CHAPTER 7
SURVEY STANDARDS

1. GENERAL

A. Surveys shall be performed to collect the field data and required information outlined in this chapter to assist in the preparation of clear, concise, and accurate set of construction plans and easement maps for sewer and water pipelines and lift station projects.

B. All field surveying shall adhere to the standards outlined in this chapter and be performed under the direct supervision of a licensed NC Professional Land Surveyor. Post-construction surveys shall be performed by a surveyor provided by Charlotte Water or the Engineer of Record and may not be employed by the contractor.

C. All surveying for Charlotte Water projects shall be oriented to the NC State Plane Coordinate System and all elevations based on NGS and or NCGS datum.

D. All data collected will be as per 21 NCAC 56.1608 (Class AA) *Classification Land Information System/Geographic Information System Surveys*, latest revision. Positional accuracy is deemed acceptable if 100% of the features are located according to the following specifications:

1) Horizontal accuracy should be in North Carolina State Plane 3200 NAD 83(2011/PA11/MA11) epoch 2010.00 for field data collection and be equal to or less than 0.10 feet (0.033 meters) to the center of the appurtenance lid or cover (center of rim for sanitary sewer and water manholes or operating nut for water or sewer valves and fire hydrants).

2) Vertical accuracy should be in NAVD 88 Geoid 18 or latest version for field data collection and be equal to or less than 0.098 feet (3 centimeters).

E. All Global Positioning System (GPS) Survey Requirements include:

1) Elevation Mask greater than 15 degrees

2) PDOP value of 5 or less

3) RMS error must be less than 70 millicycles

4) Minimum Number of 30 epochs observed

F. Topography shall be surveyed, do not use published GIS topography.

G. All surveys shall follow NCGS Chapter 87 Article 8A *Underground Utility Safety and Damage Prevention Act*, latest revision.

H. Post-construction survey requirements and standards are provided in Section 4.

2. DESIGN SURVEY REQUIREMENTS

A. Sanitary Sewer Outfall and Trunk Lines

Important procedures to follow and field information to collect for gravity sewer trunkline, at a minimum, are as follows:

1) Maintain and clear a line of sight between proposed manholes.

2) Proposed manholes shall be located with rebar or iron pipes of at least 1/2-inch diameter. This helps to relocate manholes during construction.

3) Show centerline station on guard stakes at proposed manhole locations.

4) Locate existing downstream manhole from Station 0+00 manhole with flow line elevation.

5) Locate all features within the proposed easement and temporary construction easements. Generally, locate within 25' of either side of centerline.

6) Locate all important physical features relating to the proposed line such as creeks, fences, other utility lines, property corners, buildings, large trees, R/W monuments, and road or railroad crossings.

7) Show the distance to creek banks and the width of the banks.

8) Obtain bottom elevation of creek at 100-foot distances and elevation of top of creek banks.

9) Locate any significant trees within the proposed alignment. These may be larger trees than the average or species such as walnut, dogwood, or similar specimen that may have a bearing on the final alignment or Charlotte Water's ability to obtain easements.

10) Locate any significant ground features that may affect construction such as rock outcrops and swampy ground conditions.

11) Locate any wells within 150 feet of centerline of proposed sanitary sewer.

12) Tie all elevations to NCGS or NGS monuments.

13) Verify elevation of flow line, pipe inverts, and rim of the existing manhole where the proposed sanitary sewer line begins.

14) Set temporary benchmarks (TBM) along the proposed sewer route near each manhole and establish by differential leveling. TBMs shall be located outside of the easement or area to be disturbed during construction activities.

15) Place additional temporary benchmarks adjacent to any road or underground utility crossings, as well as stream crossings that may require piers.

16) Obtain bank of creek and flow line of creek elevations at each proposed manhole.

17) When crossing underground utilities, obtain as much information as is available, such as utility locate markings and nearby visible appurtenances.

18) Obtain the location, size, and elevations on all storm drainage pipes and culverts that cross or parallel the proposed sewer centerline.

19) At road or street crossings, obtain elevations along the road in either direction as necessary.

20) At bores or tunnels under roads, perform settlement monitoring per requirements of governing agency.

21) On areas of extreme side slopes, take cross-section elevations to at least 25 feet on either side of the proposed sewer centerline.

