WILDWOOD

MEMORANDUM

To: Administration/Public Works Committee Members

From: Rick C. Brown, Director of Public Works / City Engineer

Date: January 5, 2017

Re: Consultant Selection for Town Center Sanitary Sewer Study

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Background

In January of 2003, the City of Wildwood completed a study of sanitary sewer service for the Town Center area. The 2003 study evaluated existing sanitary sewer capacity and provided the basis for MSD to expand sanitary sewer service and annex new properties for service within the Town Center including St. Louis Community College and Pond Elementary School.

Subsequent to the 2003 study, the City updated and revised the zoning regulations governing the Town Center area. Unfortunately, these land use zoning changes have resulted in MSD questioning the validity of the 2003 study. As a result, MSD is recommending that the City complete an update to the 2003 study which will consider the impact of the land use changes, as well as evaluate the feasibility of providing additional sanitary sewer service along Manchester Road to the west of Pond Elementary School. Therefore, the Department of Public Works, in conjunction with the Department of Planning, and MSD requested that Statements of Qualifications be submitted to the City by consulting engineering firms interested in completing the update to the study. A total of sixteen (16) firms submitted their qualifications for consideration. Director of Public Works Rick Brown, Assistant City Engineer Mike Hartwig, and Director of Planning and Parks Joe Vujnich completed a review and evaluation of all the qualifications received. Based on that evaluation, we have selected the firm we feel is most qualified to complete the study.

Recommendation

It is recommended that the City enter into an engineering contract to update the 2003 Town Center Sanitary Sewer Study with Donohue & Associates, Inc. for the not to exceed amount of $20,000.

Reasons for Recommendation

1. Donohue & Associates demonstrated significant experience completing similar projects for MSD.
2. Donohue demonstrated a good understanding of the project through their Statement of Qualifications.
3. Donahue's fee to complete the study is within the budget established for the project.

Attached for your information is the proposal submitted by Donahue for the study which was reviewed by the Department and MSD. Assuming a recommendation authorizing the selection of Donahue & Associates from the Committee, the Department will prepare a resolution authorizing the Mayor enter into an agreement with Donohue to complete the study. The resolution would be submitted to the City Council for consideration on January 23rd.

I will be available for any questions or comments at the January 10^{h}, 2017 Administration/Public Works Committee Meeting.

RCB

Donohue & Associates, Inc.
1415 Elbridge Payne Road, Suite 165 | Chesterfield, MO 63017
636.536.7042 | donohue-associates.com

January 3, 2017

Mr. Rick C. Brown, PE, PTOE
City of Wildwood
Director of Public Works / City Engineer
16860 Main Street
Wildwood, MO 63040

Re: Wildwood Town Center Sanitary Sewer Modeling Update (Revision 1)

Dear Mr. Brown:

Donohue & Associates, Inc. (Donohue) are honored for being selected and pleased to present this Scope of Work (SOW) and Fee Proposal for the Wildwood Town Center Sanitary Sewer HYDRA Model Update.

PROJECT APPROACH

Project Background

The City of Wildwood recently updated their Land Use plan in 2013. Based on the recommended changes and the potential addition of non-sewered areas on the western side of Town Center, the Metropolitan Sewer District has requested the City update the Caulks Creek sanitary sewer model and update the Wildwood Town Center Sanitary Sewer Study completed in 2003.

Donohue & Associates has developed a project approach that addresses the following key elements:

- A thorough update of the existing HYDRA model to minimize review process including the changes in land use based on the 2012 (or 13, see above) revision and the additional Pond District parcels to be sewered
- Accurate dry and wet weather calibration of the Hydra Model to ensure the validity of the model based on recent flowmeter data downstream of the Town Center system
- Open communication with the City of Wildwood staff regarding model development, calibration, and, most importantly, alternatives development and analysis.
- Development of alternatives that minimize impacts on the existing sewer system and provides the required capacity for the proposed changes and has the ability to sewer the Pond Historic District and surrounding non-sewered parcels on the western side of Town Center which were identified in the Request for Proposal.

