J1536.00

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

KENT COUNTY WATER AUTHORITY

WATER SUPPLY SYSTEM
FIVE YEAR CAPITAL IMPROVEMENT PROGRAM UPDATE
2017 – 2022

KCWA
Kent County Water Authority

Prepared By:

C&E Engineering
342 Park Avenue
Woonsocket, RI 02895

March 2016

Table of Contents

Page No.

Section 1.0 Introduction....1-1
- 1.1 Purpose and Scope....1-1
- 1.2 Capital Improvement Program Goals....1-3
- 1.3 Assessment Criteria....1-3
- 1.4 Prioritization Criteria....1-4
- 1.5 Evaluation Process....1-5
- 1.6 Existing System Overview....1-6
- 1.7 Capital and Infrastructure Replacement Programs....1-7
- 1.8 Cost Estimating....1-8
- 1.9 Overview of Current Projects....1-10

Section 2.0 Capital Improvement Projects – General....2-1
- Project 1 – Mishnock Water Treatment Plant High Service Mains....2-2
- Project 2 – Connection of North (Read School House Road) and South (Technology Park) High Service Pressure Gradients....2-3
- Project 3 – Bald Hill Road Water Main Loop Connection....2-5
- Project 4 – Hope Furnace Road High Service Loop....2-6
- Project 5 – Replacement of Authority Headquarters and Maintenance Facility....2-7
- Project 6 – Oaklawn Pressure Gradient – Emergency PRV Connection to Low Service Pressure Gradient....2-9
- Project 7 – Interstate 295 (I-295) Water Main Bridge Crossing at Providence Street....2-11
- Project 8 – High Service South Pressure Gradient Transmission Mains – Quaker Lane Pump Station High Service Expansion....2-12
- Project 9 – East Greenwich Transmission Mains – High Service Reinforcement/Expansion....2-14
- Project 10 – Quaker Lane Pump Station – High Service Pumps....2-16
- Project 11 – East Greenwich Well Treatment....2-17
- Project 12 – Spring Lake Well Upgrades and Treatment....2-19
- Infrastructure Replacement Projects 13 through 21....2-21

Section 3.0 Mapping and Cost Summary Tables....3-1

Tables

Table 1 - Capital Improvement Program Project Cost Summary Table

Table 2 - Capital Improvement Program – Identified Infrastructure Replacement Projects Project Cost Summary Table

Table 3 - Fiscal Year Cost Summary Table

Figures

KCWA Water Supply System Map

SECTION 1.0
INTRODUCTION

1.1 PURPOSE AND SCOPE

The Kent County Water Authority (Authority) has commissioned C&E Engineering Partners, Inc. (C&E) to prepare an update to the 2012 – 2017 Capital Improvement Program (CIP) for the Authority's water supply and distribution system that was previously updated in 2008. The Authority's original CIP was prepared in 2001 and was directed at identifying and prioritizing water system needs and improvements through fiscal year 2005 as updated in 2008 through 2014 and as updated in 2012 through 2017. The 2001 CIP and the 2008 and 2012 updated CIPs provided a program of capital improvement projects for replacement of existing and installation of new infrastructure that was required to improve the water system's function, operation and maintenance.

Through the 2001, 2008 and 2012 CIPs, the Authority sought to implement projects that were aimed at correcting inherent deficiencies in transmission and distribution resultant from the original combining of several small water distribution systems to create the Kent County Water Authority. These projects were necessary to improve and maintain an adequate level of customer service. This included treatment facilities to improve utilization of groundwater supply, increasing pressure and flow, increasing system reliability and reinforcement of the transmission and distribution piping capabilities of the water system. This 2016 update to the CIP continues to maintain consistency with the principles and goals of the Authority and its commitment to:

- Strategic goals and initiatives;
- Provide a consistent source of high quality, potable water for public consumption and fire protection;
- Reduce overall short and long term maintenance costs;
- Coordinate water system improvements to comply with local and federal guidelines for consistent management and operation of a public water supply system;
- Improve reliability and redundant capabilities to service economical residential growth.

The revised CIP consists of a system-wide evaluation to produce a detailed plan for installation of new infrastructure required to improve the water system's operation and maintenance. It provides the Authority with a planning document that employs a systematic approach to implementing projected short term (immediate) and long term (out to 5-year) needs and requirements. The evaluation phase includes necessary improvements that are required to enhance water supply, storage, pumping, treatment, transmission and distribution systems that are necessary to meet regulators and service needs of the water system.

The Authority routinely reviews its capital program in order to re-prioritize, modify and update projects from previous CIPs based on economic growth patterns and supply needs throughout the service area. As part of the preparation of this update to the CIP plan, the 2001, 2008 and 2012 CIPs were examined in consideration of those capital projects which have not been completed in order to evaluate their relative merit and priority towards achieving the current

system supply indices and overall goal of water system improvement to meet those future needs.

The CIP in addition to describing and detailing the recommended projects provides an estimated cost consideration for developing funding strategies and implementation. This includes preliminary budget estimates relative to planning, design and construction. These estimates are necessary for the Authority to justify finance initiatives and fulfill the rate filing process required to sell bonds or present a cash based funding plan to finance for both ongoing and planned capital projects. This process is intended to ensure that sufficient funding can be made available to accomplish the projects throughout the ongoing life cycle of the capital program.

This CIP document includes:

- A description of the CIP and the evaluation process used to develop the program.
- Evaluation of the projects from the 2001 CIP and the 2008 and 2012 updated CIPs which have not been implemented.
- A detailing of the capital systems, strategies and programs highlighting key projects, anticipated costs over the next five years, comparison to the previous fiscal year and identification of its accomplishments.
- A description of each capital improvement project, including planned goals, justification, priority, impact on the operation budget, responsible section, projected in-service date, project cost and financing strategy.
- Mapping to graphically detail the location of the project in the service system.

This revised Capital Improvement Program (CIP) for the Kent County Water Authority Water System was in part prepared upon information including recommendations and assessments that were developed in the following studies, reports and plans:

- Kent County Water Authority Strategic Plan, 2005
- Kent County Water Authority 2001 Capital Improvement Program
- Comprehensive Community Plans for Cities of Warwick and Cranston, Towns of West Warwick, East Greenwich, Coventry, West Greenwich and Scituate
- Kent County Water Authority, Hydraulic Storage Tank Evaluation Report, 2007
- Kent County Water Authority, Water Supply System Management Plan, 2007
- Water Supply System Five Year Capital Improvement Program Update 2009 – 2014, July 2008
- Water Supply System Five Year Capital Improvement Program Update, 2012 – 2017, January 2012
- Kent County Water Authority, 2014 Hydraulic Model Update Report, January 2015
- Kent County Water Authority, 2014 Tank Study Update Report, January 2015
- Kent County Water Authority, High Service Tank Cycling Improvement Study, September 2015
- Kent County Water Authority, Hydrant/Fire Flow Hydraulic Analysis, January 2016

The Community Comprehensive Plans contained information that was utilized to evaluate the various municipalities that comprise the Authority's water system including projections related to population changes and anticipated water demands.

1.2 CAPITAL IMPROVEMENT PROGRAM GOALS

The Authority provides water and fire service to customers in Coventry, East Greenwich, West Greenwich, Warwick and West Warwick as well as small isolated areas in Cranston, North Kingstown and Scituate. A primary goal of the Authority is to ensure that all customers are provided with a safe, reliable and adequate supply of water. To that end, this CIP is directed at providing the Authority with a planning strategy to improve water supply efficiency, optimizing withdrawal from existing and identified future sources, infrastructure redundancy and identification of water system improvements necessary to meet existing and anticipated future system needs.

This Capital Improvement Program is highlighted by the Authority's continued efforts to improve water supply capacity, treatment, pumping, storage, transmission and distribution facilities. It is imperative that capital-funded new facilities be planned and implemented in an orderly manner to ensure that all current and future customers within the service territory benefit from the proposed improvements while assuring compliance with all State and Federal Safe Drinking Water Standards.

The implementation of this CIP for the Kent County Water Authority is premised upon the need to eliminate or reduce existing deficiencies, the ability to fund projects, and the priority of the projected requirements for capital facilities in order to ensure that the Authority's service customers are supplied with an adequate quantity of high quality water.

This evaluation also considered those locations within the distribution system which realize reduced capacity flows and minimal pressures. The Authority recognizes that this could be the result of undersized or "aged" water mains, distances from supply sources or storage facilities, customers previously serviced above limiting service elevations or operational considerations with regard to capacity and limitations of pumping facilities. The evaluation considered the viability and effectiveness of existing facilities and where deemed necessary provided recommendation for either upgrade or new facilities that are necessary to meet current standards of service, maintain a high level of water quality and supply reliability.

1.3 ASSESSMENT CRITERIA

The measure by which the water supply, transmission and distribution system were assessed recognize standard practices for water works design, publications and regulations including the following: Ten State Design Standards – Recommended Guide for the Design of Water Works Facilities, American Water Works Association Standards, Rhode Island Department of Health Regulations, regulations of the Rhode Island Division of Public Utilities and Carriers (RIDPUC), prudent engineering judgment and Regulations of the Authority, as amended.

Areas of system deficiencies were identified and recommendations for system improvements for both the short (immediate one to two years) and five (5) year planning horizons were quantified. Improvement projects deemed intrinsic to increase the reliability and operation of the water system were also quantified.

1.4 PRIORITIZATION CRITERIA

Prioritizing projects is a critical aspect of any capital program planning process. The project Prioritization Criteria provided below establishes a methodology to rate the relative importance of each of the individual projects. This rating criteria was premised upon a number of factors including protection of public health and safety, improving service conditions to consumers, regulatory requirements and the ability to provide and maintain adequate levels of service to existing and future customers.

These criteria also provides a basis for decision making in determining which projects are projected to be implemented in any given year and for general scheduling of projects over the five year span of the program.

The prioritization criteria provide a method that can be applied in order to rank the projects in terms of relative importance for completion. External influences that could affect implementation such as determinations from political and governmental oversight present unknown and situational factors that in most instances are beyond the Authority's control. These elements of discovery often finance strategies to secure funding and the ability to implement any particular project. These include but are not limited to: socioeconomic factors, regulatory agencies requirements and approvals, municipal and State government, Authority policy, funding availability and infrastructure condition.

The Authority is cognizant of the need to periodically review and update its capital program and the necessity for such plans to be ***dynamic*** in nature based on economic indices and other influences and maintaining the ability to restructure to meet the intrinsic needs of the water system. Therefore, it is important that the Authority throughout the implementation of the program periodically reassess the relative merit of the upcoming year's projects. It is critical that the assessment process weigh the essential need for the specific project as well as consider other factors which could affect implementation of a specific project. These factors could affect the overall program and may require reconsideration of the implementation schedule in the best interest of the customer and system requirements.

The following categories were utilized to categorize each of the projects. These include a range of priorities from high to low:

<u>Priority 1 – Essential Projects</u>

These include projects that represent the highest priority of all capital projects. These projects meet one or more of the following criteria:

- Those projects deemed essential for providing reliable water supply to meet current and/or projected consumer demands. These generally include projects involving supply, storage, transmission and distribution.

- Those projects that are required by legislation, regulation and/or for protecting the public health and safety and projects that are already under design or construction.

Priority 2 – Necessary Projects

These include projects that must be completed, but for which the Authority has a moderate level of control as to when they should be performed. These projects generally meet the following criteria:

- Those projects which increase water supply reliability and improve delivered water quality.

- Those projects which maintain or improve level of service goals and/or operating efficiencies within the next five years.

Priority 3 - Discretionary Projects

These include all projects that should be implemented to improve level of service goals, but for which the Authority has a significant level of control as to when they may be implemented. For example, this could include projects related to installation of transmission or distribution mains required for redundancy, demolition of infrastructure as part of an improvement project, etc.

1.5 EVALUATION PROCESS

This project related to the revision of a Capital Improvement Program for the Authority which detailed necessary improvements to be completed over a five (5) year planning period. This included evaluation of potential infrastructure improvements for the entire Kent County Water Authority water supply system. The water system is supplied with a combination of surface and groundwater with water coming from groundwater wells owned by the Authority and from water purchased wholesale from the Providence Water Supply Board (PWSB), a municipal authority regulated by the Public Utilities Commission. In addition to the supply sources, the water system is comprised of a distribution and transmission pipe system, pumping stations, storage facilities and fire hydrants. The water system contains approximately 471 miles of transmission and distribution mains, five (5) storage tanks of the standpipe ground storage or elevated design, three (3) pressure booster (pumping) stations, five (5) wells and 2,377 public fire hydrants. The water system is also divided into eight (8) distinct pressure service gradients that are designed to provide adequate water pressure to service customers within each gradient.

The evaluation of capital infrastructure projects considered water system consumer demands for the current maximum day plus fire flow scenario as well as the projected consumer demands for the planning period (year 2035). By considering potential future water demands within the service area, recommended CIP projects could be evaluated for their ability to maintain customer service level goals throughout the project planning period.

For purposes of projected consumer water demands, those developed as part of the 2014 Tank Study Update Report for planning year 2035 were utilized. These water demands were premised upon population projections from Rhode Island Statewide Planning in conjunction with information derived from the Comprehensive Community Plans and Planners from each of the service communities. These population projections also included a 10 percent "allowance" for additional "unplanned" growth within the service territory. This allowance accounts for water demands that could occur from unanticipated growth, in-fill development, weather conditions or changes in water usage trends.

These projected water demands were assigned to the demand database of the Authority's computerized hydraulic model. The hydraulic model was utilized to assist in the evaluation of the water supply and distribution system and to assess potential need for CIP projects based on consideration of current as well as future (year 2035) anticipated customer demands. The model simulations were intended to evaluate the effectiveness of the water system with and without the recommended CIP projects to meet anticipated consumer demands.

As part of the evaluation process, the Authority's computer hydraulic model of the supply and distribution system was updated to include all recent (within past five years) infrastructure and capital improvement projects which were implemented by the Authority. A review of the as-built condition plans for completed projects or available design plans for pending or in progress projects was performed. This update included consideration of the following projects.

- Mishnock Water Treatment Plant
- Wakefield Street Water Main Upgrades
- Quaker Lane Pump Station Upgrade/Rehabilitation
- East Greenwich Well Upgrade/Rehabilitation
- Infrastructure Replacement (IFR) 2014
- Infrastructure Replacement (IFR) 2015
- Infrastructure Replacement (IFR) 2016

1.6 EXISTING SYSTEM OVERVIEW

The Authority provides water service to customers in the Towns of Coventry, East Greenwich, West Greenwich, West Warwick and the City of Warwick. In addition, water service is also provided to customers in isolated areas of the City of Cranston and the Towns of North Kingstown and Scituate. There exist approximately 27,700 service accounts (including residential, commercial/industrial and government users) serving a population of more than 88,000 people within these locales. The primary sources of water supply for the distribution system include the wholesale interconnections with Providence Water and the City of Warwick (which also receives wholesale supply from Providence Water) and groundwater from well fields that are owned and operated by the Authority.

The Authority's existing piping system consists of approximately 471 miles of water mains with distribution and transmission pipe sizes ranging from 2-inches to 24-inches in diameter (exclusive of customer service connections). Elevations within the service territory range from

approximately 5 feet Mean Sea Level (MSL) at coastal areas to 474 feet MSL in Coventry in the northwestern portion of the water system.

There exist two (2) primary transmission booster pump stations and three (3) distribution system booster pump stations. The transmission booster pump stations boost pressure from the wholesale connections while the distribution system booster pump stations serve to boost pressure to higher localized pressure zones within the service territory.

The water distribution system is currently divided into eight (8) pressure zones which operate at varied hydraulic pressure gradients. These pressure zones are necessary in order to maintain an adequate level of service to the customers throughout the varied topography of the service territory. Of these eight (8) pressure zones, five (5) serve the majority of the service territory and include the Low Service Pressure Gradient (334 feet), the High Service South Pressure Gradient (500 feet), the High Service North Pressure Gradient (500 feet), the Reduced Low Service Pressure Gradient (280 feet) and the Reduced High Service South Pressure Gradient (430 feet). There are also five (5) active water storage facilities and three (3) inactive water storage facilities for a total of eight (8) water storage facilities located within the distribution system. These storage facilities serve to meet customer demands and provide reserve storage for fire and emergency needs. The eight (8) pressure gradients are as follows:

- Low Service Pressure Gradient – hydraulic grade of 334 feet
- High Service South Pressure Gradient – hydraulic grade of 500 feet
- Reduced Low Service Pressure Gradient – hydraulic grade of 280 feet
- High Service North Pressure Gradient – hydraulic grade of 500 feet
- Oaklawn Service Pressure Gradient – hydraulic grade of 231 feet
- Reduced High Service South Pressure Gradient – hydraulic grade of 430 feet
- Warwick Tanks Pressure Gradient – hydraulic grade of 231 feet
- Tiogue Pressure Gradient – hydraulic grade of 425 feet

1.7 CAPITAL AND INFRASTRUCTURE REPLACEMENT PROGRAMS

The Authority in addition to its capital improvement program maintains an ongoing program for the rehabilitation of existing infrastructure through the Infrastructure Renewal and Replacement (IFR) program. This IFR program is directed at renewing and replacing existing infrastructure components including transmission and distribution water mains, mechanical equipment and building facility components that are beyond their useful life or have sufficiently deteriorated such that they can no longer sustain service at or above the minimum standards for "adequacy of service" in the published Engineering Standards and Regulators Requirements.

To aid in the process of identifying infrastructure projects, the Authority maintains a comprehensive inventory database of distribution and transmission system water mains in its infrastructure replacement plan. This inventory provides a methodology for a numerical ranking for water mains most in need of replacement. This ranking system considers material, age, diameter, dead-end location, failure and maintenance history and approximation of the physical condition and properties of a particular water main which allows an objective comparison of all water mains to calculate approximately when a particular water main should

be replaced. This ranking system is not however the sole determining factor in the development of a pipeline replacement program.

This IFR program is intended to comply with State mandates to upgrade and reinforce the water distribution system by replacing old, deteriorated and undersized water mains in an effort to improve and maintain an adequate level of customer service and fire flow. The funding mechanism for the IFR program is a cash basis independent of the bond financing used for the capital programs. The IFR program relies upon rates applied to customer billing. As such, this program is considered a "cash based" funding system. A fixed percentage of customer billing which is based upon customer water usage is assigned to a restricted cash account for funding the IFR program.

The evaluation process for capital projects also identifies particular water main replacement projects that result in an overall benefit to the water supply and distribution system. These projects would not have otherwise been evident through the pipeline ranking system process as it differs from the capital project evaluation process. Therefore, those identified projects which impact proposed capital projects consisting of pipeline replacements are identified herein as infrastructure replacement projects for consideration under the IFR program.

The benefit of identifying an intrinsic IFR project is to coordinate projects and potentially accelerate the construction within the IFR program. For example, based on the pipeline ranking system a particular water main within the system may not be scheduled for rehabilitation within the foreseeable future. The identification of this pipeline in this capital program could provide the necessary justification to consider an earlier rehabilitation through the IFR program. The Authority must weigh the collective merit of these identified infrastructure rehabilitations against other infrastructure projects identified within the IFR program.

Potential IFR projects which have been identified to hold significant benefit to the capital program will be identified herein. The identification of these projects included a description and intended benefit, location mapping and description of interrelationship with capital projects, if any. A construction cost estimate was developed for these infrastructure projects however the project would necessarily be funded under the process of the IFR program.

1.8 COST ESTIMATING

The costs estimated for the capital improvement plan are based on current dollar value with an annual escalation for inflation and were generated based upon the extent and size of the particular capital improvement project. The cost estimate for each project is presented as a distinct component which includes construction (i.e. the cost to physically construct the project).

Construction Costs

Construction costs for recent water main projects completed by the Authority were utilized to assist in estimating construction costs. These include unit prices for general water main installation in public rights of way which include pavement restoration (temporary, final trench and permanent overlay restoration).

The following unit costs for water main material and installation were utilized.

Size (diameter)	Cost per Linear Foot
12-inch	$ 300.00
16-inch	$ 325.00
20-inch	$ 350.00
24-inch	$ 400.00

The costs identified above are utilized herein and are premised on data obtained from 2015 projects which the Authority has placed out for public bid. These construction costs for similar type projects provide the best source of available information related to "actual bid" costs and were therefore utilized to develop costs for projects.

For purposes of updating budgeting costs in the future and in the fiscal year in which a project is anticipated to take place, it is recommended that the ENR (Engineering News Record) published Construction Cost Index (CCI) be utilized. Again, the costs that were utilized herein were premised upon actual construction costs for similar type projects for which the Authority has recently received competitive bids.

These capital improvement cost estimates are intended to be utilized for planning and funding purposes and are not to be considered as an actual construction cost estimate. An engineer's opinion of probable construction cost would be required following successful preparation of detailed construction design documentation to account for current market and construction costs.

Design and Related Construction Services Costs

For purposes of developing design and related construction services costs, fifteen (15) percent of the cost of the estimated construction cost was utilized. Design and related construction services costs include those costs associated with planning, preliminary and final design; geotechnical investigations, surveying and permitting; construction oversight related services and representation. This percentage is considered a general industry standard for water works utility projects of this scale and complexity.