B. Sanitary Sewer Street Extensions

Important procedures to follow and field information to collect for sanitary sewer street extensions, at a minimum, are as follows:

1) Locate all physical features within the street right-of-way or adjacent areas if feature could impact construction such as property irons and monuments, utility poles, existing valves and meters, curbs, driveways (define type), storm drainage pipes and structures, planters, mailboxes, signs, fences, trees and shrubs, gas lines, telephone cable, and electric lines at a minimum.

2) These features shall be located on both sides of the street. It may be necessary to shift to the other side during design.

3) Show width of street surface and type of pavement.

4) If proposed lines are located in existing pavement, magnails shall be used in lieu of stakes.

5) Show centerline station on guard stakes at proposed manholes. If proposed manhole is in pavement, mark with paint on pavement.

6) Locate any wells within 150' of centerline of proposed sanitary sewer.

7) Verify flow line, pipe inverts and rim of existing manhole where extension begins and the downstream manhole. Note all pipe and service lateral alignments and invert elevations.

8) Note whether there is an outside drop in the manhole.

9) If a doghouse manhole is to be use for the beginning manhole, obtain flow line, pipe inverts, rim elevations, and tie distances to both upstream and downstream manholes.

10) TBMs shall be set near the beginning of the line (do not use the existing rim), at the end of the extension, and near each proposed manhole. TBMs shall be located outside of the easement or area to be disturbed during construction activities.

11) Locate and obtain elevations of any structure (finished floor and ground) or vacant lot lower than the street. Note any structures with basements.

12) If there is a depression between the street main and any existing structure, run a profile to the structure.

13) Obtain flow line elevation and location of lateral if a lateral is already installed at the structure to be served by the extension main.

14) If the proposed extension does not extend to the crest of a hill, continue the profile to a minimum of 300 feet upstream from the terminus manhole. Charlotte Water retains the right to require additional information.

15) At bores or tunnels under roads, perform settlement monitoring per requirements of governing agency.

16) Survey parallel storm pipes and storm pipe crossings that may impact sewer pipe design elevations.

C. Water Mains

Important procedures to follow and field information to collect for water mains, at a minimum, are as follows:

1) Locate the main line valve, which will become Station 0+00, and blow-off at the end of the existing line that the proposed line will connect to and obtain the elevation of operating nut.

2) Locate all physical features within the street right-of-way or along the proposed water main alignment if feature could impact construction such as property irons and monuments, utility poles, existing valves and meters, curbs, driveways (define type), storm drainage pipes and structures, planters, mailboxes, signs, fences, trees and shrubs, gas lines, telephone cable, and electric lines at a minimum.

3) Locate any significant ground features that may affect construction such as rock outcrops and swampy ground conditions.

4) Set TBMs along the proposed route near intersections and at all creek crossings.

5) When crossing underground utilities, get as much information as is available, such as utility locate markings and nearby visible appurtenances.

6) Obtain the location, size, and elevations on all storm drainage pipes and culverts that cross or parallel the proposed water main centerline.

7) At road or street crossings, obtain elevations along the road in either direction as necessary.

8) At bores or tunnels under roads, perform settlement monitoring per requirements of governing agency.

9) On areas of extreme side slopes, take cross-section elevations to at least 25’ on either side of the proposed water main centerline.

10) For water mains 16” and larger where profiles are required, obtain centerline ground elevation, edge of pavement and side ditch elevations at 100-foot stations.

3. PRE-CONSTRUCTION SURVEY REQUIREMENTS

A. Construction Stakeout for Sanitary Sewers

1) Cut sheets are required for any sanitary sewer that is being built under a Charlotte Water contract. Cut sheets shall be signed and sealed by a licensed NC Professional Land Surveyor and shall contain the firm’s name, phone number, and email address. A sample cut sheet is provided at the end of this chapter.

2) Changes to construction grade and/or alignment from the approved construction plans to avoid obstructions must be pre-approved by Charlotte Water.

3) Place offsets for manholes outside of permanent easements but within the temporary construction easement if possible.

4) Construction stakes shall be set at every manhole and pier.

5) If benchmarks or construction stakes have been destroyed during clearing, set new TBMs or construction stakes.

6) Differential levels must be run on all construction stakes. Mark the offset from the manhole or pier and the station number on the guard stake adjacent to each offset hub.

7) Reference the centerline of all bores approximately 50 feet before beginning of bore and 50 feet past the end of bore.

