TECHNICAL MEMORANDUM

DATE March 15, 2016

TO: Joe Caracci, PE – Bensenville Director of Public Works

FROM: Christopher B. Burke, PhD, PE, D.WRE, Dist.M.ASCE
Bryan Welch, PE

CC: Nick Kottmeyer, PE – DuPage County Director of Public Works and Operations

SUBJECT: **White Pines Area Water System Rehabilitation Alternatives Analysis**
Unincorporated Bensenville, DuPage County, Illinois
(CBBEL Project No. 12-0433)

The existing White Pines Area water system has provided reliable water service to the unincorporated White Pines neighborhood for many years. However, significant portions of the White Pines Area water system have been in service for more than 70 years. Although the water system has provided an adequate level of service to the community over the years, it has deteriorated to the point of reaching the end of its useful service life. The water mains throughout the area have experienced extensive main breaks, including 150+ breaks since 1986. A significant portion of the existing mains are located within the rear yards of residential homes, which makes access to repairs difficult and costly. Additionally, recent flow testing has identified fire flow issues at various locations within the area, presumably due to the age of the mains and their being undersized (primarily 6-inch diameter).

Both the Village of Bensenville and DuPage County have made a determination that the existing water system is in need of significant rehabilitation, due to their present state of deterioration, lack of accessibility for maintenance, high maintenance costs, inability to provide proper fire protection and being undersized based on current standards.

This technical memorandum summarizes the alternatives analysis of potential water main rehabilitation approaches for the White Pines Water System Rehabilitation project in unincorporated Bensenville, Illinois. Included in this memorandum are a description of existing conditions, discussion of potential rehabilitation approaches, summary of available fire flow analyses, development of proposed alternatives, qualitative evaluation of alternatives, summary of project costs, conclusions and recommendations to assist the Village and DuPage County in selecting the best approach to rehabilitating the White Pines Area water system.

EXISTING CONDITIONS

Christopher B. Burke Engineering, Ltd. (CBBEL) was retained by the Village of Bensenville in coordination with DuPage County to perform an assessment of the existing conditions within the White Pines Area as it pertains to its water system.

CBBEL obtained and utilized the following existing conditions information in the preparation of this Technical Memorandum:

Topographic Survey and Field Reconnaissance

CBBEL originally performed a topographic survey of much of the White Pines Area in 2008 as part of a prior contract with the Village. In December 2015, CBBEL performed additional topographic survey to pick up portions of the White Pines Area that were not previously surveyed. Additionally, CBBEL performed a detailed field reconnaissance effort that entailed walking the entire limits of the 2008 survey to identify any locations that have been improved or modified. Improvements/modifications were then re-surveyed and the 2008 and 2015 survey base maps combined into one comprehensive, seamless existing conditions base map for the study area.

Utility Coordination

CBBEL submitted a design locate request to JULIE, which provided the names of all utility companies that have facilities near the White Pines Area. CBBEL obtained utility atlases from each company and identified any facilities that lie within the study area. On a few occasions, CBBEL staff met with utility representatives in the field to identify the locations of existing facilities more precisely. The existing utility information obtained by CBBEL has been drafted onto the existing conditions base map for use in identifying potential utility conflicts and minimizing utility impacts during the project design.

Geotechnical Investigation

CBBEL retained Testing Service Corporation (TSC) to obtain soil borings to determine the cross-section of existing pavements and subsurface soil conditions throughout the study area. The geotechnical investigation found that existing soil conditions were generally suitable for water main construction (including directional drilling) and that no significant or widespread concerns related to groundwater problems, running sand, unstable soils, etc. are anticipated to be encountered.

Other Documents

CBBEL was provided with a number of documents pertaining to the proposed project that may prove useful as design development progresses. These documents generally included updated utility atlases, flow test data and design/as-built engineering drawings for constructed infrastructure projects

REHABILITATION APPROACHES

For the purposes of this analysis, CBBEL was asked to consider the feasibility of three different main rehabilitation approaches, including open cut, horizontal directional drilling (HDD) and cured-in-place pipe (CIPP) lining. The following is a summary of how each approach is completed along with relative advantages and disadvantages.

Open Cut

Open cut installation consists of an excavator digging out a trench, stabilizing the trench with trench boxes or other shoring materials, placing and compacting initial backfill, installing the pipe, fittings and water service connections, placing and compacting final backfill and surface restoration.

Open cut installation is the most common construction method used for the installation of water main pipe in the Chicagoland area. It is often the most cost-effective, carries the lowest amount of risk, and provides the most flexibility and control over the work as it is being installed. Additional advantages include that open cut construction can take place virtually year-round and that in most cases the existing water system can stay in operation during construction.

The primary disadvantage to open cut installation is that it is more disruptive to the project area, including disruptions to traffic, construction dust/noise and impacts to existing features in its path such as roadway pavement, trees and landscaping, etc. Additionally, open cut usually cannot be used for railroad and major highway/waterway crossings, and in situations where the corridor is already filled with existing infrastructure that cannot be disturbed.

Horizontal Directional Drilling

Horizontal directional drilling (HDD) is a “trenchless technology” often used when open cut installation is not feasible or desirable. HDD pipe installation consists of a directional boring machine set up on one end of the installation section while the ductile iron pipe to be pulled is assembled with flexible restrained joints on the other side of the installation section. The boring machine drills a pilot hole along the proposed pipeline installation path that is steered and tracked from the surface. The pilot hole is then enlarged using a large reaming cutting tool and pulling the drilling rods back to the boring machine. Finally, the drilling rods are sent through the enlarged hole to the ductile iron pipe, connected to the pipe, and then pulled with the pipe back through the hole.

In general, HDD installations result in less disturbance to traffic and surface features of the project area than the open cut method. For this reason, HDD is often used at railroad and major highway/waterway crossings, and in situations where the corridor is already filled with existing infrastructure that cannot be disturbed. Additional advantages include that HDD construction can take place virtually year-round and that in most cases the existing water system can stay in operation during construction.

The primary disadvantage to HDD is that it is typically more expensive than open cut. Additionally, HDD will still require the main to be excavated and exposed at drilling and receiving pits, water main fittings (bends, fire hydrant tees, water service connections, etc.), resulting in the same disturbances as open cutting at those locations.

Water Main Lining

Cured-in-place pipe (CIPP) water main lining is a “trenchless technology” that can be used to rehabilitate existing mains when open cut installation is not feasible or desirable, and where existing main size/capacity is not a concern. CIPP lining involves installing a new, fully-structural and pressure rated pipe within an existing water main pipe, and is typically most cost-effective on water mains with few fittings and service connections. The CIPP lining process consists of cleaning and removing tuberculation from the host pipe, locating and mapping existing water service connection locations and impregnating the two tubular polyester jackets with a curable polymeric resin. The tube is then pulled into the host pipe, and hot water or steam is circulated throughout the tube to cure resin, allowing it to bond to the host pipe and form a structural liner. Once the liner has cured, the ends of the tube are cut off and the pipe is returned to service using standard pipe fittings. Existing water service connections on the existing host pipe are reinstated robotically from inside the lined main.

In general, CIPP lining installations result in less disturbance to traffic and surface features of the project area than the open cut method. For this reason, CIPP lining is becoming a more common approach to rehabilitating water mains at railroad and major highway/waterway crossings, and in situations where the corridor is already filled with existing infrastructure that cannot be disturbed.

A disadvantage to CIPP lining is that while the liner is structurally-independent, the new pipe diameter is smaller than the existing water main. Additionally, at-grade temporary residential water mains and services must be constructed to maintain water service to residents during the lining process. These temporary mains provide less security, as they are typical laid on the ground (in the gutter or parkway), and can cause issues where unheated water entering houses becomes very warm, since the mains are exposed to the hot air temperatures in summer months. For this same reason, CIPP lining cannot take place between late fall and early spring, due to concerns related to water freezing in the at-grade temporary mains and services. Finally, CIPP lining will still require the main to be excavated and exposed at water main fittings (bends greater than 45-degrees, fire hydrant tees, etc.) and at typically 5%-10% of the service connections, where the robotic service reinstatement effort fails. These excavation locations result in the same disturbances as open cutting at those locations.

