



*Site Utility As-Built CAD Standards for Standard
Digital File (SDF) Submission
for
Construction Documentation*

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Introduction

The purpose of this document is to supplement Rutgers University's digital Computer-Aided Drafting and Design (CAD) utility as-built plan submission standards. This effort will streamline the process of converting as-built CAD drawings to Geographic Information Systems (GIS) data for integration into the University's master utility geodatabases. Rutgers has historically mapped their utilities using AutoCAD and has received as-built drawings from contractors in AutoCAD format. University staff have recently undertaken a significant effort to convert all of their existing utility data into a GIS format.

Just like the traditional CAD drawings, paper or Mylar maps, and associated files or notebooks, a GIS database must be maintained to remain useful. Better maintenance of GIS databases benefits all users of those databases. By enforcing this standard, the University will be in a position to properly maintain their GIS databases using standardized, authoritative CAD data sources.

There are difficulties with using points and lines derived from CAD files in GIS software. Engineering design is typically completed in a CAD file that includes several, and sometimes many, plan and profile drawing sheets. When the CAD file is used to produce the development plan that is submitted, it will often not be easy to use in the GIS environment. For example, the number and organization of the plan drawings can be problematic; text is not directly associated with the object it is describing; and conventions for organizing and naming CAD layers vary from one engineering and surveying firm to another. These kinds of issues complicate the use of CAD files in the GIS environment. Thus Rutgers is implementing this standard for the format and content of required digital CAD data to supplement as-built plan submittals.

The standards contained in this document will require a format readable by an FME-based conversion tool that, when followed, will allow CAD data submitted to the University to be simply input to the tool and converted to GIS in an automated fashion. The tool will generate an error report if the input file doesn't meet the requirements of this standard, and the University may require a resubmission. To assist in conformance with the standard, template AutoCAD Drawing files (.DWG) will be provided to contractors and Rutgers employees responsible for submitting as-built drawings to the University. This standards document will cover and apply to the following utility systems:

- Combined Sewer
- Communications
- Compressed Gasses
- Electric
- Fuel
- Heating and Cooling
- Stormwater ● Water Revised April 2021

Alignment with Current University Standards

Submitted CAD drawings shall comply with existing university as-built standards, which can be found here:

<https://ipo.rutgers.edu/pdd/survey-standards>

https://ipo.rutgers.edu/sites/default/files/CAD_Standards_Manual.pdf

Required Distribution Disclaimer

Maps and other products from a GIS database are typically intended for planning, operational support, and graphic display purposes. *However, to help prevent inappropriate uses of information derived from the SDF (defined in following section below), distribution of any submitted SDFs OR electronic displays of information derived entirely or in part from one or more SDFs must include the disclaimer below. The template dwg files will include the disclaimer in the file's paper space on the disclaimer tab, and should not be removed.*

"In accepting and utilizing any drawings, reports and data on any form of electronic media generated and furnished by Rutgers University, the Consumer recognizes that all such electronic files are subject to undetectable alteration and that differences may exist between the signed and/or sealed hard copy drawings and the electronic version. The Consumer recognizes that the electronic documents are provided for convenience and informational purposes only and that the hard copy drawings, including the notes, must be reviewed for pertinent information. By accepting and utilizing any electronic drawings, reports or data, the Consumer agrees to waive any and all claims against the persons or entities who prepared the drawings, reports, and or data contained in the electronic files. The Consumer further recognizes that the electronic files contain information from documents which are instruments of service of the persons or entities that prepared them, and as the authors, those persons or entities retain all common law, statutory law and other rights including copyrights."

Required Submission Materials

In addition to the PDF plan set, consultants and internal employees submitting as-built CAD drawings to the University are required to submit one or several Standard Digital Files (SDF) containing the CAD layers pertaining to utilities located within a Rutgers campus. The SDF is a subset of the layers and features from the CAD file used to create the authoritative as-built plans. This file must be constructed using the template DWGs provided by Rutgers, which consists of the utility features outlined in this document. It will not include bearing information, the title block, border, notes, leader lines, or any background features. The SDF must be in a 2D AutoCAD DWG format; the university will not accept 3D drawing submissions.

The SDF is not simply a copy of the as-built CAD file used to print a project's PDF plan set. Only site utility features present in the as-built CAD file for the project for which approval is sought need be

included in the SDF. The SDF will be used as a source for maintaining map features and associated information for site utilities in the GIS database. The record set as defined in Section 4.0.1 of the university's [CAD Standards Manual for Construction Documentation](#) will remain the official document.

The standard requires the following two elements for the SDF submission:

1. A plan view of each utility type in the affected construction area shall be submitted in individual comprehensive drawing files (SDFs).
 - a. File format shall be 2D AutoCAD DWG, delivered via email or file transfer service.
 - b. Required drawing specifications included in this standard, such as layer names, standard line and point types, and block attribution (see the Utility-Specific Standards section) must be conformed to. Template DWG files that conform to the standards will be provided and must be utilized.
2. A comma-separated values (CSV) file of the field survey points used to create the CAD file must be included in the delivery.

Details on these two required elements are in the following sections.

Submissions require utilization of the Template DWG Files. To download the latest Template DWG Files & associated constrained value guide please visit the link below:

<https://ipo.rutgers.edu/files/cad-standards-dwgs-constrained-guidezip>

1: Plan View SDF

The required subset of CAD file layers of the affected construction area shall be submitted, in plan view, as one comprehensive drawing file. Plan view is defined as all “entities” on the same plane of zero elevation in the drawing coordinate space. The submitted drawings should only be drafted in 2D format, with no “Position Z” geometry attributes populated. However, certain blocks still contain block attributes for elevation information, such as RimElevation for manholes. The required subset of layers/utility features to include in the submission is described in Utility-Specific Standards section of this document, and are present in the provided template DWGs.

Spatial Reference

As defined in the existing University standards, the SDF shall be georeferenced to the required coordinate system. The horizontal coordinate system of the features in the SDF must match those of the surveyed points, as shown in the accompanying survey points CSV file. As the SDF is required to be drafted and submitted in 2D format, no vertical coordinate system shall be assigned to the drawing.

Horizontal Coordinate System

Submitted SDFs shall be in the NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet horizontal coordinate system. The provided template DWG files are already assigned this spatial reference.

Drawing Scale

The SDF is required to be in a one-to-one DWG scale, whereby one (1) drawing unit = one (1) U.S. Survey Foot.

2: Survey Points CSV File

A submission of the survey points used to generate the CAD file is a required element of the SDF. The points must be spatially referenced in the NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet horizontal and the NAVD88_height_(ftUS) vertical coordinate systems. The survey points file must be in CSV format, and must include the following information (fields):

1. Point ID Number
2. X Coordinate
3. Y Coordinate
4. Z Coordinate
5. Shot Type or Elevation Type
6. Shot Source
7. Owner
8. Comment
9. Utility name
10. Feature name

Graphic and Geometric Specifications

The integrity, usefulness, and required cleanup of the data converted from CAD to GIS depends heavily on a variety of factors that do not apply when data is in a CAD format. This section outlines these issues, and provides geometric rules intended to prevent them from occurring. The template DWGs take these concerns into account and are designed to avoid their occurrence when utilized. The SDF must conform to the [Utility-Specific Standards](#) which include layer names, standard line and point types, and attributes (blocks). In addition, the submitted SDF must conform to the following requirements:

Terminology

Throughout this document, specific terminology is used to refer to the different geometry types of features that will be included in the template DWG files, and subsequently, the submitted SDFs. To avoid confusion, the generalized terminology used is listed below, followed by the technical CAD equivalents of the terminology. The equivalent terms are used interchangeably, depending on the context of the specification being described.

Generalized Terminology	Technical CAD Equivalent
Point	Block
Line	Polyline
Polygon	<i>Closed Polyline</i>

Naming Conventions

The layers and blocks contained in each template DWG have a prefix at the beginning of their names indicating the utility that the infrastructure features belong to. The prefixes for each utility and layer/block name examples are outlined in the following table:

Utility	Layer and Block Prefix	Example
Communications	c_	c_Pullbox
Compressed Gas	cg_	cg_Valve
Combined Sanitary Storm (includes the sanitary sewer system alone, as well as combined infrastructure that carries both sewage and stormwater)	cs_	cs_Inlet
Electric	e_	e_Generator
Fuel	f_	f_Tank
Heating and Cooling	hc_	hc_Manhole
Stormwater	sw_	sw_Culvert
Water	w_	w_PumpHouse

Utility Infrastructure Feature Type Separation

Each type of utility infrastructure feature within the template DWGs has a unique layer, which supports the requirement that each CAD layer shall only contain a single type of utility infrastructure. For example, no inlet features should be included on a layer that consists of manholes, and no manholes should be included on a layer that consists of mains.