8) Set an offset stake at any existing manhole at the beginning of the project. Do not use an existing rim as a reference; rims may the disturbed during excavation around existing manholes.

9) Check stakes at a minimum of every 30 days. Provide Charlotte Water a letter confirming accuracy following inspections.

B. Construction Stakeout for Water Mains, Low Pressure Sewer Mains and Sanitary Sewer Force Mains

1) Cut sheets shall be signed and sealed by a licensed NC Professional Land Surveyor and shall contain the firm's name, phone number, and email address. A sample cut sheet is provided at the end of this chapter.

2) Cut sheets for water mains and sanitary sewer force mains are not required when running parallel to an existing curb.

3) Changes to construction grade and/or alignment from the approved construction plans to avoid obstructions must be pre-approved by Charlotte Water

4) Construction stakes shall be placed along the centerline of the pipe or offset from the alignment.

5) Place offsets and/or elevations for horizontal and/or vertical bends.

6) Construction stakes shall be set at grades for cut sheets on areas of critical elevation.

7) Reference the centerline of all bores approximately 50 feet before beginning of bore and 50 feet past the end of bore.

8) Check stakes at a minimum of every 30 days. Provide Charlotte Water a letter confirming accuracy following inspections.

9) Additional requirements for construction staking is provided in Part 3 of Chapters 10 and 13 for Water and Lift Station Specifications, respectively.

FIGURE 7.1: CUT SHEET SAMPLE

SANITARY SEWER CUT SHEET

PROJECT NAME: **COMPANY:**
PROJECT NUMBER: **SURVEYOR:**

EX MH#_____ TO MH#_____

STRUCTURE #	STATION #	INVERT ELEVATIONS		PIPE LENGTH	SLOPE	HUB ELEVATION	OFFSET	(-)CUT/(+)FILL	NOTES
EX MH	0+00.00	INV OUT							
		INV IN(1)							
PROP MH 1		INV OUT(EX)							
		INV IN(2)							
PROP MH 2		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 3		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 4		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 5		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 6		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 7		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 8		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 9		INV OUT(MH#)							
		INV IN(MH#)							
PROP MH 10		INV OUT(MH#)							
		INV IN(MH#)							

4. POST-CONSTRUCTION SURVEY REQUIREMENTS

All infrastructure and appurtenances (inclusive of the list on the subsequent pages) shall be field collected and inventoried to the survey specifications below after their construction has been completed. The resulting data shall be collected using Charlotte Water's current data dictionary and be delivered prior to final inspection. The data shall be submitted in an ESRI geodatabase (.gdb) and all features shall include Northing, Easting, and Elevation. Charlotte Water will provide the current data dictionary, an example geodatabase, and other necessary documents. The attributes to be collected and submitted are as follows:

A. Water Features and Attributes to be Collected and Surveyed

1) **Water Air Release (wAirRelease)**

a. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

b. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

c. Notes – used to denote any extra or pertinent information about the feature or its collection

d. Accuracy – used to store the accuracy of the data collected

   i. TSSurvey – feature located with conventional survey equipment or total station

   ii. SurveyGPS – feature located with survey grade GPS

   iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

   iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

e. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

f. Collection Date – date field for the date of collection

2) **Water Backflow Device (wBackflowDevice)**

a. Type – used to denote the type of backflow device

   i. DoubleCheck

   ii. ReducePrinciple

b. Location – used to denote the location of the backflow device

   i. AboveGround – usually inside a plastic/fiberglass, insulated housing

   ii. BelowGround – usually in a vault with a metal lid

   iii. Inside – inside a building or structure

c. Size – used to denote the size of the backflow device, noted on device

d. Manufacturer – used to denote the manufacturer of the backflow device, noted on device

e. ModelNumber – used to denote the model number of the backflow device, noted on device

f. SerialNumber – used to denote the serial number of the backflow device, noted on device

g. Accessible – used to indicate whether the feature is accessible to the surveyor

   i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

h. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

i. Notes – used to denote any extra or pertinent information about the feature or its collection

j. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

k. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

l. Collection Date – date field for the date of collection

3) **Water Blow Off Valve (wBlowOff)**

a. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

b. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

c. Notes – used to denote any extra or pertinent information about the feature or its collection

d. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

e. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

f. Collection Date – date field for the date of collection

4) **Water Hydrant (wHydrant)**

a. Manufacturer – used to denote the manufacturer of the hydrant, occasionally noted on device

