

MEMORANDUM

TO: City Council

FROM: Alfred D. Lott
City Manager

SUBJECT: ***Status Report***

DATE: January 12, 2017

1. City and MD SUN Hosting Solar Co-op Information Sessions

Neighbors in Bowie and surrounding Prince George's County can now join the Bowie Solar Co-op to get assistance with going solar and to save money. There are three upcoming information sessions at Bowie City Hall for residents to learn more. The first is on Saturday, January 28th from 10-11:30 a.m. in Council Chambers. The second is on Wednesday, February 8th from 7-8:30 p.m. in Room 243, and the third is Saturday, March 4th from 10-11:30 a.m. in Room 243. Registration for information sessions and/or the co-op itself, along with more details, can be found at www.mdsun.org/bowie. The solar co-op is based on the same principle as buying in bulk, and registration for the sessions and the co-op itself are not a commitment to install panels. Once the group is large enough, the non-profit MD SUN will help the co-op solicit competitive bids from area solar installers. Co-op members will then select a single company to complete all of the installations, and each member will have the option to purchase or lease panels individually based on the installer's group rate. By going solar as a group and choosing a single installer, each participant generally saves up to 20% off the cost of their system.

2. Whitemarsh Area Residential Development

An evaluation of the City water and sewer utility was completed by City staff and a City-hired consultant engineer in order to determine whether sufficient capacity exists for a proposed residential development located in the Whitemarsh areas along MD 450. The report was mailed to the developer, Elm Street Development, today. Although additional assessment effort would be required prior to accepting a concept design, the evaluation concluded that capacity is available. A copy of the report is attached.

The assessment responded to the developer's request concerning the capacity of the City's water and sewer utility. Since the property remains outside the City, water and sewer service cannot be provided at this time. If the developer chooses to pursue this development plan, we anticipate a request to Council for annexation in order to obtain City water/sewer services.

3. Economic Development Committee (EDC)

The Bowie EDC held their regular meeting Wednesday and conducted a mid-year review of their work plan resulting in a slight change to their topic schedule for the coming months. They also discussed their Strategic Vision and Plan and continued to finalize that document.

Attachment



City of Bowie

15901 Excalibur Road
Bowie, Maryland 20716

JAN 12 2017

Jude Burke
Vice President, Elm Street Development
1355 Beverly Road, Suite 240
McLean, VA 22101

Enclosed is a detailed report of findings related to City of Bowie water and wastewater capacity to meet the needs for a proposed development of 500 dwelling units at Whitemarsh. With the exception of sanitary sewers, the findings show that the City's water and sewer infrastructure can adequately meet the demands without additional improvements.

The findings related to the sanitary sewer were inconclusive and additional information will be required prior to approving a concept design. In order to validate capacity in the sewer, flow metering will be required over a period that includes at least one significant rain event and not less than a two-week period of recorded flow. Should you choose to proceed with the request for annexation and change in water sewer category, the City will require that you either hire services to conduct this metering and provide the recorded flow results to the City's Public Works Department, or provide the City additional funding for these services.

This letter and findings are provided only to validate existing water and wastewater capacities against the proposed additional demands. These findings should not be construed as a concept approval, nor approval of a category change.

If you have questions concerning these findings, please contact me or KCI's project engineer, Robert Ott.

Sincerely,

George J. Stephanos, P.E.
Public Works Director

Encl: KCI ltr of December 15, 2016, Whitemarsh – Water/Sewer Capacity Report

Copy: Robert Ott, KCI Project Engineer
Tom Neugebauer, Morris & Ritchie Associates, Inc.



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December 15th, 2016

City of Bowie
Attn: Mr. George Stephanos
Director of Public Works
15901 Excalibur Road
Bowie, MD 20716

Subject: **White Marsh – Water/Sewer Capacity Report**

Dear Mr. Stephanos,

On September 6th, 2016, KCI submitted a proposal for a preliminary study to analyze current conditions of the City's Water and Sewer Infrastructure related to the upstream (water) and downstream (sewer) flow paths for serving the proposed subject development. Subsequent to authorization from Bowie to perform the work and the project kick-off meeting, KCI assessed the impacts of the proposed 500 residential units on the City's existing water/wastewater infrastructure. The results of this analysis will highlight aspects of the infrastructure which require additional and more in-depth analysis. This report will summarize our findings.

Aquifers

The City's existing Groundwater Appropriation Permits (GAP) regulate the amount of water drawn from three available aquifers. The Magothy aquifer provides up to 0.2 million gallons per day (MGD) via well #1. It is important to note that a single well draws from this aquifer. This means that if well #1 fails then the other wells may exceed their withdrawal limits in order to keep up with the City's water demands. The Patapsco aquifer provides up to 1.5 MGD and serves wells #2R, #3, and #6. The Patuxent aquifer is permitted to supply 1.8 MGD via wells #4R and #5 (Appendix A). The three aquifers are collectively permitted to provide 3.5 MGD to the City of Bowie. The aquifers are permitted to supply 5.5 MGD maximum monthly average, but this limit should not be an issue at this time. According to Terry Bradley, the City's water treatment plant Superintendent, the current demand of Bowie's residents is approximately 2.0 MGD. Additionally, the City is required to reserve 1.0 MGD of its water capacity for the future demands of the proposed Melford development. The proposed Marketplace development adds a further 0.125 MGD. This leaves approximately 2.38 MGD of the City's permitted withdrawal unutilized. With ample appropriation still available, the City's GAP permits do not need to be updated in order to provide water to the proposed Whitemarsh development.