FIRE FLOW ANALYSIS

In early 2015, CBBEL developed a computerized water model for the White Pines Area for the purposes of evaluating the existing water distribution system and the viability of proposed improvement alternatives. CBBEL utilized an existing Village-wide model previously built by CBBEL along with updated model elements from the Village’s GIS information such as pipe size/type/age, break history, tank levels, average/max day water consumption and existing topography to create an updated water model for the White Pines Area. This updated water model was developed using WaterGEMS, a water distribution modeling software program that combines the capabilities of Windows, ArcGIS and Microstation to model, simulate, analyze and optimize water distribution systems of varying complexity.

The existing conditions water model was utilized primarily to identify areas of insufficient pressure or fire flow within the study area. In October 2015, the model indicated that existing pressures were acceptable throughout the study area, but a number of locations were unable to provide sufficient fire flows. While fire flow deficiencies were spread across the study area, the most severe deficiencies were focused in the southwest portion of the study area. Fire flows throughout the study area ranged from 494 gallons per minute (gpm) to well over 3,000 gpm, with a majority of locations showing a modeled available fire flow of less than 1,500 gpm. An illustration of the modeled existing available fire flow results from October 2015 can be found in Exhibit A-1.

Following development of the existing conditions in the updated water model, CBBEL prepared preliminary rehabilitation improvement scenarios that addressed fire flow issues for use in project scoping discussions with the Village and formulation of budgetary costs. These improvement scenarios were developed such that a minimum of 1,500 gpm of available fire flow was provided at all locations throughout the study area.

In late 2015, the Village provided fire flow test data to CBBEL that was reported by ME Simpson Co. to determine how much water is available for fighting fires at various locations within the study area. Twenty-two (22) hydrants were included in the fire flow test. The fire flow test data was incorporated into the updated water model to further calibrate the system, meaning that parameters of the water model were fine-tuned so that the output of the water model was consistent with how the actual existing water distribution system has been observed to operate.

Once the water model was further calibrated based on the flow test data, existing fire flow availability was recalculated. The available fire flows modeled in January 2016 were slightly less than the results of the October 2015 analysis, and the most severe flow deficiencies were still located in the southwest portion of the study area. Fire flows throughout the study area ranged from 402 gallons per minute to well over 3,000 gpm, with a significant majority of the area showing a modeled available fire flow less than 1,500 gpm. An illustration of the modeled existing available fire flow results following calibration from January 2016 can be found in Exhibit A-2.

CBBEL and the Village revisited and adjusted the preliminary improvement scenarios based on the calibrated model and a required minimum available fire flow of 1,000 gpm (reduced from 1,500 gpm used in October 2015). Additionally, other rehabilitation alternatives were investigated that would address fire flow issues and meet a variety of established project goals.

PROPOSED ALTERNATIVES

CBBEL was asked to evaluate potential alternatives for the rehabilitation of the White Pines Area water system. CBBEL developed alternatives based on the following criteria, which was established collaboratively by the Village and County:

- Minimum Available Fire Flow: 1,000 gpm
- Minimum Diameter of New Main: 8 inches
- Existing Mains to Remain in Place (constructed after mid-1980s):
    - 3rd Avenue (8-inch)
    - Briar Lane from 3rd Avenue to Red Oak (8-inch)
    - White Pines Road (12-inch)
    - Church Road (12-inch)
    - Massel Court (8-inch)
    - IL 83 Frontage Road from Woodland to Massel (8-inch)
    - Connection between Massel Court and Fisher Drive (8-inch)
- All rear yard mains shall be abandoned
- All water services shall be replaced between the main and curb box, regardless of rehabilitation approach

The Village and County have acknowledged that the project ultimately selected for construction is likely to consist of a hybrid of rehabilitation approaches, but to eliminate having to analyze a very large number of micro-alternatives, two (2) alternatives were chosen for analysis, with the understanding that the results of the analyses could be interpolated and applied to any project representing a combination of rehabilitation approaches.

Therefore, CBBEL was directed to analyze the following two (2) alternatives:

> Alternative 1 – Replace all existing mains with new mains in the roadway right-of-way.
>
> Alternative 2 – Relocate existing rear yard mains to street ROW and CIPP line existing mains in the right-of-way that do not require upsizing.

Both of the above alternatives include replacement of all fire hydrants, valves and water services from the water main up to and including the curb box, except those on the aforementioned mains installed after the mid-1980s that are not being rehabilitated as part of this project.

As previously mentioned, both Alternative 1 and Alternative 2 were modeled in WaterGEMS software. The scope of the improvements were refined and optimized to identify projects that would meet the design criteria outlined above without over-designing the system improvements. The alternatives described below reflect these refined and optimized scenarios. It is worthy to note that reducing the minimum allowable available fire flow from 1,500 gpm to 1,000 gpm in January 2016 did not impact the scope of the Alternative 1 project. However, for the Alternative 2 project, lowering the fire flow threshold did allow a couple of pipe segments that were previously required to be upsized to be lined instead.

The proposed fire flow modeling scenarios for Alternative 1 and Alternative 2 can be found in Exhibit A-3 and A-4, respectively.

Alternative 1 – Main Replacement

Alternative 1 includes the replacement of all existing water mains within the White Pines Area with new 8-inch ductile iron water mains. As previously mentioned, this alternative does not include replacement of the newer mains constructed after the mid-1980s. An illustration of the scope of Alternative 1 is provided in Appendix B-1, and generally includes:

- Abandonment of existing rear yard mains and replacement with new mains within the roadway right-of-way in front of homes.
    - Disconnection of existing private water services from rear yard mains and installation of new services from the back of each home to the new main within the roadway right-of-way in front of each home
- Abandonment of existing mains within the roadway right-of-way and replacement with new mains within the roadway right-of-way.
    - Installation of new water services from the new water main up to and including new curb boxes.
- Replacement of fire hydrants and valves and connection to new mains
- Installation of three (3) metering stations (Briar Lane, White Pines Road and Forestview Drive)

Alternative 1 will require the acquisition of temporary construction easements for properties with their services currently on rear yard mains, to facilitate relocation of their services to the new mains installed in the roadway right-of-way in front of the house.

For the purposes of this alternatives and cost analysis, the mains replaced as part of this alternative were assumed to be completed by open cut methods, since open cutting is anticipated to be the most cost-effective approach. However, we recommend that consideration be given to including a bid alternate with the final design drawings that incorporates HDD work at locations where trenchless methods are identified as potentially being advantageous. Doing so would allow the price of directional drilling and open cut methods to be compared on an "apples-to-apples" basis so that the cost-effectiveness of both approaches can be accurately evaluated.

In Alternative 1, we have identified the new 8-inch mains on IL Route 83 south of 3rd Avenue, IL Route 83 Frontage Road between White Pines Road, the connection between Woodland Avenue and Briar Lane and the connection between Red Oak Street and Crest Avenue as locations where directional drilling could be advantageous, as minimization of traffic impacts, utility conflicts and surface disturbances are anticipated to be critical.

Alternative 2 – Rear Yard Main Replacement, ROW Main Lining

Alternative 2 includes the rehabilitation of existing water mains within the White Pines Area with a combination of water main replacement and CIPP lining. As previously mentioned,

this alternative does not include replacement of the newer mains constructed after the mid-1980s. An illustration of the scope of Alternative 2 is provided in Appendix B-2, and generally includes:

- Abandonment of existing rear yard mains and replacement with new mains within the roadway right-of-way in front of homes.
    - Disconnection of existing private water services from rear yard mains and installation of new services from the back of each home to the new main within the roadway right-of-way in front of each home
- CIPP lining of existing mains located within the roadway right-of-way.
    - Installation of new water services from the lined water main up to and including new curb boxes.
- Replacement of fire hydrants and valves and connection to new and lined mains
- Installation of three (3) metering stations (Briar Lane, White Pines Road and Forestview Drive)

Alternative 2 will require the acquisition of temporary construction easements for properties with their services currently on rear yard mains, to facilitate relocation of their services to the new mains installed in the roadway right-of-way in front of the house.

For the purposes of this alternatives and cost analysis, the mains replaced as part of this alternative were assumed to be completed by open cut methods, since open cutting is anticipated to be the most cost-effective approach. However, we recommend that consideration be given to including a bid alternate with the final design drawings that incorporates HDD work at locations where trenchless methods a identified as potentially being advantageous. Doing so would allow the price of directional drilling and open cut methods to be compared on an "apples-to-apples" basis so that the cost-effectiveness of both approaches can be accurately evaluated.

In Alternative 2, we have identified the new 8-inch main on IL Route 83 south of 3rd Avenue as locations where directional drilling could be advantageous, as minimization of traffic impacts, utility conflicts and surface disturbances are anticipated to be critical.

