CITY OF NORFOLK DEPARTMENT OF UTILITIES
DESIGN AND CONSTRUCTION STANDARDS
Appendix C – Data Record Package Requirements

Appendix C outlines the Data Record Package Requirements for contractors engaged with the City of Norfolk Department of Utilities to include detailed information of data package submission requirements for the following:

- Esri File Geodatabase Template
- As-built Drawings
- GIS Update Submission Form
- Coordinates
- Quality Control
- Periodic Submittals for Data Record Package (DRP)

I. ESRI FILE GEODATABASE TEMPLATE

1.1 The Esri File Geodatabase Template and instructions for use will be provided upon request.

1.2 The Esri File Geodatabase template is being provided for convenience only, and may not include all items to be located as defined in these standards or the Contract Documents. The contractor or developer remains responsible for acquiring and submitting complete, comprehensive and accurate Component Tables to the Department.

1.3 All Assets provided in the Geodatabase shall contain at least the following general information:

A. Station Value – Relative position value used to reference utility system component to the As-Built Drawings (pipes and casings will have a station range - start and stop values)

B. Install Date – Month, Day, and Year utility system component is installed

C. Abandoned Date – Month, Day, and Year utility system component is abandoned, if applicable

D. Latitude - Geographic coordinate that specifies the north–south position of a point on the Earth's surface - latitude refers to the y-coordinate in accordance with Section IV. COORDINATES

E. Longitude - Geographic coordinate that specifies the east-west position of a point on the Earth's surface - longitude refers to the x-coordinate in accordance with Section IV. COORDINATES

F. Elevation - Elevation refers to the utility component in accordance with Section II

Coordinates 2.3 above or below a fixed reference point (the z-coordinate) in accordance with Section IV. COORDINATES

G. Status - Status of utility component: CONSTRUCTED NOT IN SERVICE, IN SERVICE, or ABANDONED

H. Collection Method – GPS or Conventional Survey

I. For GPS collected records, include:
   1. Receiver name
   2. Latitude—Position received from the GPS receiver before applying data transformations in the location profile
   3. Longitude—Position received from the GPS receiver before applying data transformations in the location profile
   4. Altitude—Ellipsoidal height received from the GPS receiver (not orthometric height, as used for z-values)
   5. Fix time
   6. Position source—Source used to collect the point or vertex, including the following possible values: User defined, Snapped, Integrated (System) Location Provider, External GNSS Receiver, or Network Location Provider.
   7. Direction of travel
   8. Speed (km/h)
   9. Azimuth
   10. Horizontal accuracy
   11. Vertical accuracy
   12. PDOP
   13. HDOP
   14. VDOP
   15. Fix type
   16. Correction age
   17. Station ID
   18. Number of satellites

1.4 Geodatabase shall contain additional information for specific utility components as outlined below

1.4.1 Water Distribution

- Water Mains
  - General Value Fields Section I 1.3
  - Material
  - Diameter
- Water Fittings
  - General Value Fields Section I 1.3
  - Type
  - Size 1
  - Size 2
  - Service Address

    - Bend Direction
    - Bend Degree
- Water Valves
    - General Value Fields Section I 1.3
    - Type
    - Diameter
    - Manufacturer
    - Manufacturer Year
    - Turns to Close
    - In Manhole?
- Water Service Lines
    - General Value Fields Section I 1.3
    - Material
    - Diameter
- Water Meter Boxes
    - General Value Fields Section I 1.3
    - Type
    - Service Address
- Fire Hydrants
    - General Value Fields Section I 1.3
    - Hydrant Size
    - Manufacturer
    - Manufacturer Year
- Casings
    - General Value Fields Section I 1.3
    - Material
- Water Sampling Stations
    - General Value Fields Section I 1.3
    - Address
    - Facility ID
- Automatic Flushing Devices
    - General Value Fields Section I 1.3
    - Model Number
    - Manufacturer
    - Size
    - Address
- Pump Stations
    - General Value Fields Section I 1.3
    - Pump Station Name
- Water Storage Tanks
    - General Value Fields Section I 1.3
    - Name
    - Style
    - Capacity
    - Foundation Pile Support
    - Material Type