Wells

The City's current water supply is provided by 6 wells, however, Well 4R located at the water treatment plant (WTP), experienced a failure shortly before KCI's walkthrough on October 26th of 2016 and needs to

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be replaced. The well is being replaced currently and its flows will return to the system as soon as reconstruction is complete. A table of the City's current and future water supply, storage and demands has been provided in Appendix A. The flows from well #4R will be included in this tabulation. The current system of wells is adequate to supply water to the City and its proposed developments.

During KCI's WTP visit, it was discovered that not all of the City's wells can be active at the same time. The current piping system will only allow flows from a maximum of three wells before the flowrate observed at the WTP ceases to increase. This shortcoming of the well network is intended to be addressed by the Raw Water Cleaning project. The cleaning project involves removing buildup from the raw water main that connects the well houses to the WTP. This project is scheduled to be completed in January of 2017, after which the raw water piping network should be re-evaluated to determine if more flow from the existing wells can be utilized. KCI has assembled several possible flow rates depending on the level of cleanliness achieved in the process of pigging the raw water mains. Once sufficiently cleaned, the increase in pipe capacity with a C-factor of 50 can be as much as 2,970 GPM. This is an overly simplistic calculation as it does not take into account limitations of the well pumping capacity, but this is representative of the typical capacity improvement available once the pipe has been cleaned. (Appendix B)

When considering the need to increase the water production of the City, the raw water main should be the first asset investigated as it is currently the limiting asset in the water production train. After the raw water cleaning job has been completed, the City should reassess the limits of their water system for other limits. Currently, it appears that the GAP quantities may be a limiting factor in the future. It may be possible to increase the water produced by the city for the foreseeable future up to the limits of the withdrawal permits. In the event that more water is required, the City should pursue increased withdrawal limits before considering other, more costly, updates to their infrastructure or operating procedures.

Water Treatment Plant

On October 26th of 2016 KCI met with the superintendent of the water treatment plant, Terry Bradley, to discuss the state of the plant and its ability to meet the demands of the City. Terry indicated that the plant is sufficiently capable of meeting the City's current demands as well as the demands of the future developments.

Once the raw water reaches the WTP, it undergoes several physical and chemical processes to make the water ready for consumption. According to the MACTEC report (Appendix C) dated April 18th, 2005, the plant is designed for a nominal capacity of 5 MGD and a peak capacity of up to 8 MGD when required, which was sufficient at the time of the report. Based on our conversations with plant staff, overall water demand has been decreasing over time due to water conservation practices and general public awareness. There are no pending permit requirements which would suggest that a major change to the existing treatment train will be required in the near future due to water quality requirements. Based on this information, it appears that the unit processes and associated equipment can provide sufficient treatment capacity to provide the water demanded by the City, the additional loads to be provided to the future Melford and Marketplace flows, and the proposed addition of 500 EDU's for the Whitemarsh development. This is assuming that all systems are maintained in good operating condition. Although the existing treatment system is appropriately designed for hydraulic capacity and water quality requirements, additional investment by the City will be required to ensure the long term sustainability and reliability of the plant.

As with other major assets, the treatment plant requires regular maintenance and periodic equipment renewal or replacement to maintain reliable and sustainable treatment results. In addition to direct renewal/replacement of aging equipment and infrastructure, technological improvements and increased expectations from regulatory agencies and end users result in the need for other upgrades and optimizations of systems within the facility. While the existing facility should physically have sufficient capacity to accommodate the additional demands, it adds additional pressure to an already aging facility. The plant has not been significantly upgraded since a project in 2000, which upgraded the sedimentation tanks as well as other minor aspects of the plant. The electrical and communication components in particular are outdated and need to be upgraded. The existing systems have exceeded their useful life and do not provide basic levels of automation which would be expected of similar facilities being constructed currently. This results in a heavy reliance upon operators for manual operation and adjustment of the treatment systems. This increases the risk of failure, reduces reliability, and increases costs when compared with modern electrical distribution and instrumentation systems. Another area of concern is the chlorine addition system that also utilizes outdated equipment which represents a significant safety risk considering the inherent dangers associated with chlorine gas. Many facilities have chosen to eliminate chlorine gas use in favor of other chemical additional systems. At minimum, this system should be upgraded with a safer system which draws chlorine through a vacuum system and reduces the potential for a gas leak from the storage cylinders.

These items represent just a few areas in need of attention at the facility as identified through a brief plant tour and discussion with the operator, but there may be other issues that need attention. We recommend that a review of the water supply, treatment, and storage system be performed to identify areas in need of rehabilitation, upgrade, or replacement. It should be noted that this recommendation is not directly related to the new water capacity request, but would serve to benefit all users, both existing and proposed.