QUALITATIVE EVALUATION OF ALTERNATIVES

Both of the alternatives evaluated in this report present opportunities to promote project success and also present challenges that will impact the implementation of the water system rehabilitation. CBBEL performed a qualitative evaluation of both alternatives with respect to utility conflicts, constructability, impacts to the public, future maintenance and access, easement requirements and permitting requirements. Results of the qualitative analysis are summarized on Table 1 below.

Alt	Utility Conflicts	Constructability	Impacts to the Public	Future Maintenance & Access	Easement Requirements	Permitting Requirements
1	➢ Significant utilities (gas/oil pipelines) along IL 83 and IL 83 Frontage Roads. These pipelines cross existing water main on IL 83 Frontage and would likely cross any proposed mains.	➢ Excavation around gas/oil pipelines along IL 83 and IL 83 Frontage Roads would be difficult and costly ➢ **HDD may or may not be feasible due to sensitivity of pipelines and uncertainty with their condition and exact location/depth** ➢ Other than IL 83/IL 83 Frontage Road, ROW is plentiful and no major or unique impediments to construction are anticipated.	➢ **No access to interior of homes required** ➢ **Existing water system remains in operation during construction.** ➢ Roads open to local traffic only during open cut construction ➢ Dust and noise during excavation and backfill ➢ Existing improvements within the ROW may require removal and replacement ➢ Consider HDD to drill beneath significant trees	➢ Water system entirely in public ROW ➢ **Entirely brand new water system** ➢ All new water services/curb box in public ROW ➢ Some new water services between main to house	➢ Easements required for rear yard service relocations ➢ Relocation of rear yard services to new ROW mains will be disruptive and costly, and vary widely depending on private improvements that may be in conflict on each lot (decks, trees, old septic fields, etc).	➢ Anticipated permits include IEPA and IDOT
2	➢ Significant utilities (gas/oil pipelines) along IL 83 and IL 83 Frontage Roads. These pipelines cross existing water main on IL 83 Frontage and would likely cross any proposed mains.	➢ Excavation around gas/oil pipelines along IL 83 would be difficult and costly ➢ **Proposed lining minimizes pipeline conflicts on IL 83 Frontage Road** ➢ Other than IL 83/IL 83 Frontage Road, ROW is plentiful and no major or unique impediments to construction are anticipated.	➢ **Interior of homes must be accessed by contractor 3-4 times for CIPP lining segments** ➢ **Temporary water mains/services are less secure.** ➢ Roads open to local traffic only on open cut segments ➢ Dust and noise during excavation and backfill ➢ **Limited disturbance of traffic and existing improvements along lining segments** ➢ Existing improvements in ROW along new main segments may require removal and replacement ➢ Consider HDD to drill beneath significant trees	➢ Water system entirely in public ROW ➢ All new water services/curb box in public ROW ➢ Some new water services between main to house ➢ **Uncertainly regarding complications with lined main repairs in future**	➢ Easements required for rear yard service relocations ➢ Relocation of rear yard services to new ROW mains will be disruptive and costly, and vary widely depending on private improvements that may be in conflict on each lot (decks, trees, old septic fields, etc).	➢ Anticipated permits include IEPA and IDOT

**Red Bold items identify differences between alternatives.*

Table 1 – Summary of Qualitative Evaluation

ESTIMATED PROJECT COSTS

CBBEL has prepared an opinion of probable construction cost for Alternative 1 and Alternative 2. The cost estimates include:

- Direct costs (labor, material, and equipment).
- Indirect costs (contractor overhead and profit, mobilization, etc.)
- Construction contingency (estimated at 10% of direct and indirect costs)
- Design and Construction engineering (estimated at 7% and 8%, respectively, of the total construction cost)
- IEPA and IDOT permitting

The cost estimate does not include:

- Land acquisition and temporary or permanent easements (exhibits, negotiations, purchases, etc.)
- Escalation
- Change Orders

Cost Analysis

The following unit costs were utilized in the preparation of the cost analysis:

Open Cut-Only Costs

- 8-Inch Diameter Water Main (Open Cut in Road) - $190/foot
  - Includes ductile iron water main, fittings, new valves/hydrants, trench backfill, pavement restoration, erosion control, traffic control and mobilization
- 8-Inch Diameter Water Main (Open Cut in IDOT ROW) - $290/foot
  - Includes same as open cut in road plus factor of approximately 50% to account for anticipated constructability/access issues due to IDOT coordination, traffic volumes and major utility (petroleum and natural gas pipeline) conflicts

CIPP Lining-Only Costs

- 6-Inch Diameter CIPP Water Main - $218/foot
  - All-inclusive cost per foot identical to IAWC/Elmhurst 2014 lining project ($458,000/2,100 feet), and is inclusive of new fire hydrants and valves. This cost is lower than the $230/foot observed on a similar 2015 project in Orland Park and the $247.89 per linear foot suggested in USEPA paper (EPA/600/R-12/012) entitled "Performance Evaluation of Innovative Water Main Rehabilitation Cured-in-Place Pipe Lining Product in Cleveland, Ohio" dated February 2012.

Open Cut & CIPP Lining Costs

- Public Water Service (Main to Curb Box) - $2,500/each
- Private Water Service (Curb Box to Rear of House) - $6,500/each

Detailed cost estimates for Alternative 1 and Alternative 2 are provided in Exhibits C-1 and C-2, respectively. The estimated costs for the two alternatives analyzed are as follows:

- Alternative 1: $6.63 million
- Alternative 2: $6.78 million

CONCLUSIONS

The foregoing analysis evaluated two potential approaches for the rehabilitation of the White Pines Area water system. Conclusions based on the alternatives analysis include:

- Both alternatives cost approximately the same.
- Both alternatives present a variety advantages and disadvantages when evaluated qualitatively:

  Primary Advantage of Alternative 1: Project results in an entirely new water system from main to water service curb boxes with a life expectancy of 75 years or more.

  Primary Advantage of Alternative 2: CIPP lining may eliminate utility conflict concerns on IL 83/IL 83 Frontage Road and will generally result in less disturbances to the project area in CIPP lining segments.

  Primary Disadvantage of Alternative 1: Main replacement work has a greater temporary impact to the public (partial road closures, dust, noise, etc.).

  Primary Disadvantage of Alternative 2: CIPP lining requires a significant amount of coordination between the Owner, Contractor and residents, as the interior of each home must be accessed at least 3 separate times during construction. The at-grade temporary water system is less secure and more susceptible to fluctuations in temperature.

- The “best” project is likely to be a hybrid between Alternative 1 and Alternative 2 that balances both cost and qualitative considerations. As previously mentioned, HDD installation should also be considered in specific applications.

RECOMMENDED PROJECT

Implementing multiple rehabilitation approaches within the project that is ultimately selected for construction will allow the Village to strike an appropriate balance between cost-effectiveness and managing qualitative considerations such as utility conflict avoidance, constructability, impacts to the public and perpetual maintenance/access.

While additional engineering investigation/design and coordination between the Village, County and residents is required before the scope of the rehabilitation project is finalized, CBBEL has developed a Recommended Project, which endeavors to implement rehabilitation alternatives to main replacement at key locations where it has been determined to be warranted and beneficial to the project. The Recommended Project is depicted in Appendix D-1. The estimated cost of the Recommended Project is $6.56 million. A detailed cost estimate can be found in Appendix D-2.

