

## CCNA2018 WORK ORDER 2

### RECLAIMED WATERLINE CORROSION EVALUATION

This Work Order Number 2 is entered into as of this 4<sup>th</sup> day of June, 2019, pursuant to that certain Continuing Consulting Engineering Services Agreement for Professional Services entered into as of this 17<sup>th</sup> day of April, 2018 (collectively referred to as the "Agreement"), by and between INDIAN RIVER COUNTY, a political subdivision of the State of Florida ("COUNTY") and Bowman Consulting ("Consultant").

The COUNTY has selected the Consultant to perform the professional services set forth on Exhibit A (Scope of Work), attached to this Work Order and made part hereof by this reference. The professional services will be performed by the Consultant for the fee schedule set forth in Exhibit B (Fee Schedule), attached to this Work Order and made a part hereof by this reference. The Consultant will perform the professional services within the timeframe more particularly set forth in Exhibit C (Time Schedule), attached to this Work Order and made a part hereof by this reference all in accordance with the terms and provisions set forth in the Agreement. Pursuant to paragraph 1.4 of the Agreement, nothing contained in any Work Order shall conflict with the terms of the Agreement and the terms of the Agreement shall be deemed to be incorporated in each individual Work Order as if fully set forth herein.

IN WITNESS WHEREOF, the parties hereto have executed this Work Order as of the date first written above.

CONSULTANT:

BOARD OF COUNTY COMMISSIONERS  
OF INDIAN RIVER COUNTY

By: \_\_\_\_\_  
Printed Name: \_\_\_\_\_  
Title: \_\_\_\_\_

By: \_\_\_\_\_  
Bob Solari, Chairman  
BCC Approved Date: \_\_\_\_\_

Attest: Jeffrey R. Smith, Clerk of Circuit  
Court And Comptroller

By: \_\_\_\_\_  
Deputy Clerk

Approved:

\_\_\_\_\_  
Jason E. Brown, County Administrator

Approved as to form and legal sufficiency:

\_\_\_\_\_  
Dylan Reingold, County Attorney

## EXHIBIT A -SCOPE OF WORK

The Bowman Consulting team will assist Indian River County Dept of Utility Services (IRCDUS) staff in conducting an evaluation of potential internal and external pipe corrosions on a segment of 20" diameter ductile iron pipeline for a reclaim water main serving IRCDUS.

This investigation will require a collaborative effort between County staff, County GIS, County Maintenance staff and field personal, the Consultant (Bowman Engineering), scientists, subconsultants and other parties. We use the word "assist" because the system knowledge, history, impacts require us to seek input ideas, and history from County staff that have dealt with the pipe corrosions for several years and have valuable historical knowledge of the main and past failures.

Bowman Consulting is conscious of the County's budget and will seek to isolate the corrosion or pitting (Corrosion) as internal or external in nature prior to focusing efforts in investigation. R&M Service Solutions will be utilized to provide visual and acoustic analysis of the interior of a segment of the reclaim main, and the results of this analysis will directly impact the focus of the investigation.

The detailed breakdown of the proposed tasks and anticipated evaluations is presented below and will be performed on an incremental basis. Corrosion analysis is unique because it can be caused by many different things. That means that we can go down an evaluation path to determine a null result. We have set this proposal up to address issues to minimize overall evaluation costs.

### **Phase IA. Initial Confirmation – Internal Corrosion**

We will rely exclusively on the visual and acoustic analysis by R&M to evaluate one selected 2,500 LF section of the main in the vicinity of known failure points for internal corrosion. The evaluation of a limited pipe segment is proposed due to the cost of the internal pipeline evaluation and analysis. We will work with County staff to determine the best run of pipe to sample based on known issues. If internal corrosion is identified as a result of the analysis, we will focus further on this source and additional wet taps and evaluation could be required to assist in identifying potential future failure points and determine the significance of internal corrosion in the main.

If internal corrosion does not appear to be evident in the limited internal analysis, our efforts will be concentrated on potential external sources and a significant savings will be realized by not evaluating the interior of the entire 2-mile run of pipe.

### **Phase IB. Initial Confirmation – External Corrosion**

It is critical to confirm whether the actual pipe surface defects are contributing to external pitting or external corrosion. It is essential that this be confirmed as it establishes the backbone of investigation. Simplistically, pitting is the extraction of the metal surface from the pipe which means that metal ions are leaving the pipeline. Conversely, corrosion is the decay and/or attraction of other things to the pipeline reduce the pipe material to ionic form.

