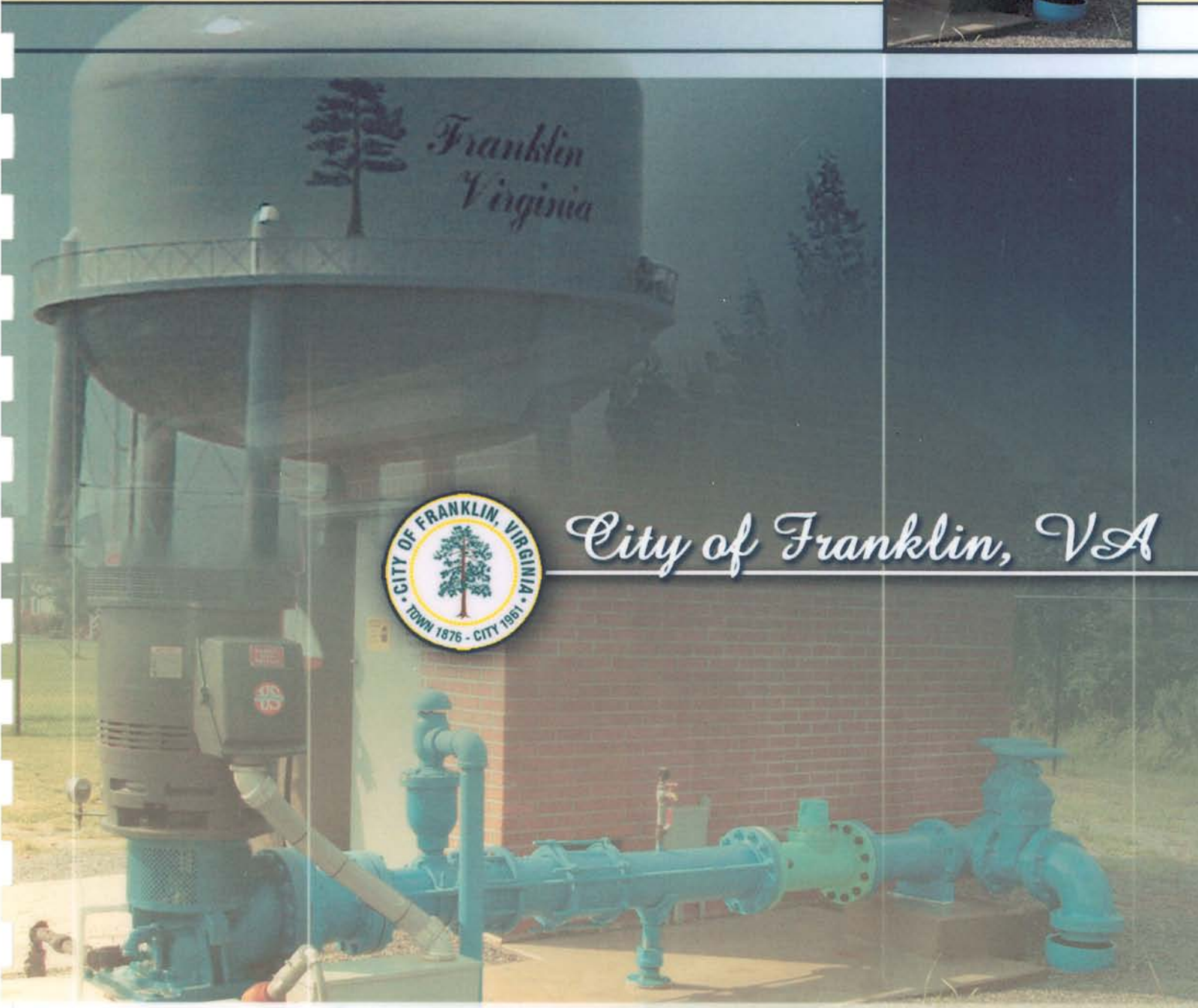


Sanitary Sewer and Water System  
*Impact Assessment*



*City of Franklin, VA*

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# City of Franklin, VA

## Sanitary Sewer and Water System Impact Assessment



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## I. EXECUTIVE SUMMARY

- The City of Franklin average demand for potable water is 1.16 million gallons per day (mgd). The City currently has production capacity for up to 2.4 mgd. At build-out, the City will require a production capacity of approximately 2.4 mgd. It is commonly accepted design practice to begin expansion plans at 80% of the production capacity. Therefore, it is recommended to ultimately expand production capacity to 3.0 mgd to provide the 2.4 mgd future requirement. Providing potable water to users outside the City, beyond those currently receiving service, will require additional capacity upgrades.
- The City's current withdrawal permit allows an average daily withdrawal of 2.9 mgd. However, up to 1.1 mgd can be requested by Southampton County. If the County uses the 1.1 mgd allowance, the withdrawal permit will need to be amended to allow a total of 3.5 mgd at City build-out (1.1 mgd Southampton County + 2.4 mgd City of Franklin).
- The current City of Franklin average wastewater flows are 0.98 million gallons per day (mgd). The permitted wastewater treatment plant capacity is 2.0 mgd. At build-out, the City will require approximately 2.4 mgd of treatment capacity. Therefore, a 1 mgd expansion will eventually be required to provide 2.4 mgd of useable capacity ( $3.0 \text{ mgd} \times 80\% = 2.4 \text{ mgd}$ ). The Pretlow Industrial Park and approximately 1000 single family dwellings can be accommodated before planning and design of a plant expansion will be required.
- Recently, an alternative to a wastewater treatment plant upgrade has been discussed and considered. The option would include construction of a regional pump station and force main by the Hampton Roads Sanitation District that would transport all current and future city sewage to the HRSD treatment facility. This option would eliminate Franklin's WWTP. This option will require additional study and consideration, but appears that it may offer a more cost effective, long term solution to the City's wastewater treatment needs.
- The existing water distribution system has seventy-nine (79) fire hydrants out of a total of 333 fire hydrants that cannot produce the required fire flow for the surrounding uses (500 gallons per minute residential, 1000 gallons per minute commercial). Twenty-nine (29) pipe upgrades will provide the required fire flows at all City hydrants. The probable costs for the upgrades will range from \$1,500,000 to \$2,000,000.
- There are three recommend sanitary sewer improvements to address current sanitary sewage collection system issues. The probable costs for the system improvements will range from \$100,000 to \$200,000. The improvements are detailed later in this report.

- As part of the flow monitoring task completed for this study, an estimate of Infiltration and Inflow (I/I) into the system was calculated. For a typical 24 hour, two-inch (2") rainfall, approximately 1 mgd of I/I entered the system. Several priority areas have been established to further identify I/I sources and effect repairs. Removal of I/I from the system recovers both system and treatment capacity. However, on an annual basis, it appears that I/I would account for only 6% of the current annual flows during an average rainfall year.
- A number of water distribution/transmission, sanitary collection/transmission, and pump station upgrades and improvements will be required to address the impact of additional development on these systems. It is assumed that new residential and commercial development will bare the cost of the required improvements.
- The following water and sewer impact study develops the modeling tools to evaluate the impact of new development on the City's water and wastewater infrastructure. Based on the best information available today concerning future build-out (inside and outside the City limits), required water distribution/transmission and wastewater collection/transmission system improvements are provided. Any rezoning of property within the City limits or different assumptions outside the City boundary will require that the model be revised and the impacts be re-evaluated.

## II. STUDY OVERVIEW

The City of Franklin water and sewer systems are beginning to experience the effects of an aging infrastructure and the demands of proposed development. In order to make sound decisions about growth, the City of Franklin conducted the following water and sewer impact assessment to determine the appropriate steps in improving existing infrastructure and the level of effort required by development to ensure that existing systems are not adversely affected by future growth. The main intent of the study is to determine the improvements required to ensure that existing and future citizens of Franklin have adequate water and sewer service.

### Development Areas

For purposes of the study, the city was divided into eight major development areas as shown below:

- N. High Street - Locations 1, 4, 25, 30, 40, UDA 6, UDA 7, and Nursing Home Addition
- North of Woodland Drive - Locations 3 and 3A
- North of Bobwhite Lane – Location UDA 5
- West of Hunterdale and North of Railroad Tracks – Locations 60 and UDA 3
- North of Clay Street and South of Railroad Tracks – Locations 7, UDA 2, and UDA 4
- North of Armory Drive and South of Clay Street – Locations 8A, 8B, 9, and 10
- South of Armory Drive and North of South Street – Location 12
- South of South Street – Locations 13, 15, and UDA 1

Maps are shown in **Appendix N – Development Area Maps**. Each development area is discussed separately for both the sewer and water systems.

### III. SANITARY SEWER SYSTEM IMPACT ASSESSMENT

#### A. Sewer System Overview

The sanitary sewer system consists of approximately 225,000 feet of gravity pipe and 950 manhole structures. Survey information was collected throughout the system to ensure complete information for the modeling effort. Flow monitoring was conducted to gauge both existing dry-weather and wet-weather conditions. Modeling of the system was completed via four different scenarios to consider a broad range of possible solutions. The four scenarios are existing dry-weather flow, dry-weather flow with future development, existing wet-weather flow, and existing wet-weather flow with future development.

#### B. Flow Monitoring

Flow meters (Marsh-McBirney Flo-Dar) were installed in 14 manholes throughout the City as shown in **Appendix A – Flow Meter Locations**. Flow data was collected for a period of 29 days from September 19, 2005 to October 17, 2005. A daily summary of flow data along with graphs from each location is also located in **Appendix A**.

The flow data yielded general information about the average and peak flows for a normal day. Two rain events were also captured during the data collection period. The first rain event occurred on September 20, 2005 around 10 pm. The event had a duration of two hours with a rain total of 2 inches. The second event began on October 8, 2005 and lasted for over 24 hours. The total rainfall accumulation was also around 2 inches.

The impact of inflow and infiltration (I & I) within the system was determined by subtracting the flow for October 1<sup>st</sup> from the flow for October 8<sup>th</sup>. October 1<sup>st</sup> was used because it is a Saturday and is a good representation of dry weather flow. October 8<sup>th</sup> was used as the rain event since it was a more representative rain event that highlights the impact of both inflow and infiltration. **Appendix B – Inflow Infiltration Summary** contains information for each flow area on the level of I & I. A priority list for system evaluation via smoke testing and television inspection was developed for City of Franklin personnel by determining the amount of I & I in gallons per day per foot of pipe. The quantity of rainwater entering the sanitary system during the October 8<sup>th</sup> event approached 1.0 million gallons per day (mgd).

#### C. Sewer Modeling

Modeling of the sewer system was accomplished using Haestad's SewerCAD<sup>®</sup>. Data collected from the flow meters was used to determine the

pattern and volume of flow throughout the system for both dry-weather and wet-weather events. As mentioned earlier, four different scenarios were considered in developing the model. The first scenario is based on dry-weather flow. The second scenario is based on dry-weather flow in combination with future development. The third scenario is based on flows during an average rain event. The inflow and infiltration is added as a supplement to the dry-weather flow. The fourth scenario is based on flows during an average rain event in combination with future development.

Flows used in the modeling process were extracted from actual flow data obtained from the flow meters installed for the study. A summary of flow data collected from the flow meters is located on the second page of **Appendix A** and is titled “Sewer Flow Data Obtained From Flow Meters”.

The basis for dry-weather flow (Scenario 1) is data obtained from the flow meters on September 28, 2005. There was no rainfall for the week prior and the week following September 28, 2005. Daily averages for this two-week period coincide well with the flows on September 28, 2005. Therefore, September 28, 2005 was chosen to be most representative of dry-weather flows for the purposes of modeling and the actual data obtained from the field for this date was used in the model. Using actual field data ensures real patterns of flow that accurately reflect demand throughout the system.

The basis for dry-weather flow including future development (Scenario 2) is three-fold. First, existing dry-weather flow is the same as in Scenario 1. Secondly, known developments with lot layouts were assigned a flow of 300 gallons per day (gpd) for each lot. Finally, Unknown Development Areas (UDA) were assigned 300 gpd for every 30,000 square feet of land – the typical area required to develop a residential lot including right-of-way.

The basis for flows during a rain event (Scenario 3) is data obtained from flow meters during the October 8, 2005 rain event. As described earlier in the Flow Monitoring section, the quantity and pattern of inflow and infiltration (I&I) was determined by subtracting flow from the prior Saturday, October 1. The net I & I was then added to the average flow for September 28, 2005. The summation of the two flow patterns was used in the modeling effort.

The basis for flows during a rain event including future development (Scenario 4) is data obtained as detailed in Scenario 3 in combination with future demand allocations as outlined under Scenario 2.

I & I is a part of any sewer system. While inflow can often be eliminated cost effectively, the cost of minimizing infiltration from an aging sanitary sewer system can be significant. Therefore, recommendations for infrastructure improvements and additions to infrastructure are based on information obtained from the Scenario 4.



#### **D. Existing Sewer Infrastructure Upgrade Recommendations**

The existing sanitary sewer system is primarily impacted in terms of capacity by infiltration and inflow during rain events. **Appendix B** –Inflow Infiltration Summary provides the level of I&I in each flow area along with a priority listing based on the level of I&I per foot of pipe.

The best way to identify sources of I&I is through smoke testing and television inspection of the pipelines. Since the City of Franklin has cleaning and television inspection equipment, this effort can be done internally at a significant cost savings. Contractors can be used to supplement work efforts as desired.

Smoke testing and television inspection should be performed one flow area at a time. Once the assessment is complete, a list of repairs with associated costs can be generated. Once funding is available and scheduled for the recommended repairs, the next flow area can then be smoke tested and television inspected. Since the sanitary sewer system is constantly aging, inspecting the entire system is not cost effective unless funding is assured and timely repairs can be made. Careful consideration should also be given to only making those repairs that provide a sound return on investment.

The second area of concern within the sanitary sewer system are the gravity lines along Franklin Street from the railroad tracks near Bogart Street to Barrett Street. Currently, two 12” lines cascade into three 12” lines which cascade into a 24” line that has reverse grade. The overhaul hydraulics in this area is poor and creates a constant surcharged condition. It is recommended that this group of lines be replaced with one 18” line at a constant slope of 0.17%. **Appendix M** – Location Maps for Existing Sewer System Upgrades shows the proposed layout.

#### **E. Future Development Along N. High Street– Sewer Impact**

There are eight potential developments along the N. High Street corridor starting from Fairview and ending at the Franklin City line. The existing gravity infrastructure along High Street and Franklin Street cannot support the potential development. A regional pump station (P100) is proposed to serve locations 1, 4, 20, 25, 40, and UDA 6 as shown on Map 1 – Sanitary & Water Overview. Specific information on the pump station and force main are located in **Appendix C** – Sanitary Sewer Impact Assessment. A combination of an 8” and 10” force main is proposed to convey the sewage from the regional pump station to the 18” gravity line located along South Street (just North of Wastewater Treatment Plant). A new pump station is also recommended for serving location UDA 7. A 6” force main will convey the sewage and connect to the 10” force main from P100 (See Map 1). Detailed information on pump station P200 and appurtenances is also found

in Appendix C. The 27-unit addition to the existing nursing home along N. High Street can use existing connections and flow into the existing River Road Farms pump station (01). The impact to pump station 01 is minimal. Details on the impact of the additional 27 units are located in **Appendix C**.

**F. Future Development North of Woodland Drive- Sewer Impact**

There are two development areas north of Woodland Drive. Wyndham Crossing (Location 3), which is already an approved subdivision, will convey sewage to the Woodland I pump station (02) via a new gravity system that ties into Woodland Drive. The impact of Location 3 on pump station 02 is not significant. The second development area is currently being considered as an adult community (Location 3A) with 457 units. The adult community will likely feed into the Woodland II (03) pump station via a gravity system. The impact on pump station 02 is considerable. Pump station and force main improvements will be required. The current configuration of pump station 02 can handle the flow from Location 3A. Detailed information for both pump station 02 and 03 is provided in **Appendix C**.

**G. Future Development North of Bobwhite Lane – Sewer Impact**

There is one potential development area north of Bobwhite Lane (UDA 5). The entire site can be served by surrounding gravity systems that flow to the Cypress Pump Station (04). The impact on pump station 04 is not significant and will not require improvements to the station. Details are shown in **Appendix C**.

**H. Development West of Hunterdale and North of Railroad Tracks – Sewer Impact**

There are two development areas west of Hunterdale Road and north of the railroad tracks. Joyner Farms (Location 60), which is already an approved subdivision, conveys sewage via a gravity collection system to the Trail Road Pump Station (14). Pump station 14 discharges to the gravity system on Hunterdale Road, which cascades to pump station 04. UDA 3 will convey sewage via existing gravity systems on both Delaware Road and Hunterdale Road. Eventually, all sewage from UDA 3 conveys to pump station 04. The overall impact to pump station 04 does not require upgrade of the existing station. Details on the impact to pump station 04 are located in **Appendix C**.

**I. Development North of Clay Street and South of Railroad Tracks- Sewer Impact**

There are three development areas north of Clay Street and south of the Norfolk Southern Railroad tracks. Madison Estates (Location 7) is proposed as a mixed-use residential property with up to 260 lots. Location 7 will convey sewage to the Clay Street Pump Station (06). UDA 2, which could

contain up to 258 residential lots, will also convey sewage to pump station 06. The impact to pump station 06 is significant. A larger wetwell will be required as well as new pumps. The existing 4" force main is adequate to handle proposed future growth, as is the downstream gravity system. The details of impact on pump station 06 are reported in **Appendix C**.

UDA 4 has the potential to be a small subdivision of approximately 9 lots. The sewage from UDA will convey to the Cypress Pump Station (04). The impact on pump station 04 is not significant as shown in **Appendix C**.

**J. Development Areas North of Armory Drive and South of Clay Street – Sewer Impact**

There are four potential developments within the area north of Armory Drive and south of Clay Street. Regency Estates (Location 9) is an ongoing development with five sections. There are still 44 residential lots to build in Franklin and approximately 20 residential lots to build in Southampton County. The remaining lots in Franklin can convey via the existing gravity system along College Drive. The impact to the existing gravity system on College Drive is not significant. The new lots in Southampton County are proposed to convey to Proposed Pump Station P400. Pump station P400 will convey sewage to the College Drive gravity system via a 4" force main. The details for proposed pump station P400 are contained in **Appendix C**. The Brandywine Subdivision (Location 8A) has residential lots in both Franklin and Southampton County. Location 8A is to be served by Pump Station P300. Pump station P300 will convey sewage to the gravity system on Clay Street. A 4" force main and larger pumps will be required to accommodate future growth to the west in Southampton County. The impact to the existing downstream gravity system is not significant. Details on pump station P300 are located in **Appendix C**. The Council Property (Location 8B) will have approximately 50 residential lots and is proposed to convey sewage to proposed pump station P400. Pump station P400 will convey sewage to the gravity system on Southampton Shopping Center Road going towards College Drive. Location 10 is proposed to be a mixed-use residential and business development. There are 120 proposed residential units and an unknown amount of business development. The business development is not likely to contribute significant sewer flows as compared to the residential flow. The flow from Location 10 is proposed to convey to proposed pump station P400. Details on pump station P400 are provided in **Appendix C**.

**K. Development South of Armory Drive and North of South Street – Sewer Impact**

There is one development area south of Armory Drive and North of South Street. The development is the Lila Camp Young Property (Location 12) and is proposed to have 289 residential units with some business use. The

business development is not likely to contribute significant sewer flows as compared to the residential flow. Sewage flow is proposed to be conveyed to Proposed Pump Station P500. Sewage will be conveyed to the gravity system on South Street via a 4" force main. The outlet point for the 4" force main is on South Street at the intersection of Thomas Street. The impact to the downstream gravity system is not significant and therefore does not require improvements. However, Location 12 does impact the Oak Street Pump Station (11). While the wetwell capacity and force main size are acceptable, the pumps will need upgrading to meet Virginia Department of Health requirements. The downstream gravity system from the Oak Street Pump Station is not significantly impacted and therefore does not warrant downstream improvements.

**L. Development South of South Street – Sewer Impact**

There are three possible development areas south of South Street. Location 13 is proposed as a mixed-use property of residential and business along the northeast side of the intersection between Highway 58 and South Street. Sewage from Location 13 is proposed to discharge to Proposed Pump Station P600 along Highway 58 as shown on Map 4. A portion of UDA 1 and Morton and Pretlow Residential Development (Location 15) is proposed to discharge to P600. The sewage from P600 will convey to the existing gravity system on Progress Parkway, which in turn flows to the Pretlow Pump Station (12). The remainder of UDA 1 and Location 15 can be served by pump station 12. Since UDA 1 is forecasted to have 300,000 gallons of flow per day, the impact on pump station 12 is significant. The impact to downstream gravity would also be significant. Therefore, this portion of the system will eventually require a new 8" force main to the Wastewater Treatment Plant. Because the impact of industrial development on sewage flows is highly uncertain, infrastructure improvements in this area should be considered incrementally to avoid the potential for unnecessary construction. Details for Proposed Pump Station P600 and Pump Station 12 are located in **Appendix C**.

**M. Southampton County Development – Sewer Impact**

The unknown impact of development in Southampton County can be significant. While Southampton County has a reservation of 1.1 mgd for water, the County does not have a reservation for sewer. Given the ability to supply water for Southampton County considerations should be made for handling a commensurate amount of sewer flow.

Proposed Pump Station P100 and associated appurtenances are being proposed to handle additional sewage flow from N. High Street in Southampton County. Any sewage conveyed from Southampton County from the N. High Street area must be conveyed to the Wastewater Treatment Plant.

Future growth in Southampton County along Hunterdale Road requires additional consideration. Existing infrastructure cannot handle extensive development in this area without another regional pump station that conveys sewage to the Wastewater Treatment Plant. The use of the proposed 10” force main along High Street is possible if upgrades to other stations using the force main are considered during the design phase.

Future growth in Southampton County along Clay Street (Business 58) will also require a new pump station that can convey sewage to the Wastewater Treatment Plant. The sewer infrastructure that exists within the Clay Street area is minimal and lacks substantial capacity to service any additional flow from Southampton County.

Future growth in Southampton County along Armory Drive should also be carefully considered. Future growth requiring upgrades to the Armory Drive Pump Station (12) above the current 200 gpm pump capacity will require a force main that conveys sewage directly to the Wastewater Treatment Plant.

**N. City of Suffolk and Isle of Wight County – Sewer Impact**

The potential exists for both Suffolk and Isle of Wight County to convey up to 500,000 gpd each to the City of Franklin. Any sewage from these two areas must be conveyed directly to the Wastewater Treatment Plant.

**O. Sewer System Impact Summary**

**Appendix D** - Impact of Future Development shows the total impact of development on the sewer infrastructure. At build out, the potential exists for an additional 1,357,900 gallons per day of sewage flow. This does not include any future flows from Southampton County, Suffolk, or Isle of Wight County. Actual flows should be monitored as development occurs since they will vary depending on the type and density of development.

## IV. WATER IMPACT SYSTEM ASSESSMENT

### A. Water System Overview

The water distribution system consists of approximately 350,000 linear feet of pipe. One-hundred and thirty-nine (139) fire hydrants were flow tested to assist in calibrating the water distribution system model. The testing was done over a three-day period from November 7-9, 2005. Flow data and fixed system pressures used for the model were taken from information gathered from the groundwater pumps and elevated storage tanks on November 10, 2005.

### B. Water Modeling

The modeling of the water system was accomplished using Haestad's WaterCAD<sup>®</sup> software. Calibration of the water model was completed using Haestad's Darwin Calibrator<sup>®</sup>. Calibration of the model used the results from the hydrant testing and daily flows from the three water storage tanks. Recommendations are based on peak flow plus required fire flow. **Appendix E** – Peak Day Flow Determination shows how the peak flow rates were calculated according to Virginia Department of Health Regulations. **Appendix F** – Hydrant Flow Testing Data provides the flow test results, **Appendix G** – Fire Flow Requirements indicates the required fire flows for the City of Franklin, and **Appendix H** provides tank flow data. **Appendix I** provides junction demand calculations.

### C. Existing Water Infrastructure Upgrade Recommendations

There are currently 79 fire hydrants throughout the City of Franklin that do not provide adequate fire flow. There are 29 recommended upgrades to the water distribution system that will result in each of the 79 fire hydrants producing the required fire flow of 500 or 1000 gpm at a residual pressure of 20 psi. Maps showing the 29 upgrade locations are provided in **Appendix K** – Location Maps for Existing Water Distribution Upgrades. **Appendix L** – Fire Flow Comparison Before and After Existing Water Distribution System Upgrades shows the increase in fire flows after upgrades are completed.

Locations 1 and 2 are located on Caterbury Court and Chaucer Court, respectively, and are shown on Map FEWR-1 in **Appendix K**. The existing 4" lines should be replaced with new 6" lines from Andrews Avenue to the existing fire hydrants on both streets. As a result of these upgrades, fire flows at 20 psi residual would increase to 661 and 757 gpm for the two hydrants in this area.

Location 3 includes 4" water lines along Bobwhite Lane, Roost Road, and Covey Drive and is shown on Map FEWR-2 in **Appendix K**. All five fire

hydrants in this neighborhood are being served with 4" lines. All lines within this neighborhood should be increased to 6" in order to provide adequate fire flow. Fire flows at 20 psi residual would increase to 712, 761, 809, 1112, and 1184 gpm for the five hydrants in this area as a result of the upgrades.

Location 4 is located on Crescent Drive and is shown on Map FEWR-3 in **Appendix K**. The existing fire hydrant is currently served by a 4" line. This hydrant should be abandoned and a new 6" tap should be made to the existing 10" line on Crescent. The new flow at 20 psi residual would be 1538 gpm.

Location 5 is located on Magnolia Avenue and is shown on Map FEWR-3 in **Appendix K**. The existing 4" line should be replaced with a new 6" line. The new flow for the two hydrants in this area at a residual pressure of 20 psi would be 641 and 707 gpm.

Locations 6 through 13 show upgrades to the water distribution system that will increase fire flows to the Cypress neighborhood, Sunset neighborhood, Barrister neighborhood, Sycamore neighborhood, College Drive south to the existing PRV, and Clay Street west of Hunterdale Road. The result is an increase in fire flows to above 500 gpm at a residual pressure of 20 psi. Details are shown on Maps FEWR-4 through FEWR-8 in **Appendix K**. Essentially, existing 4" and 6" lines are proposed to be replaced with 8" and 10" lines.

Location 14 is located on Rawlsdale Road and is shown on Map FEWR-8 in **Appendix K**. The existing 4" line should be replaced with a new 6" line. This upgrade would result in fire flows of 675 gpm at a residual pressure of 20 psi.

Location 15 is located on Forest Pine Road and is shown on FEWR-10 in **Appendix K**. A new 6" line is proposed to connect to existing 6" lines. Flow would increase to 935, 982, and 1030 gpm at a residual pressure of 20 psi for the three hydrants in this area.

Location 16 is located on Ridge Road and is shown on FEWR-9 in **Appendix K**. A new 6" line is proposed to connect the existing 4" line at the end of Ridge Road with the existing 6" line on Clay Street. The resultant fire flow for the 2 hydrants in the area is over 500 gpm at 20 psi.

Location 17 is located along Fontaine Street and Norfleet Street and is shown on FEWR-12 in **Appendix K**. The existing 4" line should be replaced with a new 6" line. The result is fire flows over 500 gpm @ 20 psi.

Location 18 is located on Madison Street and is shown on Map FEWR-14 in **Appendix K**. A new 6" line is proposed to connect the dead end line on

Madison Street to the 6" main running parallel to the railroad tracks. This upgrade will increase fire flows for 2 hydrants to above 500 gpm @ 20 psi.

Location 19 is located on South Street between Johnson Street and Thomas Street and is shown on FEWR-13 in **Appendix K**. A new 6" line is proposed to connect and loop the existing water lines on Johnson Street and Thomas Street. The result is increased fire flows to above 500 gpm at 20 psi for one hydrant.

Location 20 is located at the intersection of Oak Street and Morton Street and is shown on FEWR-20 in **Appendix K**. A new 6" line is proposed to connect the dead end line coming from Pretlow Street with the line on Oak Street. The result is an increase in fire flows for one hydrant to over 500 gpm at 20 psi.

Location 21 is located along Hayden Drive and is shown on FEWR-16 in **Appendix K**. The existing 4" line from South Street to the fire hydrant on Hayden should be replaced with a new 6" line to increase fire flows above 500 gpm @ 20 psi.

Location 22 is located on Fair Street and is shown on FEWR-15 in **Appendix K**. A new 6" line is proposed to connect the existing line on Hall Street with the dead end 4" line of Fair Street. This will increase fire flows above the stated requirements for one hydrant.

Location 23 is located on Laurel Street and is shown on FEWR-19 in **Appendix K**. A new 8" line is proposed to connect the recently installed 8" line near Pretlow Street with the existing 4" line on Laurel Street. This will increase fire flows above the required 500 gpm. Also, the fire hydrant at the end of Walnut Street can be abandoned since there is another hydrant within 250 feet.

Location 24 is located on Broad Street and is shown on FEWR-18 in **Appendix K**. The existing 4" should be replaced with a new 6" line from South Street to the second fire hydrant. The resultant fire flows for both hydrants will be over 500 gpm at the required residual pressure.

Location 25 and Location 26 are located on Barrett Street and Bogart Street, respectively, and are shown on FEWR-17 in **Appendix K**. The existing 4" lines in both cases should be replaced with new 6" lines from South Street to the hydrant. The result is fire flows meeting the minimum requirements for both hydrants.

Location 27 is located on Armory Drive and is shown on FEWR-11 in **Appendix K**. The existing fire hydrant is currently being feed by a 4" lines. A new line feeding the fire hydrant from the existing 10" line on Armory



Drive is proposed. The fire hydrant will experience an increase of over 1000 gpm at 20 psi as a result of this upgrade.

Location 28 is located on Main Street at the intersection of 5<sup>th</sup> Avenue and is shown on FEWR-21 in **Appendix K**. The existing fire hydrant is being fed by a 4" line. Replacing the 4" line from the hydrant to the main line will increase the flow to over 1000 gpm at 20 psi residual pressure.

Location 29 involves three hydrants near the intersection of East Street and 2<sup>nd</sup> Avenue and is shown on FEWR-21 in **Appendix K**. A new 8" main that ties the existing 6" main on Mechanic Street to the existing 6" main on East Street will increase flow to all three hydrants beyond 1000 gpm at 20 psi residual pressure.

#### **D. Future Development Along N. High Street –Water Impact**

The development of Locations 1, 20, 25, and UDA 6 require the extension of the existing 10" water line along High Street with a 12" water line. An existing section of 6" waterline on N. High Street just north of Fairview Avenue should also be replaced with a 10" water line. The purpose of the 12" water line is to help provide adequate flow and pressure to Southampton County should build-out occur along this corridor within the County. Locations 1, 20, 25, and UDA 6 should be served with a main 10" feeder line throughout the project. This size line is necessary to ensure adequate pressure and flow in the long-term. Location 20 should include a 10" water line that connects to the existing 6" water line on Vaughan Lane. A 10" stub should also be supplied to Locations 4 and 25. This configuration provides maximum looping of both existing and future systems. Location 25 should provide a connection to Location 4 and 20 with a 10" water line if developed first. The 40 lots at Location 40 can be served with an 8" line. UDA 6 should be looped from the new 12" water line extension back to the existing 10" waterline along N. High Street. Location 4 should be feed by a 12" waterline off the existing 10" water line on N. High Street. 10" water line connections to Locations 20 and 25 should be provided from the new 12" water line if developed first. A 12" water line connection should be provided to Location 3A if developed first. Location 35 can be served by the existing connection. The installation of a 12" waterline throughout this development area is essential to development in Southampton County along the N. High Street corridor. Should development start to occur in Southampton County along this corridor, a 12" waterline must be installed to the 12" water line leaving the Hunterdale Storage Tank. A new 16" water line would also need to be installed from the Hunterdale Storage Tank to the new 12" water line on Bobwhite Lane. A 16" line ensures that other portions of the City will not be adversely affected by a reduction in pressures. UDA 7 can be served with a 10" water line that connects directly to the existing 10" water line on Fairview Avenue.

**E. Future Development North of Woodland Drive - Water Impact**

Location 3 is currently an approved subdivision to be served by the existing 10" water line that crosses through the property. Location 3A must be served by a 12" water line that runs from the Hunterdale Storage Tank. Location 3A should also supply a 12' waterline connection to location 4 if developed first.

**F. Future Development North of Bobwhite Lane – Water Impact**

UDA 5 should be served by a 10" water line feeding directly from the Hunterdale Storage Tank. The 10" water line should connect with the existing 6" water line on Andrew Avenue.

**G. Future Development West of Hunterdale and North of Railroad Tracks – Water Impact**

Location 60 is an approved subdivision that is served by the existing 8" water line on Delaware Road. UDA 3 should be served by a 12" water line that loops from the existing 12" water line on Bobwhite Lane to the existing 8" water line on Delaware Road.

**H. Future Development North of Clay Street and South of Railroad Tracks- Water Impact**

The development of Locations 7, UDA 2, and UDA 4 require the installation of a new 10" water line from the intersection of Fairview Avenue and Crescent Drive to the intersection of Business 58 and Rawlsdale Road that will replace the existing 4" and 6" water lines. Incremental upgrades to the new 10" water line can be made depending on the development. All incremental upgrades should start at the intersection of Fairview Avenue and Crescent Drive.

**I. Future Development Areas North of Armory Drive and South of Clay Street – Water Impact**

Location 9 is currently about 70% developed. As work continues, all lines should be looped appropriately. Also, location 9 should share responsibility for upgrading the water line from the intersection of Fairview Avenue and Crescent Drive. Field-testing indicates that the Regency neighborhood (Location 9) does not meet current fire flow requirements during peak demands. Additional development will only exacerbate the situation. Location 8A should be served by an 8" water line coming from Clay Street. Location 8A should also share responsibility for upgrading the water line from Fairview and Crescent. Locations 8B and 10 should be served by an 8" water line from Southampton Shopping Center Road. The College Drive and Pretlow Water Storage Tanks serve this water line. Location 50 should be

served by a 10" water line coming from the existing 10" water line on College Drive. Location 50 should also share responsibility for upgrading the water line from Fairview and Crescent.

**J. Future Development South of Armory Drive and North of South Street – Water Impact**

Location 12 should be served by a new 12" water line that ties into the existing 6" waterline on South Street. The 12" line should also connect to the existing 10" water line on Armory Drive near the intersection of Highway 58. The new 12" line is necessary to account for the possibility of future growth along Armory Drive in Southampton County.

**K. Future Development South of South Street – Water Impact**

Locations 13, 15, and UDA 1 require extensions of new 12" water lines from the Pretlow Water Storage Tank to service the expected demand. The new 12" water line should connect to the new 12" water line from Location 12. This will supply the pressure and flow necessary to serve development along Armory Drive in Southampton County.

**L. Future Development in Southampton County – Water Impact**

There are four potential areas where water service from the City of Franklin could be extended to serve development in Southampton County. The four areas are North High Street, north on Hunterdale Road, west of Clay Street near Delaware Road, and west along Armory Drive. The recommendations set forth for each area are based on a possible development of 1.1 mgd (current allocation for water to Southampton County). Upgrades relating to development along North High Street in Southampton County were considered as part of the future development for North High Street within the City of Franklin.

The area north along Hunterdale Road in Southampton County would require an upgrade of the existing line along Hunterdale to a 12" line. The line along Bobwhite Lane to the water storage tank would also have to be upgraded to a 16".

Development along the Business 58 corridor in Southampton County will require a 12" line from Delaware Road as well as an upgrade of the existing 12" water line on Bobwhite Lane to 16". Preferably, the new 10" water line along Clay Street would also be connected for proper looping of the system.

Development in Southampton County along Armory Drive requires a new 12" line directly from the Pretlow water storage tank. The 12" line should connect to the end of the existing 10" line on Armory Drive.

## **M. Water System Impact Summary**

**Appendix D** - Impact of Future Development shows the total impact of development on the water distribution system. Future development within the City of Franklin in combination with a 1.1 mgd allocation to Southampton County and a possible 0.5 mgd allocation to Isle of Wight County could increase water consumption by 2,837,900 gpd. There is currently not enough storage capacity or pump capacity to serve all build out needs being considered in this study. Water production and storage capacities are discussed in a subsequent chapter.

