

## ATTACHMENT 2

*City of Rapid City*

# Corrosion Study for City Metallic Water Transmission Mains

## *Scope of Services*

### **Introduction**

HKM Engineering teamed with RUSTNOT Corrosion Control Services will perform the services identified in this Scope of Services.

This Scope of Services and fee estimate may be modified through an amendment to the Agreement based on results of the field investigation and time and number of tests completed. This Scope of Services summarizes our approach for the project and identifies project deliverables, schedule, and proposed testing. It should be anticipated the required testing may be modified depending on the field conditions encountered and the test results. If additional field testing or excavations are required we are prepared to complete them on a time and expense basis following your authorization.

As we discussed, in an effort to reduce project costs while obtaining the most important information to meet your goals and schedule, we have modified the schedule and proposed project scope from your Request For Proposal (RFP). This is primarily to extend the time period to allow City crews to assist during the pipe condition assessments in order to spend more of the project budget on engineering instead of excavations and surface restoration

We will coordinate work on an on-going basis with City staff with phone conversations, field testing, and informal work sessions at the project start and following submittal and review of the reports. This constant interchange of information is critical because of the close coordination required to effectively complete the work.

### **1. Preliminary Study Phase**

The goal of this phase is to coordinate and provide sufficient testing and pipe condition assessments to make recommendations on corrosion control for both the Elm and Memorial Park pipelines as well as for the 2004 Capital Improvement Plan. The ultimate goal is to start the foundation of a corrosion control program to minimize life cycle costs to the City and reduce disruption of service. This Preliminary Study Phase provides initial corrosion control recommendations, a review of present City standards, and recommended corrosion control guidelines with specifications and details.

#### **1.1 Administration/Project Start-Up**

An initial kick-off meeting to introduce project staff, review the project goals, project approach, provides the opportunity for a common understanding for all

personnel involved, defines project roles and responsibilities, identifies the anticipated schedule and clarifies where assistance from the City may be required.

Anticipated work items consist of:

- A Notice to Proceed will be issued August 5, 2003, and a project kick-off meeting will be conducted on August 12<sup>th</sup>.
- We anticipate a copy of the pipeline drawings for the metallic lines and leak data will be provided prior to the kick-off meeting. We will evaluate the field testing approach and propose adjustments, if necessary, based on Plans of water systems and the leak data provided.
- HKM/RUSTNOT will review with City staff, a list of materials and vendors for corrosion control materials (galvanic anodes, test leads, cadweld, repair coatings, etc.) anticipated to be required during the corrosion investigations. We anticipate the City will provide these materials.
- Following the initial meeting, we will provide the City a list of materials and suppliers to be acquired for the pipe conditional assessment testing. Also, we will provide recommended procedures, details and materials to utilize at leak excavations.

### 1.2 Review Existing Information

The goal of this task is review and learn from your personnel your system as quickly as possible. We will concentrate our efforts on the metallic transmission pipeline systems as first priority, but will utilize distribution type piping information to increase our knowledge.

The anticipated work items will consist of:

- Interview knowledgeable staff.
  - i. Identify and clarify information on metallic pipelines for pipe age, material, construction procedures, historical events, and leak history. Obtain Plans of existing pipelines.
  - ii. Review pipeline Plans, geotechnical information, previous reports, and leak information.
  - iii. Review water supply and chemistry information.
- Inspect, evaluate and document available pipe and fitting pieces (coupons, taps, fittings, bolting, pipe scrap pieces, etc.) with City staff. Identify the original location of the fitting pieces, to allow soil resistivity measurements to be made in specific areas.
- Review leak reporting procedures and leak repair forms with City maintenance personnel.

- Identify and contact other utilities and owners that may have impressed current cathodic protection sources to determine possible interference sources.
- Identify any additional information procured from the City or others, and review as appropriate.
- Modify route evaluation and field testing approach as appropriate.