*By definition: "**Pitting** corrosion is a localized form of corrosion by which cavities or "holes" are produced in the material. **Pitting** is considered to be more dangerous than uniform corrosion damage because it is more difficult to detect, predict and design against. Corrosion products often cover the **pits**."*

*"**Pipeline corrosion** is a natural deterioration and destruction of **pipe** material and essential properties due to electrochemical and other ingredient reactions of **pipeline** materials with their environment - on the inside as well as outside surfaces."*

The following Phases will describe the effort towards evaluating external corrosion.

## **Phase II. Research**

Bowman will coordinate with the IRCDUS GIS dept. to extract record drawing information on the year, type, material, and history of pipe breakages/repairs. Days and dates of underground pipe repairs will be pursued to determine the frequency of occurrence.

We will gather information on prior repair methods and acquire any photos, work orders, pipe coupons and field orders which might focus on the cause or causes of past pipe failures.

For example, how was the failure discovered? What was discovered at the time of the initial response to the repair? Were failures localized at joints?

If the actual pipe material as manufactured is suspected to be defective, this may raise a potential issue that may take a direction that is outside the scope of this work. This investigation excludes any legal activities associated with defective pipe stemming from the pipeline manufacture.

## **Phase III. Site Investigation**

The Bowman team will conduct onsite site investigations to identify potential contributions / sources of corrosion. This will be a walk-through visual inspection of the existing corridor to investigate for potential external corrosion sources such as the presence of overhead power, gas mains, underground wireline utilities, etc.

Additionally, a soft dig analysis of the vicinity of existing repairs is anticipated if they can be isolated by County Staff. This is intended to evaluate the condition of the existing main in the vicinity of known failure points for analysis of the type of external Corrosion evident (pitting or corrosion), and to determine potential adjacent sources of Corrosion.

Continuity testing with County Staff is anticipated to verify wireline continuity, or potential loss locations. The engineer will conduct limited onsite analysis of potential short circuit, and ground connectivity (OHM resistivity) testing will be performed using a hand-held meg device during the on-site investigations.

Subsurface Exploration:

Geotechnical Engineering work is anticipated to evaluate corrosivity of soils including chemical analysis, pH, and other items that could contribute to corrosion of the pipe. This work will also conduct a "four-point analysis" to test for transient voltages. We are anticipating this work to be conducted in multiple locations to be determined based on pipeline history, Staff input, and site evaluations.

## **Phase IV. Identify Potential Sources / Causes**

Bowman will Prepare a list of nearly 20 potential areas of concerns / sources which have the potential to contribute to the pipe's pitting or corrosion. This list will expand or collapse as research and data is evaluated, and will be generated from past experience, interpretation of site conditions, review of available records, and interviews with IRCDUS personnel who operate and maintain the pipeline.

The list will be broken down into sub categories based on experience and subject matter. Each potential source / cause will be identified, explained as a potential contributor and then be ruled out or assigned to the next level of investigation.

The following an example of an area of concern.

Trace Wire / Trace Tape:

- a. Has Trace Wire been installed?
- b. What is gauge of trace wire.
- c. Is wire coated. Is coating still present?
- d. Is there any circular discoloration on the trace wire, such as black or brown discoloration?
- e. How are splices made up? Twisted pair with cap, twisted pair with solder, plain twisted pair?
- f. Continuity: Can pipe be traced for the entire run of pipe? If not, then where is continuity lost?
- g. Were iron wedges used for continuity at the pipe joints?

### **Phase V- Informal County Workshop with Staff**

Conduct an informal workshop with IRCDUS engineering and operations staff to review the questions associated with the multiple parameters analyzed, and potential findings. This workshop is intended to review investigated parameters and the questions raised to narrow down the list of potential questions that arise from our research. Answers to our questions may lead to additional investigative pathways.

The Bowman team will perform an in-depth analysis of potential corrosion causes, and County participation will be critical in narrowing down potential sources and answering questions that may arise during the project.

There is no guarantee a definitive cause for the historical corrosion issues will be identified, but this project will provide a detailed analysis of potential causes and prepare a draft and final technical memorandum summarizing parameters evaluated and our findings.

## **SCOPE OF SERVICES**

We propose to provide the following services:

### **Task 1 - Corrosion Evaluation and Reporting (Bowman Consulting)**

#### **Phase 1 – Internal Corrosion, Site Investigation**

1. Set up first run of internal investigation, field presence during probe and CCTV investigation. Work with IRCDUS staff to locate the first portion of pipe to be evaluated. Work will include field utility locates, installation of 20" X 6" wet tap and CCTV / Acoustic evaluation of 2,500' of pipe selected jointly by Consultant and County Staff.
2. Evaluate findings from the first run to determine if internal corrosion is an issue. Review and discuss with IRCDUS staff to determine if evaluation of entire 2 miles is warranted.