Contingency Allowance Costs

It is also necessary to include a contingency for unanticipated and unforeseen costs which could occur. This amount is added to the estimate to allow for items, conditions or events for which the condition, occurrence or effect is uncertain at this time and that experience shows will likely result in increased costs to complete the project. For purposes of developing an estimate for total project cost of construction a dollar value of twenty (20) percent of the anticipated total project cost (construction, design and related services costs) was utilized.

Inflation Adjustment Factor

In order to account for the increase in costs associated with goods and services, an annual inflation factor was utilized. Most recently, the escalating cost of energy and raw materials such as steel would have a significant impact on these type construction projects. Energy costs

have more than tripled since 2001 and steel has risen upwards of twenty five (25) percent due to increase in global demand. Most recently, inflation has been in the range of two (2) to five (5) percent. For purposes of accounting for annual inflation a conservative value of four (4) percent compounded escalation factor shall be utilized.

1.9 OVERVIEW OF CURRENT PROJECTS

The Authority has ongoing construction and design related projects which are directed at redefining several of the existing service gradients. These projects are part of a long term plan to better service customers (i.e. increase water supply, pressure, service reliability and flow capacity) in these areas and to provide a more manageably efficient system with redundant supply and transmission capabilities.

Redefining pressure gradients is generally considered a capital program goal and will have an impact on some of the projects identified herein. There may however exist portions of projects that incorporate infrastructure related improvements and as such are funded through that program. A brief description of the ongoing and most recently completed project(s) and status is provided below.

A. In October 2011, the Authority broke ground on the new Mishnock Water Treatment Plant located off of Nooseneck Hill Road in Coventry, Rhode Island. The Mishnock Water Treatment Plan came online in 2013 and the Mishnock Wells were returned to service with a combined capacity of 2.6 million gallons per day (MGD). The facility provides treatment to the groundwater wells for removal of iron and manganese and future EPA requirements for radon reduction in water supply. The treatment plant currently employs chemical oxidation and coagulation followed by membrane filtration to remove iron and manganese, disinfection and pH adjustment of the groundwater supply to meet all Rhode Island Department of Health and EPA requirements for drinking water quality. The facility was designed to pump treated water to both the Low Service and High Service South Pressure Gradients. Currently, the Mishnock Water Treatment Plant provides an additional capacity of 400,000 gallons per day to the Low Service Pressure Gradient. There are pumping systems in place at the Mishnock Water Treatment Plant to additionally supply water to the High Service South Pressure Gradient. This project is awaiting the completion of a necessary transmission main on Mishnock Road.

B. The Quaker Lane Pump Station has recently undergone construction for rehabilitation to increase the pumping capacity to the Low Service Pressure Gradient. The rehabilitation of the Quaker Lane Pump Station was completed in August 2014. The recent improvements to the Quaker Lane Pump Station included the installation of three (3) new Low Service pumps each with a capacity of 1,875 gallons per minute (gpm) at 130 feet total dynamic head (TDH). There are future plans for improvements that involve installing new High Service pumps in the Quaker Lane Pump Station. These improvements are dependent on the construction of related infrastructure.

C. The East Greenwich Well is currently undergoing rehabilitation and is temporarily offline. The rehabilitation of the East Greenwich Well consists of new well pumping and piping

systems and all new mechanical, electrical and building components necessary for this well to function as a source of supply for the Authority. The hydraulic capacity of the well station has been designed around the original design capacity of 1,650 gpm at 407 feet TDH. A proposed treatment facility for the removal of manganese at the East Greenwich Well may follow in the future.

D. The Clinton Avenue Pump Station underwent construction in 2006 for rehabilitation to increase the pumping capacity to the Low Service Pressure Gradient. The new facility went online in 2007. In 2013, variable frequency controlled drives (VFD's) were installed on two (2) of the Low Service pumps at the Clinton Avenue Pump Station. These VFD's are set to operate on the pressure head at the pump station.

E. The Authority has installed an emergency interconnection with Providence Water. The Providence Water Emergency Interconnection is located off of Harding Street in West Warwick, RI along the 102-inch Providence Water aqueduct. This emergency interconnection contains two (2) pumps each rated at 2,800 gpm at 170 feet TDH designed to pump from the free water surface of the Providence Water aqueduct at a hydraulic grade of 222 feet directly into the Authority's Low Service Pressure Gradient at a hydraulic grade of 334 feet to serve as a redundant source of supply to the Authority during emergency demand conditions.

F. The Wakefield Street Tank was taken offline in 2013 due to poor water quality in the tank as a result of inconsistencies and cycling stored volumes of water back into the distribution system.

The following projects are primarily related to infrastructure replacement and as such funded through the IFR program.

A. The Fiskeville Storage Tanks have recently been shutdown, capped and removed from the water system. The West Street Tank, Tiogue Tank and old Read School House Tank have been taken offline and demolition of these tanks is planned to be completed in 2016.

B. Replacement of water mains was completed as part of IFR 2014 improvements and included the following:

- Warwick: Tollgate Road from Centerville Road to Commonwealth Avenue; Commonwealth Avenue from Tollgate Road south for 1,300 feet; Globe Street; Hilburt Street; Granite Street; Craig Road; Becker Street; Cindy Lane; Whitehall Drive; Country View Drive from Beacon Hill Drive south for 600 feet; Alger Avenue; Herbert Street; Elisha Street; Plymouth Street; Manton Street; Neptune Street
- Coventry: Sandy Bottom Road from Main Street to bridge
- East Greenwich: South County Trail (RI Route 2) RIDOT Bridge No. 733
- Scituate: Hope Avenue from Clinton Avenue to Main Street; Jackson Flat Road from Main Street west for 750 feet

- West Warwick: Highland Avenue from Harris Street to Potter Court; Legris Avenue from Coit Avenue to Centre Street; Centre Street; New London Avenue from Legris Avenue to Main Street; Bishop Street; Edith Street; Wells Street; Leaf Street; Pauline Street; Perkins Street; Lionel Avenue; Quinlan Street; Lexington Avenue; Concord Avenue; Lenox Avenue from Legris Avenue to Ridge Street; Ridge Street; Revere Avenue from Legris Avenue south for 1,890 feet; Mason Street; Ethel Street; Mary Avenue; Lassell Street; Noxon Street from Mary Avenue to Tampa Street; Bellaire Avenue; Miami Street; Davis Street; Tampa Street from Legris Avenue to Penel Drive

C. Replacement of water mains was completed as part of IFR 2015 improvements and included the following:

- West Warwick: Wakefield Street from Lombardi Lane to Wilson Street; Aster Street; Daisy Street; Begonia Street; River Street; First Street; Border Street; Factory Street from New London Avenue to Bridge Street; Second Street; Third Street; Park Boulevard; Gerald Street; Earl Street; Ledgemont Court; Saint George Street; Queen Avenue; Hilltop Avenue; New London Avenue from Factory Street to Legris Avenue
- Warwick: East Avenue from east side of bridge to Bald Hill Road; Railroad Row; Sue Street; West Pontiac Street; Pontiac Street; Rossi Street; Baker Street; Burton Street; Tillinghast Avenue from Finance Street north for 825 feet; Tucker Street; Blade Street from Tucker Street south for 1,075 feet; Commonwealth Avenue from Bald Hill Road to Tollgate Road; Orchard Avenue; Panto Road; Sophia Drive; Bridal Avenue

D. Replacement of water mains was completed as part of IFR 2016 improvements and included the following:

- Coventry: Sandy Bottom Road Bridge
- Warwick: Larchmont Road from Diamond Hill Road south for 828 feet
- West Warwick: Greene Street; Gough Avenue from Main Street to West Street; East Main Street; Pike Street; Brayton Street; Shippee Avenue from Hebert Street to McNiff Street; West Street from Shippee Avenue to Washington Street; Ritchotte Court; Riverdale Avenue; Crossen Street; Winthrop Avenue; Brewster Avenue; Standard Avenue; Capron Street; Webster Street; Cottage Street; Andrews Avenue; New London Avenue from Providence Street to Morningside Drive; Hepburn Street; Manchester Street; Coit Avenue; Grant Street; Ontario Street; Monterey Drive; Cedar Drive; Bayberry Drive; Ponderosa Drive

SECTION 2.0
CAPITAL IMPROVEMENT PROJECTS – GENERAL

All capital projects that are identified herein are presented in the following general format. A brief description of the contents of the sections is also provided.

Project Description
A description of the project including need for project, benefit, goals and objectives.

Calendar Year for Implementation
The year in which the project is anticipated to commence. The duration of the project may extend beyond the fiscal year in which it is initiated.

Type of Project
Project classification which includes new construction, rehabilitation or replacement as related to the following type of project: supply, storage, improvement of hydraulic capacity to meet existing and future domestic and fire flow demands, transmission and/or distribution water mains, level of service improvement, pumping or booster stations.

Project Priority Category
Identification of project priority and discussion (i.e. essential, necessary or discretionary type of project).

Location Mapping
Mapping depicting the general location of the project within the service territory.

Total Anticipated Construction Cost
Estimated statistical cost to implement the project in current dollars including construction, design and design related services, a twenty (20) percent contingency and a four (4) percent annual compound escalation factor for inflation. The design services include costs associated with conceptual, preliminary and final design, surveying permitting and geotechnical services.

In order to update budgeting costs for construction moving forward the ENR (Engineering News Record) published Construction Cost Index (CCI) should be utilized.

Project 1 – Mishnock Water Treatment Plant High Service Mains

Project Description
In October 2011, the Authority broke ground on the new Mishnock Water Treatment Plant located off of Nooseneck Hill Road in Coventry, Rhode Island. The Mishnock Water Treatment Plant came online in 2013 and the Mishnock Wells were returned to service with a combined capacity of 2.6 MGD. The facility provides treatment to the groundwater wells for removal of iron and manganese and future EPA requirements for radon reduction in water supply. The treatment plant currently provides for membrane filtration to remove iron and manganese and future EPA requirements for radon reduction in water supply. The treatment plant currently employs chemical oxidation and coagulation followed by membrane filtration to remove iron and manganese, disinfection and pH adjustment of the groundwater supply to meet all Rhode Island Department of Health and EPA requirements for drinking water quality. The facility was designed to pump treated water to both the Low Service and High Service South Pressure Gradients. Currently, the Mishnock Water Treatment Plant provides an additional capacity of 400,000 gallons per day to the Low Service Pressure Gradient. Upon the completion of a necessary transmission main, the Mishnock Water Treatment Plant will have the ability to supply the High Service South Pressure Gradient.

In order to convey water from the treatment plant to the existing High Service South Pressure Gradient, it will be necessary to connect an existing 16-inch ductile iron water main previously installed from the water treatment plant to Ragnell Road. A new 16-inch transmission main will be installed along Mishnock Road from the intersection of Ragnell Road to the intersection with Hopkins Hill Road for approximately 7,000 feet. The 16-inch water main would then be tied into the existing High Service South Pressure Gradient water mains in Hopkins Hill Road.

Fiscal Year
Anticipated – 2017

Type of Project
This project is considered an improvement related to water transmission and overall supply capacity to the distribution system.

Category
Project is deemed *essential* and will require coordination with the operations of the Mishnock Water Treatment Plant for conveyance of water to the High Service South Pressure Gradient.

Location and Mapping
See Figure 1

Anticipated Construction Cost
The estimated cost of construction for this project is $3,140,000.

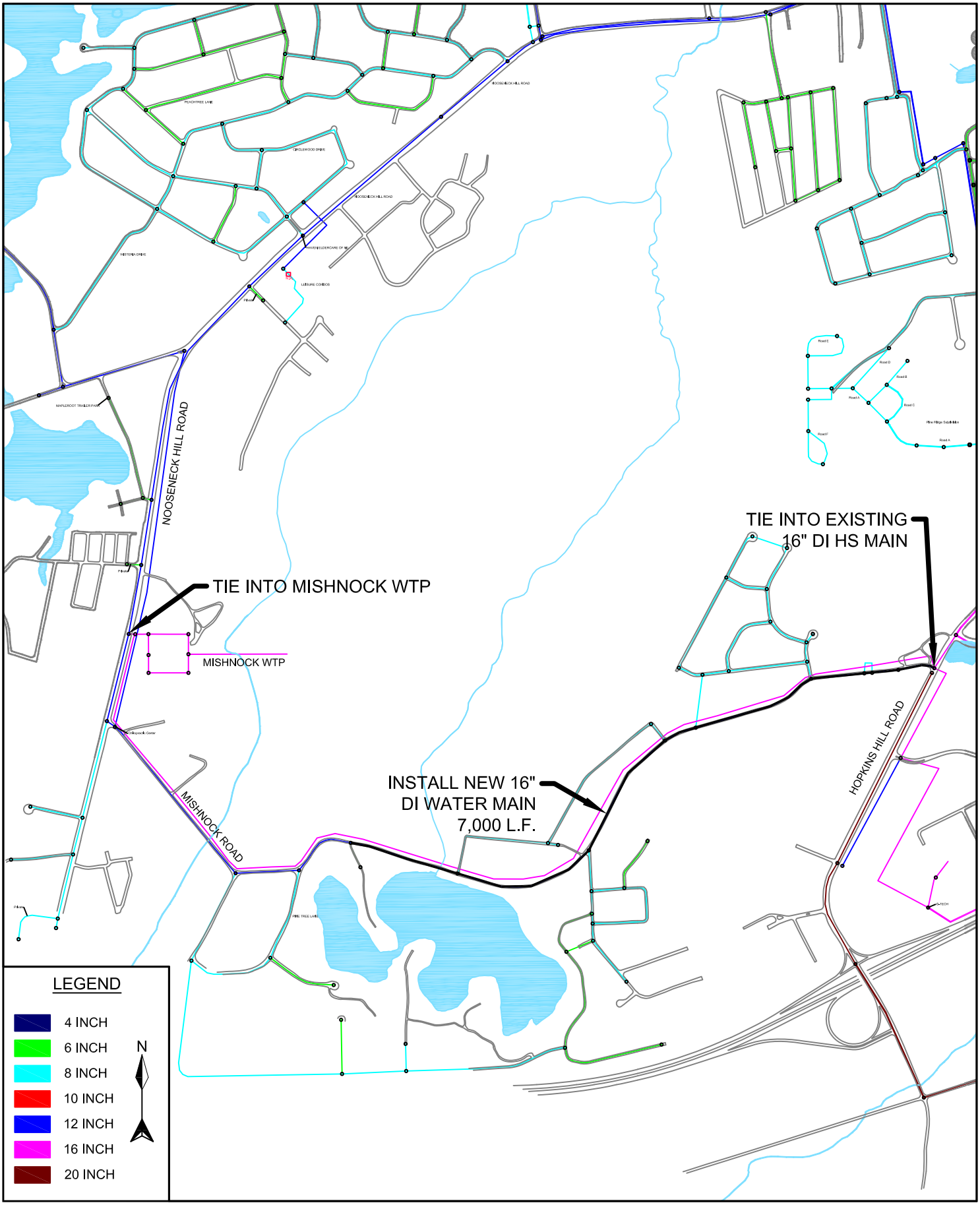


FIGURE NO. 1	KCWA Kent County Water Authority	PROJECT 1 MISHNOCK WATER MAIN - WTP TO HOPKINS HILL ROAD	C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 2 – Connection of North (Read School House Road) and South (Technology Park) High Service Pressure Gradients

Project Description

The connection between the Read School House Road (northern 500 foot gradient) and the Technology Park High Service Gradient (southern 500 foot gradient) is required in order to increase overall system supply redundancy and to permit greater flexibility in system operations. Most notably, this includes added redundancy in both storage and supply facilities for the High Service North Pressure Gradient which currently operates with a single tank and supply source. Connection with the High Service South Pressure Gradient will provide the High Service North Pressure Gradient with increased redundancy in storage and supply. The benefit to the south gradient includes an added source of supply. There have also been issues associated with high turnover rates of the Carr Pond Tank. The connection of the High Service North Pressure Gradient and the High Service South Pressure Gradient will also alleviate the high turnover rate of the Carr Pond Tank.

In order to connect the North and South High Service Pressure Gradients, it will be necessary to install a new 12-inch water main from Tiogue Avenue in the South High Service Pressure Gradient north to Main Street in the North High Service Pressure Gradient for approximately 15,377 feet. The water main improvements needed to interconnect the North and South High Service Pressure Gradients are broken down as follows:

Tiogue Avenue

Install 5,830 feet of new 12-inch water main tying into the existing 12-inch High Service South Pressure Gradient water main at the intersection of Tiogue Avenue and Jennifer Lane in proximity to the Tiogue Pressure Reducing valve station and extend to Sandy Bottom Road. Also as part of this project, approximately 3,060 feet of existing 12-inch asbestos cement Low Service Pressure Gradient water main shall be replaced with a new 12-inch ductile iron water main from the intersection of Tiogue Avenue and Pilgrim Avenue to the intersection of Tiogue Avenue and Gilles Street. There also exists approximately 3,575 feet of a 12-inch asbestos cement Low Service Pressure Gradient water main on Tiogue Avenue along this routing from Pilgrim Avenue to Sandy Bottom Road. This water main should be abandoned in place and all services, hydrants and side street tie-ins serviced by this main should be re-serviced with the existing 16-inch ductile iron Low Service Pressure Gradient water main on Tiogue Avenue.

Sandy Bottom Road

Install 399 feet of new 12-inch water main from Tiogue Avenue to Wood Street and install 2,494 feet of new 12-inch water main from Wood Street to Main Street. There exist sections of 16-inch cast iron and 8-inch asbestos cement water mains on the Low Service Pressure Gradient along this routing. These existing Low Service Gradient water mains are in the process of being replaced.

Main Street

Install 6,654 feet of new 12-inch water main from Sandy Bottom Road and connect to existing 16-inch High Service North Pressure Gradient water main at intersection of Main Street and Old Main Street.

Fiscal Year
Anticipated – 2018

Type of Project
This project is considered an improvement to overall system redundancy including supply and transmission capacity and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *essential* in order to provide interconnection of the two pressure gradients and provide for added system redundancy in supply, storage and transmission capacity.

Location and Mapping
See Figure 2

Anticipated Construction Cost
The estimated cost of construction for this project is $7,940,000.

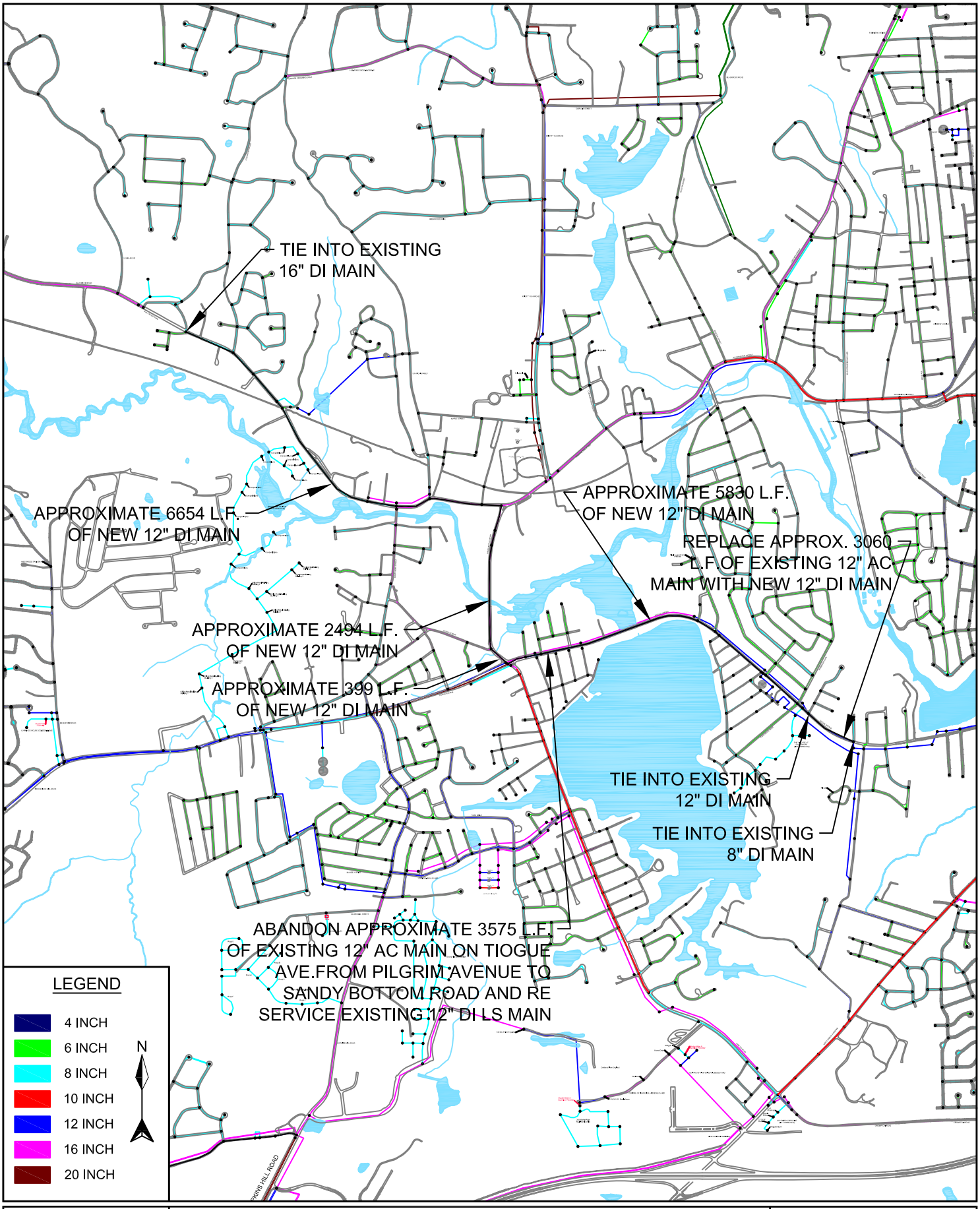


FIGURE NO. 2	KCWA Kent County Water Authority	PROJECT 2 CONNECTION OF NORTH AND SOUTH HIGH SERVICE
		C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 3 – Bald Hill Road Water Main Loop Connection

Project Description
This project consists of installing a new 8-inch looped water main connection from an existing dead end 8-inch water main located in proximity to an automobile retail facility in the vicinity of Bald Hill Road (RI Route 2). This loop connection is located within the Authority's Oaklawn Pressure Gradient that services the Oaklawn section of Cranston and the extreme northeastern portion of West Warwick. This pressure area receives water from Providence Water via the Oaklawn Avenue wholesale interconnection.