## V. WATER WITHDRAWAL AND PRODUCTION

### A. Existing System Description

The City of Franklin Waterworks is currently permitted by the Virginia Department of Health (Permit No. 3620350) for a Design Capacity of 1.8 million gallons per day (mgd). The water supply is provided by two (2) existing wells with the following rated capacities:

Hunterdale	-	1,500 gpm
Pretlow	-	1,500 gpm

Emergency backup supply can be provided from the College Drive well and the backup well at Hunterdale. Neither, however, can be used for additional permanent capacity.

The City has three water storage tanks with the following capacities:

College Drive	-	300,000 gal.
Hunterdale	-	500,000 gal.
Pretlow	-	500,000 gal.

Based on production (well) capacity the system could be permitted for 2.4 mgd (0.5 gpm/ ERC; 1 ERC = 400gpd). Based on the storage capacity, the system could be permitted for 2.6 mgd.

### B. Historic Water Demand Data

Annual water withdrawals for each well and the total withdrawal from all wells are provided graphically in **Exhibit A** for the past 15 years.

The average daily demands for 1991 through 2005 are shown in **Exhibit B**.

The average daily demand for the year 2005 was 1.16 mgd.

### C. Future Demand

Future demand for potable water was developed based on input from City Staff and the current land use map for the City. Known potential developments and their associated projected demands are provided in **Appendix D**. Also shown in **Appendix D** are seven (7) undeveloped areas within the City. These areas are assumed to build out at one unit per 30,000 square feet of land area. Any zoning changes that increase density in these areas would require re-evaluation of the associated water demand.

All new demands are based on 300 gpd per equivalent residential unit (ERC). The Virginia Department of Health has recently been receptive to use of 300 gpd/ ERC for planning purposes. The previous standard was 400 gpd/ ERC.

The known potential developments and the seven undeveloped areas (UDA's) will demand approximately 1.3 mgd of potable water. Added to the current average daily demand, the total demand for the City of Franklin at build-out is projected to be approximately 2.46 mgd. The future demand is slightly above the 2.4 mgd the current well can provide and just under the rated capacity based on storage requirements.

Given the approximate nature of demand modeling, the conclusion can be drawn that no immediate water production facility improvements are required to serve the potable water needs of the City. Planning, design, and construction of new wells and storage will be required as demand approaches 80% and 90% of the rated capacity, respectively.

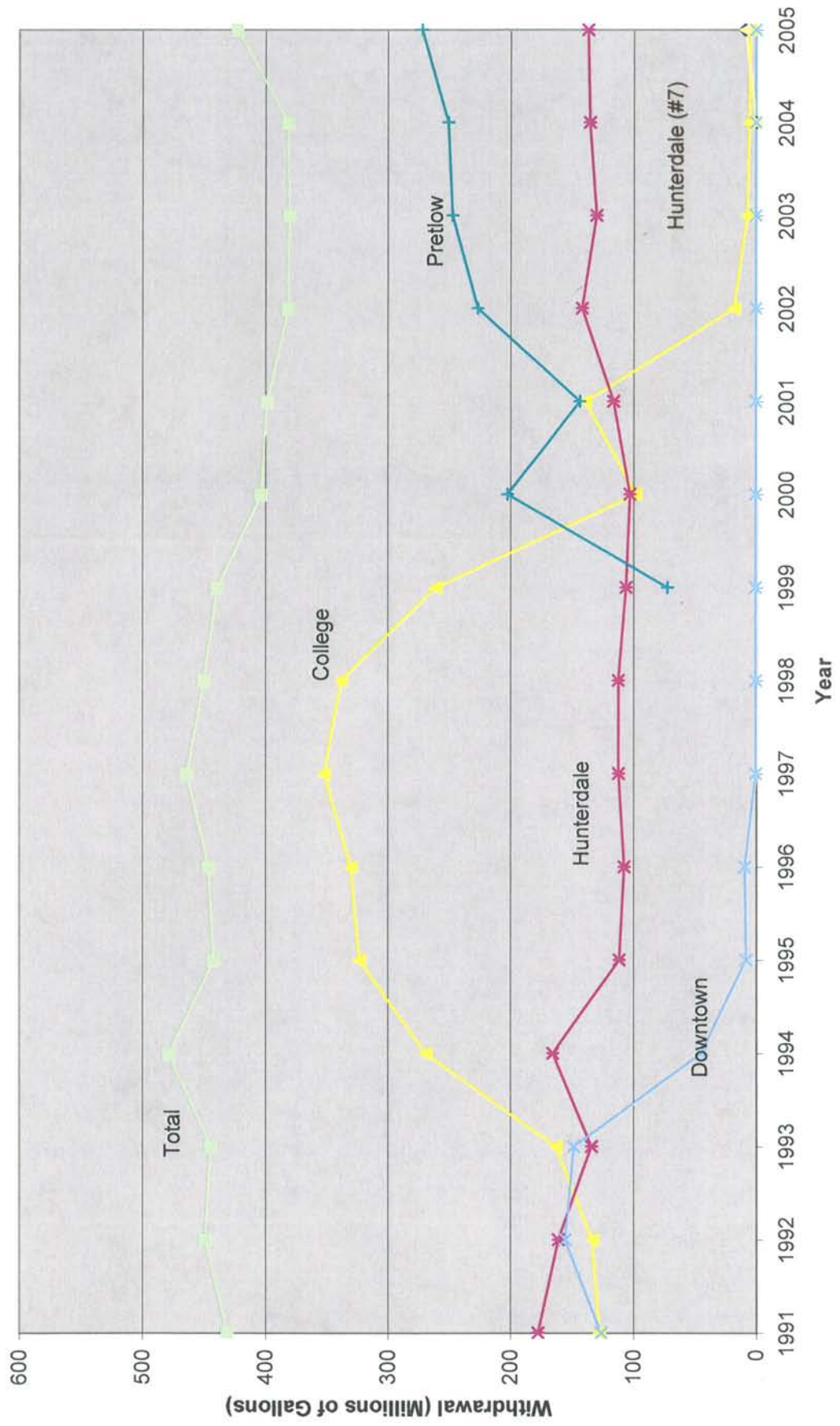
Additionally, the "permitted" capacity of the Waterworks has been limited to 1.8 mgd based on historic fluoride levels. Construction of the new Hunterdale Well and removal of the Mechanic Street and College Drive wells from the system has reduced fluoride levels as required by the Virginia Department of Health. Therefore, with the current wells and storage, the restriction could be lifted and the permitted capacity could be raised to 2.4 mgd.

Any water provided to County or other users will require additional storage, well, and pumping capacity.

#### **D. Withdrawal**

The City's current withdrawal permit allows groundwater withdrawal of 2.9 million gallons per day (mgd). The permitted allocation provides enough capacity for current and future demands within the City. However, an existing agreement between Southampton County and the City of Franklin provides up to 1.1 mgd of the allocation to Southampton County. If Southampton County uses the allocation, the Department of Environmental Quality withdrawal permit will require a modification to increase the withdrawal to 3.5 mgd (2.4 mgd for Franklin + 1.1 mgd for Southampton County).

**Exhibit A**  
**City of Franklin Water Withdrawal**



**EXHIBIT B**  
**City of Franklin**  
**Water Withdrawals**  
**(Millions of Gallons)**

Well	Year														
	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Downtown	125.81	154.94	147.9	44.06	7.67	8.68	0.063	0.065	0.159	0.064	0	0	0	0	0
College Drive	127.75	133.55	163.29	269.35	323.3	330.41	352.24	338.3	261.33	98.38	139.48	18.163	7.498	5.973	4.833
Hunterdale (#5)	177.67	160.84	133.89	165.49	111.44	107.53	112.06	112.28	105.94	102.85	116.4	141.698	130.1	135.478	136.826
Hunterdale (#7)														0.142	8.825
Pretlow									72.00	202.52	143.361	226.933	247.53	250.986	272.166
<b>Total</b>	<b>431.23</b>	<b>449.33</b>	<b>445.08</b>	<b>478.9</b>	<b>442.41</b>	<b>446.62</b>	<b>464.363</b>	<b>450.645</b>	<b>439.429</b>	<b>403.814</b>	<b>399.241</b>	<b>381.583</b>	<b>380.587</b>	<b>381.645</b>	<b>422.896</b>
<b>Average Day (MGD)</b>	<b>1.18</b>	<b>1.23</b>	<b>1.22</b>	<b>1.31</b>	<b>1.21</b>	<b>1.22</b>	<b>1.27</b>	<b>1.23</b>	<b>1.20</b>	<b>1.11</b>	<b>1.09</b>	<b>1.05</b>	<b>1.04</b>	<b>1.05</b>	<b>1.16</b>



## **VI. WASTEWATER TREATMENT**

The following is a broad overview of the City of Franklin, Virginia wastewater treatment capacity and the impact of future development on that capacity. A detailed Preliminary Engineering Report (P.E.R.) will be required to assess expansion of the wastewater treatment plant (WWTP) and the associated costs.

### **A. Existing System Description**

The City of Franklin Waste Water Treatment Plant (WWTP) is currently permitted by the Virginia Department of Environmental Quality to discharge to the Blackwater River under permit No. VA0023922, dated June 23, 2004. The permit is based on a 2 million gallon per day (2 mgd) average discharge rate.

### **B. Historic Wastewater Flows**

Annual average daily wastewater flows are provided graphically in **Exhibit C** for the year 2001 thru 2005. Average daily flows for 2005 were 0.98 million gallons per day (0.98 mgd) or about one-half the permitted discharge rate.

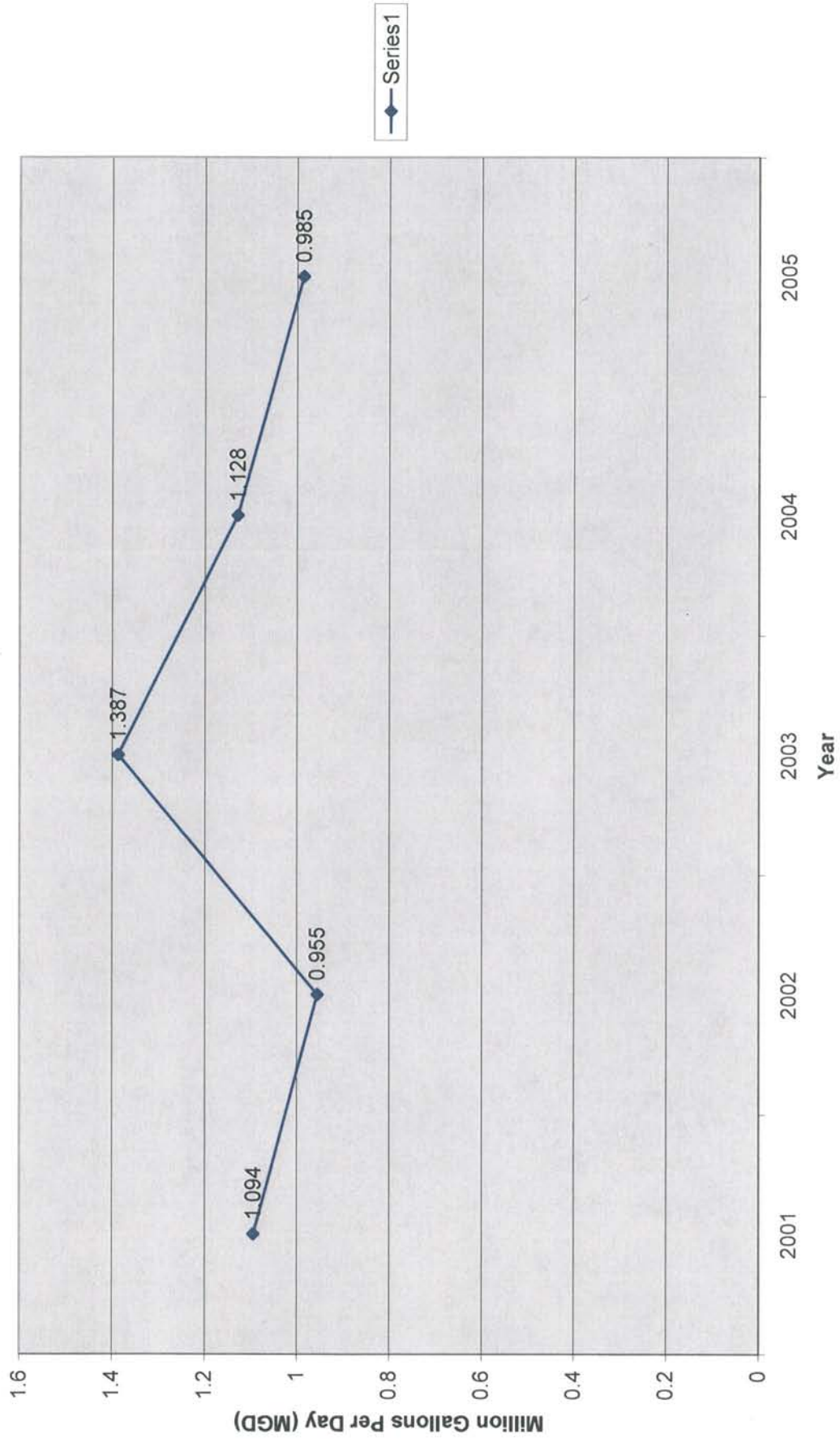
### **C. Future Demand**

Future demand for sewage treatment was developed based on input from City Staff and the current land use map for the City. Known potential developments and their associated treatment demands are provided in **Appendix D**. Also provided in **Appendix D** are seven (7) undeveloped areas within the City. The currently undeveloped areas are assumed to build out at one unit for every 30,000 square feet of land area. Any zoning changes that increase density in these areas would require re-evaluation of the associated sewage treatment demands.

All demands are based on 300 gallons per day (300 gpd) per equivalent residential unit (ERC). The Virginia Department of Health has recently been receptive to the use of 300 gpd/ERC for planning purposes. The historic standard has been 400 gpd/ERC. The known potential developments and seven undeveloped areas (UDA's) will demand approximately 1.3 mgd of additional sewage treatment capacity. Added to the current average daily demand, the total sewage demand for the City of Franklin at build-out is projected to be approximately 2.3 mgd. Since planning and design of new treatment facilities is required as flows reach 80% of the permitted capacity, a 1 mgd expansion to a capacity of 3 mgd is recommended when an expansion is required. Ultimately, a 3 mgd plant will provide enough capacity for the City at currently proposed build-out densities (3 mgd \* 80% = 2.4 mgd). For planning considerations, the probable cost of a 1 mgd expansion would likely be between \$8,000,000 and \$12,000,000.

Planning and design of a WWTP expansion will be required as average flows reach 1.6 mgd ( $2 \text{ mgd} * 80\%$ ) during three consecutive months. At 300 gpd/unit, this will allow treatment capacity for an additional 2000 single family units or a combination of less residential units plus commercial units (0.6 mgd) before planning and design of a plant expansion would be required.

Exhibit C  
City of Franklin Average Daily Wastewater Flows



## **VII. PROBABLE COSTS**

Cost opinions are located in **Appendix J – Probable Costs**. Opinions of cost for sanitary sewer include the cost upgrades for the existing sewer system. Estimates are also included for the water distribution system in the same breakdown. Upgrades within the City of Franklin related to future development should be at the expense of the developer. Upgrades to facilities conveying water or sewage to and from areas outside the City of Franklin should also be completed at the expense of the developer.

# **APPENDIX A**

## **FLOW METER LOCATIONS AND FLOW DATA**

SEWER FLOW DATA  
OBTAINED FROM FLOW METERS

Day	Date	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14
Tuesday	20-Sep	294.07	55.95	74.93	66.01	248.24	49.06	47.18	131.06	179.37	58.54	40.82	16.50	12.33	31.14
Wednesday	21-Sep	284.90	34.67	87.31	63.00	331.45	49.94	46.52	159.37	196.26	55.49	39.06	23.56	16.97	25.56
Thursday	22-Sep	169.38	34.92	58.61	77.64	239.61	45.70	45.93	154.57	150.15	51.79	34.27	16.00	14.02	19.42
Friday	23-Sep	185.66	38.61	63.89	81.02	222.69	47.92	45.95	173.84	149.78	51.49	32.80	17.17	13.82	20.61
Saturday	24-Sep	181.68	37.26	74.26	82.95	224.74	49.74	46.75	167.25	147.63	54.37	32.02	20.36	14.06	23.82
Sunday	25-Sep	171.23	40.53	64.24	86.92	202.80	50.44	48.20	153.04	144.03	52.69	35.12	18.08	13.04	20.90
Monday	26-Sep	198.57	38.86	61.41	103.19	194.97	46.36	48.72	156.75	145.92	53.34	31.77	14.36	12.72	20.90
Tuesday	27-Sep	169.17	40.02	65.43	68.16	203.86	48.16	49.17	161.69	150.02	51.56	35.94	15.55	13.38	21.45
Wednesday	28-Sep	166.93	36.44	67.29	66.11	197.42	49.36	49.93	163.34	143.28	46.27	34.59	14.68	12.20	25.05
Thursday	29-Sep	218.47	44.08	67.75	64.06	190.34	49.36	50.57	139.93	144.95	50.88	35.27	15.55	13.00	24.60
Friday	30-Sep	178.63	44.00	63.34	58.99	192.66	52.62	51.28	142.07	136.36	47.22	34.54	14.60	12.39	26.48
Saturday	1-Oct	195.12	41.36	70.31	61.86	205.55	47.31	52.24	141.99	144.47	47.61	31.93	14.61	10.45	26.63
Sunday	2-Oct	184.84	38.35	51.05	76.88	191.25	50.42	53.03	133.10	142.90	43.03	30.38	13.91	11.27	32.81
Monday	3-Oct	156.66	36.42	51.92	83.30	192.71	52.43	53.53	134.01	142.36	51.21	33.99	14.88	10.77	31.43
Tuesday	4-Oct	204.18	34.44	75.82	59.97	203.57	56.29	54.18	150.59	149.24	54.32	30.60	15.42	10.63	26.89
Wednesday	5-Oct	197.73	46.58	64.11	65.48	202.41	48.66	54.80	146.77	148.93	57.14	30.81	14.05	11.82	28.63
Thursday	6-Oct	191.19	45.10	68.04	87.33	183.09	56.30	55.50	142.00	144.13	53.98	28.53	14.89	9.50	25.23
Friday	7-Oct	216.54	38.74	89.71	60.67	281.34	46.44	56.39	163.66	176.15	53.64	36.35	17.36	18.87	28.10
Saturday	8-Oct	427.07	71.54	91.50	75.46	486.45	70.69	56.45	176.29	329.40	78.81	68.30	50.13	40.96	73.78
Sunday	9-Oct	273.32	43.27	108.09	61.18	273.59	66.26	54.06	145.51	235.52	66.72	56.27	53.99	35.42	75.56
Monday	10-Oct	246.12	59.77	78.18	62.41	224.97	59.08	52.86	152.25	178.35	58.85	46.94	35.86	27.71	60.41
Tuesday	11-Oct	215.98	31.35	74.27	79.65	226.61	52.82	52.59	137.86	160.93	52.90	42.21	29.92	23.98	47.51
Wednesday	12-Oct	203.74	48.45	73.55	67.11	209.56	50.03	52.57	137.23	159.68	56.70	39.67	26.47	25.67	42.38
Thursday	13-Oct	187.16	59.37	67.38	67.16	211.16	53.30	52.47	128.12	150.75	52.46	36.13	24.56	22.13	46.53
Friday	14-Oct	193.31	68.82	70.92	58.92	219.66	51.42	52.67	154.26	146.22	55.91	33.81	24.41	22.82	27.60
Saturday	15-Oct	265.18	68.61	76.12	71.60	206.58	51.89	52.06	154.22	153.10	53.82	35.67	23.19	26.15	29.75
Sunday	16-Oct	273.10	57.25	73.99	66.99	206.12	53.97	50.17	137.10	151.15	47.24	37.68	27.63	25.86	29.62



UNRELIABLE DATA

AVG. DAY  
AVG. WEEK

PRISM CONTRACTORS ENGINEERS, INC.  
KIMLEY-HORN AND ASSOCIATES, INC.



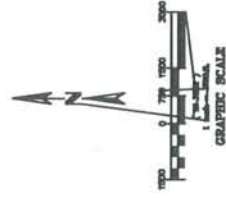
Kimley-Horn  
and Associates, Inc.



LEGEND



FLOW METER  
LOCATION



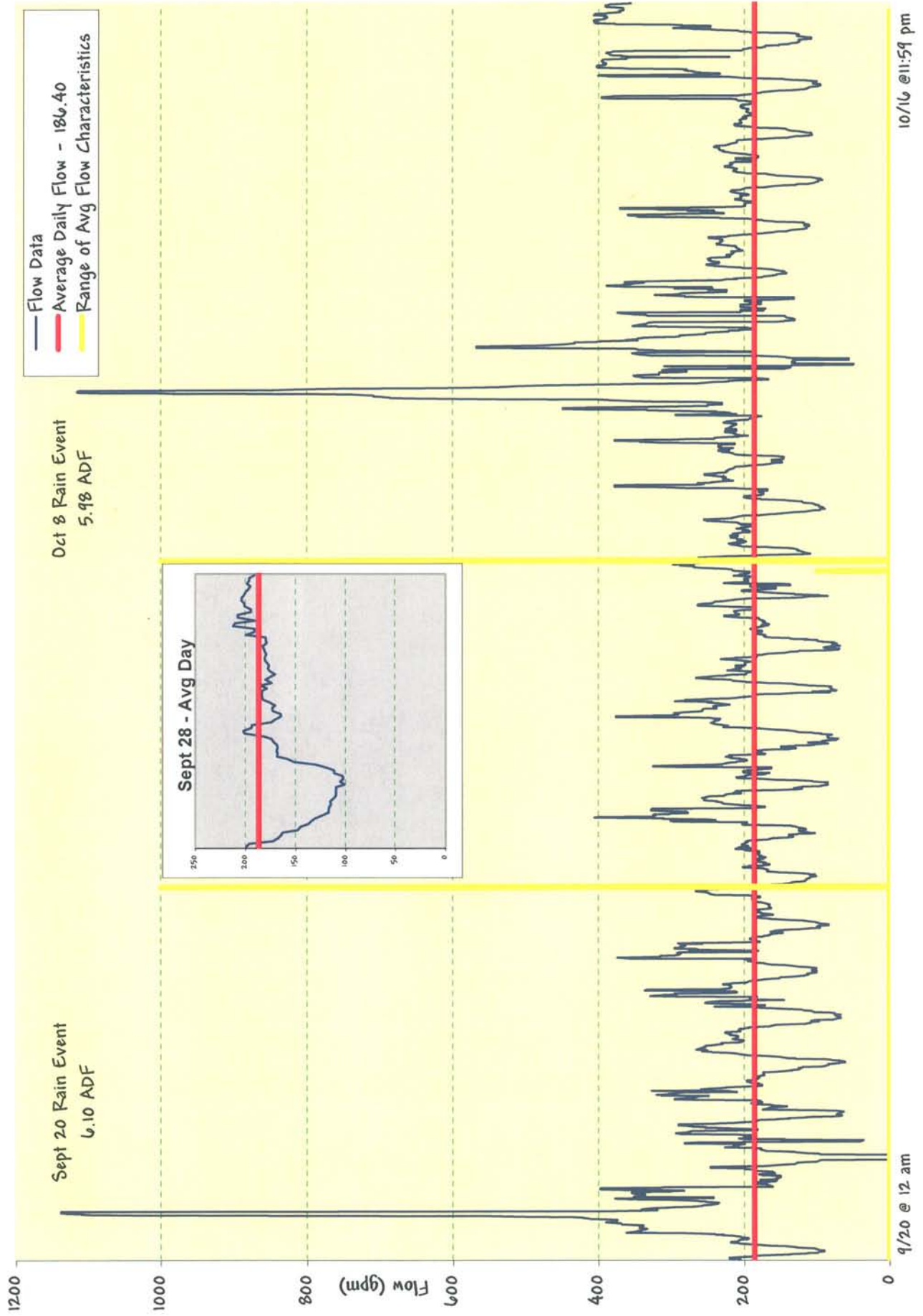
FLOW METER LOCATIONS  
FRANLIN, VIRGINIA

SEWER IMPACT ASSESSMENT

Prism Contractors 108 Quakerbridge Drive Northen, Virginia 23042 (757) 874-1021 (Office) (757) 873-0871 (Fax) PRISM@KAC.COM	Scale 1" = 100'	Date 1/28/2006
Project Sewer Impact Assessment	Sheet 1 of 1	Drawn JLD/2/06

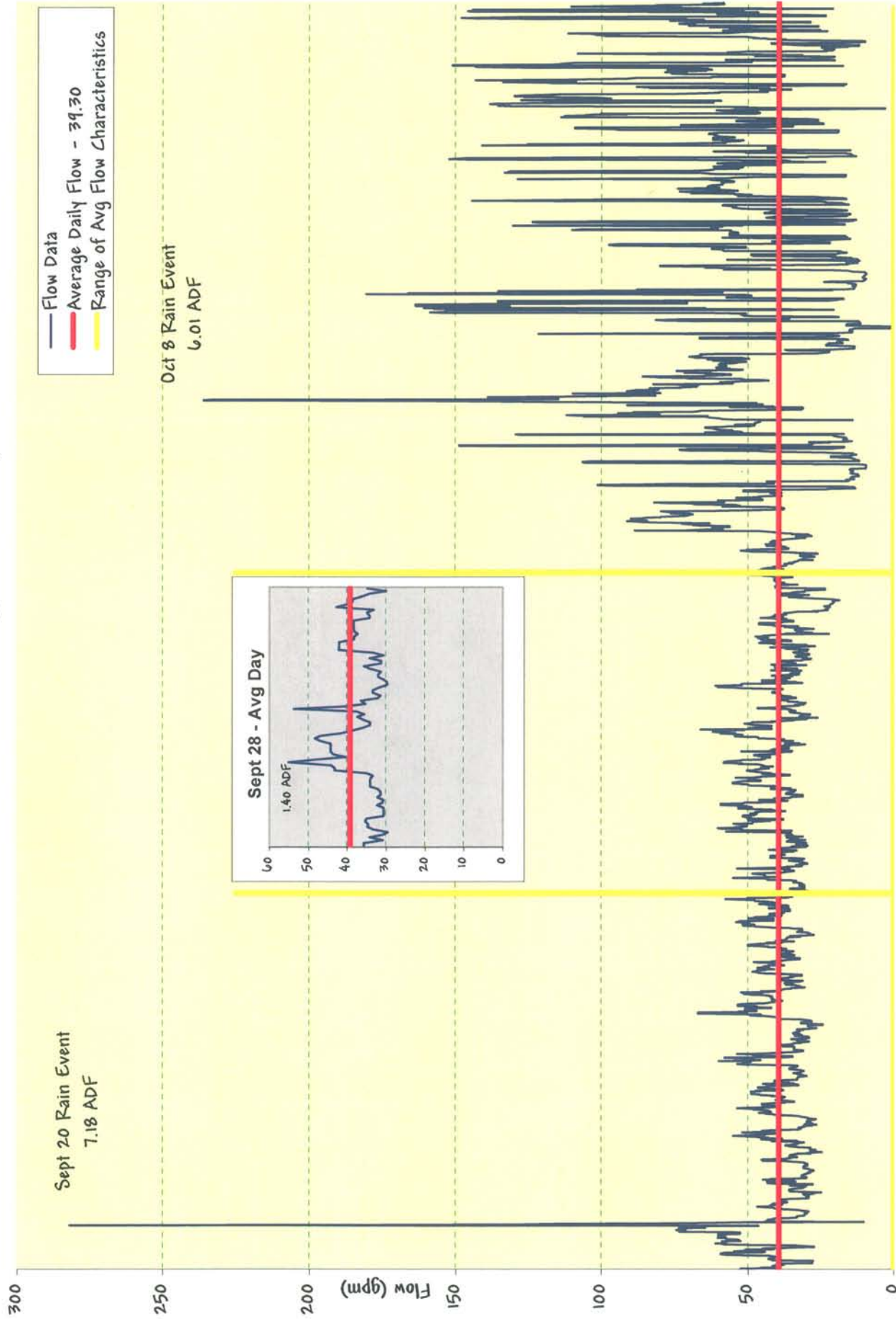


# Flow Data for Area 1 (9/20 - 10/16)





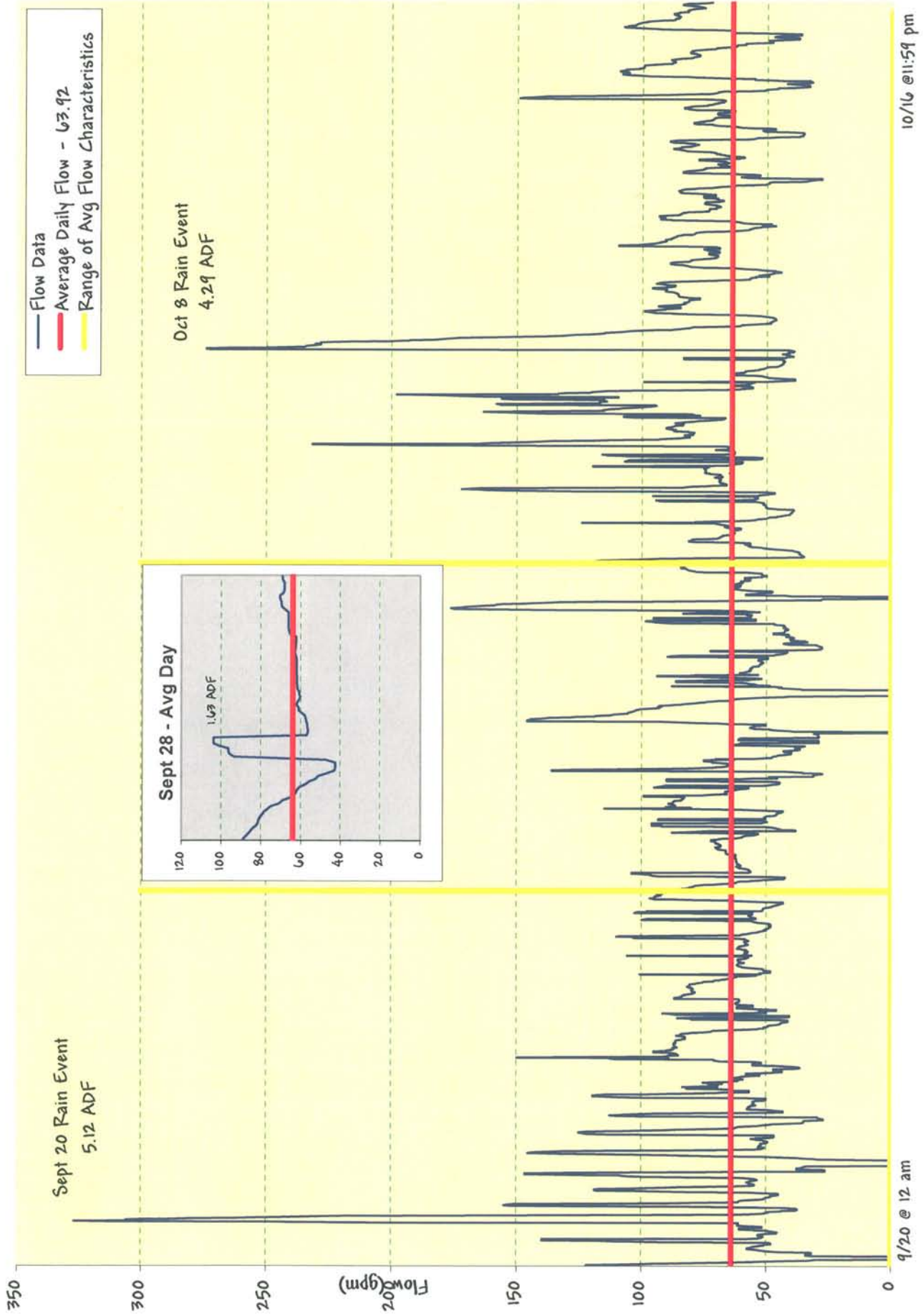
# Flow Data for Area 2 (9/20 - 10/16)



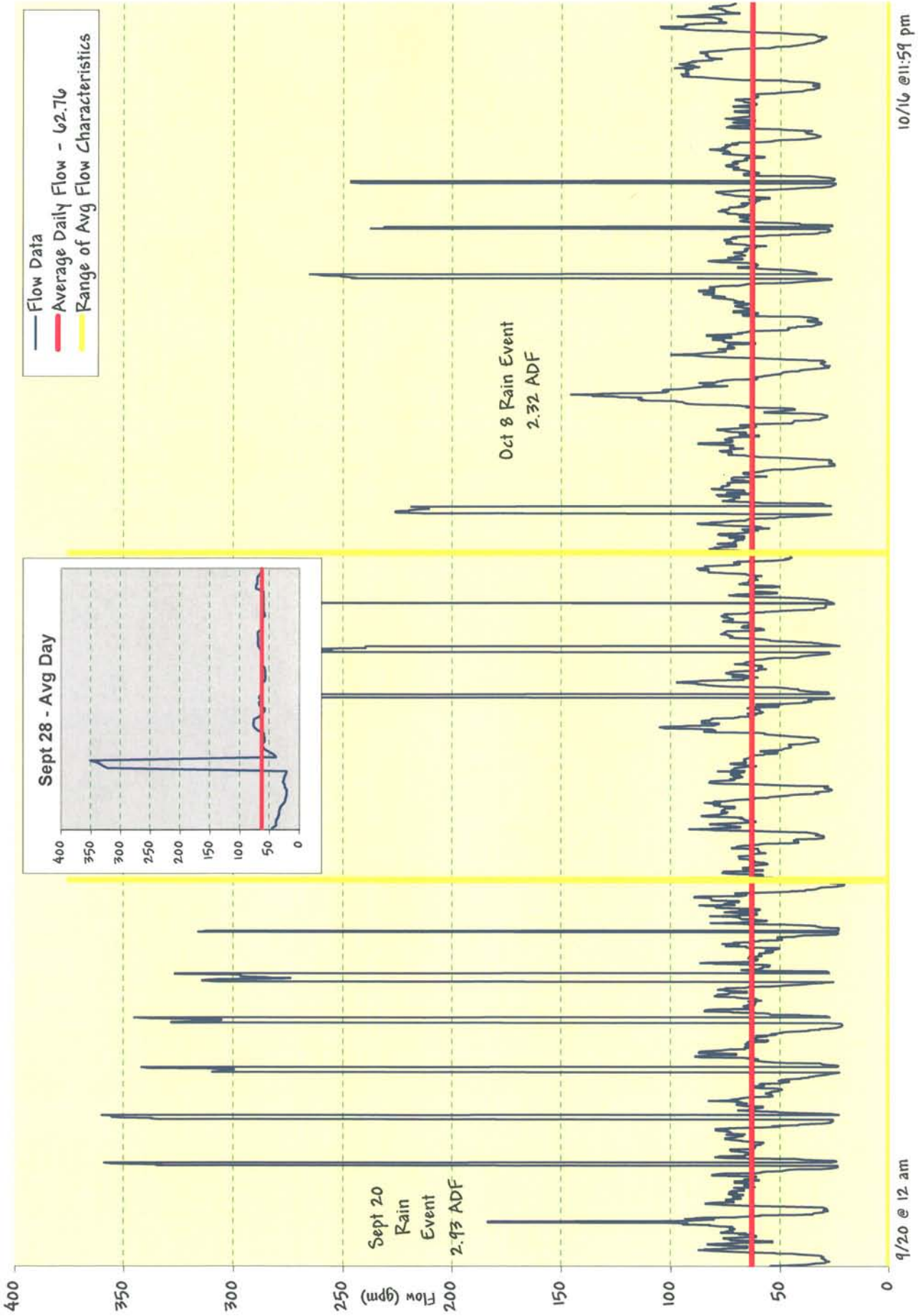
9/20 @ 12 am

10/16 @ 11:59 pm

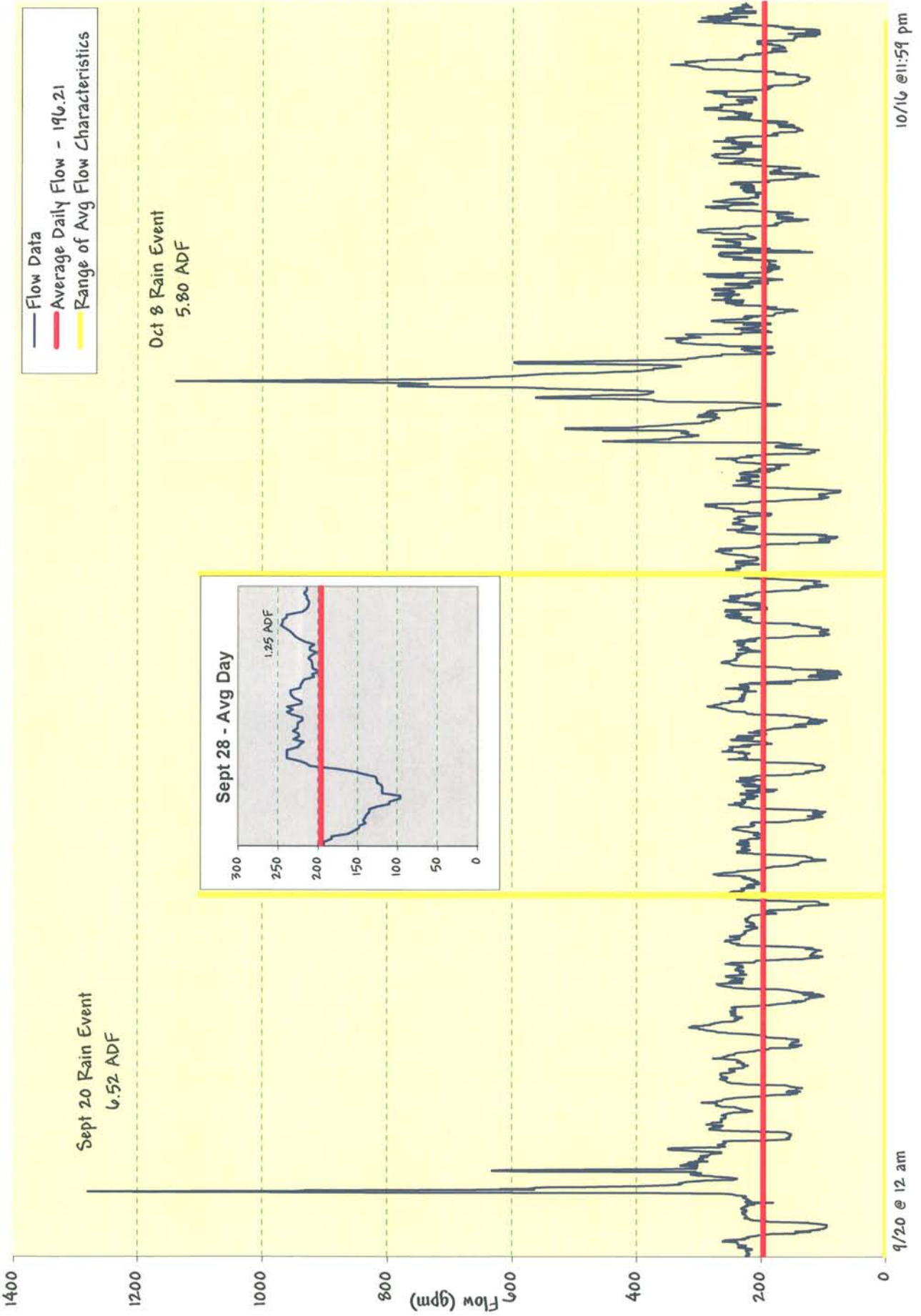
# Flow Data for Area 3 (9/20 - 10/16)



