I. Corrosion Control

All storage tanks, pumping stations, vaults, treatment equipment, and similar facilities shall be protected from corrosion using project-specific design guidelines, which are not included within this discussion. The following is to be applied to all underground water, reclaimed water, and pressurized wastewater pipelines that are to be made of metallic pipe.

In certain cases, upon completion of the Decision Process described below, Loudoun Water may choose to specify a nonmetallic piping material in an application that would otherwise be built of ductile iron.

II. Design

A. Summary

This summary outlines how Loudoun Water will determine and implement corrosion control decisions for buried metallic pipelines. The decision process considers criteria including: pipeline's size, function, accessibility, cost of repair; anticipated corrosiveness of soil; and the potential for stray currents that may affect the pipelines. Based on an evaluation of these criteria, Loudoun Water will determine the level of corrosion protection to be applied to the pipeline. Three levels of protection are considered for every pipeline and include the following:

1. standard installation with no additional features
2. enhanced protection (including polyethylene encasement and mechanical joint coating)
3. specific corrosion control design (such as joint bonding, test stations, and cathodic protection)

The decision process is described in the following sections and summarized in **Figure E.1**. The decision process consists of four steps:

Step 1: classify each pipeline

Step 2: evaluate the anticipated soil conditions for each pipeline

Step 3: identify stray currents

Step 4: determine the level of corrosion protection to be applied to each pipeline and incorporate into the construction plans and specifications

B. Decision Process

Step 1: Pipeline Classification Proposed pipelines shall be designated one of three classifications (Class 1, 2, or 3). Classifications are primarily based on size, function, and accessibility of the pipeline. Loudoun Water reserves the right to adjust the classification of individual pipelines at its own discretion.

Class 1 pipelines represent the highest priority classification. These pipelines meet any of the following criteria:

- all metallic sewer force mains, regardless of diameter;
- water mains 16 inches in diameter and greater.

Class 2 pipelines meet any of the following criteria:

- water mains 12 inches in diameter;
- water mains providing a single feed to distribution systems where a failure would result in significant disruption to customer service (approximately 50 or more service connections);
- any pipeline where repair or taking the line out of service would require exceptionally high repair costs, difficult repair conditions, or long-term customer service disruption.

Class 3 pipelines are:

- water mains less than 12 inches in diameter.

<u>Step 2: Soil Evaluation</u> Soil characteristics surrounding the pipeline trench significantly affect the rate of metallic pipeline corrosion. Where ductile iron lines are to be constructed, soil samples shall be collected and analyzed as described herein. The results of the analysis shall be submitted to Loudoun Water by the Engineer at the time of the second submission of construction plans. Construction plans will not be approved by Loudoun Water until soil results have been submitted and appropriate corrosion protection measures incorporated into the design. Guidelines for soil sample collection and analysis follow.

For all Class 1 pipes, and for Class 2 pipes where initial soil sampling and analysis warrants further investigation, Loudoun Water will require additional soil investigations, to include in situ soil resistivity and pH. These tests must be conducted and reports prepared under the supervision of an engineer who is certified by the National Association of Corrosion Engineers (NACE).

1. Collection of Soil Samples

    a. Soil samples may be collected by the geotechnical engineering firm performing geotechnical investigations for development activities as required by the Loudoun County Facility Standards Manual. Loudoun Water reserves the right to require the Engineer to collect additional samples other than those detailed herein. Further, Loudoun Water may perform additional soil investigations for corrosion considerations.

    b. Loudoun Water will direct the collection of additional soil samples of fill transported from offsite locations used for controlled backfill, in the backfill of rock trenches, or other fill conditions.

    c. Soil samples shall be collected as follows:

i) The depths of soil samples collected for corrosion evaluation shall be representative of anticipated pipeline depths. If pipeline locations and depths are not known, the samples shall be collected at a depth approximately 4.5 feet below existing grade, or the deepest location where soil is available for testing (if rock is encountered before 4.5 feet).

ii) Soil samples shall be collected from each soil boring performed as part of subdivision geotechnical investigations. The number and location of soil borings shall be consistent with the subdivision geotechnical guidelines specified by the Loudoun County Facility Standards Manual.

iii) Soil samples for pipelines outside of subdivisions evaluated by subdivision geotechnical investigations shall be taken at intervals of 1,000 linear feet along proposed pipeline alignments.

iv) Soil samples for Class 1 pipelines shall be taken at intervals of 1,000 linear feet along the anticipated alignment. Loudoun Water will supplement Class 1 soil samples with additional field data to design applicable corrosion protection components.

v) The coordinates and elevation where the sample was obtained shall be recorded and provided to Loudoun Water, including horizontal and vertical datum of the coordinate system used.