This project would include the installation of approximately 4,804 feet of new 8-inch water main from the terminus of the dead end near the interchange of Bald Hill Road and New London Avenue in Cranston and extending the 8-inch water main along Bald Hill Road and Pontiac Avenue to the existing 10-inch water main in Pontiac Avenue.

Fiscal Year
Anticipated – 2019

Type of Project
This project is considered an improvement to water quality, distribution water main "looping" and level of customer service and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *necessary* in order to optimize and maintain both water quantity (flow) and water quality by increasing the hydraulic flow capacity to the general service area of the system for both domestic and fire flow demands.

Location and Mapping
See Figure 3

Anticipated Construction Cost
The estimated cost of construction for this project is $1,580,000.

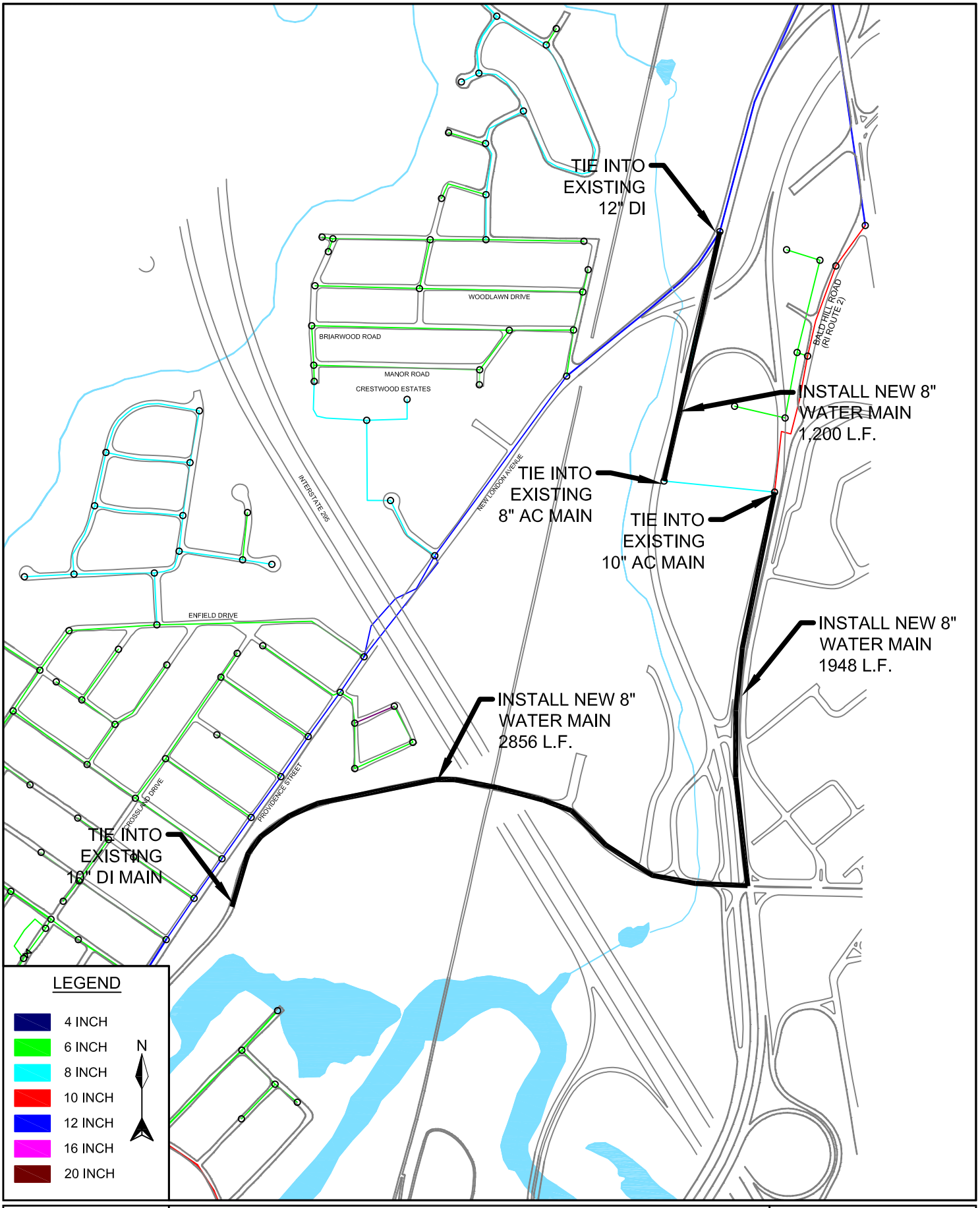


FIGURE NO.
3

KCWA
Kent County Water Authority

PROJECT 3
BALD HILL ROAD
LOOP CONNECTION

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 4 – Hope Furnace Road High Service Loop

Project Description
This project consists of installing a new 12-inch looped water main connection from an existing dead end 8-inch water main on Colvintown Road near the intersection with Hope Furnace Road. This loop connection is located within the Authority's High Service North Pressure Gradient in the northern portion of the water system located in Scituate. This pressure area receives water from Providence Water via the Clinton Avenue Pump Station.

This project would include the installation of approximately 3,624 feet of new 12-inch water main on Hope Furnace Road tying into the existing 24-inch water main at the intersection of Hope Furnace Road and Main Street and extending to the intersection of Hope Furnace Road and Colvintown Road and approximately 110 feet of new 12-inch water main on Colvintown Road from the intersection of Hope Furnace Road and Colvintown Road to the terminus of the existing 8-inch dead end water main on Colvintown Road.

Fiscal Year
Anticipated – 2018

Type of Project
This project is considered an improvement to water quality, distribution water main "looping" and level of customer service and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *necessary* in order to optimize and maintain both water quantity (flow) and water quality by increasing the hydraulic flow capacity to the general service area of the system for both domestic and fire flow demands.

Location and Mapping
See Figure 4

Anticipated Construction Cost
The estimated cost of construction for this project is $1,610,000.

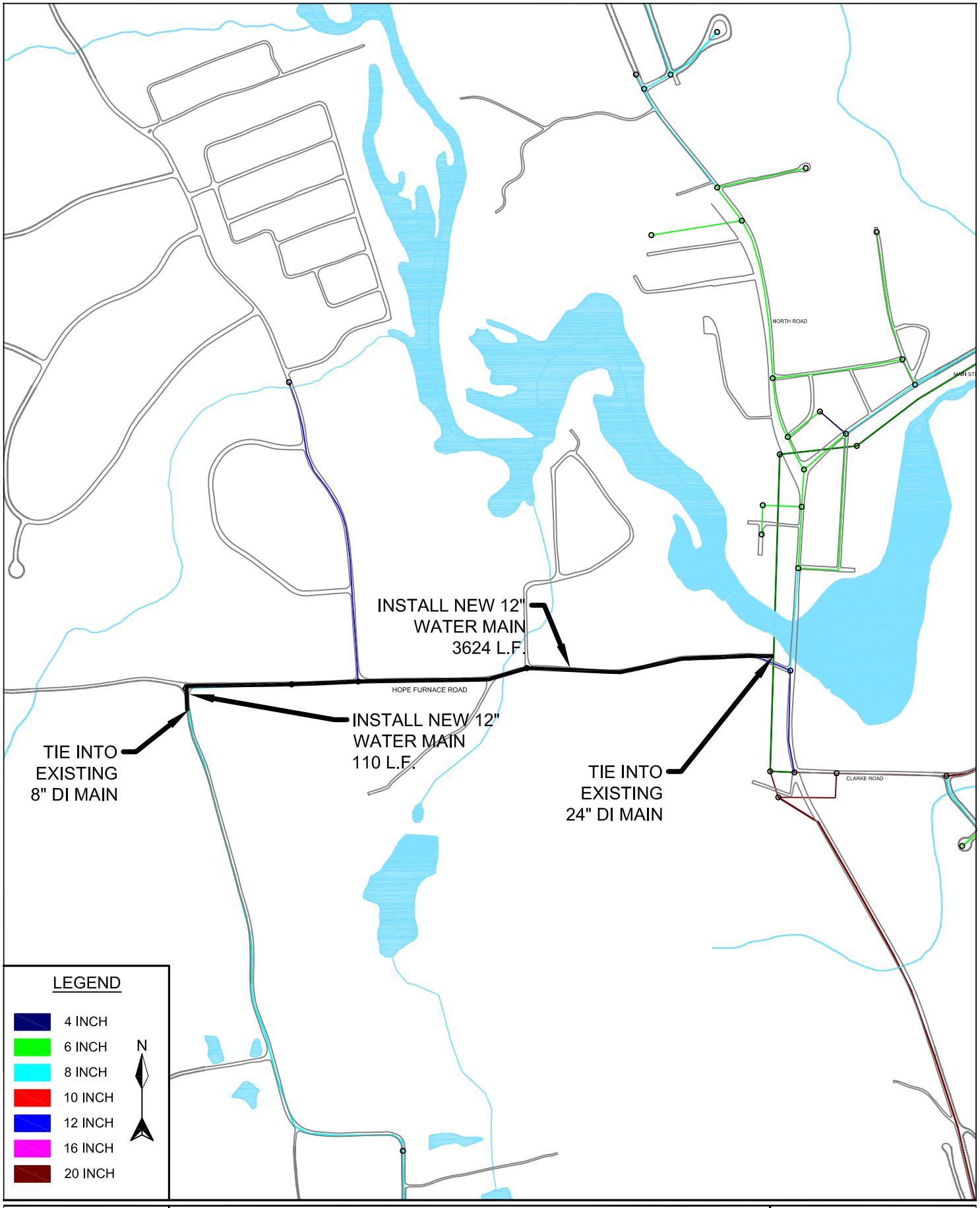


FIGURE NO. 4

KCWA Kent County Water Authority

PROJECT 4
HOPE FURNACE ROAD HIGH SERVICE LOOP

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 5 - Replacement of Authority Headquarters and Maintenance Facility

Project Description

The Authority currently operates out of a circa 1900 building renovated over 50 years ago from a defunct skating rink to its current occupancy as the Kent County Water Authority Headquarters located at 1072 Main Street in West Warwick, Rhode Island. Additional unheated garage and parts storage building facilities were subsequently added to the original structure at time of renovation. The administration and general maintenance share heated and unheated space in the building that faces Main Street, while vehicles and large equipment storage is housed in an unheated storage building to the rear of the site. Yard storage, employee and service truck parking occupy the space between both buildings and extend laterally on both sides to the limits of the site, which are bounded by chain link fences. Personnel estimate the age of the main building to be in excess of 100 years.

In 1997, the Authority commissioned a management and operation study to evaluate its Administration/Maintenance building. This evaluation concluded that the structure requires major improvements in both the short and long term. The property is too confined to allow for onsite improvements intrinsically necessary to continue operations at this location. The facility is grossly antiquated and considered too small to satisfy the Authority's current and future operational needs. Given the extreme age of the facility, this study concluded that the building has exceeded its original life expectancy and primary concerns are related to:

- Building code violations
- Lead paint and asbestos concerns
- Fire code violations
- Structural deficiencies
- Floor arrangements which are based on available space and not on user needs
- Security issues
- Inadequate yard space and concomitant inefficiencies
- No public parking in proximity to customer entrances
- Insufficient materials, equipment and vehicle storage/parking area

A 1999 evaluation and analysis of new Office and Maintenance Facilities considered potential sites for a new Kent County Water Authority facility. The evaluation included a selection of sites within the Authority's service area and a schematic building design based upon the Authority's needs at that time. A number of available sites were identified in the Coventry and West Greenwich areas, many of which are no longer available due to development.

A site plan based on business needs and available sites was developed. A concept floor plan layout was developed based on the anticipated needs and future business requirements for the Authority. This provided for a facility footprint requiring 6,500 square feet and 6 – 10 acres of required land area for the facility.

The Authority struggles to maintain operational activities at the marginal facility in West Warwick as materials storage has expanded to offsite locations that are designated as wellhead protection and tank storage properties. There have been no significant projects involving rehabilitation of the existing facility in the past 50 years as this current location is too confined to allow for a suitable renovation project to meet the Authority's needs. Consequently there continues to be a major deficiency in both office and field efficiency due to the dire need for facility replacement.

The initial phase of design must include a comprehensive management and operations study to include a needs assessment that considers both the short and long term requirements of the Authority and to review and revise conclusions and recommendations from previous evaluations accordingly.

Fiscal Year
Anticipated – 2019

Type of Project
This project is considered new property acquisition and facility construction that will replace a previously identified obsolete and functionally deficient existing facility housed within a building and property structure that has well exceeded its original occupancy for this type of business plan given the strong growth in the service area of this public water supply organization.

Category
Project is deemed *essential* to provide the expected level of service goals required by State Regulatory Requirements and the Authority's Strategic Plan.

Location and Mapping
See Figure 5 which identifies the existing facility. The location of the new facility will be dependent upon further study and availability of land. The current downturn in the real estate market affords ample opportunity to acquire property at reasonable market prices.

Anticipated Construction Cost
Facility with site preparation is estimated at $8,200,000. The cost of land purchase which is estimated at approximately 10 acres is anticipated to be in the range of $500,000 to $750,000 and will be dependent upon final location and market conditions.

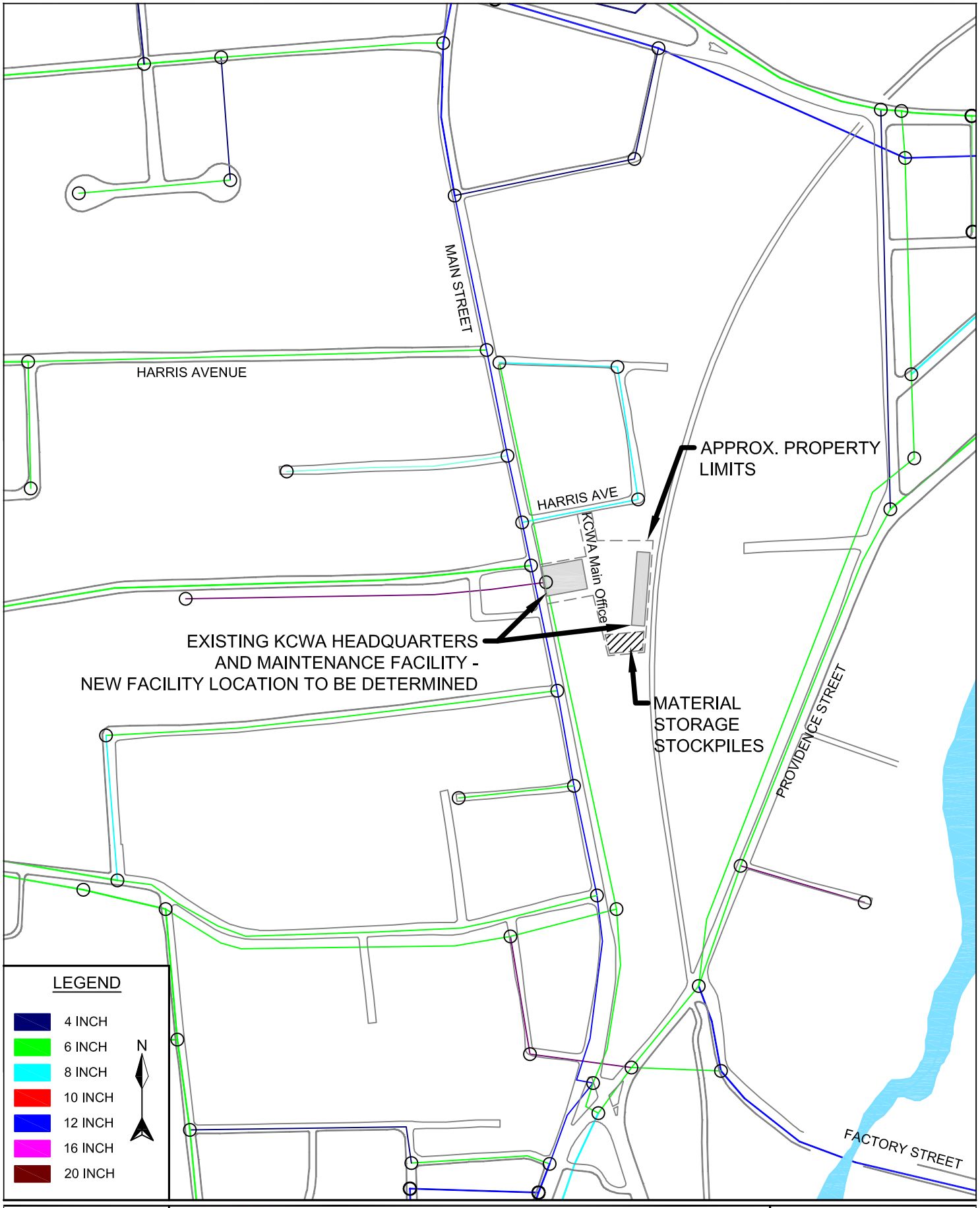


FIGURE NO. 5

KCWA Kent County Water Authority

PROJECT 5
REPLACEMENT OF AUTHORITY
HEADQUARTERS AND MAINTENANCE FACILITY

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 6 – Oaklawn Pressure Gradient – Emergency PRV Connection to Low Service Pressure Gradient

Project Description
The Oaklawn Pressure Gradient services the Oaklawn section of Cranston and the extreme northeastern portion of West Warwick. This pressure area receives water directly from Providence Water via the Oaklawn Avenue wholesale interconnection. An 8-inch master meter records the flow through the interconnection supplying this portion of the KCWA system at a hydraulic grade of approximately 231 feet MSL. There is currently only one water supply connection to this portion of the water system and there are no water storage facilities operating within the pressure gradient to provide continued service in the event of a casualty with the Providence Water wholesale connection.

This project involves the construction of an emergency Pressure Reducing Valve (PRV) supply facility that would provide the ability to transfer water from the Authority's existing Low Service Pressure Gradient that operates at a hydraulic gradient of 334 feet MSL to the Oaklawn Pressure Gradient that operates at a hydraulic gradient of 231 feet MSL during an emergency such as a contamination event or failure of the wholesale connection to Providence Water. The PRV facility would be located in vicinity to Crossland Drive in West Warwick just north of Wakefield Street. It will also be necessary to provide approximately 750 feet of new 8-inch diameter water main to loop several dead ends and connect the two service gradients and to replace approximately 361 feet of existing 6-inch asbestos cement water main on Oakland Drive with a new 8-inch ductile iron water main.

It should be noted that the Authority currently maintains locations of physical water main connections with closed valves that isolate these two pressure gradients. These valves are in the middle of the public right of way and cannot effectively be utilized to control flow and pressure to the downstream gradient. Without the PRV station the Low Service Pressure Gradient would supply the area with pressures in the range of 120 psi which are deemed excessive. This PRV station will however provide a more reliable and stable pressure interconnection between the two gradients without concern for potential over-pressurizing of the Oaklawn Pressure Gradient from the Low Service Pressure Gradient.

Fiscal Year
Anticipated – 2020

Type of Project
This project is considered an improvement to the level of customer service associated with additional supply redundancy and is consistent with the long term goal of the Authority to identify and improve overall water distribution hydraulics.

Category
Project is deemed *essential* in order to provide for an alternative water supply to this area of the distribution system in the event of an emergency. The ultimate objective is providing a supply methodology to maintain public safety and benefit in the event of an emergency at the Providence Water primary connection or failure in the distribution system.

Location and Mapping
See Figure 6

Anticipated Construction Cost
The estimated cost of construction for this project is $710,000.