- Remote Pressure Monitors
  - General Value Fields Section I 1.3

1.4.2 Wastewater Collection

- Manholes
  - General Value Fields Section I 1.3
  - Access Diameter
  - Rim Elevation
  - Lowest Invert Elevation
- Gravity Mains
  - General Value Fields Section I 1.3
  - Material
  - Diameter
  - Upstream Invert
  - Downstream Invert
- Laterals
  - General Value Fields Section I 1.3
  - Material
  - Diameter
- Cleanouts
  - General Value Fields Section I 1.3
  - Material
  - Size
  - Service Address
- Force Mains
  - General Value Fields Section I 1.3
  - Material
  - Diameter
  - MH Invert Elevation
- Fittings
  - General Value Fields Section I 1.3
  - Type
  - Size 1
  - Size 2
  - Service Address
  - Bend Direction
  - Bend Degree
- Valves
  - General Value Fields Section I 1.3
  - Type
  - Diameter
  - Manufacturer
  - Manufacturer Year
  - Turns to Close
  - In Manhole?
- Casings
  - General Value Fields Section I 1.3

    - Material
- Pump Stations
    - General Value Fields Section I 1.3
    - Pump Station Name
- Standby Bypass Pumps
    - General Value Fields Section I 1.3
    - Pump Station Name
    - Fuel Type
- Emergency Pump Connections
    - General Value Fields Section I 1.3
    - Pump Station Name

1.5 Station values in the Geodatabase will be used to correlate the component to the As-Built Drawing.

A. All components shall have a station value.

B. Water mains, water service lines, sewer gravity mains, sewer force mains, sewer gravity laterals, and casings shall have a station range value that includes the station start and station end values.

II. AS-BUILT DRAWINGS

2.1 The changes shall be included on the drawings as redline markups and shall be submitted at the frequency determined at project initiation.

A. Shall include separate documents recording:

1. Red line markup of as-built location of existing and new assets on original construction drawing (pdf format) or GIS exhibit for annual construction contract work orders only (pdf format),

2. Red line markup (pdf format) of:
    a. All previously existing assets that were taken out of service and abandoned in place, and

    b. All previously existing assets that were physically removed, demolished, and disposed of.

B. The recording of this information shall be performed at the time of construction.

C. Handwritten notes and comments shall be printed neatly and legibly and shall not damage or obscure existing information on the drawings.

D. Drawings should be submitted and approved by the City of Norfolk Construction Inspector.

III. GIS UPDATE SUBMISSION FORM

A PDF format of the GIS UPDATE SUBMISSION FORM (Appendix F-6) shall be included with the as-builts and geodatabase files and include the information as defined below.

3.1 General Information:

A. Project Name - Name of the construction project as defined by the City

B. Contractor - Name of the construction company providing construction services

C. Contractor's Representative - Name of the person (prime contractor) responsible for the accuracy of information provided in the submittal

D. Contractor Mailing Address – Mailing address of the construction company providing construction services

E. Contractor Phone Number – Phone number of contractor's representative

F. Contractor E-mail – E-mail of contractor's representative

G. Date Submitted – Month, Day, and Year the submittal is delivered to Owner

H. Licensed Land Surveyor – Signature of Land Surveyor, licensed by the Commonwealth of Virginia, to certify the accuracy of collected data in accordance with Section IV. COORDINATES

I. Signature Date – Date Licensed Land Surveyor signed off on the accuracy of the work in accordance with Section IV. COORDINATES

J. Surveyor Seal – official stamp by the licensed land surveyors to certify the work

3.2 Dataset Information

A. Description of the Dataset - A summary of the dataset's content, purpose, and how it was created

B. Date Range - When the data was initially created or updated

C. Horizontal Positional Accuracy – Horizontal position of a feature, which is expected to be within less than a foot of its true location

D. Vertical Elevation Accuracy – Vertical elevation position of a feature, which is expected to be within less than three feet of its true location

E. Means Used – Indicate whether dataset contains coordinates that were collected by GPS Only, Conventional Survey Only, or a mixture of GPS and Conventional Surveys

If GPS, GNSS Receiver Fields Included – If GPS was means for coordinate collection, indication by Yes or No if GNSS receiver fields populated in geodatabase (see General Value Fields Section I 1.3)

IV. COORDINATES

4.1 The Contractor shall be responsible for the layout of the proposed work in its entirety. The layout and collection of coordinates and elevations shall be performed under the supervision of a Licensed Land Surveyor.