2. Analysis of Soil Samples

a. All soil samples shall be tested for pH, chloride concentrations, sulfate concentration, sulfide content and resistivity (as is and saturated). Data for each sample shall be recorded on the data sheet form that accompanied the soil sample.

b. The test methods to be used for laboratory analysis shall comply with the following ASTM standards.

i) Sample Preparation (ASTM D1193)

ii) Sulfate Content (ASTM Standard Test Method D516)

iii) Chloride Content (ASTM Standard Test Method D512)

iv) Resistivity (ASTM Standard Test Method G57)

v) pH (ASTM Standard Test Method G51)

vi) Sulfide test per sodium azide-iodine qualitative tests per AWWA C105

3. Soil Classification

Based on the soil testing results, the soil shall be categorized into one of two categories: Class A or Class B. General guidelines for categorizing soils are presented below; while Loudoun Water reserves the right to adjust these guidelines based on project-specific data.

<u>Class A-Highly Corrosive Soils</u> The following laboratory test results from the collected soil samples will be used for interpretation of Class A soils. If any of these criteria are met, the soil will be considered Class A:

a. Soil resistivity values <= 5,000 ohm/cm

b. pH values of the soil <= 4.0

c. Consistent presence of sulfides in samples

d. Consistent presence of sulfates content > 50 ppm in samples

e. Consistent presence of chlorides > 50 ppm in samples

f. Four-pin (in situ) soil resistivity values <= 5,000 ohm/cm

g. In situ pH <= 4.0

Class B-Moderately Corrosive Soils The following laboratory test results from the collected soil samples will be used for the interpretation of Class B soils. All of these criteria must be met in order for the soil to be considered Class B:

a. Soil resistivity values > 5,000 ohm/cm

b. pH values of the soil > 4.0

c. Consistent absence of sulfides in samples

d. Consistent presence of sulfate contents < 50 ppm in samples

e. Consistent presence of chlorides < 50 ppm in samples

f. Four-pin (in situ) soil resistivity values > 5,000 ohm/cm.

g. In situ pH > 4.0

Step 3: Stray Currents Stray current risks for all classes of pipelines shall be identified and evaluated by the designer. The potential for stray currents will be determined using the database of impressed current systems, maintained by the Nation Association of Corrosion Engineers (NACE), Baltimore-Washington Chapter; and using information from the owner of the facility carrying the current. Mitigation measures will be incorporated into the design of the proposed pipe.

Step 4: Evaluation Using the information collected in Steps 1, 2, and 3, Loudoun Water will determine the level of corrosion protection to be included in the pipeline design. The decision process is included in **Figure E.1**. Loudoun Water reserves the right to adjust the decision process as necessary based on project-specific conditions.

All Class 1 pipelines and Class 2 pipelines in highly corrosive soils (Class A) will require a project-specific corrosion protection design. The design shall be prepared by a NACE registered engineer and incorporated into the construction plans and specifications for the proposed pipe. Generally, pipeline corrosion protection in these cases may include any of the following: polyethylene encasement, joint bonding, test stations, cathodic protection, and stray current mitigation.

Class 2 pipelines in moderately corrosive soils (Class B) and Class 3 pipelines in highly corrosive soils (Class A) will require enhanced corrosion control protection. This includes stray current mitigation as necessary, wrapping in polyethylene encasement, and coating of mechanical joints.

Class 3 pipelines in moderately corrosive soils (Class B) will be installed in accordance with standard Loudoun Water installation requirements. With the exception of stray current mitigation where necessary, corrosion protection measures will not be required.