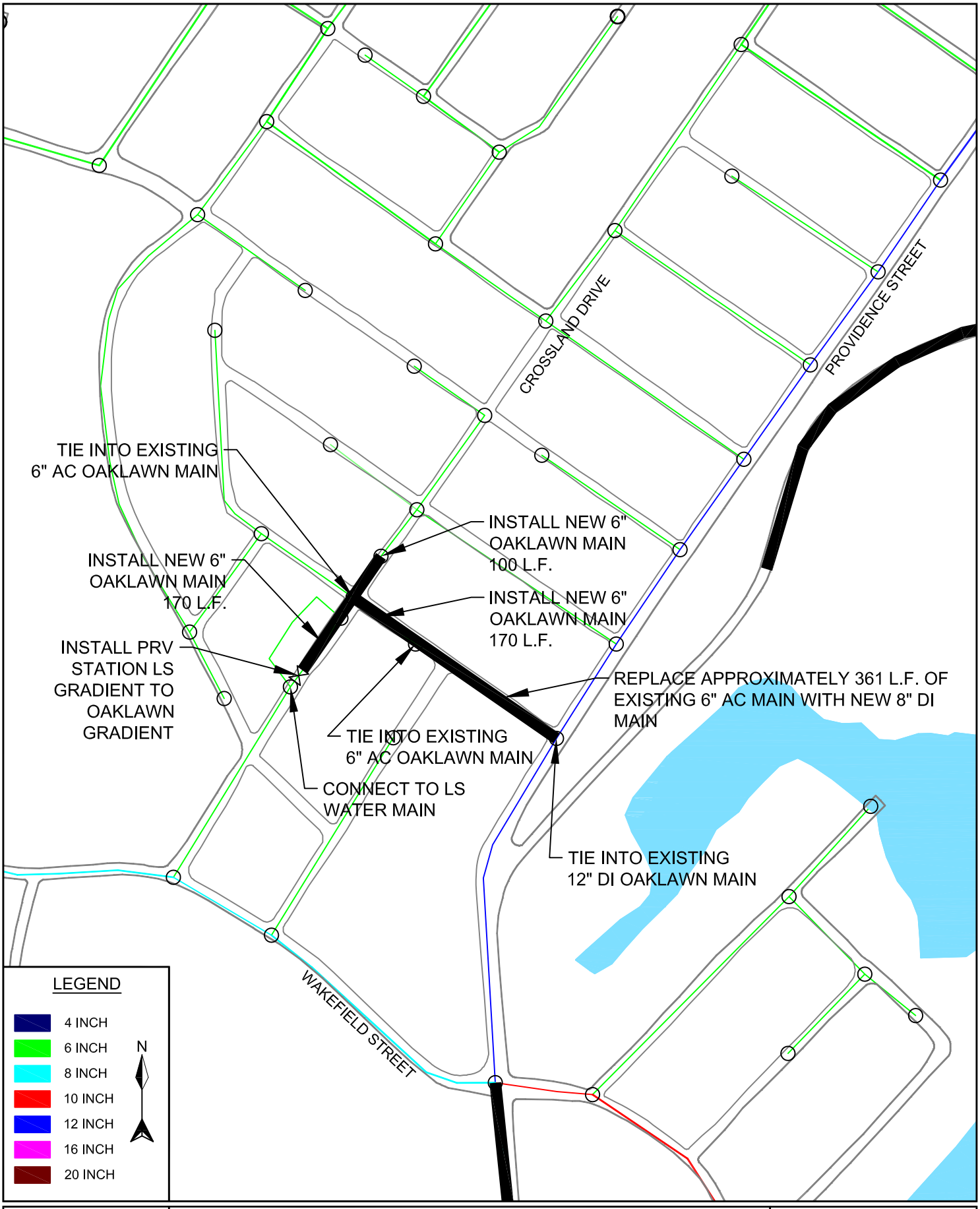


FIGURE NO. 6	KCWA Kent County Water Authority	PROJECT 6 OAKLAWN SERVICE GRADIENT EMERGENCY PRV
		C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 7 – Interstate 295 (I-295) Water Main Bridge Crossing at Providence Street

Project Description
The Oaklawn Pressure Gradient services the Oaklawn section of Cranston and the extreme northeastern portion of West Warwick. This distribution area receives water directly from Providence Water via the Oaklawn Avenue wholesale interconnection. An 8-inch master meter records the flow through the interconnection supplying this portion of the Authority's system at a hydraulic grade of approximately 231 feet MSL. There is currently only one primary water supply connection to this portion of the water system and there are no water storage facilities operating within the pressure gradient.

The 12-inch transmission main to West Warwick runs along Providence Street and crosses under Interstate 295 at the New London Avenue bridge overpass. A break or leak within this section of water main would be a major undertaking to repair and replace. Closing a valve on either side of the overpass to isolate a leak would interrupt domestic water and fire flow supply to all of the West Warwick customers between the overpass and Wakefield Street. This project includes installing a parallel 12-inch water main for approximately 480 feet attached to the bridge overpass across Interstate 295. The new water main would be interconnected to the existing 12-inch diameter water mains on either side of the bridge and provide redundant supply infrastructure crossing over a significant construction obstacle and eliminating the potential for customers to be without potable water service for an extended period of time.

Fiscal Year
Anticipated – 2020

Type of Project
This project is considered an improvement to the level of customer service associated with additional transmission and distribution system redundancy and is consistent with the long term goal of the Authority to identify and improve overall potable water and fire service distribution to its service customers.

Category
Project is deemed *essential* in order to provide for a parallel water main that traverses a significant construction obstacle on a dead end transmission main in the event of an emergency.

Location and Mapping
See Figure 7

Anticipated Construction Cost
The estimated cost of construction for this project is $770,000.

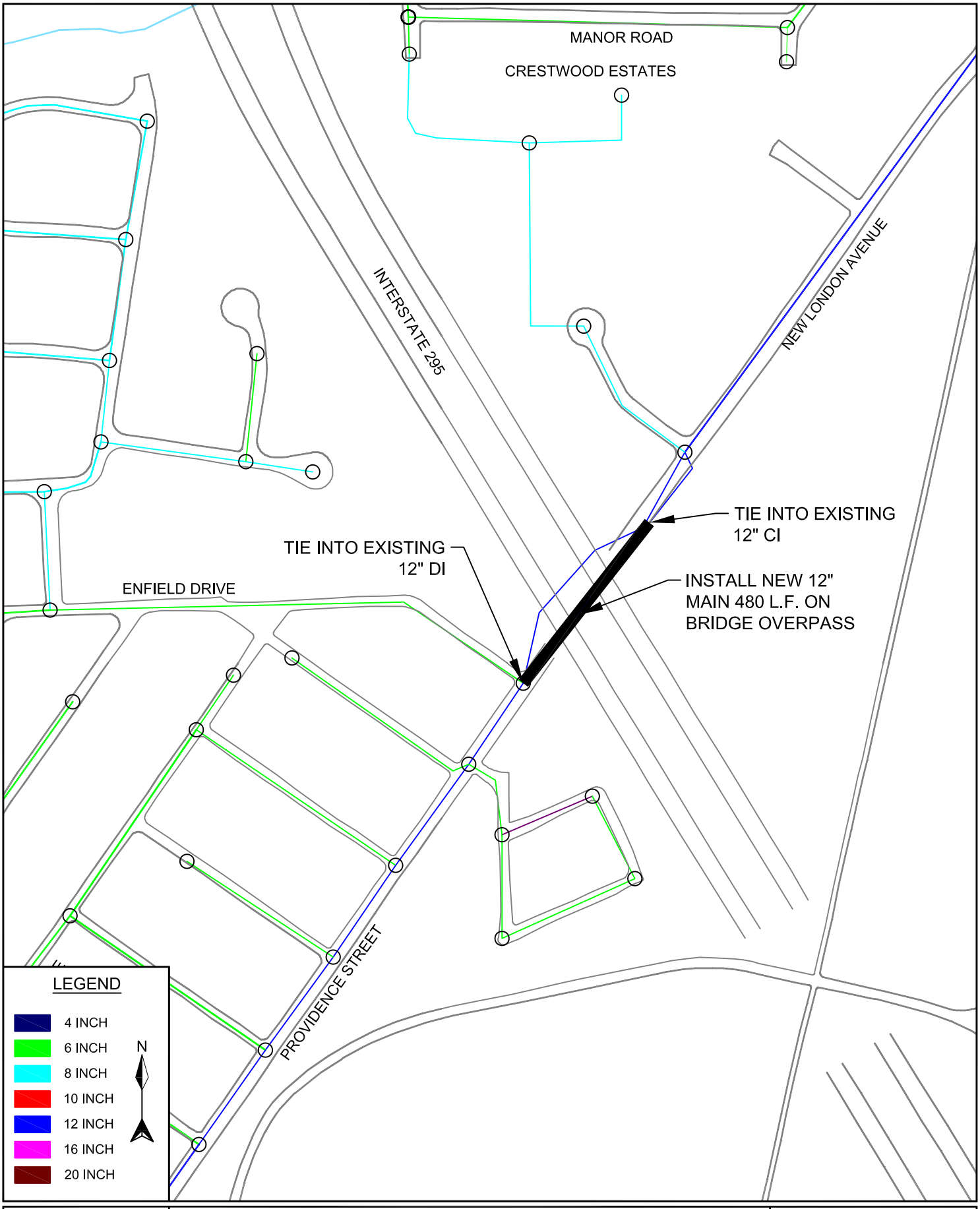


FIGURE NO.
7

KCWA
Kent County Water Authority

PROJECT 7
I-295 BRIDGE CROSSING AT
PROVIDENCE STREET

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 8 – High Service South Pressure Gradient Transmission Mains - Quaker Lane Pump Station High Service Expansion

Project Description

A project was previously completed by the Authority which increased service pressure in the Setian Lane Storage Tank area and also included expansion of the High Service South Pressure Gradient. This included an extension of a 16-inch transmission main from Crompton Road along New London Turnpike and East Greenwich Avenue to the Setian Lane Storage Tank area. These improvements resulted in valve closures to isolate the Low and High Service South Pressure Gradients. These valve closures resulted in dead end water main sections along roadways on the High Service South Pressure Gradient that extend away from the Setian Lane Low Service Pressure Gradient Storage Tank toward Bald Hill Road and Cowesett Avenue.

The Authority has recently completed an upgrade of the existing Quaker Lane Booster Pump Station to increase the pumping capacity to the Low Service Pressure Gradient and to provide the ability to pump directly to the High Service South Pressure Gradient. This upgrade was completed in August 2014. The High Service South Pressure Gradient pumps were not initially installed as part of the rehabilitation project but accommodations were provided for addition of these pumps in the future. Reference Project 10. This will require the installation of approximately 12,000 feet of 12- and 16-inch water main to tie the pump station into the High Service South Pressure Gradient water mains as follows.

- 16-inch – Quaker Lane Pump Station out to the State right of way of Route 2 (Bald Hill Road).
- 12-inch – South to the intersection with Cowesett Avenue, west on Cowesett Avenue with tie in at Kulas Road, Monterey Drive and Quaker Drive. Convert to High Service south Pressure Gradient mains.
- 16-inch – Continued south on Route 2 (Quaker Lane) to East Greenwich Avenue/Major Potter Road. Tie into 12-inch stub.
- 16-inch – Tie in at intersection of Quaker Lane and East Greenwich Avenue (west) and Major Potter Road (east).
- Continued south on Quaker Lane to intersection with James P. Murphy Industrial Highway and tie in at existing High Service South Pressure Gradient water main located at discharge to West Warwick Industrial Park Booster Pump Station (WWBP) and tie into existing High Service South Pressure Gradient water main.

This new High Service South Pressure Gradient water main will in part provide the required elimination of dead ends and strengthening of the High Service South Pressure Gradient in this area.

It is recommended that the 12-inch transmission main be extended along Cowesett Avenue from the intersection with Quaker Lane west to Kulas Road for 2,700 feet that will tie into the High Service South Pressure Gradient and increase the hydraulic capacity in this area of the system.

There exists a localized area within the Low Service Pressure Gradient to the north of Cowesett Avenue between Freemont Street and Narragansett Avenue that experiences substandard

pressures (i.e. below 20 psi under certain demand conditions). It is recommended that the 12-inch transmission main along Cowesett Avenue be extended west from Kulas Road (see above) to Lonsdale Street for an additional 1,900 feet. This would include tying into the Low Service Pressure Gradient main on Lonsdale Street and converting this to the High Service South Pressure Gradient thereby eliminating the dead end at this location. Water services with substandard pressures to the north of Cowesett Avenue could then be converted to the High Service South Pressure Gradient.

Fiscal Year
Anticipated – 2021

Type of Project
This project is considered an improvement to overall system redundancy including supply and transmission capacity and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *necessary* in order to reinforce the gradient and for expansion of the service territory.

Location and Mapping
See Figure 8

Anticipated Construction Cost
The estimated cost of construction for this project is $7,160,000.

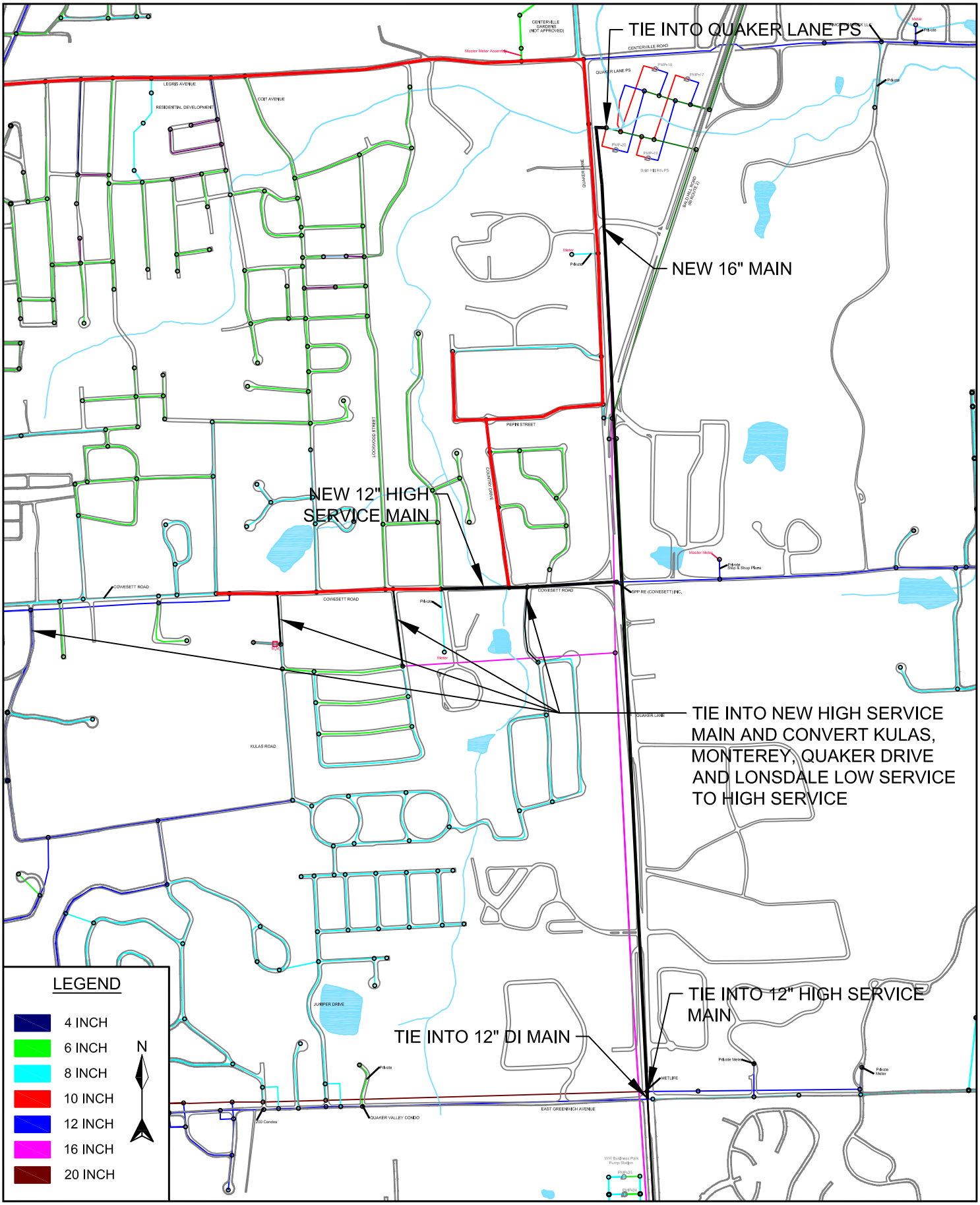


FIGURE NO. 8	KCWA Kent County Water Authority	PROJECT 8 HS TRANSMISSION MAIN - QUAKER LANE PUMP STATION	C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 9 – East Greenwich Transmission Mains – High Service Reinforcement/Expansion

Project Description
Previous Authority capital improvement projects have provided for partial expansion and reinforcement of the southern High Service Pressure Gradient. This project will expand on reinforcement of this pressure gradient as well as extend the High Service South Pressure Gradient to areas east along Division Road and Middle Road including Signal Ridge Way which is currently above elevations that are serviceable by the Low Service Pressure Gradient. This expansion will also extend service to areas which are currently not served with public water and include looped connection sections along Division Road and Shippetown Road. The new High Service South water main extension on Middle Road will also tie into the existing Low Service water main at the intersection with Tillinghast Road. A pressure reducing valve and normally closed gate valve will be installed at this location of tie in for use in emergency situations.

The following water main improvements needed to reinforce the High Service South Pressure Gradient in East Greenwich and to expand the pressure gradient to the east are as follows:

Project 9A - Division Road
Install 7,600 feet of new 16-inch water main from Shippetown Road to the approximate intersection of Old Quaker Lane and South County Trail and connect to the existing 16-inch High Service water main at this location. It is likely that significant ledge/rock will be encountered along this routing. This is evidenced from visual rock and ledge outcrops along the side of the roadway.

Once this High Service water main is in place, connect to the existing 12-inch Low Service water main at Signal Ridge Way which will be re-serviced from the High Service South Pressure Gradient. The following streets will be converted from the Low to the High Service South Pressure Gradient: Signal Ridge Way, Watch Hill Drive and Fox Run. The 20-inch Low Service transmission main that runs through Signal Ridge Way will remain as is. Consideration should be given by homeowners for installation of pressure reducing devices in residences with resulting pressures over 80 psi.

Project 9B - Shippetown Road
Install 1,200 feet of new 12-inch water main from Hidden Lane to Middle Road and connect to existing High Service South water mains.

Project 9C - Middle Road
Install 1,700 feet of new 16-inch water main from McPartland Way to Moosehorn Road and connect to existing High Service South water mains.

Project 9D - Middle Road
Install 900 feet of new 12-inch water main from end of existing 12-inch High Service water main to intersection with Tillinghast Road and connect to Low Service. This connection will

include a normally closed valve and pressure reducing valve station for use in the event of an emergency.

Fiscal Year
Anticipated – 2021 – 2022

Type of Project
This project is considered an improvement to overall system redundancy including supply and transmission capacity and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *necessary* in order to reinforce the gradient, expansion of the service territory and to re-service areas of the distribution system with higher pressure.

Location and Mapping
See Figures 9A – 9D

Anticipated Construction Cost
The estimated cost of construction for this project is as follows.

Project 9A - Division Road	$3,960,000
Project 9B - Shippetown Road	$580,000
Project 9C - Middle Road	$920,000
Project 9D - Middle Road	$670,000

INSTALL NEW 16" HIGH SERVICE MAIN 7,600 L.F.

CONNECT TO 12" LOW SERVICE MAIN

INSTALL NEW 16" HIGH SERVICE MAIN 7,600 L.F.

CONNECT TO HIGH SERVICE WATER MAIN

CONNECT TO HIGH SERVICE WATER MAIN

CONVERT THESE AREAS TO HIGH SERVICE

CLOSE ISOLATION VALVE

20" LOW SERVICE MAIN TO REMAIN

DIVISION STREET

SHIPPEE TOWN ROAD

SIGNAL RIDGE WAY

FOX RUN

WATCH HILL DRIVE

BOULDER WAY

BLUEBERRY HILL

HIDDEN RIDGE

M.M.

M.M.

Master Meter Assembly

AMTROL INC.

