



**TOWN OF NORTH CASTLE, N.Y.
QUARRY HEIGHTS
POTENTIAL WATER DISTRIBUTION SYSTEM REPORT**

JULY 19, 2023



DOLPH ROTFELD ENGINEERING DIVISION

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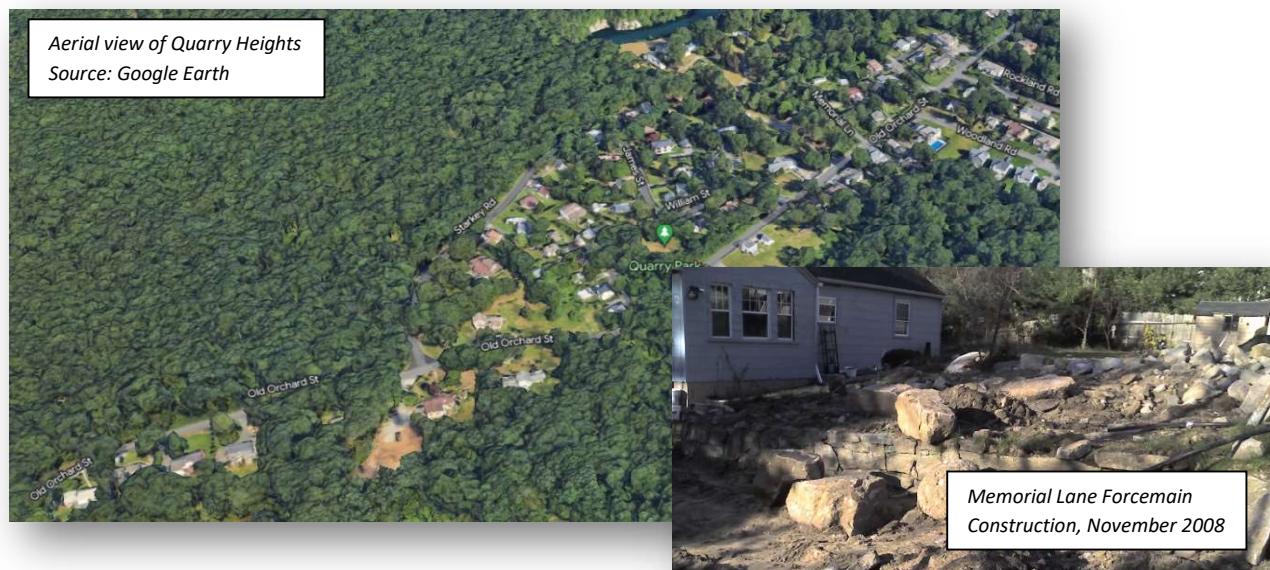
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I. INTRODUCTION

AI Engineers, Inc., Dolph Rotfeld Engineering Division has been engaged by the Town of North Castle to prepare a report studying the feasibility of providing a public water distribution system within the Quarry Heights section of the Town. Many residences in Quarry Heights are currently served by individual private wells some of which have run dry during the warmer periods of the year. The new distribution system would bring water to these homes via a connection to Westchester Joint Waterworks' (WJWW) nearby water main and alleviate the need for individual private wells. The following report will discuss the feasibility, supply and metering needs, estimated cost, and anticipated scheduling challenges for implementing such a water district and supplying the homes in Quarry Heights with a reliable source of water.

II. EXISTING CONDITIONS

The Quarry Heights section of the Town of North Castle is an entirely residential neighborhood with one-half acre and one acre zoning on the southernmost border of the Town. The Quarry Heights streets that are the subject of this study include Old Orchard Street, Johnson Place, Memorial Lane, William Street, James Street, McClure Street, and Starkey Road. The homes along these streets



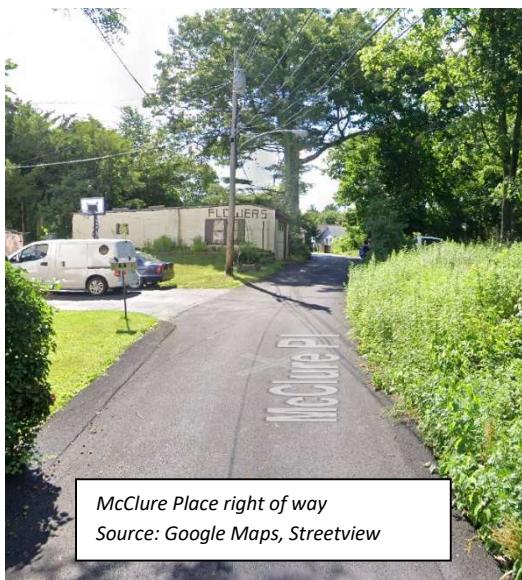
are served by a low-pressure sanitary sewer forcemain and overhead electric services. Underground drainage exists within the Town's rights of way in a few select locations. There are no other known underground utilities such as gas and communications in the rights of way in the project area except for WJWW's eight (8) inch water main in Old Orchard Street. This water main runs from north to south and terminates approximately in the vicinity of Quarry Park. The existing water main is equipped with capped tee fittings for future connections at Old Orchard's intersections with Johnson Place, Memorial Lane, and William Street. Please see **Appendix A: Existing Conditions**. WJWW has indicated that 60 psi is available in the water main at the points of future connection.

Based on AIE's experience in this neighborhood as the engineer and construction inspector of record for the installation of the abovementioned forcemain, there is high prevalence of bedrock in this area.

III. FEASIBILITY

Alignment and Physical Location of Infrastructure

Maps of existing utilities have been compiled and overlayed and then used to create a comprehensive site utility plan showing the approximate locations of all known underground infrastructure. This is the base map that was used to

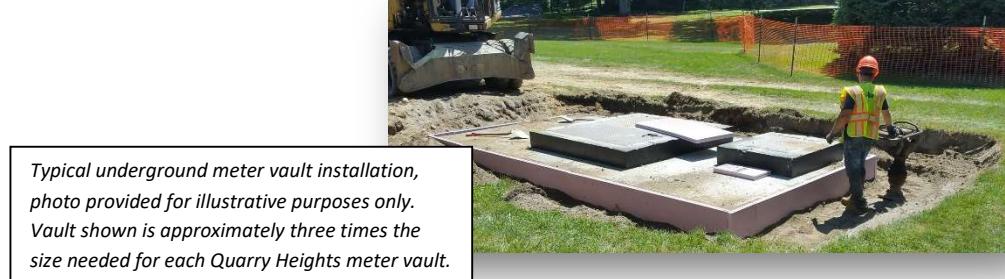


create the enclosed plans. Please see **Appendix B: Conceptual Water Main Layout Plan** and **Appendix C: Conceptual Water Main Profiles**. The narrow nature of the existing rights of way in the Quarry Heights neighborhood creates a challenge for fitting a new water main alongside the existing sanitary sewer forcemain. Complicating the alignment is the Westchester County Health Department's (WCDOH) requirements with respect to the

horizontal separation between water mains and sewer mains and drain lines. Based on conversations with WCDOH, water mains can be as close as five (5) feet to parallel sewer or drain lines as long as the water mains are encased, and water mains can be as close as seven (7) feet with no encasement. The locations of existing mains are approximate as provided on the enclosed plan (Appendix B), however, there appears to be sufficient space to meet WCDOH's requirements. WJWW has indicated initial acceptance of the Quarry Heights water district connection locations as shown on the plan as well as the conceptual system layout.

In addition to accommodating the alignments of new water mains, the existing rights of way will also need to provide for the installation of underground precast concrete meter vaults. As illustrated on the enclosed maps, a new meter vault or pit will be needed at each proposed connection to WJWW's water main on Old Orchard Street. There are three (3) in total shown on the provided plans. The operation and contents of the meter vaults are discussed further in section "IV. Water Supply" of this report.

The size of the meter vaults is based on the minimum dimensions required for the contained equipment. The vaults have been sited in roadway shoulders (but within the right of way) with top slabs and hatches that will be visible at grade. The hatch is specified as a "Bilco"-style square door which is best suited for non-traffic applications.