### 1.3 Initial Route Evaluation

Initially, we will concentrate on 33 of the 35 different metallic transmission pipeline systems identified in your request for proposal (RFP). We already have base information on two of the pipelines at this time. These two lines consist of the 30-inch line in Omaha (4,000 foot long cast iron line in Omaha) and the 10,000 foot long steel line (Omaha to the WTP). This existing information will be incorporated in our reports, as appropriate.

Of the 33 pipelines, the first two priorities will be the 8,000-foot long 20-inch coated steel line in Elm and the 1,500 feet long 24-inch cast iron line in Memorial Park.

Anticipated work items for the assessment of the remaining 136,000 feet (25.8 miles) of the 33 different pipelines will consist of:

- Conduct drive-by visual evaluation of routes with City staff to note previous historical information, leak repair locations, pipe facilities, and soil conditions as well as possible interference sources. Pipe size, material and age will be identified and recorded.
- Conduct soil resistivity measurements along pipeline routes to assess soil corrosivity. We anticipate the average spacing for the field soil resistivity measurements will be approximately 1,000 feet apart. We anticipate this initial soil survey can be completed in four man-days. We will work with City staff to provide additional soil resistivity measurements, if we cannot complete the desired measurements within the four days, or if additional soil resistivity measurements are necessary. We will also make our equipment available to City staff for the additional soil resistivity measurements. If it is determined a closer spacing of soil resistivity testing is required, this can be addressed as additional services. Soil samples received from City staff or from others' excavations in the area will also be utilized to complete soil box resistivity measurements.
- We will identify possible sources of interference (rectifiers on pipelines or underground storage tanks, etc.) for further evaluation. We will contact owners to verify dc current output and ask if they will

allow their system to be interrupted (cycled on and off) for us to test the voltage gradient in the soil at City lines. With no electrical connection to the water lines or pipeline continuity, interference testing will be of minimal value unless high voltage gradients or concentrated leak history in that area is discovered. We anticipate initial interference testing can be completed in approximately one to two man-days. If additional interference testing or mitigation is identified, it can be completed on a time and material basis.

- With City input, we will identify where potential surveys may be appropriate. These surveys require two people to perform, and consist of potential measurements made at 2 ½ to 3-foot intervals along the pipeline. Pipe-to-soil over the line potentials can be used on electrically continuous pipelines if test leads or electrical connections are available. Cell-to-cell type measurements between two reference cells on the surface, have to be used if the pipeline is electrically discontinuous. We anticipate that the City will locate the lines prior to our testing. Because of the time required to perform and accuracy considerations, these surveys will be used only at selected locations. We have assumed that the over-the line potential testing (cell-to-cell or pipe-to-soil) can be completed in approximately two man-days. If additional testing is discovered to be required, it can be completed on a time and material basis.
  
- Water corrosivity evaluation will be based on water quality information provided by the City. We will evaluate the internal condition of pipelines and coupons where available, including the section of the 30-inch steel line removed last year.

#### **1.4 Analyze Field Data**

The goal of this task is to summarize, analyze, review and select with your personnel, excavation locations for the pipe condition assessment.

The anticipated work items will consist of:

- Summarize field data and create base maps for:
  - Pipe Age and Type
  - Soil Resistivity
  - Interference Sources
  - Leak Map
  
- Review and analyze data and identify possible pipe excavation locations for review by City during Task 1.5 to select pipe excavation locations.

#### **1.5 Pipe Condition Assessment**

The goal of this task is to select, excavate, conduct a pipe condition assessment, install test leads, and complete surface restoration as required. We anticipate 20 locations will be selected, at this time, for excavations during Phase A. To minimize costs, we anticipate the City will excavate the 20 locations. We will concentrate first on the Elm and Memorial Park pipeline excavations. We anticipate pipe condition assessments will be completed in September after Labor Day, and October to minimize traffic problems. We also anticipate each excavation can be completed in approximately four to six hours, depending on pipe depth, utility conflicts, access, and cover type. Pipe condition assessments will be completed at other locations where metallic pipelines are exposed or leak repairs are being made. For budget purposes, we assume two to three excavations can be completed per day with two City crews and the 20 excavations can be completed in a seven to eight day time period. If additional time is required to complete these excavations, it can be completed as additional services on a time and material basis.