3 Story Office

Restaurant

Brooks Pharmacy Headquarters

Brooks Pharmacy Low Service (NOT APPROVED)

120 Room Hotel

PMP-34

Restaurant

Fire Service
Domestic Service

4 Story Office

2 Story Bank

3 Story Office

SOUTH COUNTY TRAIL

Rocky Hill Fairgrounds

3 1/2 Story Apartments

Condos

Condos

Condos

Master Meter and Backflow Preventor

Condos

Condos

EAST GREENWICH MEDICAL CENTER & OFFICE PHASES I, II, & III

Master Meter Assembly

PMP-2

BUILDING 1
47,250 SF

BUILDING 2
47,250 SF

SOUTH COUNTY T

LEGEND

- 4 INCH
- 6 INCH
- 8 INCH
- 10 INCH
- 12 INCH
- 16 INCH
- 20 INCH

N

FIGURE NO.
9A

KCWA
Kent County Water Authority

PROJECT 9A
DIVISION ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

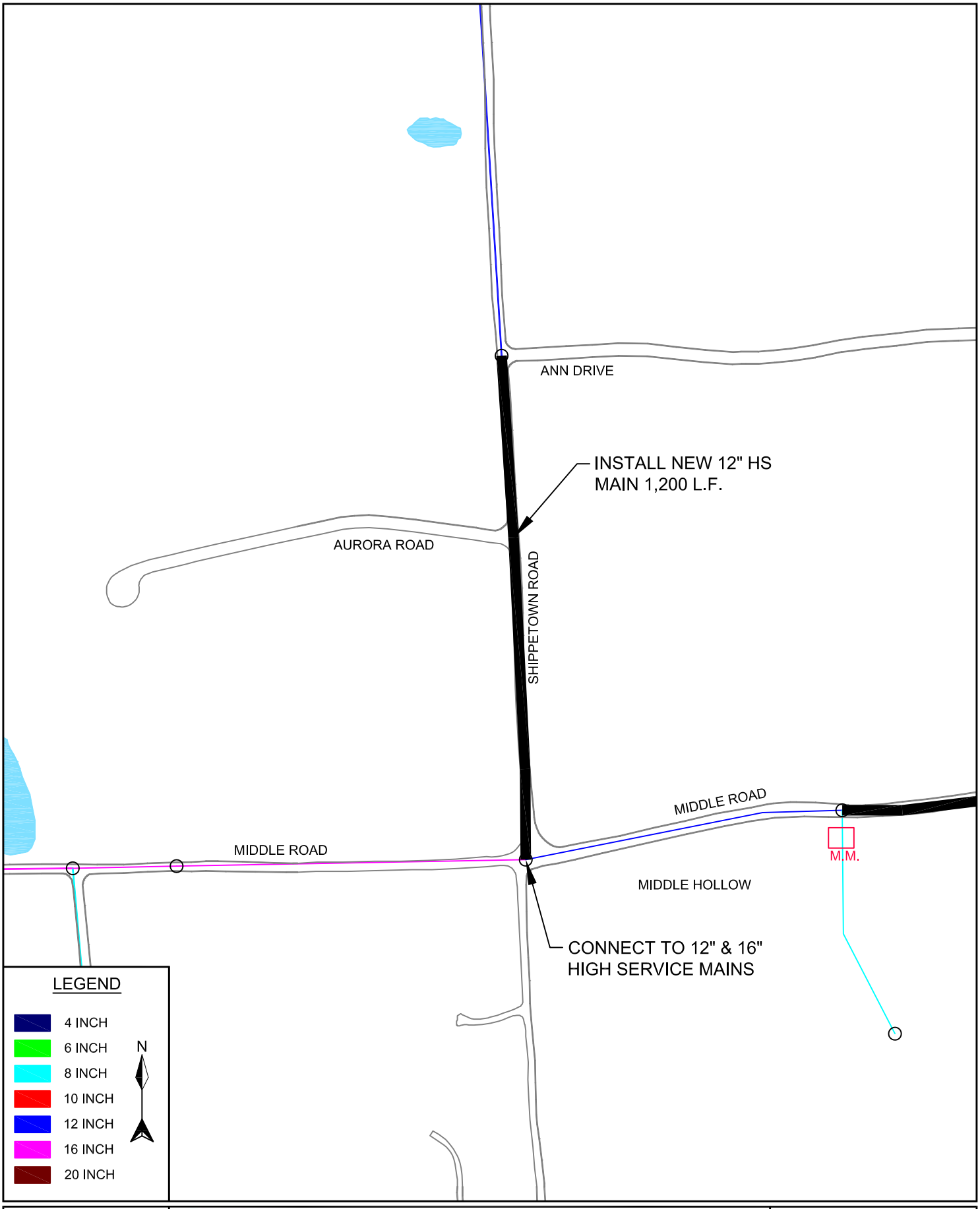


FIGURE NO.
9B

KCWA
Kent County Water Authority

PROJECT 9B
SHIPPETOWN ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

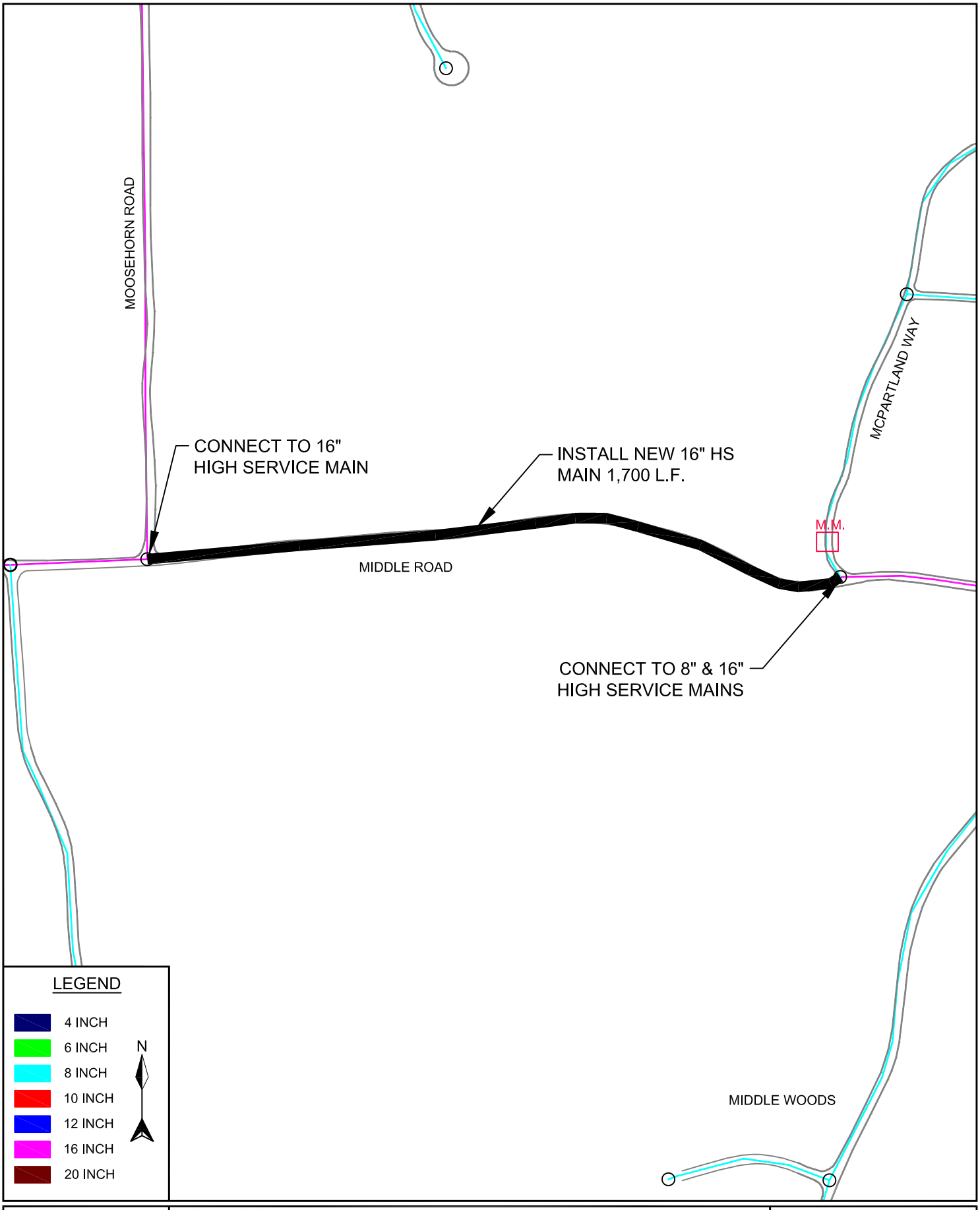


FIGURE NO.
9C

KCWA
Kent County Water Authority

PROJECT 9C
MIDDLE ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

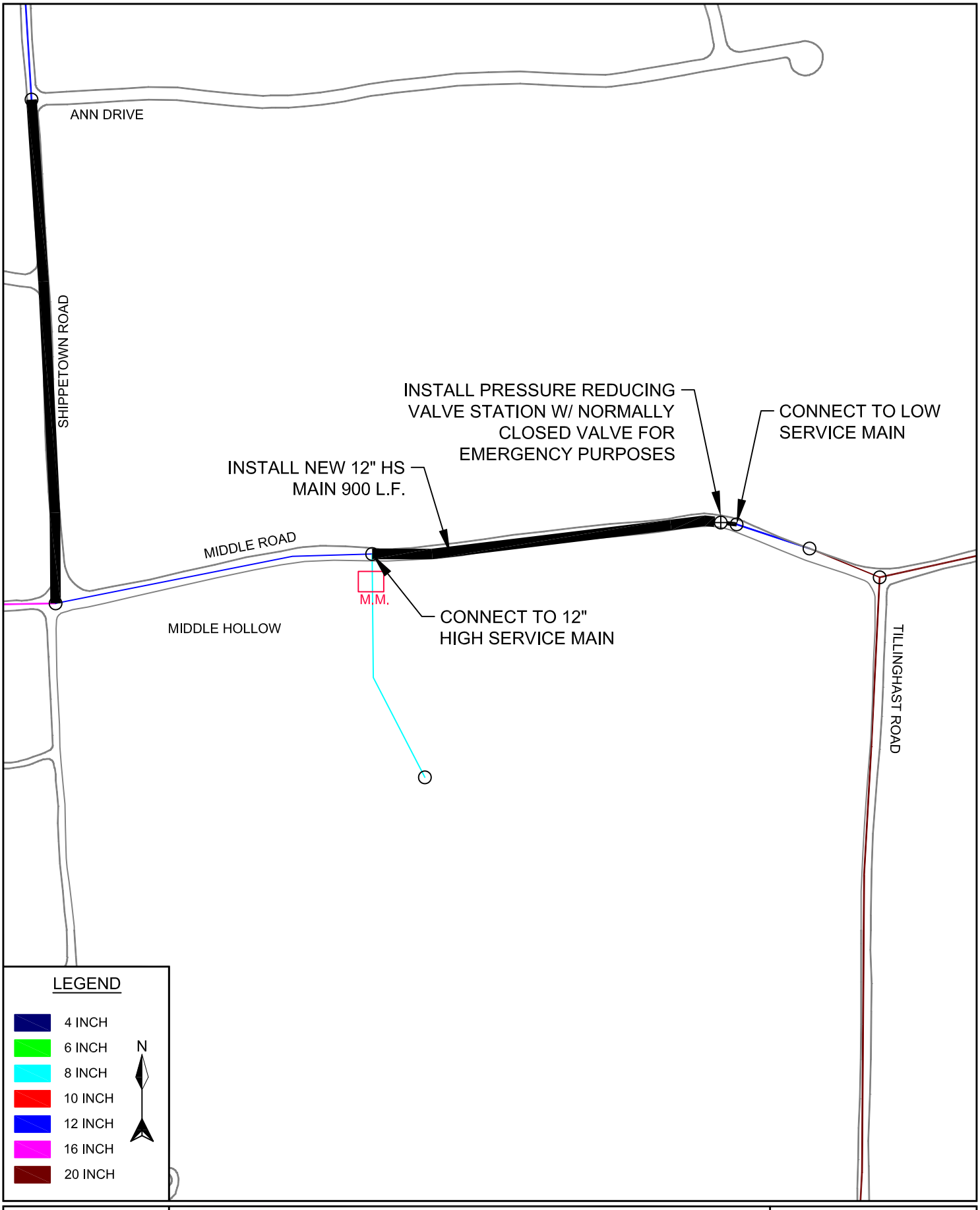


FIGURE NO. 9D

KCWA Kent County Water Authority

PROJECT 9D
MIDDLE ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 10 – Quaker Lane Pump Station – High Service Pumps

Project Description
The Authority has recently completed an upgrade of the existing Quaker Lane Booster Pump Station to increase the pumping capacity to the Low Service Pressure Gradient and to provide the ability to pump directly to the High Service South Pressure Gradient. This upgrade was completed in August 2014. The High Service South Pressure Gradient pumps were not initially installed as part of the rehabilitation project but accommodations were provided in the rehabilitation for the addition of the these pumps in the future. This will require the installation of approximately 12,000 feet of 16-inch water main to tie the pump station into the High Service South Pressure Gradient water mains as described in Project 8.

Fiscal Year
Anticipated – 2021

Type of Project
This project is considered an improvement to overall system redundancy including supply and transmission capacity and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
Project is deemed *necessary* in order to reinforce the gradient and for expansion of the service territory.

Location and Mapping
See Figure 10

Anticipated Construction Cost
The estimated cost of construction for this project is $330,000.

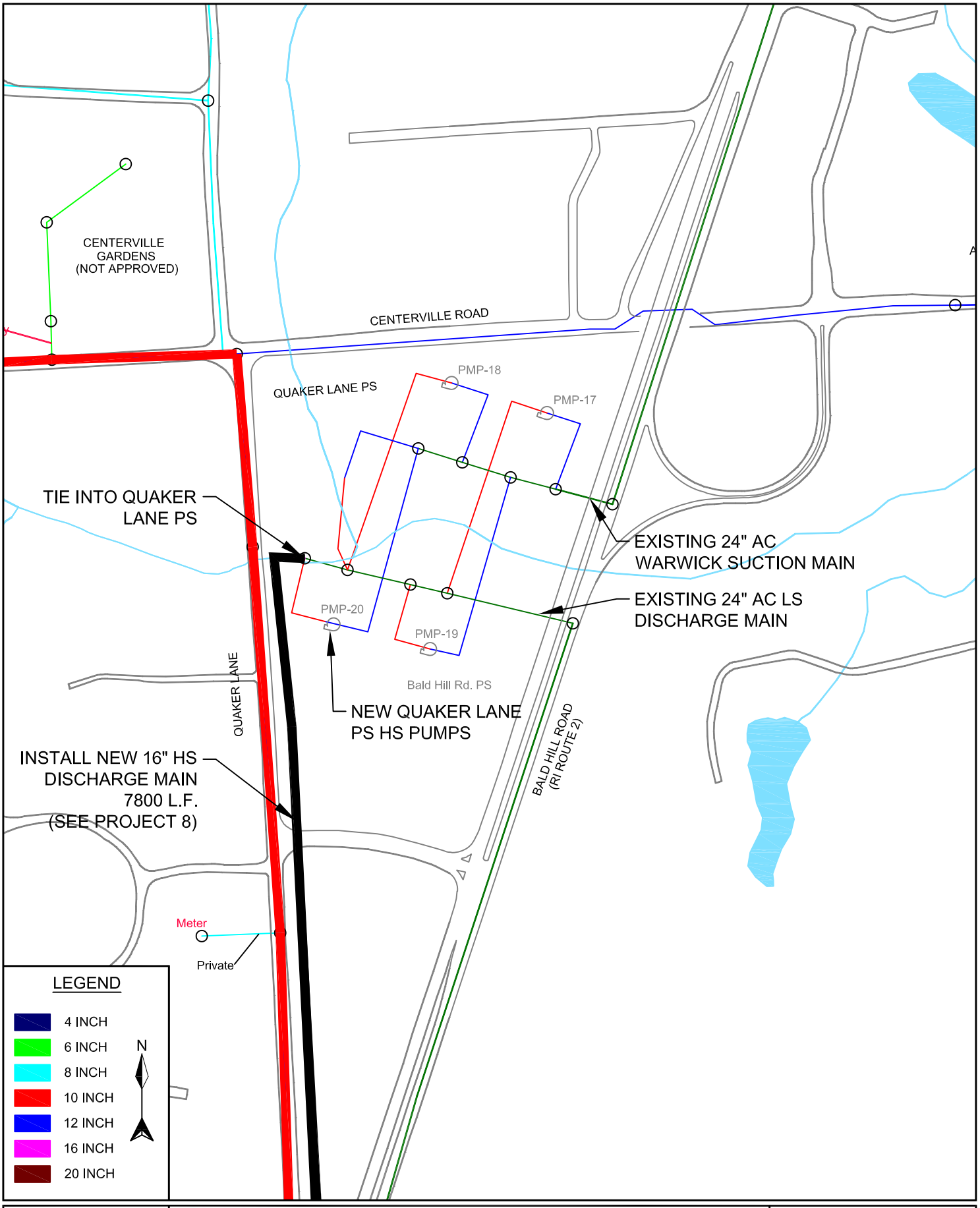


FIGURE NO. 10

KCWA Kent County Water Authority

PROJECT 10
QUAKER LANE PUMP STATION -
HIGH SERVICE PUMPS

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 11 - East Greenwich Well Treatment

Project Description

The East Greenwich Well is currently undergoing rehabilitation and is temporarily offline. The rehabilitation of the East Greenwich Well consists of new well pumping and piping systems and all new mechanical, electrical and building components necessary for this well to function as a source of supply for the Authority. The hydraulic capacity of the well station has been designed around the original design capacity of 1,650 gpm at 407 feet TDH. Provisions will be made in the new well building structure for a new treatment facility for the removal of manganese. The East Greenwich Well currently supplies water to the southeastern section of the Authority system including the Low Service Pressure Gradient and indirectly to the Potowamut section of Warwick. This well is also an intrinsic component to emergency supply capacity should a casualty or malevolent event occur with the Providence Water supply source. This well source represents a critical component to the Authority's supply and emergency strategies.

The Authority has experienced aesthetic water quality problems in this area of the distribution system. Water quality problems have been mainly attributed to the levels of manganese and to a lesser extent iron in the groundwater. These elements precipitate out and cause staining of customer plumbing fixtures which manifest into customer complaints within the distribution reaches of this supply. The Authority currently uses sequestering and a proactive flushing program to help mitigate the staining effect and customer concerns about water quality the staining creates.

In 2004, the Authority commissioned a study to address water quality concerns at this well supply facility. This included raw water quality sampling along with treatment assessment and pilot testing. The treatment pilot consisted of utilizing a sequestering agent to stabilize the soluble manganese and iron thus preventing it from quickly precipitating out of solution. The pilot study proved to be generally effective in sequestering the iron and manganese but did not totally solve the problem. As a result, any future treatment techniques must consider manganese and iron reduction/removal from the raw water supply to be effective.

A preliminary design study that included investigating suitable methods of treatment was conducted in the fall of 2009. During the preliminary design study phase for treatment, current Safe Drinking Water Act Regulations must be considered to ensure that all EPA drinking water requirements would be met. This project also considered mitigation of customer water quality complaints associated with color, taste and odor. Based on the December 2013 Treatment System Preliminary Design Report, the recommended treatment methods and protocol for the East Greenwich Well will be different than the Mishnock Water Treatment Plant technology. The most cost effective treatment technique for iron and manganese removal at the East Greenwich Well includes chemical oxidation, pressure filtration, draft aeration, pH adjustment and disinfection.

Fiscal Year
Anticipated – 2022

Type of Project
This project is considered an improvement related to water quality (treatment).

Category
Project is deemed *essential* to enhance water quality and to meet regulatory requirements.

Location and Mapping
See Figure 11

Anticipated Construction Cost
The estimated cost of construction for this project is $1,840,000.

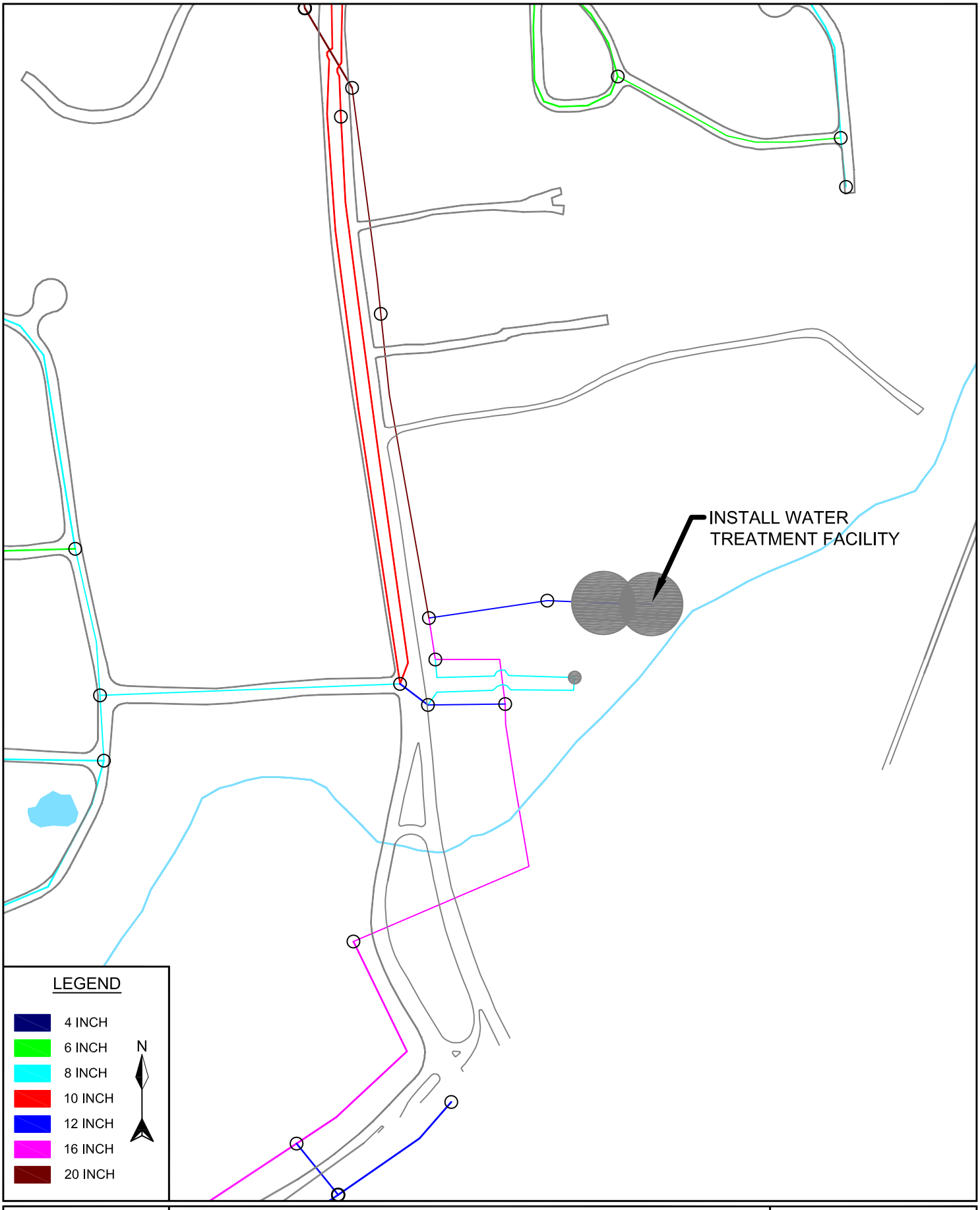


FIGURE NO.
11

KCWA
Kent County Water Authority

PROJECT 11
EAST GREENWICH WELL
UPGRADE AND TREATMENT

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Project 12 – Spring Lake Well Upgrades and Treatment

Project Description

Similar to the Mishnock and East Greenwich Wells, the Authority must rehabilitate the existing Spring Lake Well facility. This includes installation of a replacement supply well in proximity to the existing well, provide necessary raw water treatment and upgrade of facility infrastructure components. The Spring Lake Well supply is situated in the western section of the Low Service Pressure Gradient but is currently offline due to concerns related mainly to aesthetic water quality and reduced yield.

