ILLUSTRATED GEOREFERENCING GUIDELINES

Using the point-radius method as per Wieczorek, Guo, & Hijmans, 2004

CALIFORNIA PHENOLOGY NETWORK

Note: this document is intended to supplement, rather than replace, the Georeferencing Protocol. For training and reference purposes, please refer to the full Georeferencing Protocol.

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GENERAL TIPS AND TRICKS

- **Always** explain your choice of coordinates and uncertainty radius estimation using the Georeference Remarks fields. This makes the data more reproducible and verifiable.
- Look for additional information in the **habitat** and **elevation** fields that may help you find the specific locality of a specimen. For example, knowing that a specimen was collected at 1000 ft. with "NE exposure" can help you understand which side of a mountain/hill the specimen was collected on.
- Not all specimens are georeference-able! If there is considerable uncertainty about a location, or if the locality data is suspect or potentially flawed/incomplete, make a note of the uncertainty in Georeference Remarks and do not apply coordinates to the record.
- Some areas are too large to georeference. Do not georeference areas to the county level or with an uncertainty radius of 8000m or greater.
- A **feature** is a geographical or political feature, such as a mountain or city, that has a name on a map.

References:

Wieczorek J, Guo Q, Hijmans RJ. 2004. The point-radius method for georeferencing locality descriptions and calculating associated uncertainty. International Journal of Geographical Information Science. 18(8):745-767.

Zermoglio PF, Chapman AD, Wieczorek JR, Luna MC, Bloom DA. 2020. Georeferencing quick reference guide [community review draft]. Version b5a20b5.

BOUNDED AREA

Examples:

- "Las Vegas"
- "Atascadero"

Coordinates

Estimate the geographic center of the boundaries of the area. If the center does not fall within the boundaries of the area, find the smallest enclosing circle that contains the entire feature, but has its center on the boundary of the feature.

Error radius

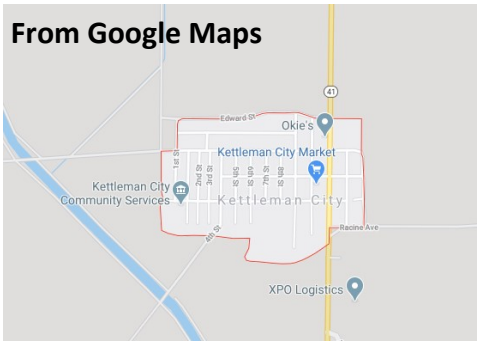
Measure distance from center of named feature to border of the named area that is furthest from the center.

CAUTION!
Some bounded areas are too large to georeference. Do not apply coordinates to county-level descriptions or larger.

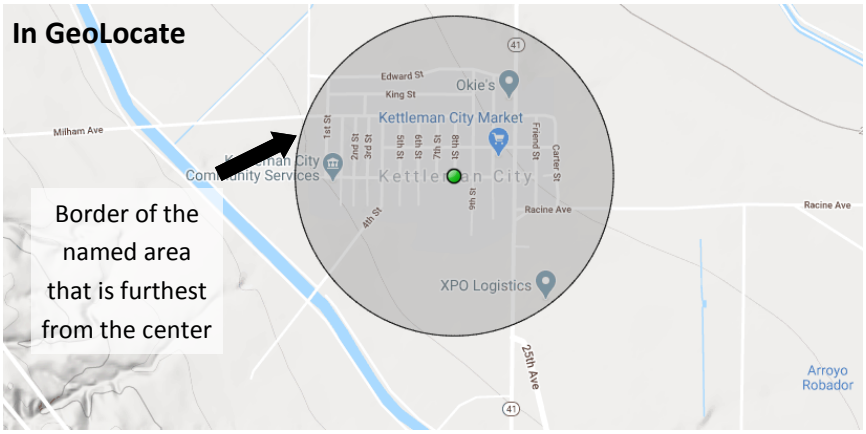
Example:

"Kettleman City"

From Google Maps



In GeoLocate



Border of the named area that is furthest from the center

UNBOUNDED AREA

Examples:

- "Hoosier Pass"
- "Hills south of Los Osos"

Coordinates

Use visual evidence on a (topographical) map to determine the approximate center of the named place/feature.

Error radius

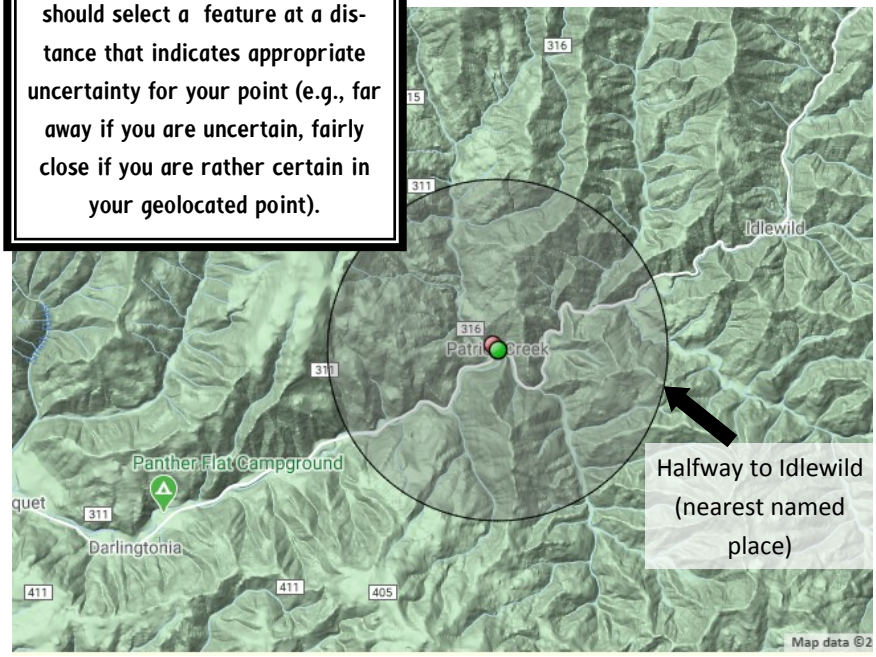
Use half the measured distance from the selected coordinates to the center of the nearest named place (that is outside the rough area encompassed by the unbounded, named place)

CAUTION!

Selecting the nearest feature for the error radius can be tricky! You should select a feature at a distance that indicates appropriate uncertainty for your point (e.g., far away if you are uncertain, fairly close if you are rather certain in your geolocated point).

Example:

"Patrick Creek area"



STREET ADDRESS

Examples:

- “1 Orchard Lane, Berkeley, CA”
- “319 Stadium Dr., Tallahassee, FL”

Coordinates

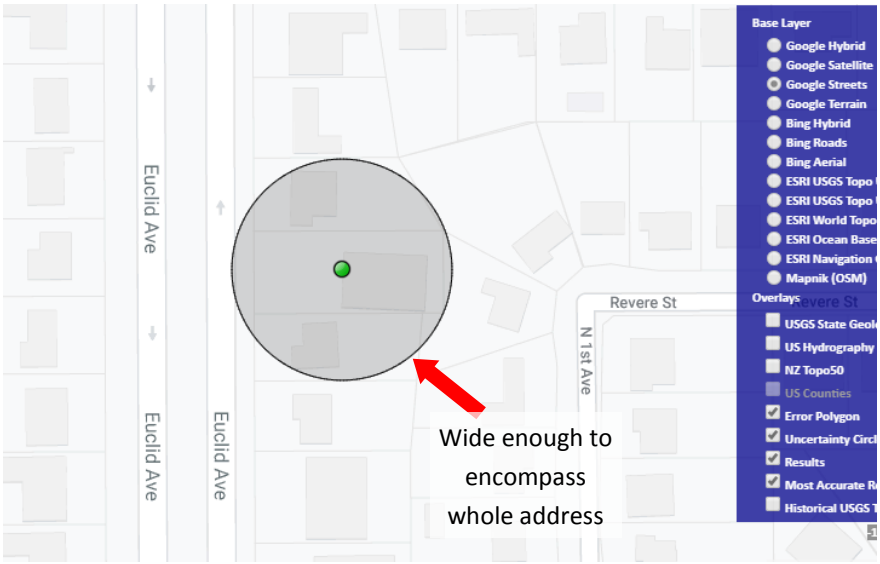
Locate the address using, e.g. Google maps

Error radius

Use half the measured distance from the coordinates to the address on either side of the given address, or as far as necessary to encompass the whole address/parcel. If the address is too difficult to determine, use half the distance to the further end of the block.