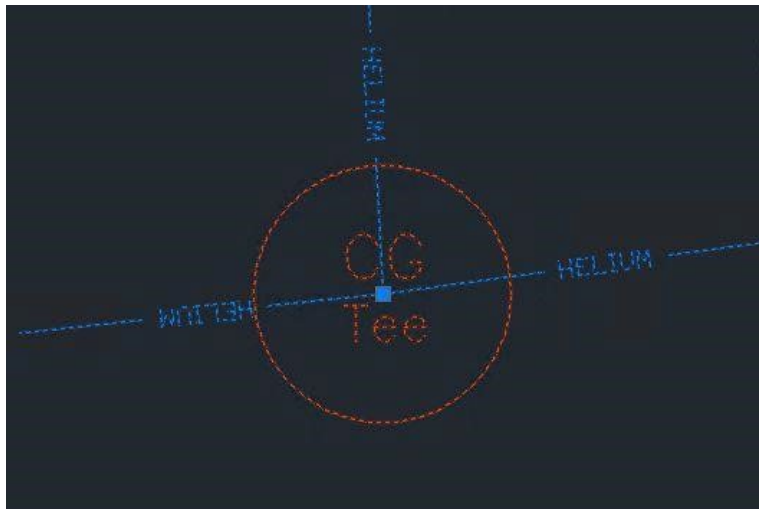
This rule consequently results in most layers containing a single CAD geometry type (point, line, or polygon). There is one general exception to this structure:

1. The inclusion of blocks to hold attributes on layers that are otherwise entirely polylines, and therefore cannot be set up as blocks themselves. See the **Blocks** section below for further

information on this topic. The separation of features by CAD layer is further outlined in the utility-specific standards section of this document.

Network Snapping

All features in a continuous network (i.e., a single drainage system including inlets, mains, laterals, manholes, swales, etc.) shall be snapped to each other. Doing so is critical to ensuring such features can be seamlessly integrated into Rutgers' existing GIS utility geometric networks without a significant data cleanup effort. For example, a sewer main must be snapped to the insertion point of the block/point features (i.e. manholes). Snapping features in a continuous network together will prevent the creation of overshoots and undershoots, which cause issues during the conversion to GIS.



Blocks and Attributes

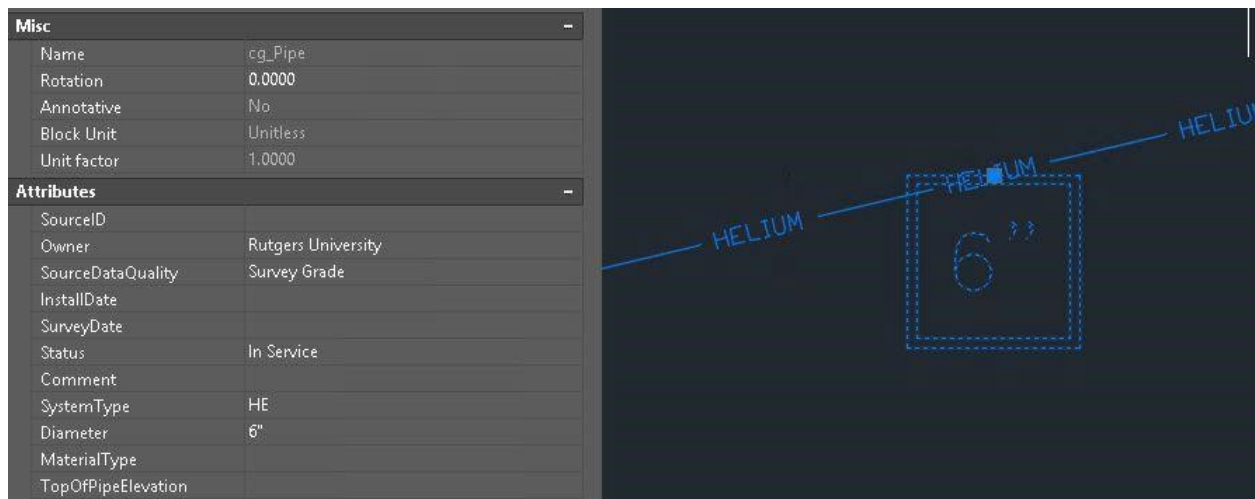
This standard requires that **the pre-built blocks provided in the template DWG files are used to represent point features and contain feature attribution.** The use of blocks for attribution is a clean method of providing additional feature information to the CAD file end user and also supports clean migration into GIS. Blocks are also used for labeling on the plan. Rather than using simple text that is not associated with any utility feature, the provided blocks are constructed with certain critical attributes configured to visually display. **This standard requires that no annotations are used in the SDFs.**

A user is not required to populate all block attributes. Attributes have been created to carry information for most relevant situations, but a user should only populate the information that is known from performing the as-built survey.

Certain block attributes are required to be populated with specified, predetermined values. These attributes correspond to what will ultimately be output GIS attributes that have a domain (also known as a picklist or dropdown list) associated with them. For the conversion to GIS to work properly, the allowable values for these attributes must be conformed to. See Utility-Specific Standards section for the attributes that fall under this requirement, and the lists of allowable values.

All point features are set up as blocks, with the insertion point placed at the block's centroid in most cases. Cases where the insertion point is not placed at the block centroid are documented in Utility-Specific Standards section. Blocks may be rescaled as needed for visual purposes, as long as the network snapping and connectivity rules outlined in this document are followed. Blocks representing point features should **not** be exploded for any reason, as doing so will cause issues with the automated conversion to GIS.

Additionally, **all polyline features representing utility lines have associated blocks, which shall be placed on the same layer as their corresponding polyline features.** They will be used to contain attributes about such features, such as diameter and material. These blocks must follow a universal placement standard for them to be properly assigned to the geometry to which they correspond. The insertion point of all blocks used in this manner must be placed directly on, and snapped to, the features which they are describing. One effective and suggested method of doing this is to use the midpoint command to snap insertion points of attribute blocks to the midpoint of their corresponding line features. Attribute blocks for linear features are the only blocks with insertion points not placed at the block centroid. Instead, these blocks' insertion points are located at the midpoint of the upper edge of the block, as shown below.



Attributes Managed as Layers

Certain block attributes that contain critical pieces of information (such as SystemType and equivalent for mainline features) are also present in and separated by corresponding layer names. This convention will ensure that this information gets properly carried across to GIS during conversion. The format of this convention is as follows:

[utility prefix]_[feature name]_[attribute value]

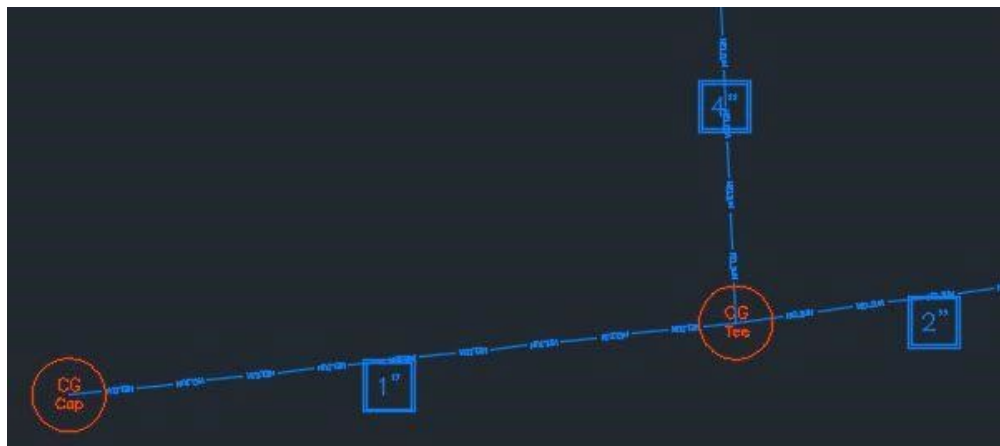
Status	Name	Freeze	Lock	Color	Linetype
	cs_Main_Forced			magenta	cs_fm
	cs_Main_Gravity			red	cs_ln

The FlowType attribute of cs_Main is managed as separate layers that are configured to have unique line types. This will allow force mains and gravity mains to exist on separate layers, ensuring their proper conversion to features in GIS.

Lines

Linear features must be created as polylines, rather than CAD lines or splines, to avoid undesired line breaks and geometrically inaccurate curvatures that will result in conversion errors.

Additionally, **lines must be broken at, and snapped to, point features along their runs** (with the exception of the blocks used to hold line attribution). Separate line features are required when there is a change in attribution from one line to the next. In this case, typically there would be a point feature there as well. Lines should not be broken at locations where no point is present and attribution does not change.