Storage

After treatment, the water for consumption is pumped to surface or elevated storage tanks. The City currently maintains three storage tanks for holding treated water. The ground storage tank at the treatment plant, the booster station ground tank located on Media Lane, and the elevated storage tank located on Belair Drive. These tanks collectively hold up to 4.2 million gallons of water when completely filled. At the City's current rate of consumption, the City needs to store 2.0 MGD for the current demands, 113,000 GPD for the Marketplace development, 125,000 GPD for the Whitmarsh development, and 1.0 MGD for the Melford development. These quantities are in addition to the fire flow demand of 1,500 gallons per minute for a 2 hour duration, or 180,000 gallons. This brings the total storage required to 3.418 MGD in the event the treatment plant is taken offline. The City's current storage is capable of supplying this quantity when at full capacity. Please see Appendix A for a breakdown of the City's storage capacity. For redundancy purposes, the City is also interconnected to the Washington Suburban Sanitary Commission (WSSC) in four locations with a fifth in development. These interconnections can be activated in the event the City's wells or treatment plant experience a failure in order to supply the City with water.

Water Distribution

On October 26th, KCI coordinated with the City of Bowie public works department to perform fire flow testing at three strategic locations. These locations coincide with potential water system connections for the proposed Whitmarsh development. The testing locations were at the intersection of Ivy Way and Irongate Lane, Behind the Hill Top Plaza Shopping Center at Racetrack Road and Annapolis Road, and at Scarlet

Oak Terrace and Annapolis Road. After testing, it was determined that all three locations projected to provide in excess of 2,500 GPM at 20 psi during a fire demand situation. The highest flow measured was taken at the hydrants at the Hill Top Plaza Shopping Center and resulted in a projected flow of approximately 3,200 GPM at 20 psi. The breakdown of the data gathered and analysis can be found in Appendix D. The water demand of the Whitemarsh development is based upon the MDE standard of 250 Gallons per Equivalent Dwelling Unit (EDU). The development's proposed 500 EDUs equates to 125,000 GPD. These flow values are averages used for planning and we anticipate a diurnal peak rate of 1.8-2.2 times higher than the average. Still, the hydrant flow results indicate the existing local water main pipes should be able to supply water to the development while maintaining the required fire flows when needed. Although these results are promising for the subject project, the City's water mains are known to have issues with tuberculation reducing the effective flow properties of its water distribution network. This fire flow test indicates that tuberculation may not currently be a significant issue for the Whitemarsh development project. However, due to the nature of tuberculation there is a possibility of restricted pipes in this area in the future. The City should continue its program of water main assessment and rehabilitation in order to reduce the effects of tuberculation throughout the water distribution network.

Wastewater Collection

KCI also gathered the necessary data and analyzed the nearby wastewater collection network directly affected by the Whitemarsh development. This analysis can be found in Appendix D. The City has provided KCI with as-built plans of their utility networks as well as flow data entering the Wastewater Treatment Plant (WWTP). It is important to note that the data points in the appendix were likely taken during high flow situations and may skew the data toward a higher average flow than is actually present in the sewer. We have analyzed the available data starting at a potential sewer tie-in point, traveling through a 24" sewer interceptor and finally entering the WWTP. See Appendix E for a plan of the proposed sewer network and tie-in location. In order to ensure continued reliable service to new and existing properties, the city should continue to inspect and maintain the existing sewage collection network.

Flow data in terms of pipe flow depths for the interceptor was gathered by Public Works personnel and can be found in Appendix D. A survey map of the interceptor can be found in Appendix E. When KCI calculated the flows conveyed by this interceptor, the flows exceeded the flow being discharged from the treatment plant. This logically means that there is a problem with the data gathered or the calculations involved. After closer examination of the data, it was determined that all of the data points were likely taken during high flow periods such as the mornings when people are showering and bathing and the afternoons when people are preparing for dinner. These times represent peaks in a typical diurnal cycle of sewage flows. Additional data points on off-peak times would need to be gathered in order to more accurately assess the flows handled by the interceptor. Collecting data points during low flow times, such as 2:00 AM, would also provide a good indication of base Infiltration and Inflow (I&I). These flows can be confirmed using an in-line gravity flow meter. Unaffected by any additional flows or developments discussed in this report is a 20" interceptor which also feeds the WWTP. This interceptor's flow capacity has been accounted for in the City's wastewater collection capacity calculations in Appendix A. Gathering data on the 20" interceptor will contribute to more accurate calculations of the remaining capacity in both of the City's interceptors. These flows can also be confirmed using an in-line gravity flow meter.

Wastewater Treatment Plant

The WWTP Superintendent, Chris Bolander, indicated that the treatment plant is not operating at its permitted discharge point and was designed with surplus capacity. The City's WWTP is permitted to discharge 3.3 MGD to the Patuxent River and currently discharges approximately 1.6 MGD. The additional flows produced by the Whitmarsh Development should not add a significant amount of flow to these figures in terms of nearing the permitted discharge values. After comparing the flow discharge from the treatment plant to our calculated flows at the 24" interceptor, it is apparent that the data gathered on the interceptor represent peak flows rather than average flows. This is likely due to the time of day when measurements were taken. Further compounding the capacity calculation discrepancy is the presence of a 20" interceptor that also feeds the WWTP. This interceptor's flow has not been measured directly but does contribute to the 1.6 MGD discharged by the treatment plant.

Note that the discussions held during the project kick-off meeting and WWTP walk through resulted in all parties agreeing that the WWTP would not be assessed in as much detail as the rest of the subject system.

Summary & Conclusion

KCI has analyzed the major components of Bowie's water and wastewater systems. Our above report is structured to match with the path of flow taken by the water initially pulled from the aquifer, eventually reaching the Whitmarsh water needs and then heading downstream to the WWTP. Along this project flow path, an array of upgrades and renovations has been suggested in order to update and improve the reliability and functionality of the City's infrastructure.

