Alaska State Parks

Trail Management Handbook

May 2015

Appendix C: Minimum Mapping Requirements

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State of Alaska, Department of Natural Resources, Division of Mining, Land and Water has written a set of minimum standards to follow when GPS-mapping trails on their managed land. The Division of Parks and Outdoor Recreation follows these requirements from the following pages when mapping all trails.

STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND AND WATER

MINIMUM MAPPING REQUIREMENTS
For
TRAIL LOCATION MAPS
On
DNR MANAGED LANDS

These guidelines define the minimum data collection and mapping criteria for preparation of trail location maps on state lands managed by the Department of Natural Resources, Division of Mining, Land and Water. They provide the procedures for field location and graphical representation of the trail and the real property affected. They are applicable only to minor travel routes accessible by foot or non-highway motorized traffic such as snow machines and ATV's. Location of major trails and roads traversable by highway vehicles and accessible to the public highway system will require Special Survey Instructions issued by the Division of Mining, Land and Water.

The "Trail Map" may be used to document the location of trails on State land which are greater than 100 feet from the nearest potential conflicting use or private/non-state property interest. (See example sheet)

These maps may not be used to document existing improvements such as utility lines or supporting facilities. The location of these must be documented with an "As-Built Survey" conducted by an Alaska Registered Land Surveyor.

1. GENERAL FIELD LOCATION STANDARDS

The horizontal mapping datum shall be the North America Datum of 1983 (NAD 83). U.S. Geological Survey "Quad." maps are published in the (NAD 27) datum though some of the more current maps show (NAD 83) grid ticks. Both the State of Alaska "Land Status Plat" and the Bureau of Land Management "Master Title Plat" use the 1927 North American Datum. Most GPS receivers allow the selection of many datums and referencing geodetic coordinates to the wrong datum can result in position errors of hundreds of meters.

All GPS data must be differentially corrected to remove inaccuracies in the GPS signals This may be accomplished either in real time or by post processing with data from a base station established at a known position in the field or with data from a commercial or government source such as the Coast Guard's RTCM SC-104 signals or a Continuously Operating Reference Station

(CORS) station. The predictable accuracy of uncorrected GPS signals is 20 meters horizontal accuracy and 45 meters vertical accuracy.

a. Data shall be gathered by using either conventional survey and mapping equipment or with differential correction global positioning system (DGPS) equipment and procedures. GPS equipment and software must be capable of obtaining at least 1-meter differential corrected accuracy and be configured with:

   i. Output coordinate datum set to (NAD 83).
   ii. Dilution of precision (DOP) levels set to 8 or less.
   iii. Elevation mask of 15 degrees.
   iv. Position fix mode set to 3D data only (minimum of 4 satellites).
   v. Data collection rate of 1-5 seconds.

b. A minimum of two property corner survey monuments need to be found and DGPS data collected and averaged for at least five (5) minutes at each point. One monument shall be near the beginning and one near the end of the trail. An additional monument shall be found and data collected at each Township crossing. One or more monument ties (or an as-built survey) may be required at change of ownership boundaries. Where required, position data shall be acquired at the nearest monumented corners where a surveyed line separates state and non-state ownership. All such ties shall be made along a property line and the point of intersection stationed. Exceptions may be made where an easement already exists for the trail on the non-state land. If additional monuments are found, collect data for three (3) minutes at each additional point. **For large projects, we recommend that prior to field work a mapping plan be prepared and approved by DNR which identifies the monuments to be tied.**

c. Both hand written field notes and the electronic files from the GPS receivers shall document the fieldwork. The following data shall be entered into the field book:

   i. Field personnel names and weather conditions.
   ii. Dates of fieldwork.
   iii. Receiver and Antenna type used.
   iv. The character and average width of the trail (i.e. 5 feet wide dirt trail with some gravel spots).

d. Additional data to be taken at individual collection points:

   i. Locations, descriptions and rubbings or photos of each monument recovered.
   ii. GPS data File Name.
   iii. Start and end time at the point.
   iv. Antenna height.
   v. Sketch of the site and general description.
   vi. Detailed description of unique features.

2. PROCEDURES FOR ROVER LOCATION OF TRAILS WITHIN STATE LANDS

a. Collect point-positioning data at the starting and ending points of the trail, as per 1.b.

b. If the trail is entirely contained within state lands then:

Set logging interval to:
a) One to five seconds for data capture while walking.
b) One second if moving faster on a vehicle.

c. All locations with unique features shall be a collection point, with DGPS data collected for a minimum of 90 seconds, and described in the field book. (1.d.vi.)

