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SECTION 6: DIGITAL SUBMITTAL REQUIREMENTS FOR GIS MAPPING

6.1 - Introduction

District CAD (Computer-Aided-Drafting) standards are set in place to ensure that all CAD drafted design improvements performed by independent engineering consultants, contractors, and developers can be readily used and easily translated for the District's GIS (Geographic Information System) network.

Construction plans result from the work of many engineers, designers, specialists, and project managers working together in a cohesive team effort. Base maps may be utilized simultaneously by disciplines such as water design, sewer design, drainage design, roadway design, landscaping design, etc. All the disciplines of a project fit against the base map, making it possible to compare and complete various design elements in tandem. This ability to work concurrently depends on developing, maintaining, and employing CAD standards which ultimately optimize the export and import of data into GIS. The goals of maintaining coherence, minimizing wasted effort in recreating design, and maximizing the effectiveness of a project team are all best served by adhering to the CAD standard and following a typical drawing/data lifecycle workflow chart. Click here for the **Flow Chart.**

6.2 - CAD to GIS Data Conversion

The Santa Margarita Water District exports CAD data to GIS at the Pre-construction phase and following the approval of the Final Record Drawing phase as indicated in PART A, Section A-3.3 of the SMWD Design Criteria and Standard Drawings for Water and Sewer Facilities dated *Month Year*.

The Pre-construction GIS and Final Record GIS drawing(s) will be a stripped-down representation of the original AutoCAD Pre-construction or Record Drawing project design elements in Model Space with feature class attributed tables assigned per pre-defined target layers corresponding to the source GIS dataset. This process allows the ability to directly access and extract GIS data within AutoCAD and transfer it back into the Districts' GIS geodatabase without necessarily leaving the AutoCAD environment. This CAD to GIS interaction increases interoperability between the two platforms and complements the district's approach towards creating a comprehensive utility information database.

6.3 – ArcGIS for AutoCAD

Many CAD systems have GIS functionality, and many GIS applications can work with CAD data. Organizations continue to have both CAD and GIS systems being used in different groups with limited and very ineffective data sharing amongst them. These traditionally disparate systems are now bridging the gap and the creation of engineering documents between CAD and GIS is now more practical. The need to create an interface between CAD and GIS has catapulted **ArcGIS for AutoCAD** as the ideal example of an integrated system where the components of CAD design technology work with the GIS database. The incorporation of **ArcGIS for AutoCAD** at Santa Margarita Water District has provided a workflow for streamlining our CAD to GIS conversion

process through the ability of importing and editing a GIS dataset that has been extracted directly from our geodatabases and stored locally within the AutoCAD drawing environment.

ArcGIS for AutoCAD is a **free**, downloadable application installed as a plug-in for the AutoCAD platform and enables AutoCAD users to access GIS data directly inside the AutoCAD interface and provides tools for preparing native AutoCAD geometry as GIS ready feature classes. ArcGIS for AutoCAD is compatible with AutoCAD versions 2017-2021. Coordinate with your IT department to install **ArcGIS for AutoCAD** from the **ESRI** web site or click on the following link for additional information: **ArcGIS for AutoCAD | Free Plug-In for Interoperability Between AutoCAD & ArcGIS (esri.com)**

6.4 – General GIS Vocabulary for AutoCAD

Feature Class – named collection of geographic elements with the same geometry type (such as point, line, or polygon), the same attribute fields, and the same spatial reference.

Feature Class Layer – a container layer that holds a cartographic representation of data. It references specific feature class data and manages symbology and other visual characteristics.

Feature Class Table – a tabular container in the form of a table with fields and values that contain information about the geometry of the features.

Spatial Reference – a geographic coordinate system that locates a position in space and defines the relationship between locations (also referred to generically as a coordinate system).

Attribute Domains – rules that describe the values of a field type, providing a method for enforcing data integrity.

6.5 - AutoCAD Feature Class Dataset

A feature class dataset is a collection of related feature classes (objects) that share a common coordinate system and its contents can be linked to a geodatabase through a web or local GIS Service provider. Local domains and features are parts of an internal database (stored directly in the DWG file) that allow attributes to be retained in feature class tables that contain District applicable attribute fields/records to be populated with typical or specific values in any number of feature class tables. The GIS domain and feature class technology available through ArcGIS for AutoCAD is user-friendly, easy to use, easy to manage and extremely reliable with data transfer. For these reasons, **Feature Class** tables shall be added to each new Domestic Water, Recycled Water, Wastewater and Storm Drain facility feature (blocks, lines, and polylines) before any attributed features can be exported and considered for integration into the District GIS geodatabases. At pre-construction and at the end of the project (record drawing phase), District staff will verify the GIS composite plan view submitted drawing file(s) for data accuracy and compliance with PART A, Section A-3.3 of the SMWD Design Criteria and Standard Drawings for Water and Sewer Facilities dated *Month Year* before converting the submitted source data into a dataset compatible to the target schema for Domestic Water, Recycled Water, Wastewater, or Storm Drain systems in GIS.

6.6 – AutoCAD Feature Class Composite Plan View Base File Compatibility

The CAD drawing file(s) to be submitted for CAD to GIS data conversion may be created in most AutoCAD-based applications or ArcGIS for AutoCAD and must be updated for GIS purposes using the ArcGIS for AutoCAD plug-in. However, Civil 3D dynamic styles and features for design projects are not applicable or compatible to the District CAD to GIS conversion process. Therefore, those engineering firms utilizing Civil 3D for design purposes will need to create a static version of the design elements by either tracing over Civil 3D Horizontal Alignments with AutoCAD Polylines and substituting Civil 3D Structures with simple AutoCAD Blocks. You may Explode an AutoCAD Civil 3D drawing to an AutoCAD static drawing file at your discretion but do not include any Civil 3D Object Styles, Xrefs or Data Shortcuts with the CAD to GIS data conversion drawing file submittal. The release of ArcGIS Pro (ESRI registered GIS mapping product) does support direct read of AutoCAD Civil 3D objects which may be added to ArcGIS Pro as feature attributes mimicking design data properties from Civil 3D objects. Unfortunately, the latter is not compatible with the district's feature class structure or standard nomenclature of field and value identifiers.