Hydra Model Update

Donohue will update the existing Caulks Creek HYDRA sanitary sewer model per the requirements in the MSD Modeling Standards and Guidelines and Data Analysis & Hydra Modeling Procedures manual. The resultant model will be capable of accurately predicting dry weather base sanitary flow and wet season I/I to within an average of +/- 10 percent of measured peak flows and volumes, while also matching the shape of the dry and wet weather hydrographs. This model then will be used to analyze the proposed land use changes as well as the additional served areas.

Collection System

The existing sanitary sewer Collection System (SY) layer will need to be extended to include new sewers constructed in the study area since the previous update of the Caulks Creek Model. A review of as-built drawings will be conducted for all sewer projects that are not reflected in the most recent version of

MSD's sewer mapping and are constructed within the portion of the watershed which could be impacted by the addition of flow from the Wildwood Town Center annexation. Donohue will search MSD records for any new SSOs in this area, but there are no extensions due to new SSOs are anticipated since this is a recently developed area. In addition, the extension of the modeled sewers into the appropriate radar rainfall pixel areas for the annexed area will be required. This effort is a relatively new requirement in the modeling standards and is necessary so that the appropriate radar rainfall data is applied to the new service areas created for the Wildwood Town Center annexation. MSD uses radar rainfall data to generate storm files which impose rainfall on the model to produce I/I.

Donohue will properly document the data sources used to acquire elevation data, pipe sizes, pipe types, etc., for sewers added to the Collection System layer as required by MSD guidelines. This will assist MSD in their review of the model so the project can proceed in a timely manner.

Base Flow Estimates

"Base flow" is made up of sanitary wastewater and dry weather infiltration. Base flow is generated and injected into the sewers in the HYDRA model using Sanitary Service (SE) areas and the population and land use information stored in the Land Use (LU layer) within these areas. The Land Use layer will be updated based on the 2016 changes to the City's Master Plan. Donohue will review the Sanitary Service layer areas in the existing Caulks Creek Model and compare these areas to the existing sewers in the Wildwood area and make any revisions/additions to the SE layer as appropriate for the model year. The existing conditions model will use the land use layer for population estimates, per capita rates, and diurnal patterns This information will be intersected with the SE layer to generate sanitary flows.

The addition of the Wildwood Town Center area will require the delineation of additional SE areas to cover this new sewer area. These SE areas would be created as their own SE layer with population estimates, per capita rates, and diurnal patterns stored in this layer directly rather than in the LU layer that was used for the existing conditions model.

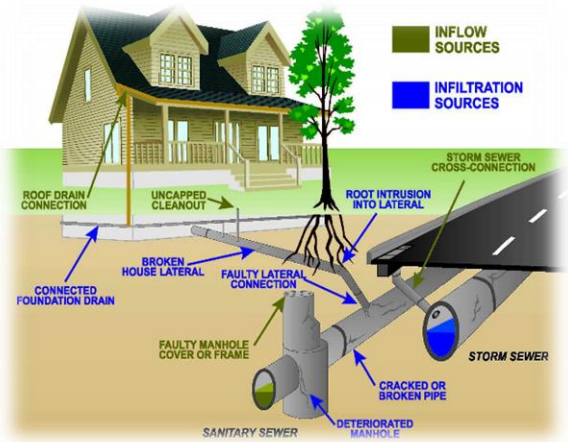
Dry weather infiltration is generally estimated as a percentage of the minimum flow rates which occur in the early morning hours of the day during the dry weather days of the flow monitoring period. Dry weather infiltration rates are stored in the Defects database of the model. These rates are adjusted up or down, as appropriate, during dry weather calibration and will be discussed further in Model Calibration.

A quick search of Missouri Sewer Operating permits was completed for this study area. Three operating permits were found including Living Word United Methodist Church, Wildwood Middle School, and Big Chief Roadhouse. Living Word has an agreement that if sanitary service is extended they are required to abandon their wastewater treatment facilities and be placed on the proposed system. It is assumed that the other permit holders have similar agreements if sanitary service is extended. As part of the project, further investigation and interviews with land owners and MDNR will determine if any other operating permits exist within the study area. Flows from these entities will be based on the operating permit and past records rather than a land use estimate.