CHRISTOPHER B. BURKE ENGINEERING, LTD.
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APPENDIX A

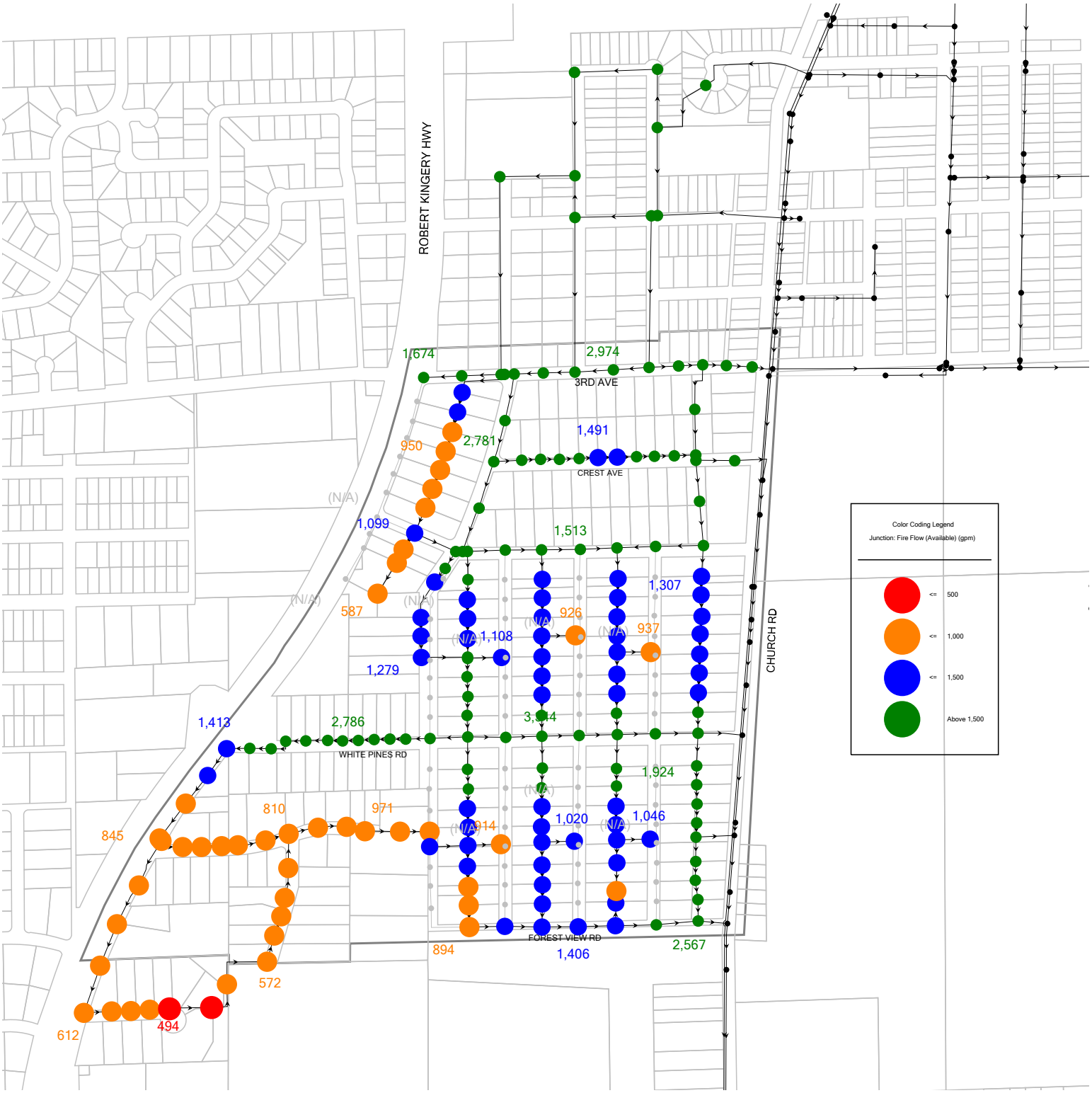
AVAILABLE FIRE FLOW EXHIBITS

EXHIBIT A-1 – Existing Available Fire Flow (October 2015)

EXHIBIT A-2 – Existing Available Fire Flow (January 2016)

EXHIBIT A-3 – Proposed Available Fire Flow (Alternative 1)

EXHIBIT A-4 – Proposed Available Fire Flow (Alternative 2)



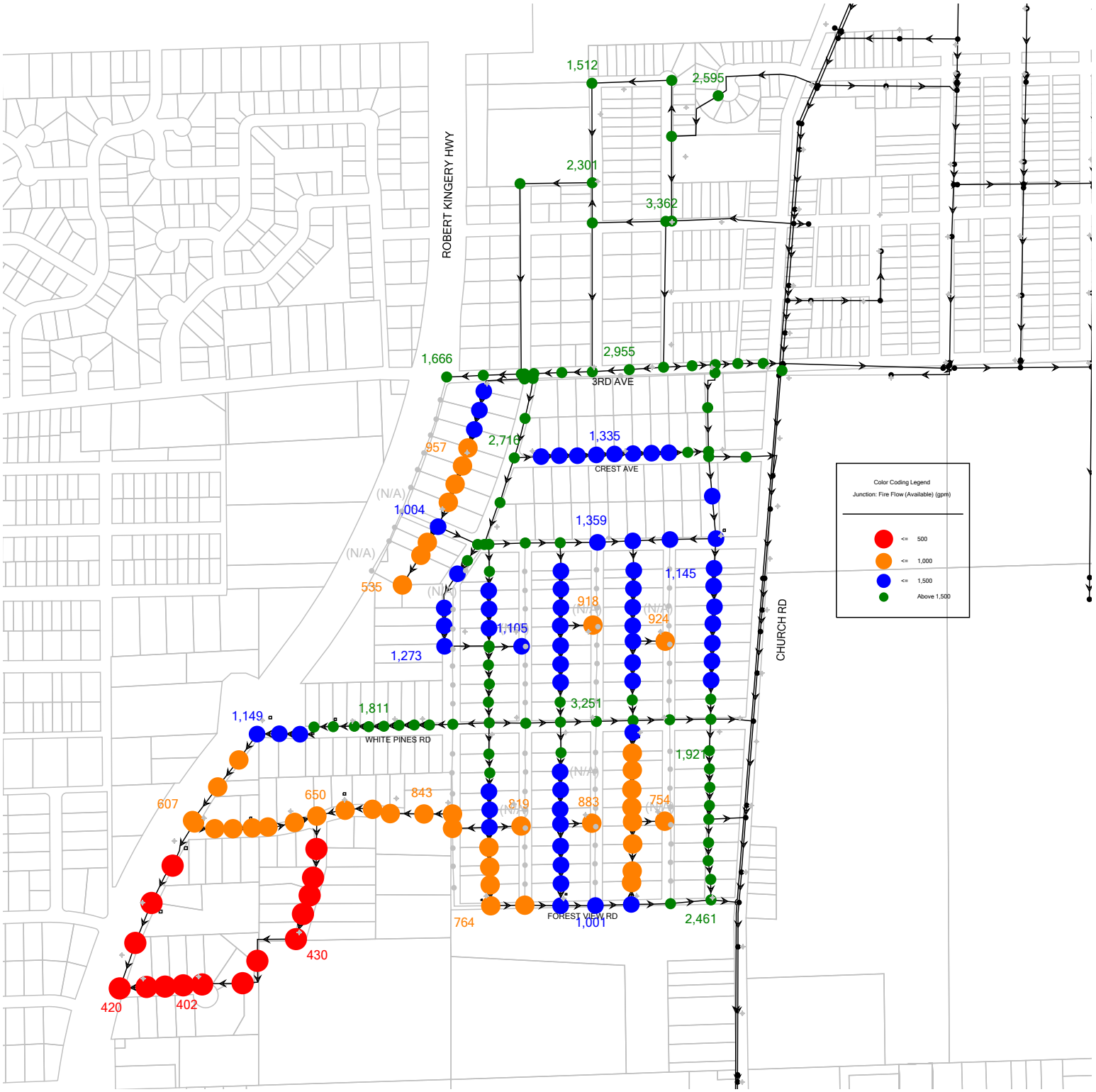
Village of Bensenville, IL
White Pines Water System Evaluation
October 2015

