



CAD & GIS ELECTRONIC DATA REQUIREMENTS

In order for projects to be more seamless and consistent, it is important that the method of drafting and structure of the drawing be standardized. As well, this will facilitate electronic data transfer with the employment of the following guidelines for standardization. These standards will be practiced to all applicable projects. If there may be instances where a variance from these GIS standards will provide more flexibility, approval must be received from South Adams County Water & Sanitations District (SACWSD) GISoffice. Check with SACWSD's GIS Supervisor. Submitted Electronic Data (GIS Shapefiles .shp, PDF's .pdf, CAD .dwg, etc.) drawings shall meet digital electronic data requirements, standards and specifications: detailed in SACWSD's [DesignStandards and Specifications](#) as well as all requirements listed within the CAD/GIS As-built Standards along with the digital submittal requirements of the SACWSD GISoffice. The Contractor shall be responsible for recording all field changes to the approved documents and the conveying of this information to the Design Engineers for the purposes of preparing Record Documents as required by the District.

Requirements for submitting GIS data: for AutoCAD/Civil 3D:

- Plans need compliance with:
 - SACWSD's Design Standards and Specifications
 - CAD/GIS As-built Standards
 - SACWSD GISoffice
 - Plans must be projected in the appropriate Projection / Coordinate system
 - SACWSD uses the following projection / Coordinates:
 - all three listed below equal the same coordinate system, just different ways to identify them-
 - North American Datum
 - NAD1983 State Plane Colorado Central FIPS 0502 (US Feet)**
 - also called, **ESRI Projection 102654** - NAD 1983 State Plane CO Central FIPS 0502 Feet
 - specifics:
 - PROJCS["NAD_1983_StatePlane_Colorado_Central_FIPS_0502_Feet",
 - GEOGCS["GCS_North_American_1983",
 - DATUM["North_American_Datum_1983",
 - SPHEROID["GRS_1980",6378137,298.257222101]],
 - PRIMEM["Greenwich",0],
 - UNIT["Degree",0.017453292519943295]],
 - PROJECTION["Lambert_Conformal_Conic_2SP"],
 - PARAMETER["False_Easting",3000000.000316083],
 - PARAMETER["False_Northing",999999.999996],
 - PARAMETER["Central_Meridian",-105.5],
 - PARAMETER["Standard_Parallel_1",38.45],
 - PARAMETER["Standard_Parallel_2",39.75],
 - PARAMETER["Latitude_Of_Origin",37.83333333333334],
 - UNIT["Foot_US",0.30480060960121924],
 - AUTHORITY["EPSG","102654"]]
 - Well-Known ID (**WKID**):
 - also called, **WKID 2232**
 - EPSG:2232: NAD83 / Colorado Central (ftUS)
 - EPSG is the European Petroleum Survey Group
 - WGS84 Bounds: -109.0500, 38.1400, -102.0500, 40.0900
 - Projected Bounds: 1979149.7191, 1130530.2041, 3992107.9609, 1841334.1528
 - Area: USA - Colorado - SPCS – C
- When you begin a CAD drawing, assign the coordinate system from the beginning.
 - In Civil 3D go to the Map Setup tab, then select Assign.
 - In the search bar you can search using Colorado
 - The coordinate system is NAD 1983 State Plane Colorado Central FIPS 0502 (US Feet).
 - The AutoCAD code is CO83-CF.

Objective: implementing a standardization method of drafting and structure of the digital drawing will facilitate electronic data transfer into GIS with the employment of the following guidelines for standardization.

Guidelines: Standard guidelines applicable to all projects--variance from these standards, approval must be received from SACWSD GIS Office. Check with SACWSD's GIS Supervisor.

- Submitted Electronic Data (CAD, GIS, PDF's, etc.) drawings shall meet requirements and specifications as detailed in SACWSD's [Design Standards and Specifications](#) as well as all requirements listed within the CAD/GIS As-built Standards.

Commerce City uses a modified projection

all electronic data must be in our projection

Contact the GIS Department if you would like projected parcel data to help align your project.

➤ **Line work design needs to be exported using polylines, points, & polygons.**

GIS data can only be submitted in one of 3 ways: **point layer, line layer, and polygon layer.**

Designating objects for digital cartography and asset records in **3 types of shapefiles:**

Point: point features represent valves, hydrants, meters, etc, and they need to connect to the line(s) they are on and associated with, and point features need to be exported on a different **shapefile** than polylines. The points (i.e, valve, etc) will be on another **shapefile** but placed in the exact same location marked by coordinates of two (poly)lines in conjunction. This creates a junction for a valve, manhole, or other features represented by points. If the correct coordinate projection is not used then the results of digital data will be inaccurate.