A. Horizontal control shall be based on the North American Datum of 1983 (NAD83), Virginia Coordinate System, South Zone which defines the geodetic coordinate system.

B. Vertical control shall be based on the North American Vertical Datum of 1988 (NAVD88), 92 Adjusted, Virginia State Plane Coordinate System and GEOID12B.

C. Horizontal accuracy for all utility components shall be measured and captured by coordinates to within 1.0 foot of the actual physical location.

D. Vertical accuracy for utility components shall be measured within 0.01 foot of the actual physical location.

E. Vertical accuracy for Gravity Sewer Slope shall be measured within 0.02 %

F. All coordinates shall be collected directly from the actual physical location of the utility component. Indirect offset methods for coordinate collection will not be accepted unless agreed upon in writing by the Owner.

G. Control shall be within 2,624.70 feet of any survey point. City of Norfolk monuments are available on the City website for reference.

4.2 Coordinates collected utilizing GPS equipment (including control points) shall include all Global Navigation Satellite System (GNSS) receiver fields as listed in Section I 1.3 H.

A. Coordinate data for at least two control points within 2,624.70 feet from any survey point shall be clearly labeled and included in each GPS deliverable.

B. Dilution of Precision (DOP) shall be within the required parameters to obtain accuracy in accordance with Section V COORDINATES.

C. A minimum of 4 satellites shall be used to support Dilution of Precision (DOP) requirements.

D. Elevation Mask shall be set to 15 degrees above the horizon.

E. All coordinates collected utilizing GPS equipment shall include horizontal location (X-value, Y-value) and elevation (Z-value).

F. GPS deliverables shall be in Esri file geodatabase template format.

4.3 The Contractor shall record coordinates for all utility system components including:

A. Water Distribution
   1. Water Mains (if specified in Contract Documents)
   2. Water Main Fittings
   3. Valves
   4. Water Service Lines (if specified in Contract Documents)
   5. Water Meter Boxes
   6. Fire Hydrants
   7. Casings
   8. Water Sampling Stations
   9. Automatic Flushing Devices
   10. Pump Stations
   11. Water Storage Tanks
   12. Remote Pressure Monitors

B. Sanitary Sewer

   1. Manholes
   2. Gravity Mains
   3. Laterals (if specified in Contract Documents)
   4. Clean Outs
   5. Force Mains (if connects to manhole or specified in Contract Documents)
   6. Sewer Main Fittings
   7. Valves
   8. Casings
   9. Pump Stations
   10. Standby Bypass Pumps
   11. Emergency Pump Connections

C. Abandoned Components
   1. All utility components uncovered as part of construction, that are not removed, shall be included in the component tables, except for:
      a. Sewer lateral connection fittings (wyes)
      b. Sewer cleanouts
      c. Water service line connection fittings (taps)
      d. Water meter boxes

e. Sewer Gravity Mains
2. Utility components including caps and plugs placed on abandoned mains shall be included in the component table with the status Abandoned
3. Utility components that are removed (not abandoned) during construction will be reflected on the As-built Drawings but, they will not be included in the Component Tables

4.4 The Contractor shall record HORIZONTAL coordinates in for all utility system components as follows:

A. Connections to existing utility components;

B. All utility components listed in Section 3.2 and associated with the Project's construction, except for pipe, unless specified in the Contract Documents;

C. All locations where exposed pipe enters the ground (for permanently exposed pipe);

D. Top of pipe locations or other components as specified in the Contract Documents.

4.5 The Contractor shall record VERTICAL elevations in for all utility system components as follows:

A. Connections to existing utility components;

B. Utility components associated with construction, including:

1. Manholes (Lowest Invert Elevation)
2. Gravity Mains (Upstream and Downstream Invert Elevations inside manholes)
3. Valves (Top of Pipe as close to valve as possible)
4. Force Mains (Invert inside manhole, if applicable)
5. Water Mains
6. Fittings
   a. Includes all fittings and connections for Water Distribution System including Water Service Line connections (Taps)
   b. Includes all fittings and connections for Sewer Force System
   c. Does not include Sewer Lateral connections (Wyes)
   d. Does not include Sewer Gravity fittings
7. Casings

C. Top of pipe elevations or other components as specified in the Contract Documents.

D. VERTICAL elevations are not required for abandoned utility components.

E. All components collected using GPS equipment shall contain Z-value, however ONLY elevation values in accordance with Section 3.2 shall be recorded in the geodatabase.