EXHIBIT A-1

MAX Daily Demand

Available Fire Flow

Existing Conditions



Village of Bensenville, IL
White Pines Water System Evaluation
January 2016

EXHIBIT A-2

MAX Daily Demand

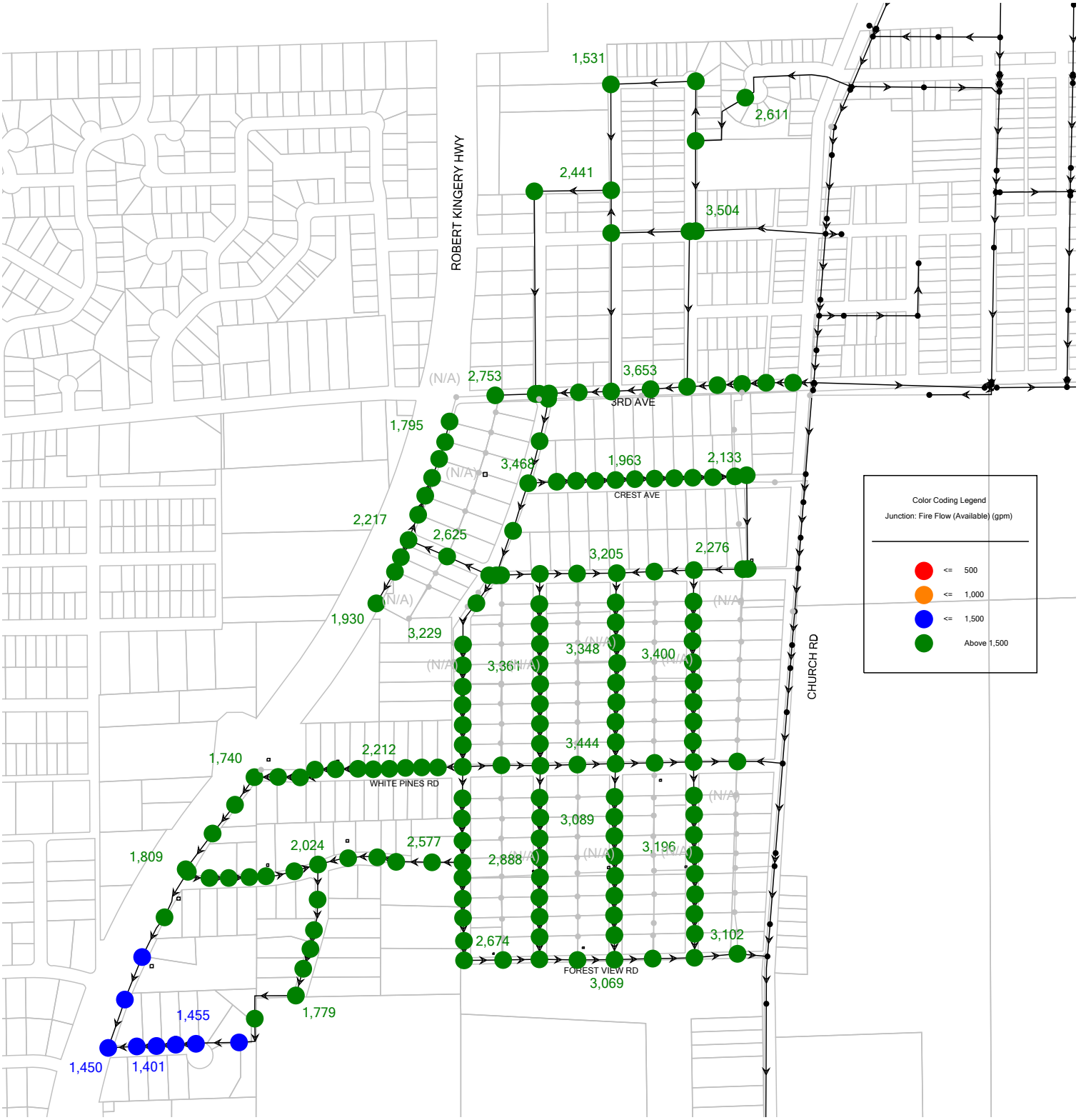
Available Fire Flow

Existing Conditions

Village of Bensenville, IL
White Pines Water System Evaluation
February 17, 2016

EXHIBIT A-3
Alternative #1
MAX Daily Demand

Available Fire Flows
All Mains Replaced Except 3rd Ave, Briar (3rd to Red Oak), White Pines and Church



Village of Bensenville, IL
White Pines Water System Evaluation
February 17, 2016

EXHIBIT A-4
Alternative #2
MAX Daily Demand

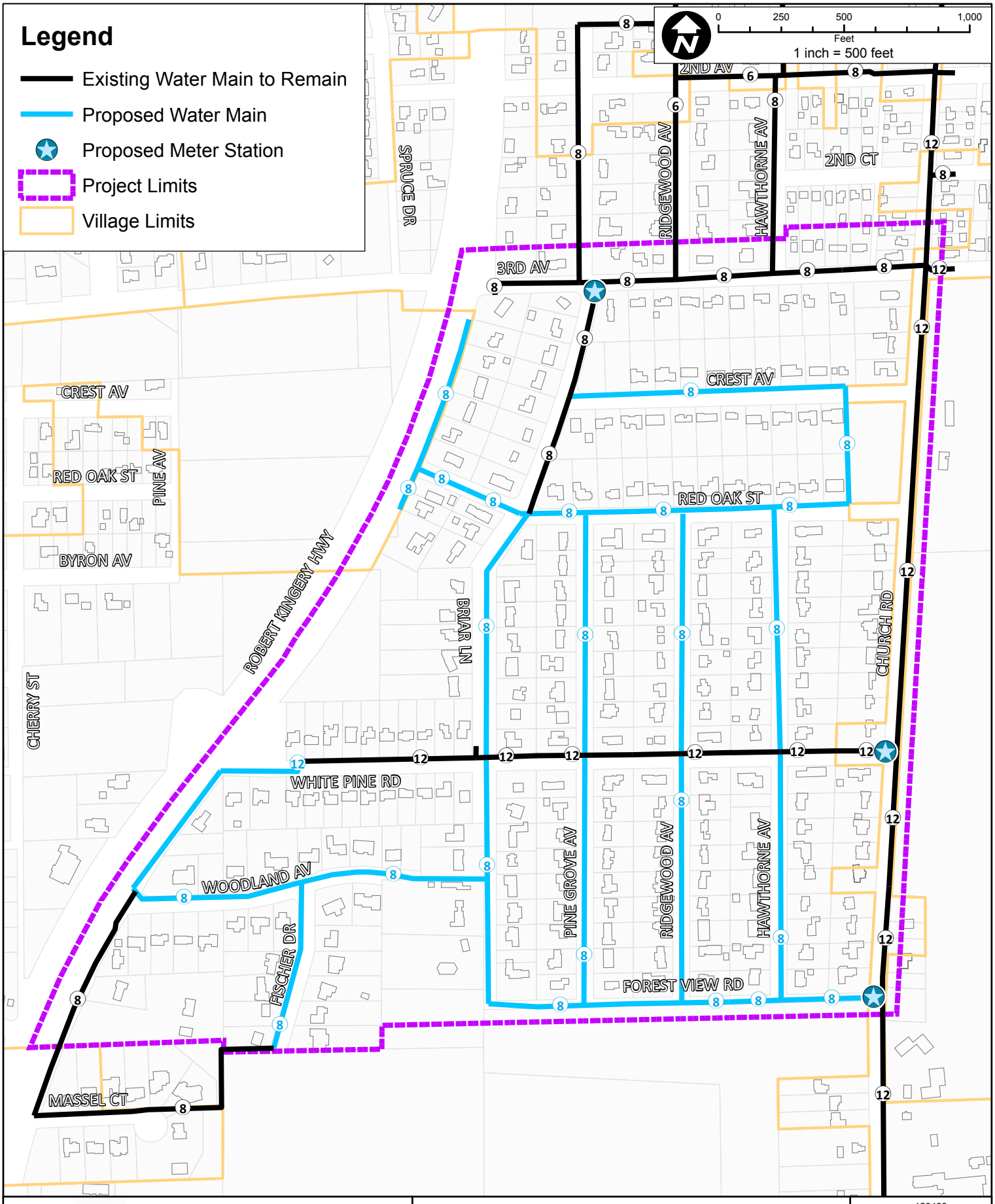
Available Fire Flows - Relocate Rear Yard Mains
Line Roadway Mains (Except 3rd Ave, Briar (3rd to Red Oak), White Pines, & Church

APPENDIX B

PROJECT SCOPE MAPS – ALTERNATIVES 1 AND 2

EXHIBIT B-1 – Alternative 1 Project Scope Map

EXHIBIT B-2 – Alternative 2 Project Scope Map



CLIENT: **VILLAGE OF BENSENVILLE**

TITLE: **WHITE PINES AREA ALTERNATIVE 1 MAIN REPLACEMENT**

PROJ. NO.	120433
DATE:	02-17-16
SHEET	1 OF 1
DRAWING NO.	**EXH B-1**

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DSGN.			SCALE:	1:6000
DWN.			AUTHOR:	DWALTERS
CHKD.			PLOT DATE:	2/18/2016
FILE:	Alternative 1			