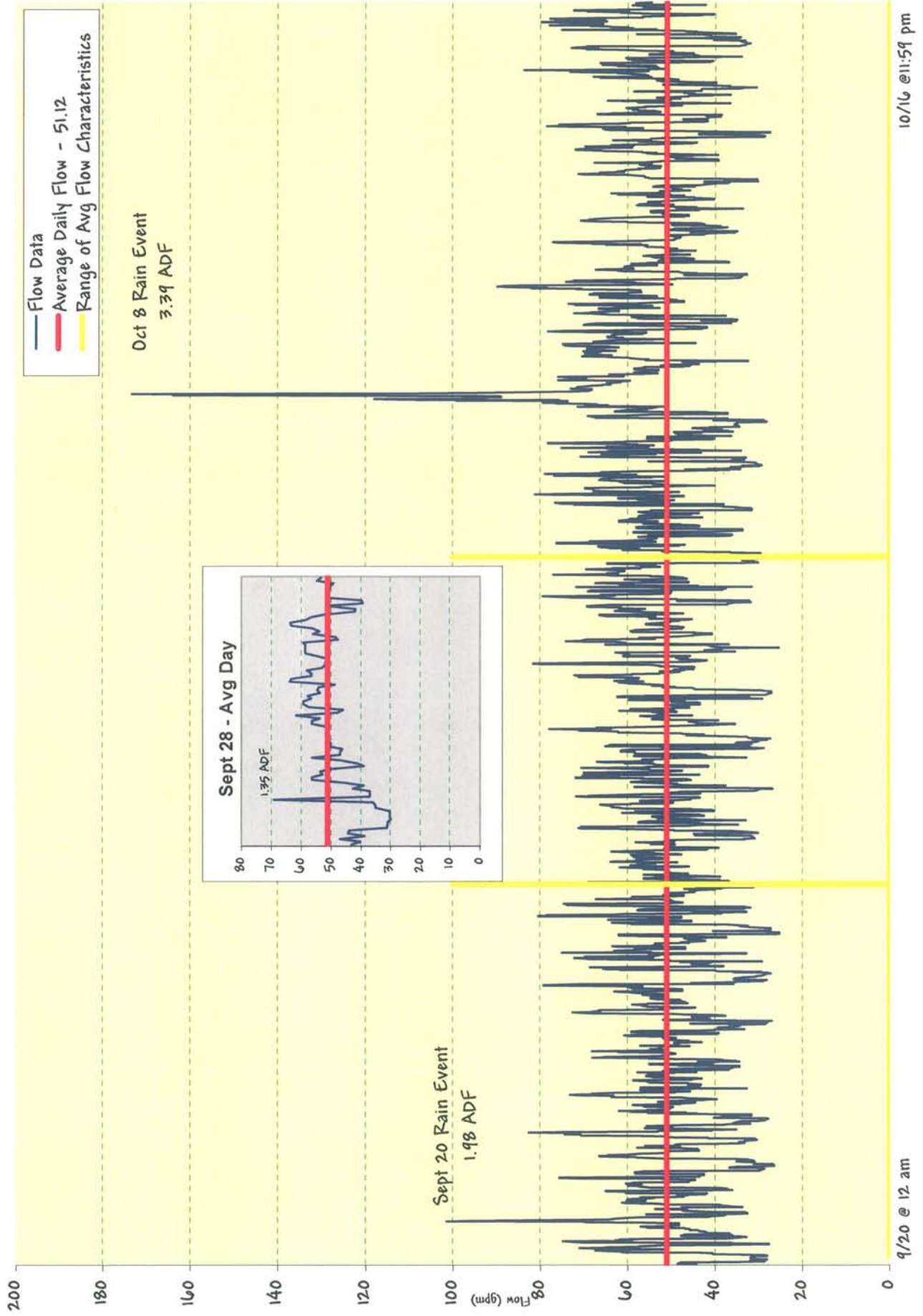
# Flow Data for Area 4 (9/20 - 10/16)



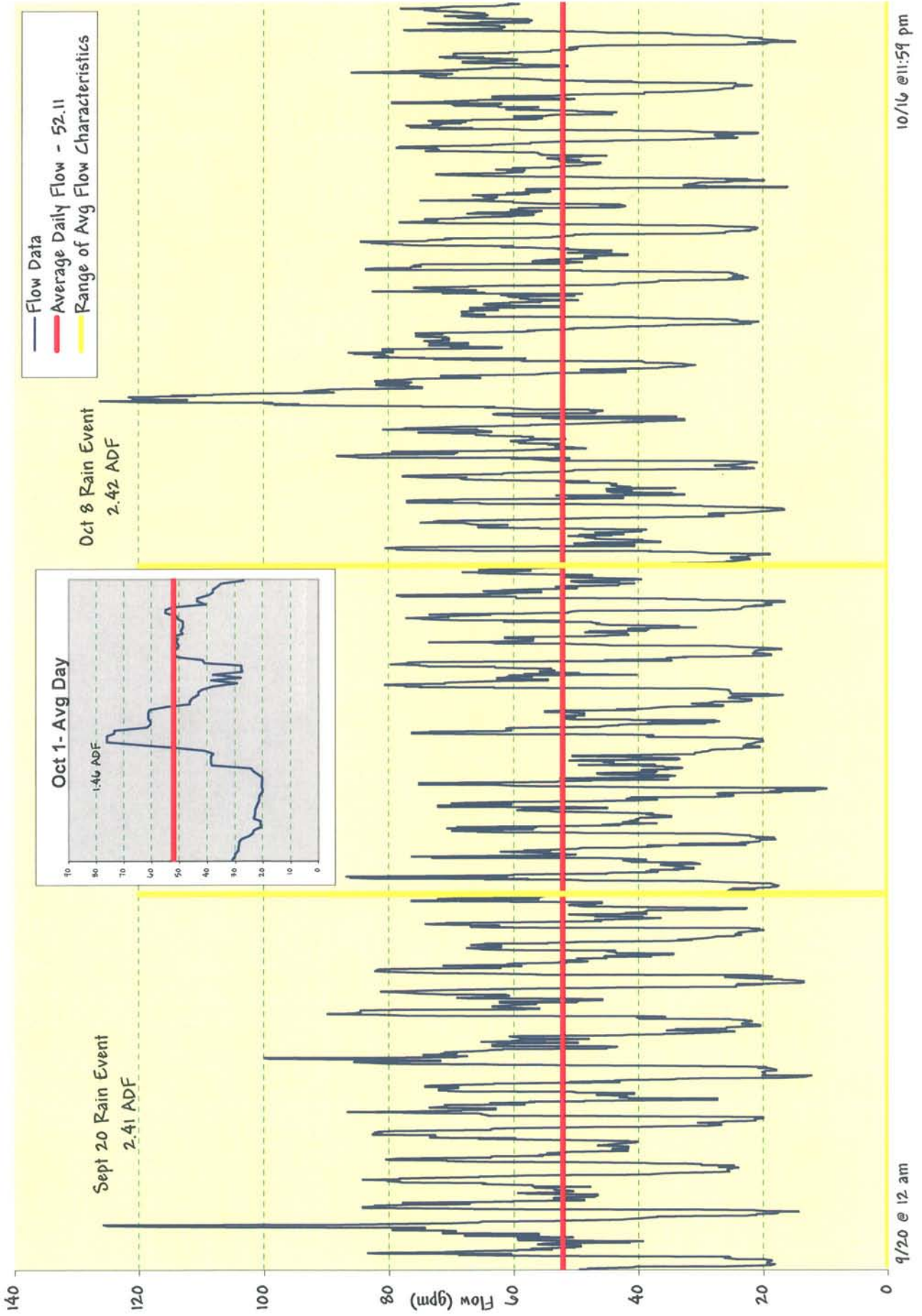
# Flow Data for Area 5 (9/20 - 10/16)



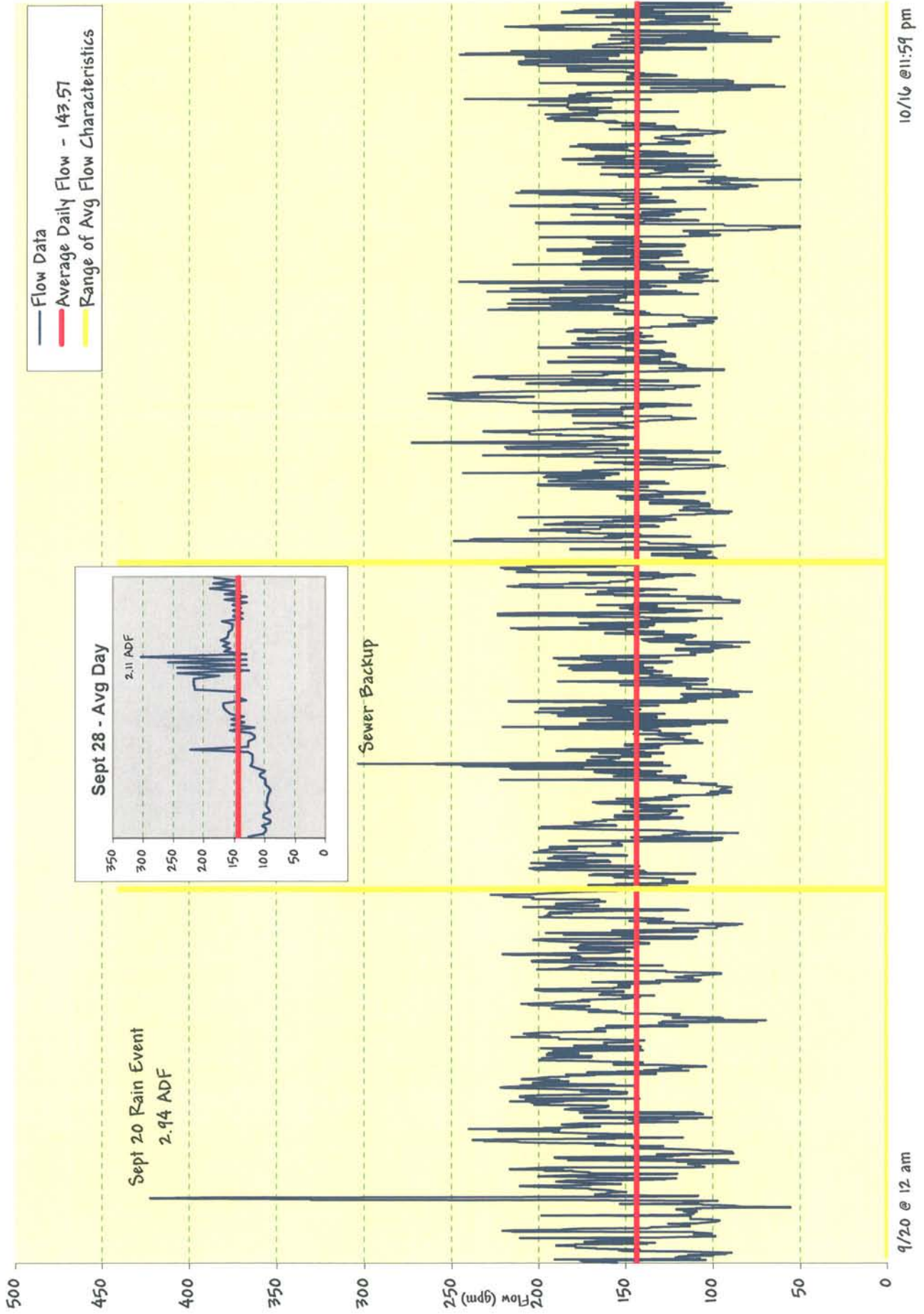
# Flow Data for Area 6 (9/20 - 10/16)



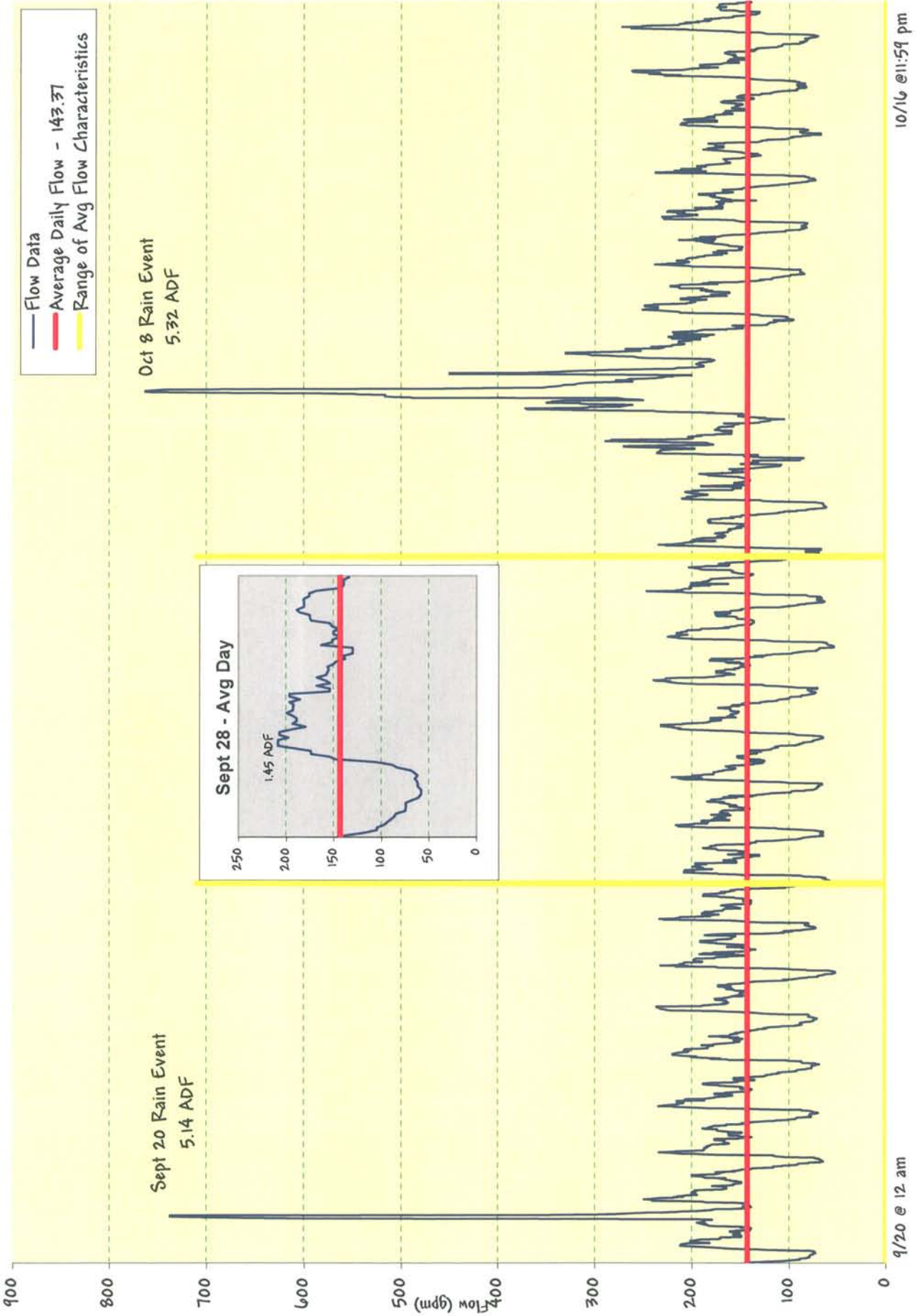
# Flow Data for Area 7 (9/20 - 10/16)



# Flow Data for Area 8 (9/20 - 10/16)

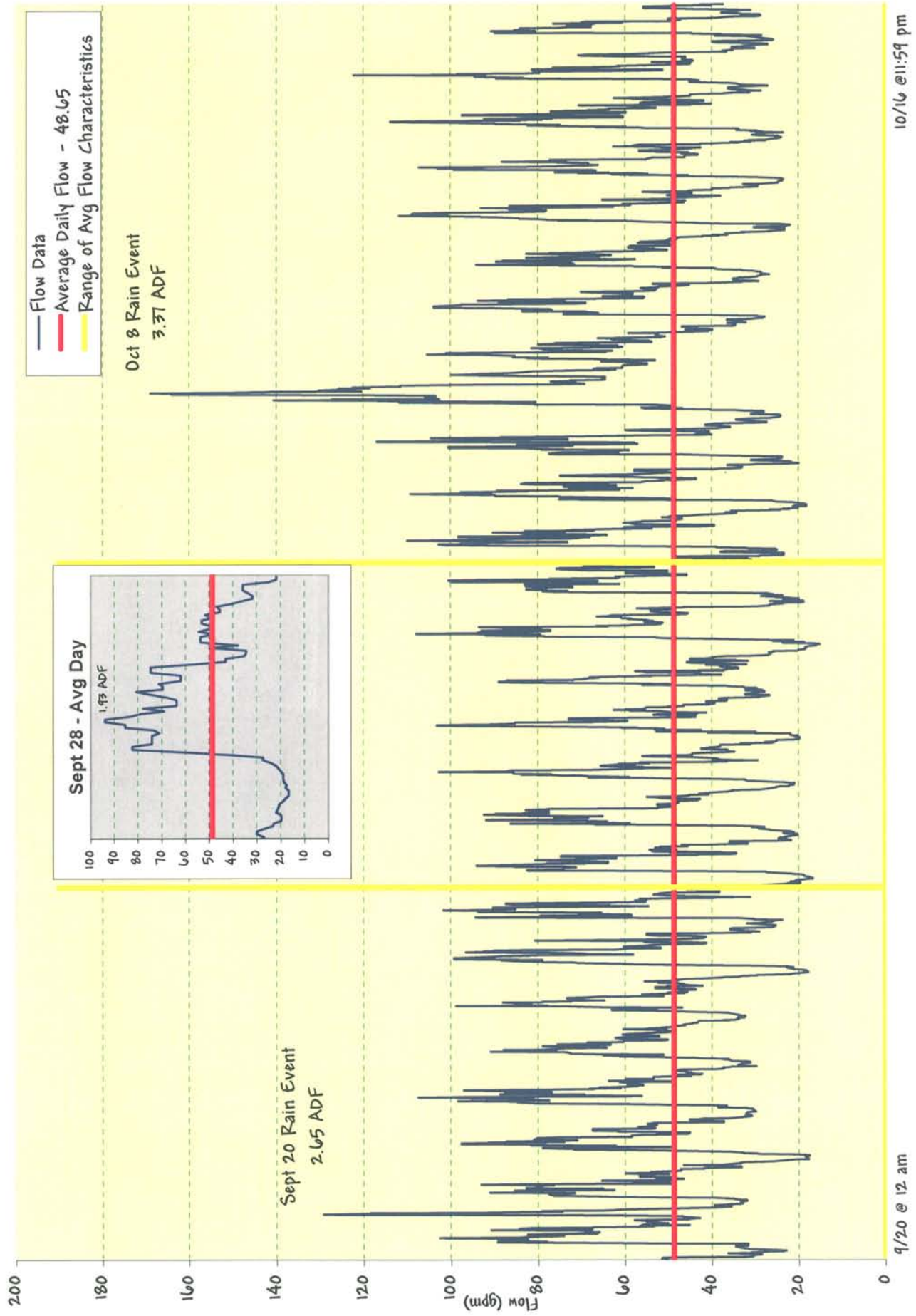


# Flow Data for Area 9 (9/20 - 10/16)

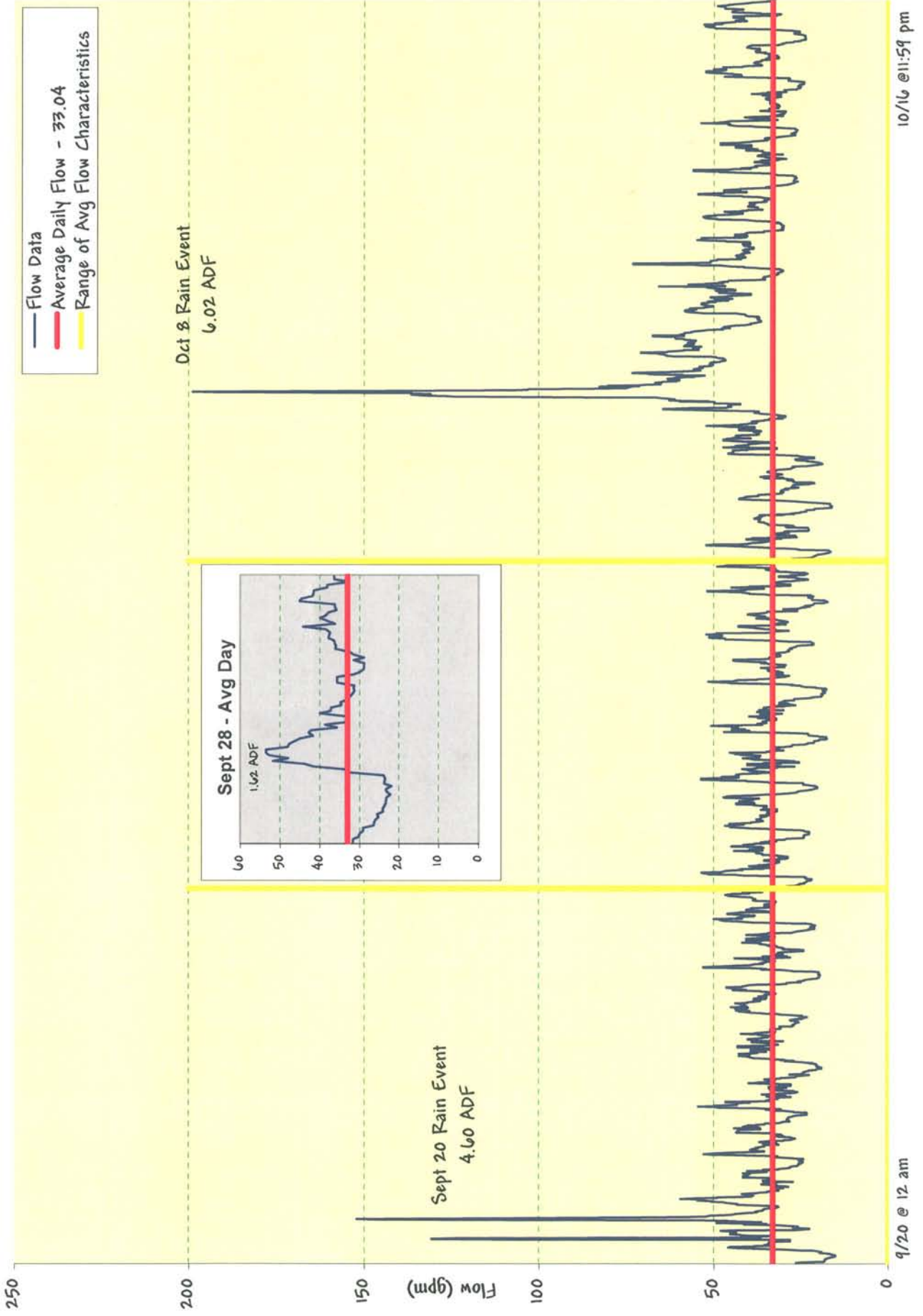




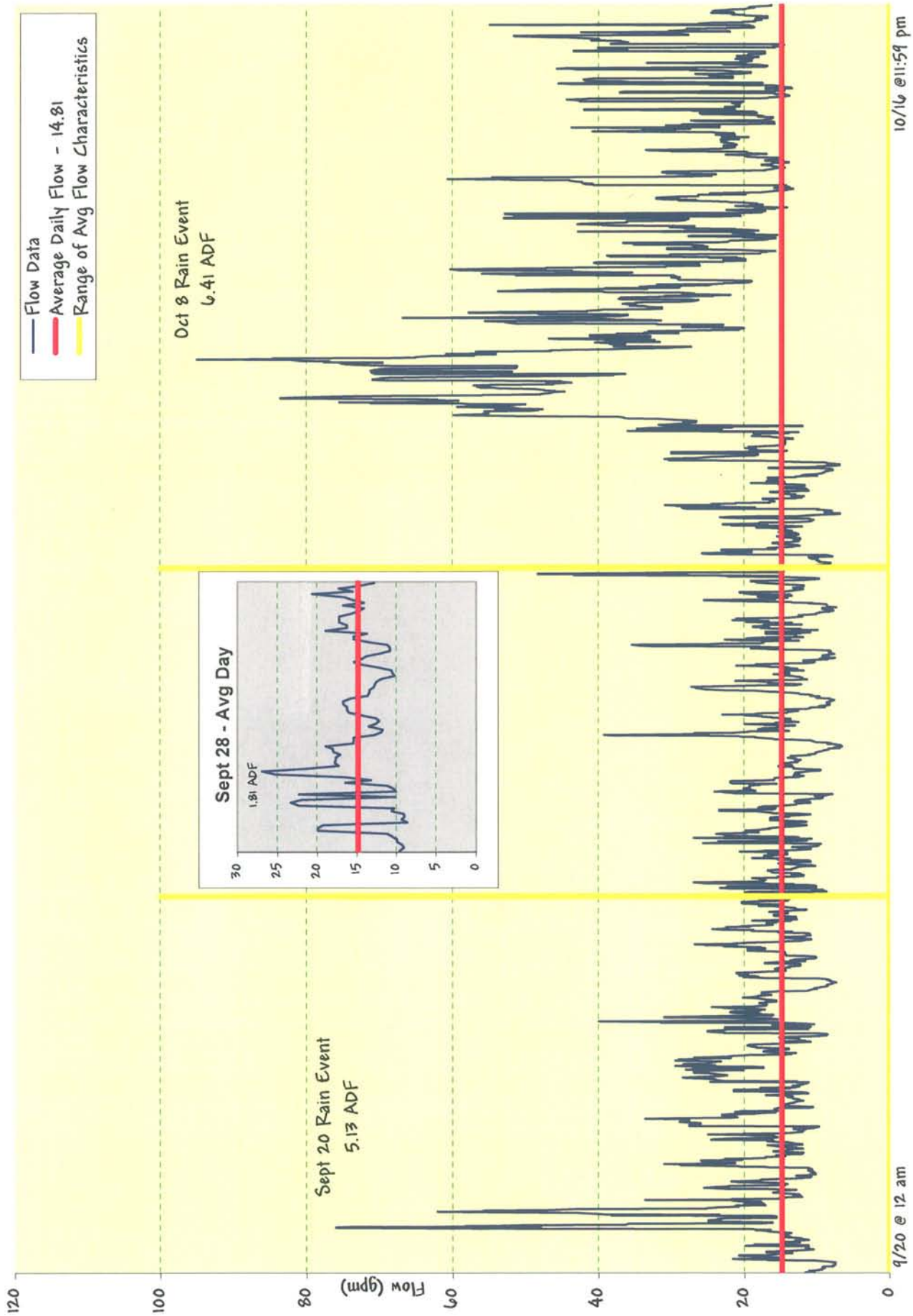
# Flow Data for Area 10 (9/20 - 10/16)



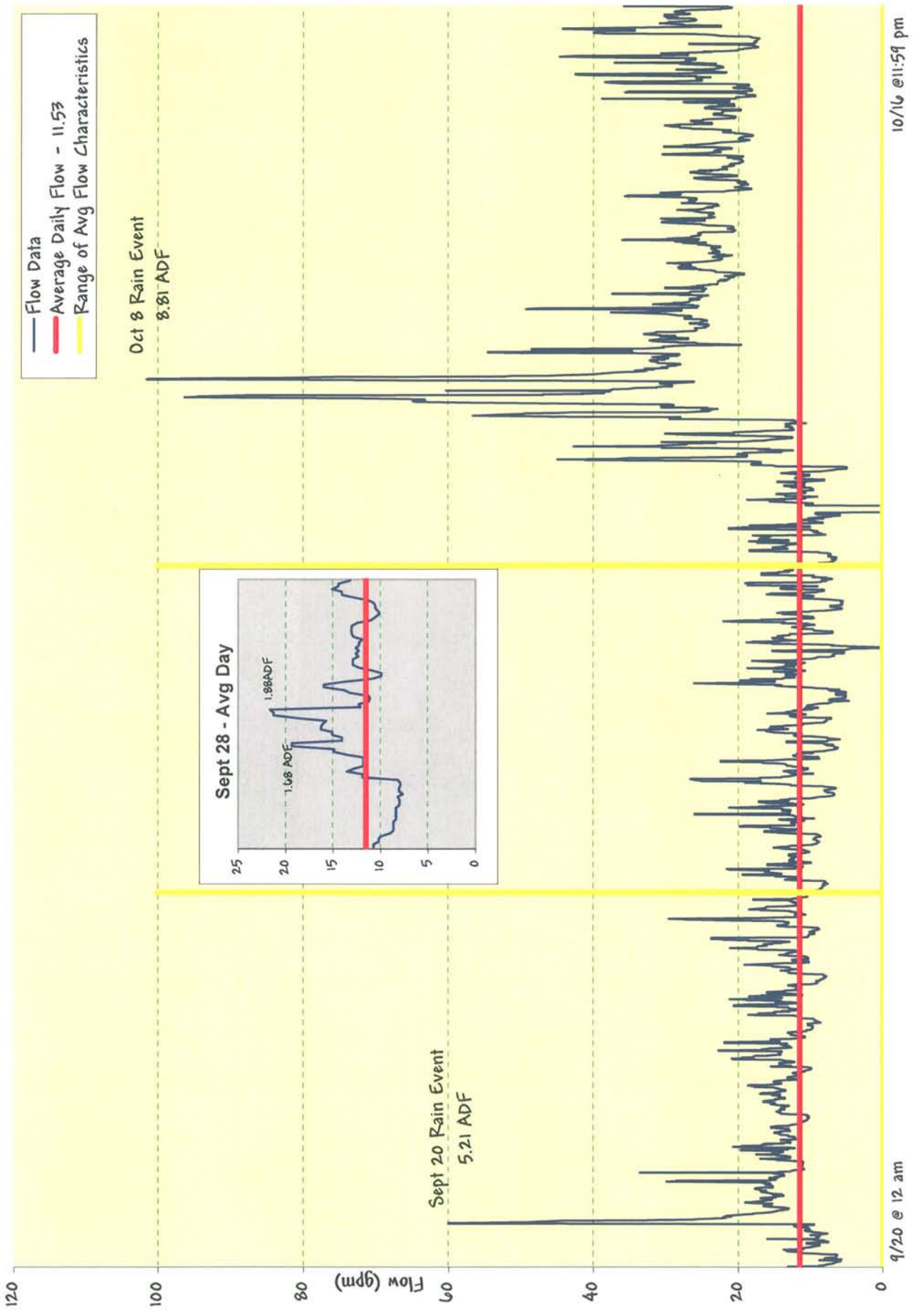
# Flow Data for Area II (9/20 - 10/16)



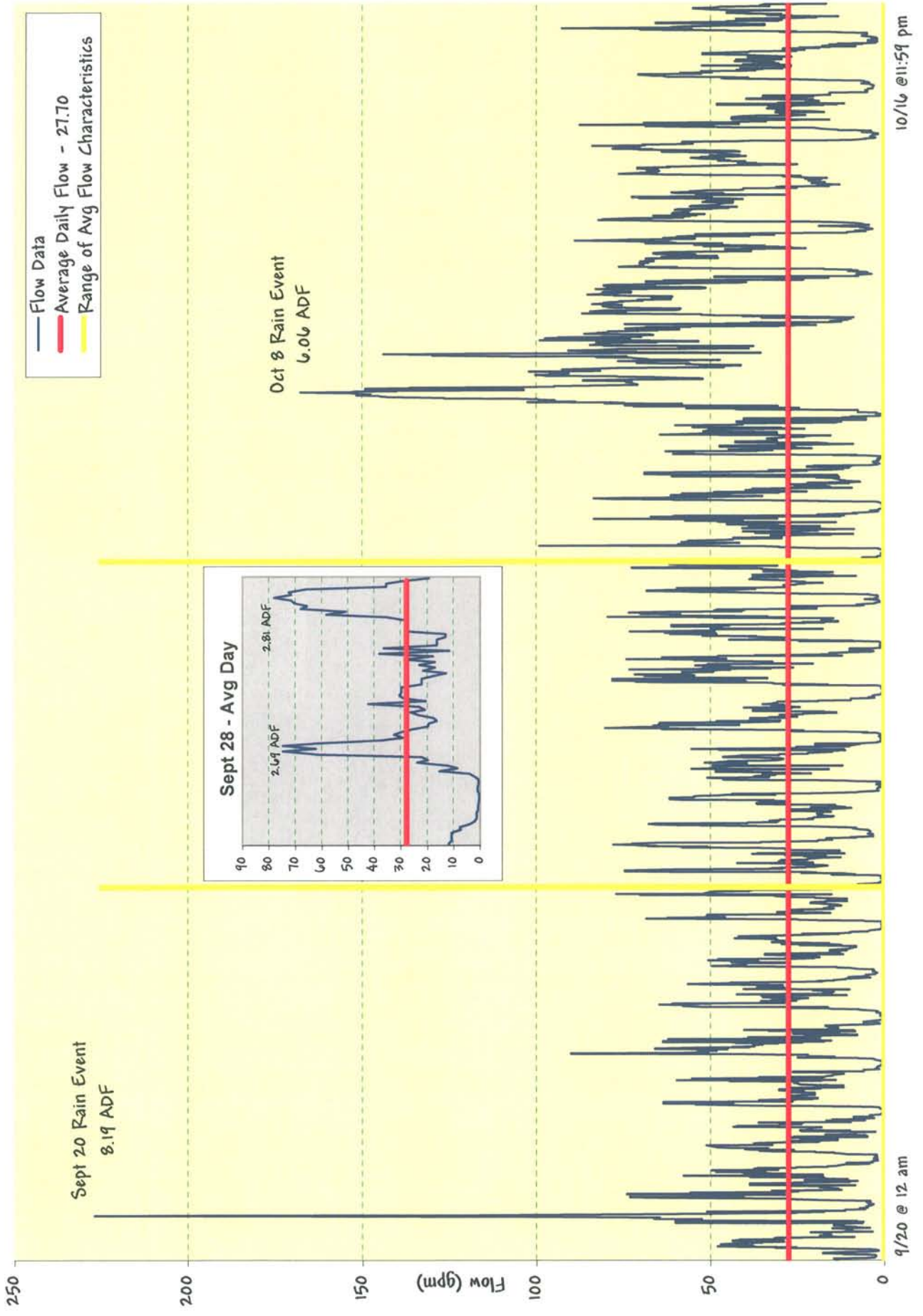
# Flow Data for Area 12 (9/20 - 10/16)



# Flow Data for Area 13 (9/20 - 10/16)



# Flow Data for Area 14 (9/20 - 10/16)



# **APPENDIX B**

## **INFLOW AND INFILTRATION (I/I) SUMMARY**

INFLOW INFILTRATION SUMMARY

Flow Area	AVG GPM	1&1 PEAK FACTOR	PEAK GPM	GPD	FT OF PIPE	GPD/FT OF PIPE	PRIORITY
1*	189.76	3.7	702.112	273,254	21,000	13.01	2
2	36.31	5.3	192.443	52,286	8,100	6.46	5
3	25.68	4.8	123.264	36,979	23,900	1.55	12
4	13.56	4.3	58.308	19,526	14,100	1.38	13
5**							
6	23.35	5.4	126.09	33,624	7,400	4.54	8
7	16.24	3.9	63.336	23,386	12,400	1.89	11
8	33.39	4.4	146.916	48,082	10,300	4.67	7
9***	153.84	3.2	492.288	149,530	21,190	7.06	4
10	31.53	3.2	100.896	45,403	14,100	3.22	9
11	36.39	4.6	167.394	52,402	8,610	6.09	6
12	35.77	1.9	67.963	51,509	5,610	9.18	3
13	31.13	2.9	90.277	44,827	3,050	14.70	1
14	47.5	2.7	128.25	68,400	33,787	2.02	10

\*AREAS 3 AND 4 SUBTRACTED

\*\*FLOW AREA 5 DATA NOT RELIABLE

\*\*\*12,000 GALLONS FROM EDGEHILL AND AREA 10 SUBTRACTED

PRISM CONTRACTORS ENGINEERS, INC.  
KIMLEY-HORN AND ASSOCIATES, INC.