In practical terms and in summary, we found the existing infrastructure to be sufficient to meet the City's proposed demands in particular to the Whitmarsh development.

The itemized list below represents areas that KCI suggests be investigated in more detail as soon as possible.

1. Raw Water Pipe: The clogged raw water pipe issue is well documented. In terms of hydraulic restrictions impacting the City's ability to serve new customers, we consider this a priority. As mentioned in the related section above, it is in the City's 2017 plans to clean this line which should alleviate the bottle-neck.
2. Water Treatment Plant: Not as much of a hydraulic restriction but equally important is the antiquation of the WTP. The details are specified above, and should be addressed in the upcoming years, somewhat independently of the subject of city growth and new water customers.
3. Local Sewer Mains: When the Whitmarsh preliminary design drawings are submitted to Bowie for their review, it will be timely for the City to decide where the sewer tie-ins should be made to prevent the overloading of any existing sewer mains. Before this process occurs, KCI recommends Bowie have the subject manholes surveyed to gather pipe invert elevations which will allow the pipe capacities to be determined. This information will be vital to determining the appropriate sanitary sewer tie-in locations for the proposed Whitmarsh project.

KCI appreciates the opportunity to work with the City on this important analysis. We were able to work very closely with key City personnel and their full support was crucial. KCI welcomes the opportunity to further discuss any of the items noted above.

Respectfully submitted,



J. Ryan Flickinger, P.E.
Project Manager



Robert Ott P.E.
Project Engineer

Appendix A
Water Supply Tabulation

City of Bowie Water Supply Tabulation							
Well	Location	Aquifer/ Formation	Well Permit #	GAP Permit#	Well Pump Rates (GPM)	Permitted Withdrawal (MGD) Annual Avg. Basis (avg.)	Permitted Withdrawal (MGD) Month of max. use (max avg.)
1 "A" (Active)	2915 Brierdale Ln	Magothy		PG61G008(09)	400	0.2	0.5
2R "B" (Active)	2915 Brierdale Ln	Patapsco		PG61G108(03)	1900	1.5	2.5
3 "D" (Active)	2803 Spangler Ln	Patapsco		PG61G108(03)	1100		
6 "6" (Active)	12215 Foxhill Ln (Foxhill Park)	Patapsco		PG61G108(03)	1300		
4R "E" (Capped)	2912 Bradford Ln (Water Plant)	Patuxent	PG-88-0226	PG61G208(03)	800	1.8	2.5
5 "F" (Active)	12215 Foxhill Ln (Foxhill Park)	Patuxent	PG-65-0085	PG61G208(03)	900		

- All permitted water withdrawal rates are based on MDE GAP records secured 12/2/16.

City of Bowie Water Storage Tabulation		
Elevated Tank	3107 Belair Dr	Capacity – 0.6 MG
Booster Station	3703 Media Ln	Capacity – 3.0 MG
Ground Storage	Water Plant	Capacity – 0.6 MG
Totals		4.2 MG

Water Treatment Plant Summary			
Description	Design Nominal Capacity (MGD)	Design Peak Capacity (MGD)	Approximate Operational Range (MGD)
Water Treatment Plant	5.0	8.0	5.0 - 5.6

- All WTP capacities are based on response to City of Bowie prepared by MACTEC on April 18, 2005

City of Bowie Capacity Vs. Demand				
Asset	Capacity	Current Demand	Current + Committed Demand	Current + Committed + Whitemarsh Demand
GAP (MGD Monthly Avg)	3.5	2.18	3.293	3.418
Wells (MGD, 16 hour operation)	6.0			
Water Tr Plant (MGD, 16 hour ops)	5.0			
Water Storage (MG)	4.2			
Water Distribution (MGD @ 20 PSI)	3.6		2.293	2.418
Wastewater Collection (MGD max)	6.88			

- Current demand includes 180,000 gallons of fire flow capacity.
- Committed demand includes 113,000 GPD to the Marketplace development and 1.0 MGD to the Melford development.
- Whitemarsh demand includes 125,000 GPD for the Whitemarsh development
- Water distribution capacity is based upon fire flow testing around the Whitemarsh development location only. Actual capacity will need to be investigated in more detail at a later date.
- Wastewater collection capacity is based upon two interceptors, 24" and 20", feeding the WWTP. Actual collection capacity at a given location will depend heavily on the smaller sewer mains in the area. The capacity at a given location will need to be investigated on a case by case basis.
- Wastewater collection demand does not include the flows from the Melford development as those sewage flows do not return to the City's wastewater treatment plant.

Robert Ott

From: John Grace -MDE- <john.grace@maryland.gov>
Sent: Friday, December 02, 2016 5:28 PM
To: Robert Ott
Cc: Norman Lazarus -MDE-
Subject: Re: Bowie GAP information request
Attachments: Bowie Patuxent permit.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

A copy of the Patuxent permit is attached for your reference.

On Fri, Dec 2, 2016 at 3:09 PM, Norman Lazarus -MDE- <norman.lazarus@maryland.gov> wrote:
Robert:

As per your request the permitted quantities for the latest version of the City of Bowie's permits are as follows:

PG1961G208(05): annual average: 1,800,000 gpd, maximum month average : 2,500,000 gpd

PG1961G108(04): annual average: 1,500,000 gpd, maximum month average: 2,500,000 gpd

PG1961G008(10): annual average: 200,000 gpd, maximum month average: 500,000 gpd

Please contact me if you have any questions.