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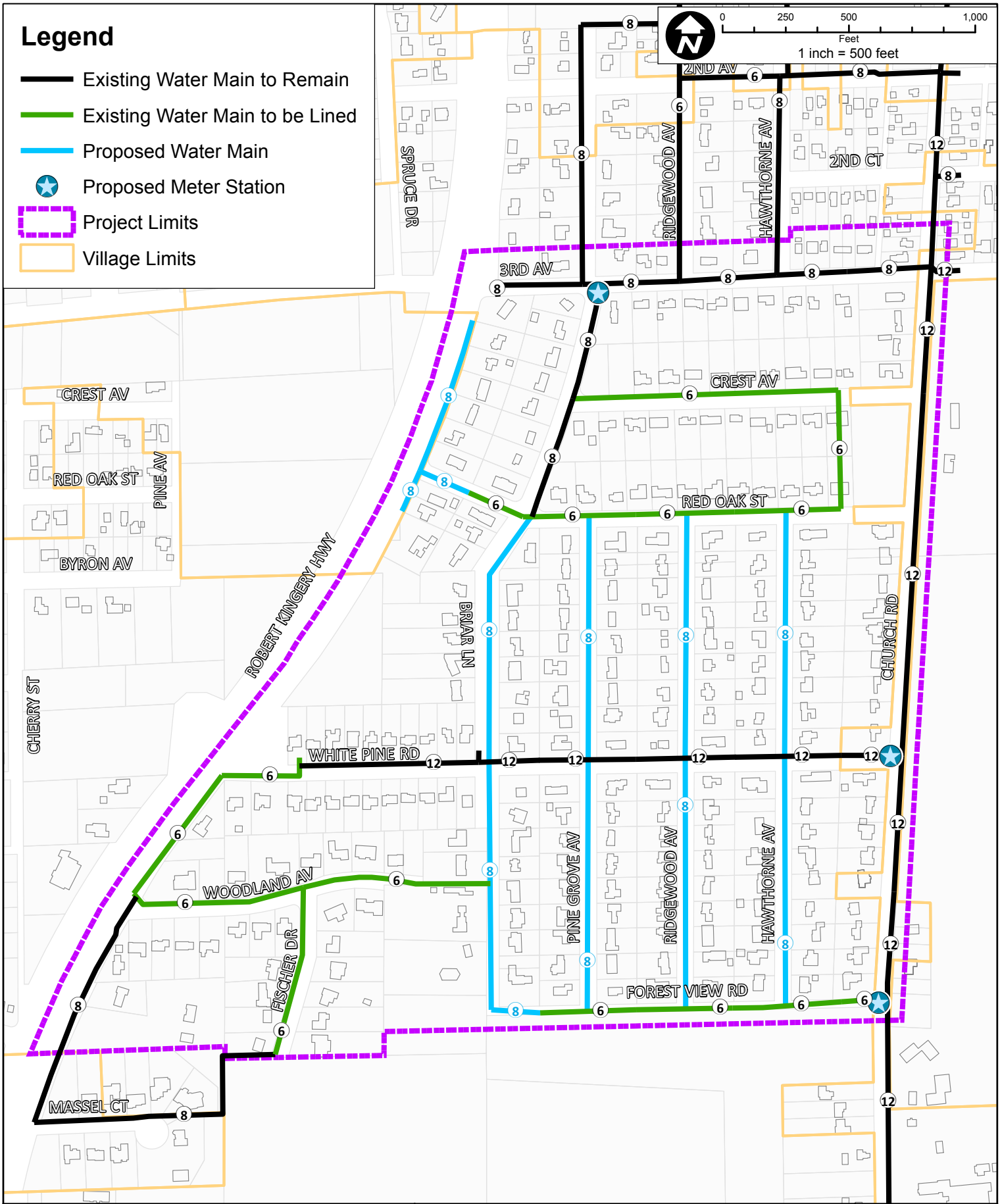

CLIENT: **VILLAGE OF BENSENVILLE**

TITLE: **WHITE PINES AREA ALTERNATIVE 2 MAIN REPLACEMENT AND LINING**

PROJ. NO.	120433
DATE:	02-17-16
SHEET	1 OF 1
DRAWING NO.	**EXH B-2**

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APPENDIX C

ESTIMATE OF COST – ALTERNATIVES 1 AND 2

EXHIBIT C-1 – Alternative 1 Estimate of Cost

EXHIBIT C-2 – Alternative 2 Estimate of Cost

EXHIBIT C - 1

WHITE PINES WATER SYSTEM IMPROVEMENTS

FEBRUARY 17, 2016

PROJECT COST ESTIMATE - ALTERNATIVE 1 - REPLACE ALL MAINS

Location	Existing Main Location	Proposed Main Location	New Water Main Length	New Water Main Cost per Ft	New Water Main WM Cost	New Public Water Service Quantity	New Public Water Service Cost per Ea	New Public Water Service Cost	New Private Water Service Quantity	New Private Water Service Cost per Ea	New Private Water Service Cost	Total Cost
8" Water Main												
Crest	Road	Road	1,200	$190	$228,000	22	$2,500	$55,000	0	$6,500	$0	$283,000
Red Oak (including Crest connect)	Road	Road	2,250	$190	$427,500	16	$2,500	$40,000	0	$6,500	$0	$467,500
Hawthorne	Rear Yard	Road	1,950	$190	$370,500	35	$2,500	$87,500	35	$6,500	$227,500	$685,500
Ridgewood	Rear Yard	Road	1,950	$190	$370,500	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Pine Grove	Rear Yard	Road	1,950	$190	$370,500	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Briar Lane (Red Oak to Forestview)	R.Yard & Road	Road	2,025	$190	$384,750	28	$2,500	$70,000	23	$6,500	$149,500	$604,250
Forestview	Roadway	Road	1,525	$190	$289,750	0	$2,500	$0	0	$6,500	$0	$289,750
Rte 83	Rear Yard	IDOT ROW	1,050	$290	$304,500	8	$2,500	$20,000	8	$6,500	$52,000	$376,500
Woodland	Road	Road	1,500	$190	$285,000	18	$2,500	$45,000	0	$6,500	$0	$330,000
Fisher	Road	Road	725	$190	$137,750	9	$2,500	$22,500	0	$6,500	$0	$160,250
Rte 83 Frontage Road	IDOT ROW	IDOT ROW	925	$290	$268,250	6	$2,500	$15,000	0	$6,500	$0	$283,250
Metering Stations												
Briar Lane @ 3rd Avenue												$120,000
White Pines @ Church Road												$140,000
Forestview Drive @ Church Road												$140,000
Construction Subtotals:			17,050		$3,437,000	214		$535,000	138		$897,000	$5,269,000
Contingency (10%):					$343,700			$53,500			$89,700	$526,900
Estimated Construction Cost:					$3,780,700			$588,500			$986,700	$5,795,900

Estimated Construction Cost:	$5,800,000
Design Engineering & Permitting (per contract):	$337,377
Construction Engineering (8%):	$463,672
Legal Fees:	$25,000
Total Engineering, Permitting & Legal:	$826,049
TOTAL PROJECT COST:	**$6,630,000**

Notes:

1. Estimate does not include work associated with the Church Road Advance Contract.

2. Estimate includes new water services, fire hydrants, valves in vaults, etc.

3. Estimate does not include any work on 3rd Avenue, Briar Lane (3rd Avenue to Red Oak), White Pines Road and Church Road.