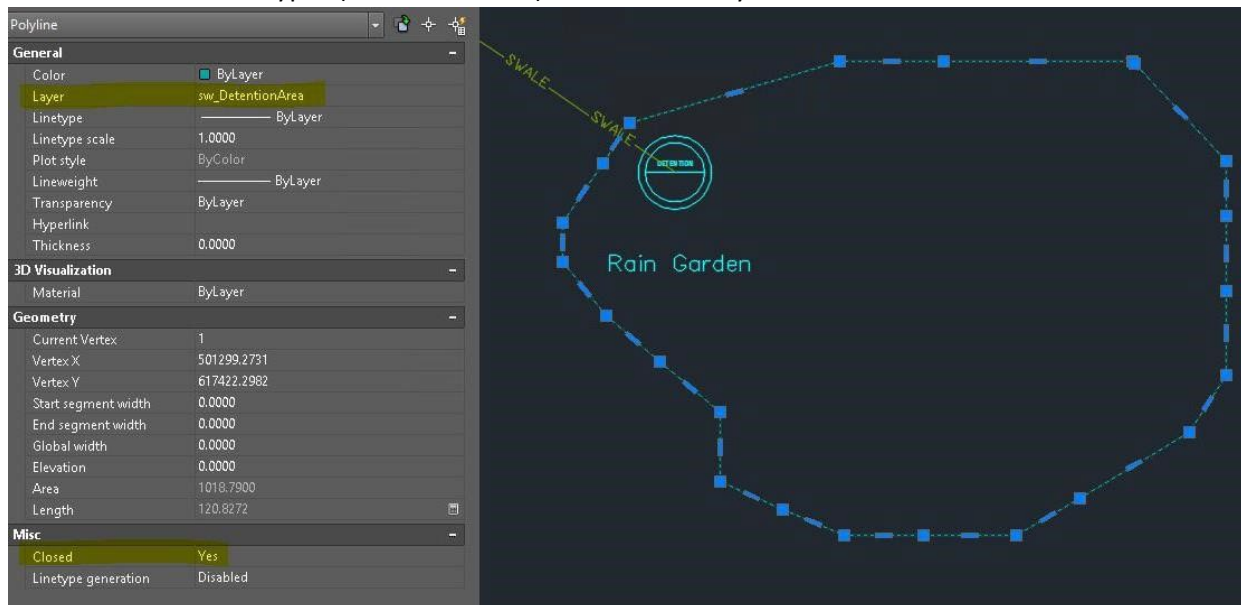


For features such as gravity flow pipes (e.g., in Combined Sewer or Stormwater), **flow direction will be specified by the digitized direction of each feature** (i.e., water flows from beginning to the end of a pipe line's digitized direction). In this way, flow direction information is contained within the feature geometry. To ensure this information accurately comes across to GIS during conversion, those creating the SDF must draw linear features in gravity systems **from the upstream node to the downstream node**.

This requirement is further specified in the utility-specific section of this document.

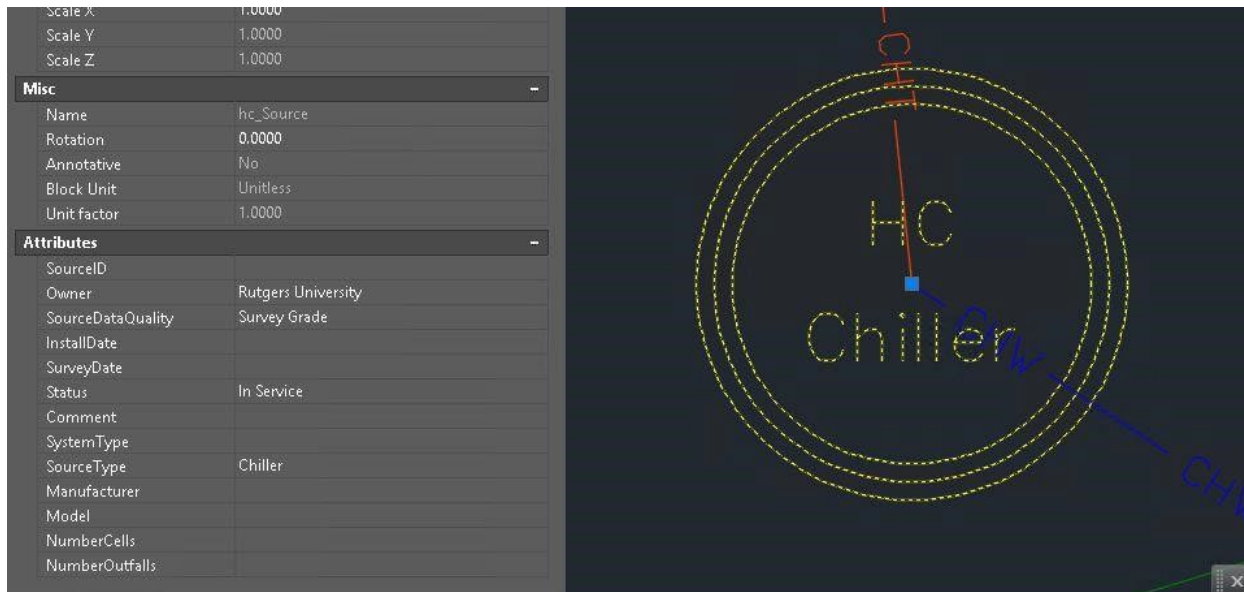
Polygons

Objects representing polygons shall be created as closed polylines. It is critical to close polylines representing polygons by snapping the two ends of the polyline to each other, or else they won't properly convert to GIS as a polygon. Hatches may also be used for cartographic effect, but shall not take the place of closed polylines to represent a polygon and will play no part in the conversion. If a polygon is to be included in the SDF, the feature should be placed on its corresponding unique layer, with no other feature types (blocks and lines) on that same layer.



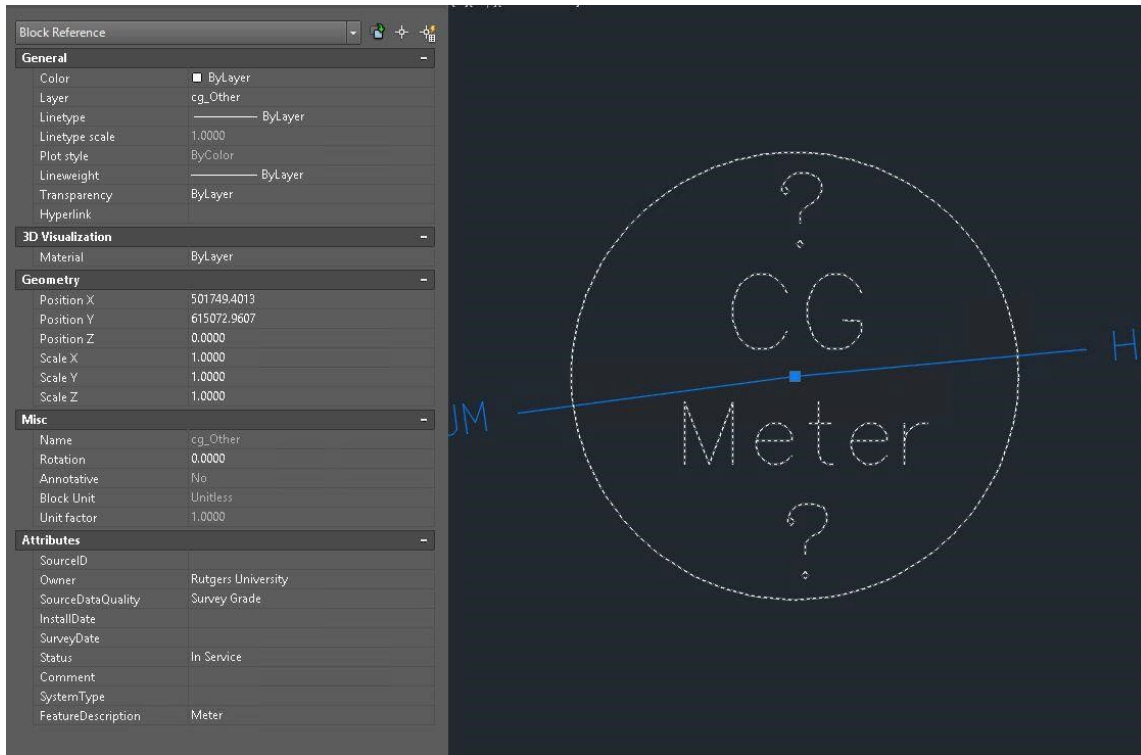
Text

All attribution required in the Utility-Specific Standards section of this document must be contained within the attribute block of the feature it describes. Certain values in the block attributes are configured to visually display as text in the drawing, but any text that exists separately from blocks will not be converted to GIS, and therefore no information in the SDF shall be included as simple text or an annotation. In the below screenshot, the attribute SourceType in the hc_Source block (Chiller) is configured to visually display.