## **APPENDIX C**

**SANITARY SEWER SYSTEM IMPACT ASSESSMENT  
(Pump Stations, Force Mains, Gravity Sewer)**



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
RIVER ROADS FARM PUMP STATION (01)		
- EXISTING	7.25	49 HOUSES X 213 GPD (BASED ON WATER STUDY)
- EXISTING NURSING HOME	9.57	97 UNITS X 142 GPD (BASED ON WATER STUDY)
- EDGEHILL IN SOUTHAMPTON COUNTY	18.75	BASED ON 90 HOUSES @ 300 GPD
- LOCATION 35 - NURSING HOME ADDITION	3.75	27 UNITS @ 200 GPD
TOTAL FLOW	39.31	
PUMP RATE REQUIRED (2.5 X ADF)	98.28	
PUMP CAPACITY CURRENT	260	BASED ON FIELD TEST
WETWELL SIZE (SF)	28.27	6' DIAMETER WETWELL (APPROX.)
AVAILABLE DRAWDOWN (FT)	2.5	
AVAILABLE VOLUME (GALLONS)	528.71	
AVAILABLE RETENTION TIME (MIN)	13.45	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	1.78	
TOTAL CYCLE TIME (MIN)	11.78	



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
WOODLAND PUMP STATION I (02)		
- EXISTING	6.06	41 HOUSES X 213 GPD (BASED ON WATER STUDY)
- LOCATION 3 - WYNDHAM CROSSING	7.08	BASED ON 34 HOMES @ 300 GPD
- WOODLAND PUMP STATION II FLOW - EXISTING	2.96	30 HOUSES X 213 GPD (BASED ON WATER STUDY)
LOCATION 3A - ADULT COMMUNITY	63.47	BASED ON 457 UNITS @ 200 GPD
- WOODLAND PS III - 13 VACANT LOTS	2.71	BASED ON 13 HOUSES @ 300 GPD
TOTAL FLOW	82.28	
PUMP RATE REQUIRED (2.5 X ADF)	205.70	
PUMP CAPACITY CURRENT	300	BASED ON FIELD TEST
NETWELL SIZE (SF)	28.27	6' DIAMETER NETWELL (APPROX.)
AVAILABLE DRAWDOWN (FT)	2.5	
AVAILABLE VOLUME (GALLONS)	528.71	
AVAILABLE RETENTION TIME (MIN)	6.43	OK
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	2.43	
TOTAL CYCLE TIME (MIN)	8.85	



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
WOODLAND PUMP STATION II (03)		
- EXISTING	2.96	30 HOUSES X 213 GPD (BASED ON WATER STUDY)
- LOCATION 3A - ADULT COMMUNITY	63.47	
- 13 VACANT LOTS	2.71	BASED ON 13 HOUSES @ 300 GPD
TOTAL FLOW	69.14	
PUMP RATE REQUIRED (2.5 X ADF)	172.84	
PUMP CAPACITY CURRENT	100	BIGGER PUMPS REQUIRED
WETWELL SIZE (SF)	28.27	6' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	2.5	CK DRAWDOWN DEPTH
AVAILABLE VOLUME (GALLONS)	528.71	UPGRADE 2" FM TO 4"
DESIRED RETENTION TIME (MIN)	7.65	OK
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	22.40	
TOTAL CYCLE TIME (MIN)	32.40	
FM SIZE	2"	UPGRADE FM TO 4"



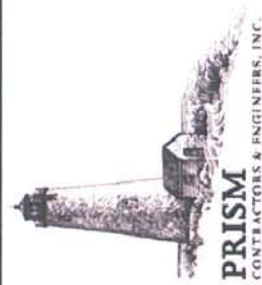
FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
CYPRESS PUMP STATION (04)		
-EXISTING	51.57	(BASED ON FLOW METER DATA)
-UNKNOWN DEVELOPMENT AREA 3	31.67	BASED ON A POSSIBLE 152 HOMES @ 300 GPD
-UNKNOWN DEVELOPMENT AREA 4	1.88	BASED ON 9 HOUSES @ 300 GPD
-LOCATION 60 JOYNER FARMS	10.42	BASED ON 50 HOUSES @ 300 GPD
-UNKNOWN DEVELOPMENT AREA 5	8.96	BASED ON A POSSIBLE 43 HOUSES @ 300 GPD
TOTAL FLOW	104.50	
PUMP RATE REQUIRED (2.5 X ADF)	261.24	
PUMP CAPACITY CURRENT	350	
WETWELL SIZE (SF)	86	RECTANGULAR WETWELL - INFO FROM PLANS
AVAILABLE DRAWDOWN (FT)	4	
AVAILABLE VOLUME (GALLONS)	2573.12	
AVAILABLE RETENTION TIME (MIN)	24.62	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	4.26	
TOTAL CYCLE TIME (MIN)	14.26	



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
RAWLS PUMP STATION (05)		NO IMPACT FROM FUTURE DEVELOPMENT
CLAY STREET PUMP STATION (06)		
- EXISTING	6.36	43 HOUSES X 213 GPD (BASED ON WATER STUDY)
- UNKNOWN DEVELOPMENT AREA 2	53.75	BASED ON 258 POSSIBLE HOUSE @ 300 GPD
- LOCATION 7 - MADISON ESTATES	54.17	BASED ON 260 HOUSES @ 300 GPD
TOTAL FLOW	114.28	
PUMP RATE REQUIRED (2.5 X ADF)	285.70	
PUMP CAPACITY CURRENT	200	NEED PUMP UPGRADE
WETWELL SIZE (SF)	19.63	5' DIAMETER WETWELL - NEED 8' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	2.5	
AVAILABLE VOLUME (GALLONS)	367.16	
AVAILABLE RETENTION TIME (MIN)	3.21	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	4"	OK
BAILEY DRIVE PUMP STATION (07)		NO IMPACT FROM FUTURE DEVELOPMENT
ARMORY DRIVE PUMP STATION (08)		NO IMPACT FROM FUTURE DEVELOPMENT
COMMERCE PARK PUMP STATION (09)		NO IMPACT FROM FUTURE DEVELOPMENT
HARRISON STREET PUMP STATION (10)		NO IMPACT FROM FUTURE DEVELOPMENT



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
OAK STREET PUMP STATION (11)		
- EXISTING	133.10	(BASED ON FLOW METER DATA)
- LOCATION 12 - LILA CAMP YOUNG	60.21	BASED ON 289 POSSIBLE HOUSES @ 300 GPD
TOTAL FLOW	193.31	
PUMP RATE REQUIRED (2.5 X ADF)	483.27	
PUMP CAPACITY CURRENT	400	NEED PUMP UPGRADE
WETWELL SIZE (SF)	78.75	
AVAILABLE DRAWDOWN (FT)	3.2	
AVAILABLE VOLUME (GALLONS)	1884.96	
AVAILABLE RETENTION TIME (MIN)	9.75	RUNTIME OKAY
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.50	
TOTAL CYCLE TIME (MIN)	16.25	
FM SIZE	6"	OK



FLOW AREA	FLAWS AVG DAY (GPM)	COMMENTS
PRETLOW PUMP STATION (12)		
- EXISTING	10.00	MINIMAL INDUSTRIAL USE (ESTIMATED)
- UNKNOWN DEVELOPMENT AREA 1 FROM P600	76.39	INDUSTRIAL USE - 110,000 GPD
- LOCATION 13	8.33	BASED ON 40 HOUSES @ 300 GPD
- PORTION OF LOCATION 15 - MORTON FROM P600	8.13	BASED ON 39 HOUSES @ 300 GPD
- UNKNOWN DEVELOPMENT AREA 1	131.94	INDUSTRIAL USE - 190,000 GPD
- OTHER PORTION OF LOCATION 15 - MORTON	8.33	BASED ON 40 HOUSES @ 300 GPD
TOTAL FLOW	243.13	
PUMP RATE REQUIRED (2.5 X ADF)	607.81	875250
PUMP CAPACITY CURRENT	210	NEED PUMP UPGRADE
WETWELL SIZE (SF)	50.26	8' DIAMETER WETWELL - NEED LARGER/DEEPER WETWELL/100 SQ.FT WOULD PROVIDE 6 MIN RETENTION
AVAILABLE DRAWDOWN (FT)	2	
AVAILABLE VOLUME (GALLONS)	751.95	
AVAILABLE RETENTION TIME (MIN)	3.09	T00 SHORT
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	2.06	
TOTAL CYCLE TIME (MIN)	5.15	
FM SIZE	6"	NEW SIZE SHOULD BE 8" FROM END OF 6" FM
FM OUTLET		PRETLOW - NEEDS TO RUN TO TREATMENT PLANT - 8400'
VAUGHAN PUMP STATION (13)		NO IMPACT FROM FUTURE DEVELOPMENT
TRAIL ROAD PUMP STATION (14)		NEW PUMP STATION ALREADY ACCOUNTS FOR FUTURE DEVELOPMENT



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P100)		
- EXISTING	0.00	
- LOCATION 1 - RIVERWOOD PROPERTY PHASE 1	16.04	BASED ON 77 HOUSES @ 300 GPD
- LOCATION 20 - RIVERWOOD PROPERTY PHASE 2	20.84	BASED ON 100 HOUSES @ 300 GPD
- LAKE CHARLES SUBDIVISION	26.25	BASED ON 126 HOUSES @ 300 GPD
- LOCATION 40 - 4 LOTS	0.83	BASED ON 4 HOUSES @ 300 GPD
- UNKNOWN DEVELOPMENT AREA 6	16.04	BASED ON A POSSIBLE 77 HOMES @ 300 GPD
- LOCATION 4 - RAWLS PROPERTY	39.60	BASED ON 190 HOMES @ 300 GPD
TOTAL FLOW	119.60	
PUMP RATE REQUIRED (2.5 X ADF)	299.00	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	78.54	10' DIAMETER WETWELL - ALLOWS ROOM FOR GROWTH FROM SOUTHAMPTON COUNTY
AVAILABLE DRAWDOWN (FT)	4.1	ALLOWS ROOM FOR GROWTH FROM SOUTHAMPTON COUNTY
AVAILABLE VOLUME (GALLONS)	2408.59	
AVAILABLE RETENTION TIME (MIN)	20.14	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	8"/10"	8" TO FAIRVIEW AND 10" FROM FAIRVIEW TO SOUTH ST.
FM VELOCITY (FT/SEC)	1.9	
FM OUTLET POINT		SOUTH ST. AT 18" GRAVITY LINE





FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P200)		
- EXISTING	0.00	
- UNKNOWN DEVELOPMENT AREA 7	112.5	BASED ON A POSSIBLE 540 HOUSES @ 300 GPD
TOTAL FLOW	112.50	
PUMP RATE REQUIRED (2.5 X ADF)	281.25	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	50.26	8' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	3	
AVAILABLE VOLUME (GALLONS)	1127.92	
AVAILABLE RETENTION TIME (MIN)	10.03	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	6"/10"	6" TO FAIRVIEW AND 10" FROM FAIRVIEW TO SOUTH ST.
FM VELOCITY (FT/SEC)	3.2	
FM OUTLET POINT		SOUTH STREET AT 18" GRAVITY LINE



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P300)		
-EXISTING	0.00	
-LOCATION 8A - BRANDYWINE	12.5	BASED ON 60 HOUSES @ 300 GPD
TOTAL FLOW	12.50	
PUMP RATE REQUIRED (2.5 X ADF)	31.25	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	28.27	6' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	1.5	
AVAILABLE VOLUME (GALLONS)	317.23	
AVAILABLE RETENTION TIME (MIN)	25.38	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	2"	MAKE 4" FOR FUTURE DEVELOPMENT
FM VELOCITY (FT/SEC)	3.5	
FM OUTLET POINT		CLAY STREET



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P400)		
- EXISTING	0.00	
- LOCATION 8B, 9 & 10	39.58	BASED ON A POSSIBLE 190 HOUSES @ 300 GPD
TOTAL FLOW	39.58	
PUMP RATE REQUIRED (2.5 X ADF)	98.96	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	28.27	6' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	2	
AVAILABLE VOLUME (GALLONS)	422.97	
AVAILABLE RETENTION TIME (MIN)	10.69	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	4"	
FM VELOCITY (FT/SEC)	2.6	
FM OUTLET POINT		SOUTHAMPTON SHOPPING CENTER ROAD
DOWNSTREAM GRAVITY IMPACT		IMPACT DOWNSTREAM IS NOT SIGNIFICANT TO GRAVITY SYSTEM



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P500)		
- EXISTING	0.00	
- LOCATION 12 - LILA CAMP YOUNG	60.21	BASED ON 289 HOUSES @ 300 GPD
TOTAL FLOW	60.21	
PUMP RATE REQUIRED (2.5 X ADF)	150.52	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	28.27	6' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	3	
AVAILABLE VOLUME (GALLONS)	634.46	
AVAILABLE RETENTION TIME (MIN)	10.54	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	4"	
FM VELOCITY (FT/SEC)	3.9	
FM OUTLET POINT		SOUTH STREET
DOWNSTREAM GRAVITY IMPACT		IMPACT DOWNSTREAM IS NOT SIGNIFICANT TO GRAVITY SYSTEM



FLOW AREA	FLOWS AVG DAY (GPM)	COMMENTS
PROPOSED PUMP STATION (P600)		
- EXISTING	0.00	
- UNKNOWN DEVELOPMENT AREA 1	76.39	INDUSTRIAL DEVELOPMENT - 110,000 GPD
- LOCATION 13	8.33	BASED ON 40 HOUSES @ 300 GPD
- PORTION OF LOCATION 15 - MORTON	8.13	BASED ON 39 HOUSES @ 300 GPD
TOTAL FLOW	92.85	
PUMP RATE REQUIRED (2.5 X ADF)	232.12	
PUMP CAPACITY CURRENT	NA	
WETWELL SIZE REQUIRED (SF)	50.26	8' DIAMETER WETWELL
AVAILABLE DRAWDOWN (FT)	3	
AVAILABLE VOLUME (GALLONS)	1127.92	
AVAILABLE RETENTION TIME (MIN)	12.15	
DESIRED RETENTION TIME (MIN)	10.00	
PUMP RUN TIME (MIN)	6.67	
TOTAL CYCLE TIME (MIN)	16.67	
FM SIZE	6"	
FM VELOCITY (FT/SEC)	2.6	
FM OUTLET POINT		GRAVITY IN PRETLOW INDUSTRIAL PARK
DOWNSTREAM GRAVITY IMPACT		IMPACT ON PRETLOW GRAVITY SYSTEM IS NOT SIGNIFICANT
NEW 1000 STUDENT HIGH SCHOOL		
- ADDITIONAL FLOW	11.11	BASED ON 16 GPD PER STUDENT
DOWNSTREAM GRAVITY IMPACT		IMPACT ON DOWNSTREAM GRAVITY IS NOT SIGNIFICANT



## **APPENDIX D**

### **FUTURE DEVELOPMENT ASSUMPTIONS**

**Impact of Future Development**

Equivalent Residential Connections (ERC)

Based on VDH Regulation 12 VAC5-590-690

Storage                    150\*                    Gals/ERC                    (See Letter from Renee Hall dated 6/22/2005)  
 Pumping                    0.5                    GPM/ERC

1 ERC = 400 GPD (Existing)

1 ERC = 300 GPD (Proposed Development (See Letter from Renee Hall dated 6/22/2005))

Available Storage

Hunterdale Water Storage Tank	500,000
College Drive Water Storage Tank	300,000
Preflow Water Storage Tank	500,000
<b>Storage Total</b>	<b>1,300,000</b>

Available Groundwater Pumping

Hunterdale Pump	1,500
Preflow Pump	1,500
<b>Pump Total</b>	<b>3,000</b>

Current ERC's Being Used.

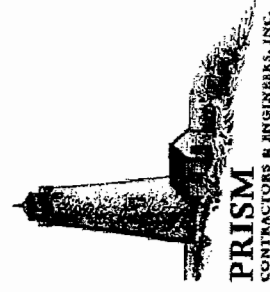
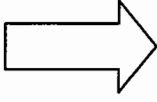
	<u>GPD</u>	<u>ERC</u>
Franklin	935,145	2,338 (Based on 1 ERC = 400 GPD)
Isle of Wight	120,000	300 (Based on 1 ERC = 400 GPD)
<b>Total</b>	<b>2,638</b>	



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Future ERC's To Be Used

	Water	Sewer	ERC
Location 1 - Riverwood Property Phase 1	23,100	23,100	77 (Based on 1 ERC = 300 GPD)
Location 3 - Wyndham Crossing	10,200	10,200	34
Location 3A - Adult Community	91,400	91,400	305
Location 4 - Rawls Property	57,000	57,000	190
Location 7 - Madison Estates	78,000	78,000	260
Location 8A - Brandywine (Franklin)	10,200	10,200	34
Location 8A - Brandywine (SHC)	7,800	7,800	26
Location 8B - Council Property	15,000	15,000	50
Location 9 - Regency Estates (SHC)	6,000	6,000	20
Location 9 - Regency Estates (Franklin)	13,200	13,200	44
Location 10 - Mixed Use Residential	36,000	36,000	120
Location 12 - Lila Camp Property	86,700	86,700	289
Location 13 - Mixed Use	12,000	12,000	40
Location 15 - Morton and Pretlow	113,400	113,400	378
Location 20 - Riverwood Property Phase 2	30,000	30,000	100
Location 25 - Lake Charles Subdivision	37,800	37,800	126
Location 30 - New High School (1000 Students)	16,000	16,000	53
Location 35 - Nursing Home Addition	5,400	5,400	18
Location 60 - Joyner Farms	15,000	15,000	50
UDA 1	300,000	300,000	1,000
UDA 2	77,400	77,400	258
UDA 3	45,600	45,600	152
UDA 4	2,700	2,700	9
UDA 5	12,900	12,900	43
UDA 6	23,100	23,100	77
UDA 7	162,000	162,000	540
IOW Future Growth	500,000	70,000	0
SHC Future Growth	1,050,000	0	3,500
<b>Totals</b>	<b>2,837,900</b>	<b>1,357,900</b>	<b>7,793</b>



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Storage Required - 200 Gal/ERC Existing/150 Gal/ERC Future  
 Storage Currently Being Used 527,573  
 Storage for Future Growth 1,168,950  
 Storage Available After Future Development -396,523

Pumping Required - 0.5 GPM/ERC  
 Pumping Currently Being Used 1,319  
 Pumping for Future Growth 3,897  
 Pump Capacity Available After Future Development -2,215



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# **APPENDIX E**

## **PEAK FLOW DAY DETERMINATION (Water System)**

## Peak Day Flow Determination

College Drive - Well #4 Flows for 2003		Hunterdale - Well #5 Flows for 2003		Pretlow - Well #6 Flows for 2003		Totals Flow for 2003	
	(Gallons)		(Gallons)		(Gallons)		(Gallons)
Jan	1,511,000	Jan	10,732,000	Jan	22,021,000	Jan	34,264,000
Feb	485,000	Feb	9,384,000	Feb	20,469,000	Feb	30,338,000
Mar	439,000	Mar	10,325,000	Mar	19,502,000	Mar	30,266,000
April	527,000	April	10,069,000	April	18,911,000	April	29,507,000
May	464,000	May	11,251,000	May	21,276,000	May	32,991,000
June	794,000	June	10,299,000	June	21,592,000	June	32,685,000
July	474,000	July	12,355,000	July	23,280,000	July	36,109,000
Aug	432,000	Aug	11,661,000	Aug	22,123,000	Aug	34,216,000
Sep	972,000	Sep	12,006,000	Sep	20,375,000	Sep	33,353,000
Oct	531,000	Oct	10,868,000	Oct	20,436,000	Oct	31,835,000
Nov	446,000	Nov	10,618,000	Nov	18,508,000	Nov	29,572,000
Dec	423,000	Dec	10,532,000	Dec	19,037,000	Dec	29,992,000
<b>Total</b>	<b>7,498,000</b>	<b>Total</b>	<b>130,100,000</b>	<b>Total</b>	<b>247,530,000</b>	<b>Total</b>	<b>385,128,000</b>
Daily Avg	20,542	Daily Avg	356,438	Daily Avg	678,164	Daily Avg	1,055,145
Max. Day (Sept)	571,000	Max. Day (Sept)	800,000	Max. Day (May)	1,013,000		

Max. Day for Well #4 appears to be an anomaly - Will not include in calculation for peak day flow

Use a weighted average to determine peak day flow

Daily Avg. of Well #5 + Well #6	1,034,603
Well #5 Percentage of Daily Avg.	34.45%
Well #6 Percentage of Daily Avg.	65.55%
Well #5 Peak Flow	2.24
Well #6 Peak Flow	1.49
<b>Average Peak Flow Based on Percentage of Daily Avg.</b>	<b>1.75</b>

\*\*Information Sources

Department of Environmental Quality (DEQ) Annual Report of Water Withdrawals - City of Franklin  
For the Period: January 1, 2003 to December 31, 2003

Virginia Department of Health (VDH) Regulations  
12VAC5-590-690 (Capacity of Waterworks)

Section C states flow at 20 psi will be the greater of peak hourly flow or max. day flow plus fire flow, whichever is greater.



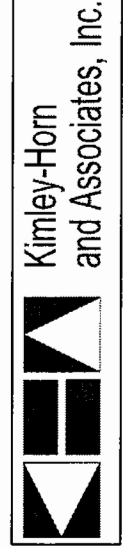
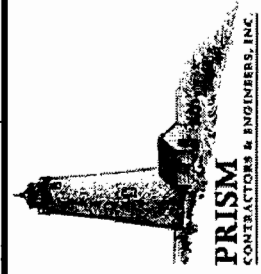
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## **APPENDIX F**

### **FIRE HYDRANT FLOW TEST DATA**

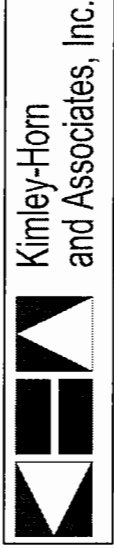
HYDRANT FLOW TESTING DATA

Field Hydrant	Field Pressure		Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
	Hydrant	Pressure							
61	125	50	36	32.05	0.8	844	8-Nov	15:00	
103	104	50	20	5.53	0.8	350	8-Nov	13:55	
106	107	50	30	6.26	0.8	373	8-Nov	13:50	
113	112	52	42	20.54	0.8	675	8-Nov	14:00	
114	112	52	36	14.7	0.8	571	8-Nov	14:05	
116	117	52	42	40.56	0.8	949	8-Nov	14:15	
118	117	52	40	34.21	0.8	871	8-Nov	14:25	
119	117	52	40	36.99	0.8	906	8-Nov	14:30	
120	123	50	38	38	0.9	1033	8-Nov	14:45	
124	123	50	25	21.34	0.8	688	8-Nov	14:40	
130	133	60	36	36.99	0.8	906	8-Nov	15:20	
131	133	60	50	34.31	0.8	873	8-Nov	15:35	
134	500	54	31	25.64	0.8	754	9-Nov	8:25	
135	500	54	30	25.89	0.8	758	9-Nov	8:10	
136	140	50	34	32.02	0.8	843	8-Nov	15:55	
144	141	60	34	26.62	0.8	769	8-Nov	15:50	
146	147	57	50	43.82	0.8	986	9-Nov	9:40	
148	150	56	42	33.85	0.7	759	9-Nov	10:30	
153	204	57	48	33.03	0.7	749	9-Nov	9:55	
166	170	68	26	19.91	0.8	665	9-Nov	10:15	
169	170	68	30	18.03	0.7	554	9-Nov	10:05	
174	204	57	50	7.65	0.7	361	9-Nov	10:00	
179	197	57	36	20.62	0.7	592	9-Nov	10:55	



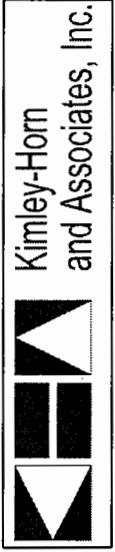
HYDRANT FLOW TESTING DATA

Field Flow Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
182	191	57	25	11.22	0.8	449	9-Nov	9:25
190	204	57	50	20.74	0.7	594	9-Nov	9:50
196	197	57	38	2.02	0.7	185	9-Nov	10:50
201	191	57	32	14.16	0.7	491	9-Nov	9:30
214	215	72	48	41.56	0.8	961	9-Nov	11:55
216	215	72	45	38.71	0.8	927	9-Nov	12:00
218	150	58	44	38.35	0.7	807	9-Nov	10:43
260	231	72	50	34.13	0.8	870	9-Nov	11:30
264	263	72	32	29.69	0.8	812	9-Nov	11:40
275	277	72	44	16.74	0.7	533	9-Nov	12:15
278	277	72	34	15.7	0.8	590	9-Nov	12:05
288	286	54	38	32.22	0.8	846	9-Nov	11:05
289	231	72	46	29.9	0.8	815	9-Nov	11:25
296	295	65	32	32.97	0.8	856	9-Nov	11:15
300	298	75	25	11.7	0.8	510	9-Nov	12:25
304	303	72	14	10.42	0.8	481	19-Nov	13:35
310	343	53	14	12.33	0.7	458	9-Nov	14:35
314	315	56	22	5.69	0.7	311	9-Nov	9:15
317	315	56	17	11.29	0.7	438	9-Nov	9:20
323	427	54	15	9.54	0.8	460	9-Nov	9:00
325	315	56	16	9.47	0.8	459	9-Nov	9:10
335	337	70	34	7.44	0.8	406	9-Nov	13:50
338	363	54	3	7.01	0.8	394	9-Nov	14:05



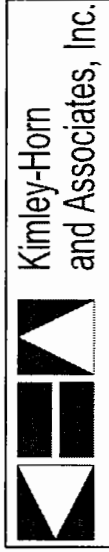
HYDRANT FLOW TESTING DATA

Field Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
346	343	53	34	2.27	0.8	224	9-Nov	14:30
354	434	62	32	5.23	0.8	341	9-Nov	15:35
372	363	54	12	8.42	0.8	432	9-Nov	14:20
379	337	70	32	4.81	0.7	286	9-Nov	14:00
382	337	70	31	6.57	0.7	334	9-Nov	13:55
401	396	56	11	9.45	0.7	401	9-Nov	15:05
406	409	57	12	9.84	0.7	409	9-Nov	14:55
411	427	54	16	7.23	0.8	401	9-Nov	9:00
413	417	63	8	2.72	0.8	246	9-Nov	8:50
425	303	72	10	9.55	0.8	460	9-Nov	13:40
428	417	63	15	1.83	0.8	202	9-Nov	8:45
1002	1007	53	53	52	0.8	1074	7-Nov	8:35
1016	1007	53	52	51	0.8	1064	7-Nov	8:40
1028	1036	56	42	36.9	0.8	905	7-Nov	8:55
1063	1094	54	43	40	0.8	942	7-Nov	9:05
1072	1086	54	24	7	0.9	443	7-Nov	9:20
1082	1099	54	39	9.45	0.8	458	7-Nov	9:35
1084	1086	54	17	7.65	0.8	412	7-Nov	9:30
1095	1094	54	40	35.02	0.8	882	7-Nov	9:10
1114	1661	62	39	26.09	0.8	761	7-Nov	10:05
1135	1134	54	30	11.97	0.7	451	7-Nov	10:30
1135	1134	54	30	11.97	0.7	451	7-Nov	10:30
1136	1137	54	38	12.17	0.8	520	7-Nov	10:25



HYDRANT FLOW TESTING DATA

Field Flow Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
1144	1137	54	29	25.45	0.8	752	7-Nov	10:20
1146	1185	54	51	30.26	0.7	717	7-Nov	14:15
1160	1159	55	44	35.88	0.8	893	7-Nov	13:55
1161	1162	55	43	32.14	0.8	845	7-Nov	14:05
1163	1162	55	43	34.44	0.8	874	7-Nov	14:10
1171	1172	54	27	14.21	0.7	491	7-Nov	13:45
1173	1172	54	37	28.79	0.7	700	7-Nov	13:50
1219	1220	54	44	31.61	0.7	733	7-Nov	10:45
1222	1221	52	42	28.49	0.7	696	7-Nov	11:15
1223	1285	54	44	26.94	0.7	677	7-Nov	11:55
1224	1279	53	48	38.43	0.7	808	7-Nov	12:05
1225	1274	52	47	38.27	0.7	807	7-Nov	12:25
1227	1252	53	49	35.2	0.8	884	7-Nov	13:10
1228	1229	53	30.5	26.75	0.8	771	7-Nov	13:55
1234	1229	53	33	18.52	0.7	561	7-Nov	12:40
1245	1246	54	24	14.28	0.7	493	7-Nov	12:55
1247	1246	54	26	19.38	0.7	574	7-Nov	13:00
1261	1181	53	50	44.2	0.8	991	7-Nov	13:35
1261	1226	53	49	40.9	0.7	834	7-Nov	13:3
1261	1262	53	49	44.9	0.8	998	7-Nov	13:25
1271	1274	52	46	33.41	0.7	754	7-Nov	12:20
1277	1279	53	42	32.61	0.8	851	7-Nov	12:00





HYDRANT FLOW TESTING DATA

Field Flow Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
1297	1303	52	47	2.33	0.7	199	7-Nov	11:30
1299	1221	52	49	8.11	0.7	371	7-Nov	11:05
1305	1303	52	45	14	0.9	627	7-Nov	11:25
1324	1330	53	39	34.43	0.8	874	7-Nov	14:55
1325	1330	53	39	33.78	0.8	866	7-Nov	15:00
1345	1285	54	54	32.77	0.8	853	7-Nov	11:50
1373	1374	55	40	38.97	0.8	930	7-Nov	14:25
1379	1660	59	48	12.85	0.8	534	7-Nov	15:10
1381	1380	59	52	11.2	0.8	499	7-Nov	15:20
1405	1406	53	94	32.38	0.8	848	7-Nov	3:40
1408	1611	53	45	34.82	0.8	879	7-Nov	15:45
1422	1423	55	37	35.97	0.8	894	8-Nov	9:25
1424	1423	55	40	37.98	0.8	918	8-Nov	9:30
1438	1380	59	45	23.32	0.8	720	7-Nov	15:25
1447	1448	58	45	35.35	0.8	886	8-Nov	9:00
1459	1482	58	53	12.98	0.8	537	8-Nov	9:10
1460	1454	58	42	20.22	0.8	670	8-Nov	9:05
1469	1476	57	34	32.53	0.8	850	8-Nov	8:30
1481	1482	58	46	29.42	0.8	808	8-Nov	9:15
1486	1487	57	46	29.59	0.8	811	8-Nov	8:02
1496	1495	60	45	30	0.9	918	8-Nov	8:40
1550	1549	53	42	35.88	0.8	893	8-Nov	13:10



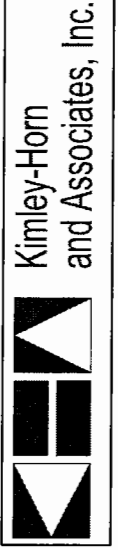
HYDRANT FLOW TESTING DATA

Field Flow Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
1554	1555	50	38	25.1	0.8	746	8-Nov	12:10
1565	1564	54	40	35.41	0.8	887	8-Nov	13:25
1570	1571	52	40	45.77	0.8	1008	8-Nov	12:00
1581	1582	51	40	36.43	0.8	899	8-Nov	13:35
1583	1582	51	48	41.15	0.7	836	8-Nov	13:30
1587	1571	52	47	41.15	0.8	956	8-Nov	11:55
1590	1571	52	52	47.19	0.8	1024	8-Nov	11:50
1591	1571	52	50	44.33	0.8	992	8-Nov	13:45
1608	1415	53	46	35.36	0.8	886	8-Nov	10:30
1610	1608	53	42	36.78	0.8	904	8-Nov	10:35
1613	1611	53	46	31.7	0.8	839	7-Nov	15:50
1614	1655	48	36	23.8	0.8	727	8-Nov	11:10
1615	1611	53	47	36.81	0.8	904	7-Nov	15:55
1618	1617	51	43	31.06	0.8	830	8-Nov	10:55
1619	1637	49	40	37.08	0.8	907	8-Nov	10:15
1628	1621	50	45	34.9	0.8	880	8-Nov	10:50
1631	1621	50	46	11.59	0.8	507	8-Nov	10:45
1636	1637	49	39	36.09	0.8	895	8-Nov	10:10
1638	1655	48	42	9.42	0.8	457	8-Nov	11:20
1644	1655	48	42	15.63	0.8	589	8-Nov	11:15
1657	1487	57	43	24.58	0.8	739	8-Nov	8:15
1659	1476	57	52	16.75	0.8	610	8-Nov	8:25



HYDRANT FLOW TESTING DATA

Field Flow Hydrant	Field Pressure Hydrant	Static Pressure	Residual Pressure	Flow (psi)	Hydrant Coeff	Flow (gpm)	Test Date	Test Time
1662	1661	62	43	24.23	0.8	733	7-Nov	10:00
1663	1661	62	41	23.94	0.8	729	7-Nov	9:55
1664	1220	54	42	24.68	0.7	648	7-Nov	10:55
1667	1665	62	5	16.07	0.8	597	9-Nov	15:40
2000	1448	58	45	32.12	0.8	844	8-Nov	8:55



# **APPENDIX G**

## **FIRE FLOW REQUIREMENTS**



FIRE & RESCUE

October 13, 2005

Mrs. Kendra Hardy  
Assistant District Engineer  
Commonwealth of Virginia  
Department of Health  
Office of Drinking Water  
Environmental Engineering Field Office  
830 Southampton Avenue, Room 2058  
Norfolk, VA 23510

Dear Mrs. Hardy,

This letter is to inform you of the minimum flow requirements that must be met or exceeded for residential or commercial development projects. Listed below are the minimum flows and residual pressures required for a specific development type:

Development Type	Minimum Flow in Gallon Per Minutes	Minimum Residual Pressure in Pounds Per Square Inch
RESIDENTIAL	500	20
COMMERCIAL	1000	20

By using the above criteria we hope to ensure that water at adequate flows and pressures will be available for emergency use and will not have extreme adverse effects on the domestic usage.