4. Estimate does not include roadway resurfacing.

EXHIBIT C - 2

WHITE PINES WATER SYSTEM IMPROVEMENTS

FEBRUARY 17, 2016

PROJECT COST ESTIMATE - ALTERNATIVE 2 - REPLACEMENT REAR YARD MAINS / LINING ROADWAY MAINS

	Existing	Proposed	New Water Main			CIPP Water Main Lining			New Public Water Service			New Private Water Service			
Location	Main Location	Main Location	Length	Cost per Ft	WM Cost	Quantity	Cost per Ea	Cost	Quantity	Cost per Ea	Cost	Quantity	Cost per Ea	Cost	Total Cost
8" Water Main															
Crest	Road	Lining	0	$190	$0	1,200	$218	$261,600	22	$2,500	$55,000	0	$6,500	$0	$316,600
Red Oak (including Crest connect)	Road	Lining	250	$190	$47,500	2,000	$218	$436,000	16	$2,500	$40,000	0	$6,500	$0	$523,500
Hawthorne	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	35	$2,500	$87,500	35	$6,500	$227,500	$685,500
Ridgewood	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Pine Grove	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Briar Lane (Red Oak to Forestview)	R.Yard & Road	Road	2,025	$190	$384,750	0	$218	$0	28	$2,500	$70,000	23	$6,500	$149,500	$604,250
Forestview	Roadway	Lining	200	$190	$38,000	1,325	$218	$288,850	0	$2,500	$0	0	$6,500	$0	$326,850
Rte 83	Rear Yard	IDOT ROW	1,050	$290	$304,500	0	$218	$0	8	$2,500	$20,000	8	$6,500	$52,000	$376,500
Woodland	Road	Lining	0	$190	$0	1,500	$218	$327,000	18	$2,500	$45,000	0	$6,500	$0	$372,000
Fisher	Road	Lining	0	$190	$0	725	$218	$158,050	9	$2,500	$22,500	0	$6,500	$0	$180,550
Rte 83 Frontage Road	IDOT ROW	Lining	0	$290	$0	925	$218	$201,650	6	$2,500	$15,000	0	$6,500	$0	$216,650
Metering Stations															
Briar Lane @ 3rd Avenue															$120,000
White Pines @ Church Road															$140,000
Forestview Drive @ Church Road															$140,000
Construction Subtotals:			9,375		$1,886,250	7,675		$1,673,150	214		$535,000	138		$897,000	$5,391,400
Contingency (10%):					$188,625			$167,315			$53,500			$89,700	$539,140
Estimated Construction Cost:					$2,074,875			$1,840,465			$588,500			$986,700	$5,930,540

Estimated Construction Cost:	$5,940,000
Design Engineering & Permitting (per contract):	$337,377
Construction Engineering (8%):	$474,444
Legal Fees:	$25,000
Total Engineering, Permitting & Legal:	$836,821
TOTAL PROJECT COST:	**$6,780,000**

Notes:

1. Estimate does not include work associated with the Church Road Advance Contract.

2. Estimate includes new water services, fire hydrants, valves in vaults, etc.

3. Water main lining cost per foot same as IAWC/Elmhurst 2014 lining project ($458,000/2,100 feet), and is inclusive of new fire hydrants and valves. This cost is lower than the $230/foot observed on a similar 2015 project in Orland Park and the $247.89 per linear foot referenced in USEPA paper (EPA/600/R-12/012) entitled "Performance Evaluation of Innovative Water Main Rehabilitation Cured-in-Place Pipe Lining Product in Cleveland, Ohio" dated February 2012.

4. Estimate does not account for any issues caused by the existing host pipe or service condition related to CIPP lining.

5. Estimate does not include any work on 3rd Avenue, Briar Lane (3rd Avenue to Red Oak), White Pines Road and Church Road.

6. Estimate does not include roadway resurfacing.

EXHIBIT C-3

WHITE PINES WATER SYSTEM IMPROVEMENTS

UNIT COST ASSUMPTIONS - FEBRUARY 17, 2016

8" WATER MAIN

	Unit	Quantity	Unit Price	Cost	Cost per Foot	Remarks
8" DIWM	FOOT	1	$90	$90.00	$90.00	
8" VALVE IN VAULT	EACH	1	$4,500	$4,500.00	$9.00	1 VV per 500 feet
FIRE HYDRANT	EACH	1	$3,500	$3,500.00	$10.00	1 FH per 350 feet
TRENCH BACKFILL	CU YD	0.90	$30	$27.00	$27.00	
PAVEMENT RESTORATION	SQ YD	0.67	$60	$40.20	$40.20	
EROSION CONTROL	L SUM	1.5%			$2.64	
TRAFFIC CONTROL & PROTECTION	L SUM	3%			$5.37	
MOBILIZATION	L SUM	4%			$7.37	
					$191.58	
PUBLIC WATER SERVICE (INCL B-BOX)	EACH	1	$2,500	$2,500.00		
1" COPPER WATER SERVICE	FOOT	125	$40	$5,000.00		
PRIVATE PROPERTY RESTORATION	L SUM	1	$1,500	$1,500.00		
				$6,500.00		
CIPP LINING (ELMHURST)	FOOT				$218.00	"All in" cost
CIPP LINING (ORLAND PARK)	FOOT				$230.00	"All in" cost

	UNIT	CALC'D	**ASSUMED**
DIWM, 8" (IN ROAD)	FOOT	$191.58	**$190**
DIWM, 8" (IN IL 83 ROW)	FOOT	$287.36	**$290**
PRIVATE WATER SERVICE	EACH	$6,500.00	**$6,500**
PUBLIC WATER SERVICE (INCL B-BOX)	EACH	$2,500.00	**$2,500**
CIPP LINING, 6"			**$218**

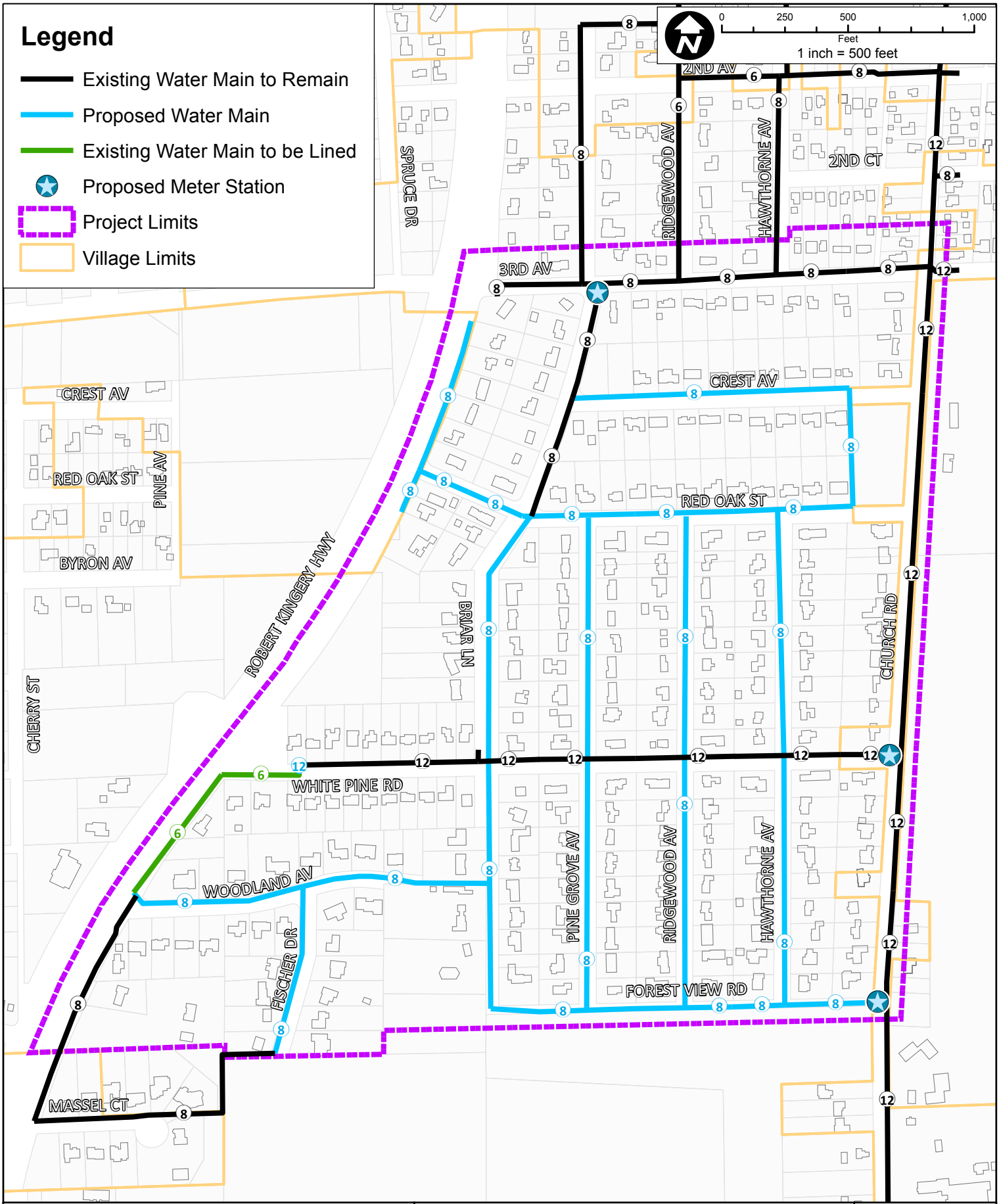
APPENDIX D

RECOMMENDED PROJECT

EXHIBIT D-1 – Recommended Project Scope Map

EXHIBIT D-2 – Recommended Project Estimate of Cost

EXHIBIT D-3 – Proposed Available Fire Flow (Recommended Project)