Handling Features with No Unique Layer in the Templates

Features that do not have a unique block or layer in the template DWG should be placed in the generic [utility prefix]_Other layers and blocks that have been built into each utility template DWG file to account for these cases. The name of the feature represented by the block must be populated in the FeatureDescription attribute. This attribute will visually display as a cue for what infrastructure feature the block represents.



Public Utilities

For the purpose of this document, Public Utilities are defined as infrastructure that simply passes through the survey area but does not connect to the university's utility distribution. If there are public utilities surveyed in the project area and were included in the as-built submitted to Rutgers, these should also be included in the SDF. The template DWGs provide for capturing these features properly to support conversion to GIS. Use the utility feature-specific blocks and layers (cs_Main, cg_Pipe, etc.) for capturing utilities that are not owned by Rutgers but either connect to the Rutgers utility systems or pass through the campus. Populate the Owner attribute to signify the owner, if known.

Utility-Specific Standards

The following section outlines the utility-specific standards, and must be referenced while drafting the SDF to ensure all features included in the drawing are correctly captured and attributed. It is also recommended that this is referenced while drafting the as-built. A list of features included in the templates, as well as an appendix of allowable values for constrained attributes is included.

The constrained values guide can be found [here](#). Note that all Diameter attribute values must be in inches, while all elevation and depth attributes must be in feet. Do not include any text or symbols (such as ‘, “, in, ft, inches, feet, etc.) in the attribute values. Also note that all date attribute values (InstallDate, SurveyDate, etc.) must follow the YYYYMMDD format.

CAD Drawing Templates

All submitted SDFs shall be created using the templates provided by this standard. The template files cover all eight utilities, and include blocks for point features, layers with custom Linetypes for linear features, specified layers for polygons (to be constructed as closed polylines), and separate blocks, intended to hold the attributes for all non-point features that otherwise cannot contain attribution. Attribute blocks, as mentioned in the blocks section above, must be snapped directly to the linear feature they are describing, and are contained within the same layer. The names of the template DWG files are listed below:

Utility System	Template DWG File Name
Combined Sanitary Storm	cs_Template.dwg
Communications	c_Template.dwg
Compressed Gasses	cg_Template.dwg
Electric	e_Template.dwg
Fuel	f_Template.dwg
Heating and Cooling	hc_Template.dwg
Stormwater	sw_Template.dwg
Water	w_Template.dwg

Constrained values guide: <https://ipo.rutgers.edu/files/cad-standards-dwgs-constrained-guidezip>

Templates features Legend

The following pages of this document outline and define the utility features that are included in each template DWG file. If the features are present in a project, they must be captured in the SDF. Below each feature name is a list of attributes included in the feature's corresponding block. These attributes must be populated, if known.

Some attributes allow for open ended responses, while others that include a parenthesized indicator after the attribute name - for example (dYesNo) - have a predefined list of values that must be conformed to when populating the attribute. These attributes are known as "constrained attributes". The lists of the permitted values for the constrained attributes can be found in the CAD Templates Constrained Values Guide under the "Permitted Values" column header. This guide must be referenced while populating constrained attributes to ensure the values will accurately come across to GIS during the automated SDF conversion process.

In addition to being present in a block, certain attributes are also broken out by unique CAD layers, with the attribute name appended as a suffix after the feature name. For example, the attribute FlowType for cs_Main is one such occurrence of this structure, and the resulting CAD layers are cs_Main_Forc ed and cs_Main_Gravity. Such attributes are flagged with a **bracketed yellow highlight**. For features that follow this structure, the features must be placed on the correct layer, **and** the block attribute must be populated.

Default attribute values are flagged with a **bracketed blue highlight**. Blocks with insertion points not located at the block centroid are highlighted with **bracketed green highlight**.

The below generalized example mimics and summarizes the structure of the following pages:

Utility Name

Feature Type

- [CAD block/layer name] - [feature definition] [Indicates block insertion point not at centroid]
 - [block attribute] (domain name indicating predefined attribute values)
 - [block attribute] **[Indicates attribute values are structured as unique CAD layers]**
 - [block attribute] [Indicates default attribute value in CAD block]

Common Attributes - Shared by all features across all Blocks

- SourceID
- Owner (dOwner) [Default to Rutgers University]
- SourceDataQuality (dSourceDataQuality) [Default to Survey Grade]
- InstallDate
- SurveyDate

- Status (dStatus) [Default to In Service]
- Comment

Compressed Gasses Network

Points

- cg_FacilityAccess - Virtual point where the utility network meets and passes through a building face
 - EntranceRoom
- cg_MarkerBall - Balls used to mark utility location often for tracing purposes
- cg_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dcgPointType) [Attribute managed as layers]
 - Bend
 - Cap
 - Connection
 - Tee
 - Vent
- cg_Source - source point for connection to transmission network
 - SourceType (dcgSourceType) [Attribute managed as layers]
 - Compressor
 - Tank
 - SystemType (dcgSystemType)
- cg_StubUp - a roughed-in, network connection point
 - SystemType (dcgSystemType)
- cg_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dcgShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench

- Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
- Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
- Markout Paint – measured at the finished ground surface, where markout paint mark is visible
- Shot Source (dcgShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
- Comment
- cg_TurnDown - A fitting that provides a vertical change in direction
 - Degree (dDegree)
- cg_Valve - a device used to control the passage of fluid or gas through a pipe
 - SystemType (dcgSystemType)
 - TurnDirection (dcgTurnDirection)
 - isAboveGround - (dYesNo)
- cg_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - FeatureDescription

Lines

- cg_Pipe - A pipe conveying compressed gas [Insertion point not at centroid]
 - SystemType (dcgSystemType) [Attribute managed as layers]
 - COMP AIR - Compressed Air
 - HE - Helium
 - NITRO - Nitrogen
 - MaterialType (dcgMaterialType)
 - TopOfPipeElevation
 - Diameter (dcgPipeDiameter)

Polygons

- [None]

Combined Sewer System

Points

- cs_BestManagementPractice - Stormwater management facilities that are the most effective measures to reduce runoff and pollutants
 - BMPTType (dswBMPTType) [Attribute managed as layers]
 - Bioretention System
 - Blue Roof
 - Cistern
 - Dry Well
 - Extended detention Basin
 - Grass Swales
 - Green Roof
 - Manufactured Treatment Device
 - Pervious Paving System
 - Sand Filter
 - Standard Constructed Wetland
 - Subsurface Gravel
 - Vegetative Filter Strip
 - Wet Ponds
 - Wetlands
 - isStormwater (dYesNo) [default to yes]
- cs_CleanOut - access point to the pipe/line that allows for blockages to be removed
 - CleanOutDiameter (dcsCleanOutDiameter)
 - MaterialType (dcsMaterialType)
 - isStormwater (dYesNo)DetentionType (dcsDetentionType) [Attribute managed as layers]

- BMP Structure
 - Concrete Chamber
 - Pipe
 - isAboveGround (dYesNo)
 - DetentionBMPTType (dcsDetentionBMPTType)
 - StructureBottomElevation
 - isStormwater (dYesNo) [default to yes]
- cs_FacilityAccess - Virtual point where the utility network meets and passes through a building face
 - EntranceRoom
- cs_FlowArrow - Virtual arrows representing flow direction for visual purposes ○ Rotation
- cs_HoldingTank (dcsTankCapacity) - A tank for storing combined sewer water
 - Capacity (dcsTankCapacity)
 - isConfined (dYesNo) [default to Yes]
 - isStormwater (dYesNo) [default to No]
- cs_Inlet - device that allows surface water to enter the stormwater drainage system ○ InletType (dswInletType) [Attribute managed as layers]
 - Drop Inlet
 - Pre-Cast Catch Basin
 - Trench Drain
 - Recycle Drain
 - GrateElevation
 - GrateLength
 - GrateShape (dswGrateShape)
 - GrateType (dswGrateType)
 - GrateWidth
 - GrateDiameter
 - StructureBottomElevation
 - isStormwater (dYesNo) [default to Yes]
- cs_LiftStation - facility that moves water from a lower elevation to a higher elevation ○ isStormwater (dYesNo) [default to No]
- cs_Manhole - large covered access points that allow for access to and maintenance of underground utilities