The anticipated work items will consist of:

- With City staff, we will select excavation locations. We anticipate the City will provide the recommended corrosion control materials required at these locations. This is anticipated to include test wires, cadwelds, galvanic anodes, and valve boxes for test station boxes.
  
- City staff will arrange for locates, traffic control, and excavate and expose the pipeline for approximately 5 to 6 feet and 1 to 2 feet below the pipe at selected locations. City staff will remove and replace asphalt or concrete pavement as required and remove cast iron or ductile iron graphitization by sandblasting to verify presence of any corrosion, and be able to identify what type, and to what degree and depth of corrosion. City staff will install test leads, valve box, anodes, cadwelds, and handy caps or pipe repair coating as required and complete the surface restoration. We propose two test leads and two anodes be installed at each excavation. The anodes can be attached to the pipe through a test wire in a flush test station valve box. We will conduct a training demonstration with City staff and any Contractor's personnel interested in how to do cadwelding, and install anodes during one of the first excavations. We anticipate all excavations can be completed in eight man-days. We will attempt to conduct additional soil resistivity measurements during slack time while waiting for the City crews to prepare the pipe for our evaluation.
  
- Evaluate pipe condition and conduct ultrasonic, coating thickness, pit depth, and potential measurements at each location. We will document and photograph pipe conditions.

- Soil samples will be collected for soil box resistivity measurement in an as received and saturated condition. The AWWA C105 10-point field testing will also be conducted from the soil samples at the site.
- Conduct, at selected locations, chloride and sulfate tests to determine amount of corrosive salts that may be present. For budget purposes we anticipate four soil samples will be tested.
- Conduct initial continuity, CP, and current requirement testing after enough excavations and test leads have been installed on specific cast iron or ductile iron line. We anticipate this will take two man-days for the ductile iron and cast iron lines exposed during Phase A.
- Conduct initial continuity, CP, electrical isolation, and current requirement testing on the Elm 20-inch steel line. We anticipate this will take two man-days after the test leads are installed.

### **1.6 Preliminary Report**

The goal of this task is to summarize, analyze, review and prepare a draft report with recommendations for City review and comment. We will work closely with City staff and discuss the separate sections during development of the report recommendations.

The anticipated work items consist of:

- Summarize field data for the draft report.
- Update base maps.
- For Elm and Memorial Park pipelines, identify available corrosion control options for these two line based on the field testing results.
- For the Elm steel pipeline, we anticipate cathodic protection is an economical option and will evaluate various cathodic protection alternatives and prepare preliminary budget level cost estimates. If the line is electrically continuous and electrically isolated we will provide the necessary details and specifications to protect the line with galvanic anodes as part or prior to the street improvements. If the line is not electrically continuous or electrically isolated the level of effort both for design and field testing will be greater and can be completed on a time and material basis depending on the corrosion control option selected by the City.
- Include basic information and general discussion sections and figures on corrosion and corrosion control alternatives.

- Develop preliminary Corrosive Zones based on existing information and City input.
- Develop general Corrosion Protection Guidelines including a proposed risk assessment approach for metallic pipelines. We will work with City personnel to develop protection criteria for both new and existing transmission and distribution type piping, including metallic fittings on plastic pipelines.
- Review and provide recommendations on the existing City Standards and Details from a corrosion control perspective.
- Provide draft Corrosion Control Standard Specification and Details.
- Compare alternatives and corrosion control options available along with range of cost table for City evaluation.
- Summarize and provide recommendations with cost estimates for any specific pipelines needed for the 2004 Capital Improvement Plan (CIP). Currently we feel that the two pipelines that should be considered in the 2004 CIP process are the two steel lines. We will provide recommendations for and cost estimates for the corrosion control work anticipated for the two steel lines. We will also evaluate the Memorial Park cast iron line to determine if it needs immediate attention during 2004. It is anticipated that the other ductile iron and cast iron lines are a lower priority.
- Identify the additional areas to investigate and verify soil corrosivity and pipe conditions during the Phase B portion of this project. This will also include possible interference areas for possible installation of test leads and pipe excavations.
- The draft report will be submitted by November 11, 2003.

