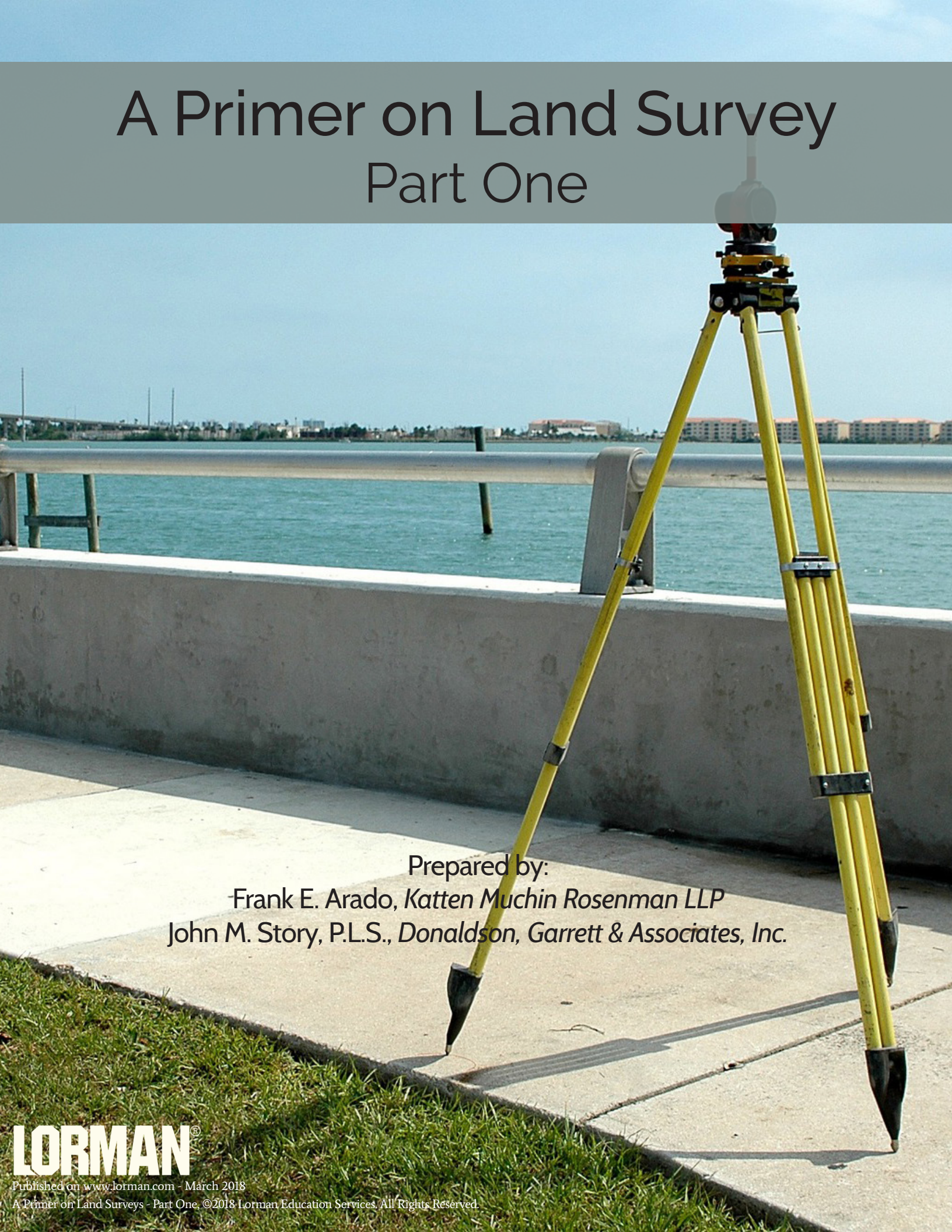
A Primer on Land Survey
Part One



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A Primer on Land Surveys – Part One

The purpose of this material is to provide a basic understanding of what land surveying is, what land surveyors seek to accomplish when they practice their profession, and what kind of process is necessary to perform a land survey.