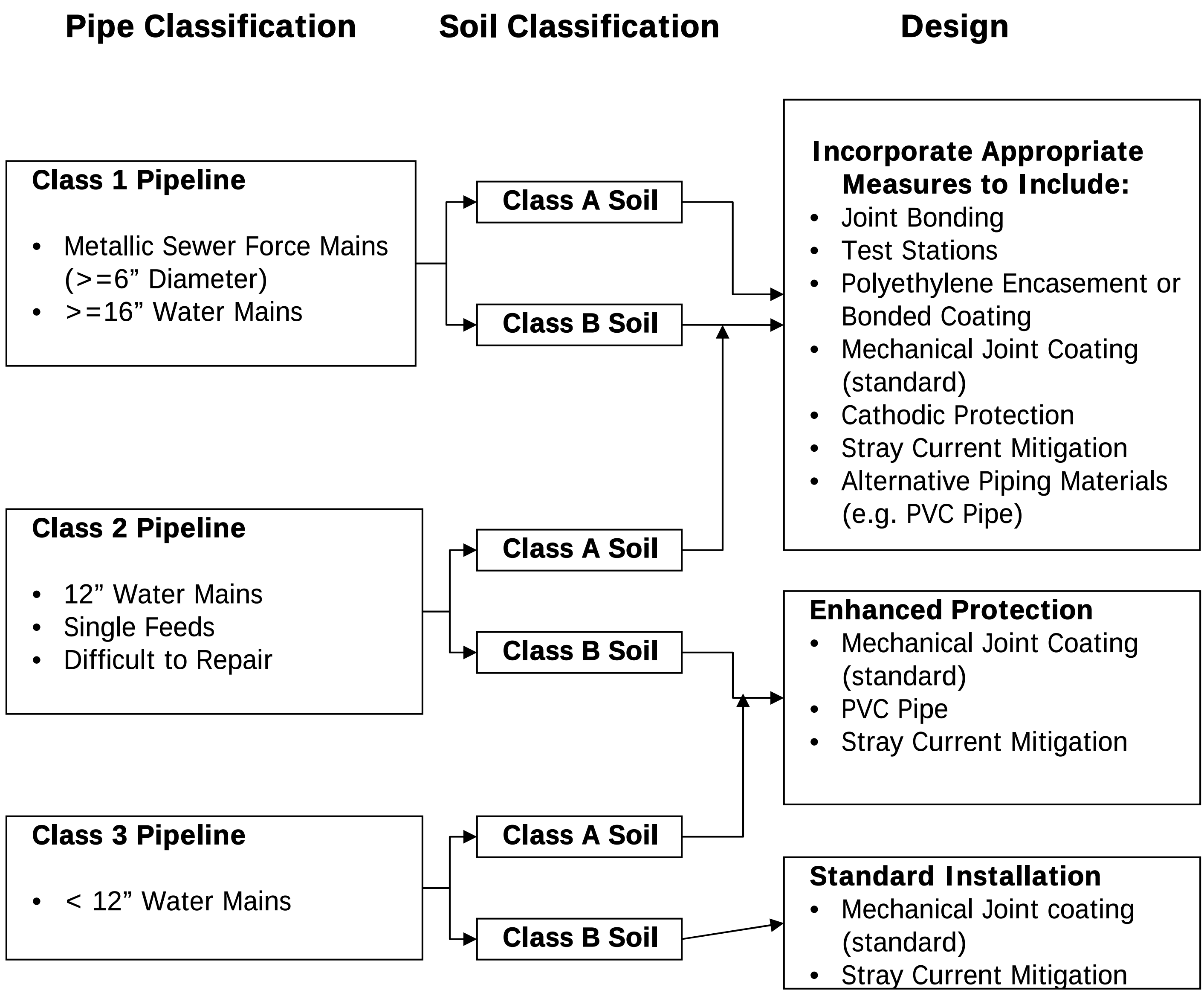

Figure E.1 – Decision Process

III. Installation Requirements

All installations of corrosion control measures shall be made according to the approved construction plans and specifications for the project, the *Standard Details* and the *Approved Materials List* (Appendices F and G of this Manual). Upon completion of the work, it shall be tested, operated, inspected and surveyed. Any and all repairs or replacement of defective or improperly installed corrosion control systems shall be made by the contractor, no additional cost to Loudoun Water.

A. Contractor Qualifications

1. Installation, quality assurance, and testing personnel must have demonstrated experience with similar work. Resume of work experience shall be submitted to the Loudoun Water for approval.

2. Personnel shall be specifically named in qualification submittal and have completed at least three successful corrosion control systems within the last three years for underground pipelines of similar type, similar size and equal complexity.

3. Personnel shall be a full-time contractor or subcontractor employees. Part-time or contract personnel hired only for this work will not be permitted.