Wet Weather Infiltration/Inflow Estimates

The hydraulic model will be used to derive I/I flows from inflow areas and infiltration rates entered in the HYDRA Defects database in the same manner as dry weather infiltration previously described. Wet season I/I is comprised of three parts:

- Inflow – stormwater flow that drains directly into the sanitary sewer and typically makes up the majority of the peak flow rate in the system for a given storm.
- Rapid Infiltration (or Rainfall Dependent Infiltration) – stormwater that enters the sanitary sewer indirectly (more slowly).
- Wet Weather Infiltration – increased groundwater infiltration due to heightened groundwater levels occurring during wet periods.



Typical Sources of Inflow & Infiltration

Model Calibration

. It is important to not only match the model to the measured peak flow rates and volume, but to match the shape of the dry and wet weather hydrographs as well. Model calibration should also be matched by adjusting the appropriate model component to achieve calibration; this is especially true of wet weather (storm event) calibration where there are more model parameters that can be used during calibration. Our abilities to analyze the measured flow hydrographs and adjust the proper model parameters during calibration is one reason MSD has sought out the services of our project team members over the past several years.

A number of occurrences can and will result in differences when flow meter data and model-predicted flows are compared that are often misinterpreted to some degree and if not properly recognized, improper calibration adjustments are made. Examples of these occurrences include:

- Sewer surcharging and backwater due to undersized sewers or blockages in the sewer main not allowing flow to reach the flow meter in an unimpeded fashion.
- Flow leaving the system through an overflow or out a manhole cover when the sewer backs up
- Bypass pumping from sewer construction
- Errors in the recorded flow or rainfall data itself

These limitations must be given careful consideration when calibrating a model. Blindly inputting data and forcing the model to match the observed response could result in a model that does not accurately reflect the true nature of the system. Therefore, all model adjustments will be made only within a reasonable range; if model adjustments beyond these limits are required to calibrate the model, then the rainfall flow and system configuration data, will be given a thorough review to identify the cause of the discrepancy. For example, increasing dry weather infiltration to unreasonable levels to compensate for what may be underestimated land use data might improve calibration results, but would be misleading.

The flow rates routed through the HYDRA model are virtually unaffected by undersized sewers that cannot convey a given flow. The model routes a given flow down through the sewer system whether the sewer can handle the flow or not, but HYDRA will show a surcharged sewer system in the sewer profile and will indicate the sewer is overcharged (under capacity), so surcharging is a common issue to watch for during calibration.

It is critical that modelers select the appropriate storms to use for wet weather calibration. This is particularly true due to HYDRA's inability to account for the effects of antecedent soil moisture conditions (AMC) on wet weather flows. Base GWI and RDI are often much greater during periods of high antecedent moisture (typically in the spring) than during dry periods (summer). Since HYDRA is unable to account for this phenomenon, potential calibration storms must be screened for those that have moderate (average) AMC so as to not be overly or insufficiently conservative during the development of system expansion alternatives.

Alternative Development

Donohue will develop sewer routing alternatives for the City of Wildwood that maximize the likelihood the additional areas can be connected to the MSD system while minimizing the capital improvements costs to do so. Donohue will first hold a meeting with City staff to assimilate their knowledge of the Pond Historic District and any proposed developments that may impact the alternative development. In addition, Donohue will use the changes in land use GIS data provided by the City. Using the existing HYDRA model and design storms provided by MSD, Donohue will determine which of the existing sewers and pump stations in the area have the most available capacity to accept the additional flow. We will then evaluate the feasibility and costs of conveying the additional flow to the existing sewer system. Other alternatives will likely consider the construction of new pump station(s) and force main(s), I/I reduction, or simply upsizing existing sewers, if necessary, so they can accommodate the additional flow.

Since sanitary sewers generally follow surface drainage, the general drainage boundaries for the Wildwood Town Center annexation area were reviewed to identify likely sewer routes. The figure on the next page shows the general topography and potential connection points to the MSD-Caulks Creek sewer system. We anticipate the new sewers will follow the same general flow directions except in cases where sewers can be sloped to cross minor drainage divides or it is more cost effective to collect flow to a point and then pump flow across drainage boundaries.