On Fri, Dec 2, 2016 at 2:39 PM, John Grace -MDE- <john.grace@maryland.gov> wrote:
please respond

----- Forwarded message -----

From: Robert Ott <Robert.Ott@kci.com>
Date: Fri, Dec 2, 2016 at 1:56 PM
Subject: Bowie GAP information request
To: "<john.grace@maryland.gov>" <john.grace@maryland.gov>
Cc: Ryan Flickinger <Ryan.Flickinger@kci.com>

John,

Thank you for speaking to me on such short notice. The permit I am looking for is the City of Bowie's permit # PG61G208 (03) for the Patuxent Aquifer. Specifically I need to know the most up to date daily withdrawal

averages (monthly and yearly) the permit allows. If it is an easy piece of information to procure, I would also appreciate the same figures for the Patapsco and Magothy aquifers as well. Permit #'s PG61G108 and 008 respectively.

Thank you so much.

Robert J. Ott, P.E.

Project Engineer



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Norman H. Lazarus
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Baltimore, MD 21230

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Appendix B

Raw Water C-Factor Calculations

Raw Water Main C-Factor Analysis

900.00	Flow Rate (gpm)
2.01	Flow Rate (cfs)
15	C-Factor
1827	Length of Pipe

Pipe Diameter (in)	Actual Inside Pipe Diameter (in)	X - Sectional Area (sqft)	Flow Rate (cfs)	Velocity (fps)	Head Loss (ft) / 100ft
20.00	20.00	2.18	2.01	0.92	0.9501

New C Factor	Q (GPM)
30	1782.396
50	2970.66
70	4158.924

Appendix C
MACTEC Report

MACTEC RESPONSE TO THE CITY OF BOWIE FOR ADDITIONAL WATER AT THE MSTC

Background

On April 18, 2005, MACTEC received a request from John Fitzwater, Assistant City Manager for the City of Bowie, MD to evaluate an increased water allotment for the Maryland Science and Technology Center (MSTC). The MSTC developer, MIE, requests a future water allotment of 500,000 gpd (gallons per day). This exceeds the 200,000 gpd committed to MSTC in the 1985 agreement with Bowie. Watek was hired by MIE to investigate alternatives for future MSTC water and sewer. The least expensive sewer option is to construct a pipeline beneath Route 50 to the Washington Suburban Sanitary Commission (WSSC) Green Branch Wastewater Pumping Station and this option is being pursued with WSSC.

MACTEC reviewed available information on the Bowie water system including past reports and data on MSTC, to prepare this response for the MIE request for additional water. MACTEC also contacted Steve Collins of Watek to confirm the 500,000 gpd amount. John Illig, the Bowie Water Plant Superintendent, provided important information on the current status of the water system.

Bowie Water System

The Bowie water system consists of six water supply wells, a water treatment plant to remove iron and other undesirable constituents from the well water, one elevated and two ground level storage tanks, and the water distribution system. The water system has been well maintained and many improvements have been made in recent years.

Projected Water Consumption

The following is a calculation for the future water consumption from the MSTC. MGD denotes million gallons per day. The water consumption is projected to be 500,000 gpd or 0.5 MGD. The maximum daily flow is estimated to be 2 times the average daily flow or $2 \times 0.5 \text{ MGD} = 1.0 \text{ MGD}$. The peak hourly flow is estimated to be 2 times the maximum daily flow or $2 \times 1.0 \text{ MGD} = 2.0 \text{ MGD}$. Applying these same factors to the 2.3 MGD currently treated by the Bowie water plant results in the following:

<u>Flow Parameter</u>	<u>Current Bowie Demand</u>	<u>+ MSTC Demand</u>	<u>= Future Demand</u>
Average Daily Flow (MGD)	2.3	0.5	2.8
Maximum Daily Flow (MGD)	4.6	1.0	5.6
Peak Hourly Flow (MGD)	9.2	2.0	11.2

The maximum daily demand is a flow that can be expected to occur during summertime drought conditions. The water system must be able to supply this demand for an extended period of time, perhaps two months or more. The peak hourly flow may occur during this maximum demand period and stored water assists in supplying this flow.

Water Wells

The Bowie water wells are not subject to a decline in output during drought conditions because the wells draw their water from three different deep aquifers. The Maryland Department of the Environment (MDE) allows a 3.0 MGD yearly average withdrawal from these aquifers and a 5.0 MGD summertime maximum day withdrawal. This permit will have to be modified to allow the future projected 5.6 MGD maximum daily usage. If the MDE will not allow these higher withdrawal rates, a water conservation program or a supplemental water source will be necessary.

About 7.5 MGD can be supplied to the water plant by maximizing the carrying capacity of the pipeline collecting the well water and operating the wells in the proper sequence. This is more than the 5.6 MGD projected maximum daily demand, so the well supply is adequate with all large volume wells in good operating condition. Well 2, which supplies about 3 MGD, now has a portable emergency generator that was used extensively during Hurricane Isabel. This generator is scheduled for permanent installation this summer. Installing an emergency generator at another well, such as the high producing Well # 4, is advisable to ensure adequacy of future supply.