If I can be of further assistance, please feel free to contact me.

Sincerely yours,

Vince Holt  
Director of Emergency Services

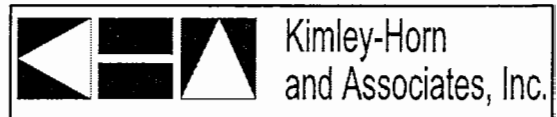
cc: Mr. Russ Pace - Public Works  
Mr. Steve Watson - Public Works

## **APPENDIX H**

### TANK FLOW DATA

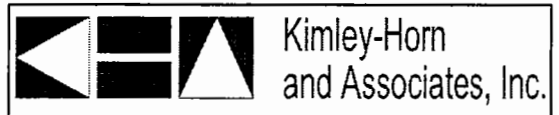
## Tank Flow Data

<u>Time</u>	<u>College Drive Tank Elev</u>	<u>Pretflow Tank Elev</u>	<u>Hunterdale Tank Elev</u>
23:00	114.80	116.6	114.0
0:00	115.60	118.8	113.5
1:00	116.30	117.4	113.1
2:00	116.50	116.4	112.6
3:00	116.20	115.6	112.4
4:00	115.80	116.4	112.0
5:00	116.30	118.9	112.7
6:00	116.50	117.5	114.1
7:00	115.70	116.2	112.9
8:00	115.00	115.3	111.6
9:00	114.80	118.2	110.5
10:00	115.20	117.9	110.4
11:00	116.10	115.9	111.8
12:00	115.50	115.5	113.3
13:00	114.90	117.1	113.8
14:00	115.10	118.9	112.9
15:00	115.50	119	113.4
16:00	115.70	117.4	113.8
17:00	115.30	116.2	113.1
18:00	114.70	115.7	112.2
19:00	114.80	118.4	111.3
20:00	115.20	118.1	110.3
21:00	115.10	116.6	110.7
22:00	114.80	115.4	112.1
23:00	115.10	118.2	113.9
0:00			



	Preilow Pump Run Time		Hunterdale Pump Run Time
3:38 P ON		4:30 H ON	
4:56 P OFF	1:18	5:56 H OFF	1:26
7:56 P ON		9:41 H ON	
9:23 P OFF	1:27	12:32 H OFF	2:51
12:23 P ON		14:30 H ON	
13:50 P OFF	1:27	15:26 H OFF	0:56
14:30 P ON		20:23 H ON	
14:56 P OFF	0:26	23:08 H OFF	2:45
17:50 P ON			
19:20 P OFF	1:30	Total (hr:min)	7:58
22:02 P ON			
23:20 P OFF	1:18		
Total (hr:min)	7:26		

Total Gal	732,550	385,816
Pump GPM	1,642.49	807.15
Dia (ft)	56.00	62.25
Area (Sq.Ft)	2,462.94	3,043.38





# **APPENDIX I**

## **JUNCTION DEMAND DATA**

Junction	Junction Demand	# of Houses	Houses Demand Total	Commercial Sq Ft	Commercial Demand Total	School # of Students	School Demand Total	Churches Demand Total	Churches Demand Total	Hospital Demand Total	Hospital Demand Total	Nursing Home Demand Total	Nursing Home Demand Total	Appts Demand Total	Appts Demand Total	College Faculty Demand Total	College Demand Total	NOMA	
Northside Area																			
3-111	0.92	7	1,410.09	7,441	1,315.53													YMCA	
3-118	1.03	4	861.95			171	0,887.95											High School	
3-119	4.30	4	861.95																
3-145	0.57	12	2,707.31																
3-15	1.92	12	2,707.31																
3-154	1.71	7	1,410.09																
3-155	1.03	7	1,410.09																
3-166	2.37	10	3,405.11																
3-168	0.44	3	698.51																
3-16	1.48	10	2,028.02																
3-160	1.39	4	1,195.76																
3-162	1.77	12	2,924.34																
3-165	1.18	8	1,702.50																
3-166	1.18	8	1,702.50																
3-172	0.84	6	1,271.07																
3-173	1.03	8	1,028.00																
3-171	1.03	7	1,410.09																
3-18	1.58	10	2,028.02																
3-183	1.52	10	2,028.02																
3-184	2.07	14	2,707.31																
3-186	2.31	11	4,044.98																
3-188	1.52	11	2,028.02																
3-184	0.30	2	405.72																
3-18	1.03	7	1,410.09																
3-192	1.52	11	2,028.02																
3-195	1.03	11	2,028.02																
3-198	1.18	8	1,702.50																
3-2	0.74	5	1,064.31																
3-20	0.74	5	1,064.31																
3-21	2.51	17	3,018.05																
3-22	1.77	15	2,028.02																
3-222	1.03	11	2,028.02																
3-224	1.39	4	1,195.76																
3-226	0.57	4	861.95																
3-23	0.74	5	1,064.31																
3-230	22.51	5	1,064.31							955	32,199.40		71	13,705.07					121 Public Total/955 Occupied on 10/21/09
3-235	1.50	4	861.95																
3-236	0.57	4	861.95																
3-14	0.84	6	1,271.07																
3-15	1.18	8	1,702.50																
3-154	3.10	21	4,470.40																
3-156	1.03	11	2,028.02																
3-158	0.84	6	1,271.07																
3-16	0.74	5	1,064.31																
3-166	1.92	11	2,028.02																
3-212	0.44	3	698.51																
3-216	1.03	7	1,410.09																
3-216	1.48	10	2,028.02																
3-17	1.18	8	1,702.50																
3-170	1.18	8	1,702.50																
3-178	0.57	4	861.95																
3-281	1.52	11	2,028.02																
3-283	1.18	8	1,702.50																
3-284	1.18	8	1,702.50																
3-23	0.57	4	861.95																
3-252	2.22	10	2,028.02																
3-253	1.48	10	2,028.02																
3-254	1.03	7	1,410.09																





Junction	Township Demand	# of Houses	Houses Demand Total	Commercial Sq. Ft.	Commercial Demand Total	School # of Students	School Demand Total	Churches Demand Total	Hospital Demand Total	Nursing Home Demand Total	Appts Demand Total	College & Faculty Demand Total	College Demand Total	Notes
<b>Parkway/College Area</b>														
3-1022	0.11	1	162.32	14,271	2,602.17									
3-1023	1.94	1	1,023.17											
3-1024	11.42	17	2,795.52											
3-1025	1.92	4	1,460.75											
3-1026	1.01	1	1,795.27											
3-1027	1.24	1	1,460.75											
3-1028	1.01	4	4,058.11											
3-1029	2.82	4	1,441.30											
3-1030	0.42	10	1,623.25											
3-1031	1.19	10	1,623.25											
3-1032	1.80	16	2,577.17											
3-1033	1.47	19	2,110.22											
3-1034	1.80	16	2,577.17											
3-1035	1.58	14	2,322.94											
3-1036	1.19	10	1,623.25											
3-1037	0.50	8	1,278.60											
3-1038	1.01	4	1,460.75											
3-1039	1.01	11	1,795.27											
3-1040	1.24	13	2,729.46											
3-1041	2.57	32	3,729.46	1,594	1,023.17									
3-1042	1.61	8	1,278.60											
3-1043	0.68	6	173.75											
3-1044	7.14	15	2,144.81											
3-1045	1.14	11	3,024.17											
3-1046	1.12	11	2,757.52											
3-1047	9.23	24	4,707.41	64,579	11,442.49									
3-1048	7.95	14	2,272.54											
3-1049	5.04	7	1,196.27											
3-1050	2.87	4	1,460.75											
3-1051	0.66	4	1,623.25											
3-1052	1.01	10	1,623.25											
3-1053	9.54	10	1,623.25											
3-1054	7.99	19	3,110.22											
3-1055	1.47	19	2,444.81											
3-1056	3.71	21	3,428.82											
3-1057	2.25	20	3,246.45											
3-1058	2.51	23	3,729.46											
3-1059	2.14	11	3,024.17											
3-1060	6.89	47	7,623.25	7,891	1,640.34									
3-1061	0.70	5	811.62											
3-1062	1.24	11	1,795.27											
3-1063	0.50	5	811.62											
3-1064	1.78	14	2,272.54	3,192	248.80									
3-1065	3.61	14	2,272.54	1,714	231.92									
3-1066	0.42	4	1,441.30											
3-1067	0.97	4	1,623.25											
3-1068	2.99	24	4,220.44	4,604	562.13									
3-1069	1.87	16	1,623.25											
3-1070	2.37	16	2,577.17	1,196	298.41									
3-1071	1.24	5	811.62	5,234	1,144.41									
3-1072	0.14	1	1,278.60											
3-1073	0.82	5	2,177											
3-1074	0.50	5	811.62											
3-1075	0.89	4	1,441.30	3,164	578.21									
3-1076	0.55	4	1,441.30											



Truckee	Truckee Demand	# of Houses	Houses Demand Total	Commercial Sq. Ft.	Commercial Demand Total	School # of Students	School Demand Total	Churches Demand Total	Hospital Demand Total	Increasing Home Demand Total	Appts Demand Total	College Faculty Demand Total	College Demand Total	Notes
3-1215	2.03	18	2,121.34											
3-1216	1.40	3	406.47	6,514	2,015.26									
3-1217	0.52	3	312.12	2,312	314.10									
3-1218	1.64	15	2,434.81								10	1,623.25		
3-1219	2.87	11	1,795.21											
3-1220	1.58	14	2,272.54											
3-1221	2.03	11	1,795.21											
3-1222	1.84	5	811.62	19,388	1,804.48			2.25	0.00					
3-1223	0.34	3	406.47											
3-1224	0.50	12	1,278.60											
3-1225	1.64	12	1,541.81											
3-1226	2.46	22	3,271.14											
3-1227	1.58	14	2,272.54											
3-1228	1.58	14	2,272.54											
3-1229	0.78	7	1,066.27											
3-1230	0.48	4	778.95											
3-1231	2.14	19	2,102.22											
3-1232	0.50	8	1,278.60											
3-1233	1.19	10	1,623.25					3,764	0.00					
3-1234	1.01	4	1,460.91											
3-1235	1.58	14	2,272.54											
3-1236	1.95	12	1,541.81					3,195	0.00					
3-1237	2.03	18	2,121.34											
3-1238	0.74	7	1,066.27											
3-1239	2.25	20	3,246.48											
3-1240	1.19	10	1,623.25											
3-1241	0.68	6	978.95											
3-1242	2.03	18	2,121.34											
3-1243	2.25	20	3,246.48											
3-1244	0.71	7	1,066.27											
3-1245	1.34	2	324.65	11,826	1,541.81									
3-1246	0.33			2,470	297.64									
3-1247	0.33			4,952	561.64									
3-1248	5.64	12	1,541.81	31,607	5,393.8									
3-1249	0.50	8	1,278.60											
3-1250	0.41	4	622.92	4,236	571.62									
3-1251	1.24	11	1,795.21	9,164	516.21									
3-1252	0.68	6	978.95											
3-1253	0.50	8	1,278.60											
3-1254	0.50	8	1,278.60											
3-1255	0.34	3	406.47											
3-1256	1.95	12	1,541.81											
3-1257	1.58	14	2,272.54											
3-1258	0.45	4	541.30											
3-1259	0.54	5	811.62											
3-1260	1.61	4	1,460.91											
3-1261	1.19	10	1,623.25											
3-1262	1.95	12	1,541.81											
3-1263	0.50	8	1,278.60					3,444	0.00					
3-1264	0.50	8	1,278.60											
3-1265	0.50	8	1,278.60											
3-1266	4.40	12	1,623.25								31	6,390.66		
3-1267	1.19	10	1,623.25											
3-1268	4.40	12	1,623.25	51,181	6,144.81									
3-1269	0.60	1	622.92	5,510	745.34			15,217	0.00					
3-1270	3.27	3	25,847	25,847	4,846.60									
3-1271	0.34	3	406.47											
3-1272	0.34	3	406.47											
3-1273	1.58	14	2,272.54	4,181	595.89									



Sanction	Sanction Demand	# of Houses	Houses Demand Total	Commercial Sq Ft	Commercial Demand Total	School # of Students	School Demand Total	Churches Demand Total	Hospital Demand Total	Nursing Home Demand Total	Nursing Homes Demand Total	Apts Demand Total	College & Faculty Demand Total	College Demand Total	Notes
3--1421	9.91	14	2,372.54	15,280	2,609.01										
3--1422	0.00														
3--1423	1.57	4	1,417.30	12,107	1,645.84			0.716							
3--1440	2.98				4,289.71										
3--1461	4.97				6,210.36										
3--1466	4.95				7,191.47			28,748							
3--1467	0.71				1,028.39										
3--1465	2.99				24,894										
3--1465	9.72				93,551			17,075							
3--1470	9.71				91,442										
3--1472	9.14	7	1,196.27	30,997	4,141.04										
3--1465	4.14				5,664.78										
3--1472	1.57				16,174										
3--1479	84.75 (DN)														
3--1478	1.82				11,921			1,978							
3--1500	1.50				1,618										
3--1502	1.86				15,644										
3--1503	1.37				19,972										
3--1504	1.87				3,468.82										
3--1504	1.87				3,100.82										
3--1501	1.82				2,757.52										
3--1501	1.01				1,400.92										
3--1500	0.94				486.47										
3--1502	1.08				1,623.25										
3--1504	2.09				2,321.84										
3--1506	1.95				1,931.87										
3--1501	2.71				9,815.71										
3--1504	5.07				54,011										
3--1505	4.40				40,881										
3--1508	36.96				987,092										
3--1540	5.07				60,782										
3--1541	25.21				249,418										
3--1545	18.97				201,568										
3--1509	1.64				11,055										
3--1504	1.97				20,075										
3--1504	4.87				51,872										
3--1506	8.84				9,707										
3--1505	9.49				7,016.75										
3--1507	6.65				18,024										
3--1511	1.24				1,786.51										
3--1606	2.64				25,012										
3--1609	2.95				4,597										
3--1622	4.49				4,464										
3--1623	0.42														
3--1624	2.14														
3--1627	2.14														
3--1638	1.64				2,434.87										
3--1641	0.68				979.95										
3--1646	1.01				1,460.92										
3--1650	2.10				2,434.87										
3--1654	1.24				1,786.51										
	508.71	1408.00	22,895.76	171,806.00	210,748.98	1950.00	8088.07	12,462.00	0.00	80.00	867.71	596.00	8745.95	1648.00	1946.77



Water Flow Pattern Data

HR	11-Data	11/07/2025 Pattern	12-Data	12/07/2025 Pattern
0	0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.000
ADP	0.000	0.000	0.000	0.000

Hunterdale Area Data

Units	Houses	Commercial	School	Churches	Hospitals	Nursing	Appts
Units	1,163	54,165	1,161	21,895	195	971	334
GPD	300	250	13	0	300	200	300
Subtotal Flow	348,500	13,662	15,073	0	40,500	13,400	100,200
Total Flow	543,755						
Target Flow	395,310						
Adj Factor	0.7295						
Rev Units	1,163	54,165	1,161	21,895	195	971	334
Rev GPD	219	177	9	0	219	142	219
Rev Subtotal Flow	247,558	1,614	10,101	0	32,144	13,705	71,016
Total Flow	395,310						
Target Flow	395,310						
Adj Factor	1.0000						
Rev Units	1,163	54,165	1,161	21,895	195	971	334
Rev GPD	219	177	9	0	219	142	219
Rev Subtotal Flow	247,558	1,614	10,101	0	32,144	13,705	71,016
Total Flow	395,310						
Target Flow	395,310						
Adj Factor	1.0000						
Rev Units	1,163	54,165	1,161	21,895	195	971	334
Rev GPD	219	177	9	0	219	142	219
Rev Subtotal Flow	247,558	1,614	10,101	0	32,144	13,705	71,016
Total Flow	395,310						
Target Flow	395,310						
Adj Factor	1.0000						

Princeton/College Area Data

Units	Houses	Commercial	School	Churches	Hospitals	Nursing	Appts	College
Units	1,163	1,170	84	124	14	80	574	1,164
GPD	300	250	13	0	300	200	300	15
Subtotal Flow	422,400	444,215	14,850	0	0	10,000	100,800	25,200
Total Flow	1,093,025							
Target Flow	792,550							
Adj Factor	0.5411							
Rev Units	1,163	1,170	84	124	14	80	574	1,164
Rev GPD	162	195	7	0	162	108	162	8
Rev Subtotal Flow	228,523	217,411	8,081	0	0	8,157	87,000	13,668
Total Flow	792,550							
Target Flow	792,550							
Adj Factor	1.0000							



## **APPENDIX J**

### **PROBABLE COSTS FOR RECOMMENDED IMPROVEMENTS TO EXISTING WATER AND SEWER SYSTEMS**



**Existing Sanitary Sewer System Upgrades**

<b>Location</b>		<b>Cost Opinion</b>				
<b>No.</b>	<b>Location</b>	<b>Description</b>	<b>Qty</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Sub-Total</b>
1	Franklin Extended - Bogart North to RR Tracks	Remove 2-12" Lines - Install New 18" Gravity	220	LF	\$150.00	\$33,000.00
2	Franklin - Bogart to Barrett	Remove 3-12" Lines - Install New 18" Gravity	305	LF	\$155.00	\$47,275.00
3	Barrett Street	Remove 24" Reverse Grade Line - Install New 18" Gravity	85	LF	\$160.00	\$13,600.00
						<b>\$93,875.00</b>



**PRISM**  
CONTRACTORS & ENGINEERS, INC.



**Kimley-Horn**  
and Associates, Inc.

## Existing Water Distribution System Upgrades - Cost Opinion

Location									
No.	Location	Description	Qty	Unit	Unit Cost	Sub-Total			
1	Canterbury Court	Remove 4"/ Install New 6" w/ Appurtenances	625	LF	\$69.00	\$43,125.00			
2	Chaucer Court	Remove 4"/ Install New 6" w/ Appurtenances	630	LF	\$69.00	\$43,470.00			
3	Bobwhite, Quail Roost, Covey	Remove 4"/ Install New 6" w/ Appurtenances	3155	LF	\$69.00	\$217,695.00			
4	Crescent Drive Fire Hydrant (FH-174)	Install New 6" Hydrant Connection from 10"	1	EA	\$3,500.00	\$3,500.00			
5	Magnolia Avenue	Remove 4"/ Install New 6" w/ Appurtenances	900	LF	\$69.00	\$62,100.00			
6	Fairview (Crescent to Hunterdale)	Remove 4" & 6"/Install New 10" w/ Appurtenances	1310	LF	\$77.00	\$100,870.00			
7	Fairview & Robinhood (Hunterdale to FH)	Remove 4"/ Install New 8" w/ Appurtenances	2440	LF	\$77.00	\$187,880.00			
8	Southampton Road Fire Hydrant (FH-315)	Remove 4"/ Install New 6" w/ Appurtenances	17	LF	\$69.00	\$1,173.00			
9	Cypress Avenue	Remove 6"/ Install New 8" w/ Appurtenances	450	LF	\$77.00	\$34,650.00			
10	Southampton Road Fire Hydrant (FH-325)	Remove 4"/ Install New 6" w/ Appurtenances	12	LF	\$69.00	\$828.00			
11	Southampton Road	Remove 6"/ Install New 8" w/ Appurtenances	1130	LF	\$77.00	\$87,010.00			
12	Southampton Road Fire Hydrant (FH-323)	Remove 4"/ Install New 6" w/ Appurtenances	15	LF	\$69.00	\$1,035.00			
13	Clay Street	Remove 4" & 6"/Install New 8" w/ Appurtenances	4050	LF	\$77.00	\$311,850.00			
14	Rawlsdale	Remove 4"/ Install New 6" w/ Appurtenances	950	LF	\$69.00	\$65,550.00			
15	Forest Pine Road	Install New 6" Main	107	LF	\$64.00	\$6,848.00			
16	Meadow Lane Area	Remove 4"/ Install New 6" w/ Appurtenances	1210	LF	\$69.00	\$83,490.00			
17	Norfleet and Fontaine Street	Remove 4"/ Install New 6" w/ Appurtenances	1450	LF	\$69.00	\$100,050.00			
18	Madison Street	Install New 6" Main	50	LF	\$64.00	\$3,200.00			



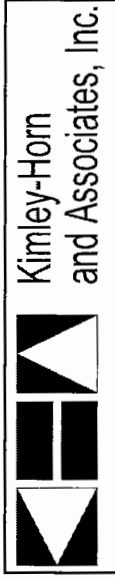
**PRISM**  
CONTRACTORS & ENGINEERS, INC.



**Kimley-Horn  
and Associates, Inc.**

**Existing Water Distribution System Upgrades - Cost Opinion**

<b>Location No.</b>	<b>Location</b>	<b>Description</b>	<b>Qty</b>	<b>Unit</b>	<b>Unit Cost</b>	<b>Sub-Total</b>
19	South St. near Johnson St.	Install New 6" Main	400	LF	\$64.00	\$25,600.00
20	Morton @ Oak St.	Install New 6" Main	36	LF	\$64.00	\$2,304.00
21	Hayden Drive	Remove 4"/ Install New 6" w/ Appurtenances	520	LF	\$69.00	\$35,880.00
22	Fair Street	Install New 6" Main	25	LF	\$64.00	\$1,600.00
23	Laurel Street	Install New 8" Main	400	LF	\$72.00	\$28,800.00
24	Broad Street	Remove 4"/ Install New 6" w/ Appurtenances	920	LF	\$69.00	\$63,480.00
25	Barret Street	Remove 4"/ Install New 6" w/ Appurtenances	242	LF	\$69.00	\$16,698.00
26	Bogart Street	Remove 4"/ Install New 6" w/ Appurtenances	335	LF	\$69.00	\$23,115.00
27	Armory Drive	Remove 4"/ Install New 6" w/ Appurtenances	80	LF	\$69.00	\$5,520.00
28	Main St. @ 5th Avenue	Remove 4"/ Install New 6" w/ Appurtenances	25	LF	\$69.00	\$1,725.00
29	2nd Avenue Between East and Mechanic	Install New 8" Main	270	LF	\$72.00	\$19,440.00
						<b>\$1,578,486.00</b>



# **APPENDIX K**

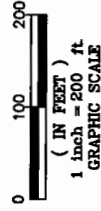
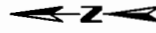
**LOCATION MAPS FOR RECOMMENDED WATER DISTRIBUTION  
SYSTEM UPGRADES  
(To Enhance Fire Flows)**



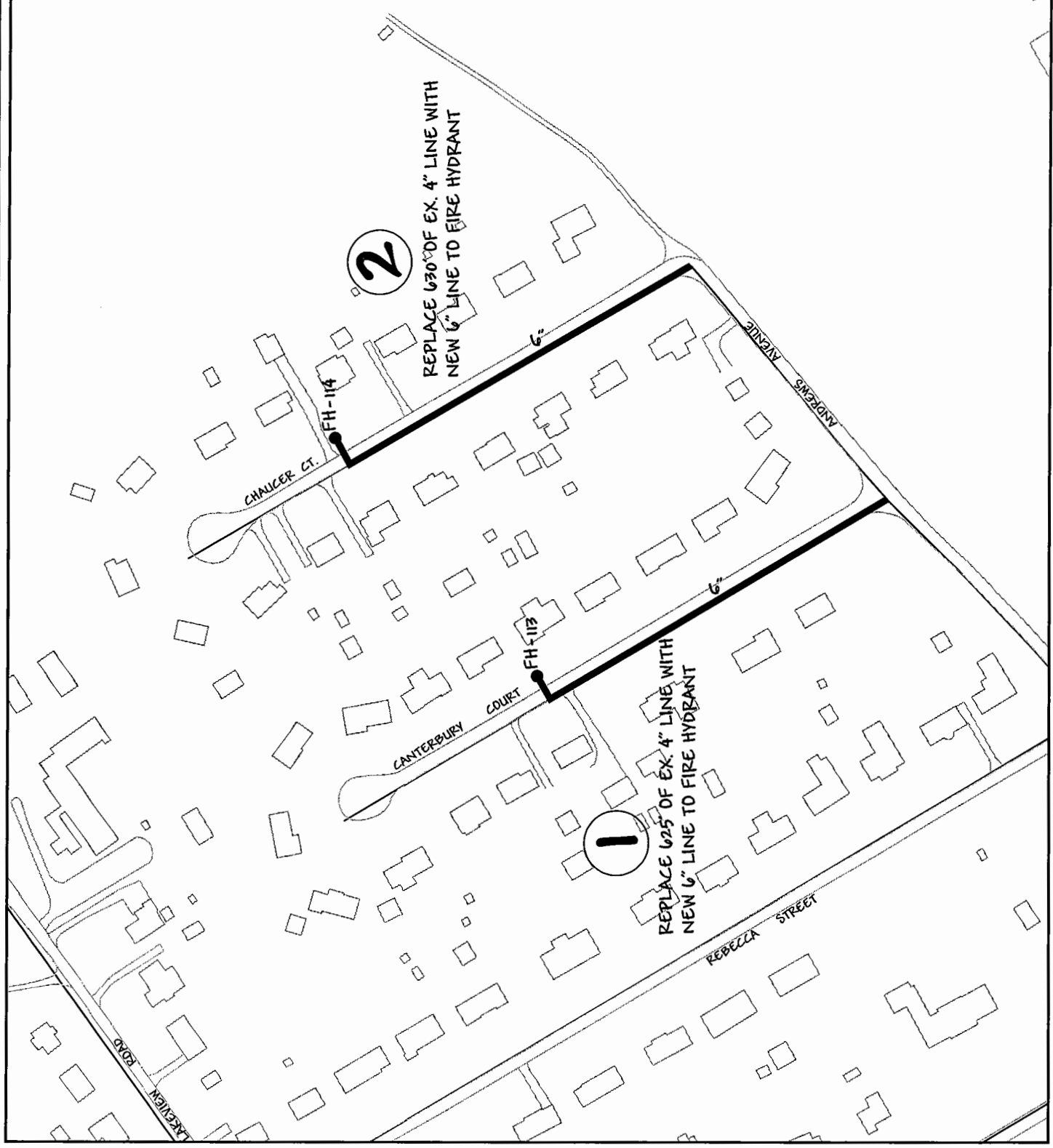
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - 4,500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



<b>WATER SYSTEM FRANKLIN, VIRGINIA</b>	
EXISTING SYSTEM	
<b>RECOMMENDED IMPROVEMENTS</b>	
DATE	1/17/2008
DRAWN BY	JK
CHECKED BY	JK
PROJECT NO.	08-001 (08/04)
SCALE	AS SHOWN
PROJECT LOCATION	FRANKLIN WATER MAIN - OVERALL
PROJECT NO.	FEWR-1

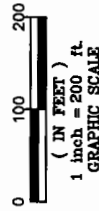
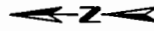




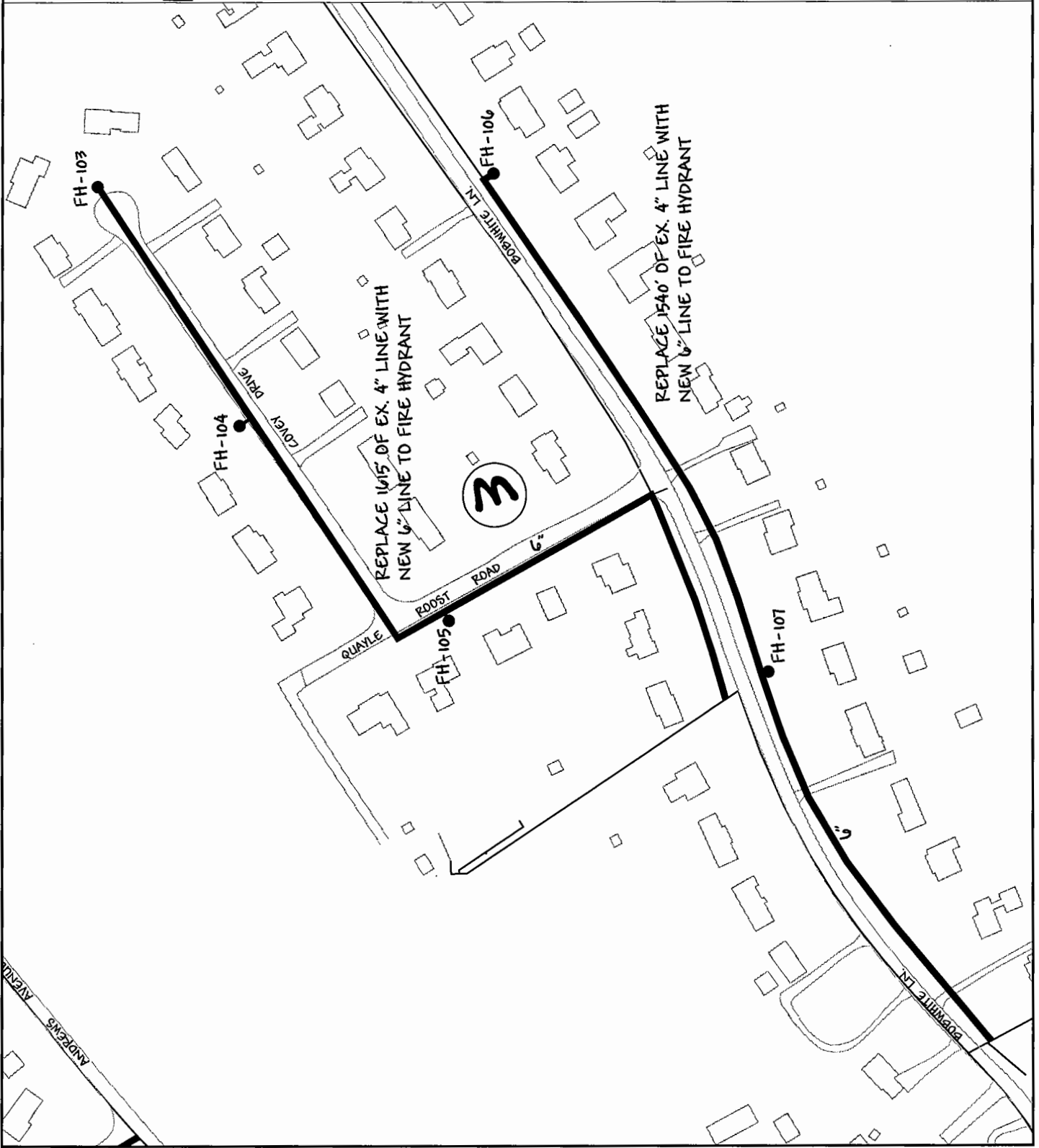
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



<b>WATER SYSTEM</b>	
<b>FRANKLIN, VIRGINIA</b>	
EXISTING SYSTEM	
RECOMMENDED IMPROVEMENTS	
PRISM CONTRACTORS & ENGINEERS, INC.	DATE: 7/1/2006
108 Old Dominion Drive	SCALE: 1" = 200'
Yorktown, Virginia 23692	DATE: 7/1/2006
(757) 874-1021 (Off/VA)	PROJECT: 05-001
(757) 879-0873 (FAX)	FRANKLIN WATER MAINS - OVERALL
www.prisma.com	DRAWN BY: FEWR-2

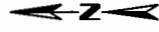




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

**WATER SYSTEM  
FRANKLIN, VIRGINIA**  
EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	NO.	SCALE
105 Old Sedley Road Yorktown, Virginia 23692	10/1/00	100	1" = 200'
(OFF) 870-1021 (ORLA)	PROJECT	FRANKLIN WATER MAINS - GENERAL	
(OFF) 873-0873 (FAX)	DESIGNED BY	KIMLEY-HORN & ASSOCIATES, INC.	
www.prismco.com	DATE	10/1/00	

FEINR-3

**4**  
TAP EX. 10" MAIN FOR 8" OF NEW 6" HYDRANT LINE. INCLUDES NEW VALVE AND HYDRANT. EX. HYDRANT SERVED BY 4" LINE SHOULD BE ABANDONED.

FH-174

**5**

REPLACE 100' OF EX. 4" LINE WITH NEW 6" PIPE LINE TO FIRE HYDRANT

FH-201

FH-200

FH-198

CRESCENT DRIVE

MYRTLE DR

OLD SEDLEY ROAD

OLD SEDLEY ROAD

MAGNOLIA AVE

BRANDON LN

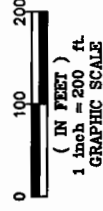


Kimley-Horn  
and Associates, Inc.



**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN

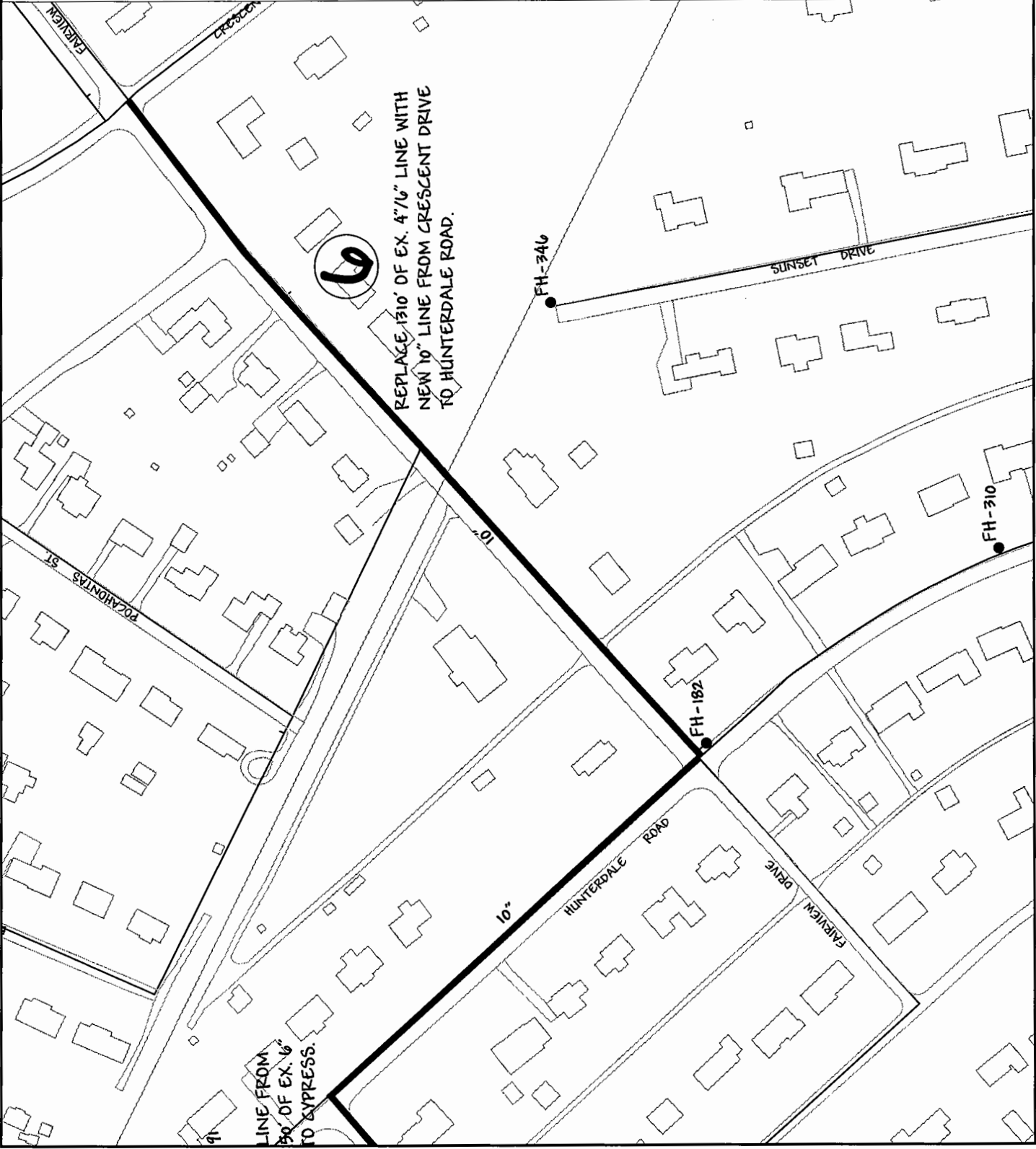


**WATER SYSTEM  
FRANKLIN, VIRGINIA**

**EXISTING SYSTEM**

**RECOMMENDED IMPROVEMENTS**

Project Name	DATE	BY	CHK
PRISM CONTRACTORS & ENGINEERS, INC.			
108 Quarters Road			
Verdeben, Virginia 22684			
(703) 576-0000 (City)	Est. No.	7/1/2004	
(703) 576-0000 (Fax)	Sheet No.		
www.prism.com	Scale		
			<b>FWJR-4</b>



REPLACE 1310' OF EX. 4"/6" LINE WITH  
NEW 10" LINE FROM CRESCENT DRIVE  
TO HUNTERDALE ROAD.

