

Chapter 9 – Design Guides

9.11 CIVIL AND SITE GUIDE

9.11.3 SURVEY STANDARDS

A. INTRODUCTION

1. Surveys required for OGS projects consist of 2 general types: Topographic and utility surveys, and Property/Boundary surveys. These surveys are typically obtained through Term Assignment to Consultant firms that perform surveying as their primary professional service, or multi-discipline firms with licensed survey staff.
2. Surveys are one of the initial requirements for all projects involving site development or underground utility infrastructure upgrades. As such, survey assignments must be performed in an expeditious manner once assigned, and must conform to all standards defined in this document for survey procedures and output of final deliverables.

B. PROCEDURES FOR NEW PROJECTS

1. ALL Survey work will be coordinated through the PM.
2. Survey information can be obtained by one of the following methods:
 - a. The PM requests survey information from BU2. A Survey Coordinator within BU2 will then contract the needed work through one of OGS's Survey Term Service Agreements.
 - b. The PM obtains the required survey information via term assignment through one of OGS's Survey Term Service Agreements.
 - c. The PM or a Surveyor Coordinator within BU2 obtains the survey information from a sub-consultant to an A/E or E/A Consultant Term or a Stand-Alone Contract. While this is the least preferred method to obtain survey information, if it is used, the surveyor shall still adhere to the standards listed in this Section. The OGS PM should still check with BU2 to see if historical survey information exists for their project area.
3. The PM is responsible for getting survey information and researching existing survey information as required for their project.
 - a. Requests for a survey should occur during the project's initial development.
 - b. Survey information may already exist for the project.
 - 1) Research of Existing/Historical Data: OGS BU2 has existing survey information for all agencies (Correctional Facilities, State Hospitals, DOT Facilities, etc.). PMs should check with BU2 and review existing information before ordering a new survey.
 - 2) If a new survey is required: PMs are encouraged to talk to BU2 to review appropriate survey methods, coordinate other survey work that

may be ongoing within a particular facility, and/or review consultant fee proposals.

4. Survey Record Closeout: All final surveys shall be prepared, stamped, signed, and submitted by a licensed land surveyor.
 - a. Electronic and paper copies of Final Surveys and all survey related information shall be provided to BU2 for inclusion in the Electronic FacilityInfo Folder and permanent survey files.

C. STANDARDS:

1. **Legend and Symbols:** Symbols to be used on surveys for utilities, contours, buildings, property lines, etc., shall conform to those in use by OGS. A legend of standard symbols will be provided. Any deviation from the standard symbols shall be approved prior to use on any maps submitted. If additional symbols are required, include the symbol and description in the Legend of the survey. Surveys not conforming to the established standards shall be returned for correction at no cost to the State.
2. **Digital Files:** Design and Construction has established a standard Legend (symbols, line styles, etc.), Layering System (names, colors, line types, etc.), and Plotting Format for surveys submitted in digital format. These standards are derived from the National CADD Standards. Due to the variety of CADD systems in use by OGS and its Consultants, strict adherence to these standards is mandatory. Surveys not conforming to the digital standards will be returned for correction, at no additional cost to the State. Digital copies of all standards will be furnished prior to the first assignment.
 - a. In general, surveys will be incorporated as background reference (XREF) for design drawings produced by the State or one of its Consultants, and will not be modified.
 - b. The Model Space file is the only format of the digital survey file which will be used for design documents. In addition to the survey data, include in Model Space the Legend, Graphic Scale, North Arrow, tie point information, and General Survey Notes specific to the survey being submitted. Do NOT include title blocks, borders, company logos, match lines, generic disclaimers, or other extraneous information in the Model Space view of the survey.
 - c. Paper Space (Layout Tab) files will only be required for those surveys intended to be plotted and distributed in a Paper or Mylar format. The requirements for Layout Tabs will be specified for those surveys whenever required.

D. TOPOGRAPHIC AND UTILITY SURVEY

1. **General Requirements:** The maps shall contain, in proper position, with their proper names (where applicable) all topographic, cultural and relief features located within the survey area including, but not limited to:
 - a. Boundary lines (Federal, State, Municipal, Local, Parks logged off areas, Woods, etc.)

- b. Individual property lines and property line markers (found).
- c. Buildings, including Name and Building Number.
- d. Building floor elevations (primary floor elevation, and elevations at all openings; spot elevations at all building corners).
- e. Cemeteries.
- f. Contours, spot elevations.
- g. Curbing.
- h. Paving, including composition (i.e., gravel, asphalt, concrete, etc.).
- i. Highways, streets and roads, including composition (i.e., gravel, asphalt, concrete, etc.).
- j. Parking lot striping.
- k. Flood plains, Marshes, swamps, bogs, wetlands.
- l. Mines, Borrow pits, quarries.
- m. Overhead utility lines and utility poles, including name and number where possible.
- n. Underground utilities and associated structures [See requirements in 3) below].
- o. Drainage ways, swales.
- p. Signage – include symbol only, (text on sign not required to record).
- q. Railroads.
- r. Rock outcrops.
- s. Structures, besides buildings; structures include such items as: Bridges, Culverts, Trestles, Piers, Retaining walls, Dams, Transformer and other substations, Airfields, and Oil, water and other storage tanks.
- t. Trails.
- u. Trees (include size, species and diameter of crown).
- v. Tunnels (height, width, type, elevation).
- w. Vegetation (woods lines, orchards, hedgerows, etc.).
- x. Water bodies (canals, rivers, streams, ponds, reservoirs, etc.).
- y. At secure Facilities locate and identify all security related features (fences, gates, microwave, CCTV, etc.).
- z. Other similar details of land use or physical features identified as to size and type.
- aa. Other topographic features which may be unique to the survey area.

2. Buildings:

- a. Buildings and similar dimensioned objects shall be correctly oriented and shown to scale.
- b. Building outline indicated shall be the exterior building wall, not the roof overhang.
- c. Indicate the Building Name, Number and primary Floor Elevation. Indicate also the first floor elevation at all building entrances, and spot elevations at all building corners, steps, window wells, areaways, and ramps. Include basement elevations when required.
- d. Hatching of building; use minimal amount to depict shape of building.

3. Utilities:

- a. Indicate all underground utilities and structures. Include size and material of lines (6" PVC, 12" DIP, etc.) and type of structures (manhole, catch basin, hydrant, valve, signal manhole, etc.).
- b. Sanitary and Storm: Indicate rim and invert elevations of all sanitary and storm sewers at each structure, and inverts at exit point from buildings. If required for clarity, and when directed in the assignment, include plan sketch of sanitary and storm structures showing the location, size, and inverts of all pipes.
- c. Electric and Signal: Remove covers of all electric and signal manholes and structures, and record size of structures and configurations of conduits and/or conductors. Include this information for each structure in sketch format conforming to the example provided. If structures are full of water, make arrangements with Facility to pump out all water. If the Facility is unable to perform the pumping, it may be necessary to employ a company to provide this service. Approval for this additional service must be obtained prior to initiating the work.
- d. Where utilities are shown from record information, indicate source of data, and record on plans.
- e. In those cases where underground utilities cannot be verified by field survey or record data, it may be necessary to employ a utility location service to determine the existence/location of buried utilities. Approval for use of such services shall be requested and granted prior to assignment of any work.

4. Security Features:

- a. Locate and identify all elements of the perimeter security systems, including but not limited to:
 - 1) Perimeter fences (include type, height, number and size of security coils).
 - 2) Gate locations, including size, type and swing direction, with gate number when possible.
 - 3) Electronic security components on fences or between fences (light poles, CCTV poles, FAS boxes, microwave, infrared, intercom stations, sensor cable, etc.).
 - 4) Include information on any labels specifically attached to equipment, poles, etc. as identifying reference.
- b. Within secure facilities the covers of underground utility structures may be locked or sealed shut. Make all necessary arrangements with Facility personnel to open secure covers. If the number of locked/secure structures is extensive, coordinate with the Facility and establish specific utility locations and time periods during which structures will be opened and made available for survey.

5. Vertical Control:

- a. Topographic surveys of new property parcels shall be based on North American Vertical Datum of 1988 (NAVD88), unless otherwise approved.
- b. Surveys at existing facilities shall be referenced to local facility datum, unless otherwise directed. Source of local datum will be provided by OGS from record information. Verify local datum before proceeding with the work.

provide for readability of contours at match lines of adjacent sheets in Layout Space.

- d. Show elevations at all building corners and entrances, centerline and edges of paving, top and bottom of curbs and walls, top and toe of slopes and swales, and at sufficient locations in open areas of the site to accurately define grades and drainage patterns.