Water Treatment Plant

The water plant is designed with a nominal capacity of 5.0 MGD and a peak capacity for 8.0 MGD. A water plant can operate for extended periods of time at its nominal capacity since the mechanical equipment has enough redundancy to provide a margin of safety. Operation at peak capacity offers no standby capability and a plant can only operate at this rate for a short time period.

The Bowie water plant has produced up to 7.5 MGD in the 1969 through 1971 years. Since that time, its highest production was 5.5 MGD in July 1987.

The many improvements made to the water plant in recent years have likely raised its nominal capacity somewhat. The higher nominal capacity is likely close to the 5.6 MGD projected future maximum daily demand. Good design practice, as per the American Water Works Association, states that the nominal capacity of a water plant should exceed the maximum daily demand. Plant expansion or additional treatment works are necessary when the maximum daily demand approaches the nominal capacity.

The water plant should be operated at 5.6 MGD for a period of time to test the nominal capacity rating. During this test period, the water plant should utilize the

emergency generator to verify its capability at 5.6 MGD. If the plant capacity is found to be less than the 5.6 MGD, other options must be explored.

Distribution piping to the MSTC

The distribution piping to the MSTC must be able to supply the necessary quantity of water at sufficient pressure under the condition of the greatest projected usage. This condition will either be maximum daily flow plus fire protection or peak hourly flow.

As stated in a previous MACTEC report, Prince George's County requires a fire flow of up to 1,500 gpm at the base of the sprinkler riser at a building. The County also requires the addition of an outside fire hydrant flow, up to 500 gallons per minute (gpm) for a high hazard area. Therefore, the total required fire flow for the MSTC should be 2,000 gpm. Adding the 1 MGD (694 gpm) maximum daily flow to the total required fire flow results in a pipeline design flow for MSTC of 2,694 gpm. Comparing this to the 1,389 gpm peak hourly flow, the maximum flow plus fire flow is greater and governs for pipeline sizing.

The distribution pipeline to the MSTC consists of 18 -inch pipe from the Bowie water plant to the Derbyshire Subdivision and 16 -inch pipe to the connection with the MSTC piping near the tunnel entrance on the west side of Route 3. The maximum day demand for the approximately 75 homes served along the pipeline in Bowie Forest and Derbyshire Subdivision is about 100 gpm, so the design flow for the 18 -inch pipe section is $2,694 + 100 = 2,794$ gpm.

Using these flow rates and a Hazen-Williams roughness coefficient (C) of 100, the available pressure at the Junction Bowie System is about 66 pounds per square inch (psi). This should be adequate residual pressure for fire flow and domestic consumption at MSTC. Watek must verify this by hydraulic analysis of the on-site MSTC water distribution system.

Storage

The Bowie Water System has a 3 MGD pumped storage facility with emergency generator, an elevated storage tank, and a ground level tank at the water plant. This amount of storage should be adequate for the projected future system demand when the new WSSC interconnection is completed. The Watek analysis of the MSTC water distribution system will either confirm this assumption or indicate any additional storage needs.

WSSC Interconnection

There are currently two small volume interconnections between the Bowie water system and the surrounding WSSC water system. A large interconnection is planned to be constructed in the near future off Route 197 in the Millstream Drive vicinity. This

new interconnection will provide a major backup water source of high reliability to the Bowie water system.

Conclusions and Recommendations

The Bowie water system has had numerous improvements made to it in recent years and is considered to be adequate to serve the 500,000 gpd projected future demand at MSTC, assuming no other major developments are connected to the system and the new WSSC interconnection is constructed. It is recommended that an emergency generator be added to one of the large producing wells, such as Well #4, and that the water plant be tested at 5.6 MGD output or greater to verify its adequacy to supply future maximum demand.

In addition, Watek must confirm that the operating pressure supplied at the Bowie/MSTC water interconnection is adequate for projected future demands in the MSTC on-site distribution system.

Appendix D
Water & Sewer Hydraulic Analysis

Fire Flow Test Results & Analysis

	Ivy Way	Shopping Center	Scarlet Oak Ter.
Q-f (GPM): flow measured during test	1275	1275	1190
P-s (psi): Static Pressure	105	81	75
P-r (psi): Residual Pressure	85	70	66
Q-20 (GPM): Flow predicted at 20 psi	2785	3215	3163

$$Q_{20} = Q_f \times \frac{(P_s - 20)^{0.54}}{(P_s - P_r)^{0.54}}$$

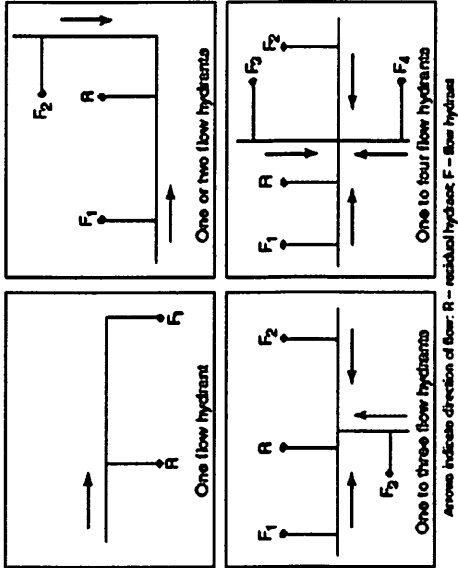
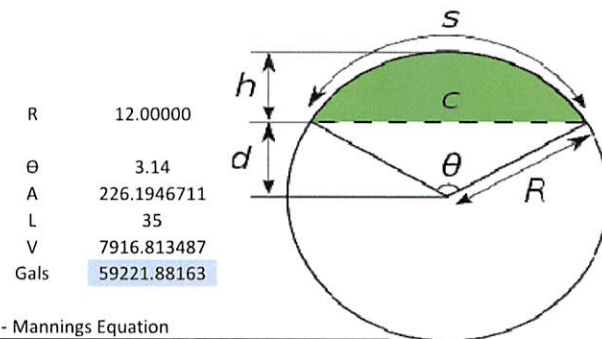


FIGURE 4.3.4 Suggested Test Layout for Hydrants.