Domestic Daily Usage

Domestic water usage of the new Quarry Heights water district was calculated using available boundary survey mapping of the neighborhood (to estimate the number of users) and conservative unit flow rates based on the presumed age of the existing homes' fixtures. As indicated in the chart below, the estimated peak demand from the new Quarry Heights water district is projected to be 60 gallons per minute using a peaking factor of 4.

| Type of Home | Number of Homes | Number of Bedrooms | Flow Per Bedroom* (gpd) | Demand Per Home (gpd) | Average Daily Demand (gpd) | Average Daily Demand (gpm) | Peak Rate (gpm)** |
|---------------|-----------------|--------------------|-------------------------|-----------------------|----------------------------|----------------------------|-------------------|
| Single Family | 48 | 3 | 150 | 450 | 21,600 | 15 | 60 |

*Flow per bedroom based on NYSDEC Design Standards for Intermediate Sized Wastewater Treatment Systems, Dated 3/5/2014, Table B-3, p. B-16, ("150 gpd for pre 1980 fixtures")

**Based on a peaking factor of 4

Anticipated Fire Flow Pressure Losses

The following analysis is provided for the sizing of water mains using available information and the anticipated pressure losses as discussed in each section. Prior to final design it is recommended that water main sizing for adequate fire flow be coordinated with WJWW's hydraulic models of their system.

Starting with a supplied pressure of 60 psi at WJWW's water main in Old Orchard Street, the projected resulting pressure was calculated in other parts of the proposed Quarry Heights water district. The greatest anticipated draw on the system would be during a firefighting scenario in which, based on the National Fire Protection Association's recommendations for one- and two-family dwellings not exceeding 5,000 square feet, a minimum of 1,000 gallons per minute must be supplied for one (1) hour. WCDOH requires that 35 psi is provided at the property line of each user under all conditions except during a fire flow.

Johnson Place

The end of Johnson Place is approximately 17 feet lower than Old Orchard Street. Based on elevation alone, the drop in grade represents an increase of approximately seven (7) psi in pressure at the end of Johnson Place. Drawing 1,000 gpm through a six (6) inch water main that runs the entire length of Johnson Place (approximately 260 linear feet) would generate friction head loss of approximately ten (10) psi. The head loss through a six (6) inch meter at this flow rate is less than one-and-a-half (1.5) psi. The net pressure loss of approximately four-and-a-half (4.5) psi is negligible. Therefore, a six (6) inch water main is sufficient to supply Johnson Place.

Memorial Lane

The end of Memorial Lane is approximately 31 feet lower than Old Orchard Street. Based on elevation alone, the drop in grade represents an increase of approximately 13 psi in pressure at the end of Memorial Lane. Drawing 1,000 gpm through a six (6) inch water main that runs the entire length of Memorial Lane (approximately 375 linear feet) would generate friction head loss of approximately 14 psi. The head loss through a six (6) inch meter at this flow rate is less than one-and-a-half (1.5) psi. The net pressure loss of approximately two-and-a-half (2.5) psi is negligible. Therefore, a six (6) inch water main is sufficient to supply Memorial Lane.

Starkey Road High Point via William Street

The high point of Starkey Road is approximately six (6) feet higher than Old Orchard Street. This location was chosen to be analyzed because of its relative elevation to Old Orchard Street. It is the location of the greatest expected loss of pressure in the new water main and therefore the most vulnerable. Based on elevation alone, the rise in grade represents a decrease of approximately three (3) psi in pressure at the high point of Starkey Road. Drawing 1,000 gpm through an eight (8) inch water main that runs on William Street to Starkey Road and to its high point (approximately 1,110 total linear feet) would generate

friction head loss of approximately 11 psi. The head loss through an eight (8) inch meter at this flow rate is less than one (1) psi. The combined pressure loss of approximately 15 psi is tolerable. Therefore, an eight (8) inch water main is sufficient to supply the high point Starkey Road.



IV. WATER SUPPLY FROM WESTCHESTER JOINT WATER WORKS

The source of the drinking water that would be supplied to the new Quarry Heights water district is the New York City Water Supply System via WJWW. Based on preliminary discussions with WJWW, WJWW's system has capacity to support the supply of water to Quarry Heights. They have also indicated their willingness to allow the Town of North Castle to make the necessary connections to supply water as described in this study. As described in the previous section, three (3) connections would be made to WJWW's water main in Old Orchard Street. Connections would occur at three tees that are already in place and capped at the following intersections:

- Old Orchard Street and Johnson Place
- Old Orchard Street and Memorial Lane
- Old Orchard Street and William Street

As with all users of water from New York City's Water Supply System, the New York City Department of Environmental Protection (NYCDEP) will have to

approve the new Quarry Heights water district and will set limits on water usage based on the population served. NYCDEP may impose additional fees if usage exceeds the allowable limits.

Usage Metering

Immediately after each connection a master water meter is needed for WJWW billing purposes and to gauge potential losses in the main. WJWW will use the combined flow readings from these three (3) master meters to invoice the Town of North Castle. Individual service connections for each residence will be made downstream of the master meters. Each service connection will need its own meter which will be installed within each residence where the water service enters the structure. The individual meters will then be used by the Town to invoice each customer's usage.

Meter Vaults

In addition to the meters, the subgrade master meter vaults will be fitted with check valves to prevent backflow, a sump pump for drainage, and appurtenances to assist in vault accessibility and remote meter reading. WJWW has indicated their initial acceptance of the typical vault detail that is provided in **Appendix D**. The piping for the interior sump pump is shown discharging at finished grade (to daylight) due to the absence of nearby existing drainage infrastructure to which it would otherwise connect. The pits are not expected to experience groundwater infiltration since they would be installed mostly within bedrock, nor are the vaults likely to experience water main leaks. Therefore, discharge from the sump pumps would be infrequent and would perhaps only occur during water meter maintenance work or during catastrophic storm events.

V. COST ESTIMATE

Cost estimates are provided in **Appendix E**. The estimates have been prepared for the work described in this study and include soft costs such as grant application services, estimated design and permitting fees, professional public

bidding assistance, anticipated construction costs, construction administration and inspection services, and project close-out support. Cost estimates have been separated by alignment runs corresponding to the enclosed profiles. Cost estimates are also provided for the total project. Estimates only cover infrastructure installed within the Town's right of way and end at each potential user's property line with a service valve and curb box. Costs to install services from the curb box to the user's home, individual meters, and any required backflow prevention devices are not included. The cost to connect to the curb box and install service lateral piping to each home would be the responsibility of the homeowner.



There are a few challenges to the installation of a water distribution system in Quarry Heights that contribute to a high estimated construction cost. One of the major factors is the presence of extensive bedrock throughout the site, which requires labor-intensive rock removal operations. A related added cost is that the excavated material cannot be reused as backfill. The excavated rock must be disposed of offsite and clean backfill material must be imported. The use of controlled density backfill (or "K-Crete") has been included in the cost estimate as

this material eliminates unwanted settlement in the restored surface of the road and provides encasement protection where horizontal separations from other utilities is needed.

The contractor will also need to take special care when excavating and installing the water main with respect to the existing sanitary sewer forcemain that the

new water main will parallel for its entire run, and within narrow right-of-way lanes. Potential alignment conflicts or inadvertent damage to existing facilities will cause delays, extend the project schedule, and add cost to construction.

The limited space available for staging and storing equipment and materials within the compact neighborhood further complicates the construction process, which can lead to additional expenses. These expenses can include the securing of an offsite staging area, downtime while rotating equipment in and out of the construction zone (mobilization/demobilization), trucking related to daily material deliveries when material cannot be stored onsite, etc. While all of these factors contribute to the high construction cost, it is the rock removal that represents the greatest cost factor due to its time-consuming and resource-intensive nature.

VI. ANTICIPATED CONSTRUCTION SCHEDULE

There are several factors that can influence the timing and duration of a construction project. Water main extensions and improvement projects require Westchester County Department of Health review and approval which, depending on the complexity of the system, can last for months and even up to a year to complete. The preparation of construction drawings and contract documents for public bidding can last 3 to 4 months followed by the bidding process and contract award and signing which might also last 1 to 2 months. The construction period itself is less predictable.