b. HydrantType – used to denote the style of hydrant

i. Standard – hydrant with one large connection

ii. DoubleSTORZ – hydrant with two large STORZ connections

iii. AirRelease – hydrant which doubles as an air release, usually painted blue

iv. NonConforming – hydrant with no large connections

v. Other – hydrant which does not fit the other options

c. BarrelSize – used to denote the barrel size of the hydrant, occasionally noted on device

d. FabricationYear – used to denote the year the hydrant was made, occasionally noted on device

e. SteamerStreet – used to denote the street the main steamer connection faces

f. SteamerConnection – used to denote the type of steamer connection

i. CMUD 4.875x6 – standard, non-STORZ connection

ii. STORZ – STORZ connection

iii. Other – some other type of connection, rare

g. Color – used to denote the predominant paint color of the hydrant

i. Black - usually only found in Uptown Charlotte

ii. Blue – denotes an air release hydrant

iii. Green - rare

iv. Red – usually denotes a private hydrant

v. Yellow – vast majority of hydrants

vi. NotPainted – rare

h. Notes – used to denote any extra or pertinent information about the feature or its collection

i. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

j. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

k. Collection Date – date field for the date of collection

5) **Water Manhole (wManhole)**

a. LidType – used to denote the type of manhole lid

i. CMUDStandard – 24" lid

ii. CMUDLarge – 30" lid

b. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

c. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

d. Notes – used to denote any extra or pertinent information about the feature or its collection

e. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

f. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

g. Collection Date – date field for the date of collection

6) **Water Meter (wMeter)**

a. MeterSerial – used to denote the serial number of the meter

b. ERTSerial – used to denote the serial number of the encoder receiver transmitter

c. HouseNumber – used to denote the house number corresponding to the meter, should only be populated when obvious

d. StreetName – used to denote the street name corresponding with the house number

e. LidType – used to denote the style of lid

   i. Epoxy – white or green epoxy lid

   ii. HingedMetalDoors – metal door(s) with hinge(s)

   iii. MetalPlates – metal lid with no hinges

   iv. Concrete – concrete surrounding smaller metal plate with hinge

   v. Other – other type of lid which does not fit the other options

f. Accessible – used to indicate whether the feature is accessible to the surveyor

   i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

   ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

   iii. Unknown – typically used if the feature is not found

g. InaccessibleReason – used to indicate the reason the feature is inaccessible

   i. PavedOver – feature is paved over with asphalt or concrete

   ii. FullofDirt – feature is full of dirt or debris

   iii. FullofWater – feature is full of water

   iv. Locked – feature is locked and/or lock is unable to be operated due to damage

   v. Sealed – feature has been sealed with tar or other material that is not easily replaced

   vi. SubGrade – feature is buried more than 1 foot below existing grade

   vii. Obstruction – feature is covered by debris or other objects that prevent access

   viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

   ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

h. Notes – used to denote any extra or pertinent information about the feature or its collection

i. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

j. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

k. Collection Date – date field for the date of collection

7) **Water Valve (wValve)**

a. Subtype – used to denote the function of the valve

i. Inline – mainline valve

ii. Service – valve on a service connection

iii. HydrantGuard – valve on a hydrant service connection

iv. Unknown – used when unable to determine the function of the valve

b. Cover – used to denote whether the valve has a cover or not

i. Yes

ii. No

iii. Unknown

c. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

d. InaccessibleReason – used to indicate the reason the feature is inaccessible

   i. PavedOver – feature is paved over with asphalt or concrete

   ii. FullofDirt – feature is full of dirt or debris

   iii. FullofWater – feature is full of water

   iv. Locked – feature is locked and/or lock is unable to be operated due to damage

   v. Sealed – feature has been sealed with tar or other material that is not easily replaced

   vi. SubGrade – feature is buried more than 1 foot below existing grade

   vii. Obstruction – feature is covered by debris or other objects that prevent access

   viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

   ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

e. Notes – used to denote any extra or pertinent information about the feature or its collection

f. Accuracy – used to store the accuracy of the data collected

   i. TSSurvey – feature located with conventional survey equipment or total station

   ii. SurveyGPS – feature located with survey grade GPS

   iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

   iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

g. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

h. Collection Date – date field for the date of collection

8) **Water Main (wMain)**

Should be used only for cartographic connectivity. Not intended to be used for top of pipe collection.