4. Only personnel approved by Loudoun Water shall be permitted. Personnel changes during course of project must be minimized and submitted by Loudoun Water at least two (2) weeks prior to planned implementation.

5. The contractor shall oversee and certify installation and related testing, including pipe joint bonding, magnesium anode ground-beds, and corrosion control equipment.

6. The contractor shall issue a letter of compliance indicating all corrosion control measures are satisfactorily installed and are in compliance with contract documents. The letter of compliance shall be signed by the contractor's responsible person.

B. Thermite Welding

1. All thermite welds shall be made as shown on Figure CP-2 of the *Standard Details* and in accordance with the manufacturer's recommendations using the proper combination of equipment for the pipe and wire size being welded. All welding materials and equipment shall be the product of a single manufacturer.

2. Assure that the area where the attachment is to be made is absolutely dry. Remove mill coating, dirt, grime, and grease from the pipe or fitting surface at the weld location by wire brushing or by the use of suitable safety solvents. Clean a two-inch square area of the pipe or fitting surface at the weld location to a bright shiny surface, free of all serious pits and flaws by the use of a mechanical grinder.

3. Prepare the wire for welding by assuring that the cable is absolutely dry. The cable shall be free of dirt, grease, and other foreign products. Cut the cable in such a way as to avoid flattening or forcing it out of round. To prevent deformation of the cable, cut the cable

with cable cutters. Remove the insulation in such a manner that will avoid damage to strands. Install adapter sleeves for all bonds and test wires prior to welding. Either prefabricated factory sleeved joint bonds or bond wires with formed sleeves made in the field are acceptable. Hold the cable at an approximate 30 degree angle to the pipe surface when welding.

4. When the weld has cooled, tap with the two pound hammer while pulling firmly on the wire. Remake unsound welds and retest. Thoroughly clean mold and mold covers after completion of each weld to assure that no slag will penetrate into the next weld.

5. After the soundness of the weld has been verified, thoroughly clean the weld with a stiff wire brush and coat with an elastometric cap. Apply primer over the entire weld area. Push the dome of the prefabricated cap containing elastometric material firmly into the weld area. Lift the wire away from the pipe and apply the elastometric material coating completely around and underneath the wire. Push the wire back down on the pipe.

C. Prepackaged Anodes

1. The prepackaged anodes shall be installed where indicated. Prior to installation, remove all shipping covers from the anode (the packaged box shall not be removed). Install the anodes in existing soils (free from rocks, roots, organic material, trash or any other debris) and backfill with existing soil (as described above). Do not install the anode in sand, rock, or gravel backfill. Do not lower the anode into the excavation by the lead wire. If necessary, temporarily wrap a rope around the anode and lower the anode into the excavation by the rope. Remove the rope after the anode is installed. Provide a minimum spacing of two feet from other pipelines. Pre-soak the anode with 5 gallons of water after placement, but prior to backfilling.

2. Anode header cable shall be buried a minimum of 18 inches below grade. Handle wire with care. All anode lead wire to header cable splices shall be made with a compression connector as shown in Figure CP-5 of the *Standard Details*. Tape the splice with three layers of high voltage rubber splicing tape (50% overlap). Terminate the ends of the anode lead cable in the test stations in accordance with Figure CP-6 of the *Standard Details*.

D. Bonded Joints

1. All pipeline joints within the cathodic protection areas, including those on pipe, fittings, valves, all branch connections, shall be bonded with two insulated copper cables as shown on Figure CP-1 of the *Standard Details*.

E. Test Station

1. Install test stations at the locations required. Test stations are to be located directly over the pipeline except in areas that would place the station in the roadway. Locate these test stations to the closest point at the edge of the road. Test station pedestals or boxes shall be in accordance with Figures CP-6, CP-7, CP-8, CP-9, and CP-10 of the *Standard Details*. Pedestals are preferred, and will be used where suitable to their surroundings. Test boxes will be used where test station must be flush with the surrounding grade.

2. Attach test wires as indicated using the proper thermite welding equipment and charges specified for the wire size and respective pipe material. Follow all procedures as outlined above.

3. All test station wires shall be routed a minimum of 18 inches below finish grade. Maintain sufficient slack in the test wires so that the wires can extend a minimum of 18 inches from the compression thermal lugs for 0.25 inch bolt size. Install a shunt to connect the anode lead to the pipe lead where indicated on the design drawings.