Fastrax Pump Station

The northern of the two potential tie-in points shown would route flow to the Fastrax Pump Station at the Highway 109 and Manchester Road intersection's southwest quadrant and convey flow through a 10-inch force main. The second location would be connecting to the gravity sanitary system within Manchester road adjacent to Pond Elementary School.

The project team will maintain contact with the City as alternatives continue to be developed and questions arise.

Alternative Analysis and Reporting

After the Development of Alternatives is complete, the project team will reconvene with City Staff to present the draft alternatives and receive comments. Donohue will deliver a technical memorandum to ultimately be submitted to MSD comparing the design condition for the existing sewer system and indicating the impacts of the addition of the annexed sewer system. These comparisons will include flow hydrographs, and more importantly, hydraulic grade lines (depth of flow in the sewer). Comparisons of all alternatives and associated costs will be provided. Any revisions requested by MSD will be evaluated and the technical memorandum resubmitted as necessary.

PROJECT SCOPE OF SERVICES

- Donohue will obtain a copy of the existing Caulks Creek Watershed Model from MSD.
- The Wildwood Town Center modeled collection system will be updated to represent the existing sewers constructed in Wildwood Area that affect the Town Center area since the original model was developed and last updated in 2003.
- Donohue will delineate and/or modify existing service areas for the new developments in the Wildwood Town Center area, following the parcel fines to generate the boundaries.
- Using the meter data provided by MSD, Donohue will verify the calibration for the sanitary flows to flow meter data to reflect dry-season conditions within +/- 10% for both the peak flow and total volume.
- Once dry weather calibration has been accomplished, the HYDRA model will be submitted MSD Development Review as a P-job for review and comment.
- Donohue will use the meter and rainfall data provided by MSD, verify the wet weather calibration meets the wet-season criteria within +1- 20% for both the peak flow and total volume. If any adjustments are necessary, the patterns of the meter data will be calibrated to one storm event and be verified by two other storm events. Any calibration results should take into account the antecedent conditions for the area when reviewing the metered data and comparing it to the model.
- Once wet weather calibration has been accomplished, Donohue will submit the wet-weather calibrated model to MSD for review and comment prior to proceeding to scenario generation.
- Using the design storm provided by MSD, Donohue will complete a model run and analyze the downstream portions of the model for surcharging conditions and capacity issues. This will be the baseline to determine what if any improvements are needed to convey flows for future developments in the Wildwood Town Center area.
- Donohue will create additional SE layers, including estimates of population, per-capita rates, volumes, and diurnal patterns as necessary to estimate flows for future planned developments within the Wildwood Town Center area.
- Donohue will run the design storm using the newly created layers that include the annexed area in conjunction with the 2030 Land Use Layer as provided by MSD.
- The Fast Track Pump Station impacted by the updated land use plan will be analyzed separate from the hydraulic model. A comparison of the design flow vs future flows will be completed based on the results of the updated hydraulic model.
- Donohue will compare the model results before and after the annexed area for deficiencies and produce a technical memorandum discussing the differences. This memorandum will include alternatives for correcting the capacity issues as well as associated costs.

ASSUMPTIONS

- Our Fee assumes no survey will be required and updates to the model will be based on as-built information and the MSD GIS Database
- The MSD Modeling Standards and Guidelines and MSD's Data Analysis & Hydra Modeling Procedures will be used as the modeling procedure.
- The City of Wildwood will provide population estimates for future areas
- Donohue will use per capita rates, and diurnal patterns for residential and commercial developments based on MSD guidelines.
- The City of Wildwood and MSD will complete reviews and provide written comments (3 total) within 15 business days

- The modeling software to be used will be HYDRA 7
- The City of Wildwood will provide the consultant with estimates regarding land use, population density, and business types.
- MSD will provide Donohue with the 2030 Land Use Layer for the Model
- City of Wildwood and/or MSD shall provide all land owner agreements for sanitary sewer service if sanitary sewer is provided for parcels that currently have private sanitary sewer systems.