Autodesk Revit BIM project files (*.rvt) are also not directly compatible to the current version of the ArcGIS for AutoCAD software. However, Revit does provide DWG compatibility using the Autodesk ObjectDBX toolkit. Utilize the Revit button > Export > and select export setup for either DXF or DWG formats.

6.7 – AutoCAD Feature Class Template and Prototype Drawings

The procedure outlined in upcoming section 6.18 utilizes a District supplied AutoCAD Feature Class Template drawing file with pre-defined Feature Class tables locally embedded within the native drawing file format. The given feature class tables were autogenerated within the AutoCAD environment using ArcGIS for AutoCAD when the domains (from District system geodatabases) were loaded through the Local GIS Map Service connection. The feature class tables come with default District assigned fields and values made suitable and available for immediate use after attaching feature class tables to your AutoCAD project geometry. Prototype drawing files with attached sample Feature Class tables are also available as an example of acceptable District GIS digital submittal requirements for the Pre-construction and Final Record Drawing Composite Plan View Submission. The District AutoCAD template and prototype drawing files (identified per District facility type) are available for download through the district web site. Click **here** to download and view the Feature Class Template and example Prototype Drawings.

6.8 – AutoCAD Feature Class User Implementation Drawings

AutoCAD example Prototype drawing files (*.dwg) and Template file (*.dwt) downloaded from Santa Margarita Water District web site are projected to the coordinate system indicated by the district. The downloadable blank Template file (SMWD-CADtoGIS-Template.dwt) contains all system-wide applicable District pre-defined feature class tables for Domestic Water, Recycled Water, Wastewater, and Storm Drain. Utilize the District supplied blank template file by inserting your own AutoCAD static design elements (not Civil 3D with dynamic components) into the blank template to depict your design elements with Feature Class tables. Then simply follow procedure to attach and edit Feature Class tables as outlined in upcoming sections 6.18a through 6.18b.

Inserting the District supplied Template file (*.dwt) as a drawing file into your original or copy of the design drawing file will not engage the Feature Class technology available through ArcGIS for AutoCAD. The local GIS service will be disconnected, and all domain and feature classes will not be available.

Submittal of user implementation CAD to GIS drawing file (AutoCAD Feature Class Composite Plan View Base File) shall be required to adhere to the coordinate projection as specified in PART A, Section A-3.3.6 of the SMWD Design Criteria and Standard Drawings for Water and Sewer Facilities dated *Month Year*.

6.9 - AutoCAD Objects Requiring GIS Data Conversion

Blocks, Lines/Polylines and Closed Polylines/Polygons are AutoCAD object types that may have attributed data which can be extracted to GIS. A general explanation of these object types interchangeable across AutoCAD and GIS platforms are as follows:

AutoCAD ***Objects*** (lines, arcs, polylines, and blocks) are equivalent to GIS ***Features*** (a cartographic point, line or polygon with a spatial location in the real-world landscape that can be used in GIS for storage, visualization and analysis).

AutoCAD ***Blocks*** (named groups of objects that act as a single object such as drawing symbols) are equivalent to GIS ***Points*** (discrete location on the earth's surface represented by an x-y coordinate). i.e., manholes, valves, hydrants, meters, fittings, catch basins, etc.

AutoCAD ***Lines*** (a segment with a start and an end point) and ***Polylines*** (connected sequence of line segments to create a single object) are equivalent to GIS ***Lines*** (vector lines used to represent the shape and location of geographic objects, such as pipelines and street centerlines). i.e., pipes, laterals, storm drain lines, etc.

AutoCAD closed ***Polylines/Polygons*** (irregular objects with closed boundaries) are equivalent to GIS ***Polygons*** (fully closed areas bound by straight line segments, arcs and curves created between vertices). i.e., footprint outline of vaults, pump stations, tanks, etc.

Additional classification details for object types and network connectivity purposes are defined in ensuing section 6.10 – General Drafting Capture Standards for AutoCAD GIS Data.

6.10 - General Drafting Capture Standards for AutoCAD GIS Data

All new utility infrastructure features, such as manholes, inlets, pipes, pump stations, valves, etc. must be drafted relative to the following GIS Data Capture Standards and in a manner that is consistent with current and future GIS atlas map guidelines.

All new utility features (AutoCAD objects) must be placed on their appropriate GIS feature class layers in Model Space to isolate and facilitate the conversion of CAD data to GIS. Included discipline target layers within the district supplied Template file correspond to the source feature geometrics in GIS. Therefore, each AutoCAD object type will be required to be assigned to its own specific layer in association with given predefined GIS Feature Class table names as identified in ensuing data capture standards sections 6.11 through 6.16 or per prototype drawing as indicated in preceding section 6.7.

All end user AutoCAD Blocks to be captured must be created on layer 0 using the Bylayer setting which allows all the block properties to default to the same properties as defined in the layer where the block resides. This will facilitate the use of feature class attribution and validate GIS integration.

Utility easements, pipe casings and pipe encasements shall be drawn as Closed Polylines with no two (2) segments intersecting each other. Use minimum width of 10 feet for casings.

Perimeter of building footprint (outer most wall) shall be drawn as Closed Polyline with no two (2) segments intersecting each other.