The existing well has been redeveloped several times and effective capacity can no longer be recovered through the redevelopment process. A replacement well is therefore warranted. Water quality concerns within this area of the distribution system consist of increased levels of iron and manganese which have been attributed to the groundwater source. It is anticipated that any replacement well facility will require treatment for iron and manganese reduction/removal, radon removal, pH adjustment and disinfection.

During the preliminary design phase for treatment, current Safe Drinking Water Act Regulations must be considered to ensure that all known EPA requirements for drinking water are met. This project will also mitigate tenets of historic water quality complaints from service customers. It is anticipated that the recommended treatment methods and protocol for the Spring Lake Well will include a treatment technique similar to the technology that is proposed for the East Greenwich Well. The selected treatment technique for iron and manganese removal at the East Greenwich Well includes chemical oxidation, pressure filtration, draft aeration, pH adjustment, fluoride addition and disinfection.

A summary of the scope of this rehabilitation follows:

- Conduct raw water quality and treatment train pilot studies.
- Conduct a preliminary design investigation.
- Install a replacement well and decommission the existing well.
- Size new pump and motor for the production well, as required, in order to achieve the most efficient operation and maximize yield.
- Provide surge control.
- Provide instrumentation for automated control and operation of the facility using SCADA system.
- Replace the existing flow meter.
- Provide a stand-by generator (propane or natural gas) and remove existing stand-by drive and gasoline fuel tank.

- Construct building to house treatment infrastructure and equipment for aeration, clearwell, chemical feed equipment for chlorination, pH adjustment by potassium hydroxide and fluoridation.

- Provide cost effective treatment as determined during the preliminary design phase for iron and manganese removal and radon mitigation.

- Construct the new facilities to comply with current building code requirements (mechanical, electrical, plumbing, HVAC, fire and life safety) and install new motor control center. Install emergency generator to ensure uninterrupted operation of the facility and to maximize system reliability.

Fiscal Year
Anticipated – 2022

Type of Project
This project is considered an improvement related to water quality (treatment) and overall supply capacity (maximize well yield).

Category
Project is deemed *essential* to enhance water quality and maximize supply capabilities from this area of the distribution system.

Location and Mapping
See Figure 12

Anticipated Construction Cost
The estimated cost of construction for this project is $6,210,000.

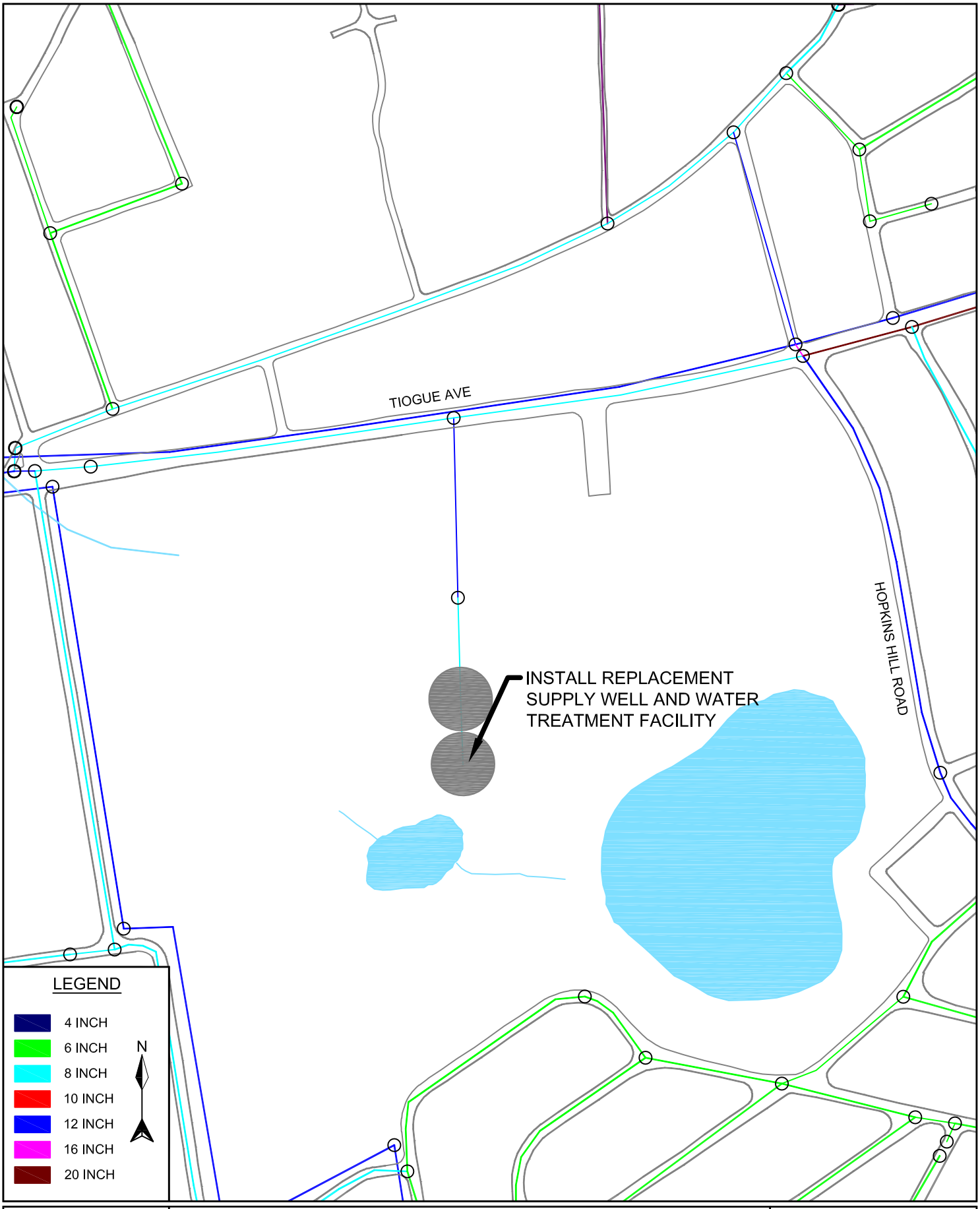


FIGURE NO.
12

KCWA
Kent County Water Authority

PROJECT 12
SPRING LAKE WELL
UPGRADE AND TREATMENT

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

Infrastructure Replacement Projects 13 through 21

Infrastructure Replacement of Low Service Pressure Gradient Transmission Mains – Reinforcement/Expansion/Hydraulic Capacity Improvement

Project Description

The primary goal was to identify Low Service Pressure Gradient water mains that are related to the conveyance of water from supply sources and storage facilities to areas within the distribution system which are limited in hydraulic flow capacity due to size, age or a combination of both. This is typically evidenced in transmission water mains that exhibit "high" head losses during normal (average day) and peak (maximum day and peak hour) system demand conditions.

These transmission water main segments are critical in that they convey flow from supply sources (i.e. Clinton Avenue and Quaker Lane Pump Stations and groundwater well stations) to distribution system booster stations, storage facilities and customer demand areas throughout the distribution system. These transmission water mains are also critical for conveying fire flows from the storage facilities to areas throughout the distribution system.

The Authority's computer hydraulic model was also utilized to locate those water main segments that exhibit high head loss under the various demand conditions. This included performance of steady state model simulations under average day and maximum day demand scenarios for projected future demands.

Infrastructure Replacement Program

As required by legislative mandate, the Authority maintains an ongoing Infrastructure Replacement Program (IFR) which is intended to upgrade and reinforce the water distribution system by replacing old, deteriorated and undersized water mains and other infrastructure (tanks, pump stations, reservoirs, etc.). This program is intended to improve and maintain an adequate level of customer service and fire flow throughout the distribution system. The funding mechanism for the IFR program is independent of the capital program and relies upon the rate structure for customer service billing. The projects identified in this section will be funded under the Authority's IFR program.

The benefit of identifying an IFR project herein is to potentially accelerate the projects listed within the IFR program in conjunction with Capital Projects. For example, based on the pipeline ranking system a particular water main within the system may not be scheduled for rehabilitation within the timeline necessary to facilitate use of a programmed capital project. The identification of this pipeline in this capital program could provide the necessary justification to consider an earlier rehabilitation through the IFR program. The Authority must weigh the relative merit of these identified infrastructure rehabilitations against other infrastructure projects identified within the IFR program.

The identification of these projects included a description and anticipated benefit, location mapping, description of interrelationship with capital projects and estimate of cost. No priority rank was developed for these infrastructure projects as this would be performed under the process of IFR program assessment. The intent is to use this additional justification in the IFR evaluation process.

Project 13 – Centerville Road in Warwick
Replace 1,800 feet of 8-inch diameter asbestos cement water main and 1,200 feet of 8-inch diameter cast iron water main with 3,000 feet of 12-inch diameter water main on Centerville Road between the I-95 ramp and Toll Gate Road. Provide tie in of water mains on all cross streets.

Project 14 – Arnold Road in Coventry
Replace 6,100 feet of 16-inch diameter cast iron water main with 6,100 feet of 16-inch diameter water main on Arnold Road from Crestwood Road to Tiogue Avenue. Provide tie in of water mains on all cross streets.

Project 15 – Country Drive/Pepin Street in West Warwick
Replace 1,100 feet of 8-inch diameter asbestos cement water main on Country Drive with 1,100 feet of 12-inch diameter water main from Pepin Street to Cowesett Road. Replace 1,700 feet of 8-inch diameter asbestos cement water main on Pepin Street with 1,700 feet of 12-inch diameter water main from Quaker Lane to Old Carriage Road. Note that this project will require an easement for water main installation from the end of Country Drive to Pepin Street (approximately 200 feet).

In the event that this easement cannot be obtained or the cost and logistics to install the water main through this area are impractical and not viable then the project would need to be reconsidered.

Project 16 – Quaker Lane in Warwick and West Warwick
Replace 1,500 feet of 8-inch diameter asbestos cement water main and 1,100 feet of 8-inch diameter PVC water main with 2,600 feet of 12-inch diameter water main on Quaker Lane from Pepin Street to Centerville Road. Provide tie in of water mains on all cross streets.

Project 17 – Washington Street in Coventry
Replace 6,100 feet of 12-inch diameter cast iron water main with 6,100 feet of 16-inch diameter water main on Washington Street from Read Avenue to Contentment Drive. Provide tie in of water mains on all cross streets.

Project 18 – Cowesett Road in West Warwick
Replace 1,800 feet of 8-inch diameter asbestos cement water main with 1,800 feet of 12-inch diameter Low Service water main on Cowesett Road from Narragansett Avenue to Cochran Street. This project will require close coordination with CIP Project 8 which includes extending High Service South water mains west on Cowesett Avenue from Quaker Lane with tie-ins at Kulas Road, Monterey Drive and Quaker Drive to eliminate dead ends at these locations and loop the High Service South water mains. Provide tie in of water mains on all cross streets.

Upon completion of both projects there will be parallel High Service South and Low Service water mains in this section of Cowesett Road.

Project 19 – West Warwick Avenue in West Warwick
Replace 3,000 feet of 6-inch diameter cast iron water main and 300 feet of 8-inch diameter cast iron water main on West Warwick Avenue with 3,300 feet of 12-inch diameter water main from Main Street to Washington Street. Provide tie in of water mains on all cross streets.

Project 20 – East Avenue in Warwick
Replace 1,700 feet of 10-inch diameter cast iron water main with 1,700 feet of 12-inch diameter water main on East Avenue from River Street to Tillinghast Avenue. Provide tie in of water mains on all cross streets.

Project 21 – New London Turnpike in West Warwick
Replace 400 feet of 8-inch diameter asbestos cement water main, 600 feet of 12-inch diameter ductile iron water main, 600 feet of 12-inch PVC water main, 5,700 feet of 12-inch diameter asbestos cement water main and 2,300 feet of 8-inch cast iron water main on New London Turnpike with 9,600 feet of 16-inch diameter water main from Cowesett Road to Arnold Road. Provide tie in of water mains on all cross streets.

Fiscal Year
To be determined under the infrastructure replacement program.

Type of Project
This project is considered an improvement to overall system transmission capacity and is consistent with the long term goal of the Authority to identify and improve overall water service.

Category
This project is deemed *essential* in keeping with the goals of the Infrastructure Replacement Program and will serve to increase the hydraulic flow capacity throughout the Low Service Pressure Gradient in order to meet existing and future consumer system demands and fire flow requirements.

Location and Mapping
See Figures 13 – 21

Anticipated Construction Cost
These projects are to be funded through the Authority's IFR program. The estimated cost of construction for this project is as follows.

Project Description	Cost	Anticipated Year
Project 13 – Centerville Road in Warwick	$1,250,000	2017
Project 14 – Arnold Road in Coventry	$2,850,000	2018
Project 15 – Country Drive/Pepin Street in W. Warwick	$1,260,000	2019
Project 16 – Quaker Lane in Warwick and W. Warwick	$1,170,000	2019
Project 17 – Washington Street in Coventry	$3,070,000	2020
Project 18 – Cowesett Road in W. Warwick	$870,000	2021
Project 19 – West Warwick Avenue in W. Warwick	$1,590,000	2021
Project 20 – East Avenue in Warwick	$710,000	2017
Project 21 – New London Turnpike in West Warwick	$5,170,000	2022

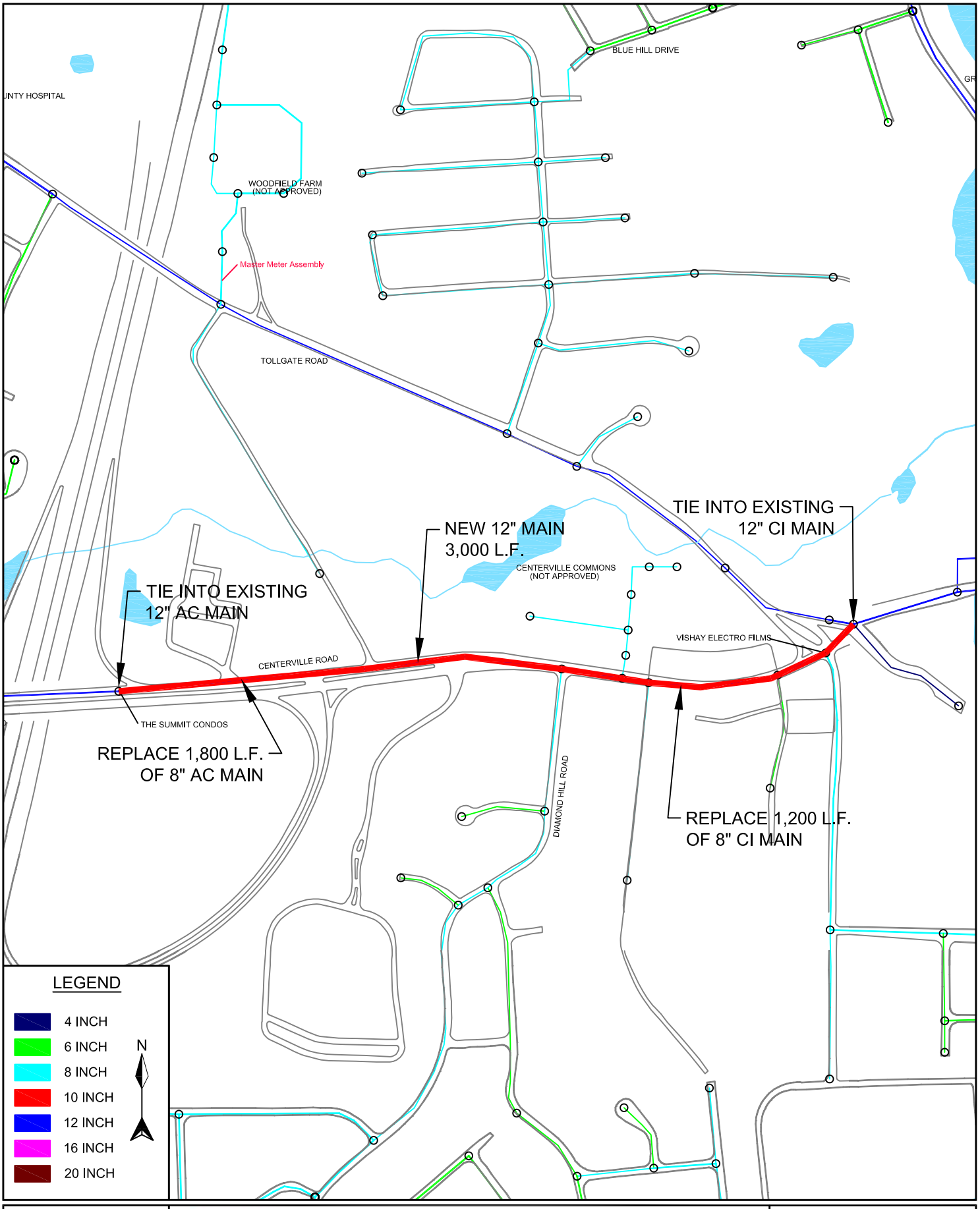


FIGURE NO.
13

KCWA
Kent County Water Authority

PROJECT 13
CENTERVILLE ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

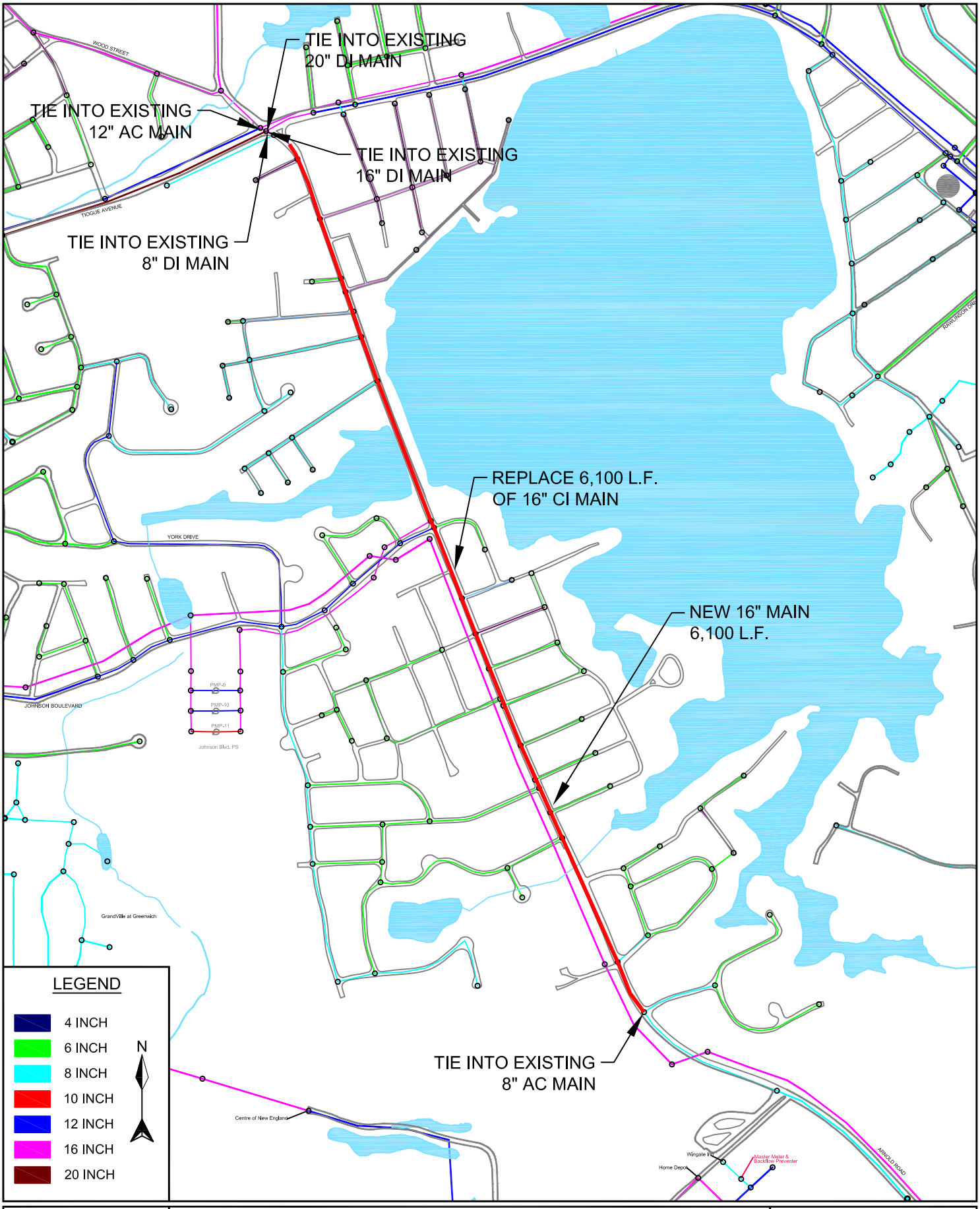


FIGURE NO. 14	KCWA Kent County Water Authority	PROJECT 14 ARNOLD ROAD	C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