4. The test stations shall be set in poured concrete in accordance with Figure CP-11 of the *Standard Details*. Cathodic protection test station pad concrete shall be Class B concrete. The flush mounted test station lids shall be free of concrete and not cemented over.

F. Clearance Requirements

1. A minimum of 6” separation shall be maintained from any foreign pipeline or structures. If 12” separation is not possible, positive separation shall be provided using glass mesh.

G. Electrical Isolation

1. Insulating Flanges: Approved insulating flanges shall be installed in accordance with specific design considerations.

2. Insulating Unions: Approved insulating unions shall be installed in accordance with specific design considerations to isolate bimetallic service lines and other type connections that may create corrosion conditions from dissimilar metallic connections.

3. Die-electric Pipe Materials: Approved die-electric pipe materials shall be used to isolate metallic pipe where specified as part of design consideration for foreign pipe line crossings as part of stray current mitigation considerations. A section of polyvinyl chloride (PVC) pipe may be a suitable material for this purpose. Pipe materials, thickness design, and pipe specifications shall be provided by Loudoun Water.

H. Trench Excavation

1. The trench and backfill material around the pipeline shall be clean of all debris, such as trash, wood, and rocks. Strip forms at blockings.

I. Record Drawings

Record Drawings will be prepared to accurately document the installed location and configuration of each test station, including:

1. test station number per the test station schedule on the plans and installed pipeline station number.

2. three dimensional ties between test station and existing permanent datum.

3. wire routing, size, insulation color and termination configured on terminal board.

4. pipeline station numbers for wire attachments to pipe.

5. anode locations, where installed, including pipeline station number, depth and distance from pipe.

IV. Post-Installation Quality Assurance and Acceptance Testing

After the installation is complete, the contractor or the owner's consulting engineer will conduct the following post-installation quality assurance and acceptance testing, to verify the work. The repair or replacement of any defective or improperly installed systems shall be the sole responsibility of the contractor.

A. Test Station Wires

1. All test station wires shall be field verified for electrical continuity after connection of the wires on the terminal board in the test station and prior to the installation of any shunts on the terminal board. The testing will verify that the test wires have been properly installed and have not been damaged during backfilling and final test station installation. The test station wire verification shall be performed with an industry standard high impedance voltmeter and a copper/copper sulfate reference electrode.

2. The test station wire verification shall be performed by placing a copper/copper sulfate reference electrode in the soil adjacent to the test station being tested. Connect the copper/copper sulfate reference electrode to the positive terminal of the voltmeter with a test lead. Connect the test wire to be verified to the negative terminal of the voltmeter with a test lead. Record the resultant structure-to-earth potential. Without moving the copper/copper sulfate reference electrode, repeat this measurement for every wire in the test station.

3. Acceptance criteria shall be as follows:

   a. Ductile iron pipe normally has a voltage to ground potential of between 0.50 and 0.65 volt to a copper/copper sulfate reference, adjacent test leads on the pipe shall have the exact same potential. Voltage to ground measurements outside of this range will require further evaluation.

   b. Magnesium anodes shall be between 1.55 and 1.65 volts to a copper/copper sulfate reference. Voltage to ground measurements outside of this range will require further evaluation.

4. Results of the test wire verification testing shall be documented. Documentation shall include the following (Table 1):

   a. name of the Corrosion Technician performing test;

   b. date of each test;

   c. station number of test wires;

   d. test wire color and size;

e. structure that the test wire is connected to;

f. structure-to-earth potential for each test wire;

g. statement that the test wire has been installed properly in accordance with the criteria listed above. Data shall be maintained for inclusion in the final quality assurance report.

B. Linear Electrical Continuity

1. The linear electrical continuity of the bonded water main shall be tested to confirm that pipe joint bond cables have been properly installed and have not been damaged during backfilling. The testing will verify that the water main is electrically continuous in accordance with design specifications (Table 2).

2. The linear electrical continuity testing shall be performed with a combination voltmeter/ammeter, a 12-volt battery capable of at least 80 amperes short circuit current, and test wires and leads of sufficient length to extend over the length of pipe being tested (Table 2).

3. The linear electrical continuity testing shall be performed by impressing a DC current between adjacent test stations while simultaneously measuring the resultant voltage drop on the pipeline between the adjacent test stations. Voltage and current measurements shall be recorded with the current applied and immediately after the current is turned off (Table 2).