10. Wetlands:

- a. Wetlands encountered on a site will be delineated by OGS Environmental Permit staff or an assigned consultant. If delineation is performed prior to the survey, record locations of all "flagging", and notations included on the flagging. If delineation is performed after completion of the survey, a GPS point file or AutoCAD block depicting the outlines of the delineated areas will be provided for insertion into the survey at the coordinates noted.

11. Deliverables:

- a. All surveys shall be submitted as digital Model Space files in AutoCAD "DWG" format, in the version of AutoCAD currently in use by the State. The initial survey file may be submitted by email. Once approved, the final survey map shall be submitted on CD-ROM, with a printed label identifying the Facility, Map/Drawing title, date, and name of the firm.
- b. If plotted maps, or electronic Plot Sheets are required, the specifics will be included in the assignment. A standard digital sheet, with borders, title block, etc. will be provided. If the survey exceeds a single sheet when plotted on a standard 24" x 36" sheet, provide a separate electronic .DWG file with the OGS border sheet, and individual layout TABS for each plot sheet. The number assigned to each plot sheet shall begin with VF-1, VF-2, etc. The overall total survey shall remain a single file referenced in Model Space.
- c. **Match Lines:** If the map exceeds the standard drawing size, match lines shall be provided for the plot sheets, ½" from, and parallel to the border on all sides. All work on the sheet shall extend to the match lines. Show a key on each plotted map, and each plot sheet in the electronic map, indicating the relationship of each map to all maps in the set.
- d. **Full Facility Submissions:** When the survey involves a complete Facility, provide 4 sets of paper copies of each plot sheet, with utilities printed in color, and the remainder of the survey plotted in black. This requirement will be indicated in the assignment. In addition, provide a PDF version of each plot sheet, with utilities indicated in color.
- e. If original survey data is required, submit in Land Development Desktop format, with full retention of "X, Y, and Z" values for each survey data point.
- f. When required, submit ground control data used to orient the survey, set up vertical and horizontal controls, and establish the scale of the survey. For each survey baseline point, submit a description of the point, its coordinate value, and a sketch indicating ties to at least 3 permanent points of reference. Submit this information within the Model Space file, or on individual sheets (8 ½" x 11") in .PDF format.
- g. **Size of Maps:** Map size will be 24" x 36". Top, bottom and right hand margin borders shall be ½". The left hand margin border shall be 1-1/2". The maximum size of any map shall not exceed 36" x 48".

- h. **Material:** When reproducible maps are required, sheets shall be plotted in permanent medium on a polyester film base material such as Mylar, Stabilene, Cronaflex, or approved equal, with a minimum thickness of 0.004 inches.
- i. **Titles:** Appropriate titles shall be placed at the lower right hand corner of each map sheet, including L.S. stamp of SURVEYOR. Include Project Number assigned to the survey.

12. Reporting:

- a. Written status of all on-going survey assignments shall be submitted on a bi-weekly basis, in the format defined by the State.

E. DRAFTING STANDARDS

1. General:

- a. In general, the surveys produced for OGS, while capable of great intelligence through the use of modern software and object technology, will be simply used as a backdrop for new design projects. While end products for the surveyor, they will typically be the starting point for new work, and in most cases will be simply XREFed to the final site plans, and not be altered in any way. Toward that end, all linework, contours, blocks, etc. must be kept simple and generic. When drafting the final maps, consider the ultimate user will be using the survey as a background.
- b. Use the symbols and line types indicated in the Legend and survey standards provided. The symbols used in the OGS Legend conform to symbols used since the early 1900's. As good or bad as these symbols might be, there are more than a million drawings on file with these same symbols.
- c. Symbols defined in the Legend need not be labeled at each occurrence in the survey. In those situations where additional symbols are required, make sure to add the new symbol to the Legend of the survey file submitted.
- d. Fence lines are many times drawn with the individual circles so far apart that they appear as another utility line. The circle spacing on the line should not be more than 20 ft. with the lines and circles touching each other. [Poor fence line example] [Proper fence line example].
- e. With placing text on the drawing, a width factor of .80 shall be used for all text heights used within the survey

2. Buildings:

- a. Buildings are to be labeled with the Building Name, Number, and Floor Elevation. The number is very important, and should be depicted within a circle. If the actual building number cannot be determined, request this information.
- b. Labeling the building type is not necessary. Ex: "2-story brick".
- c. Hatching of building; use minimal amount to depict shape of building.