#### **Phase 2 – Research**

3. Review GIS and available record information such as shop drawings, etc., for this run of pipeline. Interview field personnel that may have witnessed corrosion issues, where they are located, review photos taken and pipeline repairs made, review past coupons taken from this run of pipeline

4. Perform utility research; request record information to determine what other utilities are in the area.
5. Evaluate findings from the information accumulated to see if it indicates a corrosion source and determine next steps.

### **Phase 3 - External Corrosion, Site Investigation**

6. Field presence during Geotechnical investigation for Four Point Test Method to evaluate transient voltages, and sampling of soil for corrosivity, pH, and other characteristics.
7. Field presence during soft digs to evaluate pipe at locations selected jointly with IRCDUS staff to visually inspect the exterior condition of the pipe in identified repair locations and other locations as determined during field investigation and soils testing.
8. We will perform independent field investigations with IRCDUS staff to review items such as continuity testing.
9. We will review local utilities such as underground gas to determine if cathodic protection or nearby infrastructure is present.

### **Phase 4 - External Corrosion, Potential Sources / Causes**

10. Prepare a list of about 20 potential areas of concern and sources which have potential to contribute to pitting or corrosion. The list will expand or collapse based on our findings. Each potential source / cause will be identified, explained as a potential contributor and then be ruled out or assigned to the next level of investigation.

### **Phase 5 – Workshop / Summary Memorandum**

11. Conduct an informal workshop with IRCDUS engineering and operations staff to review the questions associated with the multiple parameters analyzed, and potential findings. This workshop is intended to review investigated parameters and the questions raised to narrow down the list of potential questions that arise from our research.
12. Prepare an engineering memorandum of the findings of the investigation and evaluations and provide recommendations, if warranted, to mitigate any Corrosion issues identified. We will tabulate the issues evaluated and findings and based on the conclusions formed we will provide recommended mitigation measures.

## **Task 2 - Geotechnical Engineering Services**

1. Perform four-point test method for transient current and take soil samples at 10 locations and test soils for corrosive parameters.

## **Task 3 - Pipe Diagnostics (2,500' Limited Inspection Option)**

1. Inspection platform for live insertion & inspection including acoustic leak detection, visual condition assessment and pipeline tracing.
2. 20" x 6" wet tap including excavation and restore excavation.
3. Does not include trenching equipment or dewatering.

## **Task 4 - Soft Digs**

1. Perform 10 soft digs, outside the pavement area, up to 5' deep and exposing 3' – 4' of pipe for visual inspection.
2. Coordinate with IRCDUS staff for and our contractor for potential limited excavation of identified external Corrosion locations for closer examination.

## **Task 5 – Corrosion Evaluation**

1. Assist with field analysis and evaluation of collected information and developing mitigation methods.
2. Provide subject matter and historical expertise and research assistance on Corrosion causes or contributors as needed.
3. Provide engineering assistance in evaluation of compiled data and drawing conclusions.

## **Task 6 – Excavation Contractor**

1. Mobilize, excavate and limited dewatering for wet tap, then backfill and compact. Up to two mobilizations to excavate at soft dig locations that identify external corrosion to further evaluate the condition. Excavations are anticipated to be on the order of 5-6' deep and up to 6'x8' or as required for stable slopes. Dewatering is anticipated to be 57 stone in the excavation with trash pump as dewatering by rule, then backfill and compact restoration. Limited MOT.

**Limitations:**

- A. Limited excavation, dewatering by rule, to review external corrosion identified with soft digs. We have allowed for up to 3 mobilizations

**SERVICES AND/OR INFORMATION TO BE PROVIDED BY OTHERS**

Client or others will provide the following services and/or information:

- A. County will make available GIS, asbuilt drawings, and other records regarding the pipe and installation and maintenance.
- B. Provide record-drawings and information of existing improvements and utility-owned facilities and other substructures.

**SPECIFIC EXCLUSIONS**

Specifically, not included in the above Scope of Services/Compensation are the following:

- A. None.

## EXHIBIT B – FEE SCHEDULE

### COMPENSATION

We will provide the requested services on a Lump Sum Cost, with estimated task breakdown below:

#### Design Services:

<b>Task</b>	<b>Design Services</b>	<b>Fee</b>
1.	Corrosion Evaluation and Memorandum	\$34,600
2.	Geotechnical Evaluation	\$6,050
3.	Pipe Diagnostics	\$22,825
4.	Soft Digs	\$7,200
5.	Corrosion Specialist	\$4,950
6.	Excavation Contractor	\$9,240
	<b>Total</b>	<b>\$84,865</b>



## **EXHIBIT C – TIME SCHEDULE**

Bowman Consulting anticipates delivery of the final Corrosion Evaluation Report 120 days following award and notice to proceed with the project. Any schedule impacts will be discussed with the client as early in the process as possible to minimize any potential impacts.