New SMWD property boundary lines shall be drawn as Closed Polylines and attributed with given survey information shown on plans.

The separation of Domestic Water, Recycled Water, Wastewater and Storm Drain GIS composite plan view base files into separate drawing files per corresponding District system is optional. Preferred GIS composite plan view base file submittal is one drawing file to include all District systems (when applicable) combined into the same Model Space. The latter submittal method reduces possible feature class duplication and makes it easier for District GIS staff to verify feature count during import process into District geodatabases.

A system of distinctive utility feature numbers (Entity ID) will be used by the district to code each utility feature with a unique identifier. This field value will be self-generated by the ArcGIS for AutoCAD software and coded by default. The ID value is read-only, is used for internal lists and processing for ArcGIS for AutoCAD, and it does not have much value other than to distinguish one entity from another in feature class tables.

All existing water facilities that were abandoned or removed shall be shown and captured on corresponding layers associated with feature class tables for *AbandonedLines* or *AbandonedPoints*.

Annotations and leaders corresponding to any related information depicted on the drawings (such as labels for pipe size, contract numbers, sewer rim elevation and invert) can be placed on the annotation layer comparable with the Digital GIS Data Model Reference Layer Names requirement noted in upcoming section 6.17.

Note: Annotations and Leaders will **NOT** be captured for GIS conversion due to current incompatibility and unreliable results. These components as well as other AutoCAD objects (such as Civil 3D elements) may be evaluated in the future assuming the recent announcement of partnership between ESRI and Autodesk will continue to provide AEC users with enhancements for sharing bi-directional data between two disparate graphical platforms and bridging the gap between BIM and GIS mapping technologies.

6.11 – Basemap GIS Data Capture Standards

Basemap line work (i.e., survey data) that form specific backgrounds for SMWD atlas grid maps shall be drawn and captured to ensure a seamless transition into District geodatabases.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD GIS geodatabases. **Do not Rename or Delete** any of the subject Feature Class layer names in the CAD to GIS Template since this will disconnect the association between Feature Class tables and Feature Class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per Feature Class table names as follows:

Feature Class table name	CAD Entity	Description
Building_Footprints	Closed Polyline	(Residential & Commercial bldgs not owned by SMWD)
County_TractMap	Closed Polyline	(County Tract boundaries)
District_Property	Closed Polyline	(SMWD owned Property boundaries)
Easements	Closed Polyline	(Utility Easements for Water, Sewer & Storm Drain)
SMWD_CountyStreets	Polyline	(Street centerline geometry for new developments)

6.12 - Domestic Water GIS Data Capture Standards

Domestic Water facility structures, line work and blocks shall be drawn and captured to ensure a seamless transition into the District's Domestic Water GIS geodatabase.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD Domestic Water GIS geodatabase. **Do not Rename or Delete** any of the subject Feature Class layer names in the CAD to GIS Template since this will disconnect the association between Feature Class tables and Feature Class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per Feature Class table names as follows:

Feature Class table name	CAD Entity	Description
wAbandonedLines	Polyline	(Abandoned Dom Water Mains, lats, CP lines)
wAbandonedPoints	Block	(Abandoned appurts, valve, fitting, pump, hydrant, etc.)
wCasing	Closed Polyline	(Pipe Casings & other containers around pipes)
*wControlValve*s	Block	(AV, BO, Altitude, BP, Check, Flow Cntrl, Press Red, etc.)
wCP_Line	Polyline	(Cath Protect-Tracer, ETS or Rectifier Wire Lines)
wCP_Point	Block	(CP Station, ETS, TWAS)
wFittings	Block	(Cap, Coupling, Cross, Reducer, Tap, Tee)
wHydrants	Block	(Water Fire Hydrants symbol only)
wLateralLines	Polyline	(Service connection lines)
wMains	Polyline	(Domestic Water Distribution Mains)
wManway	Block	(Hinged & bolted inspection Manway Access)

wNetworkStructures	Block	(Production Well, Meter Station for geometric network)
wPressReducStation	Block	(PRS symbol for geometric network, footprint NA)
wPump	Block	(Pump symbol only for each pump inside PS)
wPumpStation	Block	(Pump Station symbol for geometric network)
wReservoir	Block	(Reservoir symbol only, tank footprint NA)
wServiceConnection	Block	(Water Meters - single or multiple)
wStructure	Closed Polyline	(Structure outlines for Pump Sta, Meter Sta, Reservoir)
wSystemValves	Block	(Ball, Butterfly, Diaphragm, Gate)
wThrustBlock	Block	(Concrete Thrust Blocks to prevent movement)
wUnderGroundEnclosure	Closed Polyline	(Meter vault, Valve vault – underground only)

Domestic Water Mains: shall consist of continuous polylines and connection points split per the following conditions: Valve (always closed valve, i.e., pressure zone valves & pressure reducing valves), Fitting (Cross, Reducer, Tee, Cap), Pump, Treatment Plant, Tank, Reservoir, and Production Wells. Do not split water mains at System Valves (center of valve) that occur near street intersections. Do not split water mains at Laterals, only split at pipe intersections and if there is a change in diameter, material, or District Contract/Tract number. Capture new pipes in feature class table *wMains*. Capture abandoned pipes in feature class table *wAbandonedLines.*

Fire Hydrants: lateral connections to water mains require a gate valve on the lateral between the hydrant and connection to the water main. Use approximate location of valve as shown on recorded design plan (valve location will be adjusted by District after Record Drawing condition is confirmed). Capture the fire hydrant symbol in feature class table *wHydrants* and capture lateral connecting fire hydrant to main line in feature class table *wLateraLines*. Capture fire hydrant valve on lateral line in feature class table *wSystemValves* and do not split lateral at valve.

Manway: special entry access to main line pipes, vessels, or storage tanks for ease of inspection, maintenance, or cleaning purposes. Place a block representing a Manway Access assembly on the main line and capture in the feature class table *wManway*. Do not split water mains at center of manway access.

Network Structures: capture blocks (symbols) in the feature class table *wNetworkStructures* for Production Wells, Well Heads and Meter Stations. These components pertain to geometric networks to be included for modeling or analyzing purposes.

Pressure Reducing Stations: use closed polyline to represent the PRS building structure and capture in the feature class table *wStructure* and place PRS block (symbol) in the feature class table *wPressReducStation*. Place the PRS valves within the vault on main line and capture valves in the *wControlValves* or *wSystemValves* feature class tables. Split main line at beginning/end of the corresponding control valve where pressure is reduced from one zone to another.

Pump: detailed components inside a pump station building shall be required to be captured individually for network connectivity and future modeling purposes. Use a Pump block (representing each pump) and capture all the pumps in feature class table *wPump*. Capture all control valves (such as altitude, backflow preventor, flow control & pressure reducing) in feature class table *wControlValves*. Capture suction and discharge pipes inside pump station in feature class table *wMains* and split pipes at pump feature to isolate and allow for designation of suction and discharge pressure zones.

Pump Stations: capture all components inside a pump station building as one object (block) for geometric network purposes and place in feature class table *wPumpStation*. Capture perimeter of building footprint as closed polyline and place in feature class table *wStructure*. Capture suction pipe coming into the Pump Station object as one pipe. Capture the multiple discharge pipes going out of the Pump Station object as one pipe and place both suction and discharge pipes in feature class table *wMains.* Split pipes at pump station object (block) to isolate and allow for designation of suction and discharge pressure zones.

Reservoirs: place block at center of reservoir and connect water main to the block representing the reservoir. Capture the reservoir block (symbol) in feature class table *wReservoir* and place the footprint (perimeter of tank outline) in feature class table *wStructure*.

Thrust Blocks: concrete blocks are installed to prevent damage to pipes caused by unsupported pipe movement. Use a standard block symbol to represent a concrete thrust block and capture thrust block symbol in feature class table *wThrustBlock*.

Underground Vaults: use closed polyline to represent underground meter vault or valve vault and capture in the feature class table *wUnderGroundEnclosure*. Place pertinent valve features on the main segment that goes through the vault or on bypass segments as indicated on the record drawing plans.

Valve clusters: graphically place System Valves 7.5 feet from center of fitting to center of valve. This will allow adequate separation for viewing purposes and atlas map printing legibility. If a system valve is designed to be located just beyond the 7.5 feet threshold, then place valve at the recorded design plan station. Capture system valves in feature class table *wSystemValves*.

Water Service Connections: sometimes referred to as water meters. Capture water meter box as a block in feature class table *wServiceConnection* and laterals in feature class table *wLateralLines* at approximate locations by placing center of water meter block at end of service lateral. Water meter placement will be field verified in GIS by the District for final approval.

6.13 - Recycled Water GIS Data Capture Standards

Recycled Water facility structures, line work and blocks shall be drawn and captured to ensure a seamless transition into the District's Recycled Water GIS geodatabase.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD Recycled Water GIS geodatabase. **Do not Rename or Delete** any of the subject Feature Class layer names in the CAD to GIS Template since this will disconnect the association between Feature Class tables and Feature

Class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per feature class table names as follows:

Feature Class table name	CAD Entity	Description
rwAbandonedLine	Polyline	(Abandoned Recycled Water Distribution Mains)
rwAbandonedPoint	Block	(Abandoned appurts, valve, fitting, pump, etc.)
rwCasing	Closed Polyline	(Pipe Casings & other containers around pipes)
rwControlValve	Block	(AV, BO, Altitude, BP, Flow Control, Press Red)
rwCP_Line	Polyline	(Cathodic Protection Lateral Line)
rwCP_Point	Block	(CP Station, ETS, TWAS)
rwFittings	Block	(Cap, Coupling, Cross, Reducer, Tap, Tee)
rwLateralLines	Polyline	(Service connection lines)
rwMains	Polyline	(Recycled Water Distribution Mains)
rwManway	Block	(hinged & bolted inspection Manway Access)
rwNetworkStructures	Block	(Purification/Treatment Plant for geometric network)
rwPressureReducingStation	Block	(PRS symbol for geometric network, footprint NA)
rwPumps	Block	(Pump symbol only for each pump inside PS)
rwPumpStation	Block	(Pump Station symbol for geometric network)
rwReservoir	Block	(Reservoir symbol only, tank footprint NA)
rwServiceConnections	Block	(Recycled Water Irrigation Meters)
rwStructure	Closed Polyline	(Structure outlines for Pump Sta, Meter Sta, Reservoir)
rwSystemValves	Block	(Ball, Butterfly, Diaphragm, Gate)
rwThrustBlock	Block	(Concrete Thrust Blocks to prevent movement)
rwUnderGroundEnclosure	Closed Polyline	(Meter vault, Valve vault – underground only)

Recycled Water Mains: shall consist of continuous polylines and connection points split per the following conditions: Valve (always closed valve, i.e., pressure zone valves & pressure reducing valves), Fitting (Cross, Reducer, Tee, Cap), Pump, Treatment Plant, Tank and Reservoirs. Do not split water mains at System Valves (center of valve) that occur near street intersections. Do not split water mains at Laterals, only split at pipe intersections and if there is a change in diameter, material, or District Contract/Tract number. Capture new pipes in feature class table *rwMains*. Capture abandoned pipes in feature class table *rwAbandonedLine.*

Manway: special entry access to main line pipes, vessels, or storage tanks for ease of inspection, maintenance, or cleaning purposes. Place a block representing a Manway Access assembly on the main line and capture in the feature class table *rwManway*. Do not split water mains at center of manway access.