3. Utility Lines:

- a. Do **NOT** use the special or complex line types for depicting utility lines in the final survey. The text in these types of lines appears at pre-defined intervals,

regardless of what might be “under” the line text. In most cases this line text occurs too often, and many times obscures other important information on the survey drawing, or in the final design drawing which XREF’s the survey. Also, text built into the complex lines is very dependent on LT Scale, particularly when plotting. Incidents have occurred where surveys did not display any utility identification text when plotted. It was an LT Scale problem.

- b. Draw utility lines as simple lines or polylines, with text inserted only at the spacing required to adequately identify the utility. Locate the text so it is legible, and does not obliterate or conflict with other information. *[Special line example]* *[Good line example]*.
- c. Label each utility line with the size and type of material. (6” PVC, 2” copper, 12” DIP, etc.). Label it on the line, at least once between each structure. *[Example]*
- d. Where the final survey will extend over multiple Layout Sheets in Paper Space, include additional labels as required so utilities are easily identified on all layout sheets.

4. Utility Structures:

- a. Use the symbols indicated in the standard legend provided. As an example, a manhole located on a sanitary sewer line should be labeled “SA”. Storm Sewer Manholes should be labeled “ST”. Electric and signal manholes should be labeled with an “E” and “S” inside the manhole symbol.
- b. The standard for labeling the finish elevation of a structure in the OGS Legend has previously been TF 327.5, for Top of Frame. The industry standard refers to this as Rim, which is acceptable. Therefore, label the finished surface of manholes, etc. as Rim 327.5, or R=327.5. The OGS Legend has been changed accordingly.
- c. Similar changes apply to the inverts of pipes within structures. Label as I 468.45, or I=468.45.
- d. Unless absolutely necessary, omit the use of tabular information at utility structures, particularly storm and sanitary manholes. It looks neat, but all that text invariably obscures something else, and a future user may move it out of the way, or worse yet, erase it. Label the inverts ABOVE or BELOW the utility line, immediately adjacent to where a pipe enters/leaves the structure. If there is not enough room immediately adjacent to the structure, use leader arrows. If tables for sanitary and storm structures cannot be avoided, the information relative to the inverts must also be indicated on the survey, at the actual location of the structure.
- e. A separate Table of Structures shall be included to depict all information relative to Electric and Signal manholes and structures. (See Table E-1 for recording information for electrical and signal manholes.)
- f. A text height of .24 for the invert information appears to be the most readable. In some cases, text height of .20, is acceptable were there are multiple utility lines coming into one structure.

5. Contours:

- a. Most firms are using specialized software programs to process the survey data and create contours. The contours created from these programs are

intelligent objects. The contours for purposes of OGS surveys do not require the intelligence (Z value), and are intended to be simply lines. If intelligent contours are required for a project involving extensive earthwork or profiles, this requirement will be specified in the assignment. Otherwise, convert all contours to LWPOLYLINES for submission in the final survey.

- b. Contours in the real world do not come to points. Therefore, contours shall be splined, or smoothed, in the final survey to represent the natural condition of the land (even at the expense of increased file size).
- c. Existing contours are typically not labeled sufficiently. Label at the ends of each contour, and at appropriate locations along the contour for readability. In areas of steep slopes, labeling the 5' or 10' contours may be sufficient. Good judgment should be used so that contour elevations can be determined without chasing contours across the entire drawing. When labeling the contours, stack the contour labels as much as possible.
- d. Where the final survey extends over multiple Layout Sheets in Paper Space, additional labels should be included as required so contours are easily identified from one sheet to another.

6. Points:

- a. Most firms use specialized software for processing the surveys. These programs typically create a block of each point with 4 pieces of information... PointNumber, Elevation, Description and TickMark for the node. The only information required to be visible in the survey is the Elevation, and the TickMark to indicate the location of the elevation. Explode the point blocks and place the point information on separate layers so Description and PointNumber layers can be turned off.
- b. Where possible, eliminate the Tick Mark which indicates the coordinate location of the point. In lieu of the Tick Mark, insert the elevation so that the decimal point of the elevation text is inserted on the Node of the Tick Mark.

7. Examples:

- a. [Sample Survey Output \(pdf version\)](#).
- b. [Sample Survey Output \(dwg version\)](#).