24" Wastewater Interceptor Flow Analysis

Pipe Diameter	2												
Manhole Rim to Invert	7.56												
Date	Time	Rim to Water	Water in pipe (in)	d	Θ	A	Gal/LF	GPM	MGD	% of Pipe	GPM w/ Development	MGD	% of Pipe
8/9/2016	8:00 AM	6.46	13.2	-1.2	2.94	254.9	13.24306	1,668.98	2.40	56%	2,068.98	2.98	70%
8/9/2016	3:00 PM	6.54	12.24	-0.24	3.10	232.0	12.04874	1,518.46	2.19	51%	1,918.46	2.76	65%
8/10/2016	8:00 AM	6.46	13.2	-1.2	2.94	254.9	13.24306	1,668.98	2.40	56%	2,068.98	2.98	70%
8/10/2016	3:00 PM	6.54	12.24	-0.24	3.10	232.0	12.04874	1,518.46	2.19	51%	1,918.46	2.76	65%
8/11/2016	8:00 AM	6.4	13.92	-1.92	2.82	272.1	14.1329	1,781.12	2.56	60%	2,181.12	3.14	74%
8/11/2016	3:00 PM	6.54	12.24	-0.24	3.10	232.0	12.04874	1,518.46	2.19	51%	1,918.46	2.76	65%
8/12/2016	8:00 AM	6.4	13.92	-1.92	2.82	272.1	14.1329	1,781.12	2.56	60%	2,181.12	3.14	74%
8/12/2016	3:00 PM	6.46	13.2	-1.2	2.94	254.9	13.24306	1,668.98	2.40	56%	2,068.98	2.98	70%
8/16/2016	8:00 AM	6.28	15.36	-3.36	2.57	305.8	15.88296	2,001.68	2.88	68%	2,401.68	3.46	81%
8/16/2016	3:00 PM	6.4	13.92	-1.92	2.82	272.1	14.1329	1,781.12	2.56	60%	2,181.12	3.14	74%
8/17/2016	8:00 AM	6.36	14.4	-2.4	2.74	283.4	14.72149	1,855.30	2.67	63%	2,255.30	3.25	76%
8/17/2016	3:00 PM	6.36	14.4	-2.4	2.74	283.4	14.72149	1,855.30	2.67	63%	2,255.30	3.25	76%
8/18/2016	8:00 AM	6.22	16.08	-4.08	2.45	322.2	16.73618	2,109.21	3.04	71%	2,509.21	3.61	85%
8/18/2016	3:00 PM	6.36	14.4	-2.4	2.74	283.4	14.72149	1,855.30	2.67	63%	2,255.30	3.25	76%
8/19/2016	8:00 AM	6.32	14.88	-2.88	2.66	294.6	15.30518	1,928.86	2.78	65%	2,328.86	3.35	79%
8/19/2016	3:00 PM	6.36	14.4	-2.4	2.74	283.4	14.72149	1,855.30	2.67	63%	2,255.30	3.25	76%
8/22/2016	8:00 AM												
8/22/2016	3:00 PM												
8/23/2016	8:00 AM	6.36	14.4	-2.4	2.74	283.4	14.72149	1,855.30	2.67	63%	2,255.30	3.25	76%
8/23/2016	3:00 PM												
8/24/2016	8:00 AM												
8/24/2016	3:00 PM												
8/25/2016	8:00 AM	6.28	15.36	-3.36	2.57	305.8	15.88296	2,001.68	2.88	68%	2,401.68	3.46	81%
8/25/2016	3:00 PM	6.28	15.36	-3.36	2.57	305.8	15.88296	2,001.68	2.88	68%	2,401.68	3.46	81%
8/26/2016	8:00 AM	6.42	13.68	-1.68	2.86	266.4	13.83709	1,743.84	2.51	59%	2,143.84	3.09	72%
8/26/2016	3:00 PM	6.41	13.8	-1.8	2.84	269.2	13.98511	1,762.50	2.54	60%	2,162.50	3.11	73%



Sewer Capacity Calculations - Mannings Equation

Start Elevation	52.74	See Appendix E
End Elevation	52.35	
Length of Pipe	395.23	

S = 0.001

n = 0.014

Pipe Diameter (inches)	Pipe Diameter (ft)	X-Sectional Area (sq.ft.)	Wetted Perimeter (Full Flow)	Q (cfs)	Velocity (fps)	Q (gpm)	Q (mgd)
24.00	2.00	3.14	0.50	6.60	2.10	2,960.02	4.26

20.00	1.67	2.18	0.42	4.06	1.86	1,820.30	2.62
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Total Interceptors Capacity 4,780.32 6.88

Appendix E
Sewer Interceptor Survey Map

NAVD 83/2011 (HORIZ.)
NAVD 88 (VERT.)