- isConfined (dYesNo) [default to Yes]
- isDogHouse (dYesNo)
- hasOffsetLid (dYesNo)
- StructureBottomElevation
- RimElevation
- isStormwater (dYesNo)
- cs_MarkerBall - Balls used to mark utility location often for tracing purposes ○ isStormwater
- cs_Meter - Meter for measuring utility usage and/or flow quantity
 - isAboveGround (dYesNo)
 - isStormwater (dYesNo) [default to No]
- cs_MeterChamber - prefabricated inspection chamber housing meter assemblies
 - isStormwater (dYesNo) [default to No]
- cs_ManufacturedTreatmentDevice - prefabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff
 - Manufacturer (dswManufacturer)
 - MTDType (dswMTDType)
 - isStormwater (dYesNo) [default to Yes]
- cs_Opening - point where drainage enters culvert or system
 - OpeningType (dcsOpeningType) [Attribute managed as layers]
 - Headwall Opening
 - Flared End Opening
 -
 - Manufacturer (dswMPipe Opening)
 - isStormwater (dYesNo) [Default to Yes]
- cs_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - isStormwater (dYesNo)
 - FeatureDescription
- cs_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dcsPointType) [Attribute managed as layers]

- Acid Waste Station
 - Acid Pit
 - Air Water Separator
 - Bend
 - Bypass Valve
 - Cap
 - Connection
 - Grease Separator
 - Outlet Structure - pond exit
 - Overflow
 - Reducer
 - Scour Hole
 - Sediment Separator
 - Stub Up
 - Wash Water Treatment
 - Tee
 - Tracer Station
 - Yard Drain
 - Wye
 - Vent
- isStormwater
- cs_Pump - device that moves water into specific area/facilities
 - InletDiameter
 - DischargeDiameter (csDischargeDiameter)
 - RatedFlow (dcsRatedFlow)
 - isGrinder (dYesNo)
 - NormalStatus (dcsOpenClose)
 - isStormwater (dYesNo) [default to No]
- cs_Retention - storage facilities for stormwater for an unlimited period of time
 - isStormwater (dYesNo) [default to Yes]
- cs_SepticTank - underground storage tank in which wastewater/sewage is collected and treated
 - Capacity (dcsTankCapacity)
 - isConfined (dYesNo) [default to Yes]

- isStormwater (dYesNo) [default to No]
- cs_SumpPump - sump pumps sitting inside manholes
 - DischargeDiameter (dcsDischargeDiameter)
 - RatedFlow (dcsRatedFlow)
 - isStormwater (dYesNo)
- cs_SumpWell - sump pumps that stand alone, not inside manholes
 - DischargeDiameter (dcsDischargeDiameter)
 - RatedFlow (dcsRatedFlow)
 - isStormwater (dYesNo)
- cs_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dcsShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench
 - Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
 - Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
 - Shot Source (dcsShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
 - Comment
- cs_TurnDown - A fitting that provides a vertical change in direction
 - Degree (dDegree)

- isStormwater (dYesNo) [default to No]

Lines

Common Line Attributes

- Diameter (dcsDiameter)
- hasTracer (dYesNo)
- MaterialType (dcsMaterialType) - except cs_Swale
- DownstreamTopOfPipeElevation
- UpstreamInvert
- DownstreamInvert
- UpstreamTopOfPipeElevation

Line Features

- cs_Lateral - A branched line that leads from an inlet point or building to a main line [Insertion point not at centroid]
 - EllipticalSize (dcsEllipticalSize)
 - FlowType (dswFlowType) [Attribute managed as layers]
 - Forced
 - Gravity
 - ForceType (dswForceType)
 - PipeShape (dcsPipeShape)
 - isStormwater (dYesNo) [default to Yes]
- cs_Main - higher capacity line central to the utility network that is fed by laterals
 - EllipticalSize (dcsEllipticalSize) [Insertion point not at centroid]
 - FlowType (dswFlowType) [Attribute managed as layers]
 - Forced
 - Gravity
 - PipeShape (dcsPipeShape)
 - isStormwater (dYesNo)
- cs_TrenchDrainLine - linear narrow type of drain installed at an angle [Insertion point not at centroid]
 - isStormwater (dYesNo) [default to Yes]

- cs_UnderDrain - pipe placed under soil surface to intercept and convey runoff or groundwater. [Insertion point not at centroid]
 - isPerforated (dYesNo)
 - isStormwater (dYesNo) [default to Yes]

Polygons

- cs_LeachField - underground area fed by septic tanks that filters wastewater back into soil
- cs_ManholeStructureArea - the footprint of a manhole structure
- cs_DetentionArea - the footprint of a detention feature
- cs_RetentionArea - the footprint of a retention feature
- cs_SepticTankArea - the footprint of a septic tank

Fuel Network

Points

- f_FacilityAccesss - Virtual point where the utility network meets and passes through a building face
 - EntranceRoom
- f_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - hasOffsetLid (dYesNo)
- f_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dfPointType) [Attribute managed as layers]
 - Cap
 - Connection
 - Fill
 - Pump
 - Stub Up
 - Transition

- Vault

- Vent

- FuelType (dfFuelType)
 - isAboveGround (dYesNo)
 - isMetered (dYesNo)
- f_MarkerBall - Balls used to mark utility location often for tracing purposes
- f_Meter - Meter for measuring utility usage and/or flow quantity
 - FuelType (dfFuelType)
 - isAboveGround (dYesNo)
 - isEncased (dYesNo)
 - isMonitored (dYesNo)
- f_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dfShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench
 - Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
 - Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
 - Shot Source (dfShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
 - Comment

- f_Tank - a container for storing fuel
 - FuelType (dfFuelType)
 - isConfined (dYesNo) [default to Yes]
 - isEncased (dYesNo)
 - isMonitored (dYesNo)
 - TankCapacity (dfTankCapacity) ○ TankMaterial (dfTankMaterial)
 - TankType (dfTankType)
- f_TracerStation - feature to assist in underground utility tracing purposes ○ FuelType (dfFuelType)
- f_TurnDown - A fitting that provides a vertical change in direction
 - FuelType (dfFuelType)
 - Degree (dDegree)
- f_Valve - a device used to control the passage of fluid or gas through a pipe ○ FuelType (dfFuelType)
- f_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - FeatureDescription
 - FuelType (dfFuelType)

Lines

- f_FuelLine - tube composed of a range of materials that allows for the conveyance of fluid or gas [Insertion point not at centroid]
 - Diameter (dfDiameter)
 - FuelType (dfFuelType) [Attribute managed as layers]
 - C - Combination of Diesel and Gasoline
 - CNG - Compressed Natural Gas
 - D - Diesel
 - G - Gasoline
 - NG - Natural Gas
 - LPG - Propane
 - isAboveGround (dYesNo)
 - isHighPressure (dYesNo) - denotes whether fuel line is a high pressure line
 - hasTracer(dYesNo)

- isMonitored (dYesNo)
- MaterialType (dfMaterialType)
- TopOfPipeElevation
- f_VentLine - pipe/line that allows air to escape as fuel enters tank [Insertion point not at centroid]
 - Diameter (dfDiameter)
 - MaterialType (dfMaterialType)

Polygons

- f_TankArea - the footprint of a fuel tank
- f_ManholeStructureArea - the footprint of a manhole structure

Heating and Cooling Network

Points

- hc_FacilityAccess - Virtual point where the utility network meets and passes through a building face
 - EntranceRoom
- hc_Fitting - Junction where pipes connect to pipes or devices
 - FittingType (dhcFittingType) [Attribute managed as layers]
 - Bend
 - Cap
 - Diameter (dhcDiameter)
- hc_FlowArrow - Virtual arrows representing flow direction for visual purposes
- hc_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dhcPointType) [Attribute managed as layers]
 - Anchor
 - Connection
 - Pump
 - Regulator

- Stub Up
 - Vent
 - SystemType (dhcSystemType) • hc_ValveBox - box housing valves
 - SystemType (dhcSystemType)
 - RimElevation
- hc_MarkerBall - Balls used to mark utility location often for tracing purposes
- hc_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - SystemType (dhcSystemType)
 - RimElevation
 - StructureBottomElevation - distance from top of structure to interior bottom
 - isConfined - (dYesNo) [default to Yes]
 - hasOffsetLid (dYesNo)
- hc_Handhole - shallow pull boxes used when accessing underground utilities
 - SystemType (dhcSystemType)
 - RimElevation
- hc_Meter - Meter for measuring utility usage and/or flow quantity
 - isAboveGround (dYesNo)
- hc_TracerStation - feature to assist in underground utility tracing purposes
- hc_Source - source point for connection to transmission network
 - isConfined (dYesNo) [default to Yes]
 - SourceType (dhcSourceType) [Attribute managed as layers]
 - Boiler
 - Chiller
 - Cooling Tower
 - SystemType (dhcSystemType)
 - Manufacturer (dhcManufacturer)
 - Model
 - NumberCells - (dhcNumberCells)
 - NumberOutfalls
- hc_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected

- Shot Type (dhcShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench
 - Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
 - Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
- Shot Source (dhcShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
- Comment
- hc_TurnDown - A fitting that provides a vertical change in direction
 - SystemType (dhcSystemType)
 - Degree