PROJECT SCHEDULE

During a meeting with Rick Brown on December 19, 2016, it was discussed that the project schedule duration should be between 2 to 3 months. Based on the provided scope of services included in the RFQ, MSD requires 2 review periods of the HYDRA model which last 3 weeks each, totaling 6 weeks of review time not including any review of the technical memo. These lengthy reviews drive the overall project schedule. The project time for Donohue is approximately 78 calendar days (2 ½ months). Review times include a review of the technical memo which is approximately 53 days (2 months). Every attempt will be made to accelerate the schedule; however, this will only be possible if the review times are shortened.

See the attached schedule for schedule details.

PROJECT FEE

Donohue will revise the model and prepare a technical memorandum of the findings for a lump sum not to exceed fee of **$ 20,000**.

Please feel free to contact me at (636) 400-7046 or csafford@donohue-associates.com.

Sincerely,

Chris Safford, P.E.
Project Manager

Cc Alan Callier, Donohue

Enclosures:
- Man-hour & Fee Estimate
- Schedule

City of Wildwood, Missouri
Wildwood Town Center Sanitary Sewer Modeling Update
Man-Hour and Fee Estimate (Revision 1)

DONOHUE

Task	Eng. VIII $ 225	Eng. V $ 170	Eng. IV $ 155	Eng. III $ 140	Admin III $ 80	Total Hours	Total Labor	Travel	Printing	Other	Sub	Total Cost
1.0 - Project Management												
1.01 Project Management	1		4		3	8	$ 1,085					$ 1,085
SUBTOTAL 1.0 - Project Management	1	0	4	0	3	8	$ 1,085	$ -	$ -	$ -	$ -	$ 1,085
2.0 - Hydra Modeling Update & Design Study												
2.01 Kick-off Meeting with City of Wildwood & MSD	1		2		1	4	$ 615	$ 20				$ 635
2.02 Verify the size, location, and elevation of the sewers within the existing HYDRA model versus City/MSD As-Built records.			2	8		10	$ 1,430					$ 1,430
2.03 Land Use Layer Update			2	6		8	$ 1,150					$ 1,150
2.04 Review and analyze flow monitoring data for Town Center (1 Location)				4		4	$ 560					$ 560
2.05 Extend and Delineate Sewer Subbasins to distribute flows into HYDRA Model			2	8		10	$ 1,430					$ 1,430
2.06 Calibrate HYDRA model to base (dry weather) flows. (1 Location)			2	2		4	$ 590					$ 590
2.07 Quality Control HYDRA Model		2	0	0		2	$ 340					$ 340
2.08 Submit Dry Weather Model to MSD for Review				2	1	3	$ 360	$ 25		$ 25		$ 410
2.09 Revised dry weather model based on MSD Review				4		4	$ 560					$ 560
2.10 Calibrate HYDRA model to wet weather conditions. (1 Location)				4		4	$ 560					$ 560
2.11 Quality Control HYDRA Model		2				2	$ 340					$ 340
2.12 Submit Wet Weather Model to MSD for Review				2	1	3	$ 360	$ 25		$ 25		$ 410
2.13 Revised wet weather model based on MSD Review				4		4	$ 560					$ 560
2.14 Update SE Layers for Future Planned Areas			2	4		6	$ 870					$ 870
2.15 Determine Existing System Deficiencies			2	4		6	$ 870					$ 870
2.16 Quality Control HYDRA Model		2	0	0		2	$ 340					$ 340
2.17 Determine what segments need to be improved from a capacity standpoint.			2	2		4	$ 590					$ 590
2.18 Fastrax Pump Station Analysis			3	4		7	$ 1,025					$ 1,025
2.19 Prepare Cost Estimates			3	3		6	$ 885					$ 885
2.20 Prepare Technical Memo for Design Study, assumptions, HYDRA model calibration results, and analyses results.			2	18	2	22	$ 2,990					$ 2,990
2.21 Quality Control Tech Memo		4	0	0		4	$ 680					$ 680
2.22 Tech Memo Submittal to Wildwood & MSD				2	1	3	$ 360		$ 100	$ 50		$ 510
2.23 Revise Tech Memo per comments and Submit Final Tech Memo			2	4	2	8	$ 1,030		$ 100	$ 50		$ 1,180
2.24						0	$ -					$ -
2.25						0	$ -					$ -
SUBTOTAL 2.0 - Hydra Modeling Update & Design Study	1	10	26	85	8	130	$ 18,495	$ 70	$ 200	$ 150	$ -	$ 18,915
Total	2	10	30	85	11	138	$ 19,580	$ 70	$ 200	$ 150	$ -	$ 20,000
Total Labor Dollars by Labor Class	$ 450	$ 1,700	$ 4,650	$ 11,900	$ 880							