F. PROPERTY ACQUISITION MAP SUPPLEMENT, AND PROPERTY BOUNDARY SURVEY MAP SUPPLEMENT

1. Information Required:

- a. Show boundary lines, giving length, to the nearest 100th of a foot, and bearing (including reference or basis) on each straight line; interior angles, to the nearest 20 minutes; radius, point of tangency and length of curved lines. Where no monument exists, set permanent iron pipe (monument) or other suitable permanent monument at property corners; drive pin into ground adequately to prevent movement, mark with wood stake and identify as a property corner; state on the map(s) whether corners were found or set and describe each. If required, tie property corners to 3 permanent points of reference.
- b. Furnish, on the map(s), a legal description which conforms to the Record Title Boundaries. Prior to making this survey, the SURVEYOR shall, insofar

as possible, acquire data including, but not limited to, deeds, maps, certificates or abstracts of title, section line and other boundary line locations in the vicinity.

- c. Give area in square feet if less than one acre, in acres (to 0.01 acre) if over one acre.
- d. Describe and show all structures, roads and paving, fences and walls.
- e. Describe and show all adjoining roads and highways, with current owners designated.
- f. Show recorded or otherwise known easements and rights-of-way, and State the owner of them.
- g. Note possibilities of prescriptive rights-of-way and the nature of each.
- h. Show individual lot lines and lot block numbers where appropriate.
- i. Show zoning of property; if more than one zone, show the extent of each. Show zoning of adjacent property and property across the street(s) or highway(s).
- j. Give names of owners of adjacent property. List deeds (Liber, page, year) if required.
- k. Reconcile or explain any discrepancies between the survey and the recorded legal description.
- l. Titles: Appropriate titles shall be placed at the lower right hand corner of each map sheet, including L.S. stamp.

2. Material to be Delivered to the State:

- a. Digital copy of each map, in AutoCAD "DWG" format. The Model Space file shall be in "Real World" scale. The Plot Sheet shall be at a scale at which the entire property boundary is shown on a single sheet. While the standard OGS sheet is 24"x36", property maps may be plotted on sheets up to 36" x 48" maximum. Top, bottom and right hand margin borders shall be ½". The left hand margin border shall be 1-1/2".
- b. Hard copy of each map, prepared in permanent ink or plotted in permanent medium on a reproducible polyester film base material such as Mylar, Stabilene, Cronaflex or approval equal, with a minimum thickness of 0.004 inches.
- c. Black line prints with SURVEYOR'S seal and signature (6 copies).

G. FACILITY GUIDELINES:

1. When working within State Facilities it is important to make contact with the Facility personnel and the OGS Field Staff noted in each assignment 48 hours prior to making any visit to the Facility being surveyed.
2. When working within secure Facilities of the Department of Corrections and Community Supervision, Office of Children and Family Services, and Office of Mental Health, survey staff must comply with the individual requirements of each Facility in addition to the following general requirements:
 - a. Gate passes will typically be required for each day staff will be working in or around a secure Facility. When obtaining a gate pass with the facility, provide a list of names of each employee who will be at the facility for each



day. Be advised that employees with previous criminal records may be refused entrance into a secure Facility.

- b.** If a camera is required to record survey related information (benchmarks, conduits inside of manholes, etc.) on facility grounds, prior clearance must be obtained from the Facility. Inform the Facility security personnel of the specific needs for the camera, and information to be photographed. If permission is granted, strictly comply with all restrictions established by the Facility relative to photo equipment, particularly the omission of all inmates or patients from any photo. Note that requirements and restrictions on the use of cameras vary considerably between Facilities.
- c.** If it becomes necessary to bring a vehicle inside a secure Facility, remove all but the most essential equipment prior to entering the Facility. Create an inventory sheet describing the entire contents of the vehicle. Remove PK Nails, machetes, and all other items of this nature, as they won't be allowed into the facility.
- d.** The use of spikes, stakes and PK Nails will not be permitted for establishing baseline points inside the correctional facility. The use of a chiseled X on hydrants, manholes, curbs, etc. are acceptable means of establishing baselines.

Revision History:

<i>Rev</i>	<i>Date</i>	<i>Description</i>	<i>Reviewed by:</i>	<i>Approved by:</i>
0	05/05/11	Last revised date		
1	08/06/15	Pages 1 & 2 Changed BU5 to BU2	Parnett	Parnett