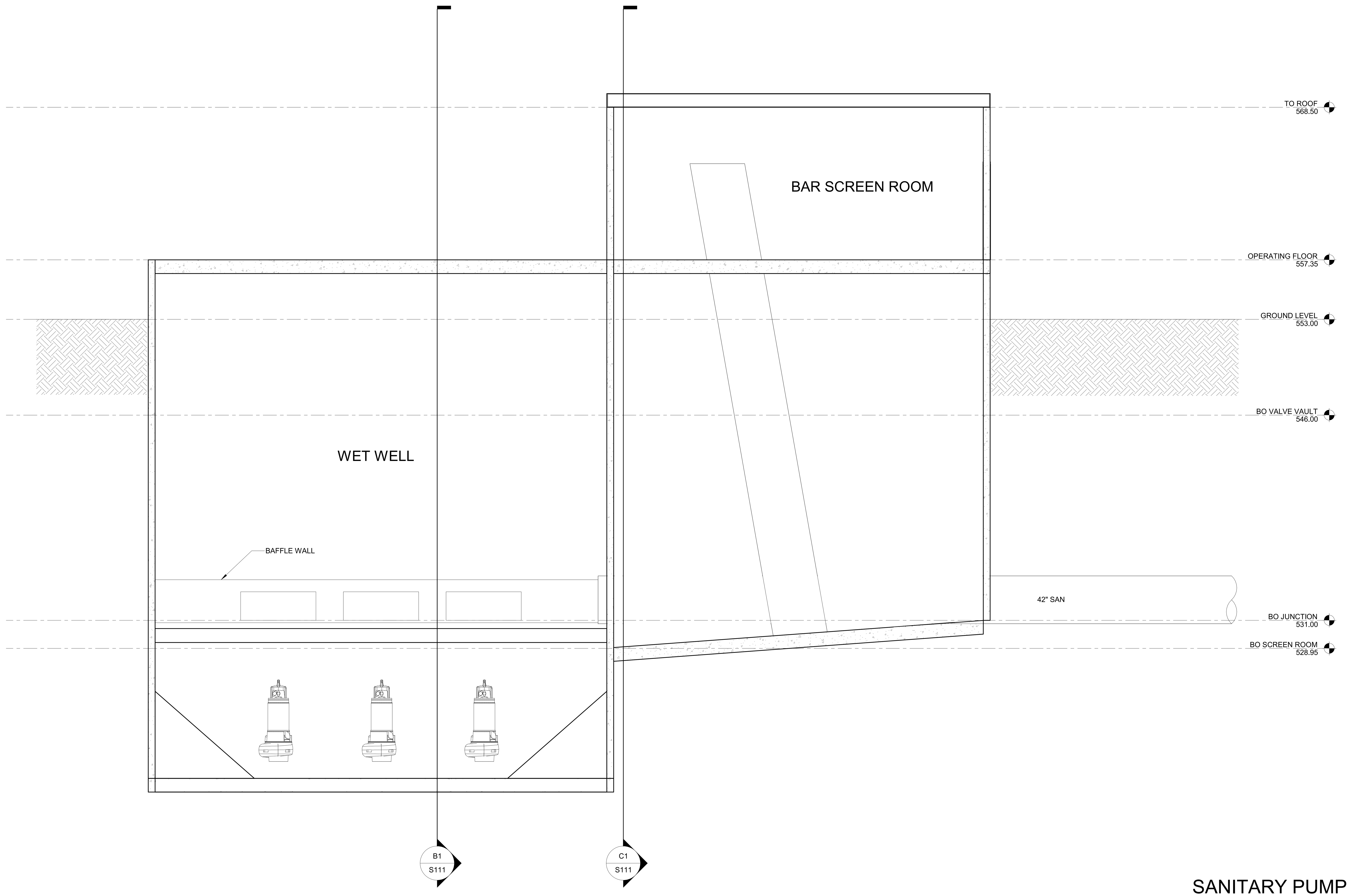


FIGURE 6-8

SANITARY PUMP STATION SECTION

CADD 04-R3

6.2.1 Process Mechanical

A single gravity main will flow into the bar screen room that will house two mechanical bar screens with wash presses for complete redundancy. The bar screen room is roughly 18 feet x 28 feet x 16 feet high. The screened wastewater will then flow to a wet well that is sized according to Hydraulic Institute standards. Overall wet well size is 24 feet x 34 feet x 34 feet deep. The screened wastewater will enter the wet well at a high level. The maximum water levels in the wet well are below the invert elevation of the screened effluent channel.

The wet well will have three 4,500 gpm submersible pumps. Pumps will operate on VFDs. The top of wet well (557.35) is shown 3.5 feet higher than the current ground elevation so that the structure is above the 1993 flood elevation (556.35, 1912 MSL). The wet well will have three 36-inch by 48-inch access hatches over the pumps to allow a crane to lift the pumps out of the wet well for servicing. Each pump discharge will have a dedicated plug valve and check valve that will combine into a 24-inch header located in a 15 feet x 34 feet valve vault. Valve vault height operating floor level will be the same as the wet well and have three access hatches for valve access and maintenance.

Dual 24-inch discharge force mains could run through the PCS tunnel underneath the railroad tracks to eliminate a new railroad pipe crossing. The abandoned east interceptor can be removed from PCS tunnel to avoid a reduction in stormwater capacity. However, construction sequencing may require that the force mains be jack and bored underneath the railroad tracks. The new 24-inch force mains will connect to the existing 24-inch Mad Creek force main and the dual 24-inch Papoose force mains on the riverfront. The dual Papoose force mains will each have a buried plug valve downstream of the connections as well as a third plug valve at the cross connection to allow one force main to be taken out of service or to direct Mad Creek flow through one or both force mains.

Odor control is not included in the cost estimate for the new sanitary pump station. The City may want odor control for this downtown pump station that receives odors industrial waste streams. Several styles of chemical scrubbers and activated carbon adsorbing technologies are available for odor control. Research shows that a filter media style vent scrubber may be a good solution as it is cost effective, easy to maintain, and has a small footprint. The scrubber is filled with a filter media, usually pellets made of various compounds, that can be attached to the end of a vent. The odorous air comes into the vent and through the scrubber where the media absorbs unpleasant smelling chemicals like hydrogen sulfide (H_2S). The air leaves the scrubber and goes out into the atmosphere. Generally, these scrubbers require minimal upkeep besides occasionally removing and replacing old filter media. Instead of a passive air system, an active, powered vent system with a vent scrubber and a makeup air pipe can be installed. An active system can be just as effective or more effective than a passive system for removing odors from hydrogen sulfide, volatile organic compounds, fatty acids and organic solids. Odors are eliminated through an ozone system or hydroxyl radical technology. Power and water supplies are typically required for these systems.

6.2.2 Architectural

Possible exterior material options for a new pump station structure include precast concrete structural panels with insulation and air space, masonry, metal panels and glass panels.

The roof structure will be precast panels with an Ethylene Propylene Diene Monomer (EPDM) roofing system with tapered insulation and roof drainage with scuppers and downspouts.

6.2.3 Structural

The valve vault, wet well and bar screen structures will be cast-in-place reinforced concrete structures. The walls will be mostly below grade and will be supported on mat slab foundations. The top slabs will be above grade. The building will be partially supported on the bar screen structure, and partially supported on shallow concrete foundations, unless it is determined that piles are required. The two portions of the building will need to be separated by an expansion joint due to the different foundations. The building structure (load-bearing elements and roof) will be a durable material, such as precast concrete, cast-in-place concrete or CMU. An exterior generator will be supported on raised concrete pedestals and will have a raised steel platform with stairs for access.

6.2.4 Mechanical

Mechanical systems serving the new pump station dry and wet wells will consist of exhaust fans, makeup air unit(s) and electric unit heaters. NFPA 820 required air change rates will be provided for a partially below-grade wastewater pumping station. Spaces will be considered unclassified or Class 1 / Division 2 and equipment will be rated according to the space it is serving.

6.2.5 Electrical

The electrical systems that power the new pump station will be in a room that is not connected to the Class 1 Div 2 spaces. This will keep the electrical systems from needing to be designed for a classified space. The electrical system will provide a new motor control center (MCC), 480V panel, step-down transformer, and 120/208V panel. Lighting and receptacle layouts will also be provided. Any conduits leaving the electrical room will include seal offs to be rated for the classified areas. A backup generator will be provided to provide power to the pumps during power outages and installed on a raised platform. A utility service location will have to be identified during design.

6.2.6 Instrumentation and Control

The Papoose Creek Pump Station will have a local control panel that will be designed to work with the City's current control system and SCADA network. Existing fiber optic cable to the site will be reused.

Major components include PLC control panel with touchscreen HMI, radar level transmitter, float switches (backup control), pressure transmitter and gauges, and a magnetic flow meter.

Major components of the pump station control narrative include:

- Pump stations will be designed for unmanned, autonomous operation. Monitoring and control logic will be programmed in the local, main PLC.
- Standard remote monitoring (typical of all City pump stations) will be included in the design.
- Remote control from City SCADA fiber optic network will include setpoint adjustment and fault reset.

Section 7 Cost Estimate

7.1 Cost Estimate

The cost estimates presented in this report are Stanley Consultants' opinion of probable construction costs (OPCC) based on study-level cost estimating that typically are within -20 and +25 percent of actual cost. Cost estimates are based on experience and represent our best judgment. Stanley Consultants has no control over cost of labor, materials, equipment, contractor methods, competitive bidding or market conditions. Therefore, we do not guarantee that proposals, bids, or actual construction costs will not vary from estimates of construction costs presented.

The construction cost estimates are presented in terms of 2025 dollars and based on the study level concepts available at this time. Actual cost will vary depending on what alternative is selected and designed and choices made as design progresses. As the timing of the construction is not firm, actual cost may vary with time due to inflation and bid climate factors.

The total construction costs also include construction contingency, market inflation, overhead and profit. Construction contingency markup is twenty percent. Market inflation is ten percent. Overhead and profit markup is fifteen percent and ten percent. Costs do not include engineering, legal, administration, or real property acquisition which would need to be added to determine probable project cost.

The OPCC for modifying the existing pump station is $6,060,000 and is presented in Table 7-1.

Table 7-1: OPCC for Modifying Papoose Pump Station

Item	Cost
General Site/Mobilization	$452,000
Demolition	$71,000
Structural/Architectural	$880,000
Process	$1,776,000
Electrical & Controls	$619,000
Mechanical	$35,000
Subtotal	$3,833,000
Contingency - 25%	$958,000
Contractor Overhead - 15%	$719,000
Contractor Profit - 10%	$550,000
Total Estimated Construction Cost	$6,060,000

The cost to modify Papoose Creek Pump Station includes:

- Replacement of three shafted pumps with three dry pit submersible pumps with associated piping and valves.
- Expansion of wet well.
- Addition of a second mechanical bar screen and washer compactor.
- Replacement of MCC, VFDs, exterior lighting, electrical service and controls.
- Addition of an emergency generator.
- Replacement of MAU and exhaust fans.
- Replacement of all doors, windows, roof, stairs and precast wall panels.
- Replacement of guardrails and floor hatches.
- Addition of monorail, structural beam support and pump hatches.
- Modifications to the stormwater diversion chamber.
- Keeping the pump station in operation during construction.

The OPCC for building a new sanitary pump station is $8,960,000 and is presented in Table 7-2.

Table 7-2: OPCC for New Sanitary Pump Station

Item	Cost
General Site/Mobilization	$525,000
Site Civil	$813,000
Structural/Architectural	$1,238,000
Process	$1,738,000
Electrical & Controls	$615,000
Mechanical	$22,000
Pump Station/Tunnel Modifications	$714,000
Total	$5,665,000
Contingency - 25%	$1,416,000
Contractor Overhead - 15%	$1,065,000
Contractor Profit - 10%	$814,000
Total Project Cost	$8,960,000

The cost of building a new sanitary pump station includes:

- Papoose tunnel modifications and junction structure.
- Bar screen room with two mechanical bar screens and two washer compactors.
- Wet well with three submersible pumps and pump hatches.
- Valve vault with associated piping, valves and hatches.
- Electrical equipment including MCC, VFDs, lighting, electrical service and controls.
- Emergency generator.
- MAU and exhaust fans.
- Modifications to the stormwater diversion chamber.
- Decommissioning of Papoose Pump Station.
- Dual 24-inch force mains from new sanitary pump station to riverfront with connections to existing force mains.

The OPCC for building a permanent stormwater pump station for local downtown drainage during river flood conditions is $7,250,000 and is presented in Table 7-3.

Table 7-3: OPCC for Stormwater Pump Station

Item	Cost
General Site/Mobilization	$410,000
Site Civil	$1,513,000
Structural/Architectural	$636,000
Process	$1,898,000
Electrical & Controls	$100,000
Mechanical	$30,000
Total	$4,587,000
Contingency - 25%	$1,145,000
Contractor Overhead - 15%	$859,000
Contractor Profit - 10%	$659,000
Total Project Cost	$7,250,000

The cost of building a stormwater pump station includes:

- Catchment and piping modifications at Sycamore and E. Mississippi Drive to convey runoff to the new pump station and isolate the local catchments from the Papoose tunnel.

- Adding catchments along Sycamore Street between E. 2nd Street and E. Mississippi Drive.
- Wet well with three submersible axial pumps and pump hatches.
- Valve vault with associated piping, valves and hatches.
- Electrical equipment including MCC, VFDs, lighting, electrical service and controls.
- Emergency generator.
- MAU and exhaust fans.
- 42-inch force main from new stormwater pump station to river including horizontal directional drilling under the railroad tracks.

The OPCC for modifying the existing catchments to accommodate two sumps is $750,000 and is presented in Table 7-4.

Table 7-4: OPCC for Portable Stormwater Pumping System

Item	Cost
General Site/Mobilization	$20,000
Site Civil	$456,000
Total	$476,000
Contingency - 25%	$118,000
Contractor Overhead - 15%	$88,000
Contractor Profit - 10%	$68,000
Total Project Cost	$750,000

The cost of modifying the local stormwater catchments to accommodate portable pumping includes:

- Two 5 feet x 5 feet x 6 feet deep sumps to house the portable pumps.
- Installation of five buried gate valves to isolate the local catchments from the Papoose tunnel.
- Catchment and piping modifications at Sycamore and E. Mississippi Drive to convey runoff to the two sumps.

The pump station OPCCs do not include costs for rehabilitation of the West and East Side Interceptors. Table 7-5 presents preliminary costs for realigning the East or West Side Interceptors as open cut method or slip lining a portion of the East Side Interceptor.