4. Calculate the voltage and current delta readings for each measurement by subtracting the "Instant Off' values from the "Current On" values. Divide the voltage delta by the current delta to calculate the measured resistance value (Table 2).

5. Calculate the theoretical resistance of the pipe section using published resistance tables for the type and diameter of the pipe that was installed (Table 3). Multiply the length of the pipe being tested by the resistance value for the type and size of pipe being tested (Table 4). Determine the number of pipe joints in the section being tested. Multiply the number of pipe joints by the theoretical resistance of the bond wires that were installed. Add the resistance value for the length of pipe to the resistance value for the pipe joints to determine the theoretical resistance value of the section of pipeline being tested.

6. Compare the measured resistance value to that calculated resistance value for the test section. The measured linear electrical resistance of the test section will be acceptable if the measured resistance value is no greater than 115% of the theoretical linear resistance value for the test station (Table 3).

7. Repeat the above test procedures between all adjacent test stations on the water main until the entire length of pipeline is tested. Actual resistances greater than 115% of the theoretical resistance will have to be re-evaluated to assure adequate electrical continuity of the pipe span.

8. Results of the linear continuity testing shall be documented. Documentation shall include the following (Tables 2 and 3):

a. name of the Corrosion Technician performing test;

b. date of each test;

c. beginning and end station numbers of test section;

d. length of the test section;

e. amount of current applied for the test;

f. voltage drop measured over the test section with current applied;

g. voltage drop measured over the test section immediately after the current is turned off;

h. calculated measured resistance of the test section;

i. type and diameter of pipe;

j. theoretical resistance per foot of pipe length;

k. length, size and number of bond cables per joint;

l. calculated resistance of bond cables across one joint;

m. number of pipe joints in test section;

n. calculated theoretical resistance of the entire pipe section;

o. percentage that the measured resistance is greater than or less than the theoretical resistance of the pipe section;

p. statement that the section of pipe has been properly bonded in accordance with acceptance criteria listed above. Continuity data shall be maintained for inclusion in the final quality assurance acceptance report.

C. Electrical Isolation

1. All insulating couplings, insulating flanges, insulating unions and insulating casing spacers shall be tested to confirm that effective electrical isolation exists between the isolated structures. The testing will verify that the insulating couplings, flanges, unions and casing spacers have been installed properly and are providing effective isolation.

2. The electrical isolation testing shall be performed with a high impedance combination volt/ammeter, a copper/copper sulfate reference electrode, a 12-volt battery and test leads of sufficient length to obtain structure-to-earth potentials and apply current to each side of the insulator.

3. The effectiveness of the electrical isolation shall be verified by measuring structure-to-earth potentials of each side of the insulator while a DC current is applied between one

side of the insulator and a temporary ground-bed. Install a temporary ground-bed by inserting steel pins into the ground directly over the pipeline and approximately 50 feet from the insulator being tested. Impress a DC current between the temporary ground-bed and the opposite side of the insulator. Using a portable reference electrode placed over the insulator, measure the structure-to-earth potential on each side of the insulator. Structure-to-earth potentials shall be measured with the current applied and immediately after the current is turned off. Structure-to-earth and current readings shall be obtained simultaneously. Record the potential and current data.

4. Effective electrical isolation of the insulating coupling, insulating flange, insulating union or insulating casing spacers will be indicated by a negative potential shift ("On" reading minus the "Instant Off' reading) on the side of the insulator closest to the ground-bed. The far side of the insulator will have a positive voltage shift ("On" reading minus the "Instant Off' reading) if the test circuit is set up properly.

5. Results of the electrical isolation testing shall be documented. Documentation shall include the following (Table 5):

   a. name of the Corrosion Technician performing test;

   b. date of each test;

   c. station number of electrical isolation;

   d. location and type of insulator tested;

   e. pipe-to-earth potentials ("On" and "Instant Off' values) on both sides of the insulator;

   f. test current ("On" and "Instant Off' values);

   g. statement that the electrical isolation is effective. Electrical isolation data must be maintained for inclusion of the final quality assurance acceptance report

D. Cathodic Protection and Stray Current Mitigation Potentials

1. For pipelines with cathodic protection and/or stray current mitigation anodes, testing shall be performed to evaluate the effectiveness of the anodes. Base structure-to-earth potential data shall be obtained at all test stations before any anode lead wires are connected to the pipe leads. The initial operating structure-to-earth potentials shall be obtained at each test station immediately after installing the shunts between the pipe and the anode leads. The base and initial operating potentials shall be measured with a high impedance digital voltmeter and a copper/copper sulfate reference electrode.