a. Notes - used to denote any extra or pertinent information about the feature or its collection

B. Wastewater Features and Attributes to be Collected and Surveyed

1) **Backflow Manhole (wwBackflowMH)**

a. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

b. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

c. Notes – used to denote any extra or pertinent information about the feature or its collection

d. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

e. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

f. Collection Date – date field for the date of collection

2) **Wastewater Cleanout (wwCleanout)**

a. LidType – used to denote the material of the cleanout lid

i. PVC

ii. DIP

iii. Brass

iv. Unknown

b. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

c. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

d. Notes – used to denote any extra or pertinent information about the feature or its collection

e. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

f. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

g. Collection Date – date field for the date of collection

3) **Low Pressure Service Box (wwLowPressureServiceBox)**

a. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

b. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

c. Notes – used to denote any extra or pertinent information about the feature or its collection

d. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

e. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

f. Collection Date – date field for the date of collection

4) **Wastewater Manhole (wwManhole)**

h. MH_Geometry – used to denote the geometry or shape of the manhole structure

i. Eccentric – manhole lid is offset slightly from the rest of the structure

ii. Concentric – manhole structure is conical, and not offset

iii. Box – manhole structure is square or rectangular, typically used for lamp holes in older areas of the system

iv. Flattop – manhole is usually precast concrete with a flat surface above ground, typically found on larger diameter mains and/or outfalls

v. Other – shape of manhole that does not fit any of the above options – provide additional details in Notes field

vi. Unknown – typically used when manhole is not accessible

i. MH_Function – used to denote the function or purpose of the manhole

i. Inline – manhole has pipes in and out, most commonly seen manhole

ii. HeadofLine – manhole has only one pipe out

iii. Lamphole – manhole has small, square lid and sides

iv. DoubleHead - manhole has no invert in and two invert out pipes typically at the same elevation

v. SiphonBox –manhole where gravity main connects to upstream and/or downstream side of siphons generally at creek crossings

vi. JunctionBox – manhole used to allow flow to pass between systems

vii. DiversionBox – manhole where flow can be diverted from one gravity line to another parallel gravity line, generally includes a weir

viii. Wetwell – manhole receiving flow for a lift station, generally very deep with a float inside

ix. Other – manhole function that does not fit any of the above options; provide additional details in Notes field

x. Unknown – typically used when manhole is not accessible

j. Material – used to denote the predominant material used to construct the manhole

i. Concrete – usually precast

ii. Brick – red brick laid with mortar

iii. MasonryBlock – concrete brick or block with or without mortar

iv. Unknown – typically used when manhole is not accessible

v. Other – material that does not fit any of the above options, provide additional details in Notes field

k. LidType – used to denote the type of lid covering the manhole opening

i. Vented – lid with holes for ventilation

ii. VentedCamLock – vented lid with locking cam devices

iii. Solid – lid with no holes for ventilation

iv. SolidCamLock – solid lid with locking cam devices

v. SolidBoltedSeal – bolted solid lid which bolts down and has a gasket around the manhole opening

vi. SolidBoltedNoSeal – solid lid which bolts down

vii. WaterTight – solid lid which has been sealed with tar or other waterproofing material

viii. WaterTightLocked – watertight lid with locking cam devices

ix. CertainTeed – specific brand of lid with a thinner lid that rotates in the frame to lock

x. Unknown – typically used when manhole is not accessible

l. LiningType – used to denote the type of material used to line manhole to prevent ground water from leaking into manhole walls