LINE FROM  
90' OF EX. 6"  
TO EXPRESS.

10"

HUNTERDALE ROAD

FH-182

EMBLEM DRIVE

FH-310

SUNSET DRIVE

FH-346

6

POCAHONTAS ST

EMBLEM DRIVE

CROSSLAND DRIVE



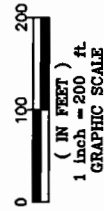
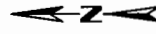


Kimley-Horn  
and Associates, Inc.



**LEGEND**

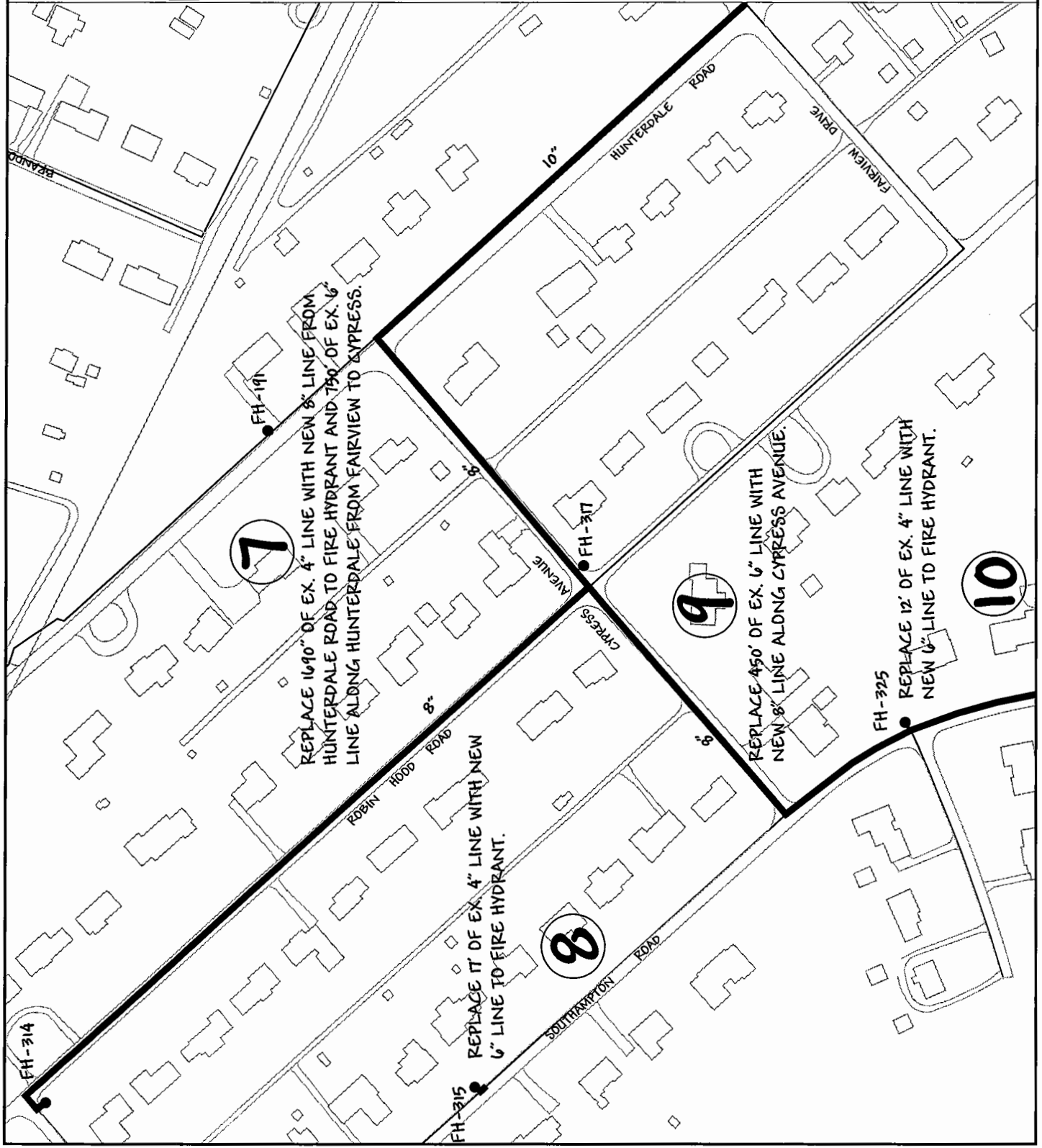
- EX. FIRE HYDRANT - < 500 GPM
- PEDP. WATER MAIN UPGRADE
- EX. WATER MAIN



**WATER SYSTEM**  
**FRANKLIN, VIRGINIA**  
EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	BY	CHKD.
208 Quakermead Drive	DATE	BY	CHKD.
Virginia Beach, VA 23462	DATE	BY	CHKD.
(757) 481-1001 (OFFICE)	DATE	BY	CHKD.
(757) 878-0878 (FAX)	DATE	BY	CHKD.
www.prismva.com	DATE	BY	CHKD.

FENR-5



**7**

REPLACE 10/10" OF EX. 4" LINE WITH NEW 8" LINE FROM HUNTERDALE ROAD TO FIRE HYDRANT AND 750' OF EX. 6" LINE ALONG HUNTERDALE FROM FAIRVIEW TO CYRESS.

**9**

REPLACE 450' OF EX. 6" LINE WITH NEW 8" LINE ALONG CYRESS AVENUE.

**8**

REPLACE 17' OF EX. 4" LINE WITH NEW 6" LINE TO FIRE HYDRANT.

**10**

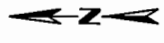
REPLACE 12' OF EX. 4" LINE WITH NEW 6" LINE TO FIRE HYDRANT.



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - 5 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



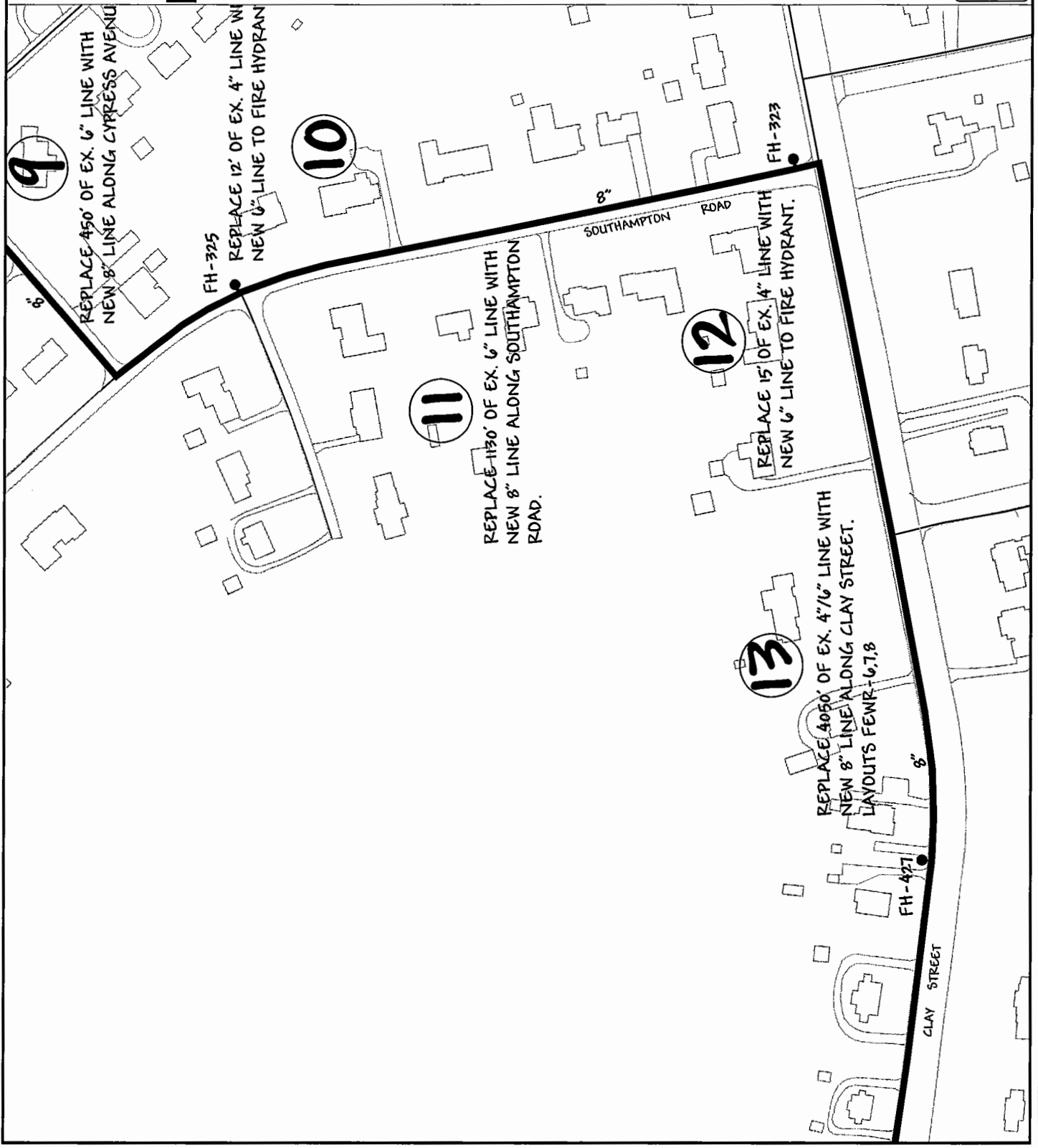
**WATER SYSTEM**  
**FRANKLIN, VIRGINIA**

EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	NO.	BY
100 Quantway Drive	DATE	NO.	BY
FRANKLIN, VIRGINIA 22030	DATE	NO.	BY
(703) 874-1024 (OFFICE)	DATE	NO.	BY
(703) 874-0877 (FAX)	DATE	NO.	BY
www.prisminc.com	DATE	NO.	BY

PREPARED BY: WALTER, BOGGS, & REBECC  
www.prisminc.com

PRISM CONTRACTORS & ENGINEERS, INC.  
DATE: 7/1/2016  
NO.: 108  
BY: WJH

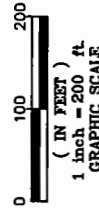
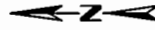




Kimley-Horn  
and Associates, Inc.

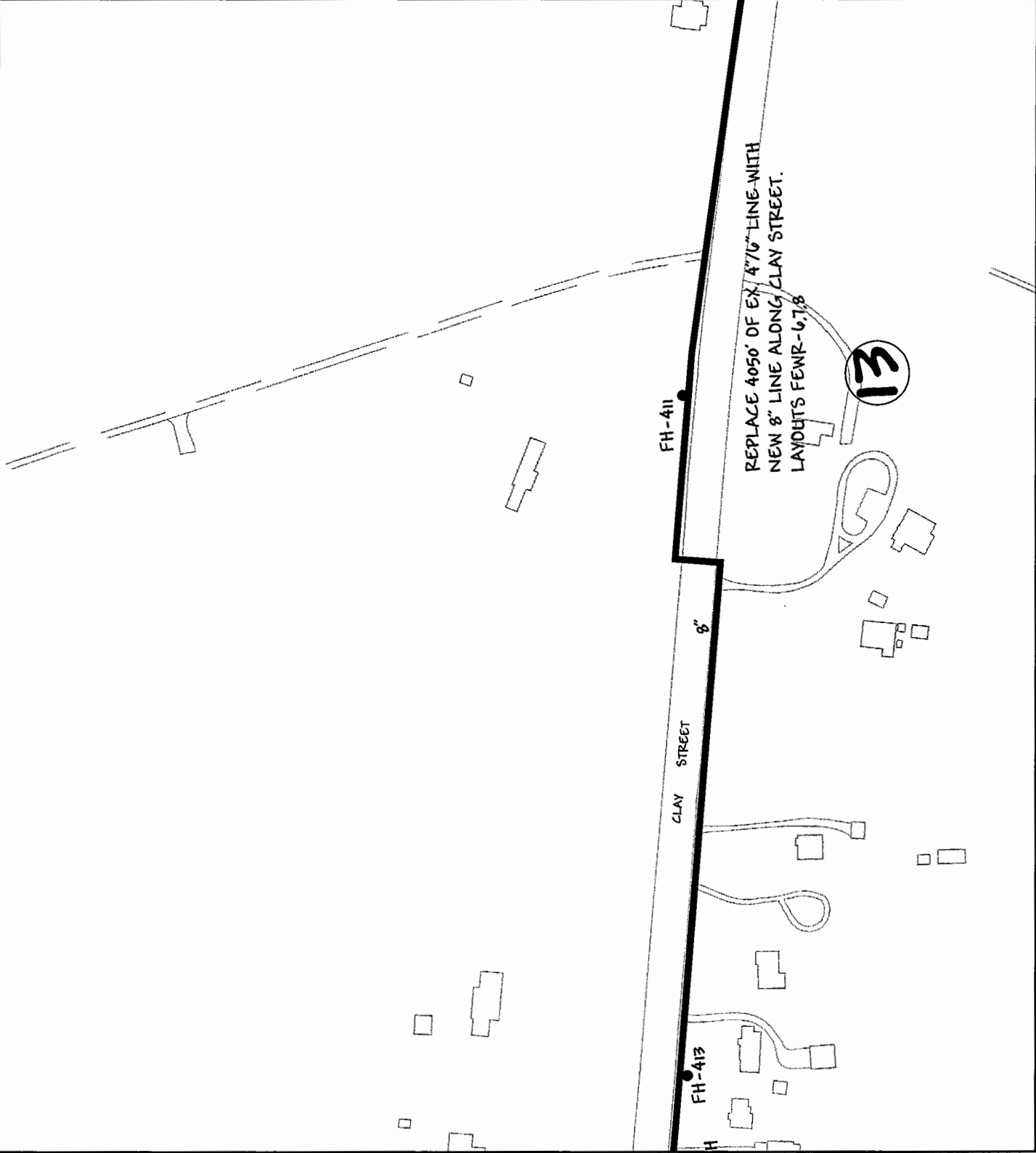
LEGEND

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



**WATER SYSTEM**  
**FRANKLIN, VIRGINIA**  
EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

Prime Contractors	DATE	DATE	DATE
108 Quakerwalk Drive	11/1/04	11/1/04	11/1/04
Franklin, Virginia 23045	11/1/04	11/1/04	11/1/04
(571) 574-1024 (Office)	11/1/04	11/1/04	11/1/04
(571) 574-0873 (Fax)	11/1/04	11/1/04	11/1/04
www.prismva.com	11/1/04	11/1/04	11/1/04
FRANKLIN WATER MAINS - GENERAL			FEWR-7

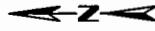




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN

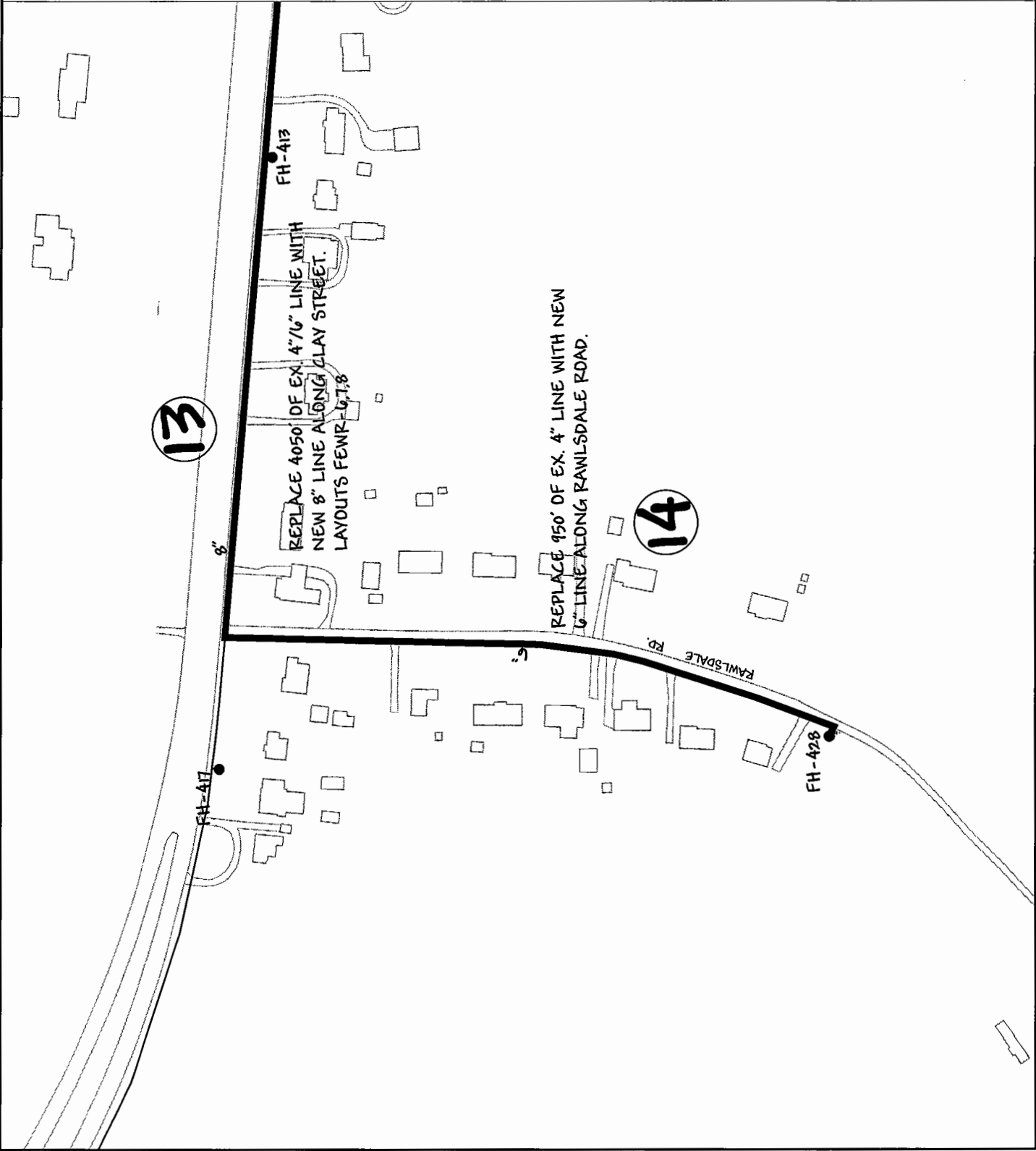


0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

**WATER SYSTEM  
FRANKLIN, VIRGINIA**

**RECOMMENDED IMPROVEMENTS**

Project	Water System Improvements	Scale	1" = 200'
Client	Franklin, VA	Date	12/15/2009
Design	100% Final	Drawn	JK
Checked	JK	Reviewed	JK
Project No.	1008	Sheet No.	17 of 20
Project Name	Water System Improvements	Project Location	Franklin, VA
Project Address	1008 Quakermark Drive Yorktown, Virginia 23692	Project Contact	Franklin Water Model - Overall
Project Phone	(571) 819-1021 (Office)	Project Email	www.prismva.com
Project Fax	(571) 819-0877 (Fax)	Project Website	FEWR-8

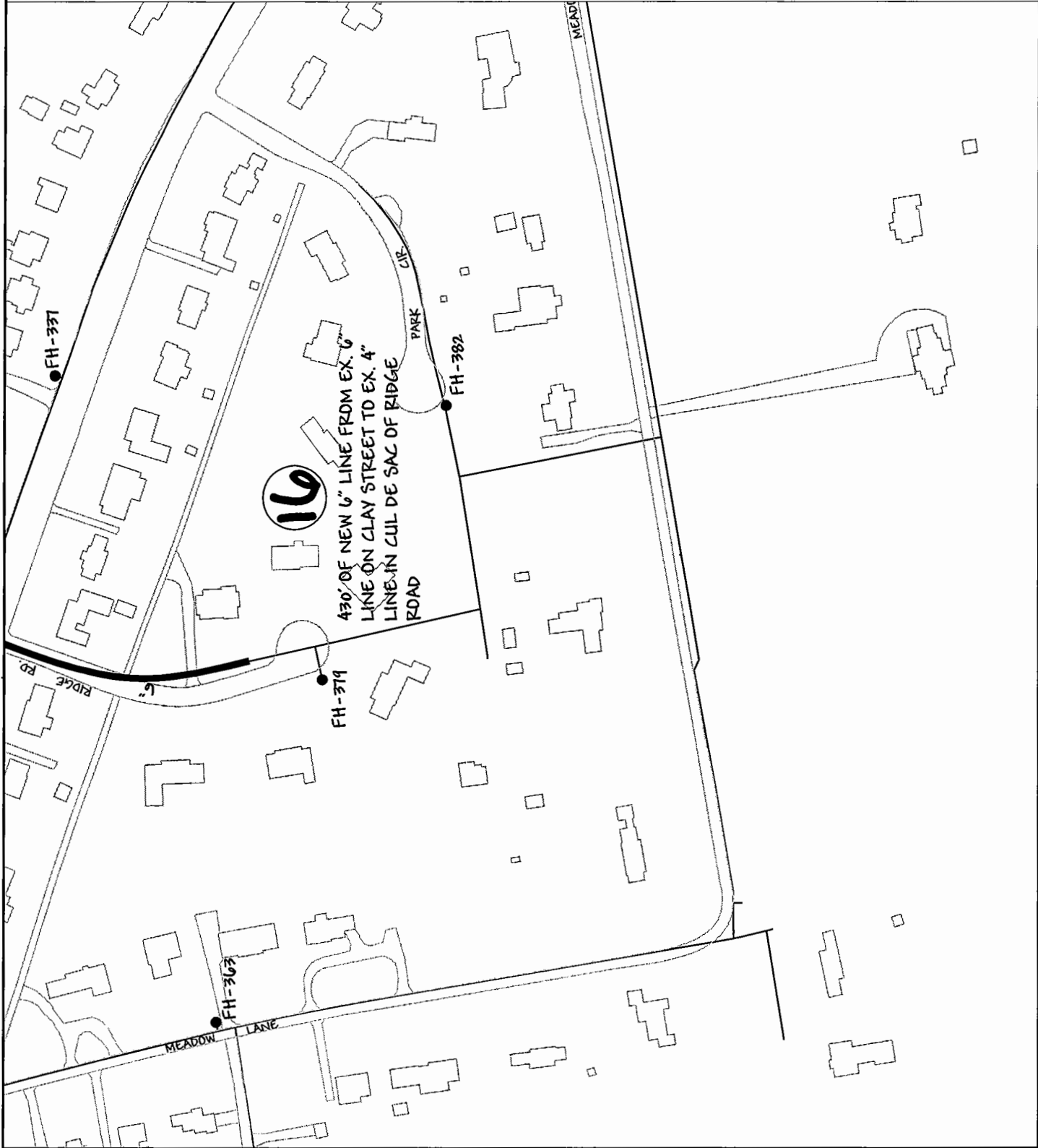
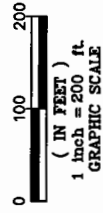
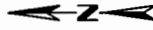




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - c. 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



**WATER SYSTEM  
FRANKLIN, VIRGINIA**

EXISTING SYSTEM

**RECOMMENDED IMPROVEMENTS**

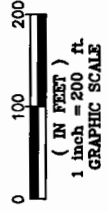
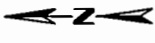
PRISM CONTRACTORS	DATE	SCALE	PROJECT NO.
108 Quakerman Drive			
Verobron, Virginia 23064			
(977) 874-1021 (O/HA)			3/17/2006
(977) 899-0872 (FA)			FRANKLIN WATER MODEL - OVERALL
www.prismca.com			FEWER-9



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN

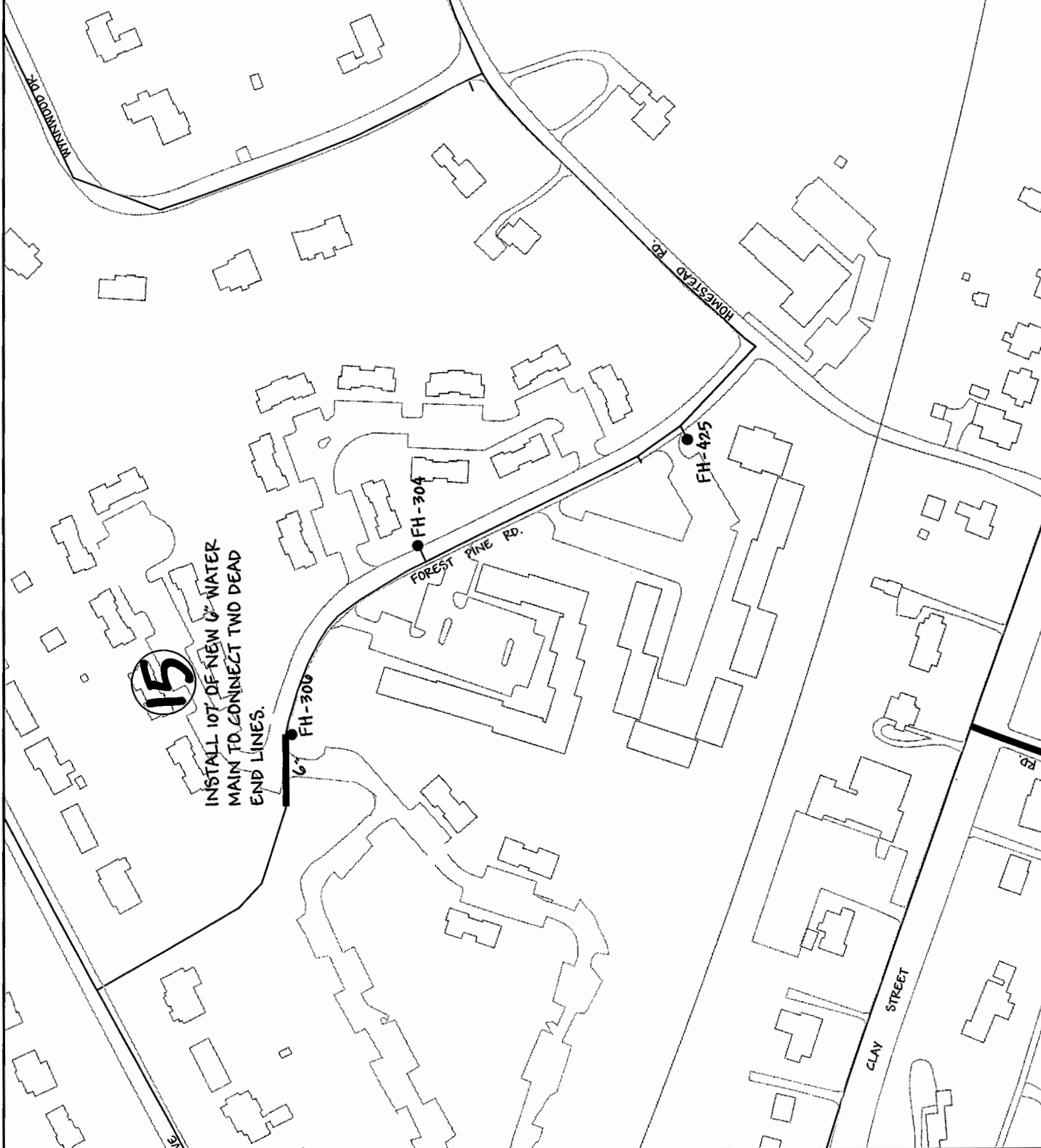


**WATER SYSTEM  
FRANKLIN, VIRGINIA**

**EXISTING SYSTEM**

**RECOMMENDED IMPROVEMENTS**

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	BY	CHK'D
108 S. CLAY ST., SUITE 200 FARMINGTON, VIRGINIA 22642 (571) 874-1021 (OFFICE) (571) 879-0878 (FAX)	7/1/2006	JK	JK
www.prismca.com	FRANKLIN WATER MAINS - GENERAL		
FWMR-10			

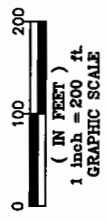
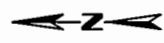




Kimley-Horn  
and Associates, Inc.

**LEGEND**

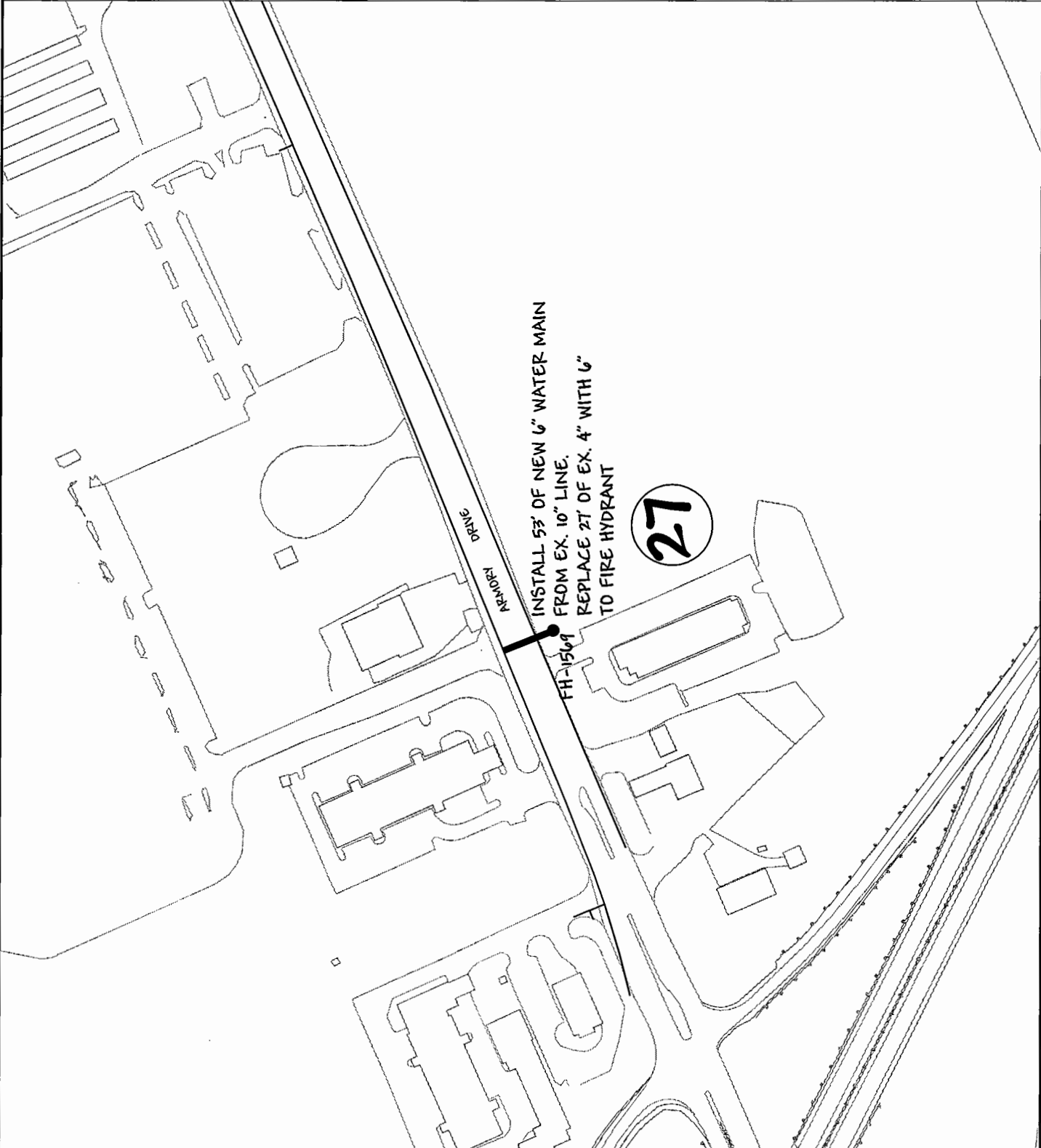
- EX. FIRE HYDRANT - 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



**WATER SYSTEM  
FRANKLIN, VIRGINIA**

EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

Project Name	Water System	Sheet No.	27
Client	Franklin, Virginia	Date	7/1/2006
Contract No.	027-001-001 (P&S)	Scale	AS SHOWN
Contractor	PRISM CONTRACTORS & ENGINEERS, INC.	Author	JK
Engineer	JK	Checker	JK
Project Manager	JK	Reviewer	JK
Project Location	Franklin, Virginia	Project No.	027-001-001
Project Description	Water System Upgrade	Project Status	Final
Project Start Date	7/1/2006	Project End Date	7/1/2006
Project Manager	JK	Project Engineer	JK
Project Designer	JK	Project Checker	JK
Project Drafter	JK	Project Reviewer	JK
Project Approver	JK	Project Signer	JK
Project Seal	JK	Project Stamp	JK
Project Title	Water System Upgrade	Project Location	Franklin, Virginia
Project Date	7/1/2006	Project No.	027-001-001
Project Status	Final	Project Manager	JK
Project Designer	JK	Project Checker	JK
Project Drafter	JK	Project Reviewer	JK
Project Approver	JK	Project Signer	JK
Project Seal	JK	Project Stamp	JK
Project Title	Water System Upgrade	Project Location	Franklin, Virginia
Project Date	7/1/2006	Project No.	027-001-001
Project Status	Final	Project Manager	JK
Project Designer	JK	Project Checker	JK
Project Drafter	JK	Project Reviewer	JK
Project Approver	JK	Project Signer	JK
Project Seal	JK	Project Stamp	JK