Network Structures: capture blocks (symbols) in this feature class table *rwNetworkStructures* for recycled water purification/treatment plants. These components pertain to geometric networks to be included for modeling or analyzing purposes.

Pressure Reducing Stations: use closed polyline to represent PRS building structure and capture in the feature class table *rwStructure* and place PRS block (symbol) on *rwPressureReducingStation*. Place PRS valves within the vault on main line and capture valves in the *rwControlValve* or *rwSystemValves* feature class tables. Split main line at the beginning/end of the corresponding control valve where pressure is reduced from one zone to another.

Pump Stations: detailed components inside a recycled water pump station building shall be required to be captured individually for network connectivity and future modeling purposes. Capture perimeter of building footprint as closed polyline and place in feature class table *rwStructure*. Use a Pump block (representing each pump) and capture all the pumps in feature class table *rwPumps*. Capture all control valves (such as altitude, backflow preventor, flow control & pressure reducing) in feature class table *rwControlValve*. Capture suction and discharge pipes inside pump station in feature class table *rwMains* and split pipes at pump feature to isolate and allow for designation of suction and discharge pressure zones

Reservoirs: place block at center of reservoir and connect recycled water main to the block representing the reservoir. Capture the reservoir block (symbol) in feature class table *rwReservoir* and place the footprint (perimeter of tank outline) in feature class table *rwStructure*.

Thrust Blocks: concrete blocks are installed to prevent damage to pipes caused by unsupported pipe movement. Use a standard block symbol to represent a concrete thrust block and capture thrust block symbol in feature class table *rwThrustBlock*.

Water Service Connections: sometimes referred to as water meters. Capture recycled water meter box in *rwServiceConnections* and laterals in *rwLateralLines* at approximate locations by placing center of water meter block at end of service lateral. Water meter placement will be field verified in GIS by the District for final approval.

Underground Vaults: use closed polyline to represent an underground meter vault or valve vault and capture on feature class table *rwUnderGroundEnclosure.* Place pertinent valve features on the main segment that goes through the vault or on bypass segments as indicated on the record drawing plans.

Valve clusters: graphically place System Valves 7.5 feet from center of fitting to center of valve. This will allow adequate separation for viewing purposes and atlas map printing legibility. If a system valve is designed to be located just beyond the 7.5 feet threshold, then place valve at the recorded design plan station. Capture system valves in feature class table *rwSystemValves*.

6.14 - Wastewater GIS Data Capture Standards

Wastewater facility structures, line work and blocks shall be drawn and captured to ensure a seamless transition into the District's Wastewater GIS geodatabase.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD Wastewater GIS geodatabase. **Do not Rename or Delete** any of the subject Feature Class layer names in the CAD to GIS Template since this will disconnect the association between Feature Class tables and Feature Class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per Feature Class table names as follows:

Feature Class table name	CAD Entity	Description
ssAband_Force_Mains	Polyline	(Abandoned Sewer Force Mains)
ssAband_GravityMain	Polyline	(Abandoned Sewer Gravity Mains)
ssCasing	Closed Polyline	(Pipe Casings & other containers around pipes)
ssCleanOut	Block	(Access points to clean out debris or blockages)
ssControlValves	Block	(Sewage Air Valve, Check, Plug)
ssFittings	Block	(Connection Coupling, Cap)
ssGravityMains	Polyline	(Sewer Gravity Mains)
ssGreaseInterceptors	Block	(Catch point for food-related grease, fats & oils)
ssLateralLines	Polyline	(Lateral Lines from cleanouts)
ssLiftStation	Block	(Sewer Lift Stations)
ssManholes	Block	(Junction that typically connects 2 or more pipes)
ssNetworkStructures	Block	(Lift Station, Treatment Plant, etc for geometric network)
ssPressurizedMains	Polyline	(Sewer Force Mains)
ssPump	Block	(Pump symbol only for each pump inside LS)
ssServiceConnections	Block	(Point where customer connects to main sewer)
ssStructure	Closed Polyline	(Structure outlines for Lift Stations)
ssThrustBlock	Block	(Concrete Thrust Blocks to prevent movement)
ssTreatmentPlant	Block	(Symbol to identify Treatment Plant)
ssUnderGroundEnclosure	Closed Polyline	(Access, Containment, Valve vaults – underground only)
ssValves	Block	(Valves to control flow - backflow/backwater)

Wastewater (Sewer) Gravity Mains: shall consist of continuous line segments or arcs (drawn as polylines) whose start (from) and end (to) line segment points are connected to structures (manholes). Sewer gravity mains between structures are to be drawn as a separate single-line entity between manholes, as opposed to double lines, or continuous polyline with multiple vertices running between two structures. The endpoints of sewer lines must be snapped to the endpoints of connecting lines, with a structure (point feature) being snapped to line endpoints. Do not split sewer gravity mains at System Valves (center of valve) or at Laterals where they connect to the main. Split line segments if there is a change in diameter, material, or District Contract/Tract number. **Note:** Direction of drawn lines representing gravity sewer lines (polylines) must match orientation of physical gravity flow from upstream towards downstream. Capture new sewer gravity pipes in feature class table *ssGravityMains*. Capture abandoned sewer gravity pipes in feature class table *ssAband_GravityMains*.

Wastewater (Sewer) Force Main pipes: shall consist of continuous connected multi-segment lines (polylines) with included bends and arcs as required. It is not required to place bends on feature class table *ssFittings*, only capture a fitting used to connect or cap a sewer main line. Only split force mains if there is a change in diameter, material, or District Contract/Tract number. Capture new sewer force main pipes in feature class table *ssPressurizedMains*. Capture abandoned sewer force main pipes in feature class table *ssAband_Force_Mains.*

Cleanouts: generally located at the upstream end of a sewer gravity main and sometimes on laterals near property lines. Locate cleanout block (symbol) at endpoints of lateral lines or on main lines and capture in feature class table *ssCleanOut*.

Control Valves: air control valves relieve the system of trapped air or vacuum; check valves are self-activating that permit liquids to flow in only one direction and plug valves provide tight shutoff. Capture these valves in feature class table *ssControlValves*.

Grease Interceptors: a device typically located outside of building designed to intercept grease and solids before they enter a wastewater disposal system. Newer systems are now located inside building. Capture as block and place in feature class table *ssGreaseInterceptors*.

Lateral Lines: small diameter pipes that run from the gravity main line to customer premises. Show sewer laterals only from main line to the property line and capture in feature class table *ssLateralLines*.

Lift Stations: detailed components inside a sewage lift station building will not be captured individually and only one feature will represent all these components. Use a lift station block (representing one of the sewage pumps) in the center of the closed polyline of the building footprint and connect sewer main to the lift station block at center of the lift station polygon (building footprint). Place Lift Station block (symbol) in feature class table *ssLiftStation*. Capture perimeter of building footprint as closed polyline and place in feature class *ssStructure.*

Manholes: a tube-type structure which connects underground pipes to the surface. Locate center of manhole at endpoint of line and use a circle defined as a block with pertinent manhole diameter as shown on design plans. Place in feature class table *ssManhole*.

Network Structures: capture blocks (symbols) in this feature class table ss*NetworkStructures* for wastewater lift stations or treatment plants. These components pertain to geometric networks to be included for modeling or analyzing purposes.

Service Connections: represent the point location where the sewer collection system meets the customer's sewer line. Use a block to represent this location (these representative points are most located at property line or right-of-way boundaries) and capture in feature class table *ssServiceConnections*.

System Valves: a device that is fitted to a pipeline primarily used to permit or prevent the flow of liquids. Often used to regulate pressure, isolate, throttle flow, prevent backflow/backwater, and relieve pressure. Capture these valves in feature class table *ssValves*.

Thrust Blocks: concrete blocks are installed to prevent damage to pipes caused by unsupported pipe movement. Use a standard block symbol to represent a concrete thrust block and capture thrust block symbol in feature class table ss*ThrustBlock*.

Vaults: use a closed polyline to represent an underground access vault, containment vault or valve vault and capture in the feature class table *ssUnderGroundEnclosure*. Place pertinent valve features on the main segment that goes through the vault structure or on bypass segments as indicated on the record drawing plans.

6.15 - Storm Drain GIS Data Capture Standards

Storm Drain facility structures, line work and blocks shall be drawn and captured to ensure a seamless transition into the District's Storm Drain GIS geodatabase. Storm Drain facilities are not maintained by the district and do require GIS capture to assist District staff in locating these facilities to prevent potential conflict with District water and sewer utilities. Incorporating storm drains into GIS will also aid in the tracing and containment of possible spills deriving from District facilities.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD Storm Drain GIS geodatabase. **Do not Rename or Delete** any of the subject Feature Class layer names in the CAD to GIS Template since this will disconnect the association between Feature Class tables and feature class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per Feature Class table names as follows:

Feature Class table name	CAD Entity	Notes
sdCasing	Closed Polyline	(Pipe Casings & other containers around pipes)
sdCleanOut	Block	(Access points to clean out debris or blockages)
sdControlValves	Block	(Flap Gate Valves – allow storm water flow)
sdCulvert	Polyline	(Short run of SD pipe crossing underneath road)
sdDetention	Closed Polyline	(Detention/Retention Ponds-flood control measures)

sdDischargePoint	Block	(Storm Drain Outlet at Discharge Point)
sdDissipator	Block	(Spillway, Energy Dissipator, Headwall)
sdDownDrainPipe	Block	(Drain grate at low points of terrace drains)
sdFitting	Block	(Bends, End Caps)
sdInlets	Block	(Catch Basins, Drop Inlet, Grate Inlet, Conc Collar)
sdManholes	Block	(Feature that connects two or more pipes)
sdNetworkStructures	Block	(Storm Drain Pump symbol)
sdOpenDrains	Polyline	(Open Channel Storm Drains, Ditches)
sdPipe	Polyline	(All Storm Drain Pipes – Gravity, Force Main, Laterals)
sdRipRap	Block	(Barrier/Breakwater Rocks for erosion control)
sdRiser	Block	(Storm Drain Riser)
sdSystemValves	Block	(Swing Check Valves)
sdWeirStructure	Block	(Walls to alter flow of SD water, prevent flooding)

Storm Drain Gravity Pipes: shall consist of continuous line segments or arcs whose start (from) and end (to) line segment points are connected to structures (manholes). Storm drain gravity mains between structures are to be drawn as a separate single-line entity between manholes (as opposed to double lines), or continuous polyline with multiple vertices running between two structures. The endpoints of storm drain lines or open channel lines must be snapped to the endpoints of connecting lines, with a structure (point feature) being snapped to line endpoints. Do not split storm drain gravity mains at System Valves (center of valve) or at Laterals where they connect to the main. Split line segments if there is a change in diameter, material, or District Contract/Tract number. **Note:** Direction of drawn lines representing gravity storm drain lines must match orientation of physical gravity flow from upstream towards downstream. Capture storm drain lines in feature class *sdPipe*.