Recently, the unavailability of material has led to significant delays to start times for utility installation projects in Westchester County. Months-long lead times have been quoted by some contractors for pipes needing to meet certain specifications and for remote metering instrumentation. Also, as is typical in utility projects within established neighborhoods, the real estate needed to stage and store equipment and materials as well to perform construction activities is often very limited. This might cause the contractor to have to develop a construction sequencing plan that might involve a specific ordering of

operations, mobilization and demobilization of certain equipment, and daily deliveries (to limit storage of materials) which could lead to delays. Particular to this project, however, it is the high incidence of bedrock throughout the site and the often-slow operations needed to remove the rock that will draw out the duration of the project. The inability to backfill with the excavated material and the need to import the backfill material instead will also add to construction duration. This is likely to be the main factor that will determine the length of time needed to complete the project.

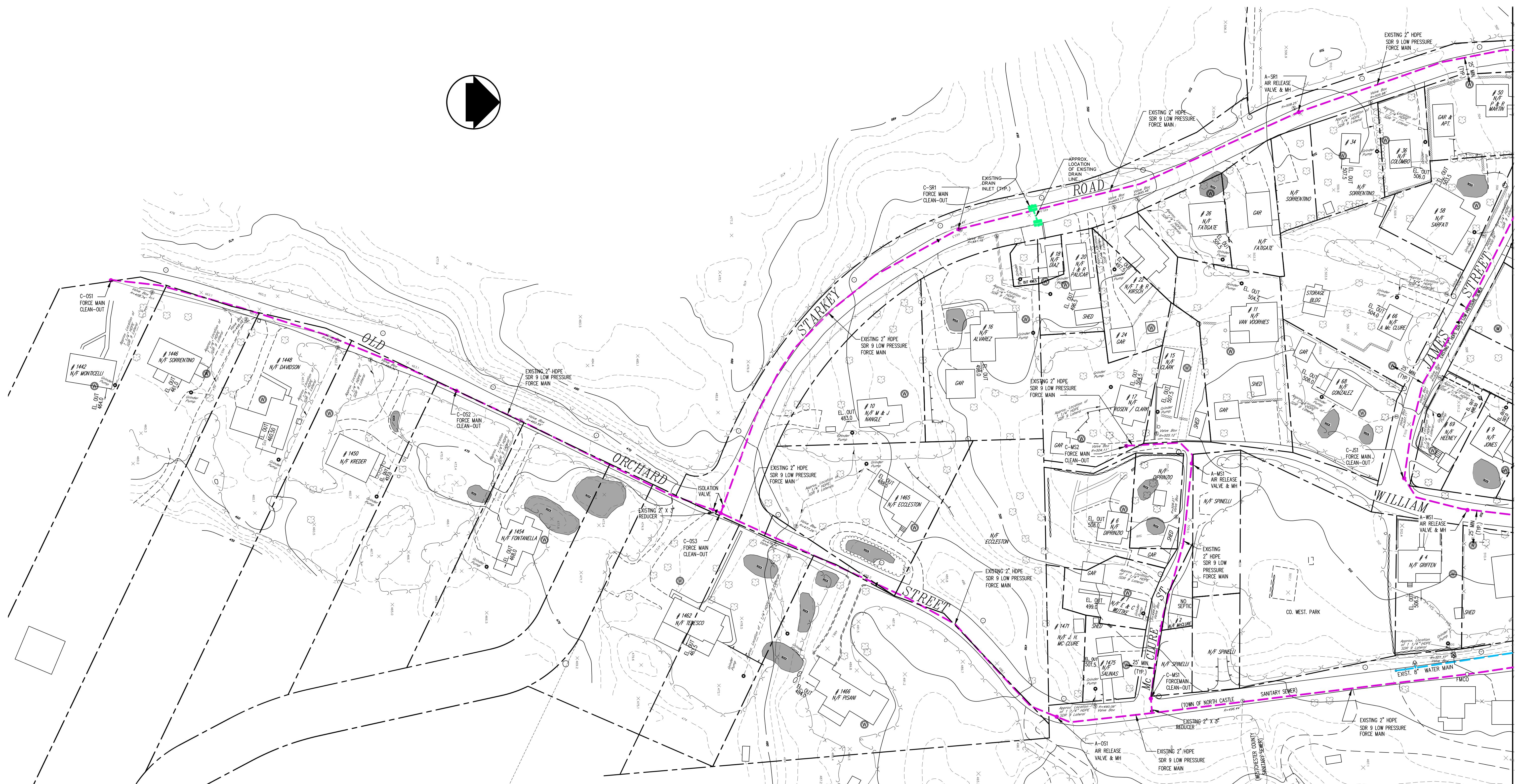
VII. EXECUTIVE SUMMARY

The objective of this report was to determine the feasibility, estimate the cost, and contemplate the process of implementing a public water distribution system in Quarry Heights, which would alleviate the potential danger of private wells running dry during warmer periods. The information that has been provided focuses on the alignment and physical location of infrastructure, domestic daily water usage, fire flow pressure losses, water supply from WJWW, metering and invoicing logistics, design and construction cost estimates, and factors affecting a potential construction schedule.

In conclusion, establishing a public water distribution system in Quarry Heights is feasible, with considerations for alignment, metering, and the water supply from WJWW. AIE/DRE recommends further coordination with WJWW and their hydraulic models to confirm needed fire flow will be provided in all areas of the new water district. The cost estimate and anticipated construction schedule indicate potential challenges related to rock excavation, material availability, and limited staging areas. However, it is possible to overcome these challenges and provide Quarry Heights with a sustainable source of drinking water and improve the water supply for homeowners currently relying on private wells.

APPENDIX A

EXISTING CONDITIONS



MATCH LINE A

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LEGEND

- EXISTING 2"-DIA. LOW PRESSURE SANITARY SEWER FORCE MAIN
- EXISTING 8"-DIA. WATER MAIN (WJWW)
- EXISTING DRAIN LINE

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MATCH LINE A



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LEGEND

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- EXISTING 8"-DIA. WATER MAIN (WJWW)
- EXISTING DRAIN LINE

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APPENDIX B

CONCEPTUAL WATER MAIN LAYOUT PLAN

MATCH LINE A



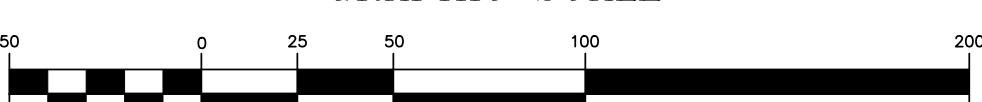
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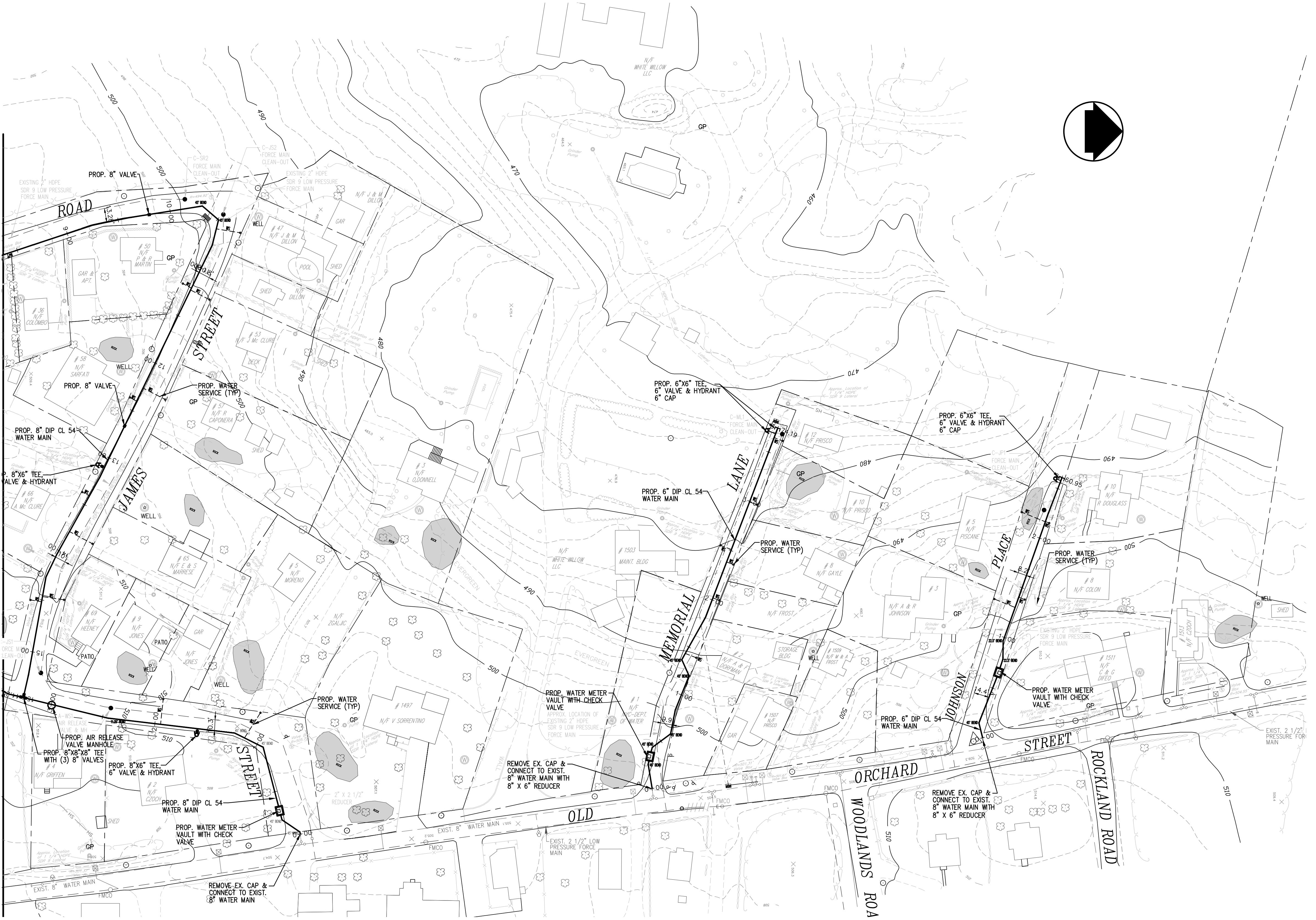
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MATCH LINE A