Assumptions

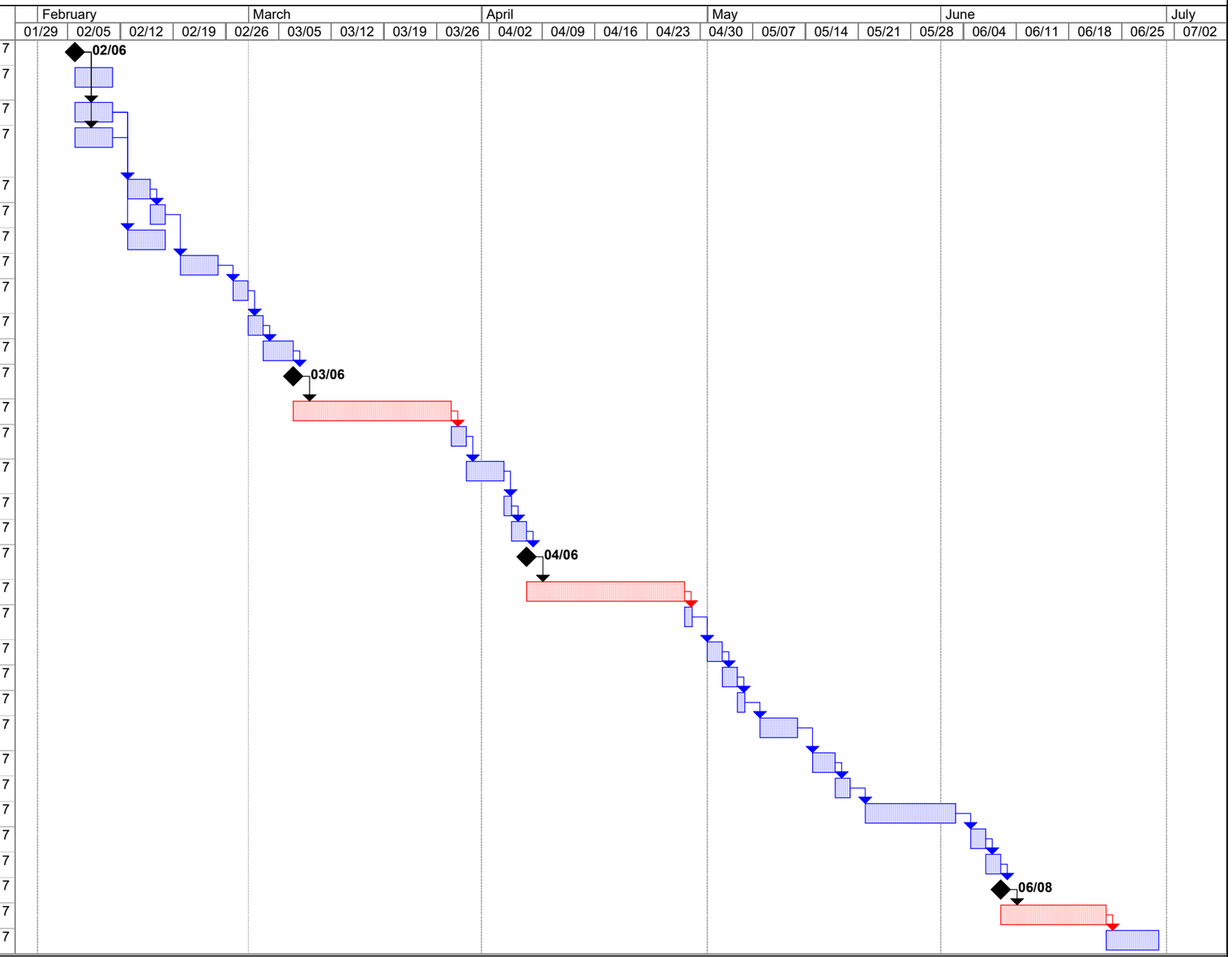
1. No survey will be required. Model updates will be based on provided As-built plans & MSD GIS System - If survey services are determined to be required, they will be performed on a time and material basis
2. 3 Copies of the Tech Memo will be submitted to the City of Wildwood, 1 to MSD
3.
4.
5.