Storm Drain Force Main Pipes: shall consist of continuous connected multi-segment lines (polylines) with included bends and arcs as required. It is not required to place bends on feature class table *sdFitting*, only capture a fitting used to connect or cap a storm drain line. Only split storm water force mains if there is a change in diameter, material, or District Contract/Tract number. Capture storm water force main pipes in feature class table *sdPipe*.

Storm Drain Lateral Lines: pipes that run from inlets (such as catch basins) to storm drain structures or gravity storm drain main lines. Lateral lines are to be drawn (as polylilnes) from center of catch basin to center of storm drain structure or connect to a storm drain main line. Capture storm drain lateral lines in feature class table *sdPipe* and catch basins/inlets in feature class table *sdInlets*.

Storm Drain Manholes: manhole/junction structure insertion point shall be center of manhole and not center of manhole lid. Storm drain lines (Invert in) shall end at center of manhole box, and storm drain lines (Invert out) shall begin at center of manhole box. Place manhole box (block) in feature class table *sdManholes*.

Storm Drain Pump Stations: detailed components inside a storm water pump station building will not be captured individually and only one feature will represent all these components. Capture perimeter of building footprint as closed polyline and place in feature class table *Building_Footprints*. Use a pump station block (representing one of the storm water pumps) in the center of the closed polyline of the building footprint and connect storm drain main to the pump station block at center of the pump station polygon (building footprint). Place Pump Station block (symbol) in feature class table *sdNetworkStructures*.

6.16 - Private Fire Water GIS Data Capture Standards

Private Fire Water facilities located only within District water utility easement lines shall be drawn and captured to ensure a seamless transition into the District's Domestic Water GIS geodatabase.

All Feature Class table layer names in the district supplied CAD to GIS Template are assigned per pre-defined target layers extracted directly from the SMWD Domestic Water GIS geodatabase. **Do not Rename or Delete** any of the subject Feature Class layer names in the prototype CAD to GIS Template since this will disconnect the association between Feature Class tables and Feature Class layers. Feature attributes for AutoCAD drawing objects are required to be defined in the AutoCAD drawing file per Feature Class table names as follows:

Feature Class table name	CAD Entity	Description
wHydrants	Block	(Pvt Fire Water Hydrant symbol only)
wLateralLines	Polyline	(Pvt Fire Water Hydrant Laterals)
wMains	Polyline	(Pvt Fire Water Distribution Mains)
wSystemValves	Block	(Pvt Fire Water Detector Check, Gate, Post Indicator)
wThrustBlock	Block	(Pvt Fire Water Concrete Thrust Blocks)

Private Fire Water Hydrants: lateral connections to private fire water mains require a gate valve on the lateral between the hydrant and connection to the fire water main. Use approximate location of valve as shown on recorded design plan (valve location will be adjusted by District after Record Drawing condition is confirmed). Capture the fire hydrant symbol in feature class table *wHydrants* and capture lateral connecting fire hydrant to main line in feature class table *wLateraLines*. Capture fire hydrant valve on lateral line in feature class table *wSystemValves* and do not split lateral at valve. **Notes**: 1. Capture private Fire Hydrants when located within District easement and if not already captured in Domestic Water system. 2. Use the "**Asset Owner**" field with a domain attribute value set to "**Private**" within the subject feature class tables.

Private Fire Water Mains: shall consist of continuous polylines and connection points split per the following conditions: Fittings (Cross, Reducer, Tee). Do not split water mains at System Valves

(center of valve) that occur near street intersections. Do not split water mains at Laterals, only split at pipe intersections and if there is a change in diameter, material, or Tract number. Capture pipes in feature class table *wMains*. **Note:** Use the "**Asset Owner**" field with a domain attribute value set to "**Private**" within the subject feature class table.

Private Fire Water System Valves: graphically place Valves 7.5 feet from center of fitting to center of valve when applicable per Record Drawing plan. This will allow adequate separation for viewing purposes and atlas map printing legibility. If a valve is designed to be located just beyond the 7.5 feet threshold, then place valve at the Record Drawing design plan location. Capture valves in feature class table *wSystemValves*. Note: detector check assemblies are typically constructed and captured with the Domestic Water system. Final detector check placement will be field verified in GIS by the District. **Note:** Use the "**Asset Owner**" field with a domain attribute value set to "**Private**" within the subject feature class table.

Private Fire Water Thrust Blocks: concrete blocks are installed to prevent damage to pipes caused by unsupported pipe movement. Use a standard block symbol to represent a concrete thrust block and capture thrust block symbol in feature class table *wThrustBlock*. **Note:** Use the "**Asset Owner**" field with a domain attribute value set to "**Private**" within the subject feature class table.

6.17 – AutoCAD GIS Data Model Reference Layer Names

This section defines reference layer names to be utilized for static objects and annotations that do not require GIS attribute data capture for AutoCAD files to be submitted for GIS data conversion. The layer name convention for static reference objects closely follows the guidelines set forth by District CAD standards and NCS (National Cad Standards) version 4.0 except for the suffix (*_STATIC) added to the end of each reference layer name. All reference facility layers may not be included in this section. Therefore, adding or revising reference layer names (for static objects only) may be necessary to convey unique drawing elements or design methods. Supplementary layers for other static objects must be consistent with the following District CAD to GIS layer format.