GRAPHIC SCALE



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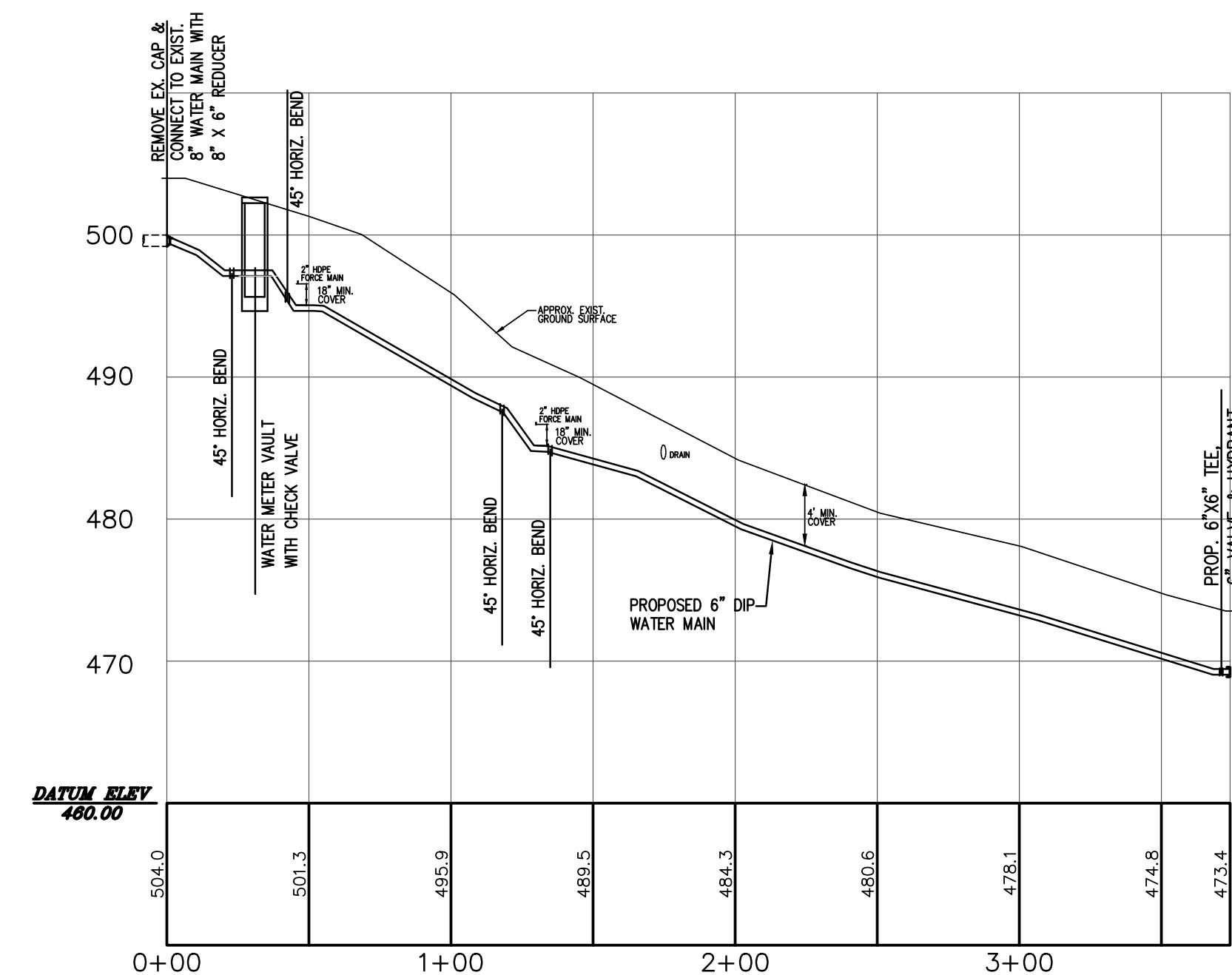
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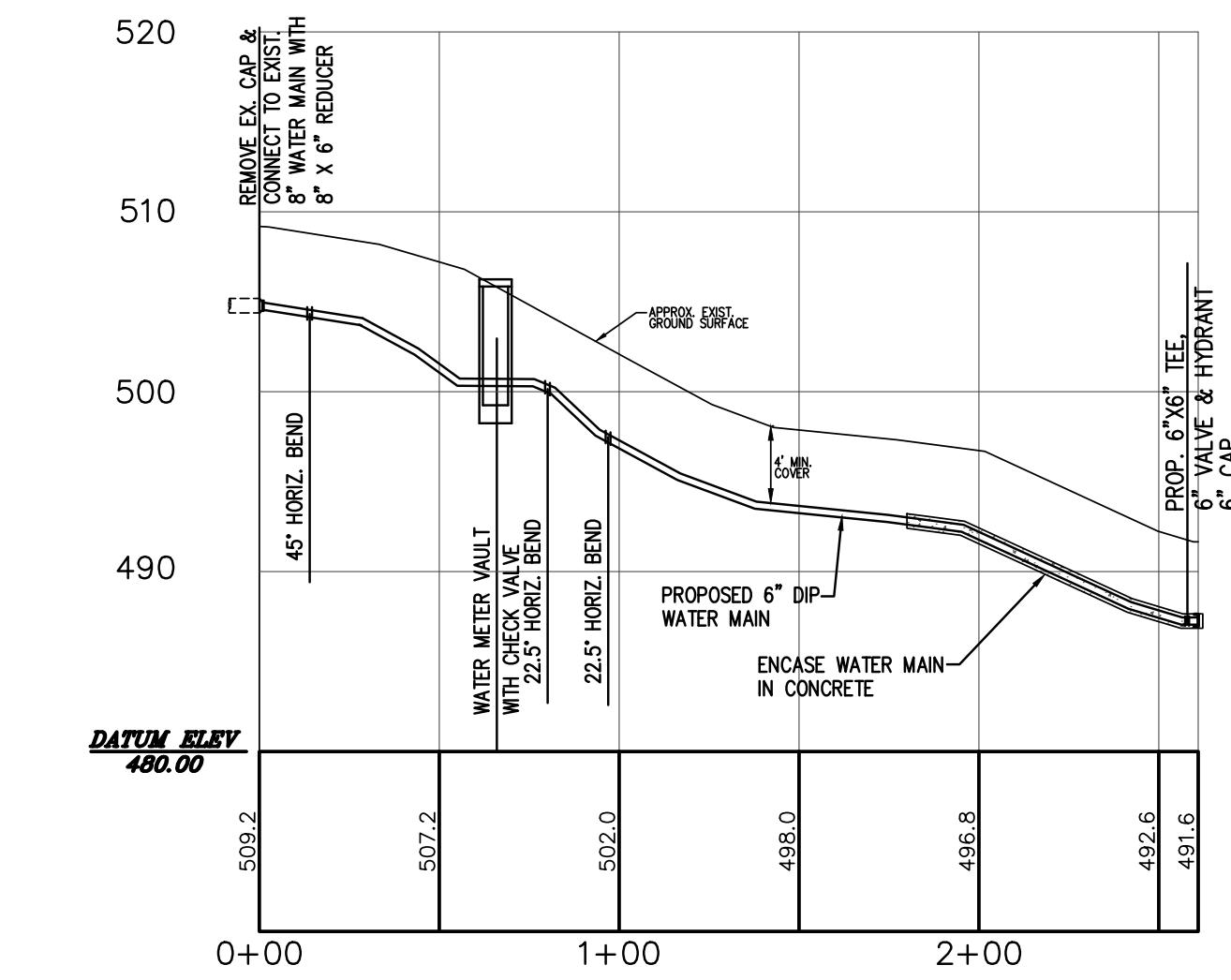
APPENDIX C