- hc_Valve - a device used to control the passage of fluid or gas through a pipe
 - SystemType (dhcSystemType)
 - isShutoff (dYesNo)
 - isAboveGround (dYesNo)
 - TurnDirection (dhcTurnDirection)
- hc_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - FeatureDescription

Lines

- hc_Conduit - tube containing heating and cooling lines [Insertion point not at centroid]
 - SystemType (dhcSystemType)
 - Diameter (dhcDiameter) - inches
- hc_Line - a tube composed of various materials that allows for the conveyance of fluid or gas [Insertion point not at centroid]
 - SystemType (dhcSystemType) [Attribute managed as layers]
 - CHT - Chiller Tower Line
 - CHW - Chilled Water
 - CW - Condenser Water
 - CNDS - Condensate
 - DOM - Domestic Hot Water
 - DUT - Dual Temperature Water
 - GTE - Geothermal
 - GLY - Glycol
 - HTHW - High Temperature Hot Water
 - LPS - Low Pressure Steam
 - MTW - Medium Temperature Hot Water
 - TopOfPipeElevation
 - hasTracer (dYesNo)
 - MaterialType (dhcMaterialType)
 - OuterJacketDiameter (dhcOuterJacketDiameter)
 - Diameter (dhcDiameter)
 - SupplyReturn (dhcSupplyReturn)
 - isDirectBuried (dYesNo)
 - isDoubleContained (dYesNo)
 - isInTunnel (dYesNo)

Polygons

- hc_Pad - A pad onto which heating and cooling system equipment is mounted
 - SystemType (dhcSystemType)
- hc_PlantArea - building footprint of a heating and cooling plant
- hc_ManholeStructureArea - the footprint of a manhole structure

Stormwater Network

Points

- sw_BestManagementPractice - Stormwater management facilities that are the most effective measures to reduce runoff and pollutants
 - BMPTType (dswBMPTType)
- sw_CleanOut - access point to the pipe/line that allows for blockages to be removed
 - CleanOutDiameter (dswCleanOutDiameter)
 - MaterialType (dswMaterialType)
- sw_Detention - storage facilities for stormwater for a limited period of time
 - DetentionType (dswDetentionType) [Attribute managed as layers]
 - BMP Structure
 - Concrete Chamber
 - Pipe
 - Rain Garden
 - DetentionBMPTType (dswDetentionBMPTType)
 - StructureBottomElevation
- sw_FlowArrow - Virtual arrows representing flow direction for visual purposes
- sw_Inlet - device that allows surface water to enter the stormwater drainage system
 - InletType (dswInletType) [Attribute managed as layers]
 - Drop Inlet
 - Pre-Cast Catch Basin
 - Trench Drain
 - Recycle Drain
 - isStormWaterCompliant (dYesNo)

- hasECOCompliantSign (dYesNo) - sign designating if inlet is draining to protected body of water
- isLabeled (dYesNo) - denotes whether the ID number of the inlet is displayed on the inlet
- isAreaDrain (dYesNo)
- GrateElevation - elevation above sea level at the surficial grate of the inlet
- GrateLength -the measured length of the grate, in inches
- GrateType (dswGrateType)
- GrateWidth - the measured width of the grate, in inches
- GrateDiameter
- StructureBottomElevation
- GrateShape (dswGrateShape) - shape of the grate
- NumberInlets
- NumberOutlets
- InletADiameter (dswDiameter) ○
- InletBDiameter (dswDiameter) ○
- InletCDiameter (dswDiameter)
- InletDDiameter (dswDiameter)
- InletEDiameter (dswDiameter)
- OutletADiameter (dswDiameter) ○
- OutletBDiameter (dswDiameter)
- OutletCDiameter (dswDiameter)
- sw_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - isConfined (dYesNo) [default Yes]
 - hasOffsetLid (dYesNo)
 - hasGratedCover (dYesNo)
 - hasECOCompliantSign (dYesNo)
 - StructureBottomElevation
 - RimElevation
 - ManholeDiameter (dswManholeDiameter)
 - NumberInlets
 - NumberOutlets
 - InletADiameter (dswDiameter) ○
 - InletBDiameter (dswDiameter) ○
 - InletCDiameter (dswDiameter)
 - InletDDiameter (dswDiameter)

- InletEDiameter (dswDiameter)
 - OutletADiameter (dswDiameter)
 - OutletBDiameter (dswDiameter)
- sw_MarkerBall - Balls used to mark utility location often for tracing purposes
- sw_ManufacturedTreatmentDevice - prefabricated stormwater treatment structure utilizing settling, filtration, absorptive/adsorptive materials, vortex separation, vegetative components, and/or other appropriate technology to remove pollutants from stormwater runoff.
 - Manufacturer (dswManufacturer)
 - MTDType (dswMTDType)
- sw_Outfall - the point where water discharges from a system into a body of water
 - OutfallDiameter (dswOutFallDiameter)
 - OutfallStructure (dswOutfallStructure) [Attribute managed as layers]
 - Pipe
 - Riser
 - Flared End
 - Headwall
 - PipeADiameter (dswDiameter) ○
 - PipeBDiameter (dswDiameter) ○
 - PipeCDiameter (dswDiameter)
 - PipeDDiameter (dswDiameter)
 - PipeEDiameter (dswDiameter)
 - NumberPipes
- sw_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - FeatureDescription
- sw_OutletControlStructure - a flow control structure for stormwater outfalls
 - StructureTopElevation
 - StructureBottomElevation
 - hasHydroBreak (dYesNo)
 - hasGratedCover (dYesNo)
 - hasWeir (dYesNo)
 - WeirLength
 - WeirElevation
 - hasOrifice (dYesNo)
 - OrificeSize
 - OrificeElevation

- **sw_Opening** - point where drainage enters culvert or system
 - OpeningType (dswOpeningType) [Attribute managed as layers]
 - Headwall Opening
 - Flared End Opening
 - Pipe Opening
 - PipeADiameter (dswDiameter)
 - PipeBDiameter (dswDiameter)
 - PipeCDiameter (dswDiameter)
 - PipeDDiameter (dswDiameter)
 - PipeEDiameter (dswDiameter)
 - NumberPipes
- **sw_Point** - generalized point block and layers to capture point features with no unique attributes
 - PointType (dswPointType) [Attribute managed as layers]
 - Air Water Separator
 - Connection
 - Outlet Structure - pond exit
 - Scour Hole
- **sw_RainLeader** - A pipe that directs stormwater from roof gutters away from a building
 - DischargeType (dswDischargeType)
 - ExteriorInterior (dswExteriorInterior)
- **sw_Retention** - storage facilities for stormwater for an unlimited period of time
- **sw_SumpPump** - sump pumps sitting inside manholes
 - DischargeDiameter (dswDischargeDiameter)
 - RatedFlow (dswRatedFlow)
- **sw_SumpWell** - sump pumps that stand alone, not inside manholes
 - DischargeDiameter (dswDischargeDiameter)
 - RatedFlow (dswRatedFlow)
- **sw_SurveyPoint** - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dswShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench

- Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
- Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
- Markout Paint – measured at the finished ground surface, where markout paint mark is visible
- Shot Source (dswShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
- Comment
- sw_TracerStation - feature to assist in underground utility tracing purposes

Lines

Common Line Attributes

- Diameter (dswDiameter)
- DownstreamInvert
- DownstreamTopOfPipeElevation
- EllipticalSize (dswEllipticalSize)
- hasTracer (dYesNo)
- MaterialType (dswMaterialType)
- UpstreamInvert
- UpstreamTopOfPipeElevation

Line Features

- sw_Culvert - pipes or boxes that connect to open channels as they move under
[Insertion point not at centroid]
 - CulvertType (dswCulvertType)
 - BoxSides (dswBoxSides)
 - OpeningSize (dswOpeningSize)
- sw_Lateral - line that leads from an inlet point to a mainline [Insertion point not at centroid]

- EllipticalSize (dcsEllipticalSize)
- FlowType (dswFlowType) [Attribute managed as layers]
 - Forced
 - Gravity
- ForceType (dswForceType)
- PipeShape (dswPipeShape)
- sw_Main - higher capacity line that is fed by laterals and is central to the utility network [Insertion point not at centroid]
 - EllipticalSize (dcsEllipticalSize)
 - FlowType (dswFlowType) [Attribute managed as layers]
 - Forced
 - Gravity
 - PipeShape (dswPipeShape)
- sw_Swale - shallow stormwater channel [Insertion point not at centroid]
 - SwaleMaterialType (dswSwaleMaterialType)
- sw_UnderDrain - pipe placed under soil surface to intercept and convey runoff or groundwater. [Insertion point not at centroid]
 - isPerforated (dYesNo)

Polygons

- sw_ManholeStructureArea - the footprint of a manhole structure
- sw_DetentionArea - the footprint of a detention feature
- sw_RetentionArea - the footprint of a retention feature