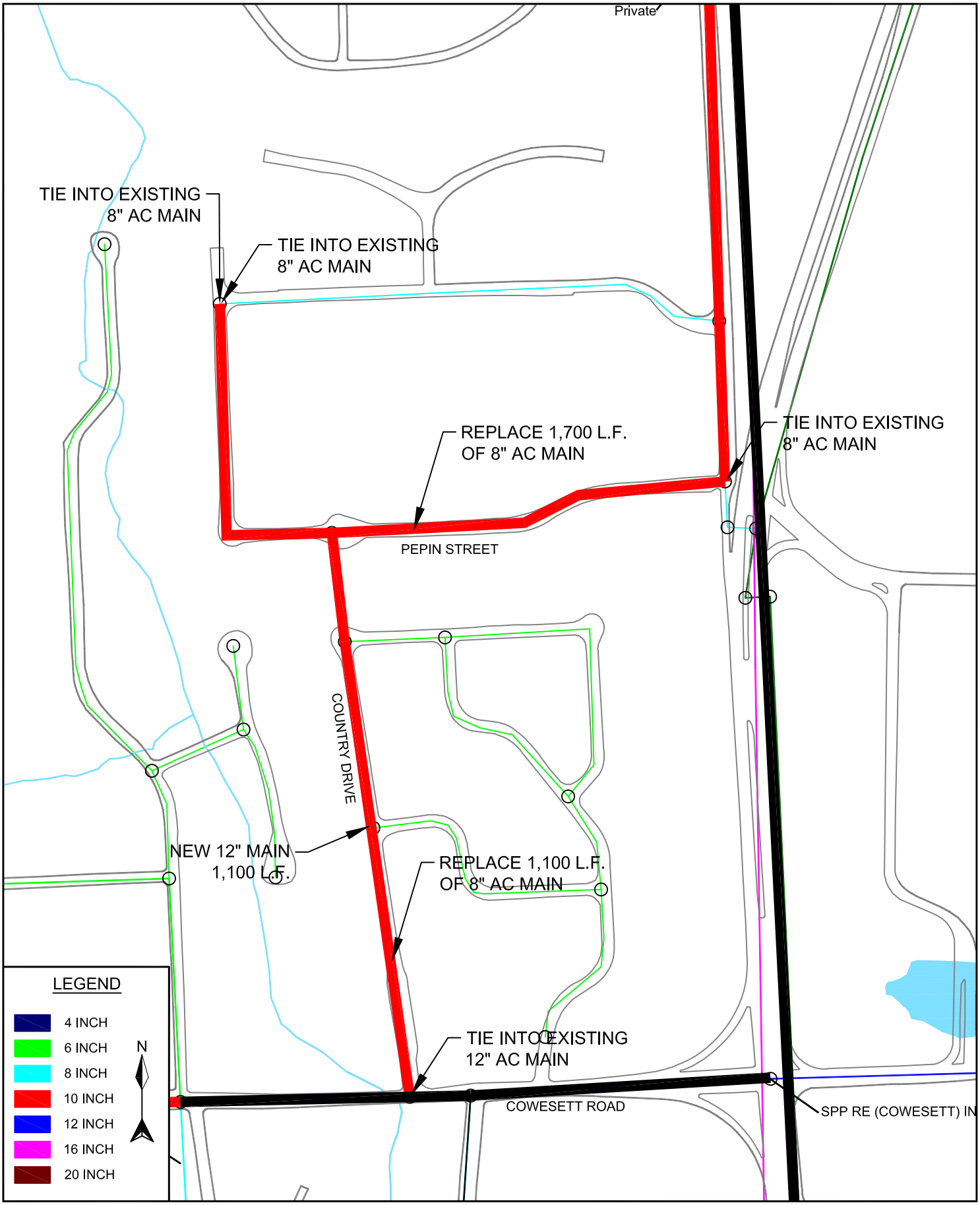


FIGURE NO.
15

KCWA
Kent County Water Authority

PROJECT 15
COUNTRY DRIVE AND
PEPIN STREET

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

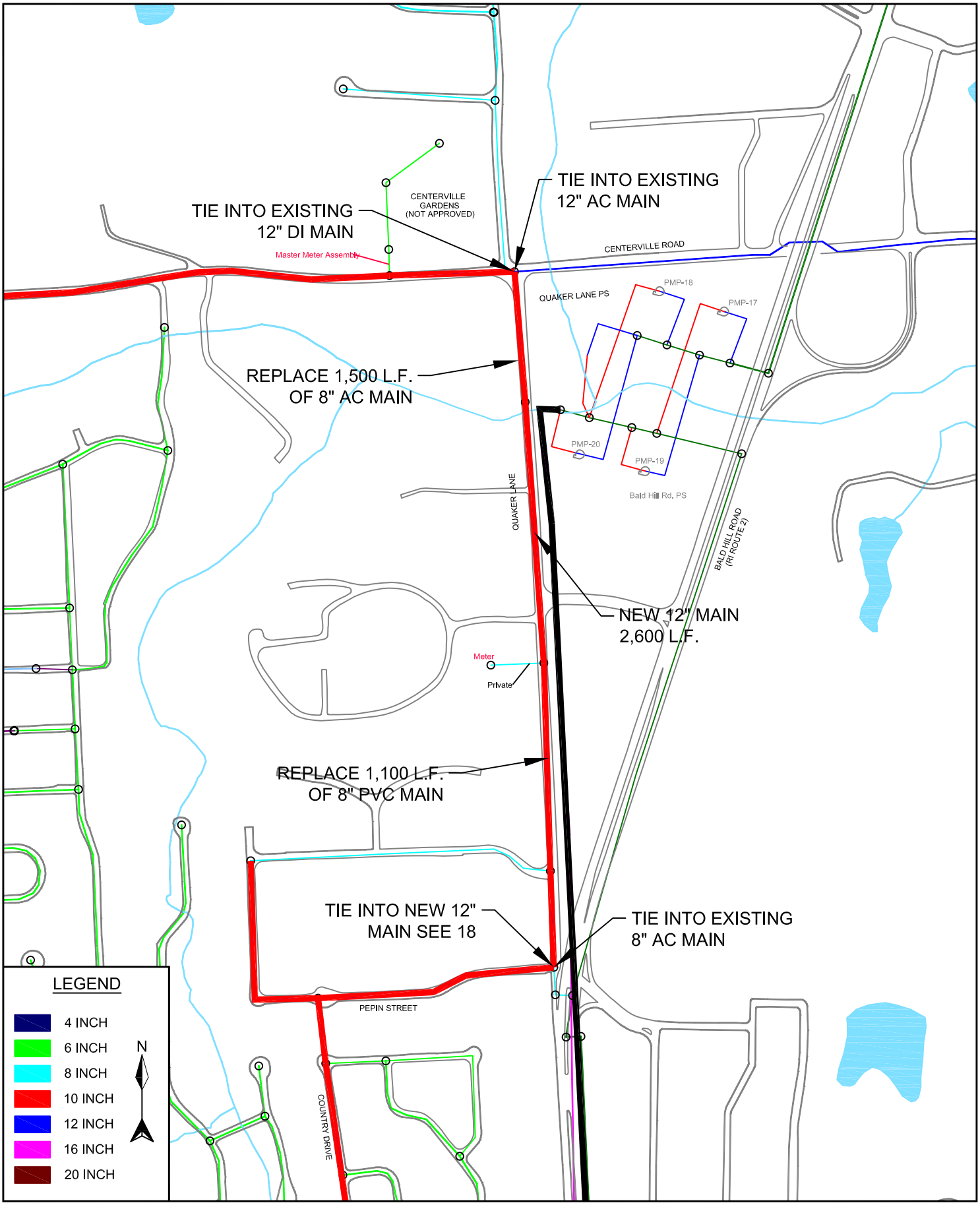


FIGURE NO.
16

KCWA
Kent County Water Authority

PROJECT 16
QUAKER LANE

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

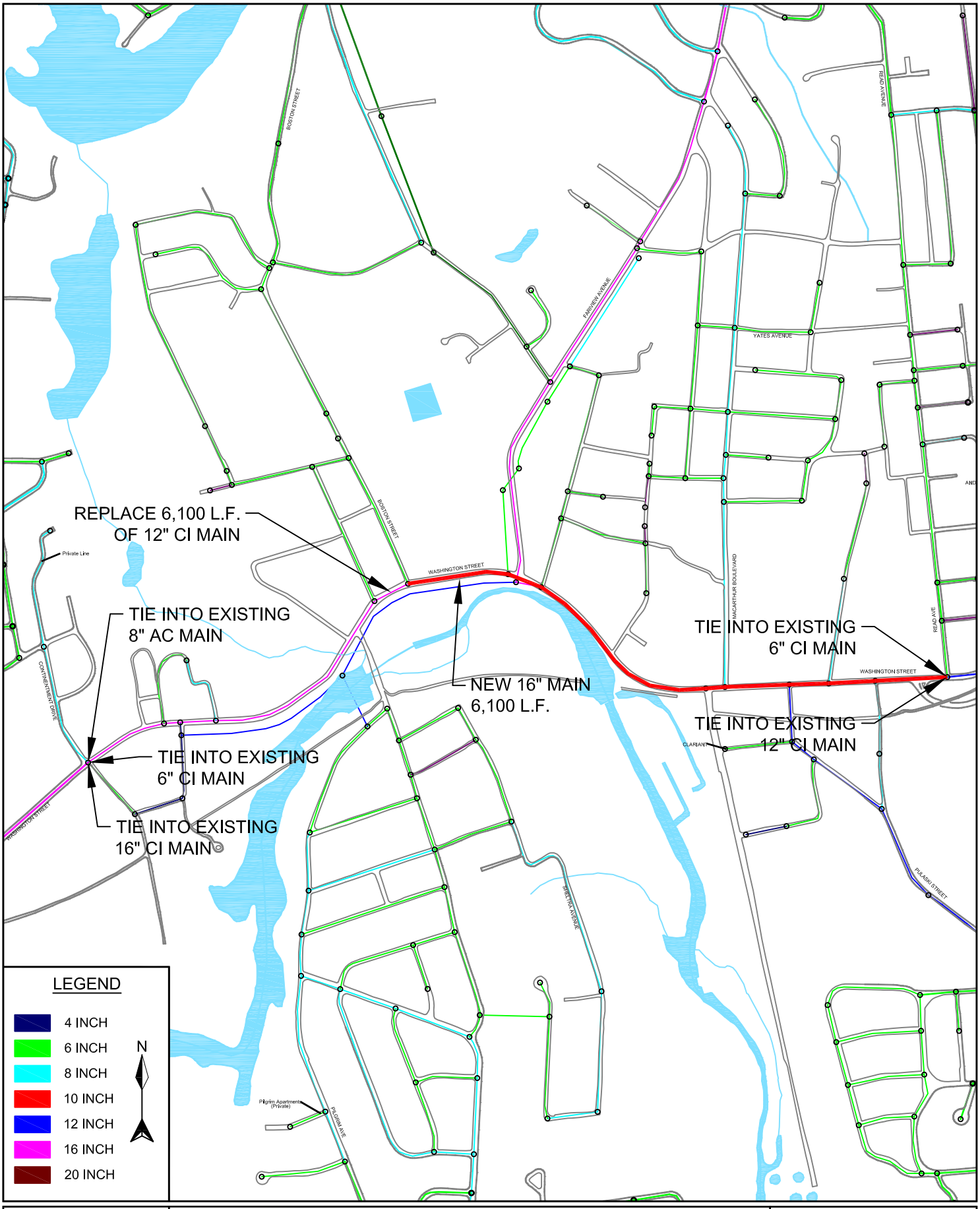


FIGURE NO.
17

KCWA
Kent County Water Authority

PROJECT 17
WASHINGTON STREET

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

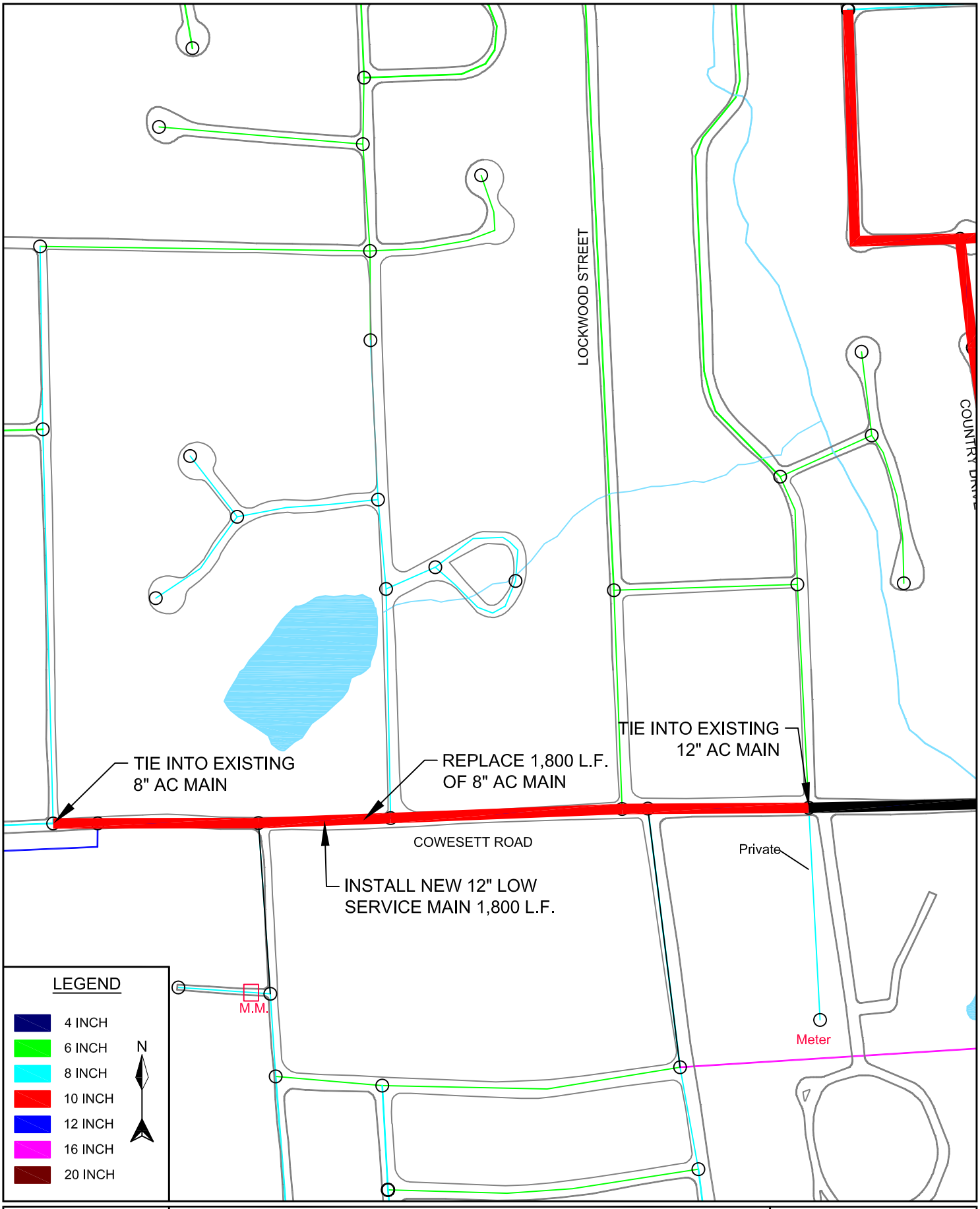


FIGURE NO. 18

KCWA Kent County Water Authority

PROJECT 18
COWESETT ROAD

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

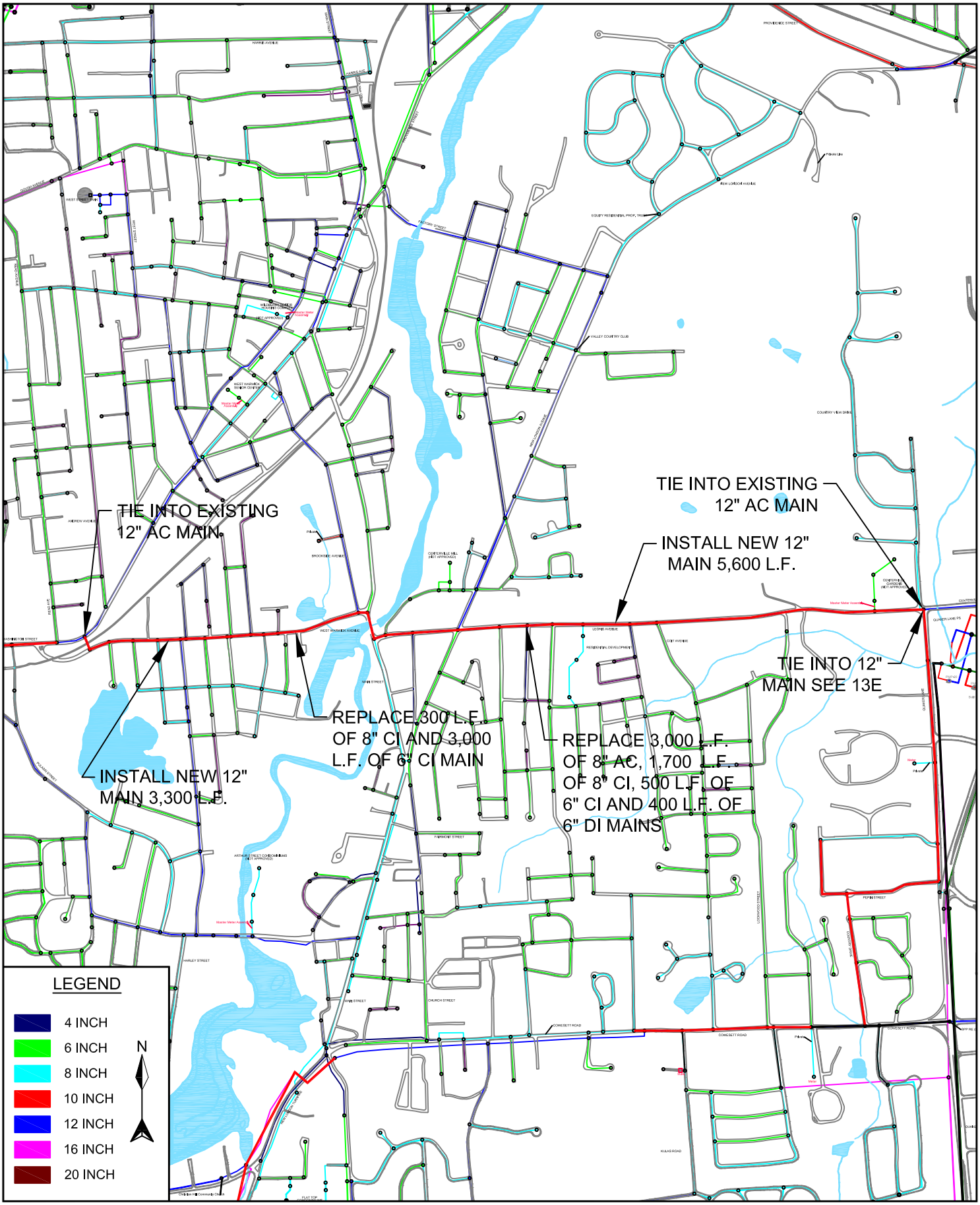


FIGURE NO. 19	KCWA Kent County Water Authority	PROJECT 19 WEST WARWICK AVENUE
		C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