Proposed **Domestic Water** Facilities – New (for reference only)

Layer Name	Color	Linetype	Description
C-DWTR-ANNO-LABL-N_STATIC	1	Continuous	Static Annotations
C-DWTR-ANNO-LDRS-N_STATIC	1	Continuous	Static Annotation Leaders

Proposed **Recycled Water** Facilities – New (for reference only)

Layer Name	Color	Linetype	Description
C-RWTR-ANNO-LABL-N_STATIC	203	Continuous	Static Annotations
C-RWTR-ANNO-LDRS-N_STATIC	203	Continuous	Static Annotation Leaders

Proposed **Wastewater** Facilities – New (for reference only)

Layer Name	Color	Linetype	Description
C-SSWR-ANNO-LABL-N_STATIC	82	Continuous	Static Annotations
C-SSWR-ANNO-LDRS-N_STATIC	82	Continuous	Static Annotation Leaders

Proposed **Storm Drain** Facilities – New (for reference only)

Layer Name	Color	Linetype	Description
C-STRM-ANNO-LABL-N_STATIC	144	Continuous	Static Annotations
C-STRM-ANNO-LDRS-N_STATIC	144	Continuous	Static Annotation Leaders

6.18 – ArcGIS for AutoCAD Procedure

Once the **ArcGIS for AutoCAD** plug-in has been successfully installed, launch your Autodesk application (AutoCAD, AutoCAD Map 3D or Civil 3D) and open one of the example prototype drawing files to view a sample Pilot area for the applicable District system. Review the included Pilot area and use the provided elements as a reference guide to replicate the CAD to GIS attribute task within the AutoCAD Feature Class Composite Plan View Base drawing file that will eventually be submitted to the Santa Margarita Water District.

Load the District supplied blank Template file (SMWD-CADtoGIS-Template.dwt) to begin your CAD to GIS attribute task. The Template has built-in layers that are associated with Feature Classes. Each predefined layer is tied to its' relevant Feature Class. Therefore, the available Feature Class table names are identical to the given Feature Class layer names. ArcGIS for AutoCAD utilizes the Feature Class to Layer Name method to ensure synchronization back to our system geodatabases through a GIS Feature Service. It is imperative that given Feature Class layer names are **NOT renamed or deleted** to prevent data loss or intervention when District GIS staff migrate your submitted feature class dataset from the drawing file back to the geodatabase.

Insert, copy, or draw your design elements on the appropriate Feature Class layers per pertinent District system data capture standards as defined in preceding sections 6.11 through 6.16. Use the Properties dialog box, MATCHPROP, or other Change Properties command to place objects that are already drawn on different layers onto the pertinent Feature Class layer names.

6.18a – Add & Edit Feature Class Table for AutoCAD Objects

1. Click on the ArcGIS ribbon tab to activate **ArcGIS** module (typical installation will place the tab at end of existing ribbon tab layout). Set your Feature Class layer current using Layer Manager or toggle on Contents from the Contents ribbon group tab by double-clicking Feature Class table to highlight selection where the object belongs.

Note: Setting the current Feature Class is optional if all objects are assigned to the correct Feature Class layer name (setting Layer current makes good practice and will lead to a desired result).

2. To begin Feature Class assignment, click on the **Identify Features** icon  in the Edit group of the ArcGIS ribbon and select the object that requires Feature Class table assignment. You may click one at a time, click one after another, or use Window to select multiple objects. Press <enter> after completed selection and the ArcGIS plug-in software will automatically add Feature Attribute tables to each selected object.

3. The **Attribute Editor** dialog box will appear identifying the corresponding Feature Layer and the number of features found. Fields are listed on the left side of the pane with adjacent cell Values to the right.

Notes:

The *Feature Attributes* dialog box will only appear when objects are successfully assigned with Feature Class tables. Objects not properly placed on correct Feature Class table Layer name will not be assigned.

If a single object was selected during Feature Class assignment, edit Field Values by clicking in the Value cell and type in pertinent value or use the toggle-down option and select one the available District default values (click here to access the **District GIS Attribute Requirements Checklist**).

If multiple objects were selected during Feature Class assignment, you may simultaneously edit field values that are common amongst all or several of the selected objects (i.e., all or several pipes that are the same size and material).

The AutoCAD Copy command may be utilized to copy an attributed object of similar characteristics to another location. The Copy command does not create a duplicate Facility ID field (EntityName) of selected object. Therefore, you can edit the attributes of the copied object independent of the original source object without compromising the integrity of the feature class technology.

Once an object (such as a drawn AutoCAD Line) is assigned and attributed using the **Identify Features** icon, the object shall not be converted into a Polyline. The PEDIT command may cause the Value attributes to change back to default empty placeholders. The same goes for Exploding a Polyline into a Line after the Polyline has been assigned and attributed. It is best practice to convert all AutoCAD Lines to Polylines for consistency purposes.

Click on Apply edits once you have completed editing the feature Values and Save Down periodically to ensure your feature class attribution task is recorded.

6.18b – View Attributes in Table form

A table containing a list of geographic features assigned per Feature Class layer may be viewed to check feature class attribution. The attribute table is arranged so that each row represents a feature, and each column represents one feature attribute.

1. Go to Contents and right-click on a Feature Class table name and select Attribute Table or double-click the Feature Class table to expand and select the Attribute Table  icon. The Attribute Table dialog box will appear depicting all features assigned per Feature Class. Check all your assigned features for consistency and edit features in the Attribute Table by clicking in the desired field value and adjusting values if needed.

6.19 – CAD to GIS Digital Submittal

Submit USB flash drive containing composite plan view submission (AutoCAD GIS drawing file) to SMWD Engineering Department or provide a link to download same from trusted and secure data centers. Refer to PART A, Section A-3.3 of the SMWD Design Criteria and Standard Drawings for Water and Sewer Facilities dated *Month Year* for additional CAD/GIS digital submittal requirements.

Note: All digital record drawing submittals to SMWD shall not be password protected. The additional step of securing files is not recommended, and it is imperative that SMWD have full access to submitted information.