CONCEPTUAL WATER MAIN PROFILES



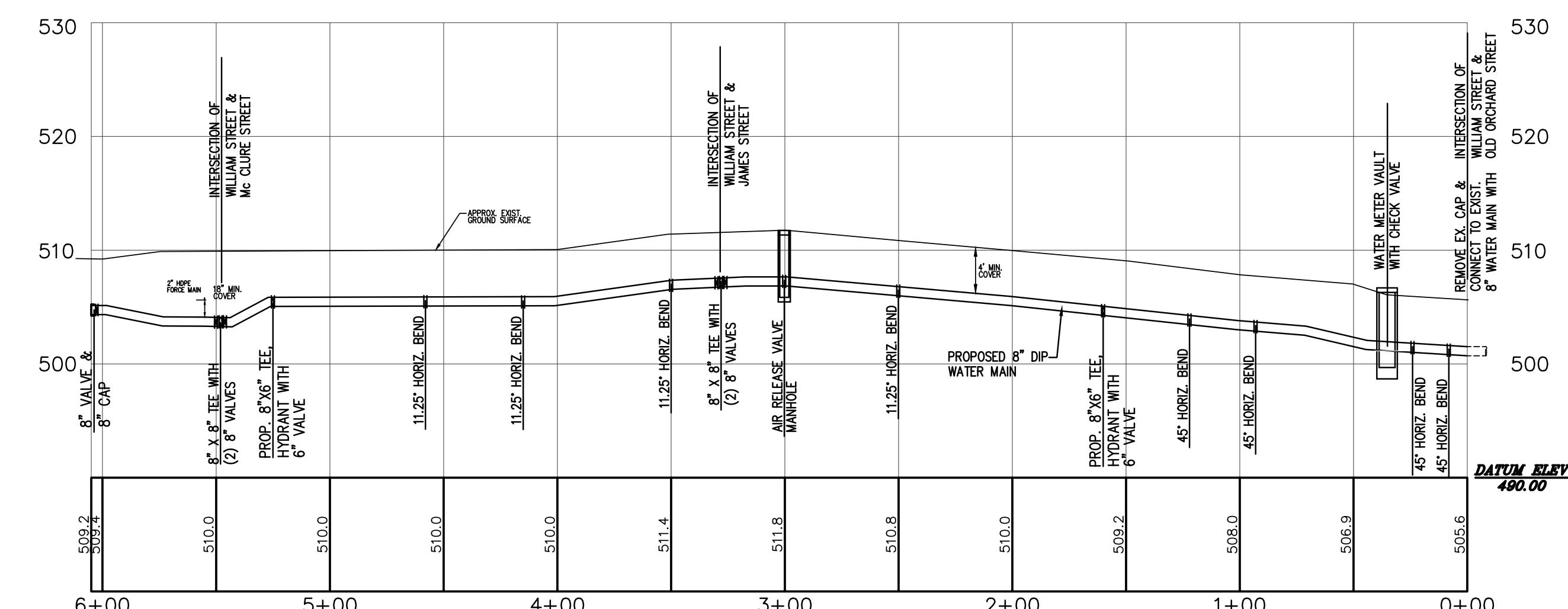
MEMORIAL LANE WATER MAIN PROFILE

SCALE : HORIZ. 1" = 50'
VERT. 1" = 10'



JOHNSON PLACE WATER MAIN PROFILE

SCALE : HORIZ. 1" = 50'
VERT. 1" = 10'



WILLIAM STREET WATER MAIN PROFILE

SCALE : HORIZ. 1" = 50'
VERT. 1" = 10'

