PROJECT NUMBER: 50171721

L16 FEATHERSTONE FORCE MAIN EVALUATION

Featherstone Sewage Pumping Station Rehabilitation Program

JUNE 2024

Dewberry

FINAL

SUBMITTED BY
Dewberry Engineers Inc.
8401 Arlington Boulevard
Fairfax, Virginia 22031-4666
703.849.0100

SUBMITTED TO
Prince William County Service Authority
4 County Complex Court
Woodbridge, VA 22192
703.335.7950

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1. EXECUTIVE SUMMARY

The 30-inch force main from the Featherstone Sewage Pump Station to the H.L. Mooney Advanced Water Reclamation Facility is nearing the end of its lifespan due corrosion induced breaks and projected future population growth. The Prince William County Service Authority contracted Dewberry Engineers Inc. to evaluate alternative alignments and solutions for the force main. The SA was presented various alternative alignments for the force main with two alternatives chosen for analysis herein. These alternatives are named Alignment A and Alignment B.1 and are analyzed in this document. These alternatives are presented in Figure 4.1.

Ultimately, Alignment B.1 is the recommended alignment due to an anticipated easier construction phase with no identified wetland impacts, easier site access, less impact to established roadways, and less required easement. This project would include the installation of a proposed 30-inch HDPE parallel force main to convey flows from the Featherstone SPS to bypass flow limitation in the existing 30-inch force main. This proposed force main would provide adequate capacity for the upgraded Featherstone SPS. The estimated cost of construction, approximately $9.0M, is greater than Alignment A ($8.3M), however, the advantages presented in Sections 4.5 and 4.6 and the summary presented in, outweigh the increased cost. Both alignment alternatives have similar impacts to hydraulics, nearby utilities, and topographical changes. More detailed analyses are presented herein.

2. INTRODUCTION

2.1 Background

The Featherstone Sewage Pump Station (SPS), also referred to as L16, was constructed in 1979 to take the Featherstone Sewage Treatment Plant offline and offload flows through a 30-inch ductile iron force main to the H.L. Mooney Advanced Water Reclamation Facility (H.L. Mooney). In early 2012, corrosion compromised the integrity of the force main section near Rippon Boulevard. The SA replaced approximately 290LF section of the compromised force main with 30” C-905 PVC. Additionally, the SA built a new air release valve and vault at the highpoint of the hill on SA property. As-builts for the emergency repair are found in Attachment E.

Due to the continued corrosion of the force main and projected future population growth, the Prince William County Service Authority (SA) contacted Dewberry Engineers Inc. (Dewberry) to evaluate the alternative solutions for the existing SPS and associated 30-inch force main. In the existing configuration, the 30-inch force main carries the flow from the Featherstone SPS (L16) south-westerly approximately 8,000 LF to H.L. Mooney. Per record drawings, there are no known connections to the force main.

Dewberry completed a preliminary evaluation of the existing 30-inch force main in Preliminary Engineering Report (PER) dated October 2023, and titled L16 Featherstone SPS and Force Main Assessment Evaluation. The recommendation from that memorandum was to replace the existing SPS with a new, larger capacity, SPS to convey larger future flows. With the larger, proposed firm pump station capacity of 23,000 GPM (33.12MGD), the velocity in the existing 30-inch diameter force main would exceed the threshold set by both the PWCSA Utility Service Manual (SA USM) and Virginia Department of Environmental Quality (DEQ) Sewage Collection and Treatment (SCAT) regulations. The report recommended that a new, single 42-inch DIP force main, or a parallel 30-inch force main, replace the existing force main. This recommendation is part of the Master Plan which proposes replacing the existing 30-inch force main with a single 42-inch force main or parallel 30-inch force mains to meet increasing flows.

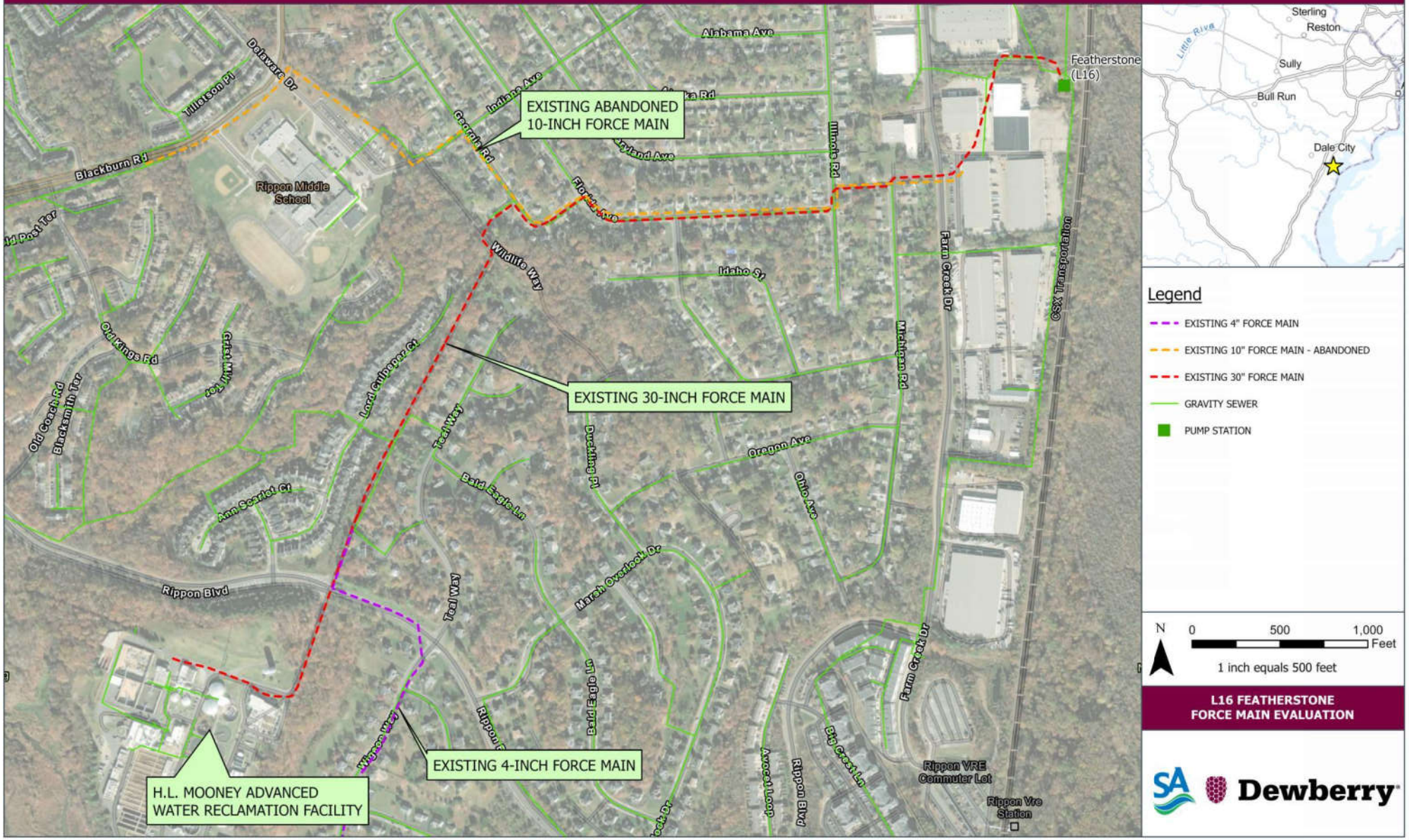
A project area map showing the location of the existing Featherstone SPS System and 30-inch force main system, is shown in Figure 2.1.

Information for this evaluation is based on the following documents:

1. Dewberry Engineers Inc., (October 2023), “L16 Featherstone SPS Short-Term Solution”, Technical Memorandum (Attachment A)

2. Dewberry Engineers Inc., (October 2023), “L16 Featherstone SPS and Force Main Assessment Evaluation”, Technical Memorandum (Attachment B)

FIGURE 2.1 - EXISTING 30" FEATHERSTONE FORCE MAIN



L16 FEATHERSTONE FORCE MAIN EVALUATION

SA Dewberry

2.2 Flows and Limitations

In addition to the projected peak hourly flow (PHF), the new Featherstone SPS will be constructed to accommodate two additional pumps to manage wet weather flow. The Master Plan presented a completed wet weather analysis to determine influent peak flows to L16 Featherstone for a 2-, 5-, and 10-year storm. A summary of the projected flows is presented in the table below.

Table 2-1 Featherstone Flow Projections (MGD)

FLOW CONDITION	2020	2025	2030	2035	2040	2045
Average Daily Flow	7.4	8.4	9.2	9.7	10.2	10.5
Peak Hour Flow (2.5 PF)	18.4	21.0	23.0	24.3	25.4	26.3
2-Year	33.2	34.3	35.1	35.6	36.0	36.4
5-Year	36.8	37.8	38.6	39.2	39.6	40.0
10-Year	39.8	40.8	41.6	42.2	42.6	43.0

The design firm capacity of the station with three pumps operating is 33.91 MGD which is adequate to manage the PHF of 26.3 MGD. However, this only accommodates wet weather flows for a 2-year storm through the existing time step. All 5-, and 10-year storm conditions – and 2-year storm weather flows beginning in 2025 - exceed the firm capacity of the station under normal operating conditions. The design firm capacity of the station with five pumps operating is 48.24 MGD. The additional pumping capacity is adequate to manage wet weather flow projections throughout the planning period for all design storms.

The peak influent wastewater flow to H. L. Mooney includes the combined future firm capacities of the Neabsco and Featherstone pumping stations. The table below provides a breakdown of the firm capacities by time step through the duration of the planning period. Recommended improvements for L16 Featherstone and L74 Neabsco will increase their firm capacity to 33.9 MGD and 34.6 MGD, respectively.

Table 2-2 Mooney Influent Flow (MGD)

INFLUENT FLOW SOURCE	EXISTING	2020	2025	2030	2035	2040	2045
L16 Featherstone	14.4	14.4	33.9	33.9	33.9	33.9	33.9
L74 Neabsco	28.7	28.7	28.7	28.7	28.7	34.6(1)	34.6
Total	43.1	43.1	62.6	62.6	62.6	68.5	68.5

(1) The L74 upgrade is a secondary project with construction assumed to take place after the end of the planning period. The proposed L16 super structure includes 6 pump slots 2 dedicated to flow eq and 4 dedicated to the pump station. Until flow eq is needed, eq pump slots can be used to convey wet weather flows to Mooney.

Based on the SA Implementation documented in the PER. Flow equalization will be deferred. The SA will monitor the operation of L16 Featherstone and based on continued growth and wet weather; flow equalization timing will be refined.

2.3 Purpose

The purpose of this technical memorandum is to explore the alignment alternatives of the force main from the Featherstone SPS to the connection points at H.L. Mooney. This memorandum will outline general alignment components, construction challenges, potential required easements and permits, discuss various site access points, cost differences, as well as other aspects of the two identified alignments to aid in Prince William County Service Authority's selection of the preferred force main routing.