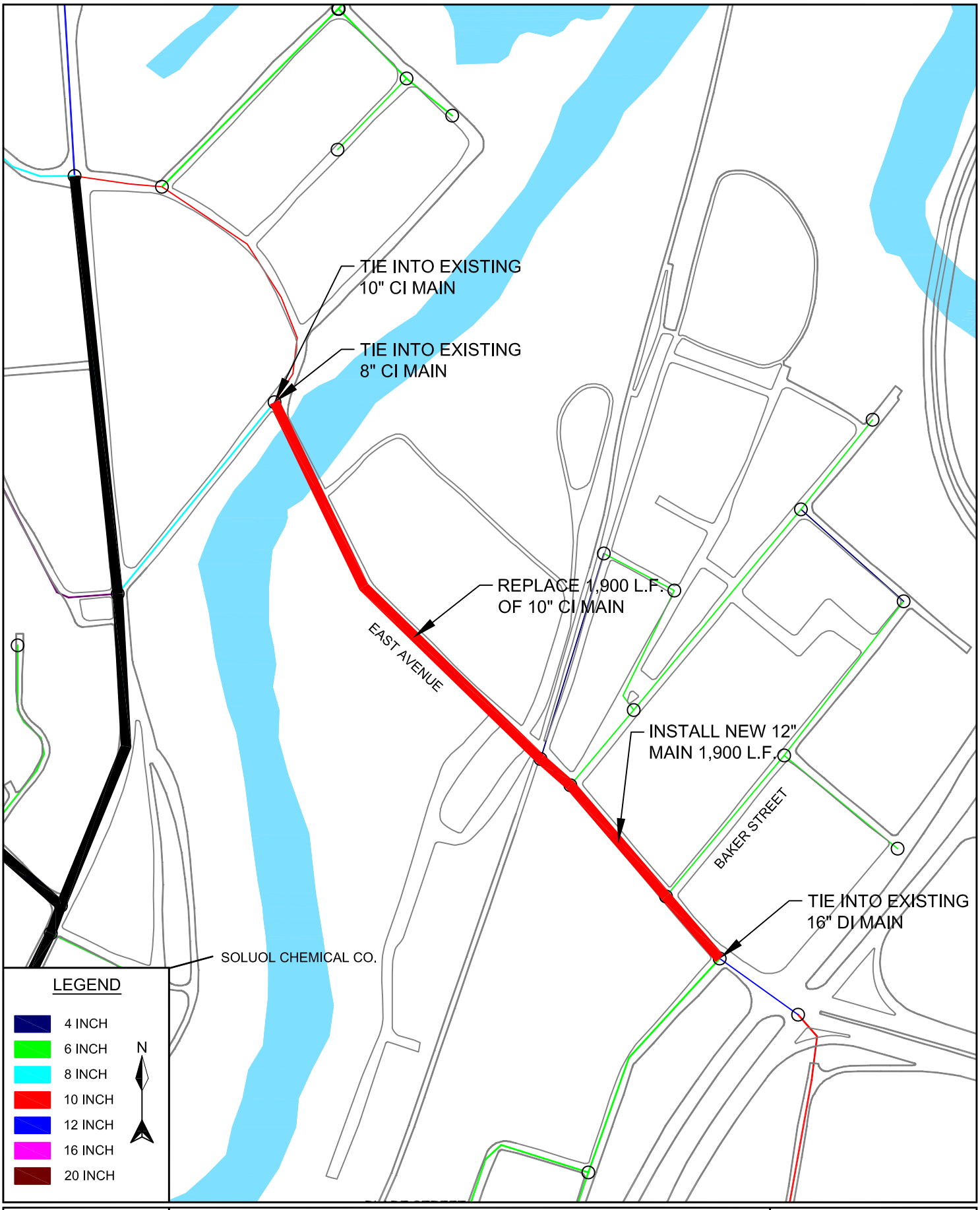


FIGURE NO.
20

KCWA
Kent County Water Authority

PROJECT 20
EAST AVENUE

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

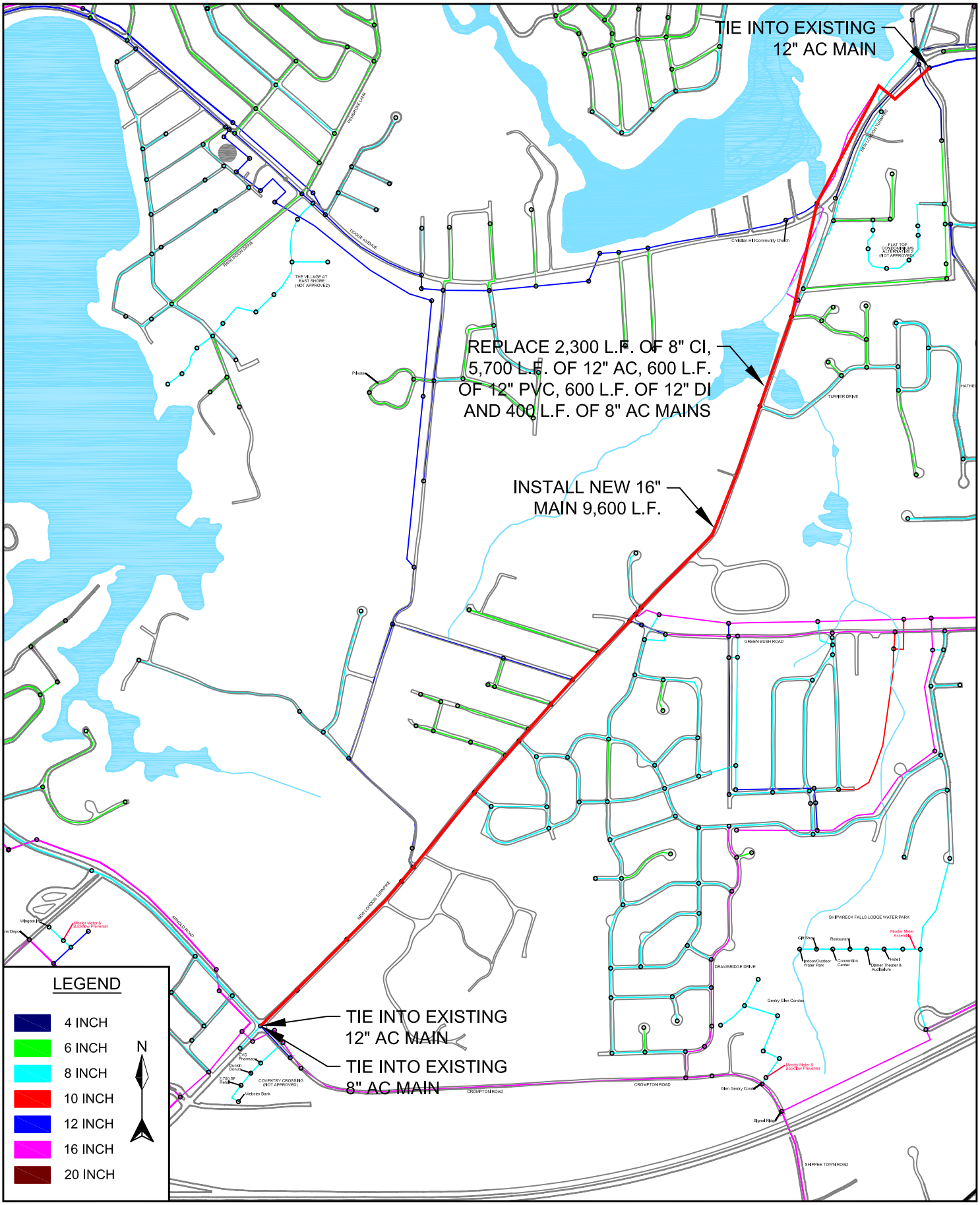


FIGURE NO. 21	KCWA Kent County Water Authority	PROJECT 21 NEW LONDON TURNPIKE	C&E ENGINEERING CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

SECTION 3.0
MAPPING AND COST SUMMARY TABLES

The capital improvement projects are identified on a system map of the Authority's transmission and distribution system which is provided as an attachment. Additionally, those projects identified as primarily related to infrastructure replacements (Projects 13 – 21) have been identified on the map.

Table 1 includes a cost summary for each of the capital projects 1 through 12. This includes a cost summary for each project including bare construction cost, design and related services cost, contingency allowance and an inflation escalation factor for each project. The table also includes the fiscal year of project performance and assigned priority category for each project.

Table 2 includes a cost summary for each of the projects identified herein that are related to infrastructure replacement and that require consideration under the Authority's Infrastructure Replacement Program. This table includes bare construction cost, design and related services cost, contingency allowance and an inflation adjustment factor for each project. Scheduling of these projects would necessarily be performed under the IFR program.

Table 3 categorizes the capital projects by fiscal year from 2017 through 2022. Projects for each fiscal year are further listed by highest to lowest priority which includes the rating category for projects as either essential, necessary or discretionary.

Table 1
Capital Improvement Program
Project Cost Summary Table

Table 1
Kent County Water Authority
Capital Improvement Program
Project Cost Summary Table

Fiscal Year	Project Number	Priority Category	Description	Construction Costs	Design and Related Service Costs	Sub Total Cost	Contingency at 20%	Project Cost	Inflation Escalation Factor - 4%	Total Project Cost *	Cumulative Total Project Cost
2017	1	E	Mishnock WTP High Service Mains	$2,275,000	$341,250	$2,616,250	$523,250	$3,139,500	$0	$3,140,000	$3,140,000
2018	2	E	North/South High Service Connection	$5,531,100	$829,665	$6,360,765	$1,272,153	$7,632,918	$305,317	$7,940,000	$11,080,000
2019	3	N	Bald Hill Road Loop	$1,056,880	$158,532	$1,215,412	$243,082	$1,458,494	$116,680	$1,580,000	$12,660,000
2018	4	N	Hope Furnace Road High Service Loop	$1,120,200	$168,030	$1,288,230	$257,646	$1,545,876	$61,835	$1,610,000	$14,270,000
2019	5	E	Replace KCWA Facility	$5,500,000	$825,000	$6,325,000	$1,265,000	$7,590,000	$607,200	$8,200,000	$22,470,000
2020	6	E	Oaklawn Gradient Emergency PRV	$454,420	$68,163	$522,583	$104,517	$627,100	$75,252	$710,000	$23,180,000
2020	7	E	I-295/Providence Street Bridge Crossing	$498,000	$74,700	$572,700	$114,540	$687,240	$82,469	$770,000	$23,950,000
2021	8	N	Quaker Lane PS High Service Expansion	$4,470,000	$670,500	$5,140,500	$1,028,100	$6,168,600	$986,976	$7,160,000	$31,110,000
2021	9A	N	Division Road	$2,470,000	$370,500	$2,840,500	$568,100	$3,408,600	$545,376	$3,960,000	
2021	9B	N	Shippetown Road	$360,000	$54,000	$414,000	$82,800	$496,800	$79,488	$580,000	
2022	9C	N	Middle Road	$552,500	$82,875	$635,375	$127,075	$762,450	$152,490	$920,000	
2022	9D	N	Middle Road	$400,000	$60,000	$460,000	$92,000	$552,000	$110,400	$670,000	$37,240,000
2021	10	N	Quaker Lane Pump Station - High Service Pumps	$200,000	$30,000	$230,000	$46,000	$276,000	$44,160	$330,000	$37,570,000
2022	11	E	East Greenwich Well Treatment	$1,107,000	$166,050	$1,273,050	$254,610	$1,527,660	$305,532	$1,840,000	$39,410,000
2022	12	E	Spring Lake Well Upgrades and Treatment	$3,750,000	$562,500	$4,312,500	$862,500	$5,175,000	$1,035,000	$6,210,000	$45,620,000
			Sub Totals:	$29,745,100	$4,461,765	$34,206,865	$6,841,373	$41,048,238	$4,508,174	$45,620,000	

Project Category
N = Necessary
D = Discretionary
E = Essential

* Rounded to $10,000.00

Table 2
Capital Improvement Program – Identified Infrastructure Replacement Projects
Project Cost Summary Table

Table 2
Kent County Water Authority
Capital Improvement Program - Identified Infrastructure Replacement Projects
Project Cost Summary Table

Project Number	Fiscal Year	Description	Construction Costs	Design and Related Service Costs	Sub Total Cost	Contingency at 20%	Project Cost	Inflation Escalation Factor - 4%	Total Project Cost
13	2017	Centerville Road	$900,000	$135,000	$1,035,000	$207,000	$1,242,000	$0	$1,250,000
14	2018	Arnold Road	$1,982,500	$297,375	$2,279,875	$455,975	$2,735,850	$109,434	$2,850,000
15	2019	Country Drive/Pepin Street	$840,000	$126,000	$966,000	$193,200	$1,159,200	$92,736	$1,260,000
16	2019	Quaker Lane	$780,000	$117,000	$897,000	$179,400	$1,076,400	$86,112	$1,170,000
17	2020	Washington Street	$1,982,500	$297,375	$2,279,875	$455,975	$2,735,850	$328,302	$3,070,000
18	2021	Cowesett Road	$540,000	$81,000	$621,000	$124,200	$745,200	$119,232	$870,000
19	2021	West Warwick Avenue	$990,000	$148,500	$1,138,500	$227,700	$1,366,200	$218,592	$1,590,000
20	2017	East Avenue	$510,000	$76,500	$586,500	$117,300	$703,800	$0	$710,000
21	2022	New London Turnpike	$3,120,000	$468,000	$3,588,000	$717,600	$4,305,600	$861,120	$5,170,000
		Sub Totals:	$11,645,000	$1,746,750	$13,391,750	$2,678,350	$16,070,100	$1,815,528	$17,940,000

Table 3
Capital Improvement Program
Fiscal Year Cost Summary Table

Table 3
Kent County Water Authority
Capital Improvement Program
Fiscal Year Cost Summary Table

Fiscal Year	Project Number	Priority Category	Description	Construction Costs	Design and Related Service Costs	Sub Total Cost	Contingency	Total Project Cost	Inflation Escalation Factor - 4%	Total Fiscal Year Cost *
2017	1	E	Mishnock WTP High Service Mains	$2,275,000	$341,250	$2,616,250	$523,250	$3,139,500	$0	$3,140,000
										$3,140,000
2018	2	E	North/South High Service Connection	$5,531,100	$829,665	$6,360,765	$1,272,153	$7,632,918	$305,317	$7,940,000
2018	4	N	Hope Furnace Road High Service Loop	$1,120,200	$168,030	$1,288,230	$257,646	$1,545,876	$61,835	$1,610,000
										$9,550,000
2019	5	E	Replace KCWA Facility	$5,500,000	$825,000	$6,325,000	$1,265,000	$7,590,000	$607,200	$8,200,000
2019	3	N	Bald Hill Road Loop	$1,056,880	$158,532	$1,215,412	$243,082	$1,458,494	$116,680	$1,580,000
										$9,780,000
2020	6	E	Oaklawn Gradient Emergency PRV	$454,420	$68,163	$522,583	$104,517	$627,100	$75,252	$710,000
2020	7	E	I-295/Providence Street Bridge Crossing	$498,000	$74,700	$572,700	$114,540	$687,240	$82,469	$770,000
										$1,480,000
2021	8	N	Quaker Lane PS High Service Expansion	$4,470,000	$670,500	$5,140,500	$1,028,100	$6,168,600	$986,976	$7,160,000
2021	9A	N	Division Road	$2,470,000	$370,500	$2,840,500	$568,100	$3,408,600	$545,376	$3,960,000
2021	9B	N	Shippetown Road	$360,000	$54,000	$414,000	$82,800	$496,800	$79,488	$580,000
2021	10	N	Quaker Lane Pump Station - High Service Pumps	$200,000	$30,000	$230,000	$46,000	$276,000	$44,160	$330,000
										$12,030,000
2022	11	E	East Greenwich Well Treatment	$1,107,000	$166,050	$1,273,050	$254,610	$1,527,660	$305,532	$1,840,000
2022	12	E	Spring Lake Well Upgrades and Treatment	$3,750,000	$562,500	$4,312,500	$862,500	$5,175,000	$1,035,000	$6,210,000
2022	9C	N	Middle Road	$552,500	$82,875	$635,375	$127,075	$762,450	$152,490	$920,000
2022	9D	N	Middle Road	$400,000	$60,000	$460,000	$92,000	$552,000	$110,400	$670,000
										$9,640,000

Project Category

N = Necessary
D = Discretionary
E = Essential

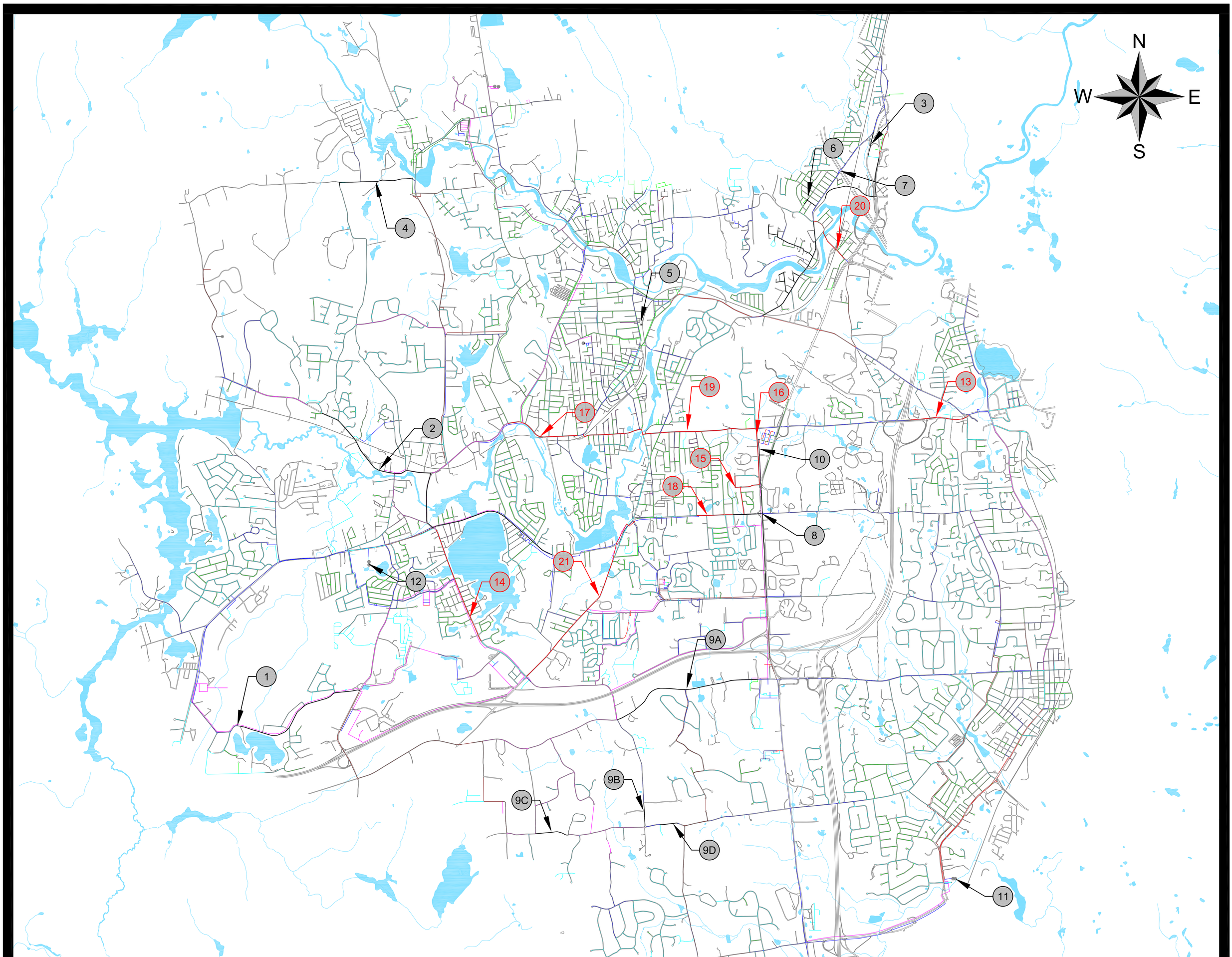
Total Cost - All Fiscal Years: $45,620,000

*Rounded to nearest $10,000

KCWA Water Supply System Map

KENT COUNTY WATER AUTHORITY

WATER SUPPLY SYSTEM MAP



INDEX TO 2017 - 2022 CIP PROJECTS

1 - MISHNOCK WATER MAIN - WTP TO HOPKINS HILL ROAD
2 - CONNECTION OF NORTH AND SOUTH HIGH SERVICE
3- BALD HILL ROAD LOOP CONNECTION
4- HOPE FURNACE RD. HIGH SERVICE LOOP
5 - REPLACE KCWA FACILITY
6 - OAKLAWN SERVICE GRADIENT EMERGENCY PRV
7 - I-295 BRIDGE CROSSING AT PROVIDENCE STREET
8 - HS TRANSMISSION MAINS - QUAKER LANE PUMP STATION
9A - DIVISION ROAD
9B - SHIPPETOWN ROAD
9C - MIDDLE ROAD
9D - MIDDLE ROAD
10 - QUAKER LANE PUMP STATION - HIGH SERVICE PUMPS
11 - EAST GREENWICH WELL UPGRADE & TREATMENT
12 - SPRING LAKE WELL UPGRADE & TREATMENT

INDEX TO 2017 - 2022 IFR PROJECTS

13- CENTERVILLE ROAD
14 - ARNOLD ROAD
15 - COUNTRY DRIVE/PEPIN STREET
16 - QUAKER LANE
17 - WASHINGTON STREET
18 - COWESETT ROAD
19 - WEST WARWICK AVENUE
20 - EAST AVENUE
21 - NEW LONDON TURNPIKE

WATER MAINS

- 4 INCH
- 6 INCH
- 8 INCH
- 10 INCH
- 12 INCH
- 16 INCH
- 20 INCH

LEGEND

- CIP IMPROVEMENTS
- IFR IMPROVEMENTS
- ROADS
- WATER BODIES

2017 - 2022 CIP AND IFR PROJECTS

MARCH 2016

C&E ENGINEERING
CIVIL ENGINEERS. ENVIRONMENTAL PROJECTS.

342 PARK AVENUE
WOONSOCKET, RI 02895
www.ceengineer.com

401.762.1711
Fax: 401.235.9088

REVISIONS:

SCALE: 1"=1750'