Water Network

Points

Common Point Attributes

This attribute is to be used for all water point features *except* for w_Valve, w_Hydrant, w_FireDepartmentConnection, w_Standpipe, and w_HoseConnection (all features that are inherently part of fire service)

- ServiceType (dwServiceType)

Point Features

- w_FacilityAccess - Virtual point where the utility network meets and passes through a building face
 - EntranceRoom
- w_Fitting - Junction where pipes connect to pipes or devices
 - FittingType (dwFittingType) [Attribute managed as layers]
 - Bend
 - Cap
 - Coupling
 - Flange
 - Line Stop
 - Reducer
 - Saddle
 - Sleeve
 - Tee
 - Wye
 - Diameter (dwDiameter)
- w_FireDepartmentConnection - fire department connection point for firefighting purposes
- w_FlowArrow - Virtual arrows representing flow direction for visual purposes
- w_Handhole - shallow pull boxes used when accessing underground utilities
 - RimElevation
- w_HoseConnection - connection point for hoses
- w_Hydrant - fixture used to access water directly from a main, equipped with nozzles
 - HydrantType (dwHydrantType) [Attribute managed as layers]
 - Fire
 - Flushing
 - Manufacturer (dwManufacturer)
 - Model (dwModel)
 - ManufactureDate
 - NozzleDiameter (dwNozzleDiameter)
 - FlowRate
- w_MarkerBall - Balls used to mark utility location often for tracing purposes
- w_Meter - Meter for measuring utility usage and/or flow quantity
 - isAboveGround (dYesNo)
 - isMeterPit (dYesNo)

- w_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - isConfined (dYesNo) [default to Yes]
 - RimElevation
- w_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - FeatureDescription
- w_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dwPointType) [Attribute managed as layers]
 - Backflow Preventer
 - Flow Alarm
 - Recycle Spigot
 - Spigot
 - Sprinkler
 - Sprinkler Controller
 - Sprinkler Distribution
 - Vent
- w_ThrustBlock - A structure, typically made of concrete, installed around a joint between two pressurized pipes for stability and reinforcement
- w_PostIndicatorValve - valve operator for automatic fire sprinkler and standpipe systems, where the system main valve is located underground outside the building
- w_Pump - facilities that move, compress, or alter the pressure of a fluid. In water system, all are centrifugal boosters.
 - InletDiameter (dwInletDiameter)
 - OutletDiameter (dwOutletDiameter)
 - RatedFlow (dwRatedFlow)
 - RatedPressure (dwRatedPressure)
- w_PumpHouse - a container for assets inside the pump station
- w_StandPipe - vertical pipe within a building fed by a water supply and featuring numerous outlets for the water, can be used for firefighting
- w_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dwShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected

- Top of Pipe – measured at the top of pipe
- Pipe Invert – measured at the interior bottom of pipe
- Bottom Trench – measured at the base of the trench
- Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
- Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
- Markout Paint – measured at the finished ground surface, where markout paint mark is visible
- Shot Source (dwShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
- Comment
- w_TracerStation - feature to assist in underground utility tracing purposes
- w_TurnDown - A fitting that provides a vertical change in direction
 - Degree (dDegree)
- w_Valve - a device used to control the passage of fluid or gas through a pipe
 - ValveType (dwValveType) [Attribute managed as layers]
 - Bypass
 - Fire
 - Gate
 - Hydrant
 - Mainline
 - Service
 - Sprinkler
 - TurnDirection (dwTurnDirection)
- w_ValveStation - central control system at a junction of pipes
- w_Well - structure created to access underground water
 - isConfined (dYesNo) [default to Yes]

Lines

- w_Lateral - line that leads from a point of service to a main line [Insertion point not at centroid]
 - LateralType (dwLateralType) - the type of lateral as distinguished by the type of water it conveys [Attribute managed as layers]
 - Fire
 - Fountain
 - Hydrant
 - Irrigation
 - Potable
 - Sensor
 - hasTracer (dYesNo)
 - MaterialType (dwMaterialType)
 - Diameter (dwDiameter)
- w_DistributionMain - higher capacity line that connects to laterals [Insertion point not at centroid]
 - Diameter (dwDiameter)
 - DistributionMainType (dwServiceType) - type of distribution main line, as distinguished by the type of water it conveys [Attribute managed as layers]
 - Fire
 - Potable
 - hasTracer (dYesNo)
 - isPressurized (dYesNo) - denotes whether water within the pipe is under pressure (for CAD)
 - MaterialType (dwMaterialType)
- w_RecycleWater - a recycled water (greywater) pipe [Insertion point not at centroid]
 - hasTracer (dYesNo)
 - MaterialType (dwMaterialType)
 - Diameter (dwDiameter)

Polygons

- w_ManholeStructureArea - Footprint of the manhole structure
- w_PumpHouseArea - size of pumphouse
- w_ValveStationArea - size of valvestation

Electric and Communications Networks

Important Note: linear layers and blocks for the electric and communications utilities are structured hierarchically. Ductbanks are at the top of the hierarchy, conduits are below ductbanks, and cables are below conduits.

For electric, cables are not included at this time so the hierarchy has two levels:

1. When there is a ductbank present, only the e_Ductbank layers and block will be used. Conduit attributes are included in the ductbank block and features to represent conduits will be created during the automated conversion to GIS. That is, if a duct bank is present, all information about the conduit within the duct bank will be captured within the e_Ductbank layers and block.
2. When no ductbank is present, the e_DirectBuriedConduit layers and block will be used.

For communications: cables are included so the hierarchy has three levels:

1. When there is a ductbank present, only the c_Ductbank layers and block will be used. Conduit and cable attributes are included in the ductbank block. Conduits and Cables will be created during the automated conversion to GIS.
2. When there is a conduit but no ductbank present, only the c_DirectBuriedConduit layers and block will be used. Cable attributes are included in this block and cables will be created during the automated conversion to GIS.
3. When there is only a cable or aerial support strand present, either the c_AerialCable, c_DirectBuriedCable, or c_SupportStrand layers and blocks will be used.

Electric Features

Common Electric Attributes

- ServiceType (deServiceType) [except e_Substation, e_TracerStation, e_Undervault, e_GroundingGridCable]

Points

- e_CapacitorBank - group of several capacitors of the same rating that are connected in series or parallel with each other to store electrical energy . The resulting bank is then used to counteract or correct a power factor lag or phase shift in an alternating current (AC) power supply
- e_ChargingStation - charging stations for electric vehicles

- e_DistributionPanel - component of the electricity supply system which divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit in a common enclosure
- e_FacilityAccess - Virtual point where the utility network meets and passes through a building face
 - Entrance Room
- e_Generator - a device that converts mechanical energy from an external source into electrical power for use in an external circuit, for emergency use
 - ServiceType (deServiceType) [default to EMG]
 - FuelType (deFuelType)
- e_GroundingWell - container for a grounding grid
- e_Handhole - shallow pull boxes used when accessing underground utilities
 - RimElevation
 - ServiceType (deServiceType)
 - isEmergency (dYesNo)
- e_Inverter - a device that converts direct current to alternating current and changes voltage
- e_Light - device that uses electric currents to produce visible light
 - ServiceType (deServiceType) [Default to Light]
- e_LightPanel - panel containing fuses or circuit breakers used to protect branch circuits serving lighting fixtures.
 - ServiceType (deServiceType) [Default to Light]
- e_LoadBreak - disconnect switch that has been designed to provide making or breaking of specified currents
- e_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - isConfined (dYesNo) [default to Yes]
 - RimElevation
 - ServiceType (deServiceType)
 - isEmergency (dYesNo)
 - Voltage (deVoltage)
- e_MarkerBall - Balls used to mark utility location often for tracing purposes
- e_Meter - termination point for connection to transmission network, for measuring usage
 - isAboveGround (dYesNo)
- e_Other - A block and layer to capture point features that are otherwise not included in the CAD templates

- ServiceType (deServiceType)
 - FeatureDescription
- e_Point - generalized point block and layers to capture point features with no unique attributes
 - ServiceType (deServiceType)
 - PointType (dePointType) [Attribute managed as layers]
 - Cap
 - Connection
- e_StubUp - a roughed-in, network connection point
 - ServiceType (deServiceType)
 - Voltage (deVoltage)
 - isGrounding (dYesNo)
 - NumberConduits (decNumberConduits)
- e_Substation - interface between parts of the distribution grid and transmission systems that step down the voltage in the transmission lines to one that is suitable for the distribution grid
- e_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (deShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
 - Pipe Invert – measured at the interior bottom of pipe
 - Bottom Trench – measured at the base of the trench
 - Trench After Backfill – measured on top of trench after trench has been backfilled but not yet brought to finished grade
 - Grade – measured at the finished ground surface, where a visual indication of the location of the infrastructure is still present (i.e. fresh pavement, cut lines in pavement)
 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
 - Shot Source (deShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level

