SECTION 1.6
SURVEY STANDARDS GUIDELINE

1.6.1 PURPOSE

The purpose of this section is to provide guidelines for site surveys incorporated into the design, construction and record drawing process of potable water, recycled water, and sewer Capital Improvement Projects (CIP). Surveys by private engineers on development projects shall conform to the requirements set forth by the governing District. This section also provides minimal guidelines for the use of Global Positioning Systems (GPS) to provide survey grade work.

These guidelines are not intended to limit the creativity of the surveyor or to reduce the quality of the work. The surveyor shall use good professional judgment in applying and using industry standards in the performance of his/her work.

1.6.2 GENERAL

It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document. The Engineer of Work may not deviate from the criteria presented in this section without prior written approval of the District's Engineer.

1.6.3 GUIDELINE

All survey work shall be performed directly under the supervision of a Land Surveyor or Civil Engineer duly licensed to practice land surveying in the State of California.

For the purpose of these guidelines, Surveyor shall refer to the Surveyor or the Surveyors representative(s) acting within the scope of the particular duties entrusted to them for performance of the work.

1.6.4 ACCURACY

Provide sufficient minimal vertical and horizontal data for accurate design of water and sewer facilities and appurtenances. Minimum vertical and horizontal control shall be determined by the District for each job.

Measurements shall be in English units or as required by the District. Except for private contracts, the Engineer will perform and be responsible for the accuracy of surveying adequate for construction.

Surveys performed for the purpose of generating topographic contours shall be performed to provide one-foot (1') accuracy with a minimum two-foot (2') contour interval.

1.6.5 DATUM

Benchmark datum descriptions shall include the following information to re-establish vertical control.

A. Exact description of location and form of monument. i.e. Standard brass cap, centerline street monument, including temporary benchmarks to be used for the construction process on or near the site.

B. Elevation of benchmark in feet.

C. There are a number of formats that can be used for a benchmark (Mean Sea Level, ellipsoidal heights, orthometric heights, assumed etc). Therefore, the District will specify the particular basis of benchmarks on each project.

1.6.6 BASIS OF BEARING

A. There are a number of formats that can be used for a basis of bearing (California coordinate system, local control etc.). Therefore, the District will specify the particular basis of bearings and coordinates on each project.

B. If the California Coordinate System is to be used, a minimum of one (1) control point on small projects and two (2) or more points on large projects will show the grid angle and rotation angle along with the latitude, longitude and scale factor controlling each area of the project.

C. If a local control is used, an accurate description of the monument(s) and coordinates used and the bearing between them will be incorporated on the cover sheet of the plans.

1.6.7 AERIAL SURVEY

Flying for procuring vertical negatives for mapping purposes and photographs shall be performed between the hours of 10:00am and 2:00pm to minimize shadows. The time of flying shall be recorded on each negative at the time of exposure.

Camera shall have forward motion compensation, and be equipped with electronic exposure system (built in light meter). Camera shall use the appropriate focal length and film format for taking vertical exposure, which will maximize the particular need of each job. This information shall be shown on the negative at time of exposure. Other requirements shall be on a job-by-job basis as required by the District.

1.6.8 SCOPE OF WORK

A. District Responsibility

1. Generally a scope of work will be provided by the District clearly defining the limits and detail of information required. The level of accuracy and detail shall be determined on a job-by-job basis and surveyed to that level in accordance with these guidelines.

2. The District shall provide to the surveyor all existing record drawings and other related documents as necessary for their use.

B. Surveyors Responsibility

1. The surveyors shall familiarize themselves with instructions given prior to the beginning of work.

2. The surveyor shall obtain all other documents and maps of record necessary to meet the requirements and accuracy standards set forth by the District and to perform all other investigative procedures to insure a complete and thorough job.

3. Prior to beginning survey work, the surveyor shall submit to the Engineer a proposed plan for establishing lines and grades for control of the project, including timetables for submitting data to Engineer during course of work.

4. The surveyor shall attempt to locate all existing controlling monuments that fall within the scope of work as determined by the District.

5. The surveyor shall submit cut sheets to the engineer prior to excavation. Any changes thereafter to the cut sheets shall be recorded as changes and a complete set of Record Cut Sheets shall be submitted to the engineer.

1.6.9 CONTRACTOR RESPONSIBILITY

This article provides suggested wording regarding Contractor responsibilities for District work only. The following information shall be included in contract documents assembled for District Capital Improvement Projects.

A. Permanent Survey Markers

1. The Contractor shall notify the District at least seven (7) days before starting work to allow for the preservation of all survey monuments, lot stakes (tagged) and benchmarks. The District has the option to use existing engineering staff or Contractor's surveyor to replace any monumentation necessary on District projects.

2. The Contractor shall not disturb survey monuments, lot stakes (tagged), or benchmarks without the consent of the District,. The Contractor shall bear the expense of replacing any monument(s) that may be disturbed without permission. If such monumentation is disturbed or destroyed by his/her operations, the contractor shall at no cost to the District have the monument(s) replaced in accordance with local and state laws. The Contractor at his/her cost shall have his/her surveyor file a Corner Record Form referencing all disturbed survey monuments in the Office of the County Surveyor to ensure replacement of survey monuments.

3. When a change is made in the finished elevation of the pavement of any roadway in which a permanent survey monument is located, the Contractor shall adjust the monument cover to the new grade within seven (7) days of finished paving unless otherwise specified. If the existing cover cannot be adjusted a new monument will be set in accordance with local and state laws.

B. Contractors Responsibility when District Surveyors are used

1. The contractor shall notify the District in writing at least two (2) working days before survey services will be required in connection with the laying out of any portion of the work. The contractor shall clear all obstacles necessary for line and grade stakes.

2. The contractor shall preserve construction survey stakes, reference points and other survey points for the duration of their usefulness. If any construction survey stakes are lost or disturbed and need to be replaced, the contractor shall be liable for and charged with the cost of their replacement and any expense resulting from their loss or destruction.

1.6.10 CONSTRUCTION STAKING

All work shall conform to the lines, elevations, and grades shown on the plans. The surveyor shall layout the project by establishing all lines and grades on the site and along the pipeline alignments as necessary to control the project.

A. Pipelines shall have offset line and grade stakes set at maximum fifty-foot (50') intervals, including all alignment and vertical deflections (bends and angles) and all pipe appurtenances. Additional stakes shall be set at all grade breaks and each station along a vertical curve as noted on the plans.

B. Access roads shall receive one set of line and grade stakes set at maximum fifty-foot (50') intervals including all alignment, vertical deflection points and points of curvature.

C. Setting slope stakes on the tops or toes of permanent slopes shall be at a maximum of fifty-foot (50') intervals.

1.6.11 RECORD DRAWING SURVEY/CHANGE ORDERS

The District may require additional survey where a change in the construction is such that it is deemed necessary to have a survey field crew locate the new position of the facility. The record drawing survey shall include coordinates that tie the new position to the existing survey for inclusion into geographical information systems (GIS) and CAD drawings.

1.6.12 USE OF GLOBAL POSITIONING SYSTEMS (G.P.S.)

The following is a set of minimum guidelines for the use of G.P.S. (Global Positioning Systems) recommended by the U.S.G.S. (US Geological Survey) to perform survey grade work. Survey grade GPS shall be consistent with the current technology employing at least two (2) receivers. One being stationary over a known point while one or more receivers is employed to collect or stake points in the field. Each receiver must be equipped to observe both carrier phases (L1 & L2), which are measured simultaneously at participating receivers.

1.6.13 STANDARD G.P.S. COLLECTION PARAMETER SETTINGS

Elevation Mask	15 degrees above horizon
PDOP Mask	6 or less
Signal to Noise Ratio (SNR)	6 or less
Logging Intervals	Minimum stationary time per point is 15 to 30 seconds per point or until a fixed location occurs. Intervals for line area features depends on the velocity at which the receiver will be traveling and the nature of the feature and the operating environment. Under normal circumstances (i.e., when the user is walking with the receiver) the interval for line and area features will be set at 2 seconds.
Satellites	There must be at least 5 satellites tracked with a sufficiently low PDOP (6 or less) for horizontal control only. A minimum of 5 satellites for horizontal and vertical control and 1 additional satellite is recommended for redundancy.

1.6.14 ACCURACY CHECKS

A sampling of known points within or near the project area should not deviate by more than the following:

Horizontal	20% of the project minimum requirements
Vertical	35% of the project minimum requirements

1.6.15 DELIVERABLES

The District shall determine the format, content and scope of the information delivered. A scope of work shall be provided by the District outlining required information. Some information that may be required could include, but not limited to:

A. Survey notes and computations

B. Datum information

C. Basis of bearing information

D. Record cut sheets

E. Field Record Drawing information

F. Cad files on compact disc (CD)

G. Minimum number of hard copies as required by the District

1.6.16 REFERENCE

Should the reader have any suggestions or questions concerning the material in this section, contact the District.

The publications listed below form a part of this section to the extent referenced and are referred to in the text by the basic designation only. Reference shall be made to the latest edition of said publications unless otherwise called for. The following list of publications, as directly referenced within the body of this document, has been provided for the users convenience. It is the responsibility of the user of these documents to make reference to and/or utilize industry standards not otherwise directly referenced within this document.

END OF SECTION