Table 7-5: Preliminary Cost Estimates for Interceptor Rehabilitation

Method	Preliminary Costs
12-inch Slip Lined Pipe	$130/LF
Realign East Interceptor	$330,000/block
Realign West Interceptor	$330,000

The slip lined cost includes inspection, rooting, and cleaning. Additional cost should be included for creating access points within the existing East Side Interceptor to pull the pipe. An access point would require removal of a portion of the concrete encasement and installation of a tee section. The tee section would have a bolted blind flange to allow access to the slip lined pipe in the future. The cost to realign the East Side Interceptor is per block and is based on the successful low bid for the Phase 6C West Hill combined sewer separation project which includes sewer installation and roadway restoration. Realigning the West Side Interceptor would only require a portion of the street to be removed and replaced and is expected to be approximately $330,000 for the two blocks.

Section 8 Conclusions and Recommendations

8.1 Sanitary Pump Station

The City's criteria for the new or modified pump station needs to address safety, be effective in meeting flow demands, and require lower maintenance. Modifying the existing pump station or building a new pump station will address these criteria.

The existing pump station is over 60 years old and much of the equipment is original and needs to be replaced. The safety report addresses many locations within the building that need to be updated to current code standards. Renovating the pump station can address most of these concerns, except for its location. The pump station is in the floodway and plant staff will still need to wade or boat through flood waters to reach the pump station for maintenance. The new pumps and wet well will be more effective in pumping dry weather and wet weather flow whether other pump stations are contributing to the main force or not. Pumps are sized to operate at their best efficiency point at all operating points. The modifications include wet well expansion to gain additional volume, but expansion was limited to pushing the wet well out further north. The wet well is longer, and the hydraulics are not ideal. The sump in the stormwater diversion chamber will be filled in to keep solids from depositing at the mouth of Papoose tunnel. Keeping the bottom level should keep solids moving through the diversion chamber and out through the new flap gates to the river. A second mechanical bar screen will provide redundancy so that flow can be diverted around a screen for maintenance.

The new sanitary pump station will address City concerns including the location being outside of the floodway. Building a new structure allows it to be designed with efficiency in mind instead of having to work within existing constraints. The wet well will be designed according to Hydraulic Institute standards to allow uniform laminar flow to the pump intake. The wet well will be deep enough to prevent the sanitary interceptors from experiencing surcharge conditions on a regular basis. The pumps will be submersible to avoid having to perform maintenance down in a dry pit. Pump hatches over each pump will allow crane access if one of the pumps needs to be removed. Most of the pump station will be below ground. The bar screen room and the electrical/control room will be the only enclosed buildings. The top of the wet well and the valve vault extend above the current ground elevation for flood protection. If the pump station were to be built in the parking lot, the parking lot could be raised up to meet the top of structure elevation. This would allow vehicles to drive over the valve vault and wet well and reduce the amount of parking lot space taken up by the pump station. The cost estimate for the design did not include raising the surrounding grade to the top of the wet well and valve vault. The Papoose Creek Sewer stormwater diversion chamber and flap gates on the riverfront will still need to be changed. This will still be part of the design even when building a new sanitary pump station to reduce sand buildup at the diversion chamber. location.

A sizable investment is needed in the existing pump station to bring the structure up to code and safety compliance. The building needs beam reinforcing to support a hoist for the new pumps and replacing the precast concrete wall panels and expanding the wet well are large cost items. Updating the pump station still does not eliminate the need for staff to enter flood waters if mechanical equipment needs maintenance. The cost estimate shows that renovating the existing 60+ year old pump station is 68 percent of the total estimated construction cost for a new pump station. Constructing a new sanitary pump stationflooding andmended option, providing the opportunity to optimize the sanitary pump station, eliminating the safety and access concerns during river flooding, and providing a greatly extended life span instead of re-investing comparable money in a 60+ year-old structure.

A cost allowance is included in the construction cost estimate for demolition and ultimate disposal of the existing Papoose Creek Pump Station. The existing structure is partly in the floodway. This could give an opportunity to make the structure a public or private asset on the river. Access to a re-purposed structure at the existing pump station location during flooding needs to be taken into consideration.

No cost is included in the construction cost estimate for the replacement of the East and West Side Interceptors. The recommendation is to open cut a new West Side Interceptor parallel to the Papoose Creek Tunnel. The East Side Interceptor inside the tunnel would be lined with a 12-inch pipe from Alley 2 behind City Hall to E. Mississippi Drive to pick up the service laterals from Alley 1, East 2nd Street, and Alley 2. The East Side Interceptor from City Hall to Cedar Street would be abandoned in place. The East Side Interceptor at Cedar Street would extend down Cedar Street to East Mississippi Drive and Sycamore Street. The two interceptors would combine just upstream of the new pump station at East Mississippi Drive, or the new interceptors would run through Papoose Creek Tunnel to the existing pump station.

The City should consider installing permanent or temporary flow meters within the East and West Branch Interceptors. Measured flows provide more accurate dry weather flow estimates, diurnal flow patterns, and inflow/infiltration within the collection system after sewer separation. This data will facilitate future hydraulic modeling calibration to provide more accurate peak flows seen at the pump station which will dictate the size of the sanitary pumps.

8.2 Stormwater Pump Station

In reviewing the Papoose Creek watershed and the amount of water that flows through Papoose Creek to the Mississippi River, building a stormwater pump station to manage the entire flow of Papoose Creek is not an option that the City should pursue. Historically, the Papoose Creek Tunnel has the capacity to pass wet weather events, and the hydraulics through the tunnel provide the head differential needed to open the flap gates to allow flow to exit to the Mississippi River even at flood conditions.

The City's challenge is in managing the stormwater runoff that does not enter Papoose Creek Tunnel. The downtown area has a large amount of impervious area, and a large volume of stormwater runoff accumulates along Sycamore Street, causing localized flooding during high-intensity short-duration rain events. When the City installs temporary flood protection along Mississippi Drive, the runoff builds up behind the flood wall and exacerbates the problem.

Building a stormwater pump station will better manage local runoff whether the river is at flood stage or not. The addition of intakes along Sycamore Street will catch the street flow and convey it to the wet well. The pumps are designed to pass the 10-year peak flow, greatly reducing the amount of street flooding typically experienced along East 2nd Street and Sycamore Street. The volume of water that would accumulate behind the flood wall during flood conditions will be minimized, allowing the pumps to quickly eliminate any flooding that does occur.

The City has stated that during flood conditions, their portable pumps can typically gain control of flooding behind the flood wall within a couple of hours. The alternative to the stormwater pump station is to design a sump system for portable pump use. This stormwater alternative would allow City staff to continue to fight floods in the same manner that they have in the past but more efficiently. The City would not see any improvement to stormwater runoff with this alternative, but the capital cost is much less than a stormwater pump station.

Regardless of the storm water pumping configuration selected, City should continue to pursue distributed storm runoff mitigation techniques in the Papoose Creek watershed, including detention basins, bioswales, green roofs, and other low-impact storm water management to minimize peak runoff flows.

The City should consider adding water level measuring systems to the Papoose Creek tunnel system at two to three locations on the main tunnel and one each in the Lower and Upper West Branch storm sewers. A minimum of one rainfall intensity meter should be installed at about the midpoint of the basin. Ideally, two to three rainfall meters would be deployed. Gathering rainfall and system water level measurements over time during a range of storm events will provide better understanding of how the system is performing and facilitate future hydraulic model calibration to assess future impacts and local downtown storm water pumping.

8.3 Pump Station Siting

This study utilized the City-owned property that is currently a parking lot abutting the east side of Sycamore Street and the north side of Mississippi Drive. While this is a probable location for new sanitary and storm pump stations, the west side of Sycamore Street abutting Mississippi Drive could also be considered. The alternate location would require property acquisition and demolition of the old NAPA Auto building, allowing replacement of this flood-prone property with a structure that is configured to be above probable flood levels.

8.4 Financing

Funding for the project has not been determined. The sanitary pump station project would be eligible for State Revolving Fund (SRF) loan financing.

8.5 Permit Requirements

This project falls under the jurisdiction of several different authorities. Following is a summary of regulatory agencies and permits anticipated for the project.

8.5.1 Iowa Department of Natural Resources (IDNR) Wastewater Section

Construction, installation or modification of any wastewater disposal system, including sanitary sewers and pump stations requires a construction permit issued by Iowa Department of Natural Resources (IDNR) Wastewater Section. IDNR reviews applications and issues construction permits based on criteria contained in "Iowa Wastewater Facilities Design Standards." IDNR's wastewater section requires a facility plan report establishing the project concept, plus submitting 60 percent and final signed plans and specifications, and permit application schedules.

8.5.2 Iowa Department of Natural Resources Storm Water Discharge Permit

Construction activities that disturb one or more acres require an IDNR National Pollutant Discharge Elimination System (NPDES) General Permit #2. This project may fall under one acre of disturbance, depending on the alternative chosen and whether this project is broken into phases. The contractor will be required to use erosion control technologies to prevent soil from getting into stormwater drainage pathways.

8.5.3 Iowa Department of Natural Resources (IDNR) – Construction Dewatering

Several IDNR clearances are required for construction dewatering. The contractor will be required to obtain permits related to construction dewatering. The following is a summary of requirements associated with construction dewatering.

- The contractor is required to obtain a permit through the State if they install dewatering wells to control trench water levels.
- A well discharge permit (General Permit #6) is required by IDNR if the well discharge is going to reach the waters of the United States.
- A water use permit is required by IDNR if water withdrawal (well or trench dewatering) is more than 25,000 gallons per day.
- IDNR field offices often require certain discharge standards depending on the local stream to which the well water is discharging.

8.5.4 U.S. Army Corps of Engineers (USACE)

Construction and excavation around streams, wetlands, or in a flood plain require permits from both USACE and IDNR. Separate applications will be submitted to USACE and IDNR Floodplains. USACE permitting will involve a pre-application consultation and application through the Regulatory Request System (RRS). The floodplain permit application will be submitted through the IDNR's PERMT system which includes review by the IDNR Floodplains and Sovereign Lands sections. The permit application package to USACE will include design drawings, and if applicable, wetland delineation and cultural resource reports. The USACE will require specific mitigation and restoration requirements for wetland disturbances and stream crossings.

- Iowa Department of Natural Resources (IDNR) Floodplains section – This section regulates construction in all floodplains and floodways in the state to protect life and property. A City floodplain development permit will be required.
- Iowa Department of Natural Resources (IDNR) Sovereign Lands section – The application will be sent to the IDNR Sovereign Lands section along with the Floodplain permit application. The IDNR PERMT system will be utilized. The Sovereign Lands department will issue a determination if a sovereign lands permit is required. Any construction on state owned lands or waters requires a sovereign lands construction permit before beginning work. A sovereign lands permit is not anticipated.

8.5.5 City of Muscatine

The contractor will be required to follow the construction requirements of the City of Muscatine and obtain any building permits or authorizations prior to construction.

8.6 Project Implementation Schedule

The project should move forward in a timely manner as the issues with the existing pump station continue to increase. The approximate time that should be allowed for design, financing, construction and commissioning is three years. Design could be performed during 2026 with bidding in the first half of 2027 allowing completion by the end of 2028.

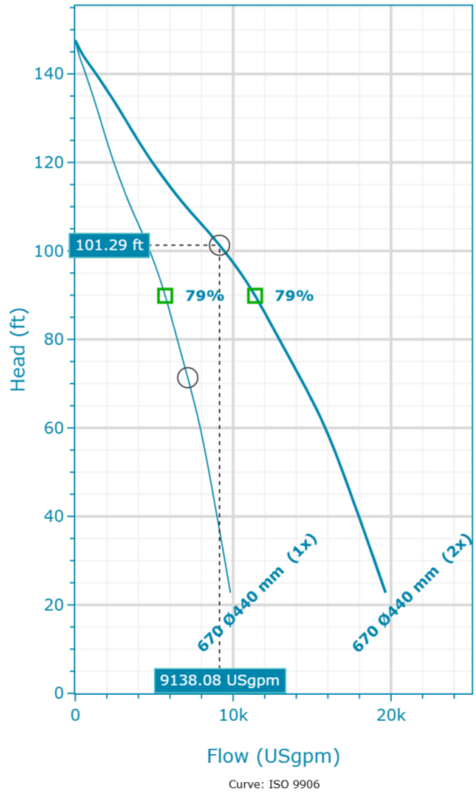
- Design – 2026
- Construction – 2027/2028

8.7 Closing

This report has been prepared by Stanley Consultants on behalf of the City of Muscatine. We wish to acknowledge the outstanding input and cooperation from City of Muscatine staff. Their valuable insights, their assistance in collecting data and providing records, and their hours of discussion and review of project development are greatly appreciated.

Appendix A Performance Curve

NT 3306/745 3~ 670 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.

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

GENERAL

Explosion Proof
Yes

Approval
FM

Max. Pumped Media Temp.
104 °F

Impeller Diameter
440 mm

MATERIAL AND COATING

Impeller Material
Hard-Iron

Volute Material
Grey Cast Iron

MOTOR

Rated Voltage
480 V

Coupling
D

Motor Efficiency Class
Standard

Rated Power
215 Hp

Cooling Jacket
Direct Media Cooling System

INSTALLATION

Installation Type
T - Vertical Permanent, Dry

NT 3306/745 3~ 670 | Product Details

Description

N 3306

Wastewater N-Technology Pump

Flygt N-pumps take on the toughest applications and get the job done. Every component is designed and manufactured to deliver sustained high efficiency. Thanks to patented N-technology with its innovative self-cleaning impeller, Flygt N-pumps deliver the highest total efficiency. They lower your energy bill and reduce unplanned maintenance costs. That adds up to total peace of mind – and big savings over the long term.
Most solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet.
Due to the mechanical self-cleaning design, a sludge concentration up to 8% can easily be pumped.

Flexible and Modular Design

This self-cleaning pump features innovative functions that make it the best choice for a broad range of applications. The modular hydraulic design enables you to tailor the hydraulics to meet the requirements of virtually any application.

- Replaceable wear ring in two materials, gray iron or Hard-Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-Iron impeller for abrasive and corrosive applications
- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties.
- The double mechanical seal system consists of two sets of mechanical shaft seals that work independently to provide double security. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media. Motor cable SUBCAB® specially developed for submersible use.
- Offers flexible cooling systems, e.g. closed loop cooling system, media cooled or external cooling.