2.4 Scope

The following items are contained within this report:

- Evaluation of two potential alternative alignments for the new force main utilizing available GIS data and record drawings

- A list of anticipated temporary and permanent easements needed to construct and maintain the proposed force main utilizing available GIS data along each alignment alternative.
- A Level 5 (-20% to +30%) conceptual opinion of probable cost for the required improvements, as well as preliminary design and construction schedules
- A desktop environmental evaluation along the force main alignments and a list of anticipated permits needed to construct the proposed force main.
- A hydraulic analysis that was completed to confirm force main sizing and acceptable hydraulic parameters.

3. CONCEPTUAL HYDRAULIC EVALUATION

The Master Plan proposed replacing the existing 30-inch force main with a single 42-inch force main or parallel 30-inch force mains to meet increasing flows. To further refine this concept, Dewberry developed a hydraulic model utilizing Bentley WaterGEMS for the Featherstone pump station to create system curves to serve as the basis of the force main alternatives evaluation. Two configurations were considered: one with two (2) parallel 30-inch force mains and the other consisting of a single 42-inch force main. Both configurations follow the existing alignment and vertical geometry and maintaining the same controlling high point. The pump selection from the PER was used to determine the operating points for each force main alignment and resulting force mains velocity.

Force mains are modeled using inside diameters for all pipes. Minor losses for the system are calculated using the velocity-head method. In agreement with the SA Water and Sewer Utility Standards Manual (USM) effective November 2022, the proposed force mains are modeled as Class-52 double cement lined DIP using inside diameters. Elevations for the existing force main alignment are taken from record drawings and for proposed force mains are taken from GIS contour data. A Hazen Williams C-factor of 130 is used for proposed force mains.

The model generated system curves that are compared to the preliminary pump selection summarized in the PER 1.4 “L16 Featherstone SPS and Force Main Assessment Evaluation” completed as part of the Featherstone Sewage Pumping Station Rehabilitation Program. This pump selection, Flygt CT 3312/865, is included as Attachment F. This pump selection was used to compare pumping rates against multiple force main configurations. The pump selection will be finalized during design once the concurrently designed pump station and force main designs reach 35%.

3.1 Projected Flows

The Master Plan includes flow projections through 2045 for various conditions. The following table provides the flow projections from the Master Plan through 2045 in 5-year time steps. Flows are shown in millions of gallons per day (MGD) for average daily flow (ADF), and peak hour flow (PHF) using a peak factor of 2.5.

Table 3-1 Featherstone Flow Projections (MGD)

FLOW CONDITION	2020	2025	2030	2035	2040	2045
Average Daily Flow	7.4	8.4	9.2	9.7	10.2	10.5
Peak Hour Flow (2.5 PF)	18.4	21.0	23.0	24.3	25.4	26.3
Design (Firm) Capacity	23.0	26.3	28.8	30.4	31.8	32.9

The proposed firm capacity of the pump station is dictated by PHF conditions. Per the USM and Virginia Sewer Collection and Treatment (SCAT) Regulations, a peaking factor of 2.5 is used. The 2045 PHF of 26.3 MGD results in a design firm capacity of 33 MGD. This ensures that the PHF will be 80% of the design firm capacity, allowing the required firm capacity to remain below design capacity throughout the planning period.

3.2 Pump Station Operating Points

The proposed pump station will be equipped with six (6) total pumps. Four (4) pumps will be used to accommodate station flows and convey wastewater to the H.L. Mooney. The station will be constructed with space for two (2) additional pumps for flow equalization to accommodate wet weather flows.

With the four (4) pump configuration, three (3) pumps will be considered duty pumps with one pump on standby per the DEQ definition of firm capacity. This means each pump would need to be rated for approximately 7,700 gpm or 11 MGD.

A system curve was developed to determine the single pump operating point and corresponding total station capacity from one pump operating through three pumps operating. With parallel 30-inch force mains, a single pump will produce 9,000 gpm, 8,550 gpm, and 8,000 gpm with one, two, or three total pumps operating, respectively. These operating points are summarized in Figure 3.1.

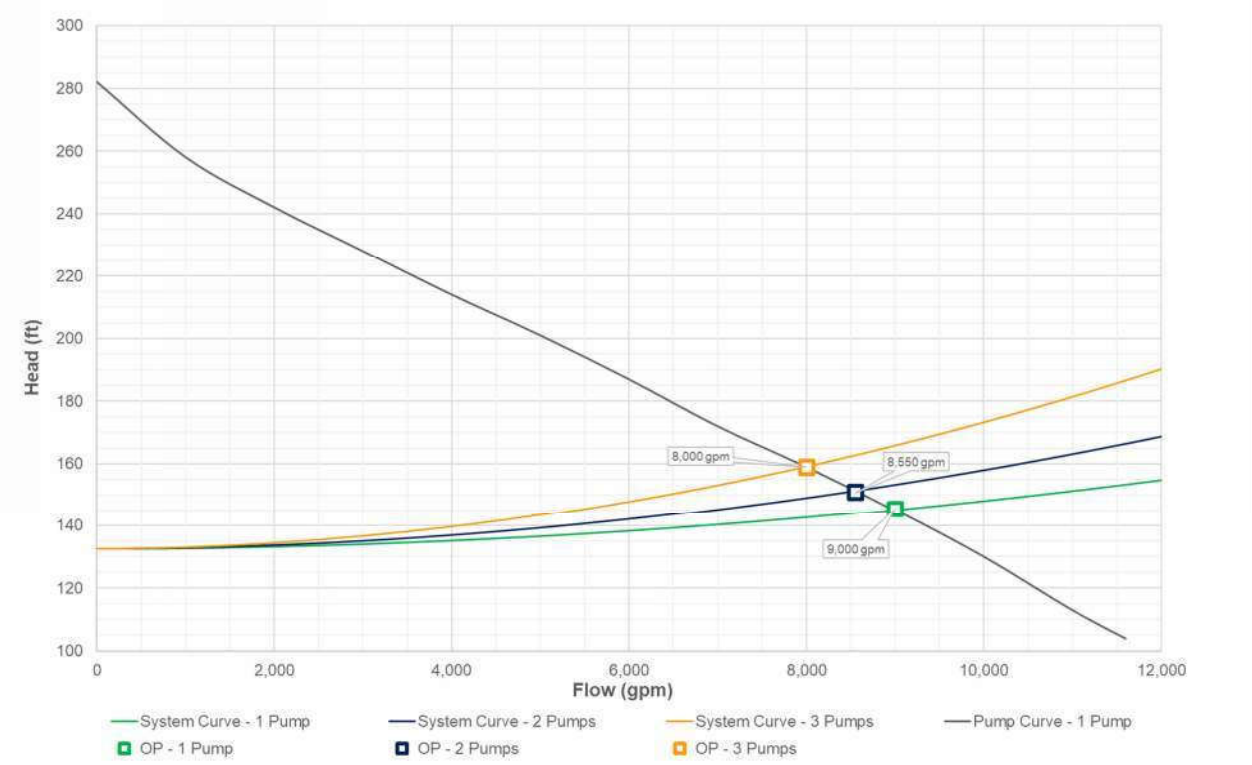


Figure 3.1 System Curve: Parallel 30-inch Force Main

Based on these results, the station capacity was determined for different combinations of pumps operating. The results are summarized in the below table. Based on this analysis, the station will be able to meet a design firm capacity of 33 MGD to accommodate the 2045 PHF of 26.3 MGD.

Table 3-2 Pumping Capacity Through Parallel 30-inch Force Mains

PUMPS OPERATING	OPERATING POINT PER PUMP	TOTAL STATION CAPACITY (MGD)
1	9,000 gpm @ 145.5'	12.7
2	8,550 gpm @ 151.0'	24.6
3	8,000 gpm @ 159.0'	34.6

With a single 42-inch force main, a single pump will produce 9,600 gpm, 9,000 gpm and 8,250 gpm with one, two, or three total pumps operating, respectively. These operating points are summarized in Figure 3.2.

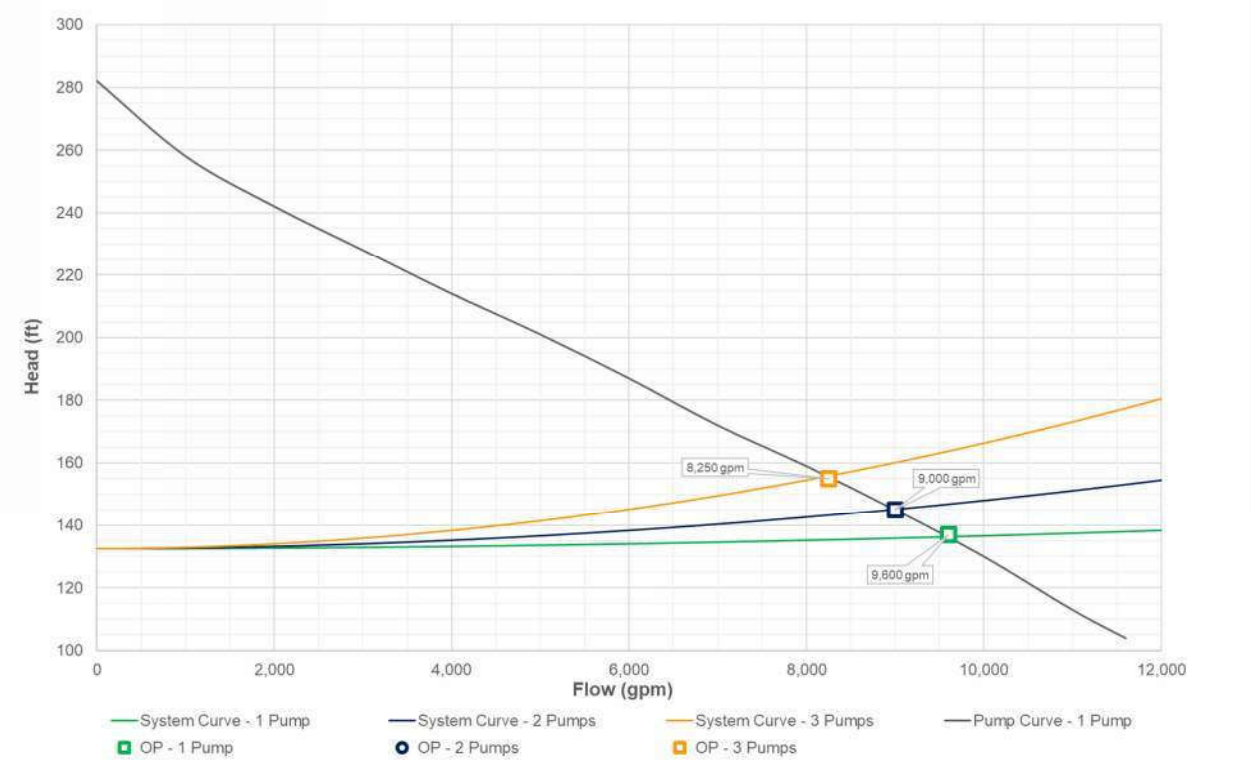


Figure 3.2 System Curve: Single 42-inch Force Main

Based on these results, the station capacity was determined for different combinations of pumps operating. The results are summarized in the below table. Based on this analysis, the station will be able to meet a design firm capacity of 33 MGD to accommodate the 2045 PHF of 26.3 MGD.