#### **1.7 Preliminary Study Report Presentation**

The goal of this task is to review with City staff, the Phase A Preliminary Study Report and confirm the items still required to be completed during the later phases of the project.

The anticipated work items will consist of:

- Conduct a workshop meeting with City staff to present our report and discuss your review comments. We will also discuss proposed Phase B testing and schedule with your personnel.
- Provide a training session and water box demonstration as part of this workshop to familiarize your personnel or council with the different

types of corrosion and corrosion control and why needed. At this time we will be available to discuss with and train your inspectors on the various items that will be required with the recommended corrosion control specifications and details.

- Complete the one-day workshop meeting on or before November 18<sup>th</sup>. This budget anticipates this workshop meeting will be conducted during the time RUSTNOT is performing investigations and a separate trip to Rapid City will not be necessary.

## **2. Phase B -Final Study Phase**

The goal of this phase is to update and complete any additional testing, pipe excavations, interference or cathodic protection testing still required after completion of the preliminary study during the fall of 2003. The schedule allows the City crews to complete more of the pipe excavations to reduce project study costs, to provide for increased engineering analysis and testing. The goal of the final study phase is to confirm anticipated corrosion activity with actual leak or pipe conditional assessments and provide a long-term proactive corrosion control program for the City.

### **2.1 Phase Field Testing**

The goal of this task is to complete any additional route evaluations, data analysis, or pipe condition assessments needed. It is anticipated that this work will be scheduled during the spring of 2004, when the City crews are available to complete the necessary pipe excavations. This work is intended to verify anticipated pipe corrosion rates with actual rates. It is anticipated this work will consist of 20 excavations by the City.

The anticipated work items will consist of:

- With City staff, select the next set of pipe excavation locations for the pipe condition assessments. We will update the data on any new leaks, soil samples, and/or pipe information completed by the City during the winter months.
- If closer soil resistivity information is required on any of the 33 transmission metallic pipelines, we will complete that on a time and material basis during this task.
- We will complete the field testing required at the pipe condition assessment locations. The testing will be completed in a similar manner as during Phase A. It is anticipated an additional 20 excavations will be completed in approximately 7 to 8 man-days. If it takes longer to complete the excavations because of the City crew availability, we will complete that on a time and material basis.



- We will complete the additional soil resistivity measurements around the city to complete the Soil Corrosivity Zone map. It is anticipated the majority of this testing can be completed during slack time in the pipe condition assessment work and have budgeted one man-days for the additional soil resistivity information. If additional soil resistivity measurements are required, we can provide the City staff with the equipment to perform the soil resistivity measurements or we can complete the additional soil resistivity measurements as additional services on a time and material basis.
- We will complete additional continuity testing, potential, CP, and interference testing on these additional pipelines being examined after the pipes have test leads installed to allow the testing to be more accurate. We anticipate the level of testing provided will take approximately two man-days.
- We will compare and verify the pipe conditions with the anticipated corrosion rate based on our previous testing results. We will conduct additional testing on a time and material basis if required after reviewing and discussing the actual versus anticipated corrosion rates with City personnel.

## **2.2 Draft 95% Report**

The goal of this task is to complete a 95-percent Final Phase draft report for review by the City.