i. Cementitious

ii. Epoxy

iii. CuredInPlace

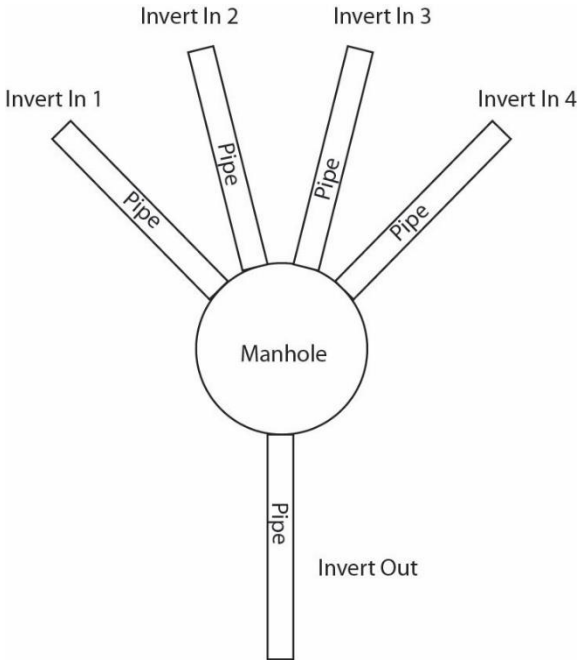
iv. PVC

v. None – no lining is visible

vi. Unknown – typically used when manhole is not accessible

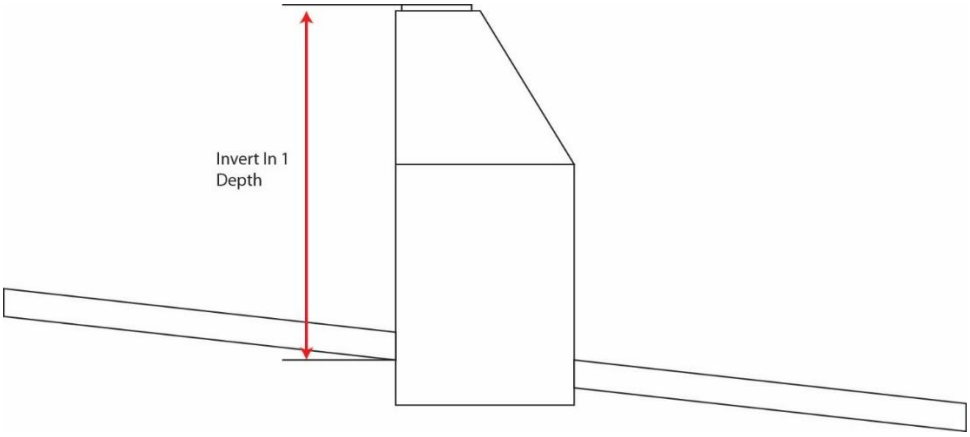
m. Manhole Invert Numbers – Invert In numbers are assigned by going clockwise around the manhole starting from the Invert Out. When going clockwise around the manhole, the first 6-inch or larger line will be named “Invert In 1”, unless that 6-inch line is an obvious lateral serving a nearby building. Lines of 4-inch are laterals are should not considered an Invert In or included in this numbering.

FIGURE 7.2: MANHOLE INVERT NUMBERS



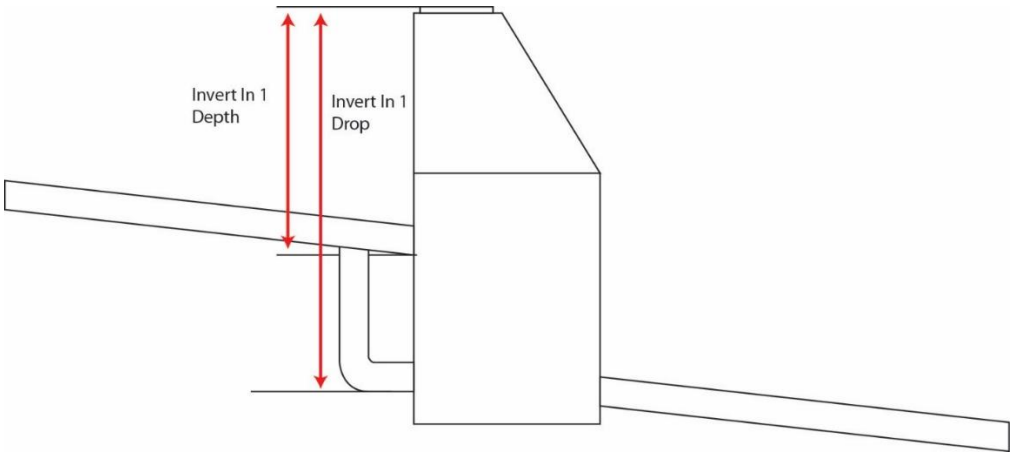
n. InvertIn1 – used to denote the distance in feet between the bottom of the pipe at Invert In 1 and the top of the manhole rim that holds the lid