Table 3-3 Pumping Capacity Through Single 42-inch Force Main

PUMPS OPERATING	OPERATING POINT PER PUMP	TOTAL STATION CAPACITY (MGD)
1	9,600 gpm @ 137.0'	13.8
2	9,000 gpm @145.0'	25.9
3	8,250 gpm @ 155.0'	35.6

Based on this analysis, a single 42-inch force main will produce higher flow at a lower head. However, parallel 30-inch force mains can produce flows within 6% of a single 42-inch force main with minimal additional TDH.

3.3 Force Main Velocity

With the pump flows confirmed, each conceptual configuration was evaluated to determine force main velocities under various conditions. Per the USM, the minimum allowable velocity needed to achieve scouring velocity is 2.0 ft/s and the maximum allowable velocity is 8.0 ft/s. The velocity level of service criteria used in the Master Plan is 6.4 ft/s which represents 80% of the maximum velocity. Exceeding this velocity would indicate a potential for exceeding the maximum velocity in the near future and would warrant a study to confirm existing and future conditions.

The below table summarizes the force main velocity with one, two, and three pumps operating. It is assumed that with parallel force mains both operating, station flow will be evenly split based on the conceptual configuration.

Table 3-4 Force Main Velocity (ft/s)		
PUMPS OPERATING	PARALLEL 30-INCH	SINGLE 42-INCH
1	1.9	2.1
2	3.7	4.0
3	5.2	5.5

A minimum scouring velocity of 2 ft/s can be met with a single pump operating a single 42-inch force main. With a single pump operating and the parallel 30-inch force mains in service, the minimum velocity would be 1.9 ft/s; therefore, consideration should be given to operating two (2) pumps simultaneously daily to maintain scouring velocities in the parallel force mains. Additional considerations for minimum velocities and operation of the parallel force mains are provided below with the recommended alternative.

The maximum allowable velocity of 8 ft/s would not be exceeded at firm capacity for parallel 30-inch force mains or with a single 42-inch force main.

Based on this analysis, both the parallel 30-inch and single 42-inch configurations meet the velocity requirements at firm capacity.

3.4 Additional Considerations

In addition to the hydraulic evaluation, additional considerations need to be considered to determine the recommended force main alternative.

SA and Dewberry staff completed drawdown testing at the existing station during the Master Plan to calibrate the existing 30-inch force main. A Hazen-Williams roughness coefficient of 75 was calculated for the existing force main. The expected coefficient should generally fall between 100 and 120. This can be impacted by usage, age, and material among other factors. The SA has reported severe corrosion near the Rippon Boulevard Crossing. Based on the low roughness and reported issues, a condition assessment is recommended to be performed to determine the condition of the force main and verify the extent or severity of the expected corrosion.

There are several technologies available that can assess the condition of the existing force main while in service, including:

- Electromagnetic Field (EMF)
- Acoustic Leak Detection
- Multi-Sensor Inspection

However, these technologies are often cost-prohibitive and require significant work to prepare the force main for the inspection. An advantage of moving forward with parallel force mains is the ability to use a phased approach. Once the new parallel force main is constructed and in service, the existing force main can be removed from service, drained, cleaned, and inspected using CCTV to identify deficiencies using Multi-Sensor Inspection (MSI) techniques like PureRobotics by Pure Technologies. This approach would be definitive and cost-effective. The results of such an assessment would allow the SA to develop either a rehabilitation plan to repair the deficiencies or replace the entire force main. Additional information about condition assessment is provided in Attachment G.

For the parallel force mains configuration, the existing 30-inch force main may be rehabilitated or replaced after the new parallel 30-inch force main is constructed and put into service. This would allow the SA to phase the construction of the force mains. The flow to exceed 8 ft/s in a single 30-inch force

main is 26.78 MGD. The station flow with two pumps in service is 24.62 MGD. Based on the projected flows, the PHF will not exceed 24.62 MGD until 2040 and will reach 26.3 MGD at the end of the planning period. Based on these flows, two pumps operating can accommodate PHF until 2040. Once three pumps are needed to meet flows, the velocity in a single 30-inch force main will exceed 8 ft/s. Therefore, both parallel force mains do not need to be in service until approximately 2040. This provides the SA with time to complete a condition assessment and study of the existing 30-inch force main to determine the most efficient method of rehabilitation or replacement.

Utilizing parallel 30-inch force mains also provides the SA with redundancy. In the event of a force main break or outage, the station can operate with only one of the parallel force mains in service. If an outage occurs to the single 42-inch force main, bypass pumping and temporary piping would be required to convey flows during the full duration of repair work.

For a single 42-inch force main, the existing 30-inch force main would be abandoned in place. A single 42-inch force main would provide adequate capacity through 2045 based on the Master Plan flow projections while remaining below 80% of its full capacity.

4. ALIGNMENT ALTERNATIVES

4.1 Overview

The Featherstone SPS is located at 15023 Farm Creek Road, Woodbridge, VA on a parcel owned by the Prince William County Service Authority and approximately 0.89 acres in size. The existing pump station discharges via a 30-inch force main to the northwest for approximately 150 LF. The force main then runs approximately 340 LF to the west along the access road of the SPS. From there, the force main jogs approximately 750 LF southwest through an industrial area until it reaches Farm Creek Drive where the force main turns to the west through an existing easement and Florida Avenue. The force main follows Florida Avenue for approximately 2,100 LF until the intersection of Georgia Road. From the intersection, the force main travels generally west along Georgia Avenue and Georgia Court before reaching Wildlife Way. The force main then travels southwest for approximately 2,100 LF along a 50-foot-wide strip of property wholly owned by the SA. The force main continues southwest across Rippon Boulevard, and onto H.L Mooney property, for approximately 650 LF before bending northwest for approximately 750 LF to the discharge point at the future headworks.

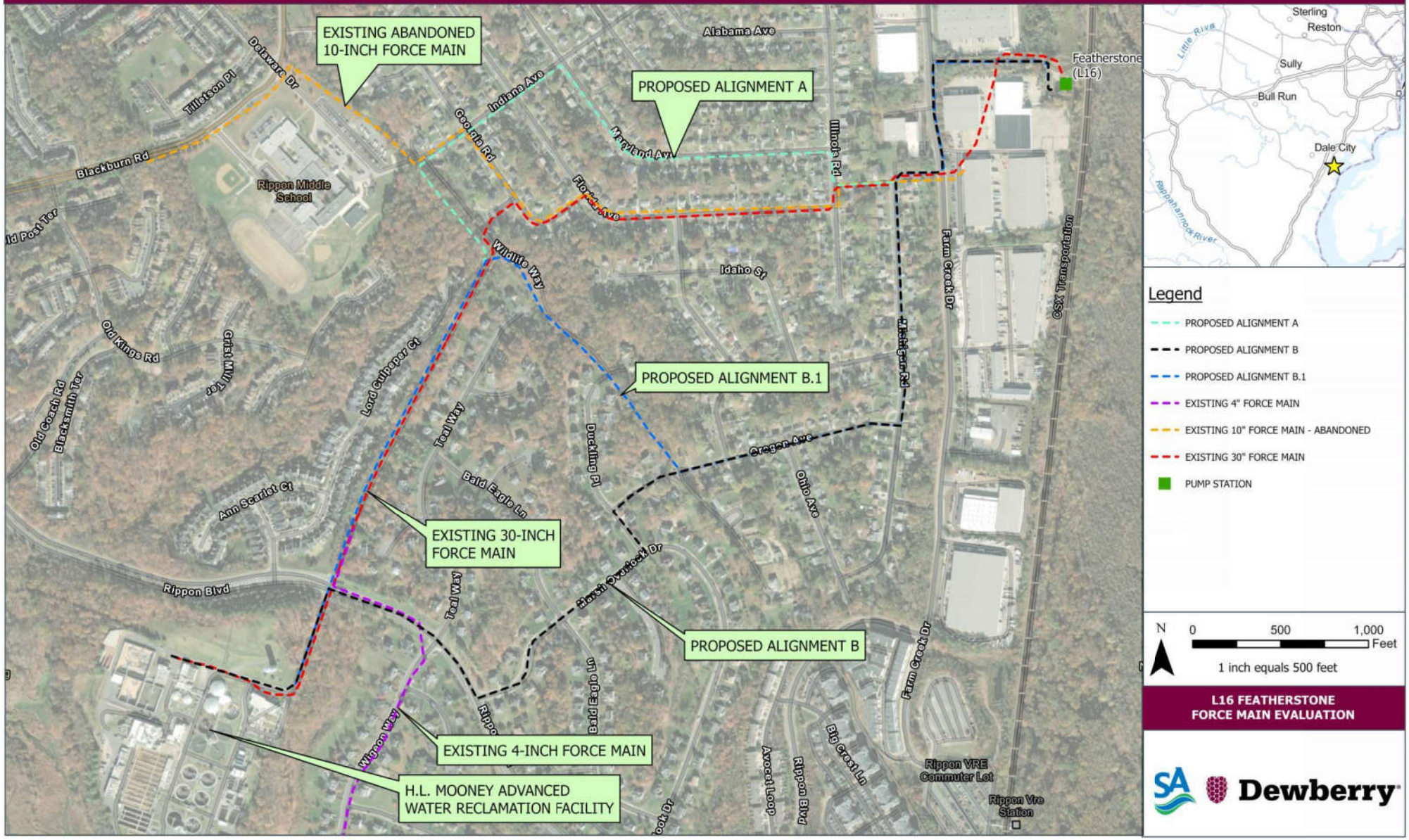
Two alternative alignments were selected for analysis out of four total alternatives presented to the SA. Alternative Alignments are shown in Figure 4.1. One alignment was outlined in the report titled L16 Featherstone SPS and Force Main Assessment Evaluation and dated October 2023 and was assumed that a new 42-inch force main was to follow the existing force main alignment. That alignment was not selected for analysis due to the multitude of utilities running the length of Florida Avenue and associated constructability challenges of likely utility relocations.

The first alternative alignment analyzed, designated Alignment A, follows the SA property and public ROW along Farm Creek Drive from the Featherstone SPS. The alignment follows the existing 30” force main until Illinois Road where it travels northwest, then southwest, and eventually southeast along public roads until Wildlife Way. The alignment then travels southwest parallel to the existing 30-inch force main to the H.L. Mooney.

The second option, Alignment B, initially follows the same path as the existing force main and Alignment A. Once the alignment reaches Michigan Road, Alignment B deviates south and southwest within the existing road right of way towards Rippon Boulevard. During analysis of Alignment B, a fourth alternative was developed to utilize Wildlife Way as a cut through between the upstream section of Alignment B and the downstream section of Alignment A. This alignment was presented to the SA and evaluated as the second alignment alternative (Alignment B.1). Alignment B.1 will mitigate disruptions in the neighborhood and avoid a section of Resource Protection Area along Marsh Overlook Drive that Alignment B will traverse.