The anticipated work items will consist of:

- Update the draft preliminary report with the additional testing results. This will include not only the field data summaries, but also the base maps, and development of a Soil Corrosivity Map.
- Identify priorities for corrosion control with City input based on our field testing, pipe assessments, future hydraulic considerations, and future road improvement projects.
- Develop various corrosion control options available for the respective pipelines including cost estimates and possible schedules for City review and input.
- Evaluate methods with City input to set up contingency funds for pipe rehabilitation or replacement work.
- If desired, we will conduct one meeting with City personnel during preparation of the draft Final Phase Report to review the priorities, risk assessment methodology, corrosion control recommendations, corrosion control options, and relative cost estimates prior to

completion of our report. We have assumed that this one-day working meeting can be completed during one trip and approximately four-man-days. Presently we have not included this in our budget estimate, but can if authorized.

- We will complete the 95-percent draft Final Phase Report and submit it by May 18<sup>th</sup>.

### **2.3 Final Study Report Presentation**

The goal of this task is to present our 95-percent Final Phase draft report to the City.

The anticipated work items will consist of:

- We will meet with City personnel in a workshop and discuss our 95-percent Final Draft report. This will include not only presentation of our report, but answering questions, and reviewing review comments from the City. We will complete the workshop meeting by June 1st. We have assumed that this one-day workshop meeting can be completed in four man-days.

### **2.4 Final Study Report**

The goal of this task is to incorporate the City review comments and complete the Final Phase report.

The anticipated work items will consist of:

- We will update the Final Phase report with the additional City review comments. We will complete the Final Phase Report and submit it by June 8th. We will provide seven bound final report copies, one unbound copy, and an electronic copy of the final report files.

### ***Schedule***

Attached is a schedule identifying the time periods to complete the detailed tasks as identified in the Scope of Services.

### ***Fee Estimate***

We propose to complete the services as identified in the Scope of Services on a time and material basis with a not to exceed amount of \$97,500. The anticipated work for each detailed task is also provided.

*City of Rapid City*  
**Corrosion Study for City Metallic Water Transmission Mains**

Outline	Task Name	Duration	Start	Finish	Cost	2003												2004											
						J	J	A	S	O	N	D	J	F	M	A	M	J	J										
0	<b>Corrosion Study for Metallic Water Transmission Mains</b>	<b>220 days</b>	<b>Tue 8/5/03</b>	<b>Mon 6/7/04</b>	<b>\$97,500.00</b>																								
1	<b>Phase A-Preliminary Study Phase</b>	<b>76 days</b>	<b>Tue 8/5/03</b>	<b>Tue 11/18/03</b>	<b>\$60,008.00</b>																								
1.1	Administration/Project Start-Up	9 days	Tue 8/5/03	Fri 8/15/03	\$5,506.00																								
1.2	Review Existing Information	8 days	Tue 8/12/03	Thu 8/21/03	\$6,950.00																								
1.3	Initial Route Evaluation	15 days	Mon 8/18/03	Fri 9/5/03	\$12,720.00																								
1.4	Analyze Field Data	10 days	Mon 9/8/03	Fri 9/19/03	\$4,604.00																								
1.5	Pipe Condition Assessment	20 days	Mon 9/22/03	Fri 10/17/03	\$14,590.00																								
1.6	Preliminary Report	20 days	Mon 10/13/03	Fri 11/7/03	\$12,058.00																								
1.7	Preliminary Study Report Presentation	7 days	Mon 11/10/03	Tue 11/18/03	\$3,580.00																								
2	<b>Phase B-Final Study Phase</b>	<b>141 days</b>	<b>Mon 11/24/03</b>	<b>Mon 6/7/04</b>	<b>\$37,492.00</b>																								
2.1	Field Testing	100 days	Mon 11/24/03	Fri 4/9/04	\$13,900.00																								
2.2	Draft (95%) Report	27 days	Mon 4/12/04	Tue 5/18/04	\$14,291.00																								
2.3	Final Study Report Presentation	10 days	Mon 5/17/04	Fri 5/28/04	\$3,363.00																								
2.4	Final Study Report	5 days	Tue 6/1/04	Mon 6/7/04	\$5,938.00																								

No. PW081203-08