Product Features

- State-of-the-art wastewater pump with N-technology
- Sustained high efficiency with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	-

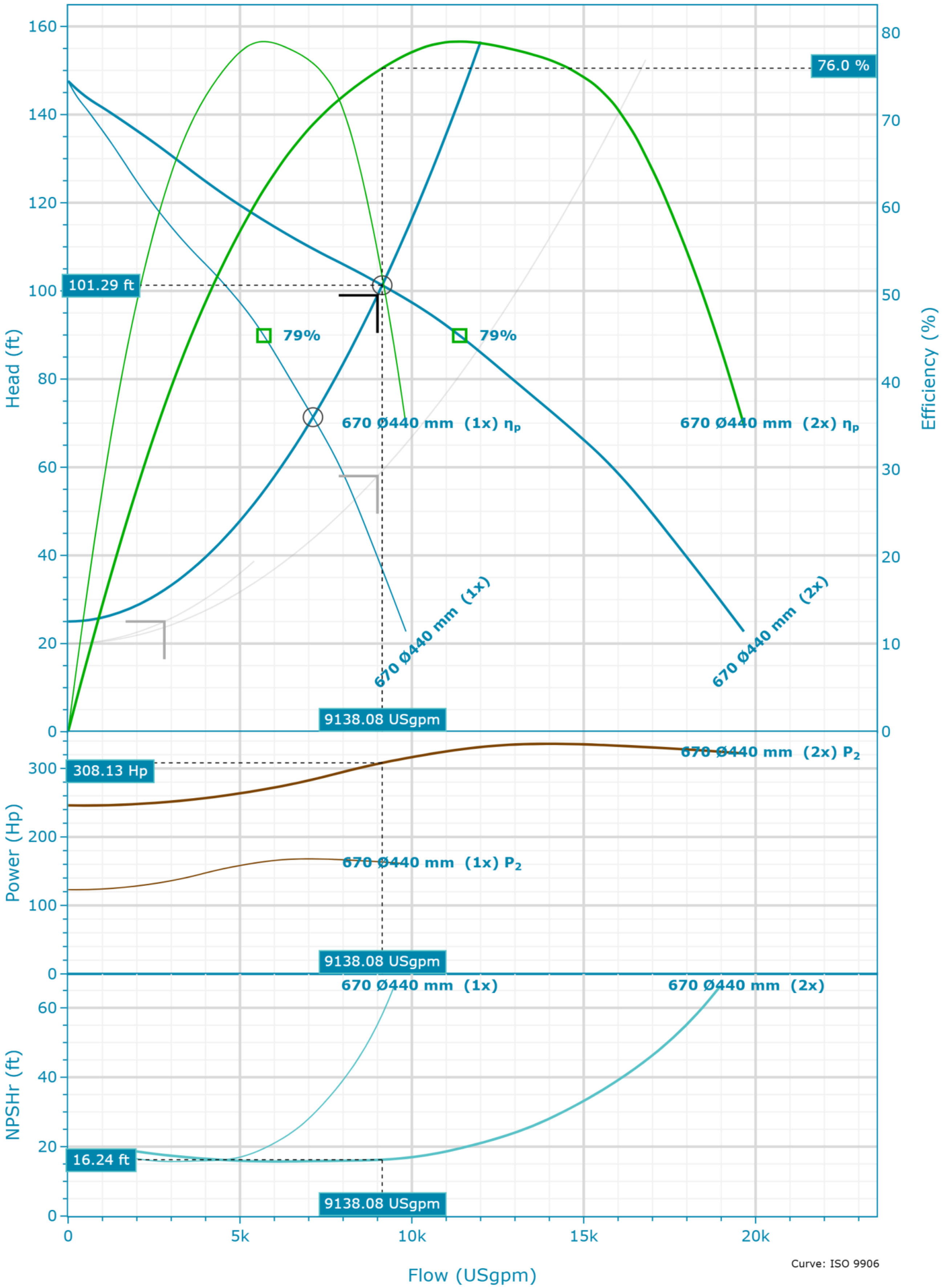
Motor

Rated Power 215 Hp	Number Of Phases 3	Start Current Ratio 6.37	Motor Issue 10
Motor Denomination 43-44-6BC	Rated Motor Speed 1,185 RPM	Insulation Class H	Locked Rotor Code H
Motor Efficiency Class Standard	Rated Voltage 480 V	Approval FM	Max starts per hour 15
Version Code 000	Rated Current 257 A	Total moment of inertia 85.1449 ft²lbf	Power Factor 100% 0.8
Frequency 60 Hz	Start Current 1,635 A	Type of duty S1	Power Factor 75% 0.75
Max P2 (1x) 167.96 Hp	Starting Current, Direct Starting 1,635 A	Stator Variant 1	Power Factor 50% 0.63
Number Of Poles 6	Starting Current, Star Delta 545 A	Motor Module 116	Efficiency 100% 93.6 %
			Efficiency 75% 93.6 %
			Efficiency 50% 92.7 %
			Cooling Jacket Direct Media Cooling System

xylem
Let's Solve Water

FLYGT
a xylem brand

NT 3306/745 3~ 670 | Hydraulic Data & Performance Curve



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

Project:	Created By:	Created On:	Last Update:
NT 3306/745 3~ 670	Taylor Musselman	7/9/25	-

xylem Let's Solve Water

FLYGT a xylem brand

Selection

Series
N 3000

Curve Code
670

Name
NT 3306/745 3~ 670

Impeller Diameter
440 mm

Frequency
60 Hz

Inlet Diameter
350 mm

Total Flow
9,000.00 USgpm

Outlet Diameter
12 in

Total Head
99.00 ft

Number Of Vanes
3

Pump Flow
4,500.00 USgpm

Pump Head
99.00 ft

System Type
Parallel Pumps

Operating Pumps
2

Standby Pumps
No Standby Pump

Fluid

Fluid Type
Water

Density
62.428 lb/ft³

Fluid Temperature
39.2 °F

Dynamic Viscosity
1.567212 cP

Specific Gravity
1

Fluid Vapor Pressure
0.118 psi

Design Point - Single Pump

Flow (1x)
4,569.04 USgpm

Input Power (P1) (1x)
164.36 Hp

Head (1x)
101.29 ft

Shaft power (P2) (1x)
154.06 Hp

Overall Efficiency (1x)
71.23 %

NPSHr (1x)
16.24 ft

Pump Efficiency (1x)
75.99 %

Static Head
25.00 ft

Flow To BEP Ratio (1x)
80.2 %

Design Point - System

Flow
9,138.08 USgpm

Input Power (P1)
328.72 Hp

Head
101.29 ft

Shaft power (P2)
308.13 Hp

Overall Efficiency (ηo)
71.23 %

NPSHR
16.24 ft

Pump Efficiency (ηp)
75.99 %

Static Head
25.00 ft

Flow To BEP Ratio
80.2 %

Design Curve - Single Pump

Rated Speed
60 Hz

BEP Flow (1x)
5,695.89 USgpm

Max Flow (1x)
9,829.34 USgpm

BEP Head (1x)
89.86 ft

H@QMin (1x)
147.62 ft

Max P2 (1x)
167.96 Hp

H@QMax (1x)
22.74 ft

BEP (1x)
79 %

Design Curve - System

Rated Speed
60 Hz

BEP Flow
11,391.79 USgpm

Max Flow
19,658.67 USgpm

BEP Head
89.86 ft

H@QMin
147.62 ft

Max P2
335.92 Hp

H@QMax
22.74 ft

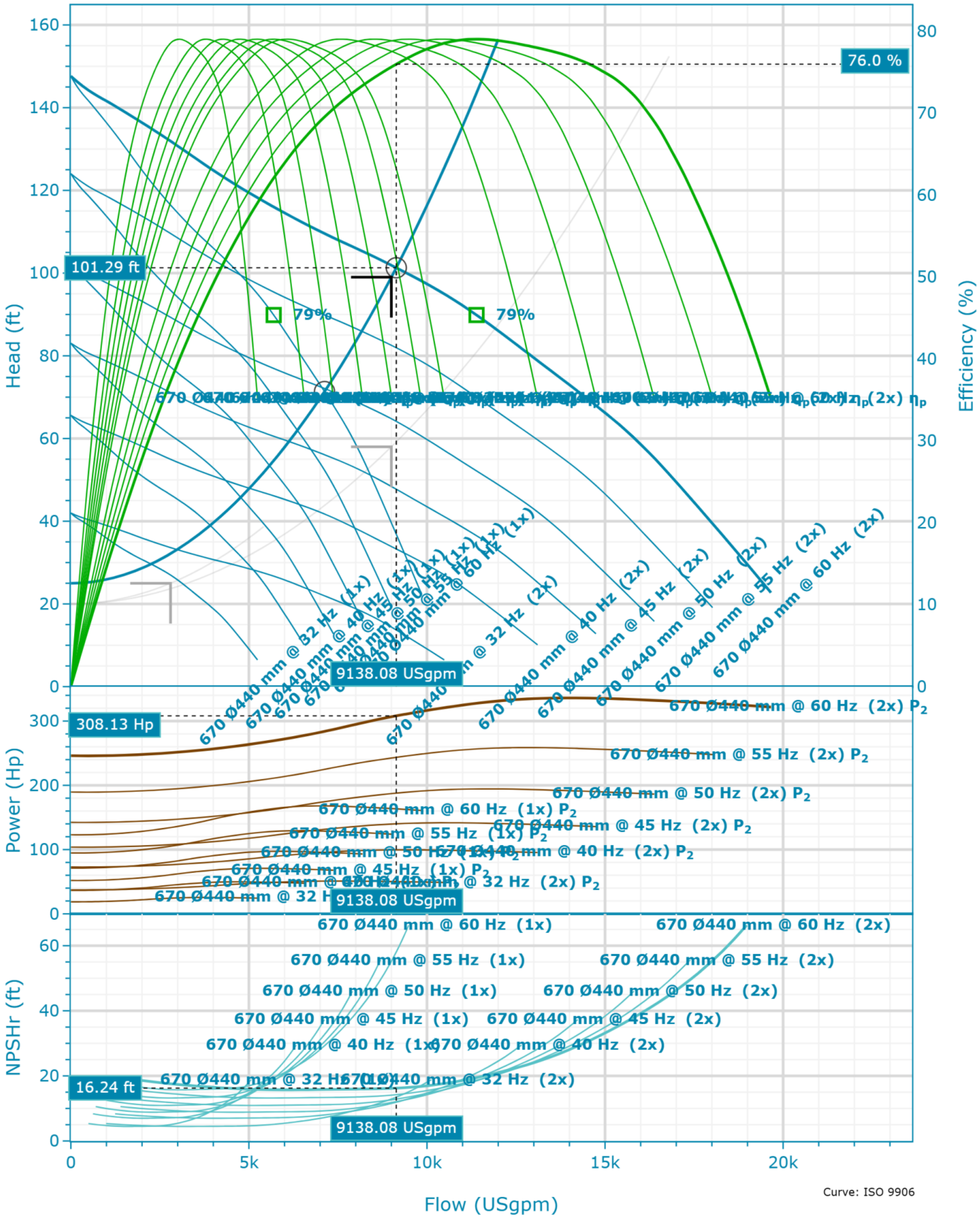
Specific Energy
0.000447 kWh/USgal

BEP
79 %

xylem
Let's Solve Water

FLYGT a xylem brand

NT 3306/745 3~ 670 | Variable Speed Analysis



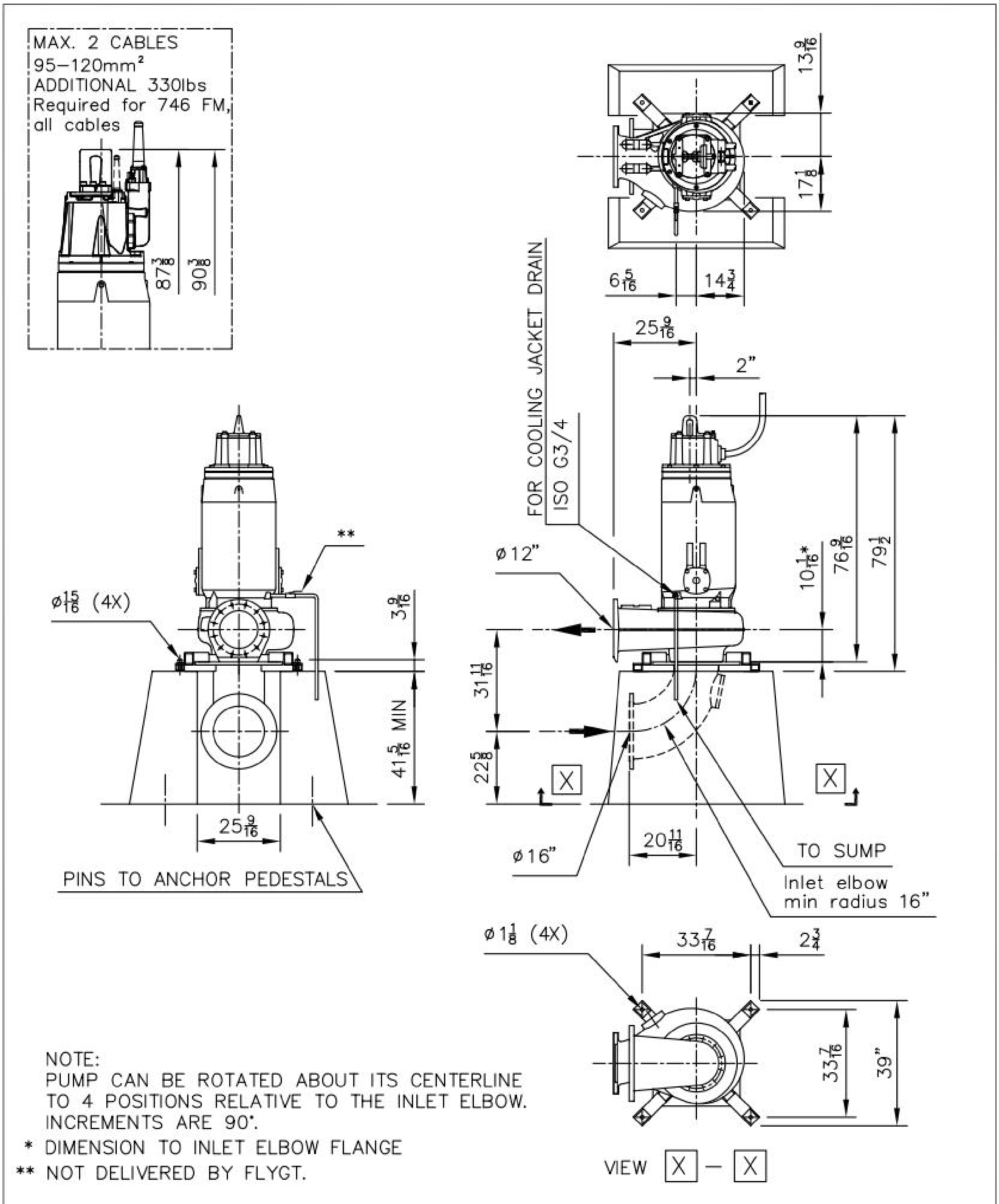
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Name	Speed	Q (1x) [USgpm]	H (1x) [ft]	P2 (1x) [Hp]	Q [USgpm]	H [ft]	P2 [Hp]	ηp [%]	SE [kWh/USgal]	NPSHr [ft]
DP @ 1x	32 Hz	2,254.12	29.64	22.79	2,254.12	29.64	22.79	74.16	0	4.55
DP @ 1x	40 Hz	3,912.77	38.99	48.86	3,912.77	38.99	48.86	78.98	0	9.04