Alignment A and Alignment B.1 details are explored in greater detail in the following sections.

FIGURE 4.1 - ALIGNMENT ALTERNATIVES OVERVIEW



4.2 Existing Utilities

To aid in identifying existing utilities and potential conflicts or challenging areas for both alignment options, a Miss Utility ticket was called in on February 8, 2024. Utilities were marked by February 27, 2024. The following utilities responded to the Miss Utility ticket:

- Comcast
- Dominion Energy Electric Distribution
- Level 3-Centurylink
- MCI-Verizon
- Products Pipe Line
- Prince William Schools - Electric
- Prince William County Water
- Prince William County Sewer
- Verizon
- Washington Gas

Besides Prince William County Water and Sewer and Comcast, all other utility companies responded with "no conflict" to the Miss Utility ticket.

Dewberry conducted a field walk of the two (2) potential alignments on February 28, 2024, to observe existing utilities and identify potential conflicts. During the field walk, additional, unmarked utilities were located in the area. There is an on-going gas distribution main project in the area and select gas, water, and sewer mains were marked sporadically. Further investigation noted communication and electric lines on poles in the area. There is the possibility that the observed existing utilities and potentially other unknown and unmarked existing utilities could cause conflicts with the alignment options. It is recommended as part of the field work conducted for the design of the force main that Subsurface Utility Engineering (SUE) and utility designation be incorporated to get a better understanding of the extent of existing utilities and resulting conflicts in the area.

4.3 Force Main Connection Points

The northern terminus of the force main will be connected to the proposed Featherstone SPS recommended in the L16 Featherstone SPS and Force Main Assessment Evaluation report. At the southern end of the alignment, a new headworks facility at H.L. Mooney is currently under design by HDR for the SA. A connection for the future force main, regardless of alignment, is included in the design.

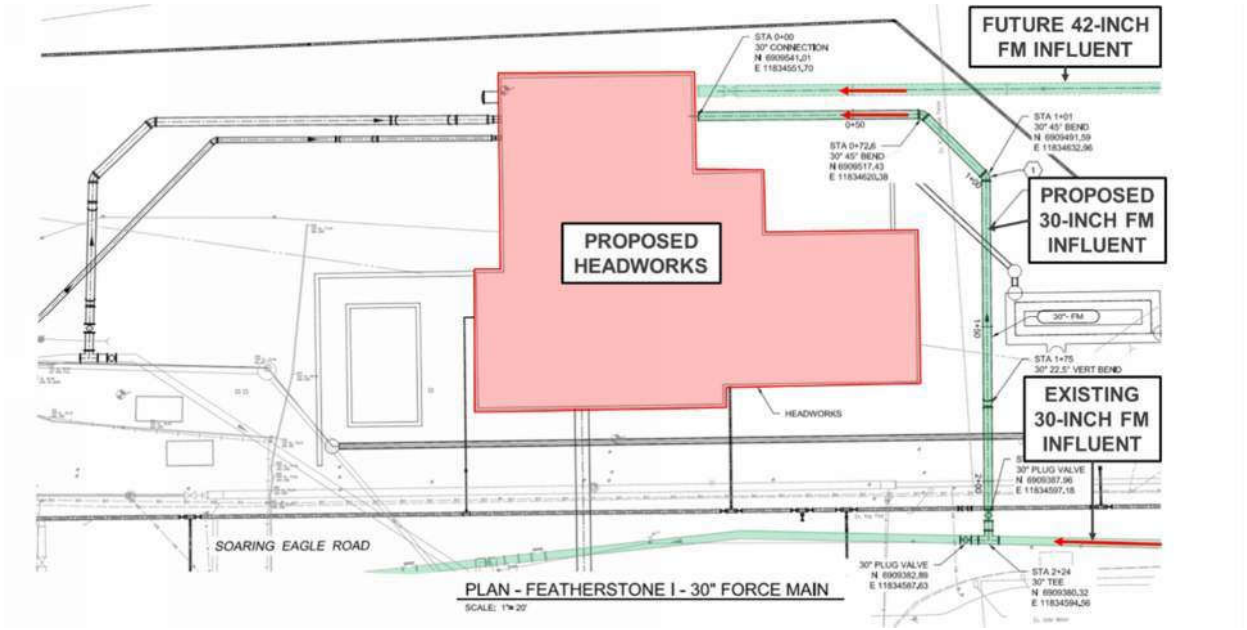


Figure 4.2 Future Headworks

4.4 Environmental Constraints & Permitting Summary

A preliminary environmental desktop review of the project corridor was completed to determine potential impacts and challenges associated with the proposed alignments. In general, it appears that both Alignment A and Alignment B.1 have similar environmental constraints and required permitting. As such, this section of the report is intended to encompass both alignment options and any distinction of the two alignments due to differences in environmental impacts or required permitting will be described within that section. Attachment C summarizes the permits anticipated to be required to construct the proposed force main.

4.4.1 Cultural and Historic Resources:

A review of the Virginia Department of Historic Resources (DHR) Virginia Cultural Resources Information System (VCRIS) database noted the Richmond Fredericksburg & Potomac railroad adjacent to the L16 Featherstone SPS, now CSX railroad, is a historic district and eligible for listing on the National Register of Historic places under Criterion A. The CSX property is eligible for listing on the National Register of Historic places, however, both force main alternative alignments will not cross nor impact the property. Both alternative alignments are located to the west of the CSX property.

Alignment A has the potential to encroach into a documented archaeological site (44PW1443). The site report is included as Attachment D. A Phase I archaeological survey may be necessary to address Section 106 requirements for future project permitting or federal funding. See Figure 4.3 for locations of cultural and historic resources near the project location.

Figure 4.3 Historical Resources Map

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

4.4.2 Waters of the U.S. and State including Wetlands:

This project will not cross tidal jurisdictional Waters of the U. S. and State (WOUS). The project alignments may contain the potential for non-tidal wetland areas which may be considered jurisdictional by the U. S. Army Corps of Engineers and/or Virginia DEQ, particularly along the existing 30 inch for both alignments near the SWM facilities at Bald Eagle Lane. According to the Prince William County GIS and VDEQ WetCAT tool information, both alignments will cross two drainages identified as streams. A Waters of the U. S. Delineation is recommended to determine the limits of jurisdictional areas to define project impacts to WOUS for future permitting. See Figure 4.4 for WetCAT information.

During the early field investigation portion of the project, a wetland delineation should be conducted and utilized to assess the extent of wetland impact locations. The delineation area should include all contractor laydown utility relocations and probable limits of disturbance. As a required element of the federal and state permit acquisition, potential avoidance and minimization strategies should be employed in the final design if practicable using alternative design and construction methodologies such as trenchless pipe installation for high impact portions of the alignment. Design of the force main should evaluate the cost benefit analysis of reducing the amount of wetlands impacted, mitigation costs required, with the feasibility of construction and associated construction costs.

Waters, Wetlands, and Resource Protection Areas are depicted in Figure 4.5.

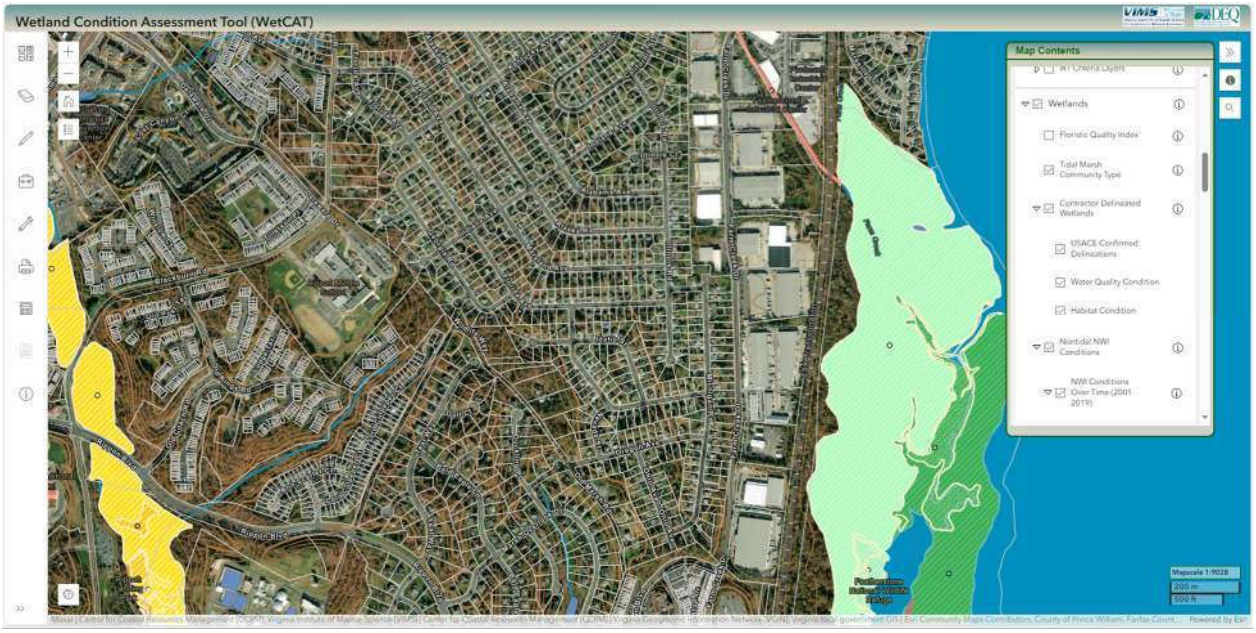


Figure 4.4 WetCAT Condition Assessment

4.4.2.1 Coastal Zone Management Act Consistency

As this project is located within the Coastal Plain, a DEQ Coastal Zone Management Act Consistency Determination may be required and will be determined during design. Most VWP General permits have been consistent with CZMA provided they meet specific conditions. Should this action be deemed required, the determination activity at DEQ typically runs parallel or just prior to the water quality permitting process.