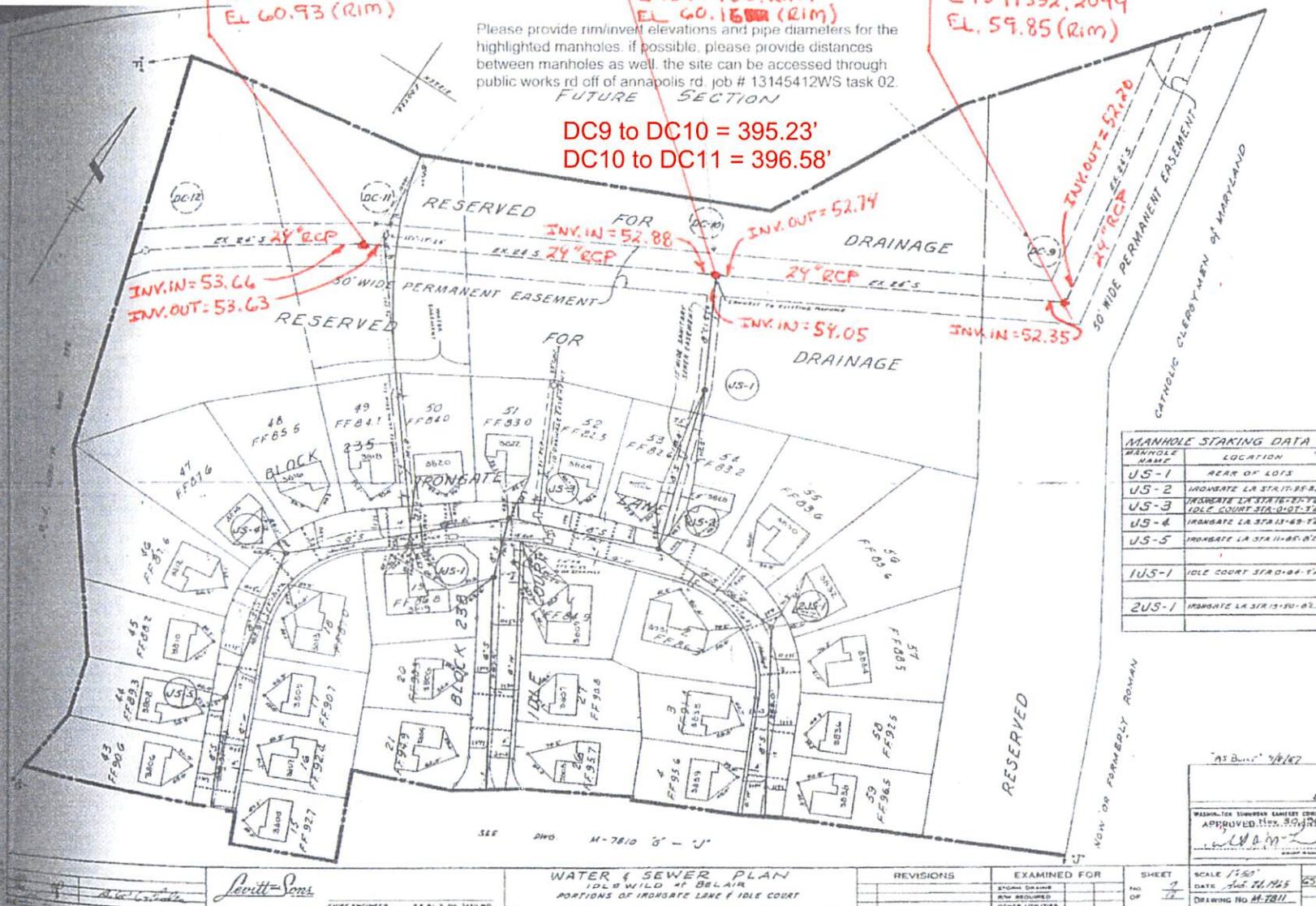
DC11
N 482461.7817
E 1390637.0321
EL 60.93 (RIM)

DC10
N 482651.3202
E 1390985.2204
EL 60.16 (RIM)

DC9
N 482840.5344
E 1391332.2099
EL 59.85 (RIM)

Please provide rim/invert elevations and pipe diameters for the highlighted manholes. If possible, please provide distances between manholes as well. The site can be accessed through public works rd off of annapolis rd. job # 13145412WS task 02.

DC9 to DC10 = 395.23'
DC10 to DC11 = 396.58'



MANHOLE STAKING DATA	
MANHOLE NAME	LOCATION
US-1	REAR OF LOTS
US-2	IRONGATE LA STR 11-88-82
US-3	IRONGATE LA STR 11-88-82
US-4	IRONGATE LA STR 11-88-82
US-5	IRONGATE LA STR 11-88-82
1US-1	IDLE COURT STR 11-88-82
2US-1	IRONGATE LA STR 11-88-82

AS BUILT 11/16/16

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WASHINGTON SUBURBAN LANDSCAPE CONSULTANTS

APPROVED: 11/16/16

11/16/16

SCALE 1\"/>

Ray Poles 11/18/16
CLARK JOHNSON 11/21/16