INSTALL 53' OF NEW 6" WATER MAIN  
FROM EX. 10" LINE.  
REPLACE 21' OF EX. 4" WITH 6"  
TO FIRE HYDRANT

27

RANNEY DRIVE

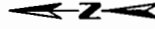
FH-1504



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



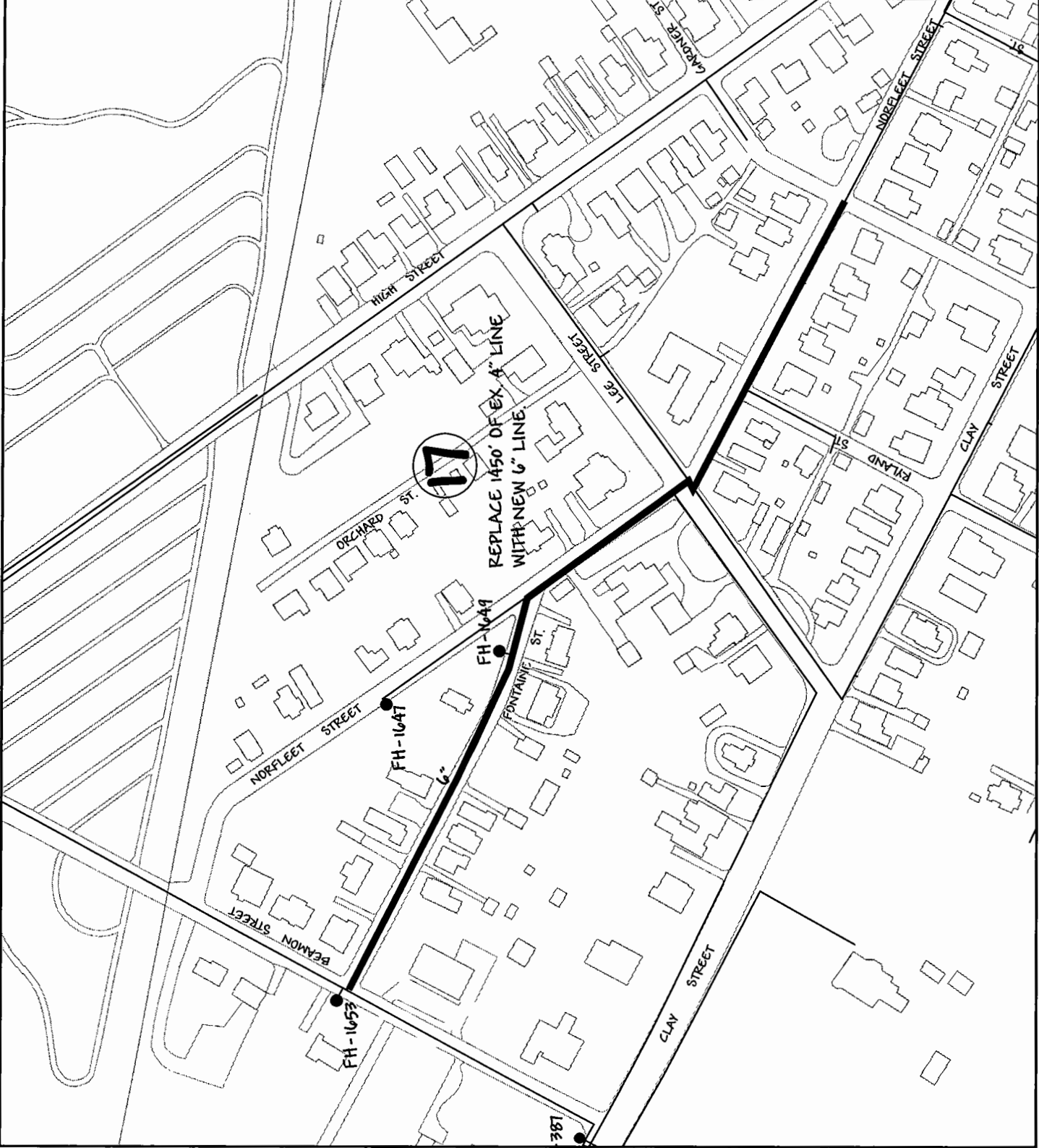
0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

**WATER SYSTEM  
FRANKLIN, VIRGINIA**  
EXISTING SYSTEM

RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	NO.	BY
108 Quakerwalk Drive Yorktown, Virginia 23695	04/11/2009	17	JK
(571) 879-1021 (Office)			
(571) 879-0878 (Fax)			
www.prismusa.com			

FEWR-12



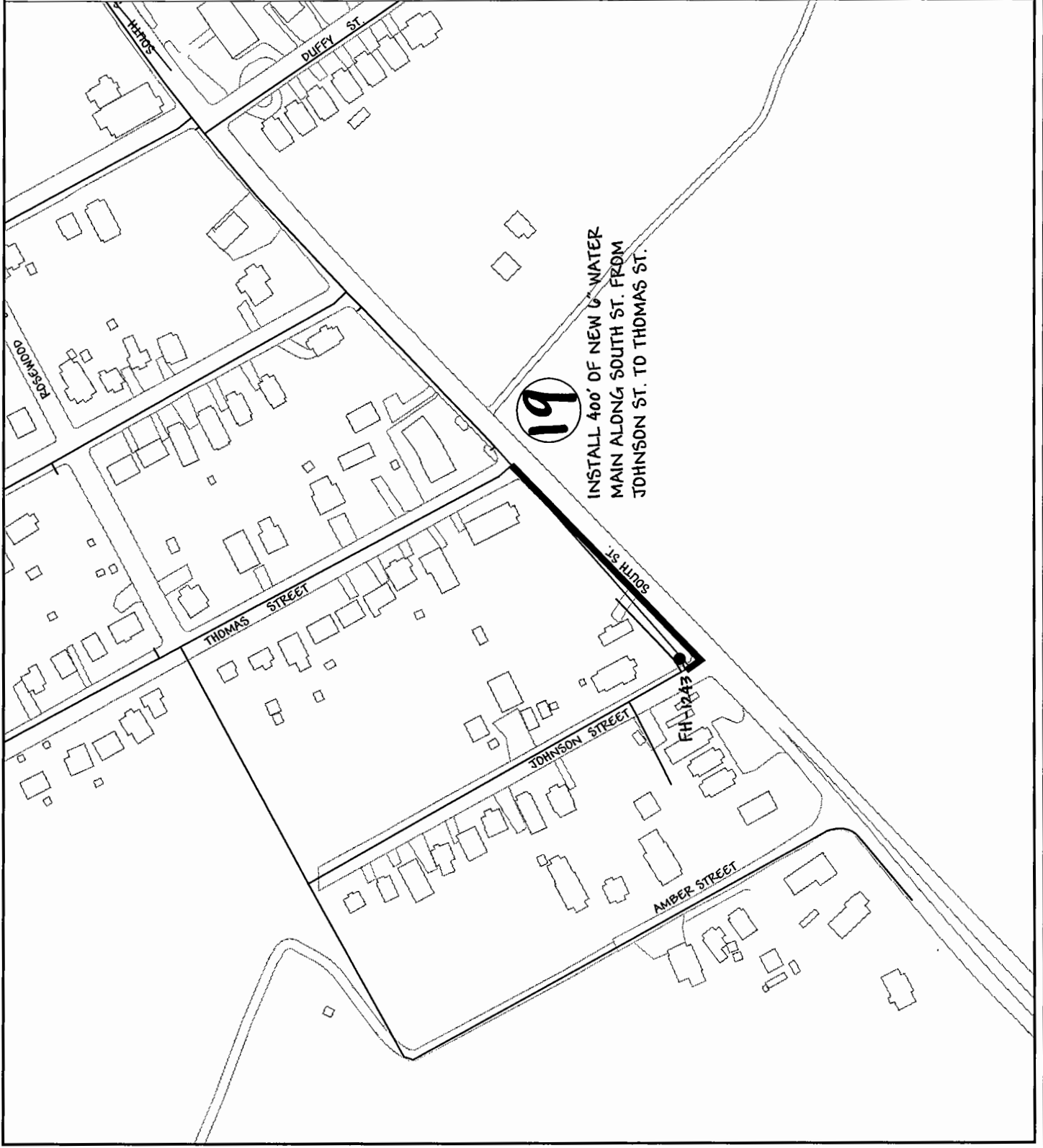
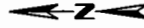




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



**19**

INSTALL 400' OF NEW 6" WATER MAIN ALONG SOUTH ST. FROM JOHNSON ST. TO THOMAS ST.

FH-1243

**WATER SYSTEM**  
**FRANKLIN, VIRGINIA**

EXISTING SYSTEM

RECOMMENDED IMPROVEMENTS

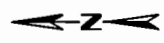
PRISM CONTRACTORS & ENGINEERS, INC.	DATE	BY	CHKD.
1000 GARDINERS DRIVE			
FRANKLIN, VIRGINIA 23841			
(757) 874-1021 (OFFICE)	DATE	BY	CHKD.
(757) 973-0873 (FAX)	7/17/2006		
www.prismusa.com			
FRANKLIN WATER MODEL - OVERALL			
FEINR-13			



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

**WATER SYSTEM**  
**FRANKLIN, VIRGINIA**

EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

DATE	BY	CHKD	APP'D
11/20/06	EH	DK	JK

Prism Contractors & Engineers, Inc.  
100 Quartersman Drive  
Franklin, VA 22031  
(571) 874-0811 (OFFICE)  
(571) 874-0811 (FAX)  
www.prismva.com

PRISM-14



INSTALL 50' OF NEW 6" WATER MAIN FROM EX. 6" TO DEAD END 4" LINE

18

EH-1290

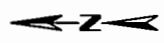
FH-1291



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

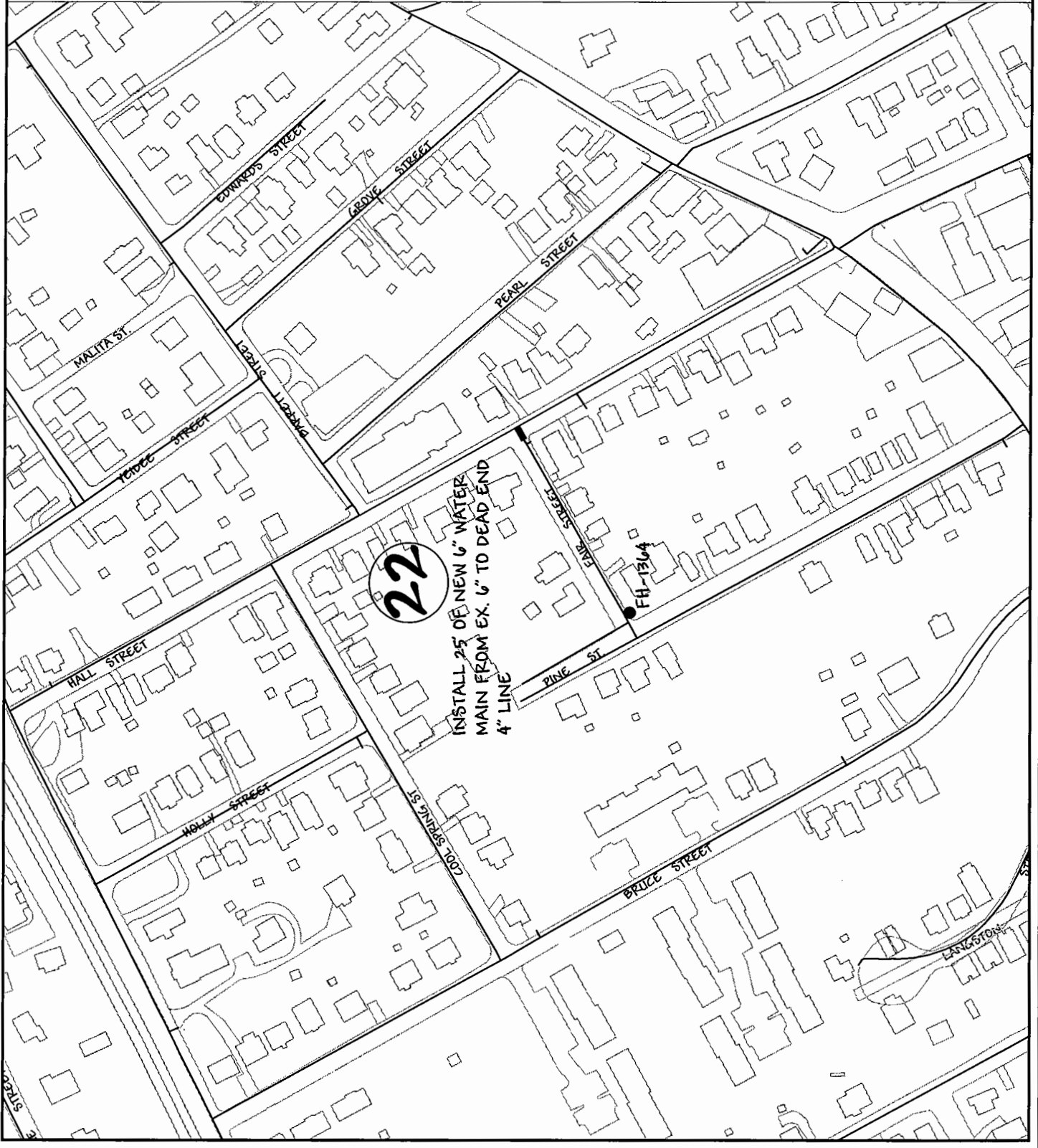
**WATER SYSTEM  
FRANKLIN, VIRGINIA**

EXISTING SYSTEM

RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	BY	CHKD.
10000 W. VIRGINIA ST., SUITE 200 FARMINGTON, VIRGINIA 22031	DATE	DATE	DATE
(571) 873-1021 (OFFICE)	PROJECT NO.	DATE	DATE
(571) 873-0675 (FAX)	PROJECT NAME	DATE	DATE
www.prismva.com	PROJECT NO.	DATE	DATE

FEWR-15

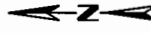




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - 4 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



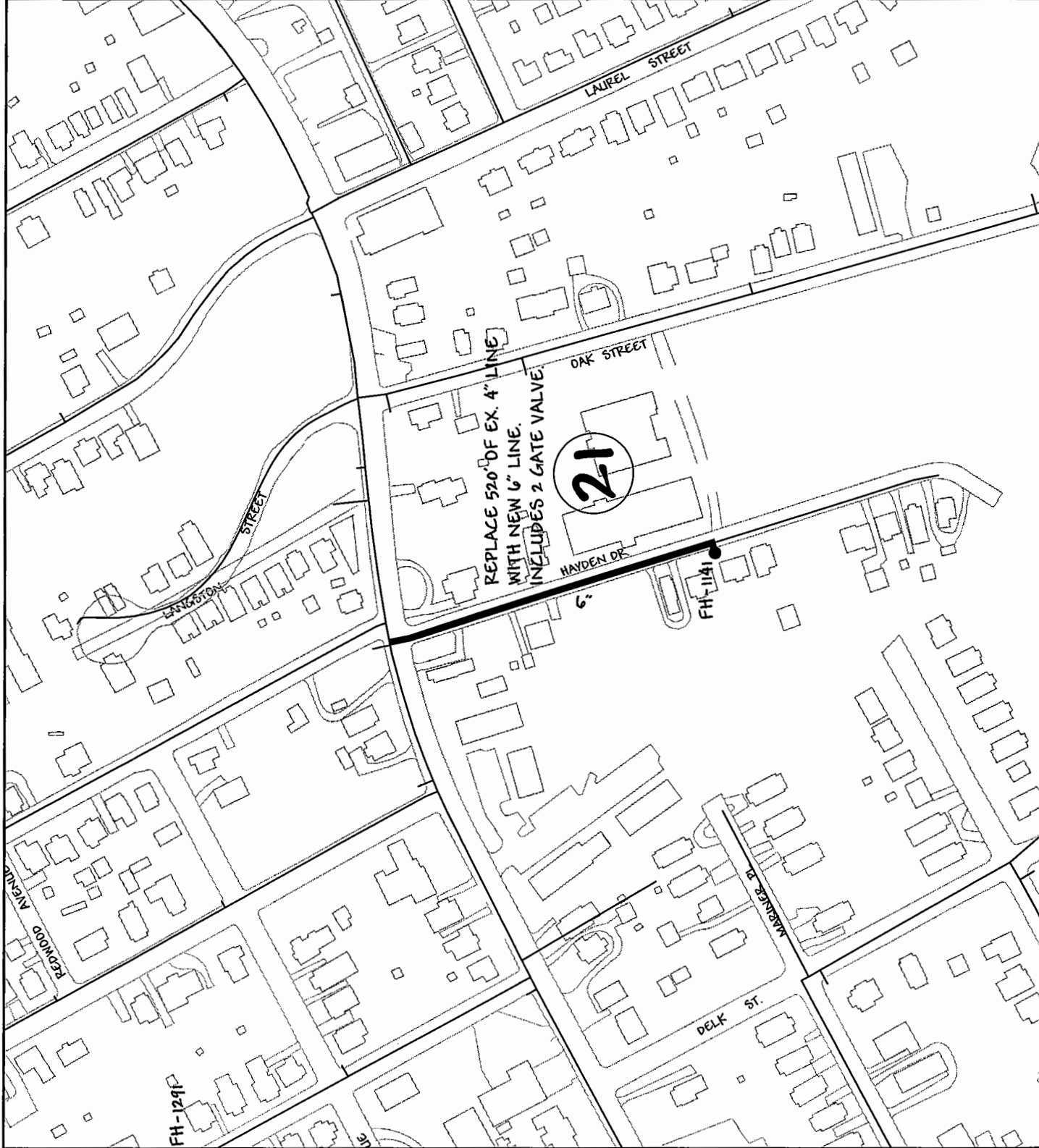
**WATER SYSTEM  
FRANKLIN, VIRGINIA**

**EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS**

Project No.	DATE	SCALE	BY	CHKD.	DATE	SCALE	BY	CHKD.	DATE

Prism Contractors & Engineers, Inc.  
108 Quakermarsh Drive  
Forkland, Virginia 23041  
(571) 516-1041 (Office)  
(571) 593-8875 (Fax)  
www.prisminc.com

FRANKLIN WATER MODEL - OVERALL  
FENR-14



FH-1291

FH-1141

21

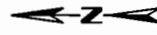
REPLACE 520' OF EX. 4" LINE  
WITH NEW 6" LINE.  
INCLUDES 2 GATE VALVE



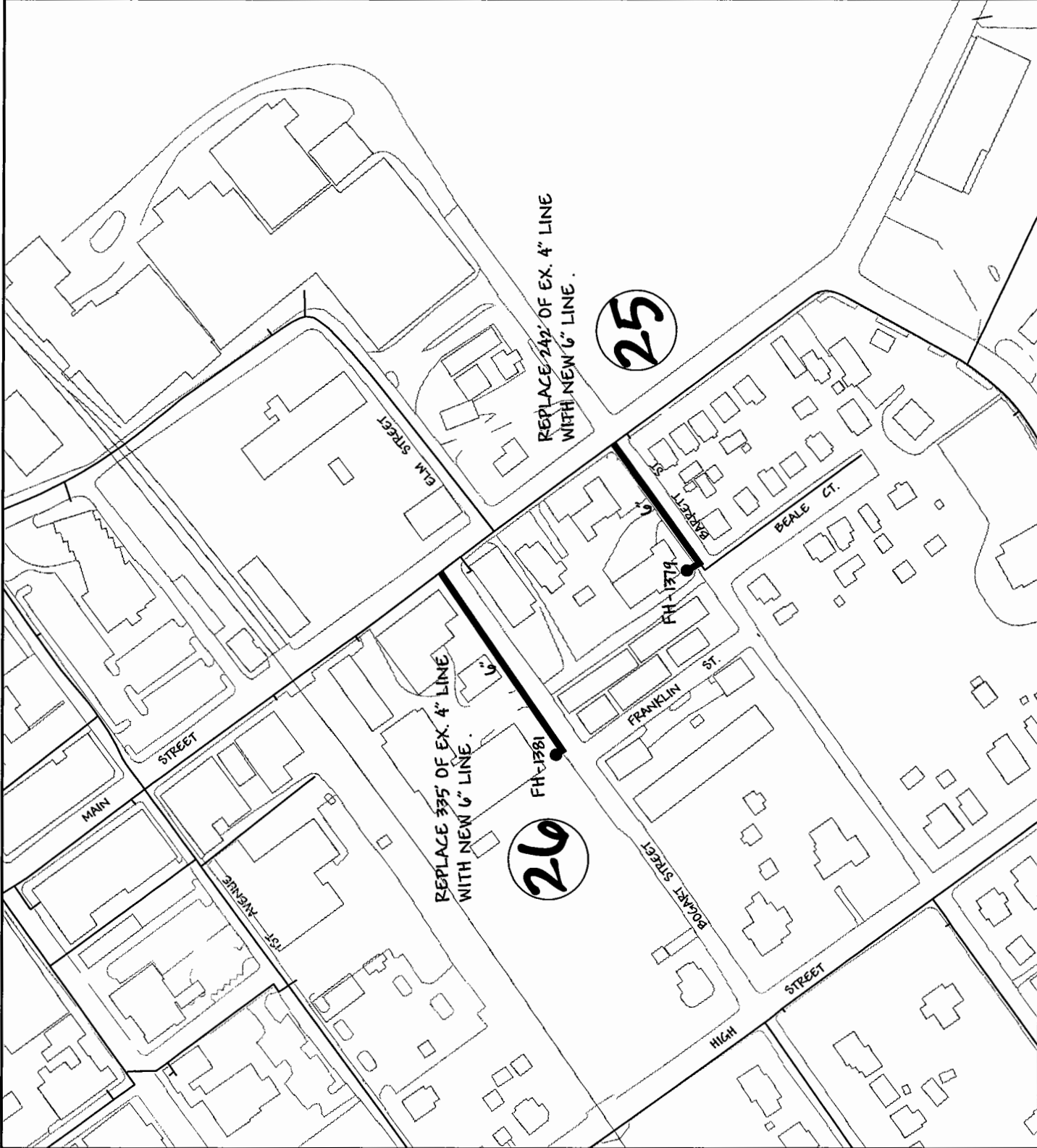
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



<b>WATER SYSTEM FRANKLIN, VIRGINIA</b>	
EXISTING SYSTEM	
RECOMMENDED IMPROVEMENTS	
PRISM CONSULTING & ENGINEERS, INC. 108 Quakermark Drive Norfolk, Virginia 23513 (757) 676-1001 (Office) (757) 676-0875 (Fax) www.prisminc.com	DATE: _____ DNE: _____ DATE: _____ EX. JOB: _____ PROJECT: FRANKLIN WATER UPGRADE - ORIGINAL SHEET: FEWR-17

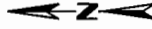




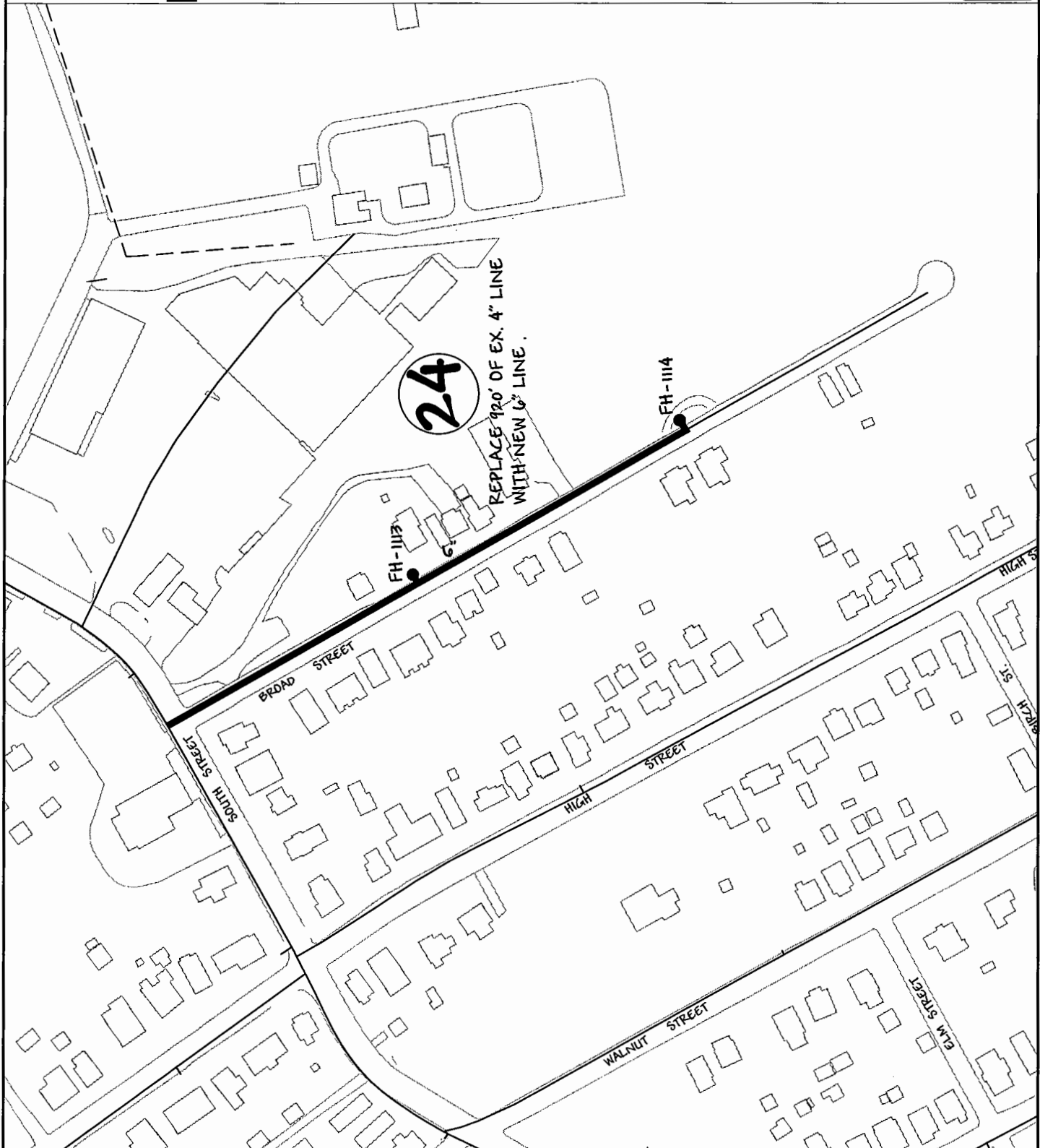
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



<b>WATER SYSTEM</b>	
<b>FRANKLIN, VIRGINIA</b>	
EXISTING SYSTEM	
RECOMMENDED IMPROVEMENTS	
PRISM CONTRACTORS & ENGINEERS, INC.	DATE: 7/1/2004
108 E. MAIN STREET	SCALE: 1" = 200'
YORKTOWN, VIRGINIA 23090	PROJECT: 010104
(757) 876-1021 (OFFICE)	DATE: 7/1/2004
(757) 879-0873 (FAX)	PROJECT: FRANKLIN WATER MAIN - OVERALL
WWW.PRISMA.COM	DRAWING NO: FENR-18

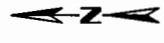




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - < 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN

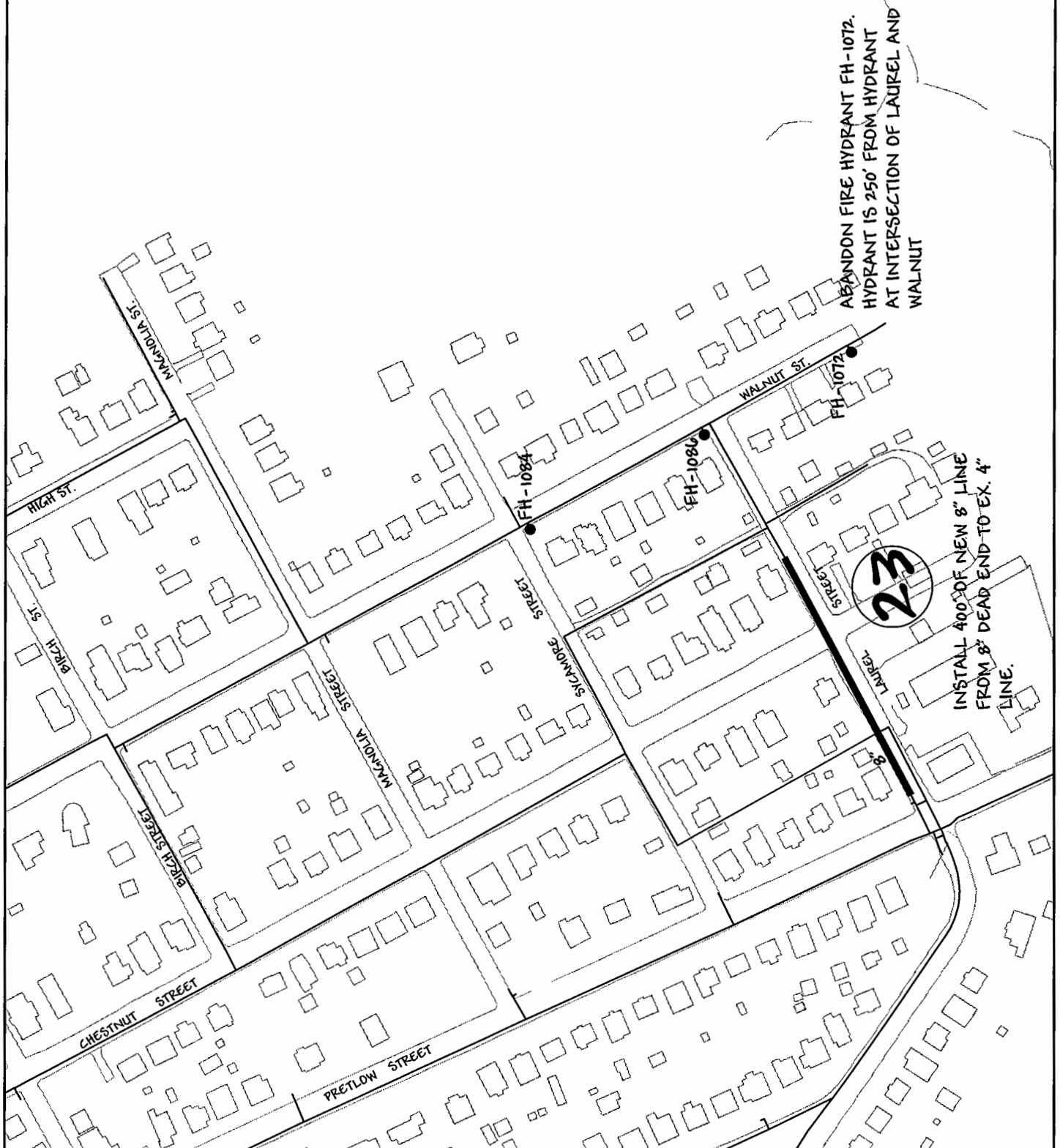


0 100 200  
( IN FEET )  
1 inch = 200 ft.  
GRAPHIC SCALE

**WATER SYSTEM**  
FRANKLIN, VIRGINIA

EXISTING SYSTEM  
RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	BY	CHKD.
105 Quakerborn Drive Franklin, VA 22031 (571) 874-1031 (OFFICE) (571) 874-0875 (FAX) www.prismva.com	11/1/2006	JK	JK
PROJECT: WATER MAIN UPGRADE - 23		SHEET NO.: 23 OF 23	



ABANDON FIRE HYDRANT FH-1072.  
HYDRANT IS 250' FROM HYDRANT  
AT INTERSECTION OF LAUREL AND  
WALNUT

INSTALL 400' OF NEW 8" LINE  
FROM 8" DEAD END TO EX. 4"  
LINE.

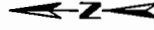
23



Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - 4 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



0 100 200  
 ( IN FEET )  
 1 inch = 200 ft.  
 GRAPHIC SCALE

**WATER SYSTEM  
FRANKLIN, VIRGINIA**

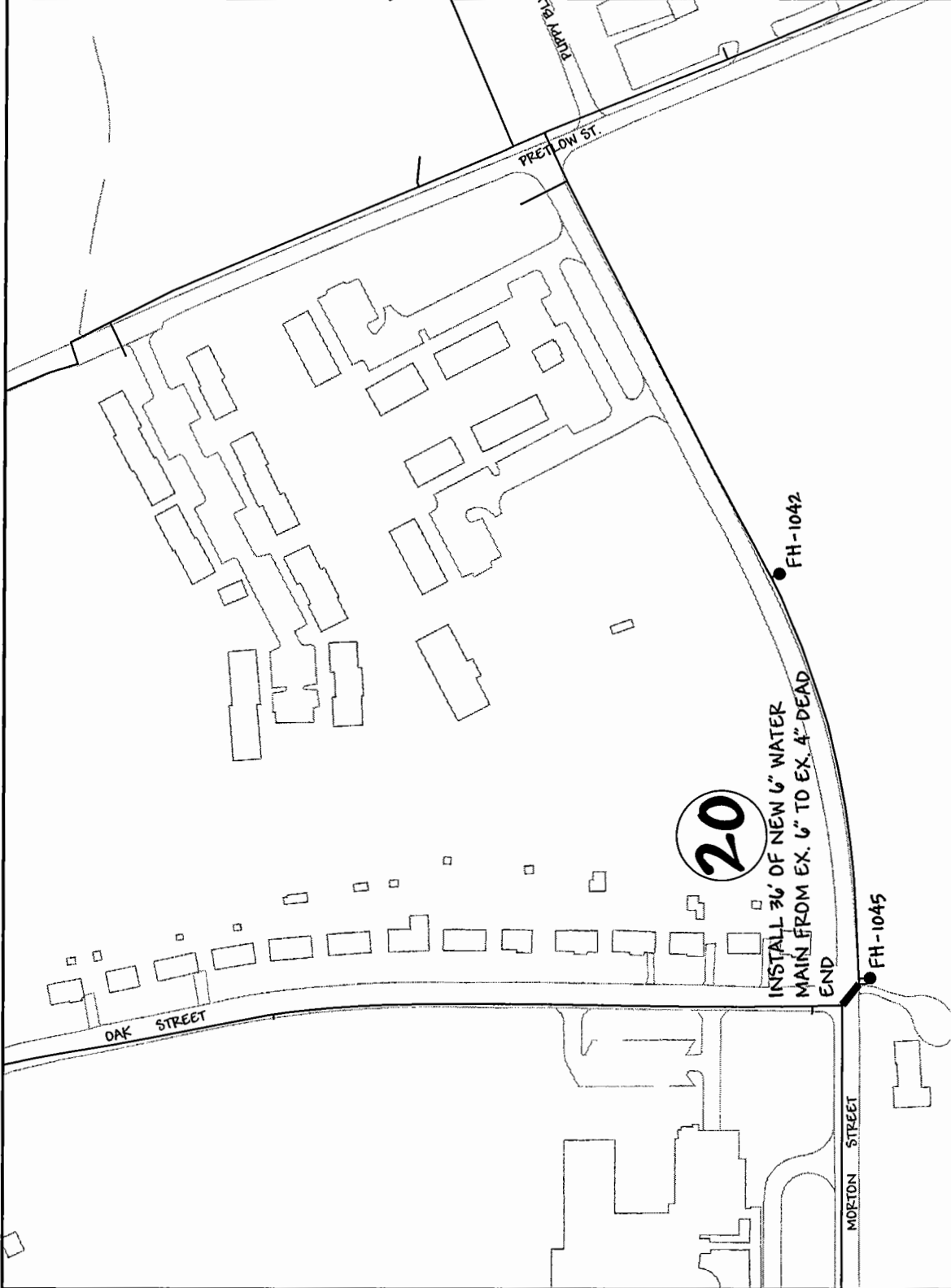
EXISTING SYSTEM

RECOMMENDED IMPROVEMENTS

PRISM CONTRACTORS	DATE	BY	CHK
100 QUAILMARCH DRIVE	11/11/2009	JK	JK
FRANKLIN, VIRGINIA 23045			
(571) 574-1021 (OFFICE)	DATE	BY	CHK
(571) 573-0873 (FAX)	11/11/2009	JK	JK
www.prismusa.com			

FRANKLIN WATER USES... ORIGINAL

FEINR-20



**20**

INSTALL 36' OF NEW 6" WATER MAIN FROM EX. 6" TO EX. 4" DEAD END

FH-1042

FH-1045

DAK STREET

PRECIOUS ST.