4.4.3 Endangered Species

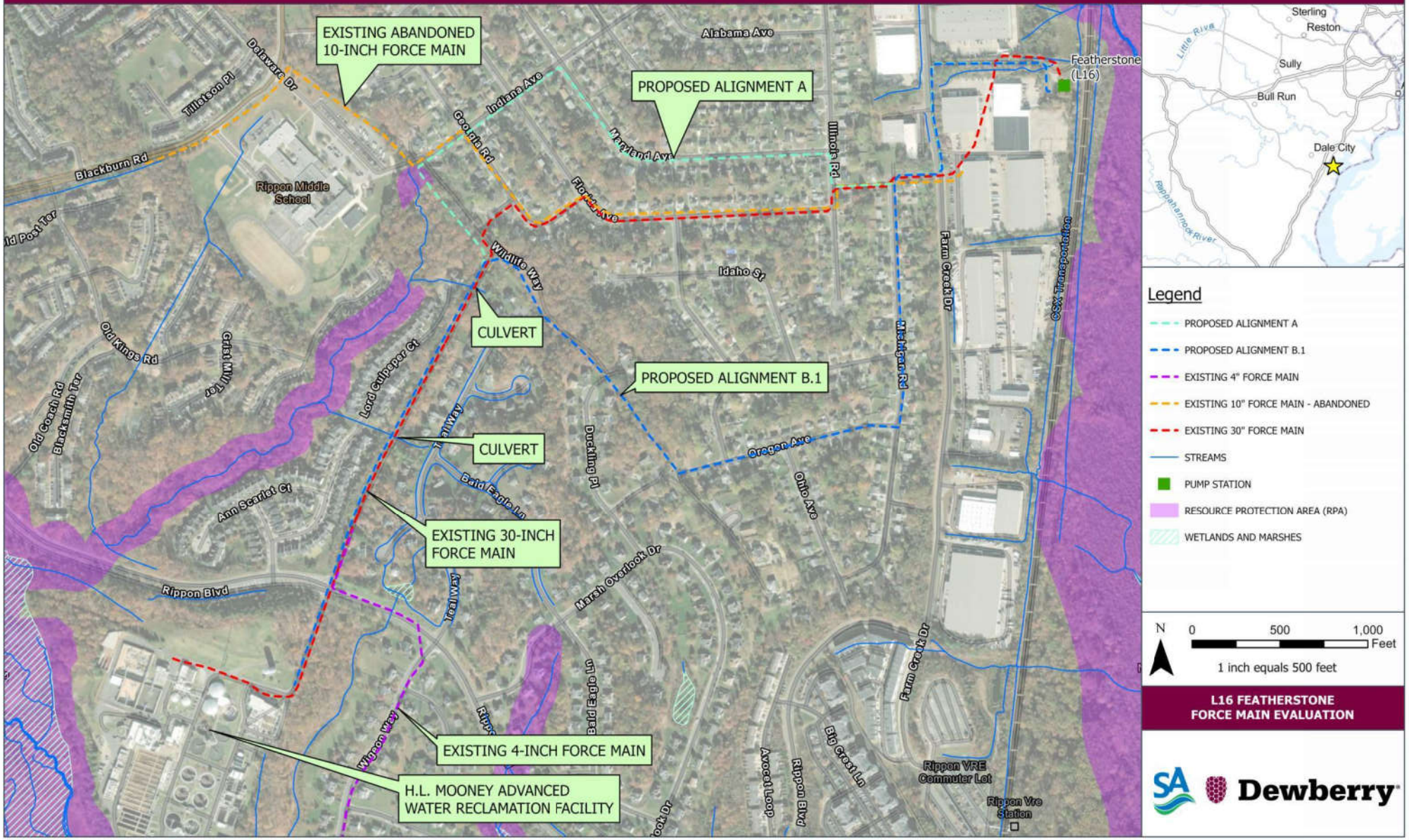
Federally listed species identified during preliminary review of the State and Federal Threatened and Endangered Species Databases included the Federally Endangered Northern Long-eared Bat (*Myotis septentrionalis*), the Tricolored Bat (*Perimyotis subflavus*) that is proposed as endangered, and the Monarch Butterfly (*Danaus plexippus*), which is currently listed as a candidate species.

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

A proposed rule to make the Tricolored Bat as an endangered species and a Species Status Assessment Report has been issued, however, there are no current protections for the species. The Monarch Butterfly is a candidate species and there are no official current protections for the butterfly, however the species is currently under study. Should the status of the two species change to threatened or endangered, project aspects may need to be altered to prevent impact to the species.

Twenty-five Bald Eagle (*Haliaeetus leucocephalus*) nests are located within 5 miles of the project area; the closest nest within approximately 1,200 feet but located outside of both primary and secondary buffers. Eagles and particularly their nests are protected under the Bald and Golden Eagle Protection Act. Construction encroachments near the nests could impact the eagle nesting success. Coordination with FWS may be required. Blasting, pile driving, and other loud construction methods could result in the need to acquire a FWS incidental take general permit and/or Time of Year Restrictions for certain aspects of construction within certain buffers around active nests.

FIGURE 4.5 - WATERS, WETLANDS, AND RESOURCE PROTECTION AREAS



Nest locations can move from year to year and a review of the latest data should be conducted during project permitting. Reviews of the State and Federal Threatened and Endangered Species Databases are only valid for 90 days and will need to be updated as design advances. The information contained in this section is based on the findings at the time of this report (April 2024).

4.4.4 Hazardous Materials

The project may require acquisition of permanent right of way, or temporary easements, therefore a Phase I Environmental Assessment is recommended for right of way acquisitions. A review of the DEQ Data Mapper noted three closed petroleum spills in the project vicinity. Although these spills are deemed closed by DEQ, there is a potential to encounter petroleum containing soils near these locations. Once an alignment is selected further studies may be necessary to assess design, construction, and disposal considerations.

If dewatering of petroleum contaminated soils is required, the project may require a VPDES (VAG83) General Permit from DEQ for Discharges from Petroleum Contaminated Sites, Groundwater remediation and Hydrostatic Tests.

4.4.5 Parks, Preservation Areas, & Chesapeake Bay Act Buffers

Neither alignment will encroach on any existing park in the project area.

Both alternative alignments will cross the edge of the County mapped Chesapeake Bay Preservation Overlay District and associated Resource Protection Areas (Figure 4.5). Public Utility lines and their appurtenant structures are typically exempt from the Chesapeake Base Preservation Act Ordinance under Section 32, Article V, Part 504 of the Prince William County Code of Ordinances, specifically noted under Part 504.14. Site development typically requires a Water Quality Impact Assessment (WQIA) and a Preservation Area Site Assessment (PASA) submittals for encroachment into the RPA, however, per the Prince William County Design and Construction Standards Manual the WQIA & PASA are not typically required for linear utility lines.

Alignment A will cross into an RPA near Wildlife Way and the existing 50-foot swathe of SA property. As the RPA in this area has no connection of the downstream buffer, and prior water quality permits and County approved Perennial Flow Determinations from Jan. 9, 2017, documented the channel in question as being intermittent. The RPA noted in the mapping may be in error and may require additional documentation.

Parks and Preservation Areas are depicted in Figure 4.6.

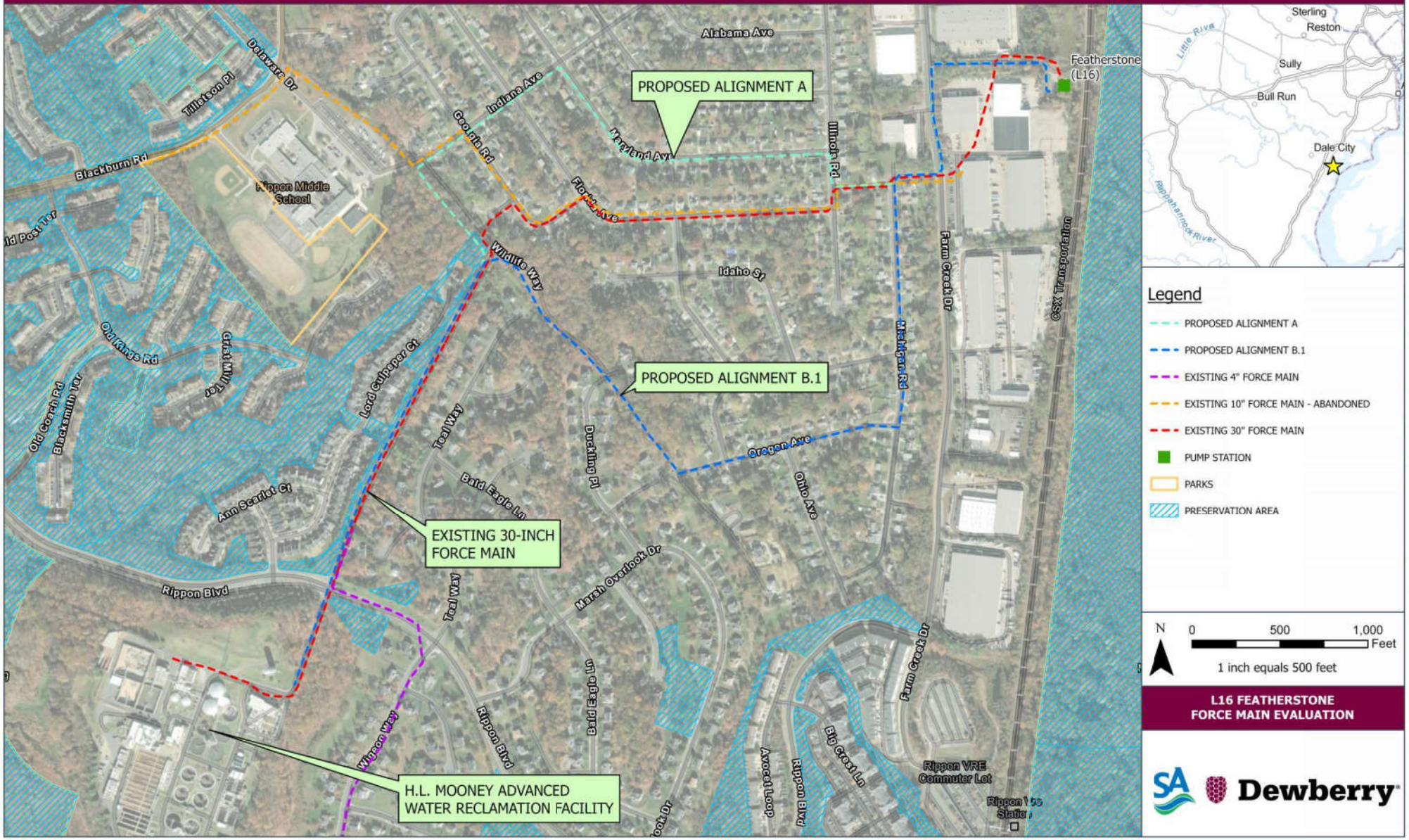
4.4.6 Geotechnical Conditions

Geotechnical subsurface conditions are not known at this time. It is recommended that soil boring be completed at a minimum at regular intervals along the selected alignment as deemed appropriate by a Geotechnical engineer, at wetland/stream crossings, and other locations identified as necessary during the design which are to be used in the development of a geotechnical report. At a minimum, this will aid the design engineer in the development of adequate pipe bedding design and alert to difficult construction areas such as high ground water tables.

4.4.7 DEQ Certificate to Construct and Certificate to Operate

Under the Sewage Collection and Treatment (SCAT) Regulations 9 VAC 25-790, this project will require obtaining a Certificate to Construct (CTC) and Certificate to Operate (CTO) through the DEQ. The CTC application process does not require the submittal of the design plans, specifications, or design calculations, but does require that all applicable DEQ regulations are followed. Per SCAT 9 VAC 25-790-90, the CTC application shall be submitted at least 180 days prior to the date that PWCSA desires to begin construction, so this process should be initiated early in the design schedule to avoid potential delays. At the end of construction, a statement shall be submitted by PWCSA assuring completion of construction and an inspection of the constructed system will be scheduled with DEQ and a CTO will be issued.