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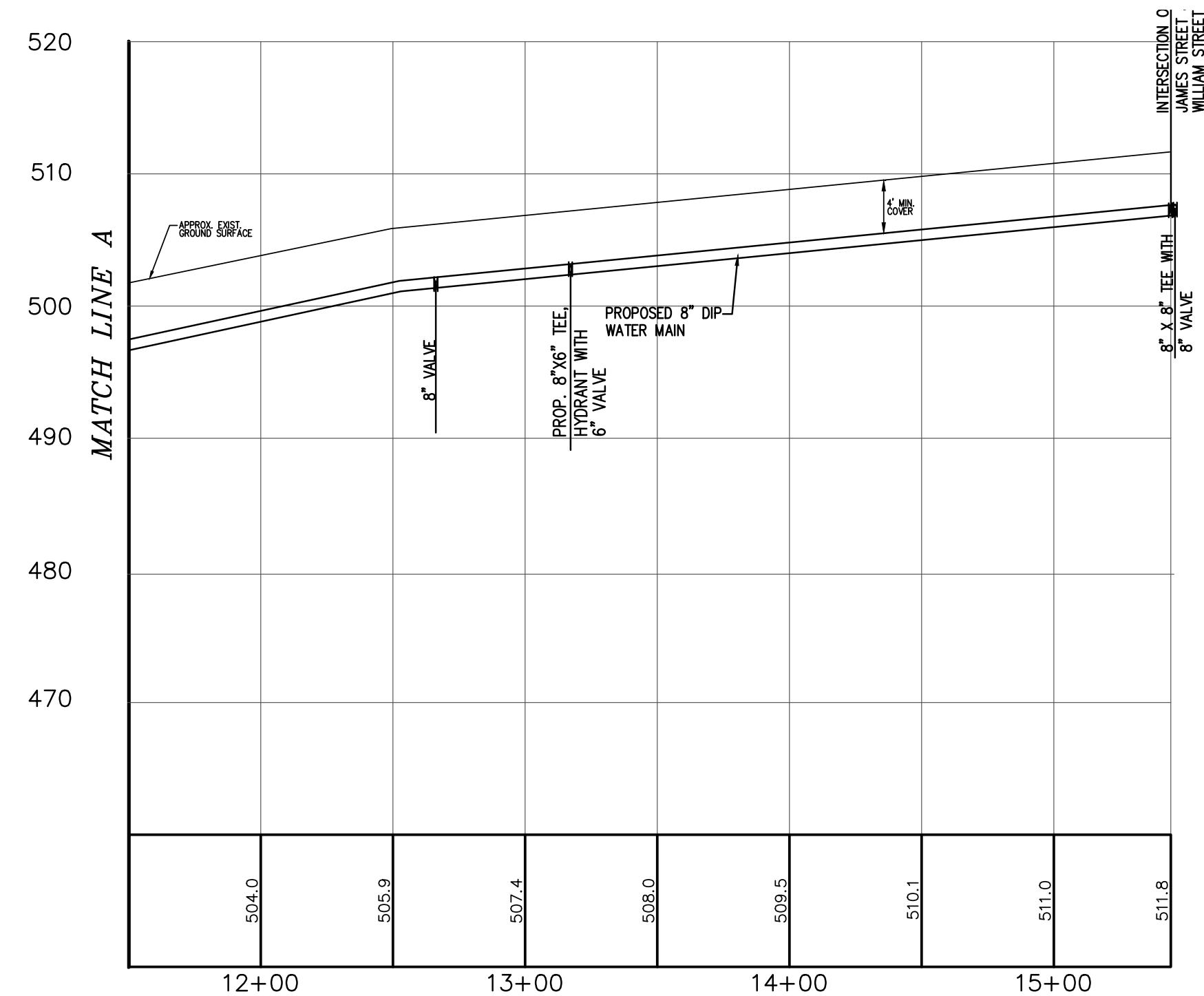
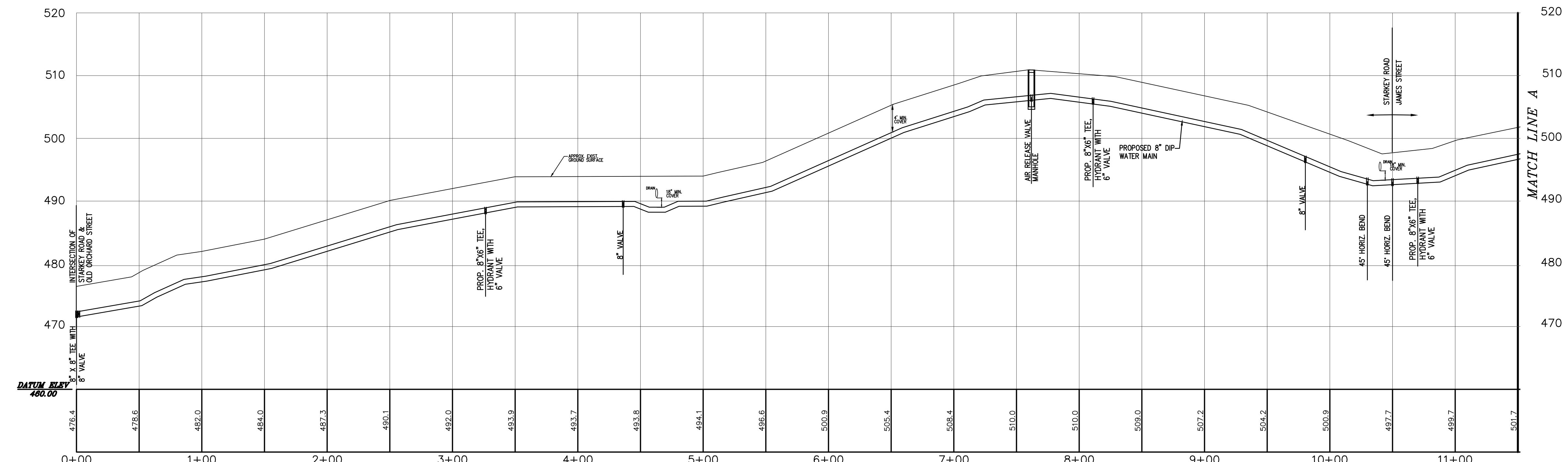
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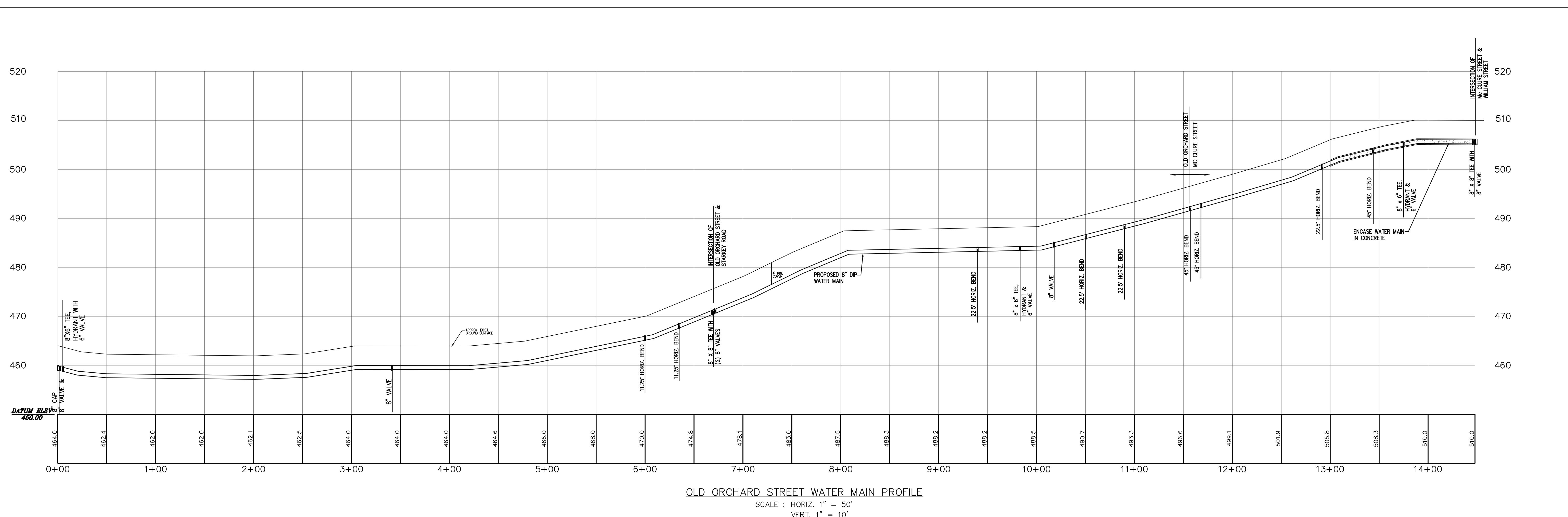
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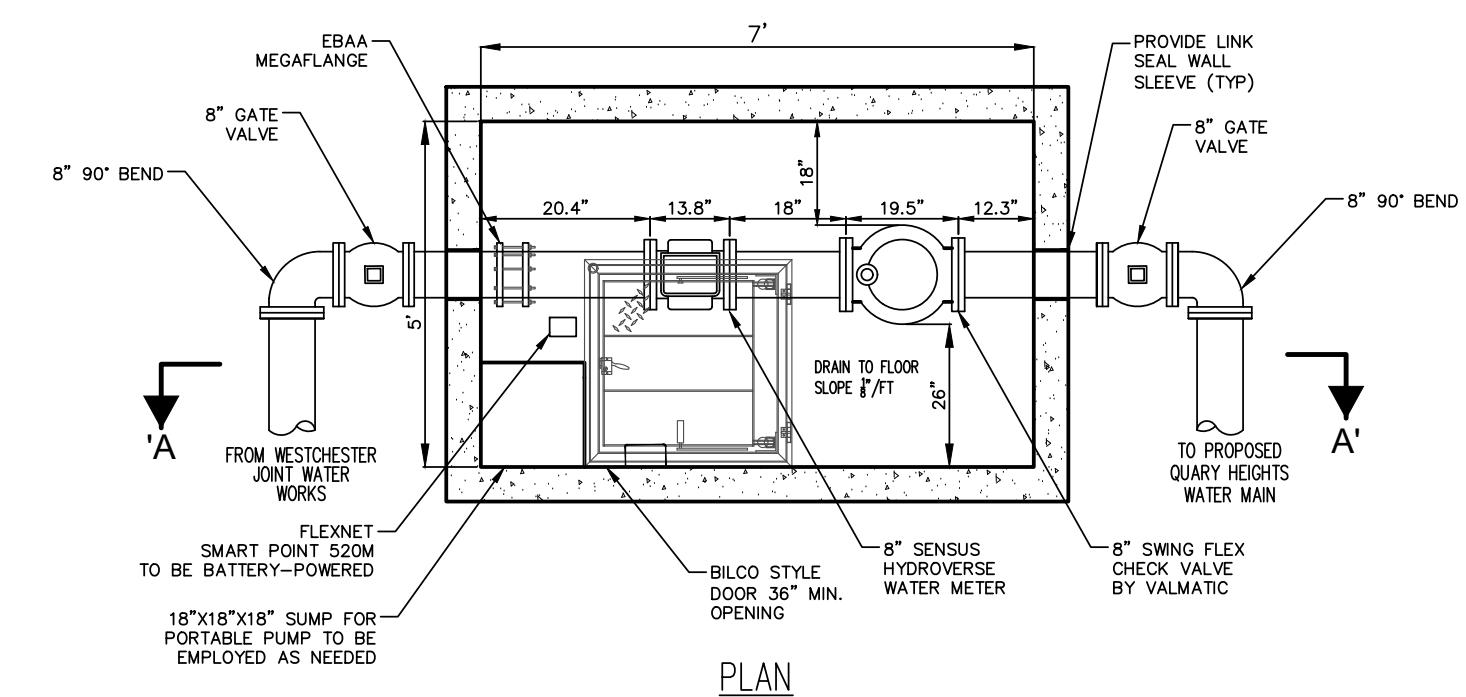
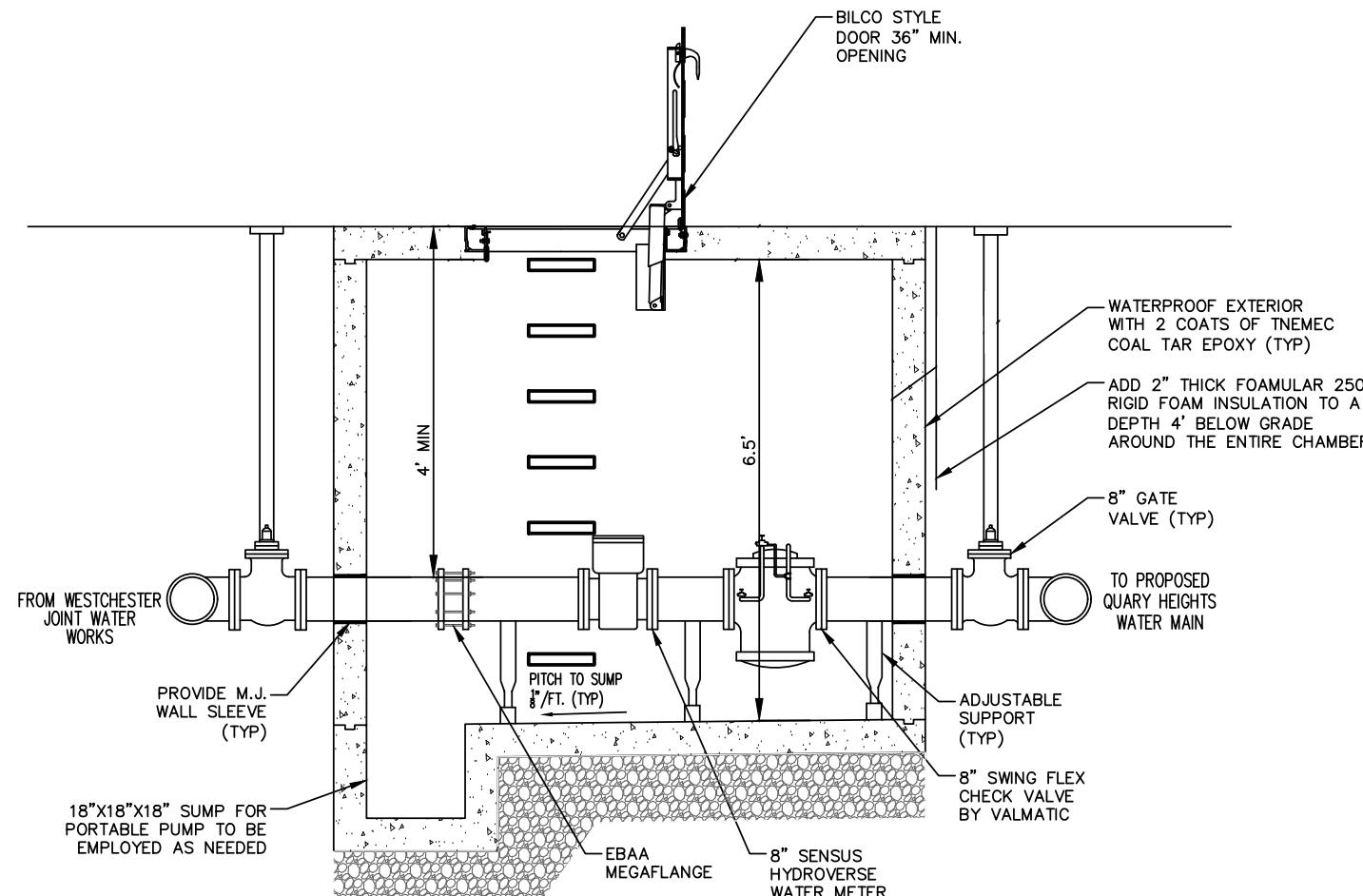
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| REV. | DATE | REVISION DESCRIPTION | SHEET NO. | PLOTTED DATE: 7/3/2023 | DESIGNER/DRAFTER: PF | ENGINEER: AI Engineers, Inc. | SIGNATURE/BLOCK: | PROJECT TITLE: QUARRY HEIGHTS CONCEPTUAL WATER DISTRIBUTION SYSTEM | MUNICIPALITY: NORTH CASTLE, NEW YORK | PROJECT NO. 3791 |
|------|------|----------------------|-----------|------------------------|----------------------|---|------------------|--|--------------------------------------|-------------------|
| | | | | | CHECKED BY: JN | | | | | DRAWING NO. C-006 |
| | | | | | APPROVED BY: AO | dolph rotfeld engineering division 570 TAXTER ROAD, ELMSFORD, NY 10523 (914) 631-8600 | | | | SHEET NO. 3 of 3 |