4.6 The Contractor shall collect horizontal location and vertical elevation from the top, center of the pipe at the utility component location unless otherwise specified:

A. Invert values are collected from the bottom, center of the pipe (where wastewater flows)

B. Offset valve boxes are collected from the top, center of the valve box

C. Valve elevations collected at the top of pipe, as close to valve as possible

4.7 In addition to the standards referenced above and in accordance with Section 3.2, coordinates shall include the following:

A. Both ends of casings

B. Each tapping sleeve separate from the valve, where applicable

C. Both valve and valve box if offset

V. QUALITY CONTROL

5.1 Upon receipt of submittals, the Owner will complete a quality review. This may include field verifying coordinates, reviewing GNSS receiver data for GPS survey methods, checking the As-Built Drawings redline markups and Geodatabase by site inspection.

5.2 Submittal acceptance shall be at the sole discretion of the Owner and will be based on the error percentage as determined during the quality control process.

A. The Owner will generally accept submittals from the Contractor where fewer than 1 percent of located components are found to be in error.

B. The Owner will return submittals for correction where more than 1 percent but less than 5 percent of components are determined to have been located in error.

Individual files including As-Built Drawings, Geodatabase, and Submission Form, will be identified by Owner for correction and resubmittal by Contractor if the errors only impact part of the submittal (e.g. missing details from the As-Built Drawing, missing components from the Geodatabase).

C. The Owner will reject all submittals and require re-collection of coordinates and component information for a submittal where more than 5 percent of components are determined to be in error.

As-Built Drawings, Geodatabase, and Submission Form, will be required for re-submittal.

D. The Contractor shall be required to correct errors or inaccuracies at no additional cost to the Owner.

1. This shall include all actions related to excavation, backfill, compaction, etc. associated with uncovering utility components.

2. This shall include all actions related to coordinate collection, As-Built Drawing redline markup, and population of the Geodatabase.

E. The Contractor shall be required to submit corrections in accordance with this appendix as well as Section 7.4 GIS REQUIREMENTS.

1. Corrections shall be submitted no later than one month following receipt of the correction request from the Owner.

2. Corrections shall be subjected to the same quality review as the original submittals.

3. Failure to submit corrections will be basis for the Owner to withhold the Contractor's payment in partial or in full.

VI. PERIODIC SUBMITTALS FOR DATA RECORD PACKAGES (DRP)

Submittals listed below shall include the following items upon completion or at frequency determined at project initiation:

4.1 Data record packages (DRP) including Construction Contract drawings with redline markups indicating the “As-Built” conditions, completed Geodatabase, and Submission Form to the Owner when construction completed or at frequency determined at project initiation.

A. Construction Contract Drawings (“As-Bid” documents, pdf format) with redline markups indicating the “As-Built” conditions. Drawings submitted in PDF format shall be scanned in color and shall be named with “As-built Drawing” followed by the project title and number, date, and contractor’s name.

B. Construction Contract Drawings (“As-Bid” documents, pdf format) with redline markups indicating Abandonments and/or Removals. Drawings submitted in PDF format shall be scanned in color and shall be named with “Abandonment Drawing” followed by the project title and number, date, and contractor’s name.

C. Esri File Geodatabase Template – the Geodatabase shall be in accordance with Section II ESRI FILE GEODATABASE and named with “Geodatabase” followed by the project title and number, date, and contractor’s name.

D. GIS Update Submission Form, signed and sealed by a Virginia licensed surveyor certifying the accuracy of coordinates and elevations may be included as a separate PDF. Named with “Submission Form” followed by the project title and number, date, and contractor’s name.

E. Corrections – corrections shall be submitted in the format requested by the Owner in accordance with Section V QUALITY CONTROL.

F. Submittals shall be delivered to the Owner together on a USB drive or other digital transmittal method approved by the Owner following the issuance of a Notice to Proceed.

4.2 Failure to keep As-Built Drawings, coordinates, Geodatabase, and GPS files accurate, current, and submitted as required will be basis for the Department to partially or fully withhold payment of the Contractor's monthly payment request.

4.3 Frequency of submittal dates will be determined following the issuance of a Notice to Proceed.