Project:	Created By:	Created On:	Last Update:
NT 3306/745 3~ 670	Taylor Musselman	7/9/25	-

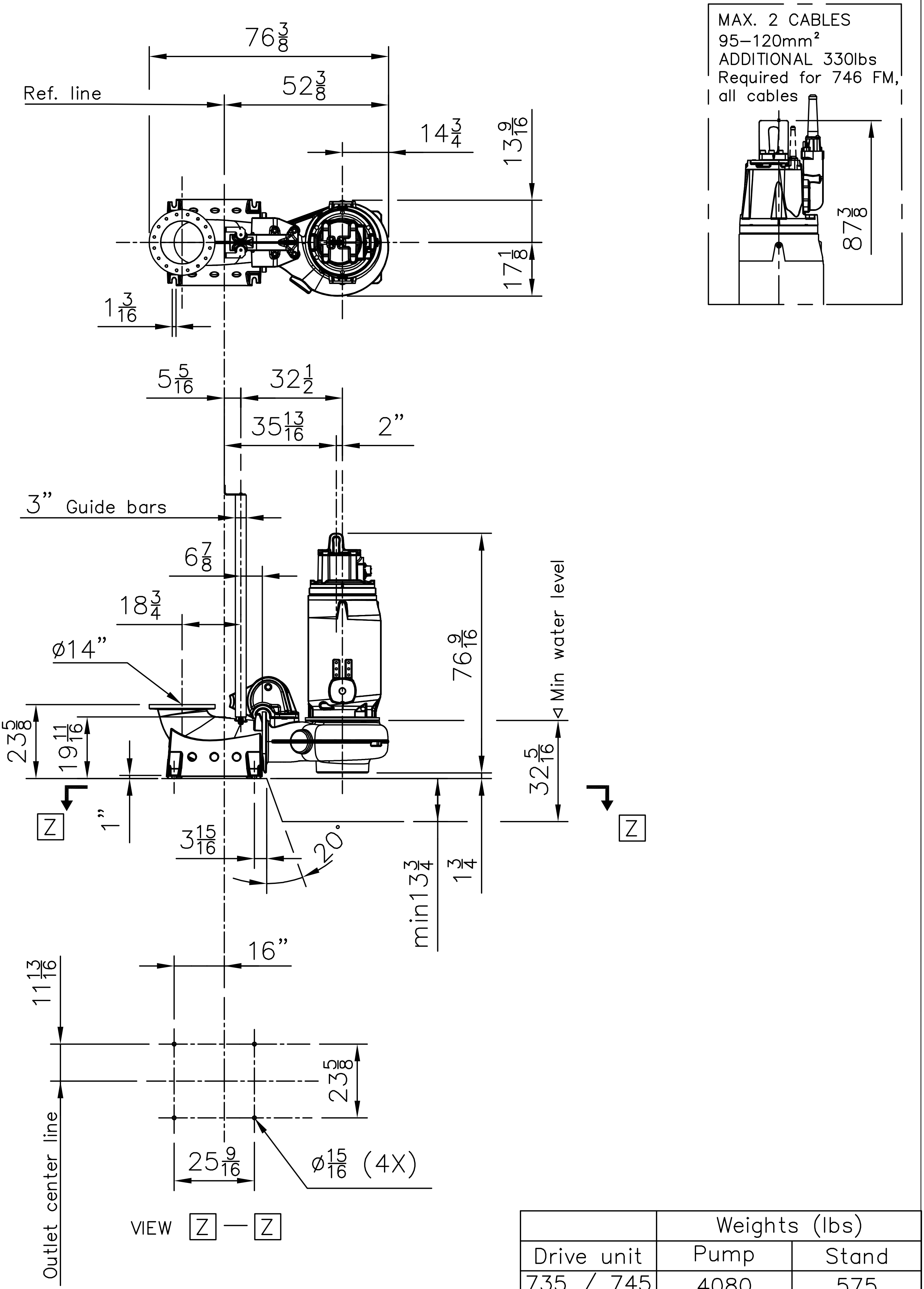
DP @ 1x	45 Hz	4,768.73	45.78	70.49	4,768.73	45.78	70.49	78.34	0	13
DP @ 1x	50 Hz	5,579.69	53.44	97.1	5,579.69	53.44	97.1	77.69	0	17.69
DP @ 1x	55 Hz	6,362.21	61.98	129.37	6,362.21	61.98	129.37	77.11	0	23.14
DP @ 1x	60 Hz	7,123.1	71.35	167.94	7,123.1	71.35	167.94	76.56	0	29.25
DP @ 2x	32 Hz	1,492	33.13	20.36	2,984	33.13	40.73	61.42	0	4.48
DP @ 2x	40 Hz	2,507.17	47.97	42.78	5,014.34	47.97	85.57	71.11	0	7.06
DP @ 2x	45 Hz	3,062.48	59.27	62.64	6,124.95	59.27	125.29	73.3	0	8.98
DP @ 2x	50 Hz	3,583.99	71.94	87.45	7,167.99	71.94	174.91	74.58	0	11.14
DP @ 2x	55 Hz	4,083.82	85.95	117.74	8,167.64	85.95	235.47	75.42	0	13.56
DP @ 2x	60 Hz	4,569.04	101.29	154.06	9,138.08	101.29	308.13	75.99	0	16.24
2 @ 1x	32 Hz	3,166.75	24.7	25.08	3,166.75	24.7	25.08	78.93	0	5.88
2 @ 1x	40 Hz	4,833.03	30.96	49.74	4,833.03	30.96	49.74	76.09	0	13.56
2 @ 1x	45 Hz	5,774.6	35.64	70.55	5,774.6	35.64	70.55	73.8	0	19.94
2 @ 1x	50 Hz	6,659.63	40.81	96.41	6,659.63	40.81	96.41	71.31	0	27.15
2 @ 1x	55 Hz	7,508.44	46.45	127.94	7,508.44	46.45	127.94	68.96	0	35.04
2 @ 1x	60 Hz	8,335.85	52.6	165.74	8,335.85	52.6	165.74	66.92	0	43.71
2 @ 2x	32 Hz	2,262.44	29.61	22.82	4,524.88	29.61	45.64	74.25	0	4.56
2 @ 2x	40 Hz	3,459.06	42.45	47.38	6,918.11	42.45	94.76	78.4	0	7.77
2 @ 2x	45 Hz	4,121.4	51.87	68.51	8,242.81	51.87	137.02	78.95	0	10.46
2 @ 2x	50 Hz	4,751.07	62.36	94.82	9,502.15	62.36	189.65	79.04	0	13.55
2 @ 2x	55 Hz	5,360.88	73.93	126.92	10,721.76	73.93	253.85	78.99	0	17
2 @ 2x	60 Hz	5,957.42	86.6	165.4	11,914.84	86.6	330.8	78.91	0	20.79
3 @ 1x	32 Hz	3,006.16	25.76	24.79	3,006.16	25.76	24.79	79.03	0	5.46
3 @ 1x	40 Hz	4,567.25	33.3	49.75	4,567.25	33.3	49.75	77.34	0	11.89
3 @ 1x	45 Hz	5,456.31	38.99	70.82	5,456.31	38.99	70.82	75.99	0	17.31
3 @ 1x	50 Hz	6,304.46	45.35	96.93	6,304.46	45.35	96.93	74.62	0	23.55
3 @ 1x	55 Hz	7,122.67	52.35	128.7	7,122.67	52.35	128.7	73.3	0	30.49
3 @ 1x	60 Hz	7,917.76	59.98	166.76	7,917.76	59.98	166.76	72.04	0	38.14
3 @ 2x	32 Hz	2,035.88	30.57	22.01	4,071.75	30.57	44.03	71.53	0	4.52
3 @ 2x	40 Hz	3,108.41	44.65	45.93	6,216.82	44.65	91.86	76.44	0	7.26
3 @ 2x	45 Hz	3,707.75	55.07	66.54	7,415.5	55.07	133.08	77.63	0	9.47
3 @ 2x	50 Hz	4,278.97	66.71	92.27	8,557.94	66.71	184.54	78.26	0	12.03
3 @ 2x	55 Hz	4,831.58	79.55	123.71	9,663.15	79.55	247.41	78.6	0	14.92
3 @ 2x	60 Hz	5,371.37	93.6	161.43	10,742.73	93.6	322.85	78.79	0	18.11

NT 3306/745 3~ 670 | Dimensional Data & Drawing



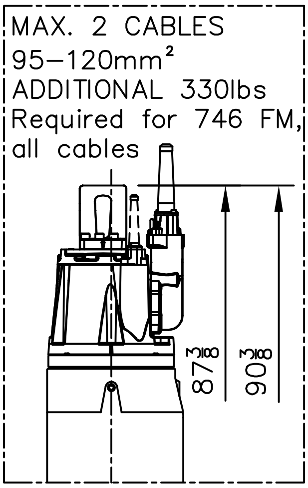
	Weights (lbs)		
Drive unit	Pump	Stand	Inlet Elbow
735/745	3860	180	375
736/746	4300	180	375

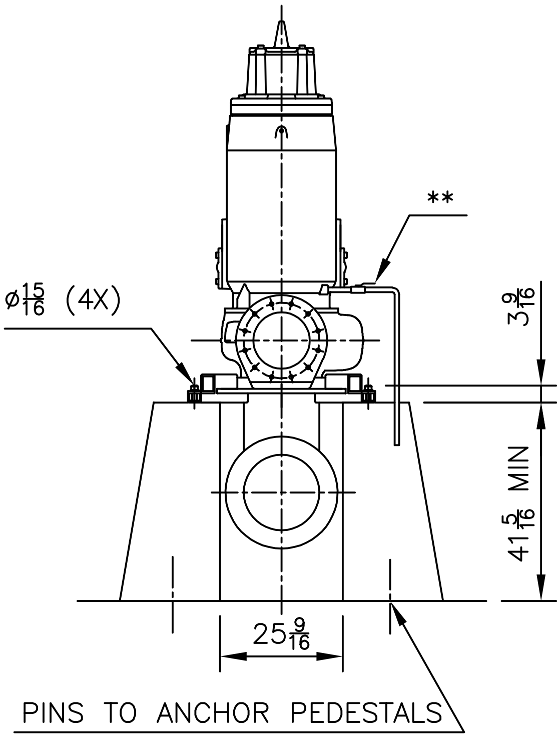
FLYGT	CT,NT 3306	Discharge outlet; Pump outlet ø12"; Pump inlet ø14"; Suction inlet ø16"	Scale 1:40	Date 221123
	735,745,736,746		Drawing number 6440900	Revision 10

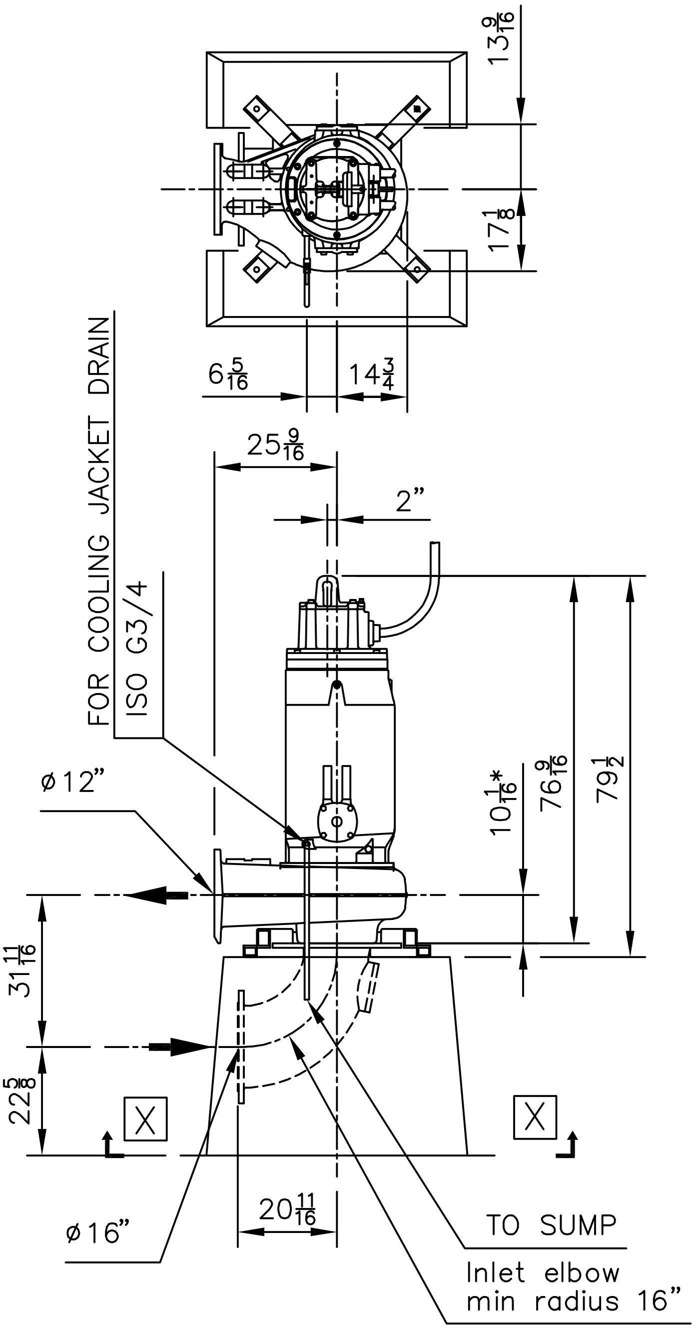


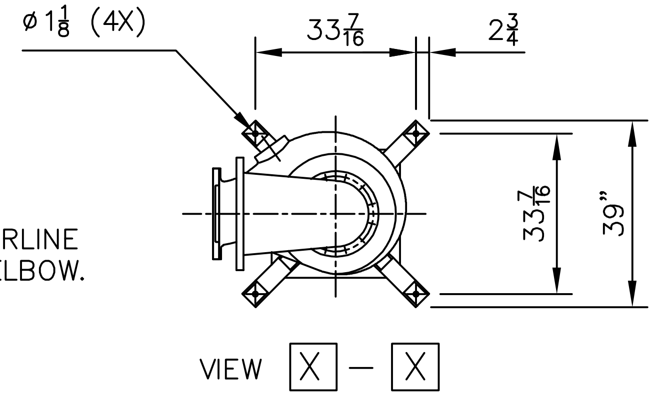
	Weights (lbs)	
Drive unit	Pump	Stand
735 / 745	4080	575
736 / 746	4525	575

FLYGT	CP,NP	3306	Discharge outlet ø14"	Scale 1:40	Date 200714
	735,745,736,746		Pump outlet ø12"	Drawing number 6441400	Revision 10
			Pump inlet		
			Suction inlet		









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

* DIMENSION TO INLET ELBOW FLANGE

** NOT DELIVERED BY FLYGT.

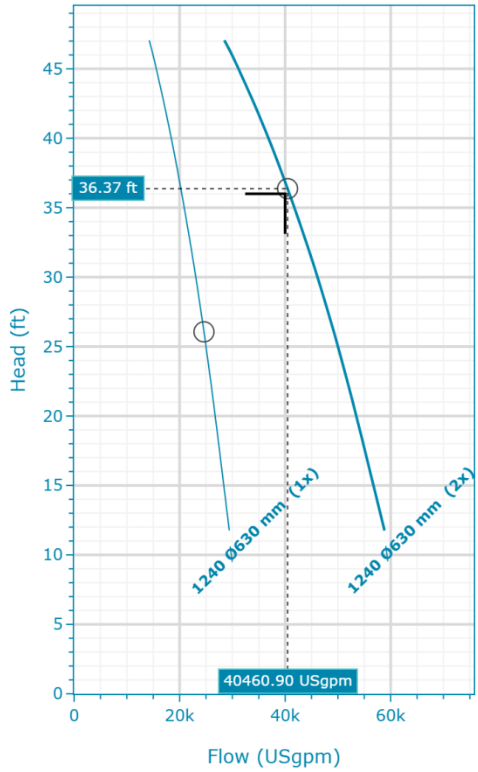
	Weights (lbs)		
Drive unit	Pump	Stand	Inlet Elbow
735/745	3860	180	375
736/746	4300	180	375

FLYGT	CT,NT	3306		Discharge outlet	Scale 1:40	Date 221123
	735,745,736,746			Pump outlet ø12" / Pump inlet ø14" / Suction inlet ø16"	Drawing number 6440900	Revision 10

LL 3602/835 3~ 1240

Created On: 7/23/25

LL 3602/835 3~ 1240 | Configuration Summary



Curve: ISO 9906

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

Shrouded multi-channel mixed flow impellers with bowl type diffuser pump casing, for fibre-free liquids.

GENERAL

Explosion Proof
No

Impeller Diameter
630 mm

Max. Pumped Media Temp.
104 °F

MATERIAL AND COATING

Impeller Material
Stainless Steel

Volute Material
Grey Cast Iron

MOTOR

Rated Voltage
460 V

Motor Efficiency Class
Standard

Coupling
D

Rated Power
240 Hp

INSTALLATION

Installation Type
L - Column Pipe Semi-Permanent, Wet

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LL 3602/835 3~ 1240 | Product Details

Description

L 3602

Mixed Flow Pump for Column Installation

The L 3602 is a mixed flow pump installed in an 800 mm column. This type of pump is intended for high flow at heads above what is used for propeller pumps. Mixed flow pumps are used in the transition area between centrifugal pumps and propeller pumps. The 4-vane impeller is available in gray cast iron or duplex stainless steel. Installation is quick and easy.

Robust and Reliable Design

- Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties.
- Martensitic stainless steel shaft for maximum strength and corrosive resistance.
- Optional duplex stainless steel shaft for superior corrosive resistance.
- Double mechanical seal system. Two sets of mechanical shaft seals work independently to provide double security. They are available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Motor cable SUBCAB® specially developed for wastewater applications.

Product Features

- Easy installation
- Motors with high power density
- Robust and reliable

Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Stainless Steel	Grey Cast Iron	-

Motor

Rated Power: 240 Hp	Number Of Phases: 3	Start Current Ratio: 4.01	Motor Issue: 13
Motor Denomination: 54-52-12AA	Rated Motor Speed: 590 RPM	Insulation Class: H	Locked Rotor Code: E
Motor Efficiency Class: Standard	Rated Voltage: 460 V	Approval: Standard	Max starts per hour: 15
Version Code: 000	Rated Current: 375 A	Total moment of inertia: 459.5696 ft²lbf	Power Factor 100%: 0.64
Frequency: 60 Hz	Start Current: 1,500 A	Type of duty: S1	Power Factor 75%: 0.58
Max P2 (1x): 226.37 Hp	Starting Current, Direct Starting: 1,500 A	Stator Variant: 1	Power Factor 50%: 0.47
Number Of Poles: 12	Starting Current, Star Delta: 500 A	Motor Module: 130	Efficiency 100%: 93 %
			Efficiency 75%: 93 %
			Efficiency 50%: 92 %

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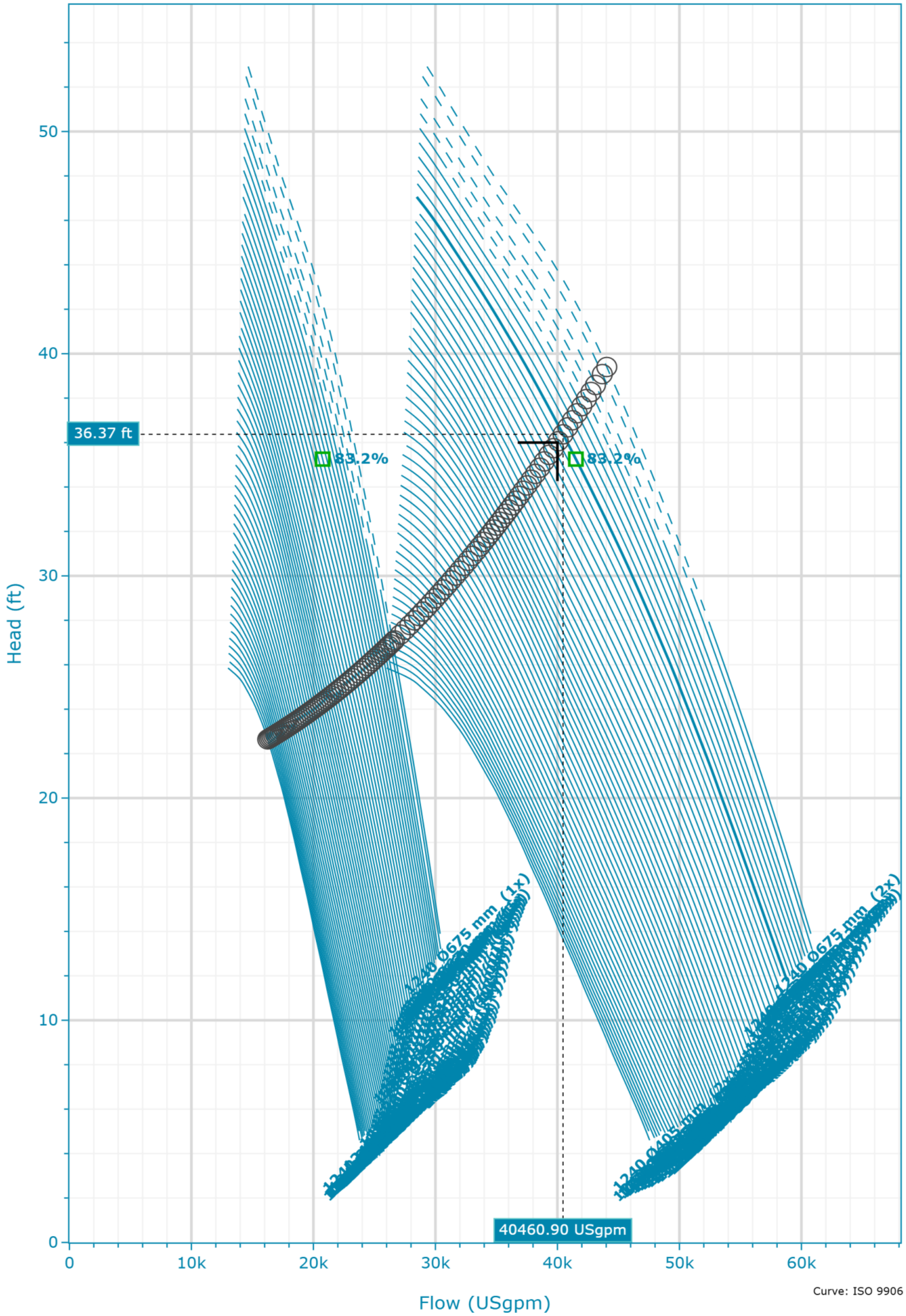
LL 3602/835 3~ 1240 | Hydraulic Data & Performance Curve



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

Selection

Series	Curve Code
L 3000	1240
Name	Impeller Diameter
LL 3602/835 3~ 1240	630 mm

Fluid

Fluid Type	Density
Water	62.428 lb/ft³
Fluid Temperature	Dynamic Viscosity
39.2 °F	1.567212 cP

Frequency	Number Of Vanes	Specific Gravity	Fluid Vapor Pressure
60 Hz	4	1	0.272 feet

Total Flow
40,000.00 USgpm

Total Head
36.00 ft

Pump Flow
20,000.00 USgpm

Pump Head
36.00 ft

System Type
Parallel Pumps

Operating Pumps
2

Standby Pumps
No Standby Pump

Design Point - Single Pump

Flow (1x)
20,230.45 USgpm

Head (1x)
36.37 ft

Overall Efficiency (1x)
77.34 %

Pump Efficiency (1x)
83.11 %

Input Power (P1) (1x)
240.66 Hp

Shaft power (P2) (1x)
223.97 Hp

NPSHr (1x)
16.7 ft

Static Head
20.00 ft

Flow To BEP Ratio (1x)
97.5 %

Design Point - System

Flow
40,460.9 USgpm

Head
36.37 ft

Overall Efficiency (ηo)
77.34 %

Pump Efficiency (ηp)
83.11 %

Input Power (P1)
481.32 Hp

Shaft power (P2)
447.93 Hp

NPSHR
16.7 ft

Static Head
20.00 ft

Flow To BEP Ratio
97.5 %

Design Curve - Single Pump

Rated Speed
60 Hz

Max Flow (1x)
29,416.02 USgpm

H@QMin (1x)
47.05 ft

H@QMax (1x)
11.76 ft

BEP (1x)
83.2 %

BEP Flow (1x)
20,756.66 USgpm

BEP Head (1x)
35.25 ft

Max P2 (1x)
226.37 Hp

Design Curve - System

Rated Speed
60 Hz

Max Flow
58,832.04 USgpm

H@QMin
47.05 ft

H@QMax
11.76 ft

BEP
83.2 %

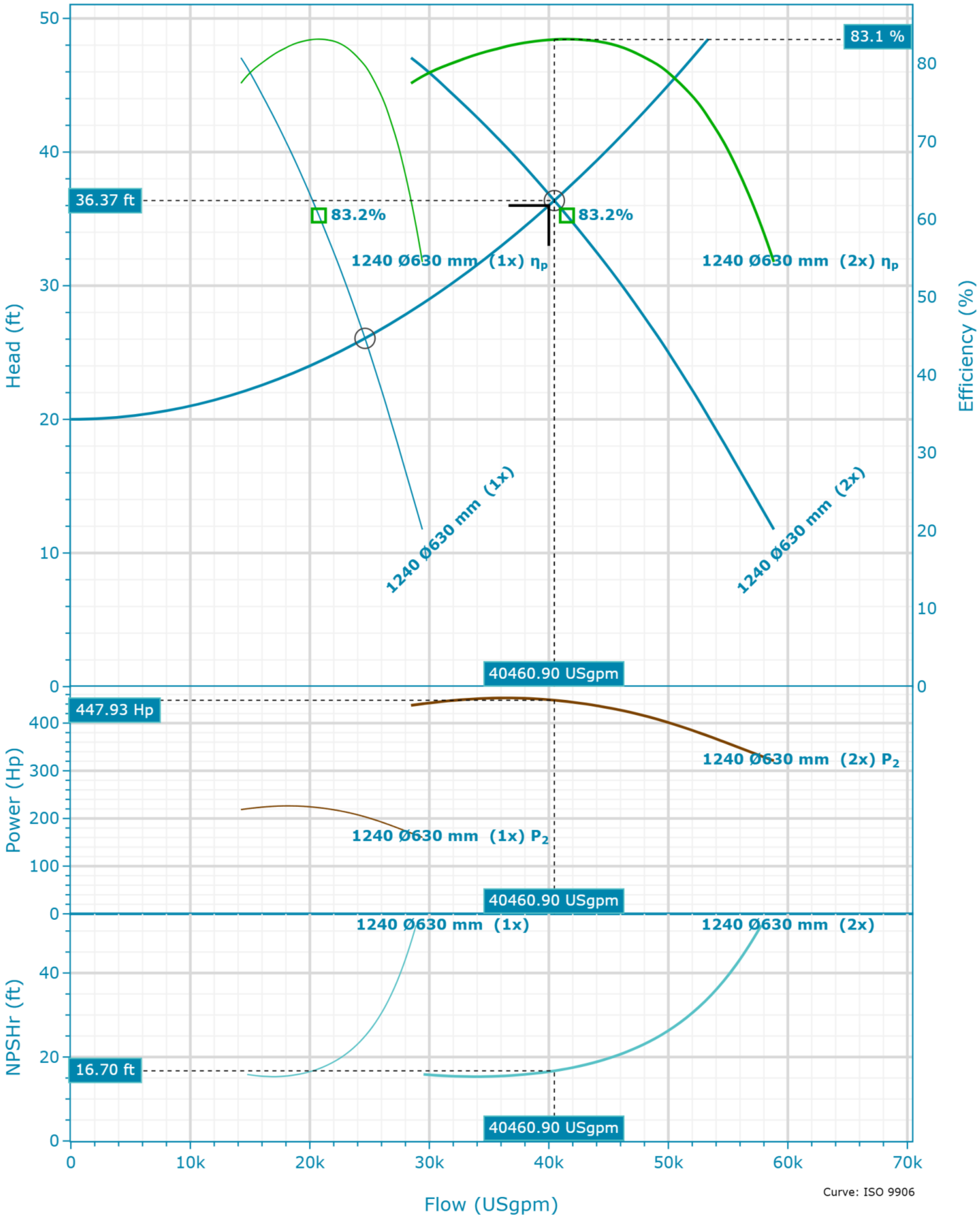
BEP Flow
41,513.32 USgpm

BEP Head
35.25 ft

Max P2
452.74 Hp

Specific Energy
0.000148 kWh/USgal

LL 3602/835 3~ 1240 | Duty Analysis

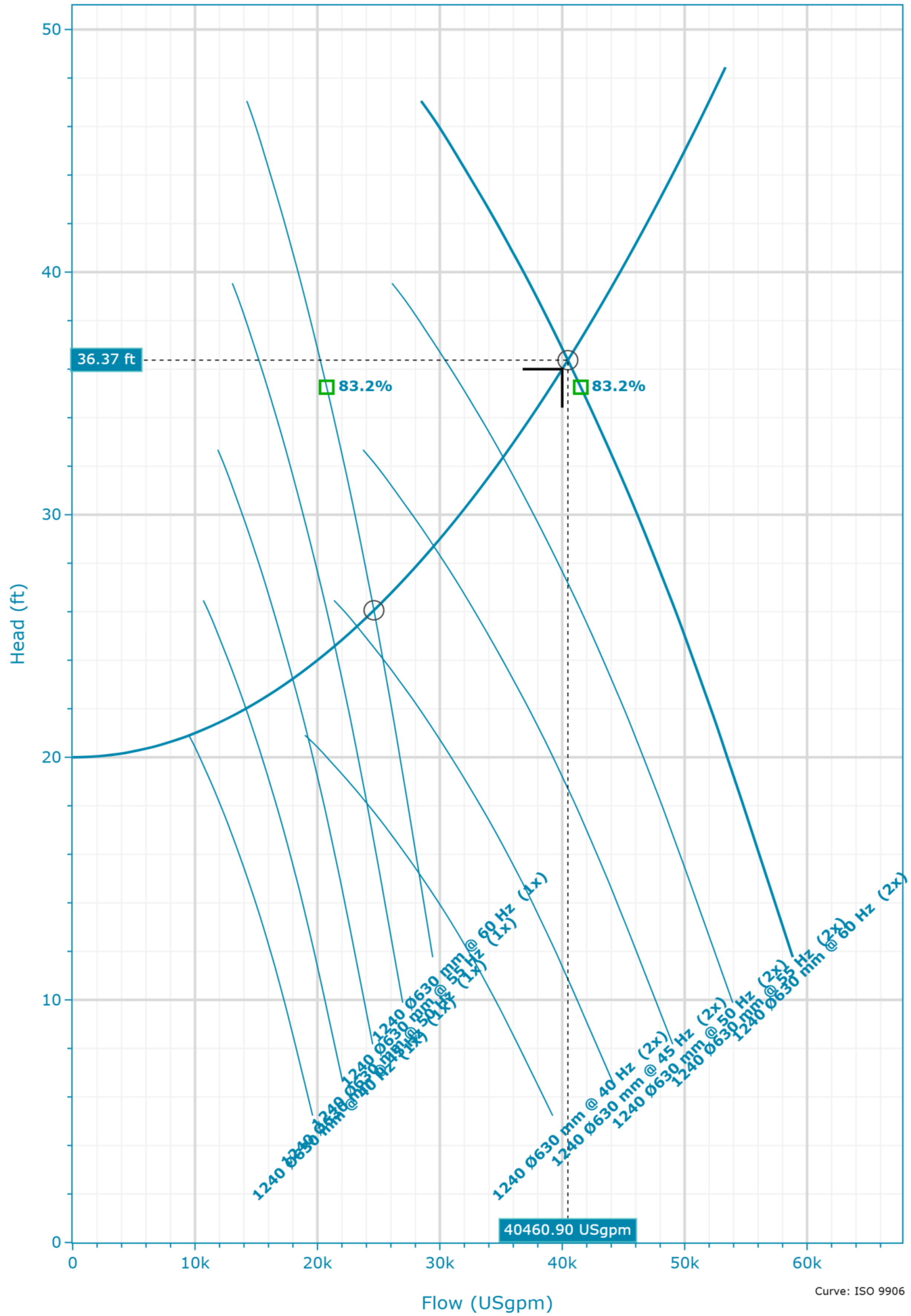


Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Name	Q (1x) [USgpm]	H (1x) [ft]	P2 (1x) [Hp]	Q [USgpm]	H [ft]	P2 [Hp]	ηp [%]	SE [kWh/USgal]	NPSHr [ft]
DP @ 1x	24,615.82	26.06	203.48	24,615.82	26.06	203.48	79.75	0	24.95
DP @ 2x	20,230.45	36.37	223.97	40,460.9	36.37	447.93	83.11	0	16.7

Project:	Created By:	Created On:	Last Update:
LL 3602/835 3~ 1240	Kyle Zaegel	7/23/25	-

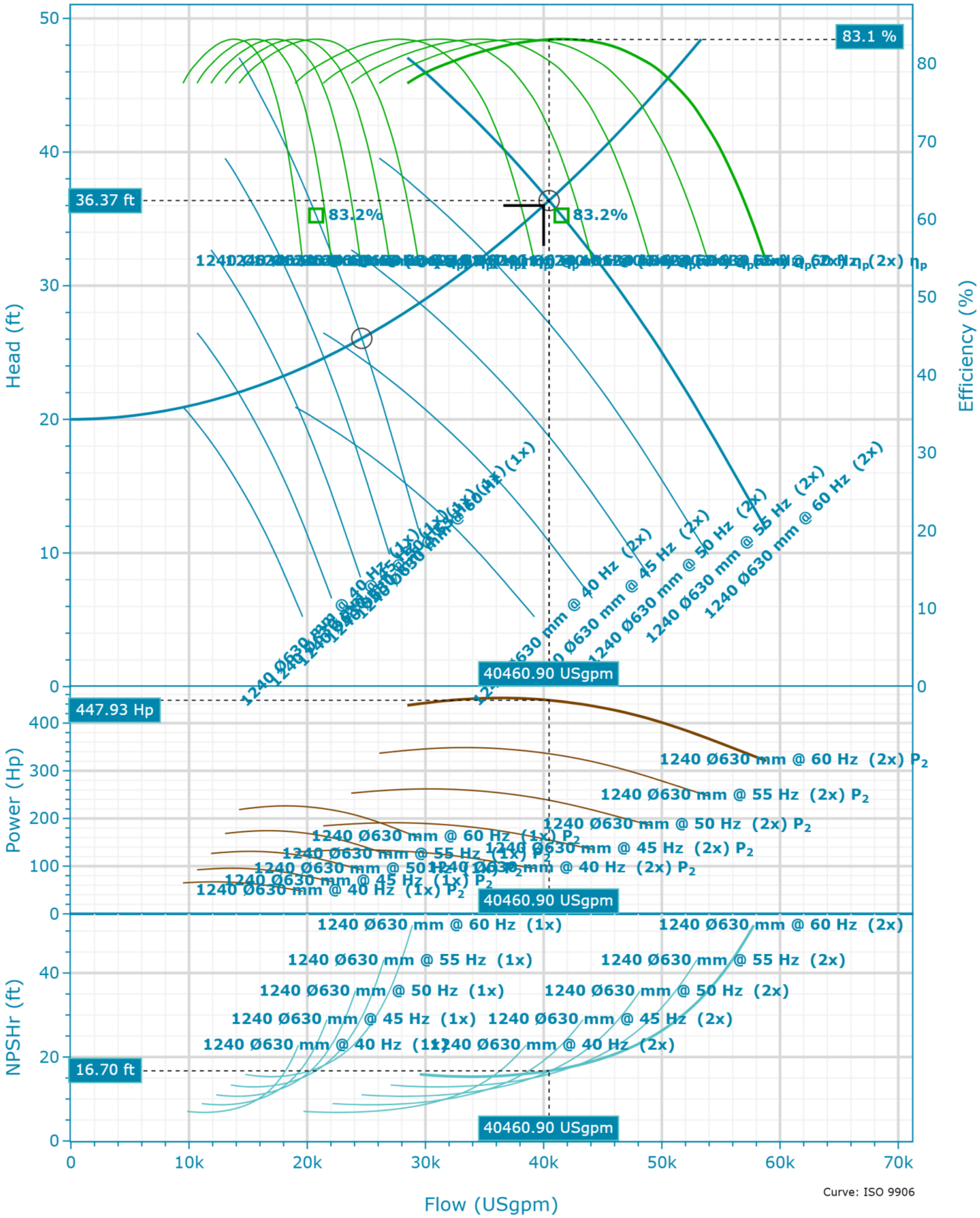
LL 3602/835 3~ 1240 | Variable Speed Curve



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

Project:	Created By:	Created On:	Last Update:
LL 3602/835 3~ 1240	Kyle Zaegel	7/23/25	-

LL 3602/835 3~ 1240 | Variable Speed Analysis

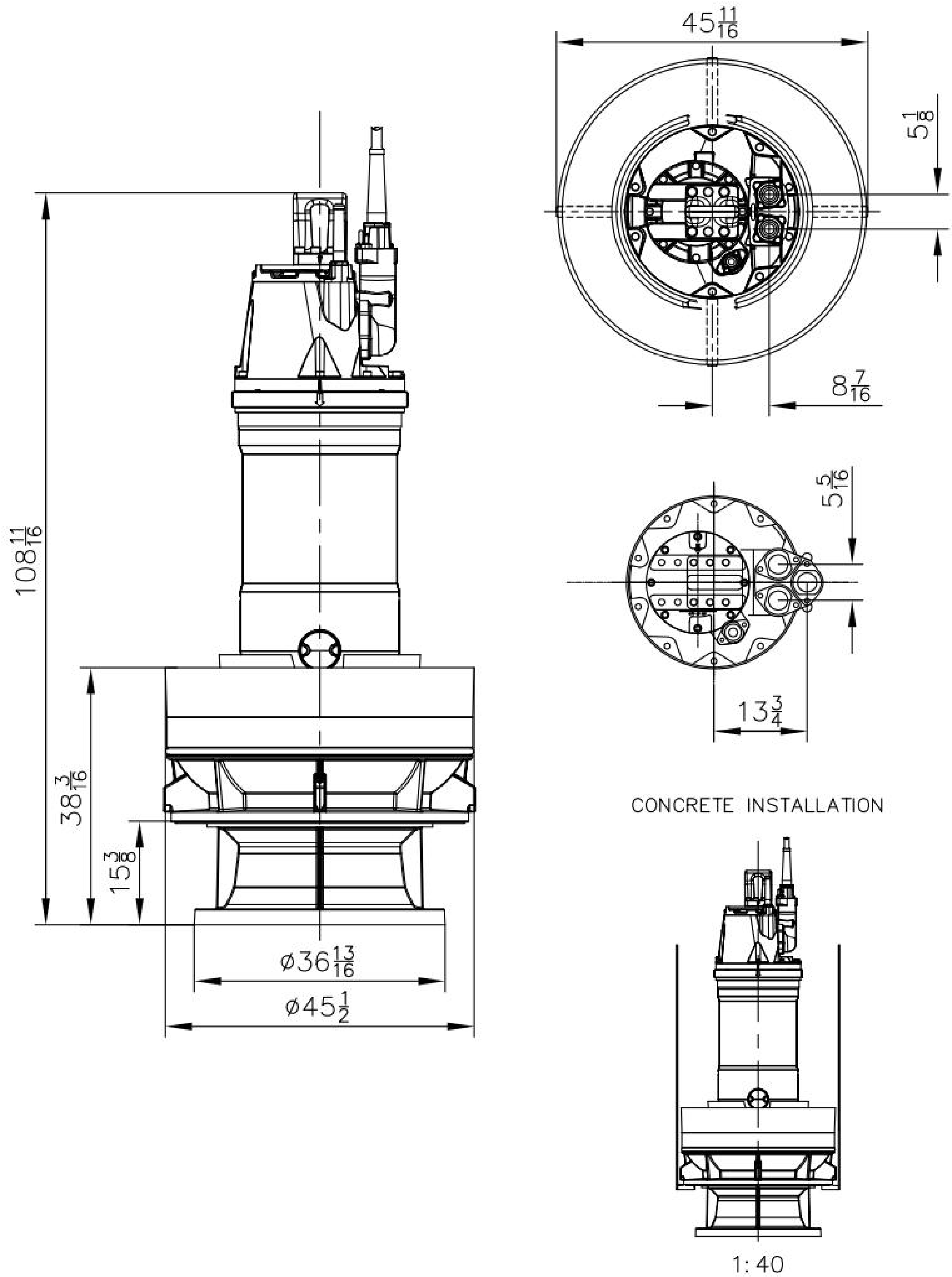


Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Name	Speed	Q (1x) [USgpm]	H (1x) [ft]	P2 (1x) [Hp]	Q [USgpm]	H [ft]	P2 [Hp]	ηp [%]	SE [kWh/USgal]	NPSHr [ft]
DP @ 1x	40 Hz	9,500.2	20.9	64.8	9,500.2	20.9	64.8	77.52	0	0.28
DP @ 1x	45 Hz	14,159.56	22	95.38	14,159.56	22	95.38	82.64	0	8.88

DP @ 1x	50 Hz	17,980.2	23.23	127.27	17,980.2	23.23	127.27	83.03	0	12.65
DP @ 1x	55 Hz	21,418.77	24.59	162.97	21,418.77	24.59	162.97	81.75	0	18.05
DP @ 1x	60 Hz	24,615.82	26.06	203.48	24,615.82	26.06	203.48	79.75	0	24.95
DP @ 2x	40 Hz	0	0	0	0	0	0	0	0	0
DP @ 2x	45 Hz	11,615.9	25.4	93.86	23,231.81	25.4	187.72	79.51	0	8.56
DP @ 2x	50 Hz	14,750.66	28.7	130.92	29,501.31	28.7	261.85	81.81	0	10.7
DP @ 2x	55 Hz	17,583.35	32.37	173.92	35,166.71	32.37	347.83	82.78	0	13.4
DP @ 2x	60 Hz	20,230.45	36.37	223.97	40,460.9	36.37	447.93	83.11	0	16.7

LL 3602/835 3~ 1240 | Dimensional Data & Drawing



	Weight(lbs)
Drive unit	Pump
835/845	7720
836/846	7940

FOR INSTALLATION, SEE FLYGT DESIGN RECOMMENDATION

FLYGT	LL	3602	Discharge outlet / Pump outlet	Scale 1:20	Date 191016	
	835,845,836,846		Pump inlet / Suction inlet	Drawing number 5864300	Revision 6	

Company	Electric Pump
Contact	Kyle Zaegel
Phone No.	5152652222
Email	kylez@electricpump.com

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NP 3202 LT 3~ 615

Created On: 7/23/25

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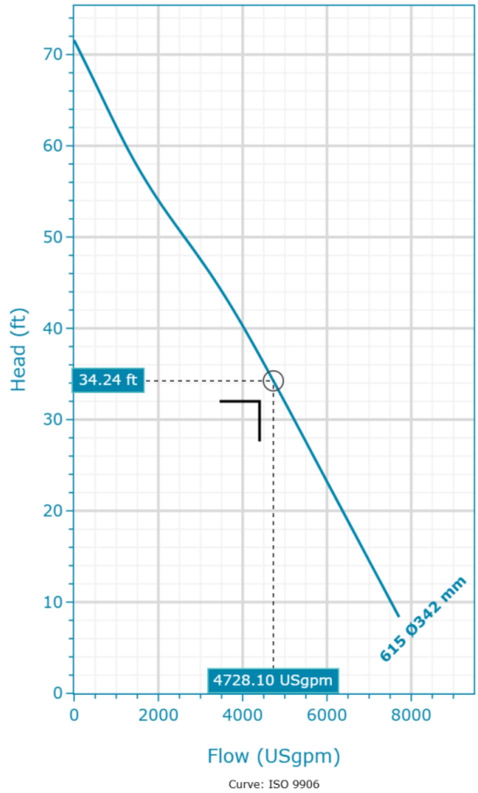
NP 3202 LT 3~ 615 | Configuration Summary



Flygt's self-cleaning non-clog N-pumps feature innovative designs and functions that deliver high sustained efficiency and the most reliable operation. This makes them the most reliable choice available for a broad range of wastewater applications for tough applications such as unscreened sewage, wastewater and sludge up to an 8 percent solids concentration. Impeller material available in Hardened cast Iron, Hard Iron and Stainless Steel to fit any wastewater application.

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

GENERAL

Explosion Proof
Yes

Max. Pumped Media Temp.
104 °F

Approval
FM

Impeller Diameter
342 mm

MATERIAL AND COATING

Impeller Material
Hard-Iron

Volute Material
Grey Cast Iron

MOTOR

Rated Voltage
460 V

Motor Efficiency Class
Standard

Coupling
D

Rated Power
60 Hp

INSTALLATION

Installation Type
P - Semi-Permanent, Wet

NP 3202 LT 3~ 615 | Product Details

Description

N 3202

The Flygt N-series are equipped with the Flygt invented N-technology with its innovative self-cleaning impeller. Solid objects entering the pump will pass through the impeller between the impeller vanes. If an object gets caught on the leading edge of one of the vanes, it will slide along the backswept shape towards the perimeter of the inlet where it will be guided by a relief groove through the pump housing. This ensures a high sustained total efficiency over time. Due to the mechanical self-cleaning design, a sludge concentration of solids up to 8% can easily be pumped. The pump can easily be installed in either permanently or temporary submerged, or horizontally or vertically dry installations.

Flexible and Modular Design

The modular hydraulic design enables customization of the hydraulics to meet the requirements of many applications.
- Replaceable wear ring in two materials, gray iron or Hard Iron, for different operation conditions
- Hardened gray iron impeller for typical wastewater applications
- Hard-Iron impeller for heavy duty wastewater applications containing abrasive and corrosive content
- Chopper ring intended for tough wastewater applications where cutting is required due to long fibres and solid concentrations up to 10-12%
- Stainless steel impeller for special applications that require duplex stainless steel

Robust and Reliable

- Short shaft overhang reduces shaft deflection and increases seal and bearing life
- Class H Motor designed for submersible use. Heat is concentrated to the stator core for improved cooling properties.
- The Plug-in seal with Active Seal system eliminates the risk associated with incorrect installation and careless handling. All in one unit. Available in Tungsten carbide (WCCR) or Silicone carbide (SiC) depending on pumped media.
- Motor cable SUBCAB® specially developed for submersible use
- Offers flexible cooling systems, e.g. closed-loop cooling system, media cooled or external cooling that allows full motor potential in dry installations.
- Premium brand bearings, greased for life, ensures a minimum of 50 000 hours of duty
- Leakage sensor and motor temperature sensor as standard

The N 3202 is available with the following options
- ATEx, FM, CSA-approvals
- Premium efficiency motors
- Hard Iron hydraulic design
- Stainless Steel hydraulic design
- Vibration-sensor, extended motor temperature sensors, additional leakage-sensor, current-sensor and pump memory
- Compatible with SmartRun® Wastewater pump controller
- Compatible with MAS 801 monitoring system

Product Features

- State-of-the-art wastewater pump with N-technology
- Sustained high efficiency pumping with energy savings up to 25%
- Flexible and modular design
- Robust and reliable

Construction Materials

Impeller Material	Volute Material	Stator Cover Material
Hard-Iron	Grey Cast Iron	-

Motor

Rated Power	60 Hp
Number Of Phases	3
Start Current Ratio	5.95
Motor Issue	11
Motor Denomination	30-29-6AA
Rated Motor Speed	1,175 RPM
Insulation Class	H
Locked Rotor Code	G
Motor Efficiency Class	Standard
Rated Voltage	460 V
Approval	FM
Max starts per hour	30
Version Code	095
Rated Current	72 A
Total moment of inertia	14.8601 ft²lbf
Power Factor 100%	0.86
Frequency	60 Hz
Start Current	430 A
Type of duty	S1
Power Factor 75%	0.82
Max P2 (1x)	50.18 Hp
Starting Current, Direct Starting	430 A
Stator Variant	1
Power Factor 50%	0.73
Number Of Poles	6
Starting Current, Star Delta	143.33 A
Motor Module	170
Efficiency 100%	90.8 %
Efficiency 75%	91.7 %
Efficiency 50%	91.6 %

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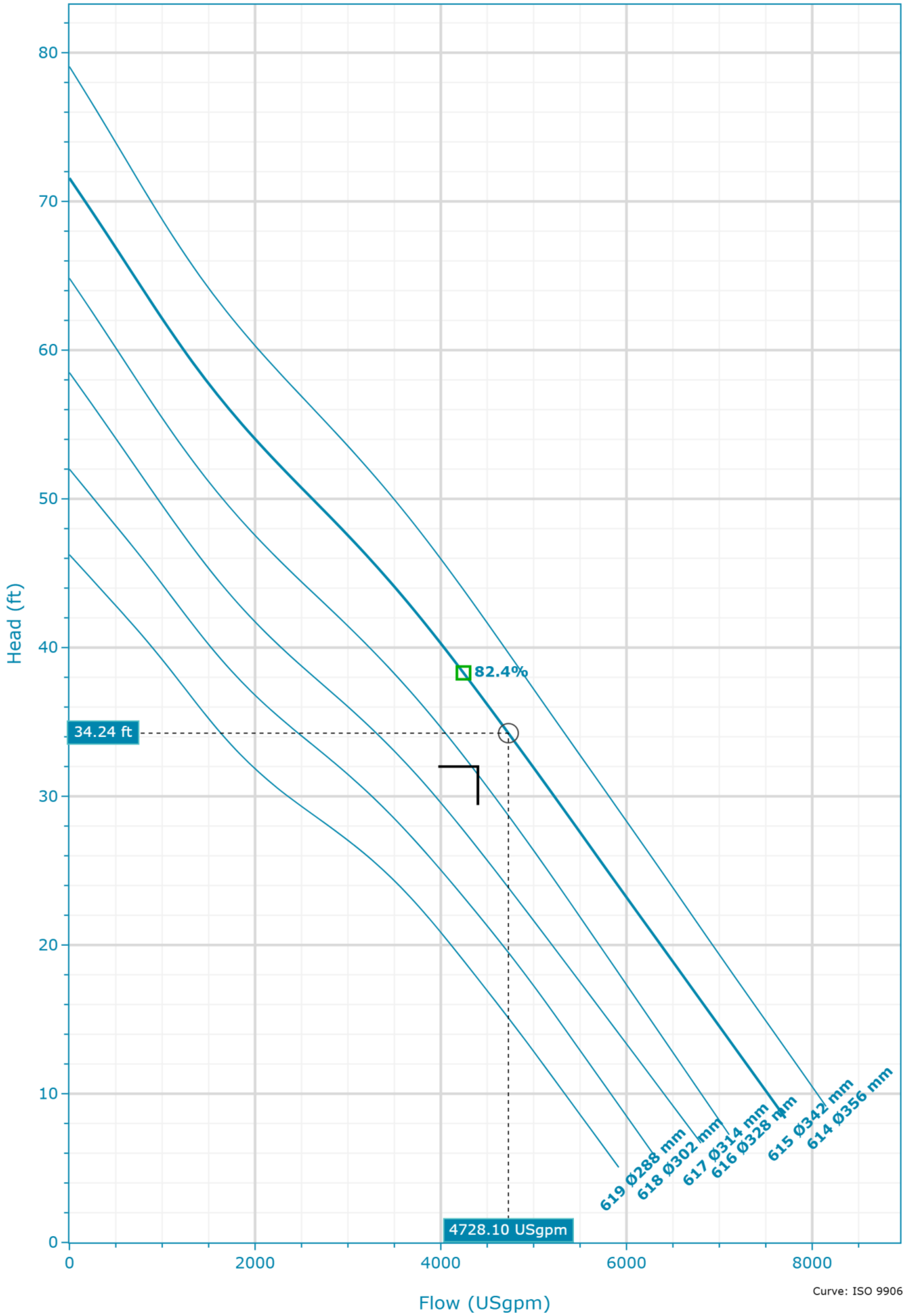
NP 3202 LT 3~ 615 | Hydraulic Data & Performance Curve



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Selection

Series	Curve Code
N 3000	615
Name	Impeller Diameter

Fluid

Fluid Type	Density
Water	62.428 lb/ft³
Fluid Temperature	Dynamic Viscosity

NP 3202 LT 3~ 615

342 mm

39.2 °F

1.567212 cP

Frequency
60 Hz

Total Flow
4,400.00 USgpm

Total Head
32.00 ft

Pump Flow
4,400.00 USgpm

Pump Head
32.00 ft

System Type
Single Pump

Operating Pumps
1

Standby Pumps
No Standby Pump

Inlet Diameter
300 mm

Outlet Diameter
12 in

Number Of Vanes
2

Specific Gravity
1

Fluid Vapor Pressure
0.272 feet

Design Point

Flow
4,728.1 USgpm

Head
34.24 ft

Overall Efficiency (ηo)
74.42 %

Pump Efficiency (ηp)
81.64 %

Input Power (P1)
55.03 Hp

Shaft power (P2)
50.17 Hp

NPSHR
22.47 ft

Static Head
17.50 ft

Flow To BEP Ratio
111.4 %

Design Curve

Rated Speed
60 Hz

Max Flow
7,712.06 USgpm

H@QMin
71.57 ft

H@QMax
8.36 ft

BEP
82.4 %

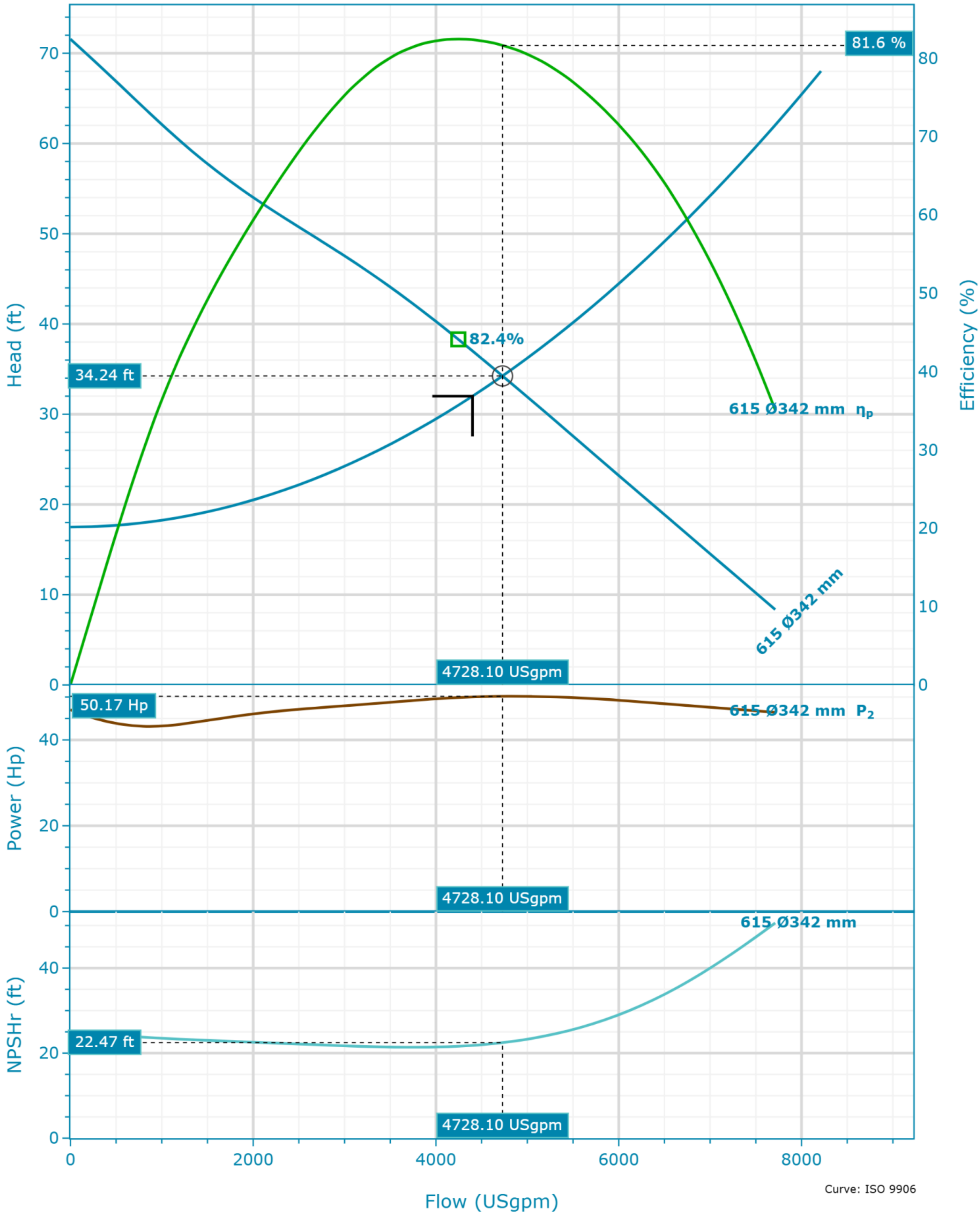
BEP Flow
4,244.75 USgpm

BEP Head
38.3 ft

Max P2
50.18 Hp

Specific Energy
0.000145 kWh/USgal

NP 3202 LT 3~ 615 | Duty Analysis



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

Name	Q (1x) [USgpm]	H (1x) [ft]	P2 (1x) [Hp]	Q [USgpm]	H [ft]	P2 [Hp]	ηp [%]	SE [kWh/USgal]	NPSHr [ft]
DP @ 1x	4,728.1	34.24	50.17	4,728.1	34.24	50.17	81.64	0	22.47