This includes, but is not limited to:
a) Bridges
b) River crossings
c) Lake boundaries
d) Buildings or structures
e) Map or note postings
f) Power / utility line crossings
g) Any feature that may have a reference in another map.

d. Prior to entering a dense forest or an area of poor satellite coverage, point-data collection should take place.

e. Upon leaving an area of poor satellite coverage another point-data collection should take place.

f. Continuous rover data collection over the entire length of the trail should be performed multiple times to cover sections where data was lost due to high DOP or lost satellite lock.

g. If the trail borders other than state lands then a survey by an Alaska Registered Land Surveyor may be necessary. Contact the Department of Natural Resources, Survey Unit to discuss.

3. DRAFTING STANDARDS

The map shall be constructed of good quality paper or other media and be one of two standard sizes: 8 1/2" x 11" or 8 1/2" x 14".

a. The title block, vicinity map, legend, notes, north arrow and graphics shall substantially conform to DNR standards.

b. All line work and lettering on the drawing must be in black drafting ink and must be accomplished with mechanical lettering equipment.

c. All property boundaries of record shall be shown with a narrow solid line. All non-boundary lines such as tie lines and easement limits shall be dashed lines. The standard centerline symbol shall be used for all right-of-way and easement centerlines. The line depicting the trail centerline shall be bolder than any other on the drawing.

d. A vicinity map is required. It shall be at whatever scale is necessary to show the entire trail and clearly indicate section, township, range and geographic information. The vicinity map should be on the first or second sheet as scale and scope of the project dictates. If multiple sheets are required, the vicinity map shall also indicate the coverage by each sheet.

e. If more than two sheets are required the legend and notes shall appear on the first sheet. All sheets shall show the project to scale, DNR's standard title block, ADL number, scale, sheet number, total number of sheets, location by section, township and range.

f. Major topographic features and improvements such as streets, roads, highways, creeks, streams and rivers that will aid in orientation shall be located and labeled on the drawing.

g. Section lines shall be shown whether they are surveyed or not.

h. Ownership of adjacent land shall be labeled (i.e., state, private, Native corporation, etc.), along with the subdivision lot and block designations, U.S. Survey number, tract, ASLS, section, aliquot part, etc. Existing trail easements shall be shown and labeled with Book & Page or Plat Number along with Recording District.

i. The graphics of the drawing shall be oriented so that north is as close as possible to the top of the sheet.

GPS Error Sources

- GPS errors are a combination of noise, bias, and blunders.

  Noise errors are the combined effect of PRN code noise (around 1 meter) and noise within the receiver (around 1 meter).

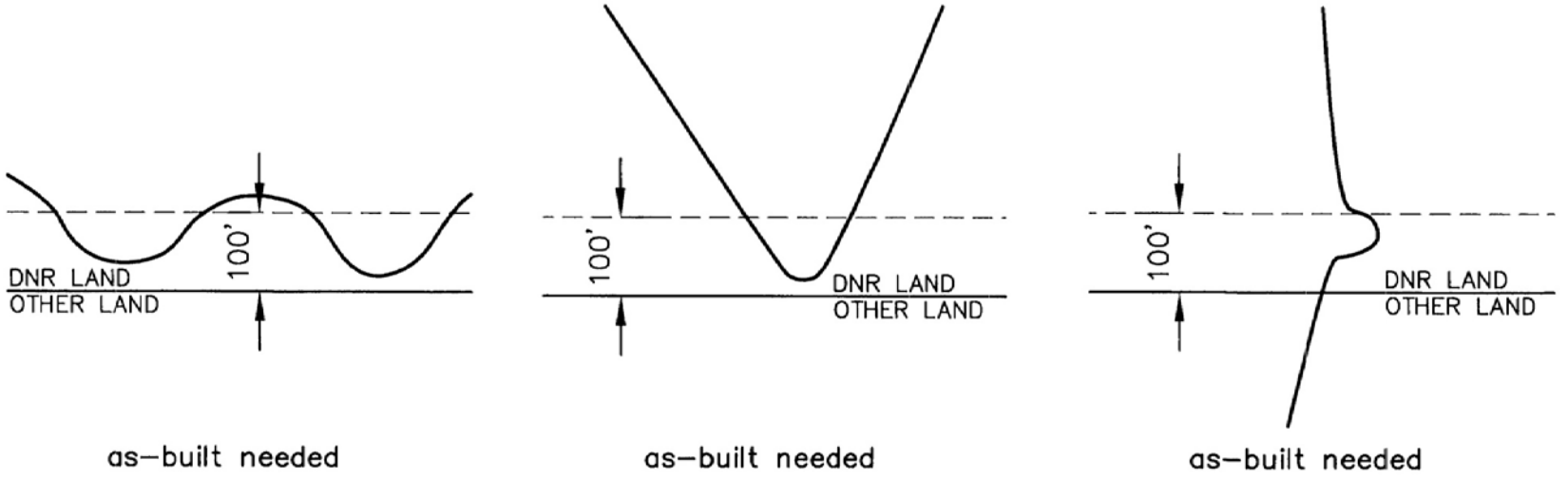
- Bias errors result from other factors:

  A. SV clock errors uncorrected by Control Segment can result in one-meter errors.
  B. Ephemeris data errors: 1 meter
  C. Tropospheric delays: 1 meter. The troposphere is the lower part (ground level to from 8 to 13 km) of the atmosphere that experiences the changes in temperature, pressure, and humidity associated with weather changes. Complex models of tropospheric delay require estimates or measurements of these parameters.
  D. Unmodeled ionosphere delays: 10 meters. The ionosphere is the layer of the atmosphere from 50 to 500 km that consists of ionized air. The transmitted model can only remove about half of the possible 70 ns of delay leaving a ten meter un-modeled residual.
  E. Multipath: 0.5 meters. Multipath is caused by reflected signals from surfaces near the receiver that can either interfere with or be mistaken for the signal that follows the straight-line path from the satellite. Multipath is difficult to detect and sometime hard to avoid.

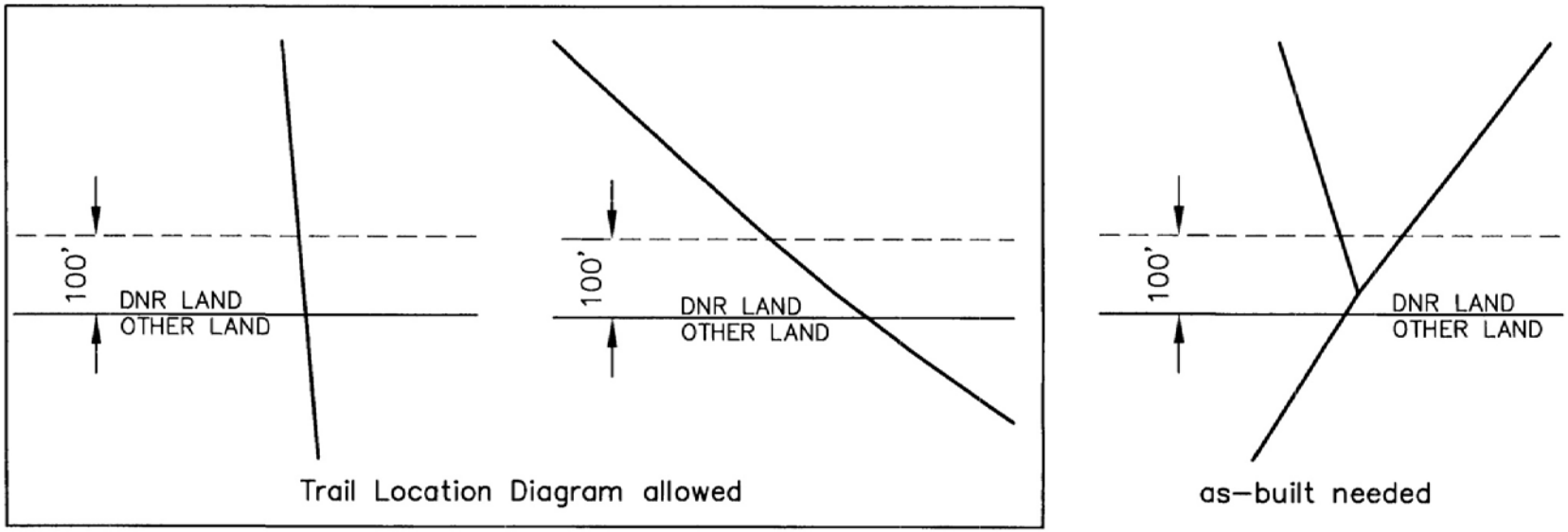
- Blunders can result in errors of hundred of kilometers.

  A. Control segment mistakes due to computer or human error can cause errors from one meter to hundreds of kilometers.
  B. User mistakes, including incorrect geodetic datum selection, can cause errors from 1 to hundreds of meters.
  C. Receiver errors from software or hardware failures can cause blunder errors of any size.

- Noise and bias errors combine, resulting in typical ranging errors of around fifteen meters for each satellite used in the position solution.



These curves may actually be on private property. For trails with identifiable features which are within 100' of a potential conflicting use or property interest, contact the DNR–Survey Unit for instructions.



EXAMPLES OF TRAIL CONFIGURATIONS WITHIN THE 100' WIDE AREA OF UNCERTAINTY