CLIENT: **VILLAGE OF BENSENVILLE**

TITLE: **WHITE PINES AREA RECOMMENDED PROJECT**

PROJ. NO. 120433
DATE: 02-17-16
SHEET 1 OF 1
DRAWING NO. **EXH D-1**

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600 · Rosemont, Illinois 60018 · (847) 823-0500

DSGN.			SCALE:	1:6000
DWN.			AUTHOR:	DWALTERS
CHKD.			PLOT DATE:	2/18/2016
FILE:	Recommended Project			

Path: N:\Bensenville\120433\GIS\Exhibits\Recommended Project.mxd

EXHIBIT D - 2

WHITE PINES WATER SYSTEM IMPROVEMENTS

FEBRUARY 17, 2016

PROJECT COST ESTIMATE - RECOMMENDED PROJECT

Location	Existing Main Location	Proposed Main Location	New Water Main			CIPP Water Main Lining			New Public Water Service			New Private Water Service			Total Cost
			Length	Cost per Ft	WM Cost	Quantity	Cost per Ea	Cost	Quantity	Cost per Ea	Cost	Quantity	Cost per Ea	Cost	
8" Water Main															
Crest	Road	Road	1,200	$190	$228,000	0	$218	$0	22	$2,500	$55,000	0	$6,500	$0	$283,000
Red Oak (including Crest connect)	Road	Road	2,250	$190	$427,500	0	$218	$0	16	$2,500	$40,000	0	$6,500	$0	$467,500
Hawthorne	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	35	$2,500	$87,500	35	$6,500	$227,500	$685,500
Ridgewood	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Pine Grove	Rear Yard	Road	1,950	$190	$370,500	0	$218	$0	36	$2,500	$90,000	36	$6,500	$234,000	$694,500
Briar Lane (Red Oak to Forestview)	R.Yard & Road	Road	2,025	$190	$384,750	0	$218	$0	28	$2,500	$70,000	23	$6,500	$149,500	$604,250
Forestview	Roadway	Road	1,525	$190	$289,750	0	$218	$0	0	$2,500	$0	0	$6,500	$0	$289,750
Rte 83	Rear Yard	Road	1,050	$290	$304,500	0	$218	$0	8	$2,500	$20,000	8	$6,500	$52,000	$376,500
Woodland	Road	Road	1,500	$190	$285,000	0	$218	$0	18	$2,500	$45,000	0	$6,500	$0	$330,000
Fisher	Road	Road	725	$190	$137,750	0	$218	$0	9	$2,500	$22,500	0	$6,500	$0	$160,250
Rte 83 Frontage Road	IDOT ROW	Lining	0	$290	$0	925	$218	$201,650	6	$2,500	$15,000	0	$6,500	$0	$216,650
Metering Stations															
Briar Lane @ 3rd Avenue															$120,000
White Pines @ Church Road															$140,000
Forestview Drive @ Church Road															$140,000
Construction Subtotals:			16,125		$3,168,750	925		$201,650	214		$535,000	138		$897,000	$5,202,400
Contingency (10%):					$316,875			$20,165			$53,500			$89,700	$520,240
Estimated Construction Cost:					$3,485,625			$221,815			$588,500			$986,700	$5,722,640

Estimated Construction Cost:	$5,730,000
Design Engineering & Permitting (per contract):	$337,377
Construction Engineering (8%):	$457,812
Legal Fees:	$25,000
Total Engineering, Permitting & Legal:	$820,189
TOTAL PROJECT COST:	**$6,560,000**

Notes:

1. Estimate does not include work associated with the Church Road Advance Contract.

2. Estimate includes new water services, fire hydrants, valves in vaults, etc.

3. Water main lining cost per foot same as IAWC/Elmhurst 2014 lining project ($458,000/2,100 feet), and is inclusive of new fire hydrants and valves. This cost is lower than the $230/foot observed on a similar 2015 project in Orland Park and the $247.89 per linear foot referenced in USEPA paper (EPA/600/R-12/012) entitled "Performance Evaluation of Innovative Water Main Rehabilitation Cured-in-Place Pipe Lining Product in Cleveland, Ohio" dated February 2012.

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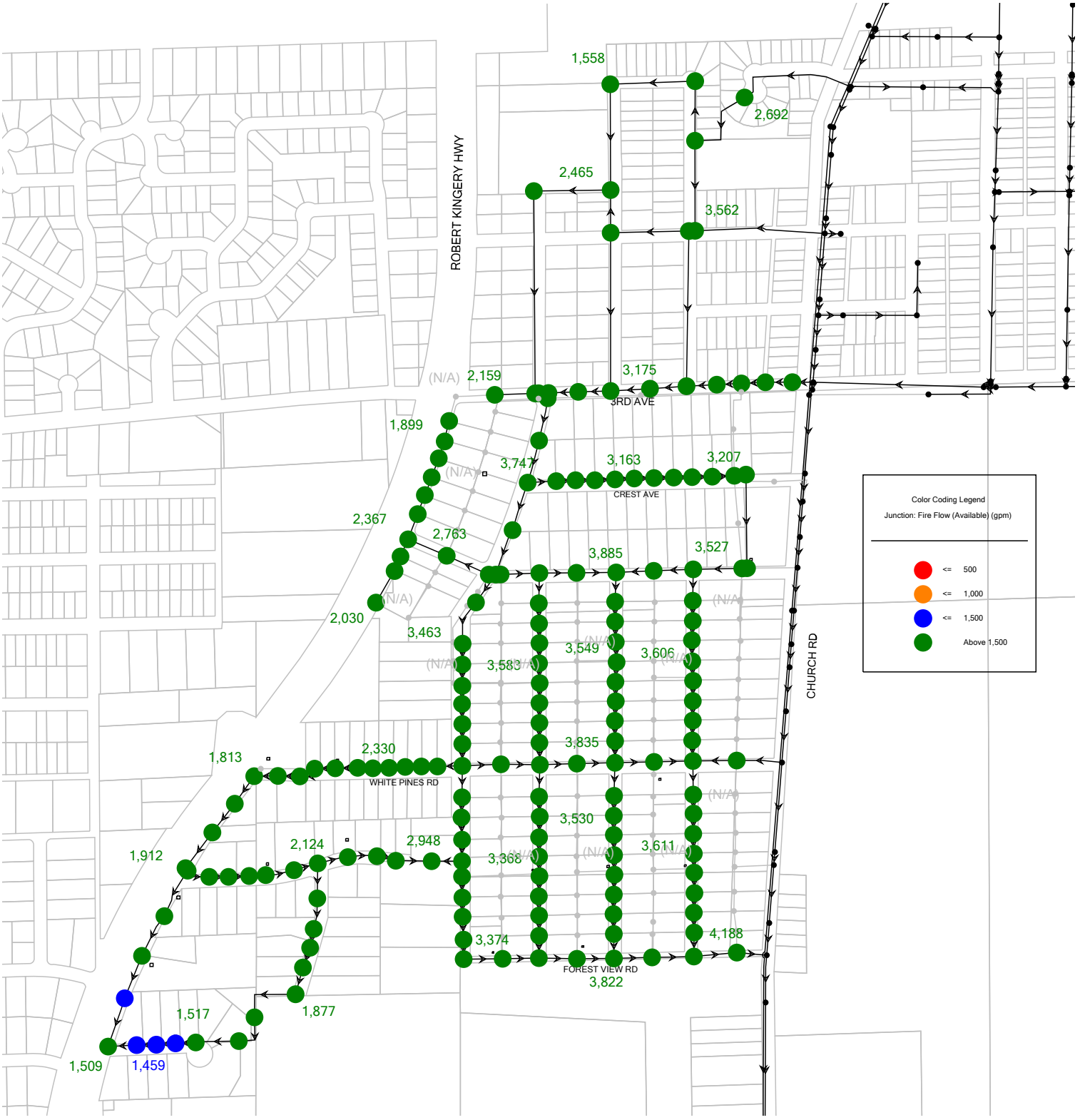
6. Estimate does not include roadway resurfacing.



Village of Bensenville, IL
White Pines Water System Evaluation
February 17, 2016

EXHIBIT D-3

MAX Daily Demand

Available Fire Flows

Recommended Project