This is a sample of the typical survey scope required to support engineering design for a City of Las Vegas capital improvement project. Surveys performed for any particular project should adhere **ONLY to the specific language included within that project's contract documents.*

100 30% DESIGN PHASE

100.1 Survey

100.1.1 General

- Professional Land Surveyor. All survey work performed for the tasks listed in this section shall be performed under the direct supervision of a Professional Land Surveyor (PLS) currently registered in the State of Nevada, excluding any aerial mapping or LiDAR scanning performed by a third-party vendor.

100.1.2 Control Survey

- General. A control survey will be performed to establish adequate control for all boundary location and topographic mapping necessary for the limits and purpose of the project. This will include all control panels/targets set for the purpose of aerial mapping or LiDAR scanning.
- Horizontal Coordinate System. The control survey shall utilize the official City of Las Vegas horizontal coordinate system defined as follows. The geodetic datum and current reference frame is NAD 83 (2011) epoch 2010.0 as determined by the reference stations that comprise the Las Vegas Valley Water District GPS network. The use of any other geodetic datum and reference frame will require approval of the City Surveyor. The mapping projection is the Nevada Coordinate Reference System (NCRS). The appropriate NCRS zone is dependent on the geographic location of the project and should be determined prior to any surveying activities. For more detailed information on the datum, GPS network and NCRS please visit the following webpage: lasvegasnevada.gov/survey.
- Vertical Control. The control survey shall utilize the official City of Las Vegas Vertical Control Network defined as follows. The vertical datum is NAVD88 as adjusted by the City in 2008, referred to as the CLV 2008 Adjustment. The Control Network is comprised of City of Las Vegas benchmarks. Only benchmarks with a published CLV 2008 Adjustment elevation shall be used. For more detailed information on the benchmarks please visit the following webpage: lasvegasnevada.gov/survey. Large projects that extend more than one-half mile in any direction shall be tied to multiple benchmarks, with no portion of the project being more than one-half mile from a project benchmark.
- Accuracy. The control survey shall have an absolute horizontal accuracy of +/- 0.05 feet relative to the project coordinate system, which meets positional certainty requirements for High Urban Land Boundary Surveys per NAC 625.666. All points used to control aerial mapping, lidar scanning and traditional optical survey methods shall have an absolute vertical accuracy of +/- 0.05 feet (relative to the project benchmarks), as permitted by the positional certainty requirements for Control Surveys per NAC 625.666.
- Boundary Control. The control survey shall incorporate sufficient survey monumentation to establish the following cadastral linework: roadway alignments, right-of-way lines, property lines and easement lines necessary for the limits and purpose of the project. Complete research of existing recorded maps, surveys, land records, and any other pertinent records shall be performed.
- Monumentation. All roadway centerline and Public Lands Survey System (PLSS) monuments within the limits of the project's proposed construction activities (not already included as part of the boundary control survey) shall be incorporated within the control survey.
- Survey Control Map. A Survey Control Map shall be prepared showing all horizontal control, vertical control and boundary control monuments included in the control survey with the relevant horizontal coordinates and elevations annotated. It shall also show all roadway alignments, right-of-way lines, property lines and easement lines established for the project along with all necessary annotation to describe the geometry of this linework.
- Record-of-Survey. Unless waived by the City Surveyor the Survey Control Map shall be formatted as a Record-of-Survey. If the Record-of-Survey requirement was waived, the completed Survey Control Map shall be formatted as specific plan sheet(s) to be sealed by the PLS.

- **Deliverables: The control survey shall be submitted and approved before the 30% design submittal will be accepted.** The "Control Survey Submittal" shall include: (1) a preliminary PDF file of the completed Survey Control Map (record-of-survey or plan sheets); (2) a CAD file containing all cadastral linework; (3) a point file containing all survey control points if not contained in the CAD file; (4) all field raw data files and field notes pertaining to the control survey.