APPENDIX D

WATER METER PIT DETAIL



TYPICAL WATER METER VAULT WITH CHECK VALVE DETAIL

NOTE: CONTRACTOR TO SUBMIT SHOW DRAWINGS FOR ALL WATER METER VAULTS TO THE ENGINEER FOR APPROVAL PRIOR TO ORDERING THE PRECAST UNITS.

QUARRY HEIGHTS
CONCEPTUAL WATER
DISTRIBUTION SYSTEM
TOWN OF NORTH CASTLE, N.Y.

AI Engineers, INC.
dolph rotfeld engineering division
570 TAXTER ROAD, ELMSFORD, NY 10523
(914) 631-8600

APPENDIX E

COST ESTIMATE

**Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE**

Johnson Place

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|-------------|
| 1M | Miscellaneous Additional Work | LS | \$10,000.00 | 1 | \$10,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 10 | \$1,000.00 |
| 5R | Rock Removal | CY | \$300.00 | 151.2 | \$45,360.00 |
| 5R-MV | Rock Removal for Meter Vault | CY | \$300.00 | 26 | \$7,800.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 27.75 | \$8,325.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 3 | \$3,000.00 |
| 13DI-6 | F & I 6-inch Class 54 Ductile Iron Pipe | LF | \$225.00 | 270 | \$60,750.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 0.2 | \$2,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 1 | \$12,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 75 | \$9,000.00 |
| 13MV | F & I Water Meter Vault | EA | \$70,000.00 | 1 | \$70,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 3 | \$1,500.00 |
| 13V-6 | F & I Water Valve (6") | EA | \$4,100.00 | 2 | \$8,200.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 10 | \$900.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 100 | \$7,500.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 25 | \$3,750.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 175 | \$1,662.50 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 151.2 | \$26,460.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$2,500.00 | 1 | \$2,500.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 20 | \$80.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 90 | \$900.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 16 | \$1,920.00 |

10% CONTINGENCY

\$28.461

TOTAL

\$313,068

**Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE**

Memorial Lane

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|-------------|
| 1M | Miscellaneous Additional Work | LS | \$10,000.00 | 1 | \$10,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 10 | \$1,000.00 |
| 5R | Rock Removal | CY | \$300.00 | 215.6 | \$64,680.00 |
| 5R-MV | Rock Removal for Meter Vault | CY | \$300.00 | 26 | \$7,800.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 55.5 | \$16,650.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 6 | \$6,000.00 |
| 13DI-6 | F & I 6-inch Class 54 Ductile Iron Pipe | LF | \$225.00 | 385 | \$86,625.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 0.3 | \$3,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 1 | \$12,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 150 | \$18,000.00 |
| 13MV | F & I Water Meter Vault | EA | \$70,000.00 | 1 | \$70,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 6 | \$3,000.00 |
| 13V-6 | F & I Water Valve (6") | EA | \$4,100.00 | 2 | \$8,200.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 10 | \$900.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 140 | \$10,500.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 35 | \$5,250.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 250 | \$2,375.00 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 215.6 | \$37,730.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$2,500.00 | 1 | \$2,500.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 20 | \$80.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 150 | \$1,500.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 25 | \$3,000.00 |