Line: linear features are line work marking the edge line or a path line and should be in a polyline format. Using polylines will eliminate any unnecessary line breaks. Each line segment becomes a finished part of a larger polyline with many angles and segments. Polylines only break at recordable features like those examples, listed above, of point features.

Polylines: Polylines represent 'single lines' to the computer in GIS and CAD program files; however, a single polyline is a 'line' made up of many line segments connected and fused at various angles, like a pipeline network. Pipes between manholes can twist, turn but they represent a single polyline, unit of pipeline, a line only interrupted by other manholes, valves and such, is where a break between lines should occur.

Snapping: The digital representation of these (poly)lines that break at these points need to connect via "snapping" the end point of one line on the exact point that begins the next (poly)line.

Snapping is a term applied to digital design programs to identify the tool in the program that will treat the end of one line as a magnet to the end of another line once the endpoint is pulled towards another (poly)line endpoint, once it gets within so many pixels, snaps like a magnet, ensuring connection on a digitally microscopic level. Make sure to use your snapping tool when creating drawings.

Otherwise, without using a snapping tool then the alternative is to use the known coordinates of the juncture of two (poly)lines which must match the point feature at that connection point.

Polygon: polygons are multi-sided objects (like a rectangle, trapezoid, triangle, circle), features meant to be represented by a shape, such as a land parcels, district boundaries, or building outlines, etc. The shape that represents the outline of a floor plan requires a polygon formatted **shapefile**.

Parcels: Parcel & lot lines need to be included in the DWG export.

DWG: Dwg is important to include in the submission to the GISoffice, however, **first file format should be shapefiles exported from a DWG.**

South Adams County Water and Sanitation District reserves the right to decline **any** submittal due to **incompatibility issues.**

Flow Modeling:

In order to be able to model the flow and analyze the system, devise statistical summaries, then all (poly)lines must connect with other lines or polylines (unless they are a terminating line segment), and hence, all points must be placed on the juncture of these (poly)lines they associate. The only line breaks between polylines should be at tees, crosses, reducers, valves and other fittings of this nature that are required to be represented and exported onto a separate **shapefile exported** layer from CAD. In GIS, lines often are intended to chart flowing product or waste, these (poly)lines need to be digitally connected in order for those GIS procedures to be possible.

Shapefiles:

Lines are contained and exported as one **shapefile** layer and points as another, likewise another **shapefile** for polygon shape features. The coordinates of the point must match the coordinates of the two (poly)line endpoints that were connected and associated to the same exact coordinate. Endpoint of one (poly)line and end point of another need to have the same exact coordinates (decimal place accurate), as the point feature.

Block References & xrefs are not allowed.

Different pipe types need to be on their own layer and involving a separate **shapefile export**. Even though they are both linear features they represent different types of pipes, different assets. Individual layers (shapefiles) can be turned on and off in digital environments for mapping applications, analysis and queries can be performed on a specific asset's layer. Potable lines must be a separate **shapefile export** than irrigation lines and sewer lines, so forth.

DWG CAD Files:

In addition to the **shapefile** layers, South Adams County Water and Sanitation District will accept **Civil 3D® 2013 through 2017 .DWG file**. The .DWG file shall be free from any intelligent (proxy).

- If the submittal was created using a program other than AutoCAD® or Civil 3D® then the submitting organization is responsible for converting the file to a plain (no proxy) **Civil 3D® 2013 through 2017.DWG file** and **exporting the features as shapefiles**.

AutoCAD/Civil 3D

- When you begin a drawing assigned the coordinate system from the beginning. In Civil 3D go to the Map Setup tab, then select Assign. In the search bar you can search using Colorado –
 - Coordinate system we use is **NAD 1983 State Plane Colorado Central FIPS 0502 (US Feet)** the AutoCAD code is CO83-CF.
 - Commerce City uses a modified projection, **all electronic data must be in our projection.**

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Exports:

Point layer shape file for identifying non-linear features (example: valves, hydrants, manholes, etc.)

Lines, called (poly)lines, for all linear features. (example: Potable lines, Irrigation lines, Sewer lines— each system's lines go on separate shapefile exports.

Polygons are for contained shapes (example: outline of building).

- submitting organization is responsible for converting the file
- SACWSD reserves the right to decline **any** submittal due to incompatibility issues.

Convert the DWG to a GIS shapefile (.shp).

Please export the DWG GIS data as **shapefiles**. If the features need to be entered into GIS then export those. Lines must be on a separate **shapefile** versus point locations. Different types of system (Potable, Irrigation, Sewer) need to have different shapefiles.