2. The structure-to-earth potential between the pipeline test lead wire, which is not directly connected to the anode leads in the test station, and a portable copper/copper sulfate reference electrode contacting the soil shall be measured, using the voltmeter. The portable electrode shall be placed adjacent to the test station for the measurement. Connect the copper/copper sulfate reference electrode to the positive terminal of the voltmeter with a test lead and connect pipeline test wire to the negative terminal of the

voltmeter with a test lead. Obtain structure-to-earth potentials ("On" values) on all test wires with the anode leads connected to the pipe.

3. Results of the structure-to-earth potential testing shall be documented. Documentation shall include the following (Table 1):

   a. name of the Corrosion Technician performing test;

   b. date of each test;

   c. station number of test wires;

   d. structure-to-earth potentials ("Native Potentials") on each test wire;

   e. structure-to-earth potentials ("On potentials") on all test wires with all anode lead wires connected to the appropriate pipe leads in all test stations;

   f. structure-to-earth potentials ("Instant Off Potentials") on all test wires immediately after the anode leads at the test station are temporary disconnected (testing performed with all other anode ground beds connected in their respective test stations and after the piping has had a minimum of one month to polarize);

   g. statement that the corrosion control system is operating in accordance with the designed corrosion control plan. Potential data shall be maintained for inclusion in the final quality assurance acceptance report.

E. Anode Operating Current

1. Initial anode operating current shall be measured at each test station where anodes are installed. The initial anode operating current shall be measured using the test station shunt and a digital voltmeter. The anode current shall be measured by connecting the positive terminal of the millivolt meter to one side of the shunt and the negative terminal of the millivolt meter to the other side if the shunt. The millivolt reading shall be obtained and recorded. Using the calibration factor of the shunt, calculate the anode current in milliamps. The anode current will be equal to the voltage reading across the shunt divided by the resistance of the shunt. Record the calculated current output of the anodes.

2. Results of the initial and final anode operating current testing shall be documented. Documentation shall include the following (Table 1):

   a. name of the corrosion technician performing tests

   b. date of each test

   c. station number of anode test wires

   d. initial anode current output (shunt measurement)

e. final anode current output (shunt measurement), testing to performed with all other anode ground-beds connected in their respective test stations and after the piping has had a minimum of one month to polarize

f. statement that the anodes are operating in accordance with the design documents. Anode current data shall be maintained for inclusion in the final quality assurance acceptance report.

F. Close-Interval Potential Survey

1. Approximately one month after the pipeline is installed and the initial anode measurements are obtained (for pipelines designated for supplemental cathodic protection), Loudoun Water shall conduct a close-interval survey on the pipeline. Close interval potential survey data will be used to evaluate the effectiveness of applied cathodic protection.

2. The close-interval potential survey shall be performed using a high impedance voltmeter, a copper/ copper sulfate reference electrode, test lead wire long enough to survey the test area, and associated clips and test leads.

3. Connect the high impedance voltmeter between the pipe leads in a test station and the copper/copper sulfate reference electrode. The voltmeter is reconnected to the pipeline at each test station along the pipeline. The Corrosion Technician places the electrodes in contact with the earth directly over the pipeline and the structure-to-earth potentials at that point are recorded. The reference electrode is then placed approximately 5 feet away from the site of the first reading and the measurement is recorded. This process continues along the entire pipeline route and potential data are collected and recorded every 5 feet.

4. The data that were collected are then tabulated and entered into a database to be graphed. The tabulated data and graphs are then submitted for analysis by the NACE certified corrosion specialist.

5. Results of the close-interval potential survey shall be documented. Documentation shall include the following (Table 6):

   a. name of the Corrosion Technician performing test;

   b. date of the test;

   c. tabulated pipe-to-earth with station numbers, test stations and features identified;

   d. graphed profile data with station numbers, test stations and features identified on the graph;

   e. statement that the corrosion control system is operating in accordance with the design considerations. Close interval survey data shall be maintained for inclusion in the final quality assurance acceptance report.