A fundamental knowledge of a land surveying should include these topics:

A. Definitions of Common Land Surveying Terms
B. What is land surveying and what purpose does it serve?
C. Types & Uses of Surveys

A. Definitions of Common Land Surveying Terms:

Following are common land surveying terms and their definitions:

- Adjoiner: A parcel of land that shares a common boundary with another
- Angle: The measure of the relationship of two intersecting lines
- Azimuth: The direction of a line expressed as a clockwise angle between 0 and 360 degrees from a reference meridian
- Balancing a Traverse: A procedure, or procedures, for distributing the accumulated measurement errors of a traverse among the observed values in order to obtain computational consistency
- Bearing: The direction of a line expressed as either a clockwise or counterclockwise angle between 0 and 90 degrees from either pole of a reference meridian
- Benchmark: An object in a relatively stable location that is at a known elevation relative to a particular vertical datum

- Blunder: A mistake or an incorrect assessment of a measured value associated with a gross misinterpretation of the facts
- Boundary Line: The invisible limits of the rights of real property
- Chain: (1.) The length of measure equal to 66 U.S. Survey feet; (2.) a surveyor's measuring tape
- Contour: A series of lines on a map connecting points of equal elevation
- Coordinate System: A method of identifying a particular point in two or three dimensions by a systematic listing of the distances from defined baselines or origins
- Corner: A point of intersection of real property boundary lines, which may, or may not, be monumented
- Course: The direction of a line segment
- Datum: A basis or measurement foundation on which a location can be defined or referenced either vertically, horizontally, or both
- Deed: A written instrument that conveys rights or interests in real property
- Easement: A right held by one party to the land of another
- Elevation: The distance, above or below, a vertical datum
- Error of Closure: The failure of the result of a set of measured values to agree mathematically with the theoretical result
- Field Notes: The written notes, sketches, and computations of a surveyor taken during and at the site of a survey
- Grade: The slope of a surface of structure
- Land Surveying: The art and science of measuring, marking, recovering, and mapping the relative positions or locations of terrain features and real property boundaries

- Legal Description: That description of a real property parcel sufficient to identify that parcel uniquely without oral testimony
- Latitude: The distance along a meridian
- Longitude: The distance between two meridians
- Map: A graphic, two-dimensional representation of the surface of the earth
- Mean sea level (MSL): The average elevation of the sea over a 19-year period. MSL is often confused with the National Geodetic Vertical Datum (NGVD) or the North American Vertical Datum (NAVD)
- Measurement: An estimation of a quantity or a distance based upon the systematic application of a standardized procedure or device
- Metes and Bounds Description: A description formed by sequentially reciting the courses and adjoiners of a real property parcel
- Meridian: A north-south line used to reference lines of a survey
- Monument: The physical object that indicates the location of a point, station, or real property corner
- More or Less: A phrase indicating a crude or uncertain value for a quantity
- National Geodetic Survey (NGS): The agency of the U.S. government that is responsible for development and maintenance of benchmarks and stations for navigation and mapping
- National Geodetic Vertical Datum (NGVD): The vertical datum established by the National Geodetic Survey that defines elevations published for use on federal maps and regulations.

The most recent vertical datum is the North American Vertical Datum 1988 (NAVD 88).