How do I create a shapefile in AutoCAD?

1. Click Insert tab Import panel Map Import .
2. In the Import Location dialog box, under Files Of Type, select shp.
3. Select the file or folder to import.
4. Click OK.

How to export polylines as a shapefile in Civil 3D? Export polylines with attributes to a shapefile

1. MAPEXPORT at the command line. This will bring up the Export Location dialog box.
2. Export Location: Choose Files of type: ESRI **Shapefile**
3. OK in the Export Dialog box and a shapefile will be created, complete with GIS attribute data,

- ❖ submitting organization is responsible for converting the file
- ❖ SACWSD reserves the right to decline **any** submittal due to incompatibility issues.

Surveying & Record Drawings

- Surveying will be completed by a licensed surveyor, working for the Developer, Engineer, or Contractor, while the trench is open with the surveying tool touching the infrastructure.
- All fittings associated with the project (Tees, Bends, Valves, Taps, Pits, Service Lines, Manholes, Test Stations, Point of Commencement, Point of Beginning, Etc...) will be surveyed horizontally and vertically to the foundation of a building(s) when applicable. If there is a question contact the SACWSD GIS Office.
- Survey points will be used to create the Record Drawings. Record Drawings will reflect how the infrastructure was actually installed. Add Red lines to Record Drawings as necessary.
- SACWSD accepts Quality Level B or higher Record Drawings.
- Record Drawings must be approved before and initial walk and or TCO / CO can be given.
- All infrastructure needs to be labeled accordingly (Size, Material, Type, Angle, Rim Elevation, Invert In, Invert Out, Slope). Labels need to be legible and neat.

FROM APPENDIX A OF DESIGN STANDARDS AND SPECIFICATIONS

The Contractor shall be responsible for recording all field changes to the approved documents and the conveying of this information to the Design Engineer for the purposes of preparing Record Documents as required by the district.

STANDARDS FOR SUBMITTING ELECTRONIC DRAWING FILES**FOR APPROVED RECORD WATER AND WASTEWATER PLANS****PRIMARY PURPOSE:**

Electronic file submittal standards and data standards were developed to facilitate the smooth integration of digital information into the District's Geographic Information System (GIS) datasets. This document is intended to provide guidance for electronic files submitted to the South Adams County Water & Sanitation District and are deemed necessary in order to establish electronic file submittal standards that:

1. Result in reliable mapping that clearly displays parcel boundaries, the District's legal boundaries, and the District's water and sewer facilities.
2. Reduce the labor and cost of updating District maps with information submitted by developers.
3. Enable the District to establish graphical relationships to parcel addresses, tax identification numbers, and the District's account numbers.

COORDINATE SYSTEM:

The District's base maps have been registered to the Colorado State Plane, Central Zone coordinate system, North American Datum (NAD) 1983, in feet. As a matter of data exchange policy, the District requires that all data must be projected as such.

Submittals that do not adhere to these guidelines, or are provided in a relative coordinate system with arbitrary origin and no projection, will not be considered and must be resubmitted.

DRAWING STANDARDS AND NAMING CONVENTIONS:

The District requests that the maps provided by developers be in both GIS shapefile, as well as, AutoCAD 14 or higher drawing file format (DWG), and that the information in the drawings be organized according to the standards established in this document. Platted property data, street centerlines and edge of pavement lines, water mains and appurtenances, and sewer mains and appurtenances shall be submitted in separate drawing files as follows:

Record drawings showing all changes from the approved construction drawings shall be submitted to the District prior to the initiation of the required warranty period of two years as defined in SACWSD's "Grant Of Acceptance Of Utilities Agreement". The record drawings will consist of a marked-up set of "Issued For Construction" drawings verifying the following:

Record drawings contain:

- All lengths, sizes, and materials of installed pipe, fittings, manholes, and any other improvement.
- Horizontal locations either by Station and Offset, or by Northing and Easting Coordinates of all manholes, bends, cleanouts, valves, taps, wyes, stubs, plugs, tees, etc.
- Invert elevations of all sanitary manholes, inlets, outlets, stub ends, top of pipe, finished rim elevation, and bottom of pipe elevations of each utility crossing, etc.
- The constructed slope of sanitary sewer pipes between manholes and structures.
- Top of pipe elevations at regular intervals and/or fittings for water lines.
- Any other variations from the construction documents must be clearly noted and detailed on the plans.
- The As-Built drawings are to be provided and stamped/signed and dated by a Colorado registered Professional Land Surveyor.
- Electronic files as outlined in the Districts Standards, Specifications are to be submitted, along with a PDF, and a hardcopy set.