10% CONTINGENCY \$37,079
TOTAL \$407,869

**Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE**

William Street

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|--------------|
| 1M | Miscellaneous Additional Work | LS | \$15,000.00 | 1 | \$15,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 15 | \$1,500.00 |
| 5R | Rock Removal | CY | \$300.00 | 352.8 | \$105,840.00 |
| 5R-MV | Rock Removal for Meter Vault | CY | \$300.00 | 26 | \$7,800.00 |
| 5R-RV | Rock Removal for Air Release Manhole | CY | \$300.00 | 9 | \$2,700.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 55.5 | \$16,650.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 6 | \$6,000.00 |
| 13DI-8 | F & I 8-inch Class 54 Ductile Iron Pipe | LF | \$250.00 | 630 | \$157,500.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 0.5 | \$5,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 2 | \$24,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 150 | \$18,000.00 |
| 13MV | F & I Water Meter Vault | EA | \$70,000.00 | 1 | \$70,000.00 |
| 13RV | F & I Air Release Valve Manhole | EA | \$15,000.00 | 1 | \$15,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 6 | \$3,000.00 |
| 13V-8 | F & I Water Valve (8") | EA | \$4,500.00 | 7 | \$31,500.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 15 | \$1,350.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 240 | \$18,000.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 55 | \$8,250.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 370 | \$3,515.00 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 352.8 | \$61,740.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$5,000.00 | 1 | \$5,000.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 20 | \$80.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 240 | \$2,400.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 40 | \$4,800.00 |

10% CONTINGENCY \$58,463
TOTAL \$643,088

**Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE**

James Street to Starkey Road

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|--------------|
| 1M | Miscellaneous Additional Work | LS | \$30,000.00 | 1 | \$30,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 30 | \$3,000.00 |
| 5R | Rock Removal | CY | \$300.00 | 907.2 | \$272,160.00 |
| 5R-RV | Rock Removal for Air Release Manhole | CY | \$300.00 | 9 | \$2,700.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 157.25 | \$47,175.00 |
| 13DI-8 | F & I 8-inch Class 54 Ductile Iron Pipe | LF | \$250.00 | 1620 | \$405,000.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 17 | \$17,000.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 1.2 | \$12,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 3 | \$36,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 425 | \$51,000.00 |
| 13RV | F & I Air Release Valve Manhole | EA | \$15,000.00 | 1 | \$15,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 17 | \$8,500.00 |
| 13V-8 | F & I Water Valve (8") | EA | \$4,500.00 | 5 | \$22,500.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 30 | \$2,700.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 590 | \$44,250.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 125 | \$18,750.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 1000 | \$9,500.00 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 907.2 | \$158,760.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$15,000.00 | 1 | \$15,000.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 40 | \$160.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 560 | \$5,600.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 100 | \$12,000.00 |

10% CONTINGENCY

\$118,876

TOTAL

\$1,307,631

Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE

Old Orchard Street to McClure Place

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|--------------|
| 1M | Miscellaneous Additional Work | LS | \$30,000.00 | 1 | \$30,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 30 | \$3,000.00 |
| 5R | Rock Removal | CY | \$300.00 | 856.8 | \$257,040.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 111 | \$33,300.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 12 | \$12,000.00 |
| 13DI-8 | F & I 8-inch Class 54 Ductile Iron Pipe | LF | \$250.00 | 1530 | \$382,500.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 1.1 | \$11,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 4 | \$48,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 300 | \$36,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 12 | \$6,000.00 |
| 13V-8 | F & I Water Valve (8") | EA | \$4,500.00 | 6 | \$27,000.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 30 | \$2,700.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 530 | \$39,750.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 130 | \$19,500.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 900 | \$8,550.00 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 856.8 | \$149,940.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$20,000.00 | 1 | \$20,000.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 0 | \$0.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 530 | \$5,300.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 90 | \$10,800.00 |

| | |
|-----------------|-------------|
| 10% CONTINGENCY | \$110,238 |
| TOTAL | \$1,212,618 |

Town of North Castle
Quarry Heights Potential Water Distribution System
ENGINEER'S ESTIMATE

TOTAL (All Streets)

Construction Cost Estimate

| Item No. | Item with Unit Price Written in Words | Unit | Bid Price | Quantity | Price Ext. |
|----------|---|------|-------------|----------|--------------|
| 1M | Miscellaneous Additional Work | LS | \$95,000.00 | 1 | \$95,000.00 |
| 2M | Miscellaneous Earth Excavation | CY | \$100.00 | 95 | \$9,500.00 |
| 5R | Rock Removal | CY | \$300.00 | 2483.6 | \$745,080.00 |
| 5R-MV | Rock Removal for Meter Vault | CY | \$300.00 | 78 | \$23,400.00 |
| 5R-RV | Rock Removal for Air Release Manhole | CY | \$300.00 | 18 | \$5,400.00 |
| 5R-WS | Rock Removal for Water Service | CY | \$300.00 | 407 | \$122,100.00 |
| 13CB | F & I Water Service Valve and Curb Box | EA | \$1,000.00 | 44 | \$44,000.00 |
| 13DI-6 | F & I 6-inch Class 54 Ductile Iron Pipe | LF | \$225.00 | 655 | \$147,375.00 |
| 13DI-8 | F & I 8-inch Class 54 Ductile Iron Pipe | LF | \$250.00 | 3780 | \$945,000.00 |
| 13FDI | F & I Ductile Iron Fittings w/ Thrust Blocks | Ton | \$10,000.00 | 3.3 | \$33,000.00 |
| 13FH | F & I Fire Hydrant Assembly Complete with Valve | EA | \$12,000.00 | 11 | \$132,000.00 |
| 13K | F & I Water Service | LF | \$120.00 | 1100 | \$132,000.00 |
| 13MV | F & I Water Meter Vault | EA | \$70,000.00 | 3 | \$210,000.00 |
| 13RV | F & I Air Release Valve Manhole | EA | \$15,000.00 | 2 | \$30,000.00 |
| 13T | F & I Water Service Taps | EA | \$500.00 | 44 | \$22,000.00 |
| 13V-6 | F & I Water Valve (6") | EA | \$4,100.00 | 4 | \$16,400.00 |
| 13V-8 | F & I Water Valve (8") | EA | \$4,500.00 | 18 | \$81,000.00 |
| 39 | F & I Crushed Stone | CY | \$90.00 | 95 | \$8,550.00 |
| 51 | F & I Temporary Pavement | SY | \$75.00 | 1600 | \$120,000.00 |
| 51A | F & I Bituminous Hot Mix Asphalt Top Course (2") for Final Trench Restoration | TON | \$150.00 | 370 | \$55,500.00 |
| 51M | Cold Milling and Removal of Bituminous Pavements (2") | SY | \$9.50 | 2695 | \$25,602.50 |
| 73 | F & I Controlled Density Backfill | CY | \$175.00 | 2483.6 | \$434,630.00 |
| 76 | Maintenance and Protection of Traffic | LS | \$45,000.00 | 1 | \$45,000.00 |
| 150B | F & I 12" Wide White Stripe | LF | \$4.00 | 100 | \$400.00 |
| 401-G | F & I Grass Seed | SY | \$10.00 | 1570 | \$15,700.00 |
| 401-TS | F & I Topsoil | CY | \$120.00 | 271 | \$32,520.00 |

| | |
|-----------------|--------------------|
| 10% CONTINGENCY | \$353,116 |
| TOTAL | \$3,884,273 |

Engineering Cost Estimate

| | |
|---|---------------------|
| Professional Services Related to Grant Applications (Includes estimated fee for grant writer and engineering support)* | \$25,000.00 |
| Westchester County Department of Health Permitting (Includes professional services to prepare application and follow-up comment resolution) | \$37,500.00 |
| Geotechnical Investigation and Survey | \$70,000.00 |
| Engineering Design, Preparation of Bid Drawings and Documents, and Bidding Assistance | \$255,000.00 |
| Construction Administration and Inspection** | \$265,000.00 |
| TOTAL | \$652,500.00 |

** The cost associated with preparing grant applications could vary greatly depending on the requirements of the application and the grant writer's fee .*

*** Construction Administration and Inspection cost estimate based on anticipated construction duration of 40 weeks.*