FIGURE 7.3: INVERT IN 1



o. InvertIn1Drop – used to denote the distance in feet between bottom of the drop pipe at Invert In 1 and the top of the manhole rim that holds the lid

FIGURE 7.4: INVERT IN 1 DROP



Repeat this process as needed for additional invert pipes:

InvertIn2 – if applicable, same as InvertIn1 applied to Invert In 2

InvertIn2Drop - if applicable, same as InvertIn1 applied to Invert In 2

InvertIn3 – if applicable, same as InvertIn1 applied to Invert In 3

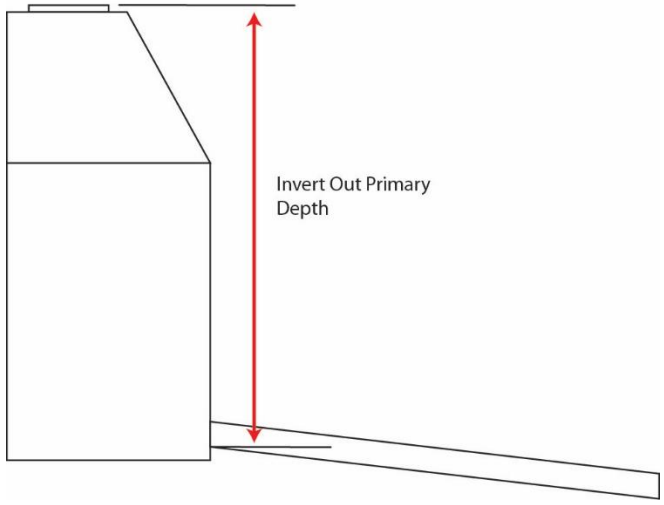
InvertIn3Drop - if applicable, same as InvertIn1 applied to Invert In 3

InvertIn4 – if applicable, same as InvertIn1 applied to Invert In 4

InvertIn4Drop - if applicable, same as InvertIn1 applied to Invert In 4

p. InvertOutPrimary – used to denote the distance in feet between bottom of the outflowing pipe at the lowest elevation or at the outflowing pipe that collects a majority of the flow leaving the manhole and the top of the manhole rim that holds the lid

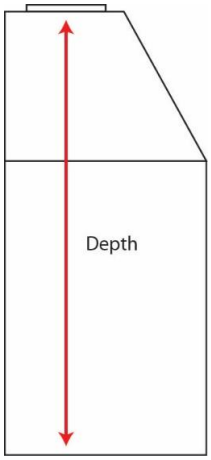
FIGURE 7.5: INVERT OUT PRIMARY



q. InvertOutSecondary – if applicable, used to denote the distance in feet between bottom of the outflowing pipe at the second lowest elevation or at the outflowing pipe that collects a minority of the flow leaving the manhole and the top of the manhole rim that holds the lid. If the Primary Out and Secondary Out are at equal depths and/or there is no majority/minority flow, then there is no preference for which Out gets which values.

r. Depth – used to denote the distance in feet from bottom trough of the manhole to the top of the manhole rim that holds the lid