MORTON STREET

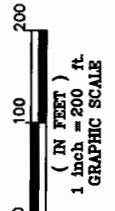
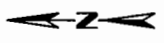




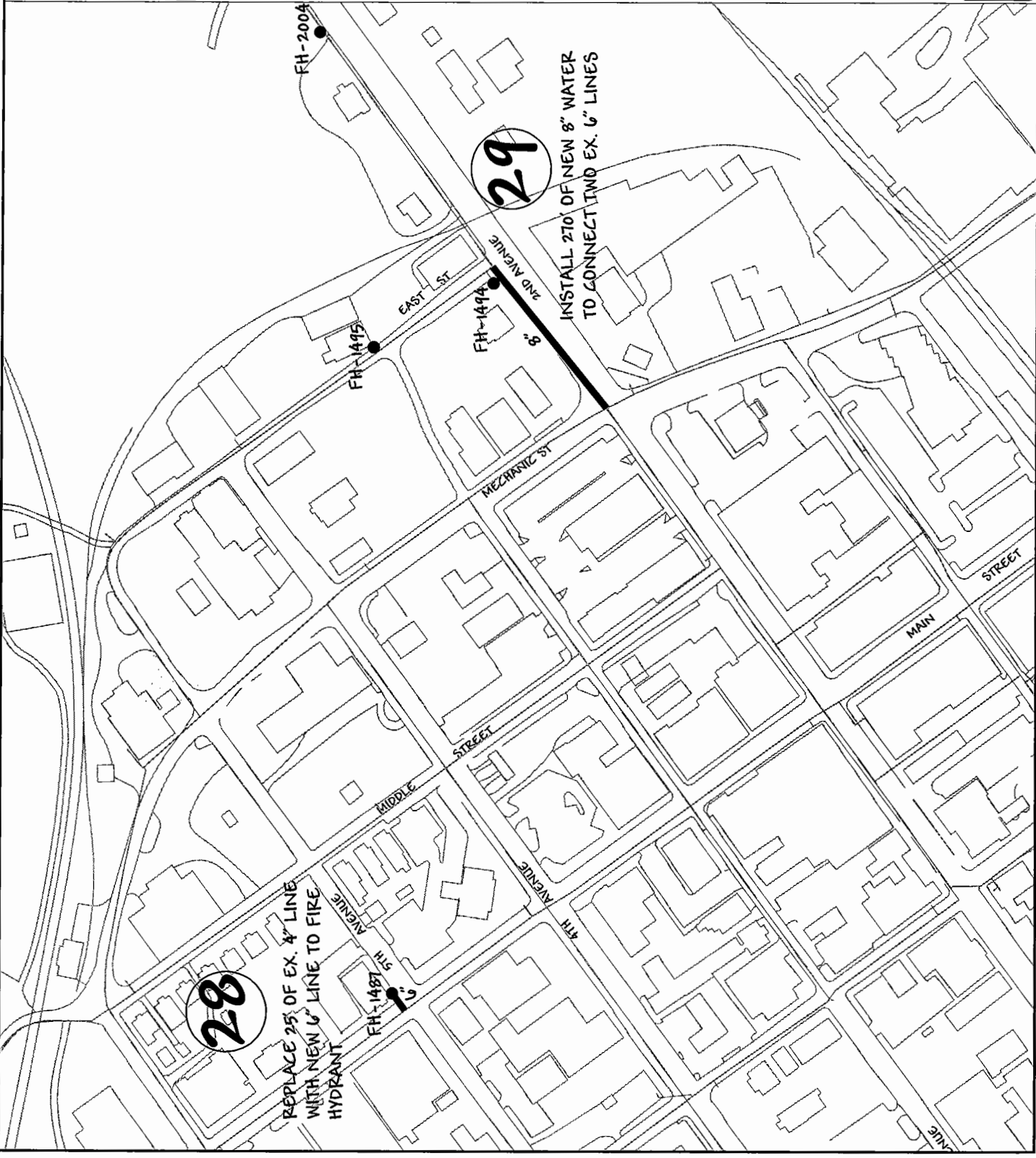
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EX. FIRE HYDRANT - 4 500 GPM
- PROP. WATER MAIN UPGRADE
- EX. WATER MAIN



<b>WATER SYSTEM</b>	
FRANKLIN, VIRGINIA	
EXISTING SYSTEM	
<b>RECOMMENDED IMPROVEMENTS</b>	
PRISM CONTRACTORS	DATE: 7/2/2009
108 GARDNER DRIVE	DRAWN BY: JH
FRANKLIN, VIRGINIA 23104	CHECKED BY: JH
(757) 874-1021 (OFFICE)	DATE: 7/2/2009
(757) 873-0873 (FAX)	PROJECT: FRANKLIN WATER UPGRADE - OVERALL
WWW.PRISMUSA.COM	SCALE: FEINR-21



# **APPENDIX L**

## **FIRE FLOW COMPARISON BEFORE AND AFTER RECOMMENDED WATER DISTRIBUTION SYSTEM UPGRADES**

Fire Hydrant	Available Fire Flow	Available Fire Flow
	(gpm @ 20 psi) Existing	(gpm @ 20 psi) After Upgrades
FH-103	257	712
FH-104	308	809
FH-1042	407	723
FH-1045	297	877
FH-105	421	1,112
FH-106	295	761
FH-107	445	1,184
FH-1072	366	380
FH-1084	482	505
FH-1086	482	511
FH-1113	408	971
FH-1114	287	798
FH-113	377	757
FH-114	362	661
FH-1141	448	955
FH-1243	334	630
FH-1290	328	813
FH-1291	423	738
FH-1364	310	682
FH-1379	431	1,159
FH-1381	382	1,265
FH-1487	981	1,206
FH-1494	805	1,280
FH-1495	920	1,331
FH-1569	239	1,376
FH-1647	432	562
FH-1649	483	945
FH-1653	312	720
FH-174	270	1,538
FH-182	456	1,188
FH-191	445	756
FH-196	477	559
FH-200	289	641
FH-2004	740	1,147
FH-201	499	707
FH-303	395	948
FH-304	376	982
FH-306	360	1,030



Kimley-Horn  
and Associates, Inc.

<b>Fire Hydrant</b>	<b>Available Fire Flow (gpm @ 20 psi) Existing</b>	<b>Available Fire Flow (gpm @ 20 psi) After Upgrades</b>
FH-310	391	712
FH-314	237	951
FH-315	320	625
FH-317	418	1,015
FH-323	336	923
FH-325	365	1,017
FH-335	339	609
FH-336	342	614
FH-337	346	622
FH-338	351	643
FH-342	359	654
FH-343	366	733
FH-346	331	562
FH-354	372	799
FH-355	370	703
FH-358	336	579
FH-360	340	598
FH-363	345	614
FH-379	280	549
FH-382	311	549
FH-387	337	605
FH-396	349	864
FH-401	351	898
FH-406	349	891
FH-409	346	856
FH-411	262	828
FH-413	188	758
FH-417	159	711
FH-425	399	935
FH-427	323	744
FH-428	137	675
FH-434	371	801
FH-435	371	801
FH-436	372	801
FH-438	372	801



# **APPENDIX M**

**LOCATION MAPS FOR RECOMMENDED SEWER SYSTEM UPGRADES**

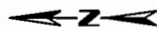


Kimley-Horn  
and Associates, Inc.

**LEGEND**

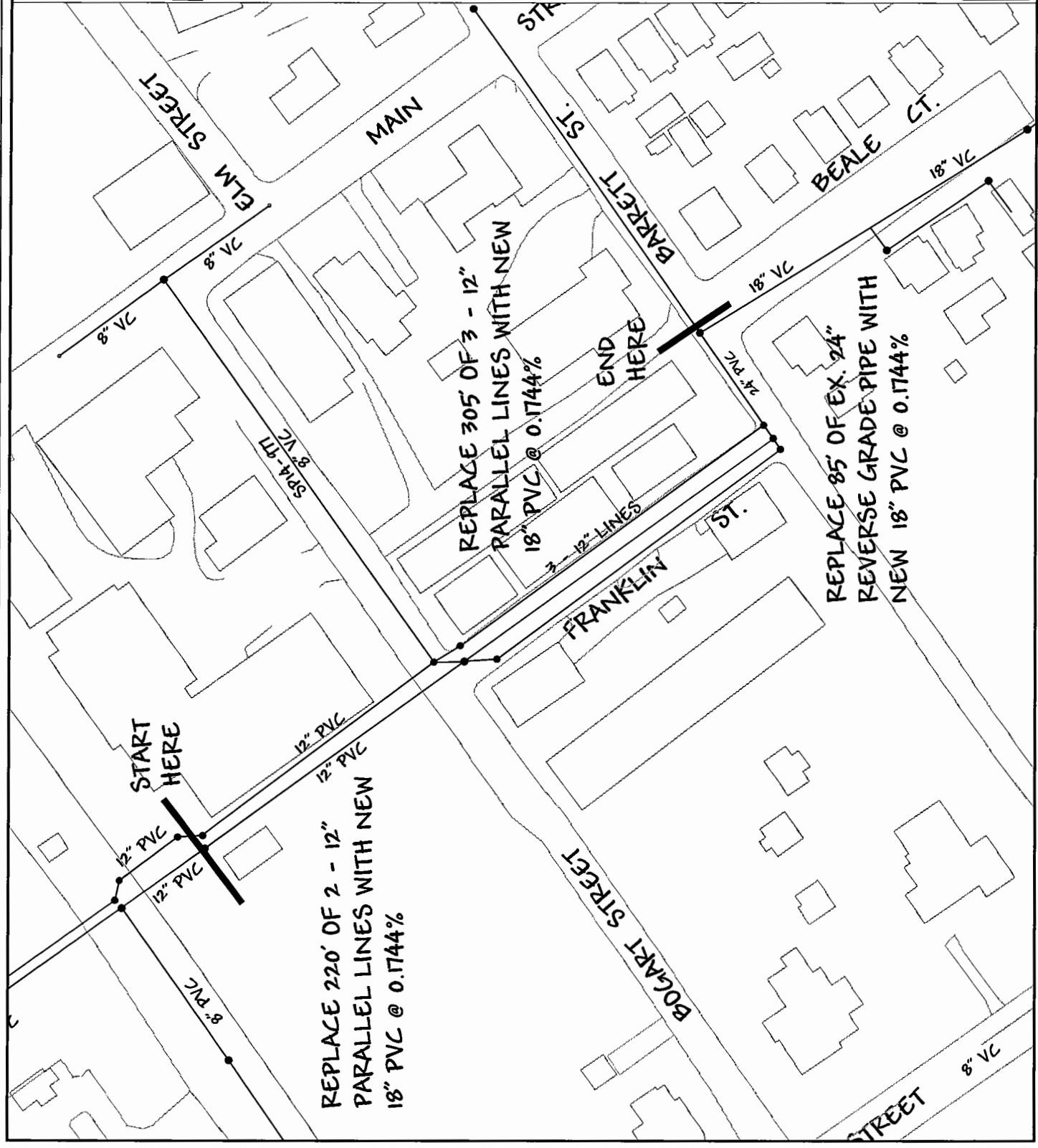
— EX. SEWER LINES

● MANHOLE



0 50 100  
( IN FEET )  
1 inch = 100 ft  
GRAPHIC SCALE

<b>SEWER SYSTEM</b>	
FRANKLIN, VIRGINIA	
EXISTING SYSTEM	
<b>RECOMMENDED IMPROVEMENTS</b>	
PRISM CONTRACTORS & ENGINEERS, INC.	DATE: 7/1/2006
1000 W. MAIN STREET, SUITE 200	SCALE: 1" = 100'
WESTON, VIRGINIA 22693	PROJECT: 06-001
(703) 874-0221 (OFFICE)	DATE: 7/1/2006
(703) 899-0878 (FAX)	DESIGNER: JESSIE L. STONE, P.E.
WWW.PRISMCA.COM	PROJECT NO.: FESR-1



# **APPENDIX N**

**DEVELOPMENT AREA MAPS  
(Future Water and Sewer System Upgrades)**



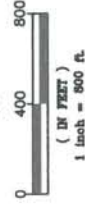
Kimley-Horn  
and Associates, Inc.

**LEGEND**

- EXISTING PUMP STATION NO UPGRADES
- EXISTING PUMP STATION NEEDS UPGRADE
- PROPOSED FUTURE PUMP STATION

**POTENTIAL DEVELOPMENT AREAS**

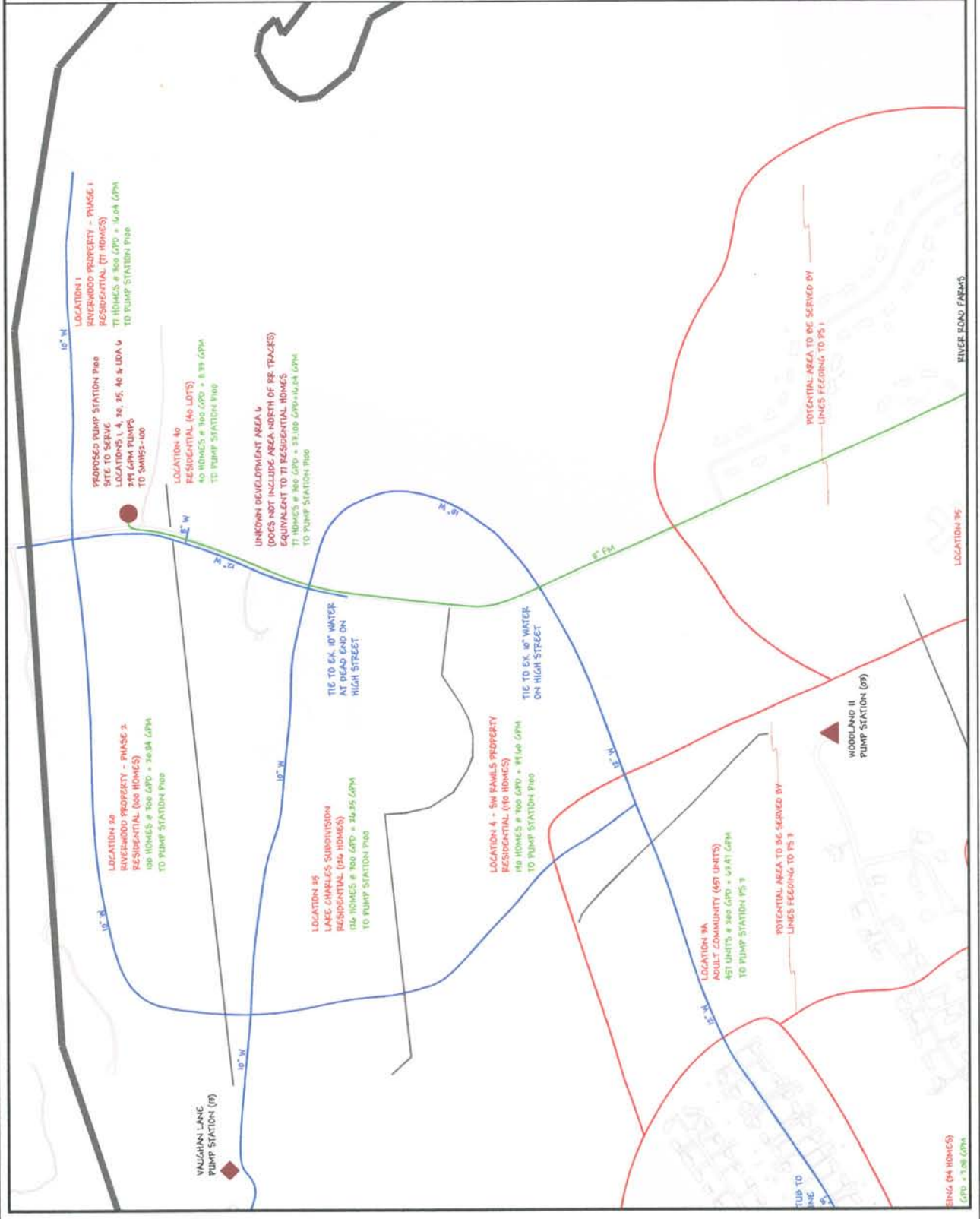
- KNOWING DEVELOPMENT AREAS
- UNKNOWN DEVELOPMENT AREAS
- PUMP STATION SERVICE AREA
- FUTURE SEWER FORCE MAIN
- FUTURE WATER MAIN
- LOT LINE (APPROX)
- STORAGE TANK



**GRAPHIC SCALE**

SANITARY SEWER & WATER OVERVIEW  
FRANKLIN, VIRGINIA  
POTENTIAL DEVELOPMENT AREAS  
MAP 1

PRISM CONSULTING & ENGINEERING, INC. 108 Quakerman Drive Verobon, Virginia 22081 (703) 919-1021 (Office) (703) 991-8915 (Fax) prisminc.com	DATE: 10/20/10 DRAWN BY: NIK CHECKED BY: NIK DATE: 10/27/10 SCALE: AS SHOWN
---	---







Kimley-Horn  
and Associates, Inc.

**LEGEND**

- ◆ EXISTING PUMP STATION NO UPGRADES
- ▲ EXISTING PUMP STATION NEEDS UPGRADE
- PROPOSED FUTURE PUMP STATION

KNOWN DEVELOPMENT AREAS  
UNKNOWN DEVELOPMENT AREAS

- PUMP STATION SERVICE AREA
- FUTURE SEWER FORCE MAIN
- FUTURE WATER MAIN
- LOT LINE (APPROX)
- STORAGE TANK

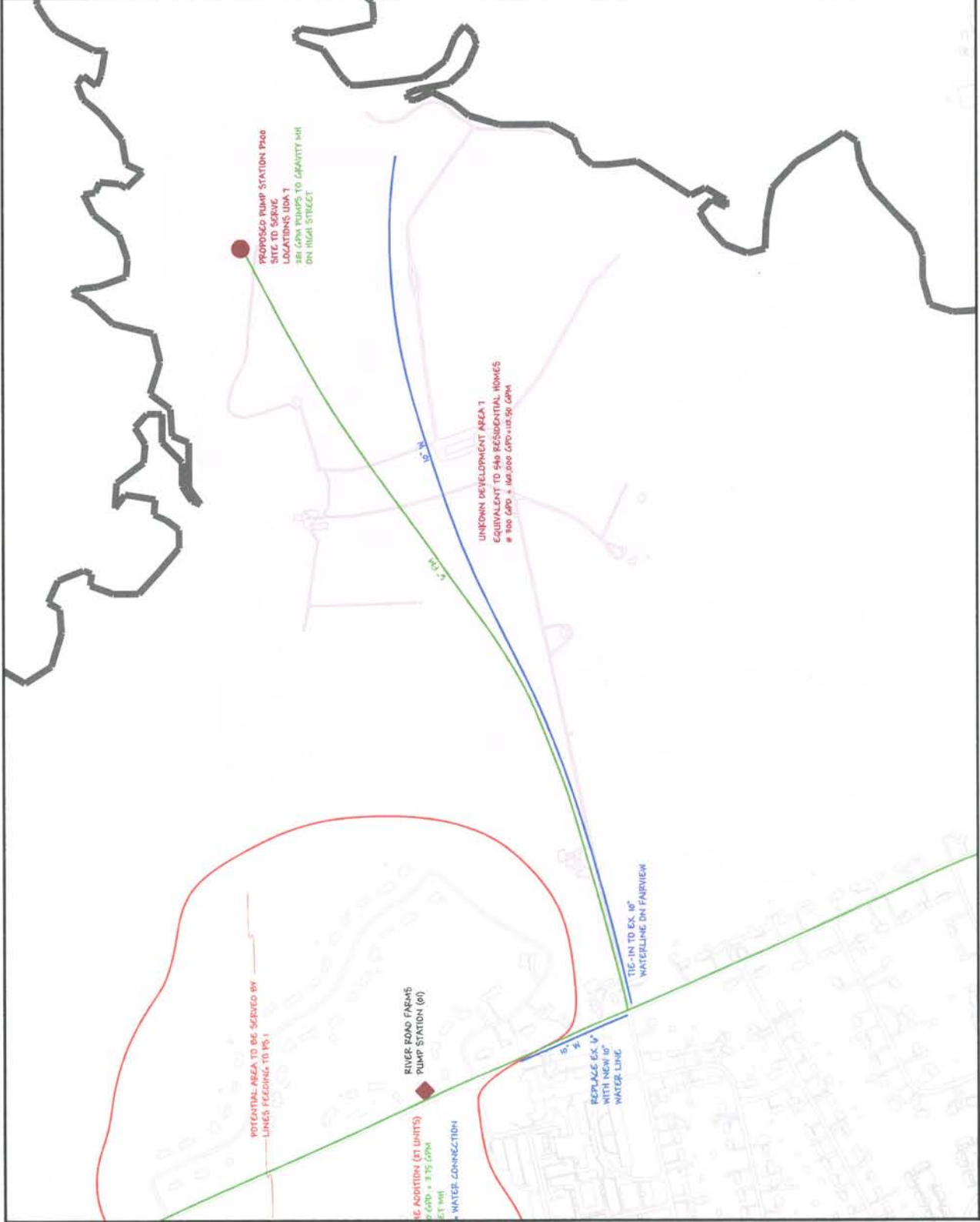


0 400 800  
( IN FEET )  
1 inch = 800 ft

**GRAPHIC SCALE**

SANITARY SEWER & WATER OVERVIEW  
FRANKLIN, VIRGINIA  
POTENTIAL DEVELOPMENT AREAS  
MAP 2

PRISM CONTRACTORS	DATE	DATE	DATE
108 Quakermead Drive Verobee, Virginia 23045 (977) 814-1031 (Office) (977) 833-8872 (Fax) prismcontractors.net			







Kimley-Horn  
and Associates, Inc.

**LEGEND**

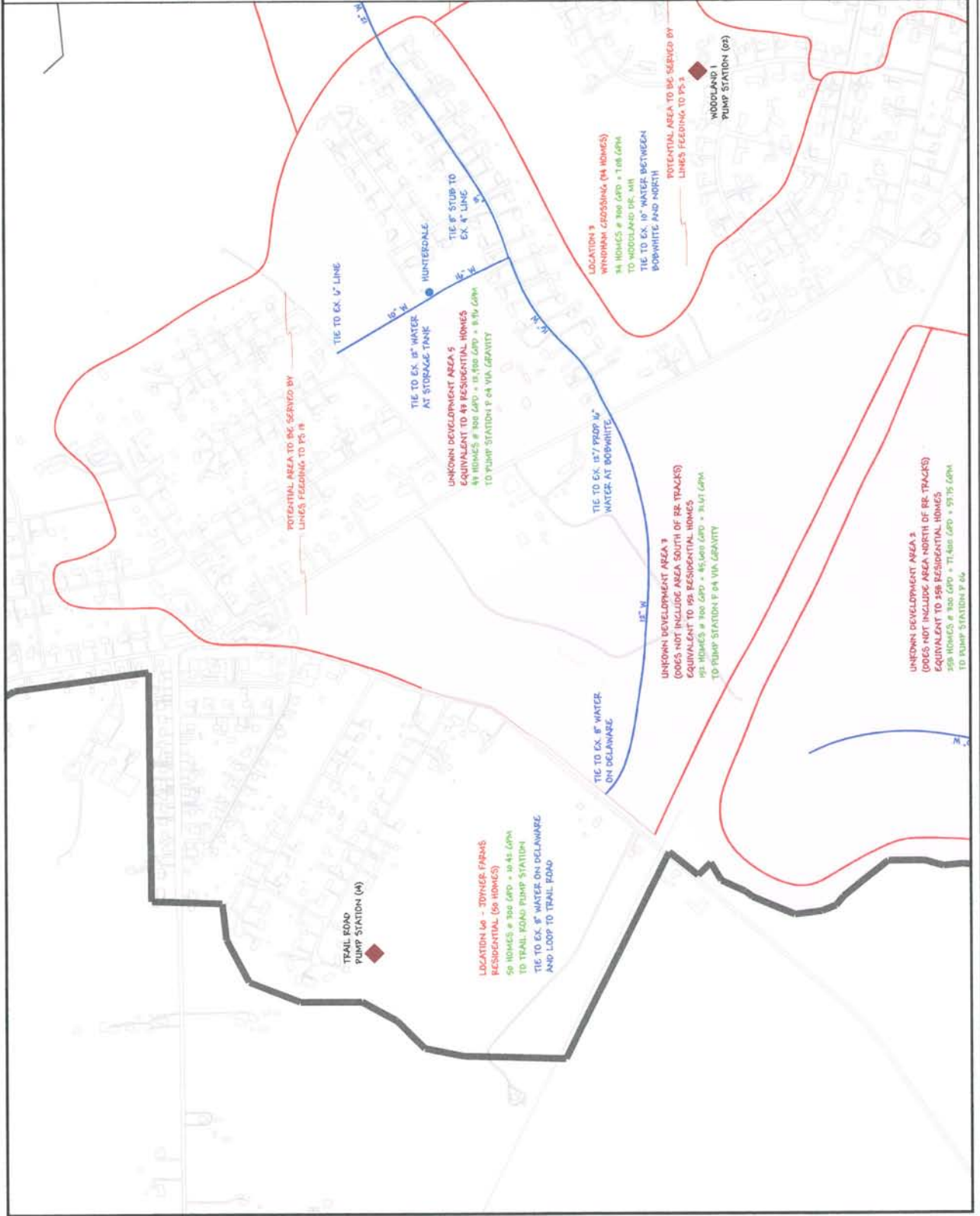
- ◆ EXISTING PUMP STATION NO UPGRADES
- ▲ EXISTING PUMP STATION NEEDS UPGRADE
- PROPOSED FUTURE PUMP STATION
- KNOWN DEVELOPMENT AREAS
- UNKNOWN DEVELOPMENT AREAS
- PUMP STATION SERVICE AREA
- FUTURE SEWER FORCE MAIN
- FUTURE WATER MAIN
- LOT LINE (APPROX)
- STORAGE TANK

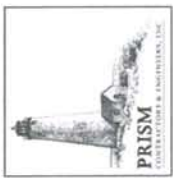


**GRAPHIC SCALE**

SANITARY SEWER & WATER OVERVIEW	
FRANKLIN, VIRGINIA	
POTENTIAL DEVELOPMENT AREAS	
MAP 4	

PRISM CONTRACTORS & ENGINEERS, INC.	DATE	DATE	DATE
1048 Quarterman Drive	10/27/2006	10/27/2006	10/27/2006
Yorktown, Virginia 23693	10/27/2006	10/27/2006	10/27/2006
(757) 893-1021 (Office)	10/27/2006	10/27/2006	10/27/2006
(757) 893-0873 (Fax)	10/27/2006	10/27/2006	10/27/2006
prismcra.com	10/27/2006	10/27/2006	10/27/2006

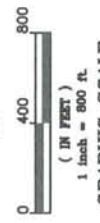
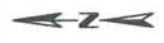




**Kimley-Horn  
and Associates, Inc.**

**LEGEND**

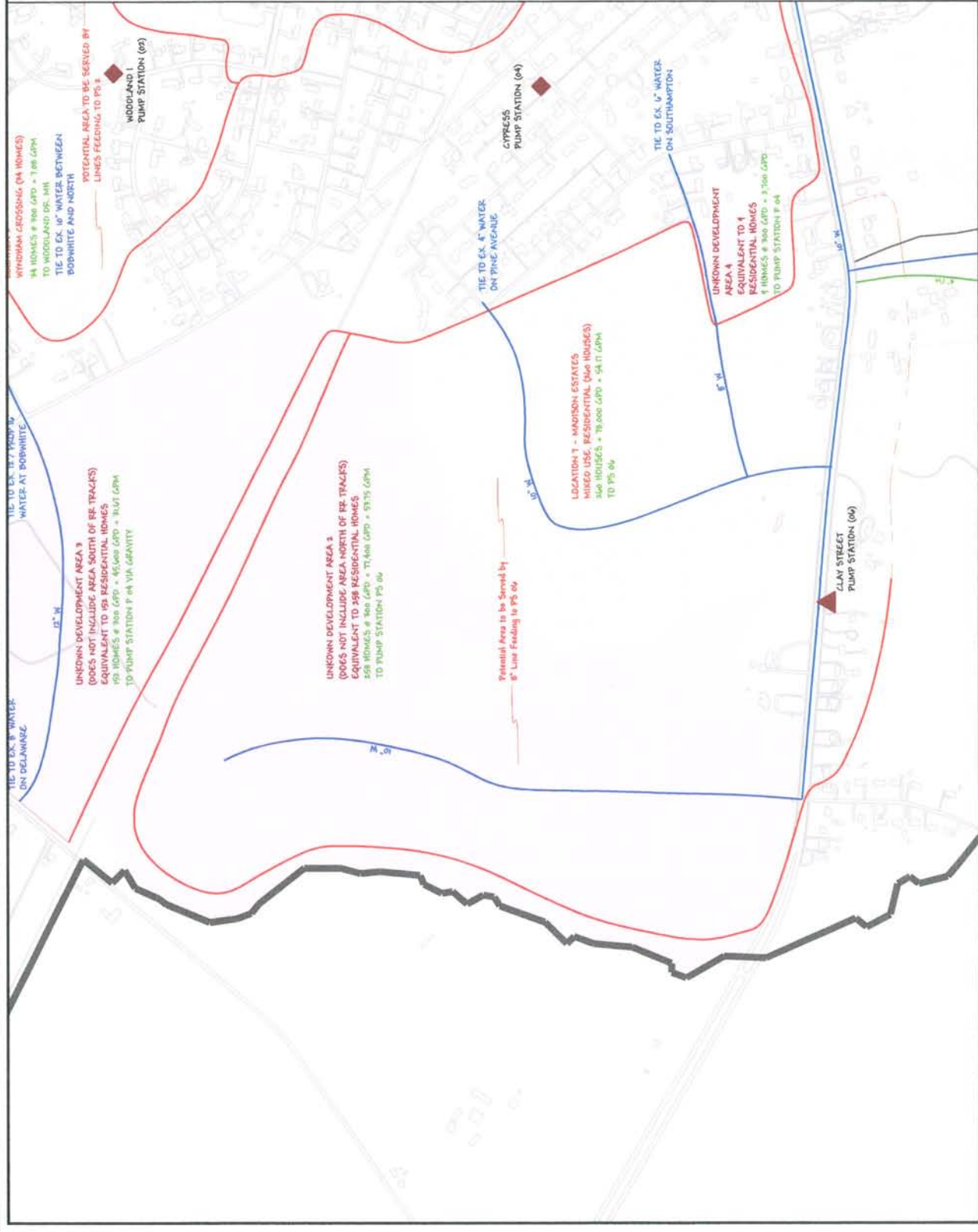
- ◆ EXISTING PUMP STATION  
NO UPGRADES
- ▲ EXISTING PUMP STATION  
NEEDS UPGRADE
- PROPOSED FUTURE  
PUMP STATION
- KNOWN DEVELOPMENT AREAS
- UNKNOWN DEVELOPMENT  
AREAS
- PUMP STATION SERVICE AREA
- FUTURE SEWER FORCE MAIN
- FUTURE WATER MAIN
- LOT LINE (APPROX)
- STORAGE TANK



**GRAPHIC SCALE**

**SANITARY SEWER & WATER OVERVIEW  
FRANKLIN, VIRGINIA  
POTENTIAL DEVELOPMENT AREAS  
MAP 5**

PRISM CONSULTING & ENGINEERING, INC.	DATE	SCALE	PROJECT NO.
100 Quakerman Drive Yorktown, Virginia 23693	DATE	SCALE	PROJECT NO.
(977) 874-1024 (Office)	DATE	SCALE	PROJECT NO.
(977) 899-0877 (Fax)	DATE	SCALE	PROJECT NO.
prism@prism.com	DATE	SCALE	PROJECT NO.





Kimley-Horn  
and Associates, Inc.

**LEGEND**

- ◆ EXISTING PUMP STATION NO UPGRADES
- ▲ EXISTING PUMP STATION NEEDS UPGRADE
- PROPOSED FUTURE PUMP STATION

**KNOWN DEVELOPMENT AREAS**

**UNKNOWN DEVELOPMENT AREAS**

**PUMP STATION SERVICE AREA**

**FUTURE SEWER FORCE MAIN**

**FUTURE WATER MAIN**

**LOT LINE (APPROX)**

**STORAGE TANK**

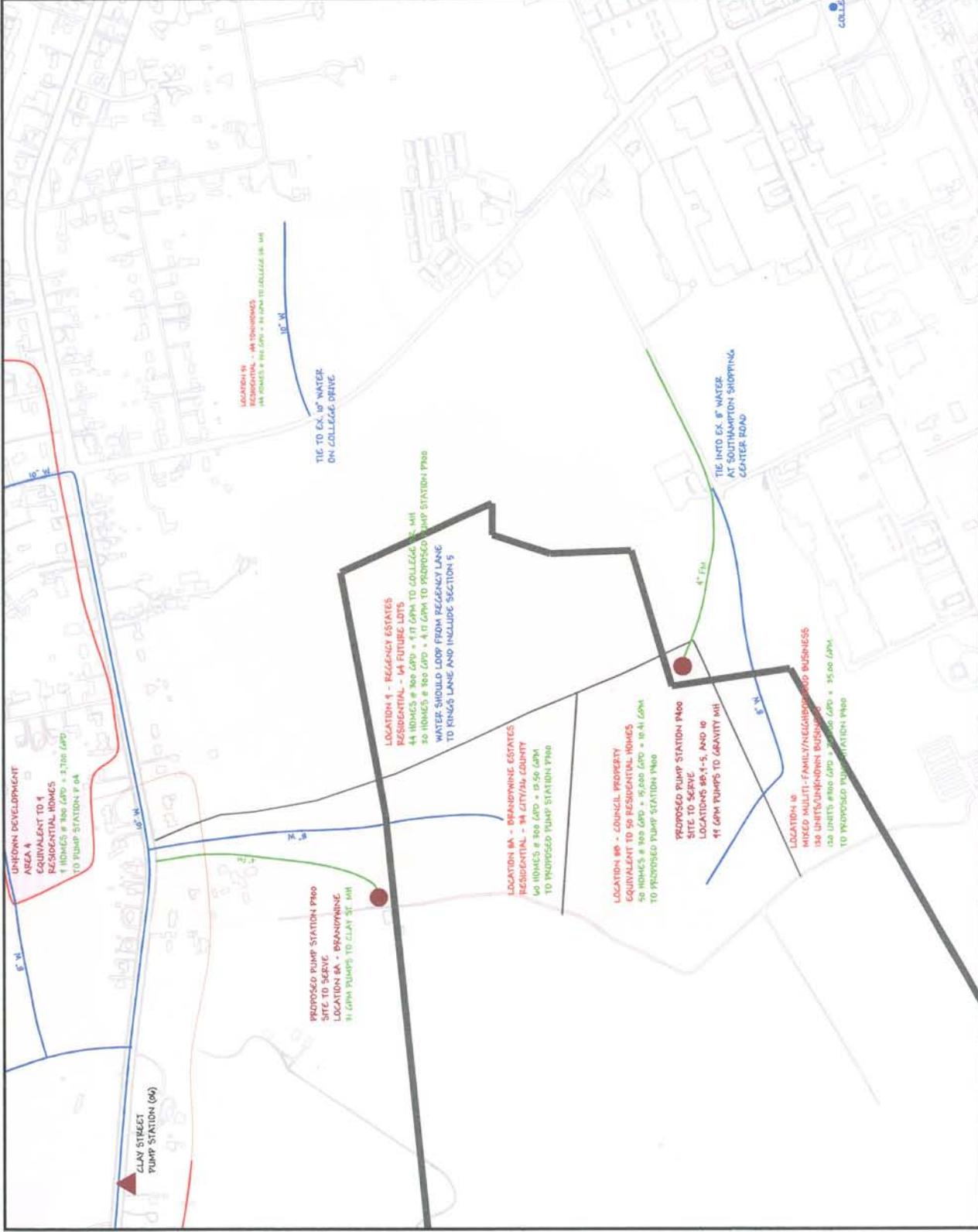


**GRAPHIC SCALE**

**SANITARY SEWER & WATER OVERVIEW**  
FRANKLIN, VIRGINIA

**POTENTIAL DEVELOPMENT AREAS**  
MAP 6

PRISM CONSULTING & ENGINEERS, INC.	DATE	DATE	DATE	DATE
108 Quakermarsh Drive Westboro, Virginia 22190	1/15/2008	1/15/2008	1/15/2008	1/15/2008
(977) 816-1011 (Office)	PRJ-006			
(977) 995-0875 (Fax)				
prisminc.com				

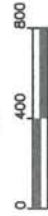
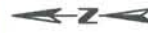




Kimley-Horn  
and Associates, Inc.

**LEGEND**

- ◆ EXISTING PUMP STATION NO UPGRADES
- ▲ EXISTING PUMP STATION NEEDS UPGRADE
- PROPOSED FUTURE PUMP STATION
- KNOWN DEVELOPMENT AREAS
- UNKNOWN DEVELOPMENT AREAS
- PUMP STATION SERVICE AREA
- FUTURE SENIOR FORCE MAIN
- FUTURE WATER MAIN
- LOT LINE (APPROX)
- STORAGE TANK



**GRAPHIC SCALE**

SANITARY SEWER & WATER OVERVIEW  
FRANKLIN, VIRGINIA  
POTENTIAL DEVELOPMENT AREAS  
MAP 9

PRISM CONSULTING & ENGINEERING, INC.	DATE	DWG	SCALE
1048 Quakermeah Drive Forsyth, Virginia 23040	DATE	DWG	SCALE
(977) 819-1091 (Office)	DATE	DWG	SCALE
(977) 893-0893 (Fax)	DATE	DWG	SCALE
prismceas.net	DATE	DWG	SCALE