100.1.3 **Topographic Survey**

- General. Based on the project control survey a topographic survey of all surface features within the project limits will be performed to serve as the base model for all engineering design. The topographic survey will consist of two primary components, 2D planimetrics of existing features and a 3D digital terrain model (DTM).
- Standard Accuracy. Except when authorized by the City Surveyor to perform aerial mapping (using manned aircraft), the topographic survey shall conform to the following accuracy requirements. The survey shall have an absolute horizontal accuracy of +/- 0.1 feet relative to the project coordinate system, as permitted by the positional certainty requirements for Engineering Design Topographic Surveys per NAC 625.666. The survey shall have an absolute vertical accuracy of +/- 0.1 feet relative to the project benchmarks. The survey shall have a relative vertical accuracy of +/- 0.05 feet between any two points within 100 feet of each other.
- Accuracy with Aerial Mapping. When authorized by the City Surveyor to perform aerial mapping (using manned aircraft), the topographic survey shall conform to the following accuracy requirements. The survey shall have an absolute horizontal accuracy of +/- 0.3 feet relative to the project coordinate system, as permitted by the positional certainty requirements for Engineering Design Topographic Surveys per NAC 625.666. The survey shall have a relative horizontal accuracy of +/- 0.1 feet between any two points within 100 feet of each other. The survey shall have an absolute vertical accuracy of +/- 0.5 feet relative to the project benchmarks. The survey shall have a relative vertical accuracy of +/- 0.1 feet between any two points within 100 feet of each other.
- Verification. Sufficient verification check measurements shall be performed to ensure the survey data meets required accuracies. This applies to aerial mapping and LiDAR scanning data obtained from a third party vendor, as well as all data obtained through field measurements.
- Limits of Survey. The design engineer shall provide detailed topographic survey limits including any areas outside the right-of-way and/or behind the back of walk. If survey is required within an enclosed area on private property, permission for access shall be obtained by the design engineer. The project may require multiple noncontiguous survey areas.
- Topographic Features. The following surface features are to be included (but not limited to): curbs, gutters, pavement edges, gradebreaks (improved and unimproved surfaces), traffic markings, signs, walls, fences, buildings, vegetation, manholes, vaults, pullboxes, pedestals, utility poles, drop inlets, and street and park furniture.
- Planimetrics Content and Level of Detail. The planimetrics data shall at a minimum indicate the following information about all topographic features within the requested survey limits: curb widths, wall and fence type, wall widths, gate locations, ground surface types (e.g., concrete, asphalt, concrete pavers, grass, decorative rock, etc.), identification of all utility features (if possible), defined boundaries of all surface utilities larger than 2.5 feet in either direction (vaults, cabinets, etc.), building footprints (not envelopes), and complete pavement markings. **These requirements also apply to any areas where aerial mapping has been authorized**.
- DTM Structure and Level of Detail. The survey for the existing ground DTM shall include all gradebreaks modeled as breaklines within the survey limits including the following: breaklines that define the wings and backs of sidewalk ramps and driveways, the top and bottom of curb faces, lip of gutters, pavement edges, steps, top and toe of slopes, and flowlines. All breaklines shall be measured at minimum 50 foot intervals. In areas with very little slope tighter intervals may be necessary. The DTM shall also include spot elevations to determine all high and low points, and sufficient spot elevations to define relatively flat areas measured at minimum 50 foot grid intervals. In areas with very little slope tighter intervals may be necessary. No data shall be visible outside the surveyed area, including "voids" within buildings or large structure where no survey measurements were obtained. This can be accomplished using interior and exterior surface boundaries within Civil 3D. The DTM shall be presented as a single Civil 3D surface object, even if there are separated survey areas, so only a single existing ground DTM has to be referenced by the design engineer. This can be accomplished using hide and show boundaries within Civil 3D. **These requirements also apply to any areas where aerial mapping has been authorized.**

- Remote Mapping. All data captured through LiDAR scanning, photogrammetric drone mapping, and when authorized, manned aerial mapping is to be completely combined with all field survey data. Separate files containing data from different collection methods will not be accepted.
- **Deliverables:** The topographic survey files shall be incorporated into the 30% Design submittal and include: (1) A CAD file containing the survey planimetrics (2D linework and symbology); (2) A CAD file containing the existing ground DTM represented as a single Civil 3D surface; (3) all field raw data files, field notes, field survey points, raw aerial mapping CAD files, LiDAR point clouds, photogrammetric drone image files, and all ground control data used for any remote (aerial, LiDAR, drone) mapping methods. These files are to be prepared under the supervision of the project's Professional Land Surveyor unless prepared by a third-party remote mapping vendor.

100.1.4 **Utility Survey**

- General. The project may require supplemental utility surveying requested by the design engineer. These surveys shall be based on the project control survey and shall meet the standard accuracy for topographic surveying per 102.1.3 of this document.
- Sanitary Sewer and Storm Drain. In addition to the surface features obtained for the topographic survey, measurements made through surface access points may be necessary to model the underground piping and structures for both sanitary sewer and storm drain systems (sometimes referred to as "dips" or "inverts"). All efforts shall be made to locate these facilities as accurately as possible both vertically and horizontally. This includes accounting for cover offsets on eccentric cylindrical manhole structures. Pipes should not be connected from center of cover to center of cover if the center of cover does not represent the center of the manhole. In the case of non-cylindrical (box-shaped) structures and very large pipes or RCB's where directly measuring the pipes are not possible, interior structure scanning will be provided by the City Surveyor whenever requested. **Failure to request this scanning does not excuse inaccurate data.**
- Gas and Water. The design engineer may request measurements to obtain the depths of the top of underground gas and water valve stems (nuts). This information is only valuable to ascertain the minimum depth of the associated piping at that one location. The City will leave the decision on whether to obtain these measurements to the design engineer.
- Utility Potholing and Designating. Any surveying required to locate reference marks placed for utility potholing or designating (AKA line locating or tracing) shall be performed by the primary project surveyor. Surveys performed directly by the potholing/designating contractor or a third-party survey firm will not be permitted.
- Overhead Utility Lines. The design engineer may request measurements to obtain the horizontal and vertical location of overhead utility lines. All efforts shall be made to locate these facilities as accurately as possible both horizontally and vertically. These measurements shall be obtained either using a total station equipped with a reflectorless EDM or by LiDAR scanning. Scanning for this purpose will be provided by the City Surveyor whenever requested.
- **Deliverables:** Prior to completion of the contract all survey data associated with these activities shall submitted to the City.

100.1.5 **Legal Descriptions**

- General. Any legal descriptions required for right-of-way and/or easement acquisitions (or any other property transactions) shall be prepared by the primary project surveyor.
- Format. All legal descriptions shall be formatted as recordable 8.5x11 documents. They shall be prepared as metes and bounds, strip, or other mathematical-type descriptions which allow for the calculation of an accurate and true area. Any existing roadway alignments, right-of-way lines, property lines or easement lines used within the legal description shall have been "surveyed" and incorporated within the project control survey. The legal descriptions shall not contain the purpose of the legal description (i.e., no mentions of right-of-way dedication, traffic signal easement, fire hydrant easement, etc.). They shall be sealed by a Professional Land Surveyor.
- **Deliverables:** All legal descriptions shall be submitted for review. PDF copies are acceptable as preliminary submittals, and hardcopies with original signatures will be requested upon approval. Include copies of any documents referenced in the legal description that predate what can be acquired through the County Assessor's webpage with the initial submittal of any legal description.

100.1.6 The Consultant will coordinate any required private property access with the City's Representative.