- North: Aligned with the axis of the earth's rotation and in the direction of that particular pole designated as "north"
- Plat: A map, prepared by a land surveyor, usually for a specific legal purpose.
- Platted Subdivision Description: A description based upon a map or plan, usually recorded, identifying a real property parcel by the letter or number designation found on that map or plan
- Point-of-beginning: The first point encountered in the narrative portion of a deed description, especially a metes and bounds description, that is a part of the real property boundary itself
- Random traverse: A traverse in which the location of stations is chosen for accessibility and intervisibility and does not have a constant relationship to any real property boundaries
- Right-of-way: Land granted (usually to the governing authority) by deed, servitude, or easement for the construction of an infrastructure. Rights-of-way may grant limited property rights or full property rights
- Spot elevation: A point on a map or chart whose height above a specified reference datum is noted, usually by a dot or a small sawbuck and elevation value
- Traverse: A systematic series of stations in which the direction and length of line segments formed by consecutive stations is measured

B. What is land surveying and what purpose does it serve?

Land Surveying is the art and science of measuring, marking, recovering and mapping the relative positions or locations for terrain features and real property boundaries by locating the positions of points

on or near the surface of the earth. Surveyors, therefore, make measurements on or near the surface of the earth. Surveying is essentially the art and science of measuring and mapping land.

When most people hear the term "land surveying" the concept of a boundary survey in real estate transactions comes to mind (the definition of boundary surveys will be discussed further in the next section). *"What Every Lawyer Should Know about Title Surveys"* (Williams and Onsrud, Real Property and Trust Law Section, American Bar Association, 1986, 1987) makes the following statement regarding the importance of land surveys:

> "A complete and accurate land survey is of fundamental importance in nearly all real estate transfers. A comprehensive land survey and physical inspection of the property is the only efficient and reliable means of delineating the physical limits of the property and locating the improvements on it. Yet land surveys are one of the least understood and most frequently overlooked elements in a real estate transaction."

Williams and Onsrud go on to list five fundamental reasons for requiring land surveys in real estate transactions:

1. The existence of the Property. A deed used to convey property must contain a description of the property. An adequate description is often determined upon whether a knowledgeable land surveyor (a Licensed, Registered or Professional Land Surveyor) can interpret the property description to reasonably locate the property physically on the ground.

2. The Relationship of the Property to Adjoining Properties. All parcels of land exist in relation to the parcels surrounding them. If an error was made in the creation of these parcels, gaps or overlaps of

the boundary lines could occur. An accurate survey will note any conflicts between the adjoin property lines.

3. Relationship of Occupied Lines to Recorded Lines. It is not unusual for the boundary lines as physically occupied by an owner to differ from the location of the deed lines. These discrepancies can be minor (a fence meandering along the property line) to severe (a multi-story building built over the property line). A land survey should always show the occupied lines, the deed record lines, and the extent of any mismatch.

4. The Location of Physical Improvements. Surveyors are often requested to locate all the physical improvements of the property to help determine the value of the property and to discover if those improvements conform to local zoning ordinances.

5. Unrecorded Easements and Other Facts not of Record. Unrecorded rights not discovered in a title search but identified by an inspection of the property such as power lines, drainage ditches, sanitary sewer lines used by others besides the land owner can be shown on a survey. A survey is required by a title company to remove the exception of the title policy in regard to "Any discrepancy, conflict, access … or other adverse circumstances affecting the Title that would be disclosed by a current inspection and accurate and complete land survey of the Land."

C. Types and Uses of Surveys:

For the purpose of this presentation nine types of surveys will be defined:

1. Boundary Surveys: Boundary surveys are also known as land, property or cadastral surveys. "[M]ade to establish or to retrace a boundary line on the ground, or to obtain data for constructing a map or plat showing a boundary line." "[T]he term refers to all

surveys …which involve the determination or depiction of property lines." (*Definitions of Surveying and Associated* Terms, American Congress on Surveying and Mapping and the American Society of Civil Engineers, 1978). As such, many surveys include the fundamental elements of a boundary survey.

2. Topographic Surveys: A topographic survey's purpose is "the determination of the configuration of the earth and the location of natural or artificial objects thereon." 21 NCAC 56.1606. Such objects might include buildings, improvements, fences, trees and streams. A topographic survey, also know as a "topo," expresses a three-dimensional concept within two-dimensional limits. This type of survey is accomplished by using spot elevations and contour lines (lines of equal elevation), and need not be necessarily be a boundary survey. Topo surveys are useful for the design and construction of improvements or developments on land, such as roads, bridges, railroads, buildings, drainage systems and water and sewer systems, as well as for forestry management.

3. ALTA/NSPS Land Title Survey (American Land Title Association & National Society of Professional Surveyors): "ALTA" surveys are made to provide lender and the title insurer with survey and location data pertinent to title insurance coverage, including the location of existing improvements on the land relative to the parcel boundaries. While ALTA surveys are generally considered a breed of boundary survey, it is important to note that the standards and implemented by ALTA/NSPS (which can be found at http://www.alta.org/publications/99alta.pdf) must be viewed within the context of state and local regulations governing surveying practices. In some cases ALTA standards may be greater or lesser than those instituted by state and local governing agencies, and the higher

standard must apply. For example, ALTA Table A, "Optional Survey Responsibilities and Specifications" lists monumentation of corners as an optional survey service; however, most, if not all, state laws requires monumentation of all corners except in limited circumstances.

4. As-built Surveys: A hybrid of boundary and topographic survey, as-built surveys document the final or current location and layout of structures on a tract of land, showing the physical characteristics of the structure (usually length and width, although sometimes the height) and the relationship between the structure's location and the boundary line. This type of survey is commonly required by a lender who has financed the construction of improvements, and be utilized in complex construction projects where the placement of features is dependent upon the precise location of previously-placed features.

5. Easement Surveys: This survey shows the location of an easement across public or private property. The most common easement surveys are those for roads, waterlines, sanitary sewer lines, storm drainage lines, and power, telephone and cable lines. Usually these surveys are of a constant width with the particular structure being located in the middle of the easement. An easement survey can be a boundary survey (easement area being acquired) or an as-built survey (completed installed improvements).

6. Construction Surveys: These surveys are performed to layout design locations prior to construction. The most common construction surveying involves laying out buildings, curb and gutter, sanitary sewer and storm sewer structures. Reference points are set on the site that aids the construction company in building the project. Generally, a drawing as the final product is not generated from construction surveys.

7. Aerial Surveys: Also known as photogrammetric surveys, these surveys are prepared using aerial photography. These surveys generally show topographic and planimetric features in combination with a boundary survey. A boundary survey cannot be performed by use of the aerial photography only, but this type of survey method is a useful tool in certain boundary surveys, as well as in fishery surveys, mining applications, archaeology, monitoring wildlife and insect populations (aerial census), and monitoring ground cover and vegetation.

8. Hydrographic Surveys: The purpose of this type of survey is to measure and describe features affecting and composing bodies of water. Hydrographic data is collected and reported under various regulations depending upon the collecting authority. In the US, hydrographic surveys of territorial waters are governed by the National Oceanographic and Atmospheric Administration (NOAA), which maintains a fleet of survey vessels. Inland surface waters such as lakes, rivers and streams fall under the authority of the US Geological Survey (USGS). Other organizations conducting hydrographic surveys include the US Coast Guard, the National Geospace Agency (oversees charting of international waters for the Dept. of Defense), the Naval Oceanographic Office, and the US Army Corps of Engineers (in connection with authority over major waterway projects). Some military combat units, such as the Navy's SEAL and engineering units perform hydrographic reconnaissance survey work. Private commercial entities perform a large segment of hydrographic surveys, especially in relation to dredging, marine construction, oil & gas exploration and drilling, and placement of submarine communication and power cables.

9. Control Surveys: This particular survey establishes the horizontal and vertical positions of reference points. These

reference points, also know as “benchmarks,” serve as a reference framework for initiating other surveys. These surveys are performed at very high accuracies, as established by government regulations. The benchmarks are usually semi-permanent monuments that often consist of brass or aluminum disks set in concrete, although other forms of monumentation, such as iron pins, are also used.