FIGURE 7.6: DEPTH



s. Vent – used to denote the presence of a vent pipe on the manhole structure

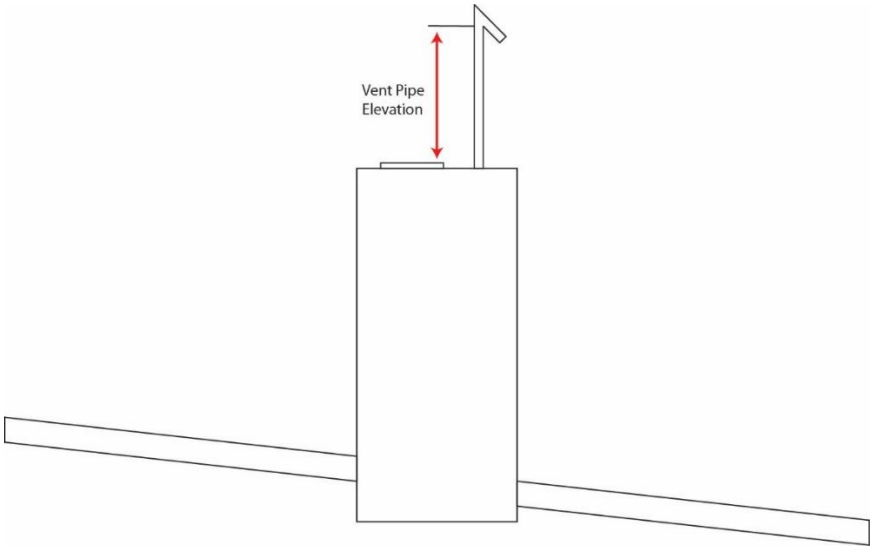
   i. Yes

   ii. No

iii. Unknown

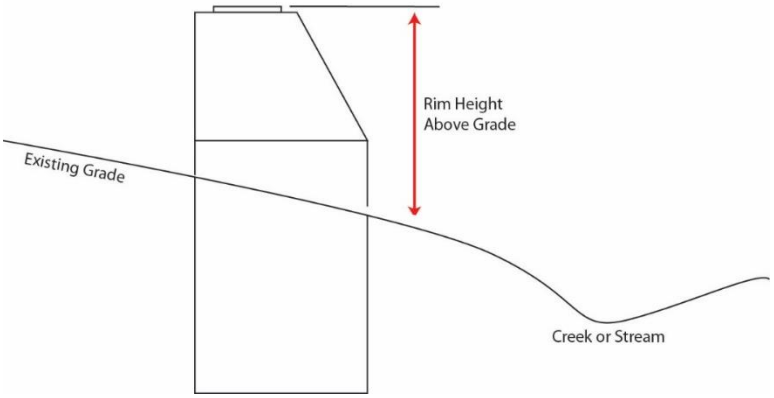
t. VentElevation – used to denote the distance in feet between the manhole rim and the inside bend of the vent pipe

FIGURE 7.7: VENT ELEVATION



u. RimHeightAboveGrade – used to denote the distance in feet between the manhole rim and the existing grade on the creek side of manhole. If the manhole is in the street or is flush with grade, enter 0 for the value. Do not leave as null or blank.

FIGURE 7.8: RIM HEIGHT ABOVE GRADE



v. Accessible – used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

w. InaccessibleReason – used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

v. Sealed – feature has been sealed with tar or other material that is not easily replaced

vi. SubGrade – feature is buried more than 1 foot below existing grade

vii. Obstruction – feature is covered by debris or other objects that prevent access

viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

x. Notes – used to denote any extra or pertinent information about the feature or its collection

y. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

z. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

aa. Collection Date – date field for the date of collection

5) **Wastewater Valve (wwValve)**

a. InManhole – used to denote whether the valve is inside a manhole or not

i. Yes

ii. No

iii. Unknown

b. Cover – used to denote whether the valve has a cover or not

i. Yes

ii. No

iii. Unknown

c. Accessible - used to indicate whether the feature is accessible to the surveyor

i. Yes – feature is accessible to the surveyor and able to be opened, if applicable

ii. No – feature is not accessible to the surveyor and/or not able to be opened, if applicable, provide additional details in InaccessibleReason field

iii. Unknown – typically used if the feature is not found

d. InaccessibleReason - used to indicate the reason the feature is inaccessible

i. PavedOver – feature is paved over with asphalt or concrete

ii. FullofDirt – feature is full of dirt or debris

iii. FullofWater – feature is full of water

iv. Locked – feature is locked and/or lock is unable to be operated due to damage

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viii. NotFound – feature is not able to be located, only used when there is reasonable evidence of the feature's potential existence

ix. Other – feature is inaccessible due to a situation that does not fit the other options, provide additional details in Notes field

e. Notes – used to denote any extra or pertinent information about the feature or its collection

f. Accuracy – used to store the accuracy of the data collected

i. TSSurvey – feature located with conventional survey equipment or total station

ii. SurveyGPS – feature located with survey grade GPS

iii. MappingGPS – feature located with mapping grade GPS, sub-meter accuracy, Not adequate for our specification

iv. Digitized – feature's location determined without survey of any kind, Not adequate for our specification

g. Surveyor – used to store the initials of the survey firm and the surveyor with a space in between (Ex. CW ABC)

h. Collection Date – date field for the date of collection

6) **Wastewater Main (wwMain) – Cartographic Sketch Only**

Should be used only for cartographic connectivity. Not intended to be used for top of pipe collection.

a. Diameter – used to denote the diameter of the wastewater main

b. Material – used to denote the material of the wastewater main

c. Notes - used to denote any extra or pertinent information about the feature or its collection