City of Wildwood, Missouri

Town Center Sanitary Sewer Model Update

Donohue & Associates, Inc.
1415 Elbridge Payne Road, Suite 165
Chesterfield, MO 63017

ID	Task Name	Duration	Start	Finish
1	Project Award & Notice to Proceed	0 days	Mon 02/06/17	Mon 02/06/17
2	Project Kickoff Meeting w/ City of Wildwood and MSD	5 days	Mon 02/06/17	Fri 02/10/17
3	MSD to Deliver Caulks Creek HYDRA Model	5 days	Mon 02/06/17	Fri 02/10/17
4	City of Wildwood to deliver Sanitary Sewer As-Builts, Planned Development Plans, Future Buildout Plans	5 days	Mon 02/06/17	Fri 02/10/17
5	Verify Existing HYDRA Model	3 days	Mon 02/13/17	Wed 02/15/17
6	Land Use Update	2 days	Thu 02/16/17	Fri 02/17/17
7	Review Flow Monitoring Data provided by MSD	5 days	Mon 02/13/17	Fri 02/17/17
8	Extend HYDRA Model	5 days	Mon 02/20/17	Fri 02/24/17
9	Calibrate HYDRA model to base (dry weather) flows. (1 Location)	2 days	Mon 02/27/17	Tue 02/28/17
10	Quality Control HYDRA Model	2 days	Wed 03/01/17	Thu 03/02/17
11	Prepare Dry Weather Model to MSD for Review	2 days	Fri 03/03/17	Mon 03/06/17
12	Submit Dry Weather Model to MSD for Review	0 days	Mon 03/06/17	Mon 03/06/17
13	MSD / Wildwood Review	15 days	Tue 03/07/17	Mon 03/27/17
14	Revised dry weather model based on MSD Review	2 days	Tue 03/28/17	Wed 03/29/17
15	Calibrate HYDRA model to wet weather conditions. (1 Location)	3 days	Thu 03/30/17	Mon 04/03/17
16	Quality Control HYDRA Model	1 day	Tue 04/04/17	Tue 04/04/17
17	Prepare Wet Weather Model to MSD for Review	2 days	Wed 04/05/17	Thu 04/06/17
18	Submit Wet Weather Model to MSD for Review	0 days	Thu 04/06/17	Thu 04/06/17
19	MSD / Wildwood Review	15 days	Fri 04/07/17	Thu 04/27/17
20	Revised wet weather model based on MSD Review	1 day	Fri 04/28/17	Fri 04/28/17
21	Update SE Layers for Future Planned Areas	2 days	Mon 05/01/17	Tue 05/02/17
22	Determine Existing System Deficiencies	2 days	Wed 05/03/17	Thu 05/04/17
23	Quality Control HYDRA Model	1 day	Fri 05/05/17	Fri 05/05/17
24	Determine what segments need to be improved from a capacity standpoint.	5 days	Mon 05/08/17	Fri 05/12/17
25	Fastrax Pump Station Analysis	3 days	Mon 05/15/17	Wed 05/17/17
26	Prepare Cost Estimates	2 days	Thu 05/18/17	Fri 05/19/17
27	Prepare Technical Memo	10 days	Mon 05/22/17	Fri 06/02/17
28	Quality Control Tech Memo	2 days	Mon 06/05/17	Tue 06/06/17
29	Finalize Tech Memo Submittal to Wildwood & MSD	2 days	Wed 06/07/17	Thu 06/08/17
30	Submit Tech Memo to Wildwood & MSD	0 days	Thu 06/08/17	Thu 06/08/17
31	MSD / Wildwood Review	10 days	Fri 06/09/17	Thu 06/22/17
32	Revise Tech Memo per comments and Submit Final Tec	5 days	Fri 06/23/17	Thu 06/29/17



Project: Schedule
Date: Wed 12/21/16

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone