ETC Engineers & Architects, Inc.

ENGINEERS ▪ ARCHITECTS ▪ PLANNERS

▪ 1510 SOUTH BROADWAY, LITTLE ROCK, AR 72202 ▪ PHONE 501-375-1786 ▪ FAX 501-375-1277 ▪

March 7, 2018

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Mr. Layne Pemberton
Enforcement Analyst
Enforcement Branch
ADEQ Office of Water Quality
5301 Northshore Drive
North Little Rock, AR 72118

Ref: City of Forrest City; Permit No.: AR0020087
Comprehensive CAP Report per Item 11, 16 & 17 of the CAO

Dear Mr. Pemberton,

In accordance with the recent Consent Administrative Order (CAO) signed by the City of Forrest City, the FCWU is required to submit to ADEQ a comprehensive Corrective Action Plan (CAP) to correct the violations described in paragraph 11, 16 and 17 of the CAO for review and approval. The CAP is to be based on a Sewer System Evaluation Study of the sewer collection system performed with an "overall goal of eliminating capacity and non-capacity related SSO's" referred in the CAO. The plan is to be developed by a P.E. licensed in the State of Arkansas.

The City has retained our services to review these violations and develop appropriate Corrective Action Plans. The plan and associated supporting documents are attached to this cover letter for your review and approval.

We have included a milestone schedule for the CAP in the attached plan as required by the CAO.

We will continue to submit reports as outlined in the CAO. Please feel free to contact me if you need additional clarifications. I can be contacted at 501-375-1786.

Sincerely,

Mizan Rahman, P.E.
Principal

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 4223
MIZANUR RAHMAN
3/7/18

CC: Mayor Larry Bryant, City of Forrest City
Mr. Calvin Murdock, Manager, Forrest City Water Utility

PROPOSED PLAN
COLLECTION SYSTEM STUDY
FOR DEVELOPING CORRECTIVE ACTION PLANS
ON SANITARY SEWER OVERFLOW's

CITY OF FORREST CITY

PLAN OBJECTIVES

The objective of the plan is to develop Corrective Action Plans (CAP) to remedy all Sanitary Sewer Overflow (SSO) incidents reported to ADEQ by the City of Forrest City Water Utility (FCWU) between March 1, 2014 and July 20, 2016 (Ref. Paragraph 10 and 16 of the Consent Administrative Order). According to the Consent Administrative Order (CAO) there were 41 SSO's reported by the FCWU during March 1, 2014 and May 8, 2015 (Ref. Paragraph 10 of CAO). There were additional 27 reported SSO's during May 9, 2015 to July 20, 2016 (Ref. paragraph 16 of CAO). Therefore, the total number of reported SSO incidents are 68 during the reported period. The CAO does not identify the locations of each reported SSO incidents. However, our review indicates that the 68 reported incident happened at 45 discrete locations. Lists of the SSO locations along with a description of causes for the overflow is included in Attachment A. Nine of those locations are within private properties and relevant private parties have since agreed to develop their own CAP to the satisfaction of the regulatory authorities. Additionally, FCWU has no legal authority to enter these properties to implement any remedial action. Therefore, the total number of SSO discrete locations that will be investigated and CAP developed in this study are 36.

A further review of the list of SSO's reported by FCWU to ADEQ over a 2 year 4-month period reveals the following facts:

- At 17 locations the SSO incidents were caused by blockage as a result of grease accumulation.
- At 5 locations the SSO incidents were caused by a 10" rain event.
- Damage to the sewer pipe by a contractor/farmer resulted SSO's at 5 locations.
- Blockage due to entry of foreign objects (caused by deliberate efforts) in the sewer pipe resulted in overflow at 4 locations.
- At 3 locations pipe blockage due to root growth caused SSOs.
- 3 incidents of SSOs happened because of power failure.
- 37 SSO locations are within the center city south of the freeway. Whereas a large part of the collection system had no reported SSO's (See map in Attachment A)

The review further indicates that the SSO's are not caused by systemic system wide issues but rather discrete local issues and are limited to center city. Therefore, we believe that a two-step investigative process involving a first step Infiltration/Inflow (I&I) study and a follow up limited Sewer System Evaluation Study (SSES) will serve the City better in developing a CAP for each SSO locations.

The primary intent of this plan is to study these 36 SSO locations and either confirm the initial diagnosis as shown in the list of SSO's in Attachment A or if necessary develop a corrective action plan for those SSO locations where the cause of incident is different than original diagnosis.

PLAN REQUIREMENTS

The CAO stipulates that the City submit to ADEQ a Corrective Action Plan that is based on a Sewer System Evaluation Study. The CAO lists the following items to be included in the SSES plan.

1. Perform smoke testing in all areas of the collection system, beginning with the highest priority area;
2. Perform televising of lines in areas deemed necessary based on smoke testing in order to locate leaks and to determine method of repair;
3. Develop a plan to address deficiencies through rehabilitation, repair, or replacement;
4. Develop a manhole inspection program, beginning in the highest priority area; and
5. Recommend a method of repair and develop a cost estimate for such.

These criteria were included in the Consent Order as a means to identify portions of the sewer system where field investigations are warranted. These field investigations are intended to evaluate the condition of sewer assets that may contribute to the Sanitary Sewer Overflows in the Forrest City waste water collection system.

Therefore, it is clear that SSES planning involves the identification and prioritization of service areas which will require SSES field activities and subsequent analysis. Criteria for prioritizing SSES Basins were not stipulated in the CAO. However, there are published documents that articulate various standards to be used for prioritizing collection system basins such as the following:

- Basins with SSOs, where SSOs have only resulted during rainfall conditions in excess of a certain frequency of rainfall over a certain recurrence interval such as 10 year 24 hour rainfall.

- Basins with SSOs caused by infrastructure defects (i.e., inadequate pipe capacity, pipe sags, offset joints, broken pipe, broken manholes etc.)

- Basins with SSO's caused by flow exceeding an actual peak flow calculated based on contributing residential unit plus contributing commercial and industrial flows, during rainfall conditions and or high groundwater conditions.

- Basins served by pump stations that exhibit excessive pump run time.

SSO CORRECTIVE ACTION PLAN

Forrest City Wastewater collection system provides services to 3219 households and 8 industrial clients. It has approximately 480,000 linear feet of various size sewer gravity lines, 19 sewer pump station and 1600 manholes.

FCWU proposes to undertake a two-step investigative process to develop CAP for the 36 SSO locations. In the first step a system wide Infiltration Inflow study will be undertaken. The study will involve collecting datasets for all wastewater assets and developing a digital map. A GIS mapping system that includes the sewer, water and storm drain system will be prepared to provide critical data necessary for subsequent investigation. Information databases

could include, but not be limited to, pipe sizes, materials, age, rim and invert elevations, grease/sediment buildup, physical condition rating, infiltration rating, location of overflows, and date of inspection. A sewer system map showing the location of the key manholes/gauging locations and subsystem boundaries will be prepared and submitted with the I/I report.

The purpose of continuous sewer flow monitoring is to collect accurate, current information on the flow characteristics of the study area. The information provided by flow monitoring will aid in locating those areas that have excessive infiltration/inflow and determine if they warrant further investigation. This task will be conducted immediately in order to minimize the study time. It should be emphasized that the flow monitoring data provides the basis for determining the need for and location of areas where additional, costly field work should be performed to develop CAPs.

The wastewater collection system will be divided into sub-systems consisting of smaller sized sewer tributaries. The sewer tributaries that have the SSO locations will be given higher priorities and closer scrutiny in flow analysis. In each subsystem a manhole will be selected for the installation of continuous flow recording meters. Rainfall and Groundwater will also be monitored throughout the study period.

The infiltration/inflow analysis is performed to determine the extent of the existence/non-existence of excessive infiltration/inflow in each sewer tributary of the Forrest City wastewater collection system. Through a systematic investigation of the wastewater sub-system, we will identify the flow rate, and type of infiltration/inflow conditions which exist in the wastewater system. The Phase I I/I Analysis investigation will include the following:

- description of existing wastewater collection system;
- estimates of average residential, industrial, commercial and institution wastewater flows
- groundwater levels within the wastewater collection system;
- continuous flow monitoring and in some cases flow isolation monitoring;
- determination of infiltration and inflow rates;
- recommendations for further investigation;

A detail scope of work for the I/I study is included as Attachment B to this plan. The scope was developed by FCWU consultants. The consultants have been given a green light to start mobilizing to begin the study.

Following the flow monitoring result, the subsystems will be ranked/prioritized based on the result of the I/I study. It is anticipated that the sub-systems with SSO locations will be in the higher priority sub-system group. If infiltration/inflow analysis results indicate presence of excessive I&I in these sub-system groups a SSES may be proposed to determine remedial action. A plan will be developed for the SSES. The plan will outline the tasks to be performed in the study and their estimated costs. SSES will be performed as a follow up to the I/I analysis to locate and identify specific Infiltration & Inflow sources in the sewer system within the specific basin. By identifying the type of each I/I source and the flow from that source during the SSES, appropriate CAP

(rehabilitation methods) can be developed. Subsequently, a study will be undertaken to determine the cost effectiveness of the removal of the I/I source. The data collected during the SSES will also be used to confirm the findings of the Infiltration/Inflow analysis and, in particular, the extent of additional investigation needed to develop appropriate rehabilitation, and/or system improvements required in the areas investigated during the SSES.

A full plan for SSES is premature at this time since the SSES plan will be based on the result of the I/I Study. However, we anticipate any SSES recommended in the I/I report will most likely include some or all of the following elements.

1. Identify Infiltration Sources – Manhole Inspection
   At the completion of the flow data analysis portion of an I/I Analysis an extensive manhole inspection and flow isolation program for all subsystems exhibiting an infiltration rate equal to or greater than a minimum rate (such as 4,000 gpd/idm).

2. Identify Inflow Sources -
   At the completion of the flow data analysis portion of an I/I Analysis, the inflow estimated to be produced from the standard design storm (such as one-year, six-hour design storm) will be used to rank all subsystems from high to low on the basis of the following: (1) volume of total inflow, (2) volume of direct inflow, and (3) volume of delayed inflow. On a first-cut basis, evaluate performing an SSES in the highest priority subsystems which account for not less than 80 percent of the total system inflow volume.

   a. Smoke Testing
      Subsystems which contain a high volume of direct inflow should be targeted for smoke testing and other inflow detection techniques aimed at identification of direct connections to the collection system.

   b. House Inspection
      Subsystems which contain a high volume of delayed inflow should be targeted for house-to-house inspections (to identify sump pump connections) and other inflow detection techniques aimed at identification of indirect connections or connections which produce inflow after a significant time delay from the beginning of a storm.

3. Rainfall Simulation
   Rainfall simulation is used to identify/confirm inflow sources to the sanitary sewer system. Dyed water flooding can identify both direct connections (catch basins) to the sanitary sewer as well as indirect connections between storm sewers or storm ditches and the sanitary sewer If the infiltration/inflow analysis demonstrates that major inflow problems occur during periods of intense rainfall, a controlled systematic check of all storm sewers that parallel or cross the sanitary sewer system and/or house services should be initiated.

4. Dyed Water Testing

Inflow sources including downspouts, area drains, patio drains, window well drains, stairwell drains and driveway drains may not always be detected with smoke testing due to trapped building service laterals or clogged drains. Dyed water flooding of storm sewers and/or storm ditches can detect line segments where there are either direct or indirect connections between the storm sewer and sanitary sewer system.

5. TV For Infiltration

TV inspection is utilized to pinpoint the exact location (s) of extraneous water entering the sewer system. This live inspection will provide valuable data which can be constructively used for analytical purposes. In addition a permanent visual record can be made for subsequent review. A cost-effectiveness analysis (C/E/A) will be performed as part of any SSES to demonstrate that the Infiltration/Inflow (I/I) entering the system is excessive. I/I is defined as being excessive if the costs for the correction of I/I conditions are less than the costs for transportation and treatment of these flows. For the purpose of this program, Infiltration rates above 4,000 gpd/idm are considered to be excessive. Thus the initial cost effective breakpoint for recommending closed circuit T.V. inspection shall be those line groupings with infiltration rates greater than 4,000 gpd/idm. When infiltration rates less than 4,000 gpd/idm are expected to be excessive a separate C/E/A must be performed for each pipe reach to justify performing closed circuit television inspection.

MILESTONE SCHEDULE

A milestone schedule is included in Attachment C

ATTACHMENT A
LISTING OF SSO LOCATIONS

CITY OF FORREST CITY

ATTACHMENT A

LISTING OF SSO LOCATIONS WITH DETAILS OF OVERFLOW REPORTING

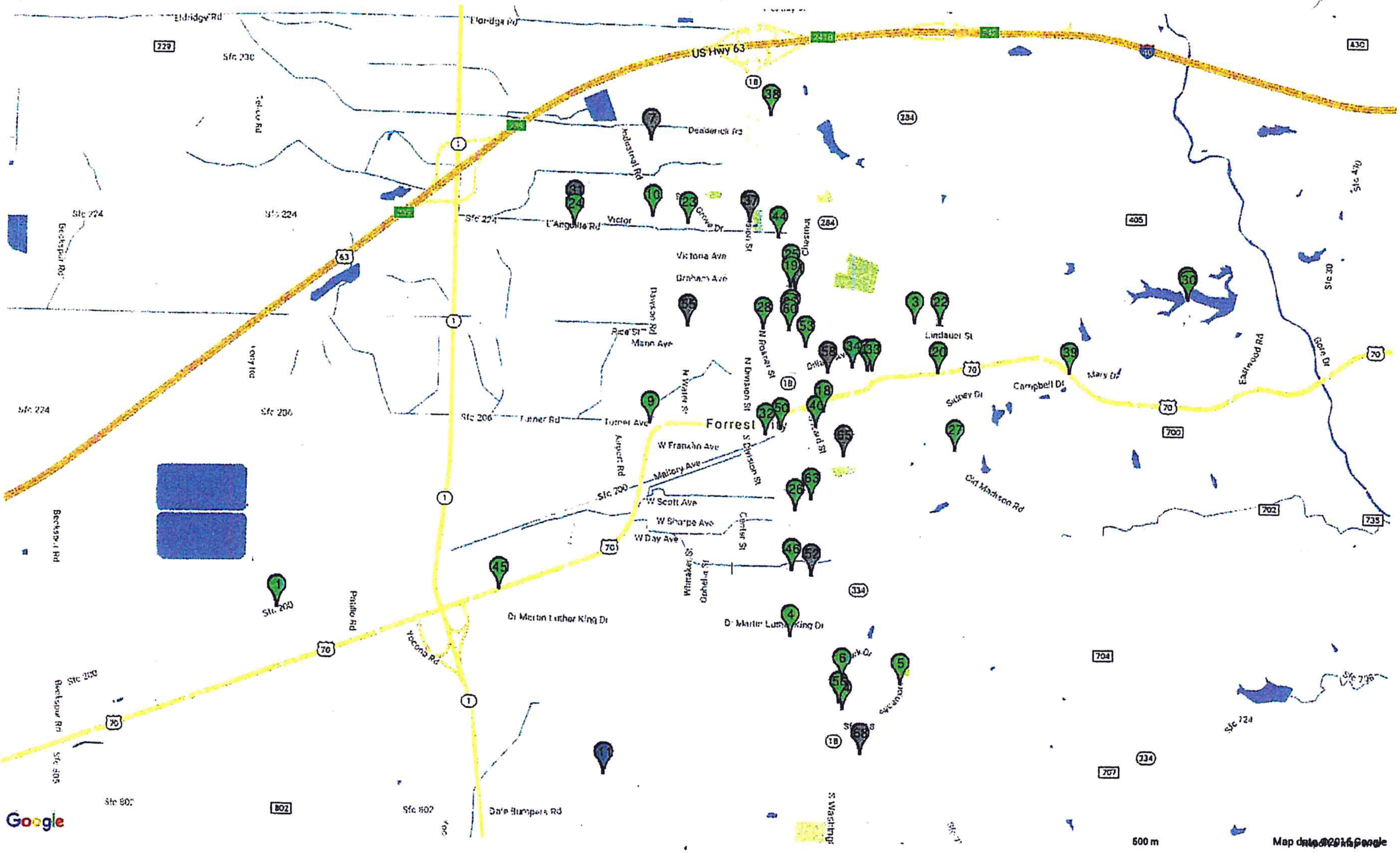
CITY OF FORREST CITY

Violation No.	SSO Discrete Location No.	Reporting Date	Location/Address	Location Note	Private / City/Prison	Cause of SSO	No. of Incidents At This Location
1	1	3/7/16	1000 Garland		City	Grease	1
2	1	10/15/14	1004 Garland		City	Grease	2
3	1	11/22/14	1004 Garland		City	Grease	3
4	1	5/19/15	1104 Garland		City	Grease	4
5	2	6/2/14	1425 N Division		Private manhole located on property	Debris in line	
6	3	1/2/16	2300 N Washington		City	Damaged by contractor	
7	4	2/25/16	2900 E Broadway	Lift Station	City	Electrical power failure by service provider	
8	5	2/23/15	300 Izard Courthouse	County Jail	City	Inmates flushing clothing	1
9	5	11/17/14	300 Izard Courthouse	County Jail	City	Inmates flushing clothing	2
10	5	7/26/15	300 Izard Courthouse	County Jail	City	Inmates flushing clothing	3
11	5	9/30/14	300 S Izard Courthouse	County Jail	City	Inmates flushing clothing	4
12	6	11/17/14	300 Mississippi		City	Grease	
13	7	5/28/15	3000 W Broadway		City	Damaged by Contractor	
14	8	8/15/14	3225 Forrest & Front St		City	Damaged by Contractor	1
15	8	9/14/14	3225 Front & Front St		City	Damaged by Contractor	2
16	9	4/12/15	416 St Francis		Private	Open cleanout	
17	10	1/31/16	424 A		Private	Open Cleanout	
18	11	5/22/14	511 N Forrest		City	Grease	
19	12	3/17/15	5901 N Washington		City	Power Failure	
20	13	1/29/15	604 W Buford		Private	Broken service line	
21	14	10/29/14	611 Sherwood		City	Grease	
22	15	4/12/16	620 Upper Lake	Lift station	City	Mechanical	
23	16	12/29/15	700 Garland		City	Grease	
24	17	6/13/14	700 Izard		City	Grease	1

25	17	9/8/15	700 Izard		City	Grease	2
26	17	9/8/15	700 Izard		City	Plumber washed service line introduced grease into system.	3
27	18	8/10/15	700 S Rosser		City	Grease	
28	19	3/5/15	711 Sherwood		City	Grease	
29	20	6/3/14	720 E South		Private	Service line collapse	
30	21	4/1/14	720 N Izard		City	Grease	
31	22	6/18/14	726 Izard		City	Grease	
32	23	6/13/14	921 Driftwood		Private open cleanout	Sanitary products	1
33	23	8/10/15	921 Driftwood		Private	Customer's children placed item in cleanout.	2
34	24	4/12/16	Albert St		City	Debris	
35	25	12/29/15	Bray St		City	Damaged by contractor	
36	26	12/29/15	Brookside & Sycamore		City	Grease	
37	27	6/29/14	Central Elementary		Private	Flood 10" rain	
38	27	9/24/14	Central Elementary		Private	Paper towels	
39	28	6/29/14	Dawson & Turner		City	Flood 10" rain	
40	29	6/29/14	Dawson Rd		City	Flood 10"rain	
41	30	7/21/15	East of Oakland	by railroad tracks	City	Roots	
42	31	8/12/14	700 Garland	Empty lot	Private	Open cleanout	
43	32	9/29/14	End of A St		City	Grease	1
44	32	1/15/15	End Of A St		City	Grease	2
45	32	1/28/15	End Of a St		City	Grease	3
46	32	4/12/15	End Of A St		City	Grease and clothing	4
47	33	11/10/14	End Of Cedar St		City	Grease	
48	34	3/4/15	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	1
49	34	9/7/15	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	2
50	34	3/3/16	Federal prison	Lift Station	Prison	Deliberate introduction of material into system	3
51	34	3/7/16	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	4

52	34	4/20/16	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	5
53	34	5/10/16	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	6
54	34	7/5/16	Federal Prison	Lift Station	Prison	Deliberate introduction of material into system	7
55	35	6/11/14	Field East of Victor St		Private open cleanout	Damaged line by farmer	
56	36	5/7/15	Izard & St Francis		City	Grease	
57	37	6/12/14	Kittle & Broadway		City	Grease	1
58	37	8/25/14	Kittle & Broadway		City	Grease	2
59	37	3/18/14	Kittle Rd & Albert		City	Paper towels	3
60	38	1/1/15	Laney Drive		City	Grease	
61	39	6/29/14	Lanquille Rd		City	Flood 10" rain	
62	40	6/29/14	Mallory Lift station	Lift Station	City	Flood10" rain	1
63	40	3/9/16	Mallory Lift station	Lift Station	City	Electrical power failure by service provider	2
64	41	5/1/15	N Izard& St Francis		City	Grease	1
65	41	5/5/14	St Francis & Izard		City	Grease	2
65	42	4/21/16	Old Madison Rd		City	Roots	
66	43	2/9/16	Rosser & div		City	Roots	
67	44	10/20/15	Upper Lake Lift Station		City	Electrical power failure by service provider	
68	45	10/24/14	West & Front St		City	Debris	

TOTAL NO. OF VIOLATIONS	68
TOTAL NO. OF DISCRETE LOCATIONS	45
NO OF PRIVATE PROPERTIES	9
NO OF SOS CITY IS RESPONSIBLE FOR	36


US Hwy 63
Forrest City
Deadenck Rd
Industrial Rd
Victor
L'Anguille Rd
Grove Dr
Chestnut
Victoria Ave
Graham Ave
Dawson Rd
Mann Ave
N Rosser St
N Division St
S Division St
N Water St
Lindauer St
Campbell Dr
Mary Dr
Eastwood Rd
Gore Dr
Sidney Dr
Old Madison Rd
Airport Rd
Turner Ave
Turner Rd
W Franklin Ave
Mallory Ave
W Scott Ave
W Sharpe Ave
W Day Ave
Center St
Whitaker St
Ophelia St
Dr Martin Luther King Dr
Pratto Rd
Yocona Rd
Dale Bumpers Rd
Eldridge Rd
Telico Rd
Beckspur Rd
S Washington
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500 m
Map data ©2016 Google

ATTACHMENT B
SCOPE OF SERVICES
INFILTRATION & INFLOW STUDY

CITY OF FORREST CITY

FORREST CITY WATER UTILITY
CITY OF FORREST CITY, ARKANSAS
PROPOSAL FOR ENGINEERING SERVICES
INFLOW/INFILTRATION ABATEMENT PROGRAM

ATTACHMENT A
SCOPE OF SERVICES

The scope described below consists of professional services designed to engage and assist the Forrest City Water Utility (FCWU/OWNER) in implementing the processes and performing the tasks related to a Sanitary Sewer Overflow (SSO) identification and remediation program. These professional services are proposed to complement the FCWU's improvement program, assist FCWU with communicating to the respective regulatory agency and address inflow and infiltration (I/I) in a phased approach.

Phase I – Sanitary Sewer Mapping

The mapping phase will compile the existing wastewater system datasets (plans, drawings, electronic files, source documents) and existing database inventory system, if available, into a homogeneous Open Database Connectivity (ODBC) compliant database access compatible with a GIS platform (ESRI Arc Map). This phase will also entail the GPS locating of all wastewater assets. The goal of the ODBC database system is to make it possible to access data from multiple applications.

The mapping project will require a collaboration between RJN Group (ENGINEER) and FCWU to gather and compile all existing maps, plans, and location data that might be available for the wastewater collection system. The mapping scope presented here is the approach to conduct a GPS inventory of the wastewater assets, developing a GIS database and creating a digitized map of the system.

This collaboration would include the following assumptions:

1. FCWU would make available to ENGINEER all existing paper maps, electronic maps and database systems for use and compilation. FCWU shall be available to ENGINEER to detail and explain information contained therein.

2. The ENGINEER shall not be responsible for verification of information provided by FCWU unless verification is requested.

3. FCWU shall coordinate with ENGINEER to gather information in an electronic format compatible with the database access system (GIS or CAD), which may include, but not necessarily limited to:
    a. Property parcels
    b. Buildings
    c. Road geometry
    d. Stream centerlines
    e. Municipal boundaries

f. Wastewater system assets (gravity mains, force mains, manholes, pump stations)

4. A reasonable effort will be made to extract as much attribute data from source information provided by the FCWU. If attribute data are absent then additional research, field work, and/or staff interviews will be conducted to verify the system.

5. ENGINEER understands and FCWU accepts that available GIS database information may be derived from third parties and, ENGINEER cannot warrant accuracy of the third-party data utilized in support for map development.

A.1.1 Project Administration

A.1.1.1 ENGINEER shall prepare and monitor schedule of work activities.

A.1.1.2 ENGINEER will perform internal project control procedures on a monthly basis including schedule and budget control, quality control review, and monthly progress reports.

A.1.1.3 ENGINEER shall order and obtain services necessary to perform the project and finalize agreements with any required subconsultants or subcontractors.

A.1.1.4 Regularly scheduled progress reports will be provided by the ENGINEER to the OWNER and designated team members.

A.1.1.5 Meet with CITY staff on a periodic basis, to update previous investigative work, to coordinate upcoming work, and to receive any input from staff. Written documentation of each meeting will be provided

A.1.1.6 Perform general consultation with appointed CITY representative on an as needed basis. Provide general overview opportunities for CITY personnel for observing regularly scheduled field inspection and testing activities.

A.1.1.7 Obtain existing information provided by CITY including maps, flow and rainfall records, facility as-built drawings, pump curves, overflow occurrence records, CIP status and other pertinent information.

A.1.2 Digital Mapping Project Implementation

A.1.2.1 The first step of the mapping project is to meet with the FCWU to outline the objectives of the project. At this kickoff meeting, FCWU will provide RJN with all the existing datasets. The mapping applications and the format and quality of the data will be discussed.

A.1.2.2 Based on the hard copy maps of the FCWU wastewater system that were provided to RJN, there are believed to be approximately 1,450 manholes within the FCWU system. RJN proposes to conduct a GPS asset inventory of 1,450 manholes.

A.1.3 ESRI Purchase, Subscription, and Implementation

A.1.3.1 Based on previous conversations regarding potential lack of manpower to keep FCWU GIS up-to-date, RJN recommends the purchase of ArcGIS Online for the initial GIS implementation for FCWU. ArcGIS Online is a cloud-based software solution provided by ESRI Inc. for organizations to have Web-based access to their GIS infrastructure anywhere they have an Internet connection, including desktops, laptops, tablets, and cell phones.

A.1.3.2 The purchase of ArcGIS Online includes five (5) concurrent user licenses. ArcGIS Online will require annual renewal for use. The subscription rates are set by ESRI, $2,500 for ArcGIS Online. The ArcGIS Online cloud will be used for storage of GIS data requiring access from the internet or mobile devices. A limited number of credits for storage and data processing are provided with the initial purchase of ArcGIS Online.

A.1.3.3 RJN will set up ArcGIS Online using the Sanitary Sewer Network schema from the Local Government Information Model and include the sanitary sewer maps and apps determined applicable during the kickoff phase of the project.

A.1.3.4 RJN will create a set of online thematic maps for FCWU to begin using ArcGIS Online immediately using readily available data from ESRI, St. Francis County, and other resources. Additional online maps will be created to take advantage of creating and editing data from mobile devices such as tablets and cell phones.

1. ENGINEER will scan available paper map copies provided by FCWU georeferenced maps based upon the position and features on the source maps as they appear. Features and assets from these hard maps will be digitized into the GIS database.

2. ENGINEER will coordinate with FCWU to develop a GIS Database for the wastewater collection system using the ESRI Sanitary Sewer Schema in the Local Government Information Model. The following assets and attributes will be included in the database:

    a. Manholes
        i. X, Y Coordinate location
        ii. Flow network continuity

    b. Gravity Mains
        i. Material
        ii. Size
        iii. Segment Length

    c. Force Mains
        i. Material
        ii. Size

iii. Length

d. Pump Stations
   i. Location

e. Air/Vacuum Release Valves
   i. Location
   ii. Size

3. The ENGINEER will develop a map book to a large format scale with a keyed index. Numbering (or alpha numeric) system of assets will be developed and approved by the FCWU.

4. Inspection Data Post Processing and QAQC: The ENGINEER will complete a Quality Assurance/Quality Control (QAQC) assessment of the raw inspection data. ENGINEER shall review the files to assess the quality and accuracy of the information. The final assessment data will be processed and formatted based on the standardized schema.

5. ENGINEER will conduct a final QAQC of the digital sanitary sewer network after the data has been integrated. The network will be validated based on geometric network connectivity and this review will also check the GIS database for attribute consistency. The ENGINEER will also QAQC the reference file attributes within the database to ensure that the digital files are accurately linked to the correct spatial feature.

A.1.4 Project Deliverables

1. GIS Inventory and Data Management Database (Electronic Media via CD DVD/ROM or equivalent)

2. Wastewater Asset Map Book

3. ArcGIS Online FCWU Wastewater System Interactive Map

A.1.5 Manhole Inventory and Asset Identification

A.1.5.1 This task will consist of the survey of manholes for detailed sanitary sewer system evaluation. The initial phase will include the survey of 1,450 manholes.

A.1.5.2 Assumptions:

1. The GPS mapping shall be conducted with sub-meter accuracy using the Arkansas state plane coordinate system.

2. ENGINEER will make every effort to locate manholes in the field. ENGINEER will spend up to 15 minutes physically locating the manhole based upon the

overall system map. If a manhole cannot be discovered, the FCWU will be notified for location assistance.

A.1.5.3 Project Deliverable

Updated wastewater system maps to reflect GPS field validation of assets.

Phase II – Sanitary Sewer Flow Monitoring

A.2 FLOW MONITORING

The flow monitoring program is intended to collect both dry and wet weather flows for a 60-day period. It is anticipated that sixteen (16) temporary flow meters owned by the ENGINEER will be installed, serviced and calibrated by ENGINEER on a regular basis.

A.2.1 SITE INVESTIGATION FOR TEMPORARY METERS

A.2.1.1 Review the collection system maps, operational information for the collection system, and the proposed hydraulic model network to select strategic flow monitoring locations.

A.2.1.2 Prepare and submit to CITY staff a map that shows the proposed flow monitoring sites.

A.2.2 METER INSTALLATION

A.2.2.1 Prepare flow metering equipment for field installation conducting a series of performance and calibration tests to verify equipment meets operating standards. Inspect the key monitoring locations to determine their suitability for installation of the equipment. If a location is identified as being unsuitable, then alternative sites will be identified and evaluated to determine their suitability for installing the selected equipment.

A.2.2.2 A sixty (60) day monitoring period is predicated on obtaining sufficient dry and wet weather conditions that include at least four (4) storm events of varying rainfall intensities to adequately analyze the performance of the collection system. In the event of adequate rainfall during the 60-day monitoring period, flow meters may be pulled, and a credit applied as approved by CITY.

A.2.3 METER MAINTENANCE

A.2.3.1 Maintain the temporary flow meters over the monitoring period to achieve at least a 90% uptime requirement. Routine service visits shall be performed on a bi-weekly basis to include in-situ depth and velocity confirmations, downloading recorded data, onsite analysis of the data, cleaning of the sensors, and replacing any defective or deficient equipment. In the event telemetry is used, data shall be downloaded and evaluated on a weekly basis. Data shall be reviewed within 24 hours of collection and field technicians will be dispatched within 48 hours to correct any issues identified.

A.2.3.2 Meter Removal (Temporary Meters)
In the event the dry and wet weather criteria have been met by the end of the scheduled monitoring period, recommend the removal of flow meters. If the criteria have not been observed during the scheduled monitoring period, advise CITY to consider extending the monitoring period.

A.2.4 RAIN GAUGE INSTALLATION

A.2.4.1 Prepare tipping bucket rain gauge equipment for field installation conducting a series of performance and calibration tests to verify equipment meets operating standards. CITY shall recommend CITY-owned sites for potential rain gauge locations. Inspect the proposed gauging locations to determine their suitability for installation of the equipment. If a location is identified as being unsuitable, then alternative sites will be identified and evaluated to determine their suitability for installing the selected equipment.

A.2.4.2 Install rain gauges with 0.01-inch accuracy to satisfy coverage requirements.

A.2.4.3 A sixty (60) day monitoring period is predicated on obtaining at least four (4) storm events of varying rainfall intensities to adequately develop and calibrate the hydraulic model. Four (4) temporary rain gauges are assumed in the cost proposal.

A.2.5 RAIN GAUGE MAINTENANCE

A.2.5.1 Service rain gauges to obtain a continuous record of rainfall conditions during the monitoring period. Routine service visits shall be performed on a bi-weekly basis to include reading confirmations, downloading recorded data, onsite analysis of the data, cleaning and replacing any defective or deficient equipment. In the event telemetry is used, data shall be downloaded and evaluated on a weekly basis. Data shall be reviewed within 24 hours of collection and field technicians will be dispatched no later than the following working day to correct any issues identified.

A.2.5.2 Rain Gauge Removal (Temporary Rain Gauges)
In the event the dry and wet weather criteria have been met by the end of the scheduled monitoring period, recommend the removal of rain gauges. If the criteria have not been observed during the scheduled monitoring period, advise CITY to consider extending the monitoring period.

A.2.6 FLOW ANALYSIS AND REPORTS

A.2.6.1 Edit raw data and develop final calibrated flow data for flow meters.

A.2.6.2 Develop depth, velocity and quantity hydrographs for dry and wet weather flow conditions.

A.2.6.3 Analyze flow data for sub-drainage basins and develop average daily

dry weather flow diurnal curves and base flow peaking factors.

A.2.6.4 Estimate peak inflow rates for selected rainfall events and determine corresponding rainfall intensity for areas tributary to all flow monitoring locations.

A.2.6.5 Determine peak infiltration rates during high groundwater conditions, if possible.

A.2.6.6 Identify and prioritize areas for further SSES investigations.

FORREST CITY WATER UTILITY
CITY OF FORREST CITY, ARKANSAS
PROPOSAL FOR ENGINEERING SERVICES
INFLOW/INFILTRATION ABATEMENT PROGRAM

ATTACHMENT B
SCHEDULE

B. SCHEDULE

The ENGINEER and OWNER agree that the project is planned to be completed according to the schedule below with an anticipated Notice to Proceed of February 26, 2018.

Task	Days
Mapping	100
Flow Monitoring	60
Data Processing	30
Deliverable to FCWU	7/13/2018

The ENGINEER shall employ manpower and other resources and use profession skill and diligence to meet the schedule; however, shall not be responsible for schedule delays resulting from conditions beyond his control. With mutual agreement, the ENGINEER and OWNER may modify the project schedule during the course of the project and if such modifications affect the ENGINEER's compensation, it shall be modified accordingly, subject to OWNER's approval.

ATTACHMENT C
MILESTONE SCHEDULE
SSO CORRECTIVE ACTION IMPLEMENTATION

CITY OF FORREST CITY

MILESTONE SCHEDULE

SANITARY SEWER OVERFLOW C0RRECTIVE ACTION PLAN

FORREST CITY WATER UTILITY