FIGURE 4.6 - PARKS AND PRESERVATION AREAS



L16 FEATHERSTONE FORCE MAIN EVALUATION

SA Dewberry

4.5 Alignment A

4.5.1 Route Description

Alignment A includes approximately 9,150LF of new force main and would begin at the Featherstone SPS and proceed from the SPS parcel to the north then west following the SPS access road to Farm Creek Drive. The force main turns south along Farm Creek Drive and then turns west across the existing easement for the 30-inch force main. The force main follows Florida Avenue until the intersection of Illinois Road. From the intersection, the force main travels north to, and west along, Maryland Avenue and to the intersection with Indiana Avenue. The force main then travels southwest along Indiana Avenue to Wildlife Way. The force main runs southeast along the property bounding Wildlife Way to the property owned by the SA. The force main then travels southwest along the western portion of the 50-foot-wide strip of property wholly owned by the SA. The force main continues southwest across Rippon Boulevard, and onto H.L Mooney property, before bending northwest to the discharge points discussed in Section 4.3.

4.5.2 Preliminary Easement Evaluation

Alignment A primarily travels within the existing right of way of neighborhood roads. The proposed force main will utilize one existing easement for the existing 30-inch force main at 15201 Michigan Road (GPIN 8391-82-5821). Increasing the width of the existing easement may be required for this parcel due to the fact that the existing 30-inch force main is routed between two properties.

The force main alignment runs within four parcels as it abuts Wildlife Way and would require easements from Prince William County Schools (GPIN's 8391-52-7730 and 8391-42-8911), 1651 Wildlife Way (GPIN 8391-51-7990), and 1752 Ann Scarlet Court (GPIN 8391-40-7055).

4.5.3 Key Stakeholders

In addition to the additional easement required from the properties mentioned in Section 4.5.2, additional stakeholders include the existing utility companies identified during utility designation.

4.5.4 Topography

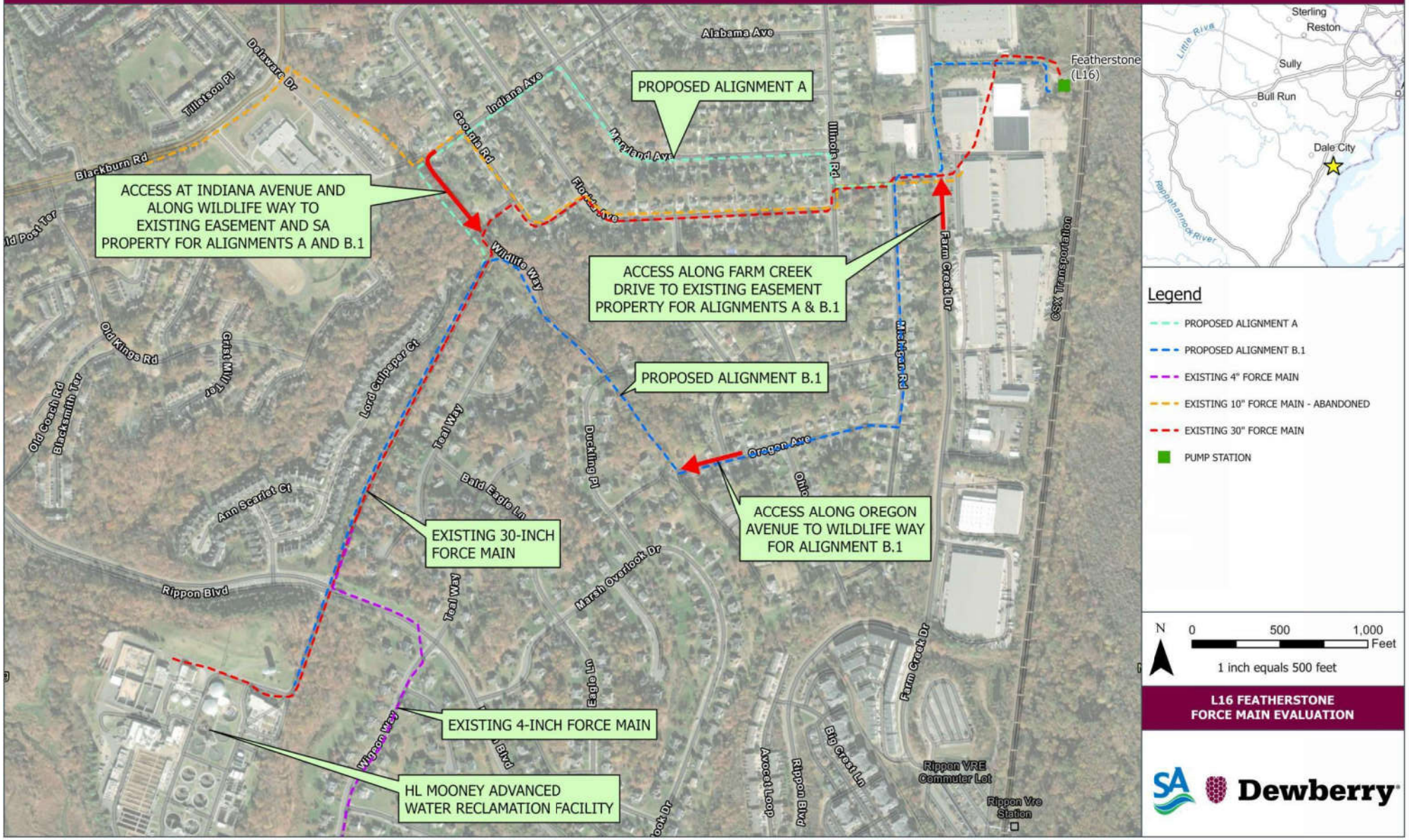
Alignment A, from the Featherstone SPS to the intersection of Florida Avenue and Illinois Road, rises from ground elevation 8 to 40 feet across approximately 1,300 LF. From the intersection to Wildlife Way, the topography gets steeper from ground elevation 40 to 104 feet across approximately 2,400 LF. Along Wildlife Way and the 50-foot-wide SA property, the topography rises and falls at two localized high points of ground elevation 118 and 126 feet and one localized low point at ground elevation 78 feet. At the two high points, it is proposed to construct an air release valve.

4.5.5 Site Access

Site access for Alignment A will primarily be from the existing roadways. For access to the existing easement at 15201 Michigan Road (GPIN 8391-82-5821), access will be from Farm Creek Drive. For access to the proposed alignment at Wildlife Way, access will be provided at the intersection of Wildlife Way and Indiana Avenue. For access to the southern portion of SA property, access can be provided via the existing access road entrance from Rippon Boulevard.

See Figure 4.7 for areas of site access.

FIGURE 4.7 - SITE ACCESS



Legend

- PROPOSED ALIGNMENT A
- PROPOSED ALIGNMENT B.1
- EXISTING 4" FORCE MAIN
- EXISTING 10" FORCE MAIN - ABANDONED
- EXISTING 30" FORCE MAIN
- PUMP STATION

N

0 500 1,000 Feet

1 inch equals 500 feet

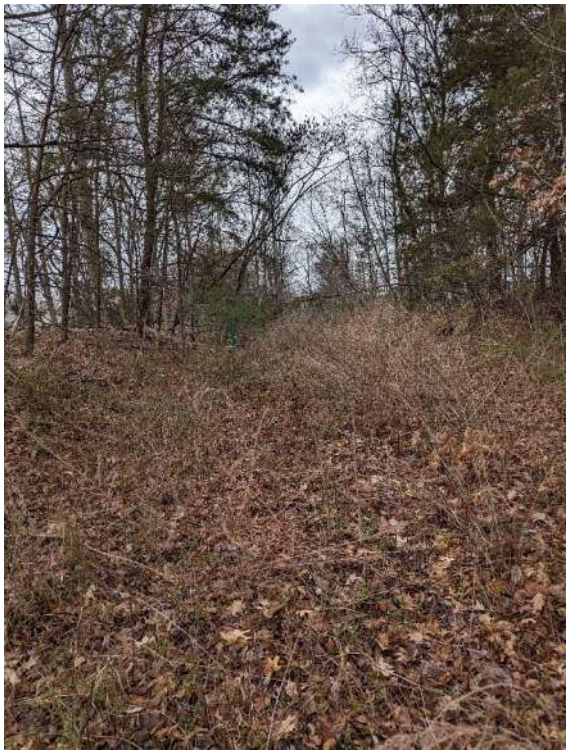
L16 FEATHERSTONE FORCE MAIN EVALUATION

SA Dewberry

4.5.6 Constructability Challenges

The northern portion of Alignment A is mostly located within the right of way on local, non-arterial roads. This will pose a maintenance of traffic challenge and require local detours during construction. Additionally, multiple utilities are located within the roadways. Utility relocations may be necessary to construct the force main. Existing utilities are discussed in more detail in Section 4.2.

A significant portion of Alignment A is located adjacent to Wildlife Way and in the 50-foot-wide strip of property owned by the SA from Wildlife Way to Rippon Boulevard. Tree clearing will be necessary for the section of force main adjacent to Wildlife Way. Elevation change in this area will increase construction difficulty through that area in regard to equipment access for the trenchless pipe installation. An existing access road from Rippon Boulevard and access from Wildlife Way will mitigate challenges in this area, however, site clearing will be necessary.



Cleared easement for 30-inch force main

4.5.7 Opinion of Probable Construction Cost

An opinion of probable construction cost (OPCC) was prepared for the proposed parallel 30-inch force main along Alignment A. The estimate class is based on the AACE International cost estimate classification system. The estimate class for this OPCC is Class 5. A Class 5 OPCC is typically associated with concept screening and has an expected low accuracy variation of -20% to -50% and a high accuracy variation of +30% to +100%. For this estimate, a low accuracy variation of -20% and a high accuracy variation of +30% has been included. Easement acquisition costs have not been included in this OPCC.

Description	Quantity	Unit	Unit Cost	Extension
General				
Mobilization (5%)	1	LS	$ 255,400	$ 255,400
General Conditions (5%)	1	LS	$ 255,400	$ 255,400
Permits and Fees (1.25%)	1	LS	$ 63,900	$ 63,900
Bonds and Insurance (2%)	1	LS	$ 102,200	$ 102,200
Start up and Testing	1	LS	$ 50,000	$ 50,000
Force Main Construction				
Erosion and Sediment Controls (2%)	1	LS	$ 46,400	$ 46,400
Furnish and install 30" DIPS DR11 HDPE force main, complete in place	6850	LF	$ 400	$ 2,740,000
Furnish and install 30" DIP CL 52 force main, complete in place	2250	LF	$ 800	$ 1,800,000
Tree removal, clearing and grubbing within limits of disturbance	1	LS	$ 10,000	$ 10,000
Pavement Restoration	1	LS	$ 460,000	$ 460,000
Maintenance of Traffic	1	LS	$ 50,000	$ 50,000
Subtotal				***$ 5,900,000***
Contractor Overhead & Profit	15	%		$ 885,000
Contingency	10	%		$ 678,500
Engineering	10	%		$ 746,400
Total Budget Estimate				***$ 8,300,000***
High Budget Estimate (+30%)				***$ 10,800,000***
Low Budget Estimate (-20%)				***$ 6,700,000***

4.6 Alignment B.1

4.6.1 Route Description

Alignment B.1 includes approximately 9,500LF of new force main and would begin at the Featherstone SPS and proceed from the SPS parcel to the north then west following the SPS access road to the Farm Creek Drive. The force main turns south along Farm Creek Drive and then west across the existing easement for the existing 30-inch force main. Alignment B.1 then turns south and follows Michigan Avenue and west along Oregon Avenue. It will then travel north through the cul-de-sac of Oregon Avenue to, and along, Wildlife Way. The force main then travels northwest to existing SA property. The force main then travels southwest along the western portion of the 50-foot-wide strip of property wholly owned by the SA. The force main continues southwest across Rippon Boulevard, and onto H.L Mooney property, before bending northwest to the discharge the proposed headworks discharge point discussed in Section 4.3.

4.6.2 Preliminary Easement Evaluation

Alignment B.1 will primarily travel within the existing right of way of neighborhood roads. The proposed force main will utilize one existing easement for the existing 30-inch force main at 15201 Michigan Road (GPIN 8391-82-5821). Increasing the width of the existing easement may be required for this parcel due to the fact that the existing 30-inch force main is routed through the property.

Utilizing this alignment will also necessitate a 1,600-foot-long easement along Wildlife Way (GPIN 8391-61-5831) to existing SA property to the northwest. Wildlife Way is wholly owned by the Dawson Landing Homeowners Association, Inc. The northern section of Wildlife Way is paved to allow access to a singular home at 1620 Wildlife Way (GPIN 8391-61-8634). South of the home, Wildlife Way is a “paper street” to

connect to Oregon Avenue and is currently forested and unimproved. See Figure 4.8 for more detail along Wildlife Way.

4.6.3 Key Stakeholders

In addition to the additional easement required from property mentioned in Section 4.6.2, additional stakeholders include the existing utility companies identified during utility designation.

4.6.4 Topography

The topography of the beginning of the alignment rises gradually from approximate ground elevation 8 to 36 beginning at the Featherstone SPS to the intersection of Michigan Road and Oregon Avenue. Ground elevation then rises significantly faster to high point elevation of 100 feet at the intersection of Marsh Road and Oregon Avenue. From Oregon Avenue along Wildlife Way, the elevation rises and falls between elevation 100 and 126 feet. Along the 50-foot-wide SA property, the topography rises and falls at two localized high points of ground elevation 118 and 126 feet and one localized low point at ground elevation 78 feet. At the two high points, it is proposed to construct an air release valve. The elevation gradually declines to ground elevation 80 feet as the alignment terminates at H.L. Mooney.

4.6.5 Site Access

Site access for Alignment B.1 will primarily be from the existing roadways. For access to the existing easement at 15201 Michigan Road (GPIN 8391-82-5821), access will be from Farm Creek Drive. For access to the proposed alignment at Wildlife Way, access will be provided at the intersection of Wildlife Way and Indiana Avenue and from Oregon Avenue. For access to the southern portion of SA property, access can be provided via the existing access road entrance from Rippon Boulevard.

See Figure 4.7 for areas of site access.

4.6.6 Constructability Challenges

A significant portion of Alignment A is located adjacent to Wildlife Way and in the 50-foot-wide strip of property owned by the SA from Wildlife Way to Rippon Boulevard. Tree clearing will be necessary for the section of force main adjacent to Wildlife Way. Elevation change in this area will increase construction difficulty through that area in regard to equipment access for the trenchless pipe installation. An existing access road from Rippon Boulevard and access from Wildlife Way will mitigate challenges in this area, however, site clearing will be necessary.

FIGURE 4.8 - ALIGNMENT B.1 DETAIL

L16 FEATHERSTONE
FORCE MAIN EVALUATION

SA Dewberry

4.6.7 Opinion of Probable Construction Cost

An opinion of probable construction cost (OPCC) was prepared for the proposed parallel 30-inch force main along Alignment B.1. The estimate class is based on the AACE International cost estimate classification system. The estimate class for this OPCC is Class 5. A Class 5 OPCC is typically associated with concept screening and has an expected low accuracy variation of -20% to -50% and a high accuracy variation of +30% to +100%. For this estimate, a low accuracy variation of -20% and a high accuracy variation of +30% has been included. Easement acquisition costs have not been included in this OPCC.

Description	Quantity	Unit	Unit Cost	Extension
General				
Mobilization (5%)	1	LS	$ 276,700	$ 276,700
General Conditions (5%)	1	LS	$ 276,700	$ 276,700
Permits and Fees (1.25%)	1	LS	$ 69,200	$ 69,200
Bonds and Insurance (2%)	1	LS	$ 110,700	$ 110,700
Start up and Testing	1	LS	$ 50,000	$ 50,000
Force Main Construction				
Erosion and Sediment Controls (2%)	1	LS	$ 108,500	$ 108,500
Furnish and install 30" DIPS DR11 HDPE force main, complete in place	7250	LF	$ 400	$ 2,900,000
Furnish and install 30" DIP CL 52 force main, complete in place	2250	LF	$ 800	$ 1,800,000
Tree removal, clearing and grubbing within limits of disturbance	1	LS	$ 75,000	$ 75,000
Pavement Restoration	1	LS	$ 600,000	$ 600,000
Maintenance of Traffic	1	LS	$ 50,000	$ 50,000
Subtotal				***$ 6,400,000***
Contractor Overhead & Profit	15	%		$ 960,000
Contingency	10	%		$ 736,000
Engineering	10	%		$ 809,600
Total Budget Estimate				***$ 9,000,000***
High Budget Estimate (+30%)				***$ 11,700,000***
Low Budget Estimate (-20%)				***$ 7,200,000***

5. ALIGNMENT ALTERNATIVES SUMMARY

The following is a summary of the advantages and disadvantages of Alignment A and Alignment B.1. The recommendation for the preferred alternative is summarized in the following section.

Table 5-1 Alignment Alternatives Summary Table

ANALYSIS ITEM	ALIGNMENT A	ALIGNMENT B.1
Opinion of Probable Construction Cost	$8,300,000 (Class 5 Range: $6,700,000 to $10,800,000)	$9,000,000 (Class 5 Range: $7,200,000 to $11,700,000)
Nearby Existing Utilities	• Existing 30-inch force main for the northern and south portions of the alignment • Existing gas, sewer, and water • Potential for additional existing utilities during SUE and field investigation	• Existing 30-inch force main for the northern and south portions of the alignment • Existing gas, sewer, and water • Potential for additional existing utilities during SUE and field investigation
Required Clearing	Existing SA property has been maintained – minor clearing will may be required; minimal clearing at existing easements likely	Existing SA property has been maintained – minor clearing will may be required; extensive clearing will be required along the Wildlife Way easement
Environmental Impacts	Slight RPA impact	No impact
Elevation Change	Elevations range from 8' to 126' with two significant hills along the 50-foot-wide SA property	Elevations range from 8' to 126' with two significant hills along the 50-foot-wide SA property
Site Access	Featherstone SPS existing access, existing roadways, through private property, and SA property	Featherstone SPS existing access, existing roadways, through private property, and SA property
Easements with Private Parcels	Access, temporary construction, and permanent utility (1651 Wildlife Way - GPIN 8391-51-7990 and 1752 Ann Scarlet Court - GPIN 8391-40-7055)	Access, temporary construction, and widened permanent utility (GPIN 8391-82-5821), and new permanent utility (GPIN 8391-61-5831)
Easements with Public Parcels (PWC)	Prince William County Schools (GPIN's 8391-52-7730 and 8391-42-8911)	None anticipated
Hydraulic Results	• Single 30-inch force main will meet PHF through 2045 • 30-inch parallel force main would be required to meet the design capacity of 33MGD of the new Featherstone SPS • Proposed L16 pumps are adequate • 1.9-5.2 ft/s force main velocity for 30-inch parallel force main • No transient concerns	• Single 30-inch force main will meet PHF through 2045 • 30-inch parallel force main would be required to meet the design capacity of 33MGD of the new Featherstone SPS • Proposed L16 pumps are adequate • 1.9 - 5.2 ft/s force main velocity for 30-inch parallel force main • No transient concerns
Advantages	• Shorter alignment • Less costly than Alignment B.1	• Minimal, if any, wetlands impact • Less easements will be required • Easier site access • Less impact to established roadways
Disadvantages	• Crosses the RPA • Potential encroachment on a documented archaeological site • More easements will be acquired	• Longer alignment and costlier

6. PROJECT SUMMARY

6.1 Overview of Recommended Project

This project would include the installation of a proposed 30-inch HDPE parallel force main to convey flows from the Featherstone SPS to augment the flow limitation in the existing 30-inch force main. This proposed parallel force main can solely provide adequate capacity for the upgraded Featherstone SPS until 2040 based on future flow projections. After the parallel force main is commissioned and on-line, the existing 30-inch force main may be taken out of service. While out of service, a condition assessment will be performed, and a rehabilitation method selected. Once rehabilitation has been completed, the existing force main may be put back into commission and the parallel force mains will provide adequate capacity past 2040. Depending on rehabilitation method, the service life of the force main may be extended as much as 50 years.

Two options, Alignment A and Alignment B.1, were identified and evaluated. Due to the summary of the associated advantages and disadvantages outlined in the previous section, it is our recommendation that Alignment B.1 is the preferred alignment due to its no identified wetland impacts, easier site access, less impact to established roadways, and less length of required easement.

6.2 Project Cost

An opinion of probable construction cost (OPCC) was prepared for Alignment B.1. The estimate class is based on the AACE International cost estimate classification system. The estimate class for this OPCC is Class 5. A Class 5 OPCC is typically associated with concept screening and has an expected low accuracy variation of -20% to -50% and a high accuracy variation of +30% to +100%. For this estimate, a low accuracy variation of -20% and a high accuracy variation of +30%.

The OPCC estimate for Alignment B.1 is $9,000,000 with a Class 5 Range of $7,200,000 to $11,700,000. Full Level 5 conceptual opinion of probable construction cost for each alignment can be found in the corresponding sections of this report.

6.3 Project Specific Operational Considerations

The recommended alignment, Alignment B.1, was evaluated with both near-term and long-term improvements. Those configurations are summarized below:

- Near term: Single 30-inch force main along the proposed alignment
- Long Term: Parallel 30-inch force mains; one (1) 30-inch force main along the proposed alignment and one (1) along the existing alignment.

These configurations were evaluated to confirm the hydraulic operation of the system following a similar methodology as the conceptual configuration evaluation above, focusing on firm capacity. This evaluation also considered the phasing of the parallel 30-inch force mains. The flows presented are based on the preliminary pump selection completed during the PER.

The model generated system curves to determine the operating points for 3-pump and 5-pump operating scenarios. The three (3) pump operating scenario assumes one out of service and reserves two (2) for flow eq to manage wet weather. The five (5) pump scenario assumes all flow is pumped to Mooney without flow equalization at L16 Featherstone SPS.

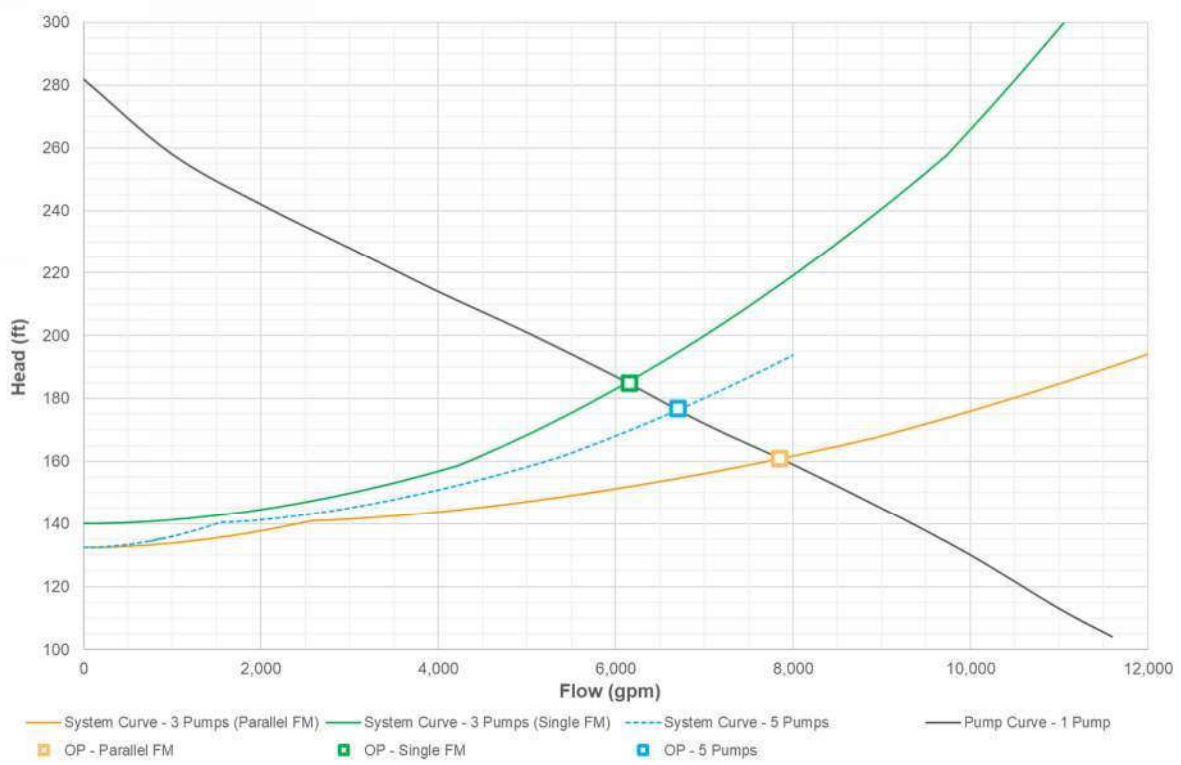


Figure 6.1 System Curve

In the near term, the single force main configuration with 3 pumps operating would convey 6,150 gpm per pump for a total of 18,450 gpm or 26.5 MGD. This firm capacity would meet the projected PHF through 2045 and satisfy design capacity through 2025.

With parallel 30-inch force mains, a single pump will convey 7,850 gpm with three pumps operating simultaneously. This would allow L16 Featherstone SPS to convey 26,550 gpm or 33.9 MGD. The station will be able to meet a design firm capacity of 33 MGD with three pumps operating to accommodate the 2045 PHF of 26.3 MGD and the design capacity of 33 MGD with the proposed alignment.

To accommodate wet weather flows, a total of six (6) pump slots were installed with pumps capable of conveying flow to H.L. Mooney instead of reserving two (2) slots for flow equalization pumps. Under its configuration, the station would be capable of conveying up to 6,700 gpm per pump for a total firm capacity of 33,500 gpm or 48.2 MGD with 5 pumps operating simultaneously. This would convey the full 10-year storm-generated flow of 43.0 MGD. However, this would exceed the rated firm capacity of the H.L. Mooney headworks of 68.5 MGD, per the Master Plan.

Alternatively, flow equalization could be constructed as needed with continued monitoring of pump station flows, reserving two (2) pump slots while meeting the design capacity of 33 MGD as discussed in the PER.

With the pump flows confirmed, the system was evaluated to determine force main velocities under various conditions. Per the USM, the maximum allowable velocity is 8.0 ft/s. The velocity level of service criteria used in the Master Plan is 6.4 ft/s which represents 80% of the maximum velocity. Exceeding this velocity would indicate a potential near-term issue and would warrant a study to confirm existing and future conditions.

The below table summarizes the force main velocity with three, and five pumps operating. It should be noted that with parallel 30-inch force mains, the station will be capable of operating with one or two force

mains, therefore velocities in both conditions are shown. It is assumed that with parallel force mains both operating, station flow will be evenly split.

Table 6-1 Force Main Velocity (ft/s)		
PUMPS OPERATING	SINGLE 30-INCH	PARALLEL 30-INCH
3	10.1	5.1
5	14.4	7.2

The maximum allowable velocity of 8 ft/s would not be exceeded at firm capacity for parallel 30-inch force mains. With one 30-inch force main in service, the velocity at firm capacity would exceed 8 ft/s. Based on this analysis, velocity requirements can be met for the proposed alignment. To avoid exceeding maximum velocity, both of the parallel 30-inch should be used when 3 or more pumps are operating.

To reduce the risk of sediment collection in the force main, a cleaning protocol to reach a velocity of 3.5 ft/s is recommended twice per day. This velocity is the minimum recommended velocity to achieve the re-suspension of solids. Under the parallel force main configuration, this would require a pumping rate of 19,100 gpm or 27.5 MGD for 15 minutes per cleaning cycle. Under ADF conditions in 2035, this would require an additional 185,000 gallons of wet well volume to supplement influent flows to maintain this pumping rate for the duration specified. The wet well would not be able to provide the needed volume to adequately flush the force mains.

To achieve a 3.5 fps velocity in a single 30-inch force main, a pumping rate of 8,150 gpm or 11.7 MGD is required. The wet well would need to supplement approximately 34,000 to 45,000 gallons with 2025 influent flows of 8.4 MGD for 15 to 20 minutes. This is approximately 11 to 15 vertical feet of wet well volume, based on the conceptual design.

To optimize the flow split between the two force mains, automated valves can be added on or near the pump station site, either in the station superstructure or in a vault in the yard. This would allow the SA to run a cleaning cycle on the force mains individually reducing the amount of wet well storage needed to facilitate a cleaning cycle.

In a pump station where the pumps represent a significant portion of the electrical loads, standard low-voltage electrical gear would be sufficient and likely the most cost-effective option when compared to medium-voltage equipment. Low-voltage equipment will require a smaller electrical room with a 36-inch equipment depth requirement compared to a 72-inch equipment depth requirement for medium-voltage. Medium voltage VFD would typically require a larger footprint and therefore an increased cost. Electrical rooms typically represent the highest dollar-per-square-foot cost in a pump station and can have significant cost implications on the overall project. Motor size and efficiency should be validated during the design process to ensure the best pump selection is made both from an operational and cost perspective.

6.4 Project Schedule

Refer to Table 6-2 for preliminary project schedule for anticipated time frame for construction of only the force main. Refer to Figure 6.2 for implementation plan concerning all of the improvements at L16 Featherstone SPS.

Table 6-2 Anticipated Design and Construction Schedule		
DESCRIPTION	DURATION (MONTHS)	CUMULATIVE DURATION (MONTHS)
30% Design	3	3
PWCSA Review	1	4
60% Design	3	7
PWCSA Review	1	8

90% Design	3	11
PWCSA and Stakeholder Review[1]	2	13
Final 100% Design	2	15
PWCSA Review	1	16
Bidding[1]	2	18
Construction[1, 2]	18	36

Notes:
1: This schedule does not account for any delays potentially associated with easement acquisition and the extent of required easements will be determined during design. The easement acquisition process (if needed) should be started as soon as required easements are known to limit impacts of construction start schedule.
2: Time of Year Restrictions required by environmental permits could impact construction start, end, duration, etc. as described in Section 2.4. The assumed 12-month duration assumes no Time of Year Restrictions. The assumed 18-months duration assumes a level of Time of Year Restrictions. Actual timeframe of construction will be finalized during design.

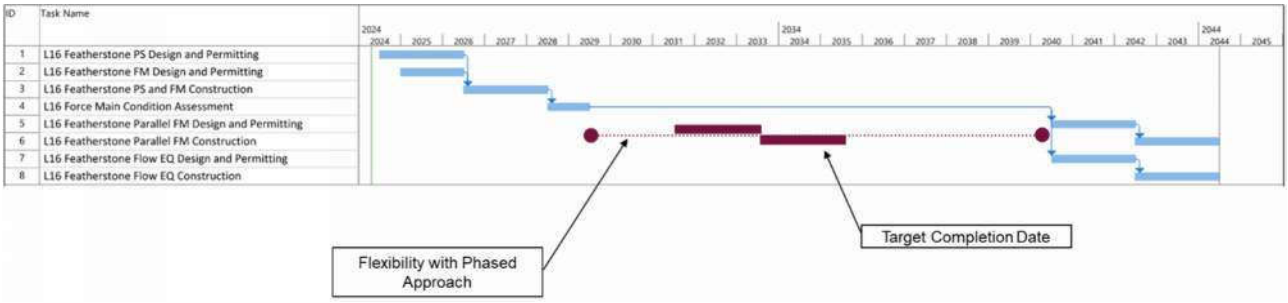


Figure 6.2 Project Implementation Plan

As shown in the implementation schedule, completion of the new 30-inch force main is required before conducting the proposed condition assessment with the existing force main out of service. Once the condition assessment is completed and a rehabilitation or replacement plan is complete, design should commence on the parallel force main. Construction was assumed to follow immediately after design of the parallel force main. Flow equalization is shown at the end of the planning period. The trigger for flow equalization will be based on the Service Authority's continued monitoring of wet weather flows and sanitary sewer overflows and is independent of the parallel force main project.

Dewberry recommends this plan continue to be updated with future assessments, updated flow projections, and observations from flow monitoring.

ATTACHMENTS

Attachment A: Dewberry Engineers Inc., (October 2023), "L16 Featherstone SPS Short-Term Solution", Technical Memorandum
Attachment B: Dewberry Engineers Inc., (October 2023), "L16 Featherstone SPS and Force Main Assessment Evaluation", Technical Memorandum
Attachment C: Permit Register
Attachment D: Report for Archaeological Site 44PW1443
Attachment E: 358-428 Featherstone FM Emergency Repair
Attachment F: Pump Curves
Attachment G: Condition Assessment Alternatives