- Hand Measurement
 - Comment
- e_Switch - electrical component that breaks or closes an electric circuit.
 - Position (dePosition)
 - SwitchType (deSwitchType) [Attribute managed as layers]
 - Loop
 - Radial
- e_TracerStation - feature to assist in underground utility tracing purposes
- e_TransferSwitch - switch that transfers the electric load between the usual source and the emergency source during a power failure
 - ServiceType (deServiceType)
 - Voltage (deVoltage)
- e_Transformer - [Includes transformers within buildings that may exist in CAD]
 - Capacity (deCapacity) - Units in kVA
 - ImpedanceFactor
 - TransformerType (deTransformerType) [Attribute managed as layers]
 - Aerial
 - Pad Mount
 - Pit
 - ServiceType (deServiceType)
 - PrimaryVoltage (dePrimaryVoltage)
 - SecondaryVoltage (deSecondaryVoltage)
 - RatingComment
- e_UnderVault - underground room providing access to underground electrical equipment

Lines

- e_AerialCable - an above-ground electric cable suspended from utility poles [Insertion point not at centroid]
 - CableMaterialType (deCableMaterialType)
 - ServiceType (deServiceType) [Attribute managed as layers]
 - 1 - Primary
 - 2 - Secondary
 - Light - Light
 - Combined - Combined
 - EMG - Emergency Power

- E-CTRL - Electric Control Wiring
 - HTHW-CTRL - HTHW Control Wiring
 - FIRE CTRL - Fire Alarm Control Wiring
 - PV-CTRL - Solar Control Wiring
- e_Ductbank - groups of conduits designed to protect and consolidate cabling to and from buildings. Block also contains information for the conduits contained within. [Insertion point not at centroid]
 - isConcreteEncased (dYesNo)
 - DuctbankMaterialType (decDuctbankMaterialType)
 - NumberConduits (decNumberConduits)
 - NumberEmptyConduits (decNumberConduits)
 - Voltage (deVoltage)
 - ServiceType (deServiceType) [Attribute managed as layers]
 - 1 - Primary
 - 2 - Secondary
 - Light - Light
 - Combined - Combined
 - EMG - Emergency Power
 - E-CTRL - Electric Control Wiring
 - HTHW-CTRL - HTHW Control Wiring
 - FIRE CTRL - Fire Alarm Control Wiring
 - PV-CTRL - Solar Control Wiring
 - DuctbankSize
 - ConduitSize (deConduitSize)
 - ConduitMaterialType (deConduitMaterialType)
- e_DirectBuriedCable - an electric cable directly buried in the ground, with no conduit or ductbank present [Insertion point not at centroid]
 - CableMaterialType (deCableMaterialType)
 - ServiceType (deServiceType) [Attribute managed as layers]
 - 1 - Primary
 - 2 - Secondary
 - Light - Light
 - Combined - Combined
 - EMG - Emergency Power
 - E-CTRL - Electric Control Wiring

- HTHW-CTRL - HTHW Control Wiring
 - FIRE CTRL - Fire Alarm Control Wiring
 - PV-CTRL - Solar Control Wiring
- Depth
- e_DirectBuriedConduit - An electric conduit directly buried in the ground [Insertion point not at centroid]
 - ConduitSize (deConduitSize)
 - ConduitMaterialType (deConduitMaterialType)
 - NumberConduits
 - ServiceType (deServiceType) [Attribute managed as layers]
 - 1 - Primary
 - 2 - Secondary
 - Light - Light
 - Combined - Combined
 - EMG - Emergency Power
 - E-CTRL - Electric Control Wiring
 - HTHW-CTRL - HTHW Control Wiring
 - FIRE CTRL - Fire Alarm Control Wiring
 - PV-CTRL - Solar Control Wiring
- e_GroundingGridCable -g rounding arrays that electrically ground structures, preventing electric shocks and to mitigate overvoltages [Insertion point not at centroid]

Polygons

- e_GroundingGridArea - web of materials to ground a building, located outside of building footprint
- e_SubstationArea - the footprint of a substation
- e_SolarField - the footprint of a solar array
- e_ManholeStructureArea - the footprint of a manhole structure

Communications Features

Common Communications Attributes

- RCMS_ID

Points

- c_FacilityAccess - Virtual point where communications line meets and passes through the building face
 - EntranceRoom
 - TerminationBuilding
 - TerminationRoom
- c_Handhole - shallow pull boxes used when accessing underground utilities
 - HandholeDimension (dcHandholeDimension)
 - DimensionComment
 - RimElevation
 - SystemType (dcSystemType)
- c_MarkerBall - Balls used to mark utility location often for tracing purposes
- c_Manhole - large covered access points that allow for access to and maintenance of underground utilities
 - isConfined (dYesNo) [default to Yes]
 - ManholeDimension (dcManholeDimension)
 - DimensionComment
 - RimElevation
 - SystemType (dcSystemType)
- c_Other - A block and layer to capture point features that are otherwise not included in the CAD templates
 - SystemType (dcSystemType)
 - FeatureDescription
- c_Pedestal - ground level cabinet housing a passive connection point for underground cables
 - Dimension
 - DimensionComment
 - SystemType (dcSystemType)
- c_Point - generalized point block and layers to capture point features with no unique attributes
 - PointType (dcPointType) [Attribute managed as layers]
 - Bend
 - Cap
 - Connection
 - Stub Up

- SystemType (dcSystemType)
- c_Pullbox - small boxes providing aboveground access to cables, usually attached to building
 - SystemType (dcSystemType)
 - PullboxDimension (dcPullBoxSize)
 - DimensionComment
- c_Riser - a transition from the underground conduit system to the aerial communication space at a utility pole
 - SystemType (dcSystemType)
- c_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (dcShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
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 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
 - Shot Source (dcShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
 - Comment
- c_TracerStation - feature to assist in underground utility tracing purposes
- c_TurnDown - A fitting that provides a vertical change in direction
 - Degree (dDegree)
 - SystemType (dcSystemType)

- c_Vault - underground box where underground fiber is spliced and rerouted
 - isConfined (dYesNo) [default to Yes] ◦ SystemType (dcSystemType)

Lines

- c_AerialCable - an above-ground communications cable suspended from utility poles
[Insertion point not at centroid]
 - CableMaterialType (dcCableMaterialType)
 - SystemType (dcSystemType) [Attribute managed as layers]
 - Fiber Optic
 - Copper
- c_DirectBuriedCable - a communications cable directly buried in the ground, with no conduit or ductbank present [Insertion point not at centroid]
 - CableMaterialType (dcCableMaterialType)
 - SystemType (dcSystemType) [Attribute managed as layers]
 - Fiber Optic
 - Copper
 - Depth
- c_DirectBuriedConduit - a conduit directly buried in the ground with no ductbank present. Block contains information for cables contained within. [Insertion point not at centroid]
 - ConduitTradeSize (dcConduitTradeSize)
 - hasTracer (dYesNo)
 - ConduitMaterialType (dcConduitMaterialType) ◦ Depth
 - CableMaterialType (dcCableMaterialType)
- c_Ductbank - groups of conduits designed to protect and consolidate cabling to and from buildings. Block also contains information for the conduits and cables contained within. [Insertion point not at centroid]
 - Depth
 - DuctbankMaterialType (dcDuctbankMaterialType)
 - hasTracer (dYesNo)
 - isConcreteEncased (dYesNo)
 - NumberConduits (dcNumberConduits)
 - ConduitTradeSize (dcConduitTradeSize)
 - ConduitMaterialType (dcConduitMaterialType)
 - NumberCables

- CableMaterialType (dcCableMaterialType)
- c_SupportStrand - a wire connecting two utility poles to support the weight of the communications cable [Insertion point not at centroid]

Polygons

- c_ManholeStructureArea - the footprint of a manhole structure

Shared Electric & Communications Features

Points

- ec_Pole - pole containing and supporting aboveground utility distribution
 - PSEG_ID - Identifier assigned by PSE&G
 - Class (decClass)
- ec_SurveyPoint - a location where a survey shot has been collected
 - Elevation – in NAVD88
 - Feature Type – the type of physical infrastructure for which a spot elevation is being collected
 - Shot Type (decShotType) - description of where the survey shot was taken relative to the infrastructure for which the data is being collected
 - Top of Pipe – measured at the top of pipe
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 - Markout Paint – measured at the finished ground surface, where markout paint mark is visible
 - Shot Source (decShotSource) – the type of equipment used to collect the survey points
 - Survey-Grade Equipment
 - Mapping-Grade Equipment
 - Survey Level
 - Hand Measurement
 - Comment

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