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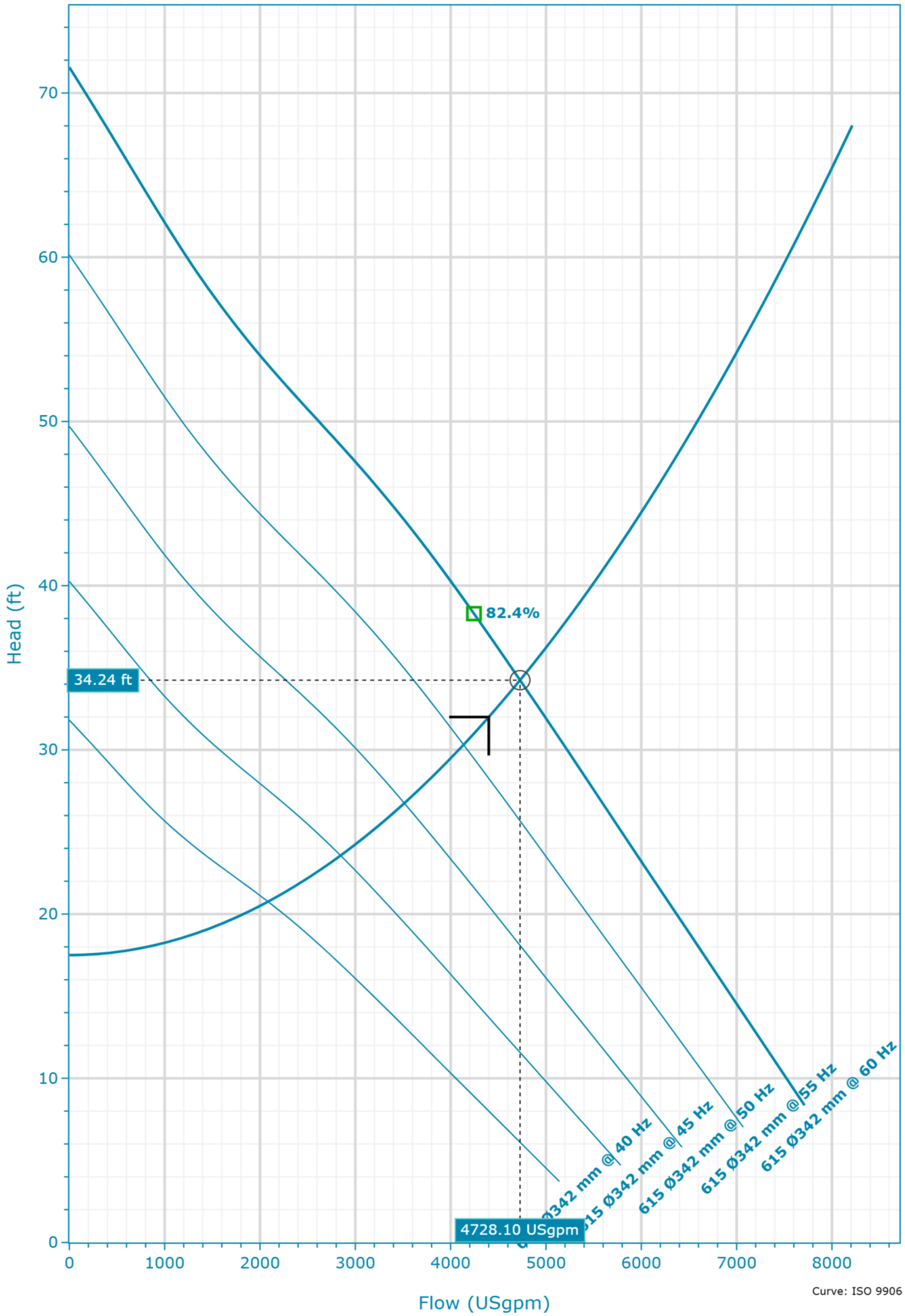
NP 3202 LT 3~ 615 | Variable Speed Curve



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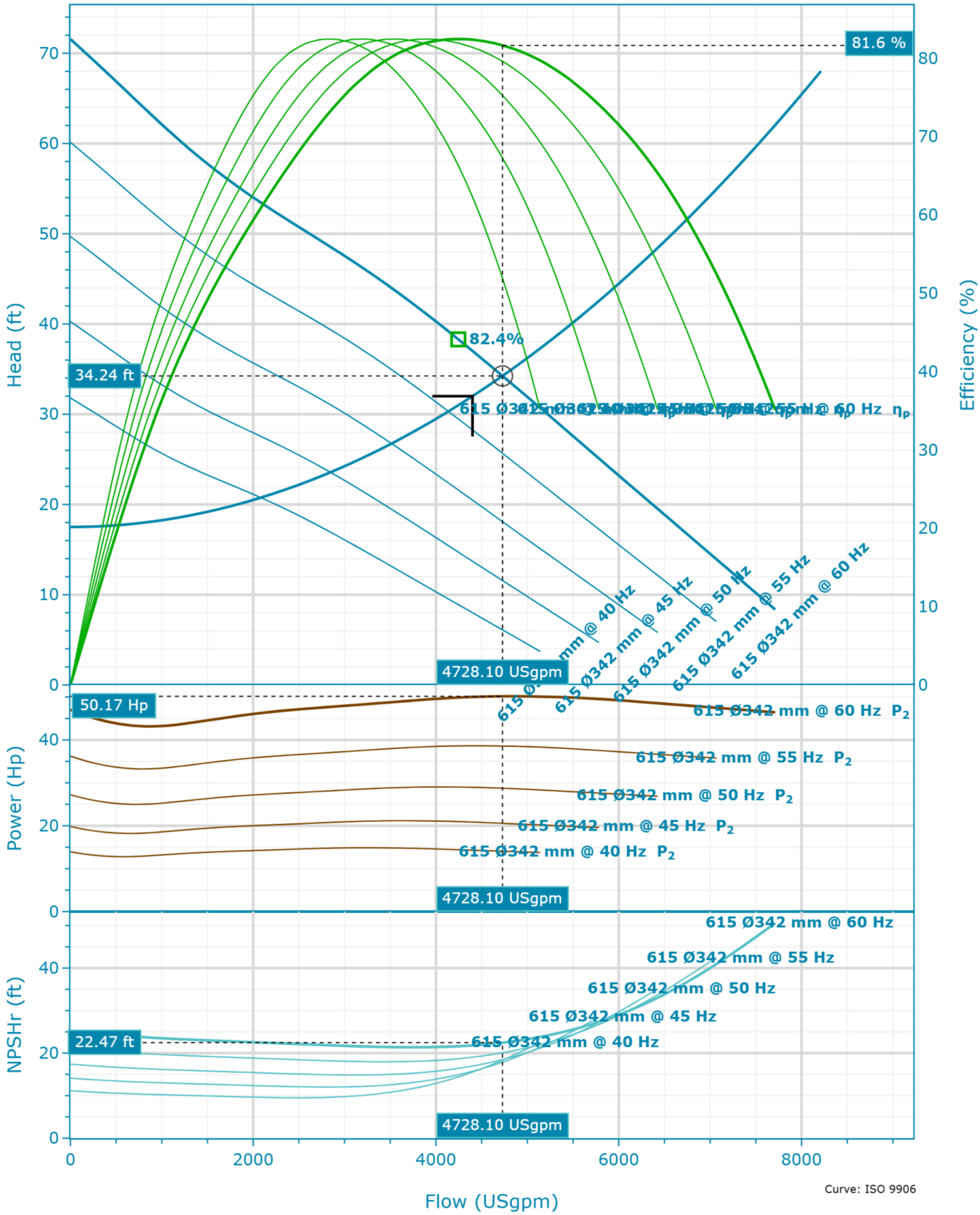
Project:	Created By:	Created On:	Last Update:
NP 3202 LT 3~ 615	Kyle Zaegel	7/23/25	-

NP 3202 LT 3~ 615 | Variable Speed Analysis



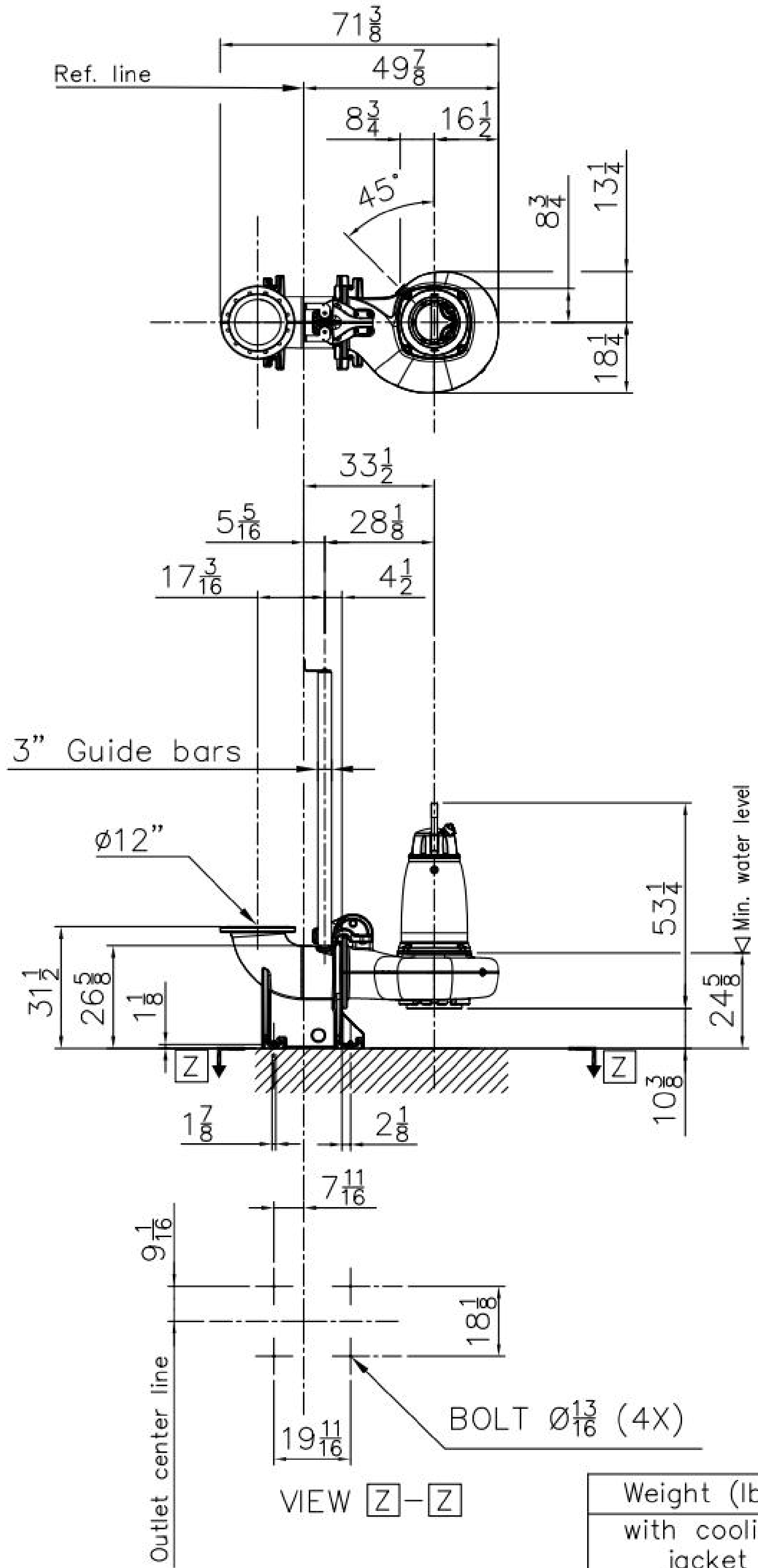
Nominal (mean) data shown. Under- and over-performance from this data should be expected due to standard manufacturing tolerances. Please consult your local Flygt representative for performance guarantees.

Name	Speed	Q (1x) [USgpm]	H (1x) [ft]	P2 (1x) [Hp]	Q [USgpm]	H [ft]	P2 [Hp]	ηp [%]	SE [kWh/USgal]	NPSHr [ft]
DP @ 1x	40 Hz	2,084.77	20.76	14.27	2,084.77	20.76	14.27	76.72	0	9.61
DP @ 1x	45 Hz	2,845.66	23.56	20.78	2,845.66	23.56	20.78	81.62	0	12.03

Project:	Created By:	Created On:	Last Update:
NP 3202 LT 3~ 615	Kyle Zaegel	7/23/25	-

DP @ 1x	50 Hz	3,514.43	26.75	28.85	3,514.43	26.75	28.85	82.44	0	15
DP @ 1x	55 Hz	4,135.87	30.31	38.58	4,135.87	30.31	38.58	82.19	0	18.49
DP @ 1x	60 Hz	4,728.1	34.24	50.17	4,728.1	34.24	50.17	81.64	0	22.47

NP 3202 LT 3~ 615 | Dimensional Data & Drawing



Weight (lbs)	Pump	Discharge
with cooling jacket	1745	645
without cooling jacket	1635	645

FLYGT	NP	3202	LT	Discharge outlet ø12"	Scale 1:40	Date 210312
	090,095,180,185,660,670			Pump outlet ø12"		
				Pump inlet	Drawing number 6841500	Revision 7
				Suction inlet		

Company	Electric Pump
Contact	Kyle Zaegel
Phone No.	5152652222
Email	kylez@electricpump.com

Let's Solve Water

Stanley Consultants INC.

www.stanleyconsultants.com

City of Muscatine

ITEM NUMBER 2026-10

IN-DEPTH ITEM - CITY COUNCIL

DATE: 1/13/2026

STAFF

SUBJECT FOR DISCUSSION

Discussion of the County Wide Emergency Plan - Emergency Management Director, Chris Jasper

EXECUTIVE SUMMARY

GENERAL DIRECTION SOUGHT AND SPECIFIC QUESTIONS TO BE ANSWERED

BACKGROUND/DISCUSSION

ATTACHMENTS