Example:

“at 2270 N. Euclid in Upland, at residence”



JUNCTION, INTERSECTION, CROSSING

Examples:

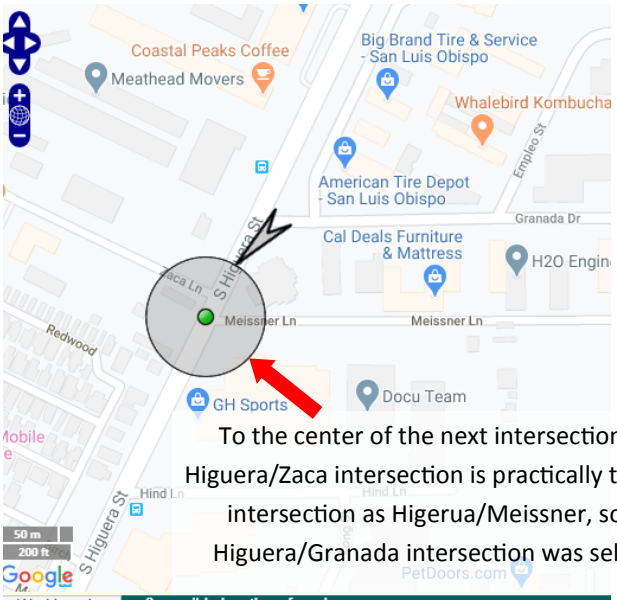
- "junction of Coora Rd. and E Siparia Rd."
- "bridge over Willamette River "

Coordinates	Use the coordinates of the center of the intersection.

Error radius	Use satellite or aerial images to find the extent of the intersection by measuring the distance from the center to the furthest part of it. If this is not possible, use the number of lanes of the larger of the two roads and multiply by 4 meters. If the locality is "near" the intersection, use half the distance to the nearest intersection or feature, whichever is less.

Example:

"near intersection of Meissner Rd and S Higuera St"



To the center of the next intersection (the Higuera/Zaca intersection is practically the same intersection as Higerua/Meissner, so the Higuera/Granada intersection was selected

RIVER, STREAM, ROAD, PATH

Examples:

- "Sacramento River "
- "Los Osos Valley Road"

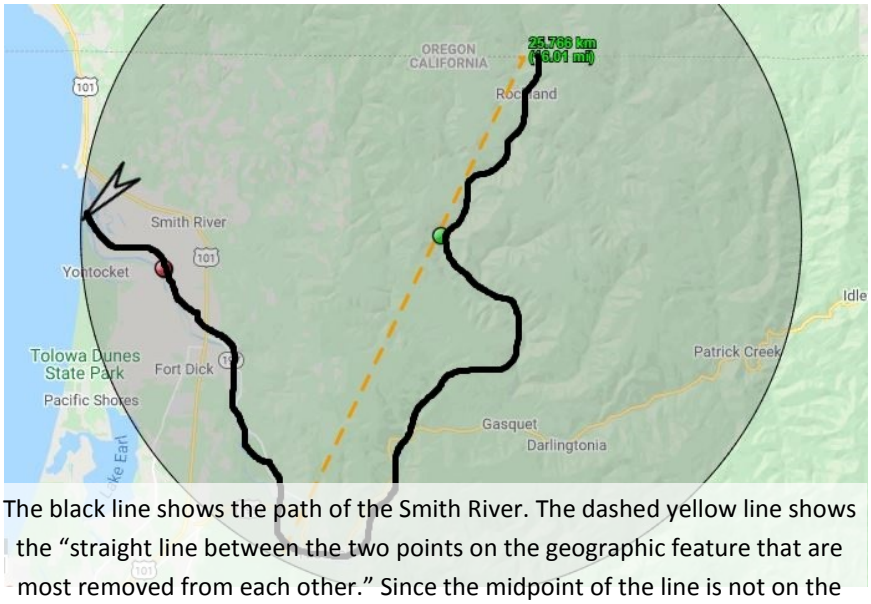
Coordinates

Make a straight line between the two points on the geographic feature that are most removed from each other, yet still within the administrative boundaries (e.g., county) specified in the locality description. Choose the point on the feature nearest to the midpoint of the line.

Error radius

Use one of the ends of the straight line that you made between the two points on the geographic feature that are most removed from each other, yet still within the specified administrative boundaries

Example: "California, Del Norte County, Smith River"



The black line shows the path of the Smith River. The dashed yellow line shows the "straight line between the two points on the geographic feature that are most removed from each other." Since the midpoint of the line is not on the river, we find the point on the river closest to the midpoint of the line. Then the error radius extends to the furthest end point of that river (grey arrow).

NEAR A NAMED PLACE

Examples:

- "vicinity of Mt. Hood"
- "near Sacramento"

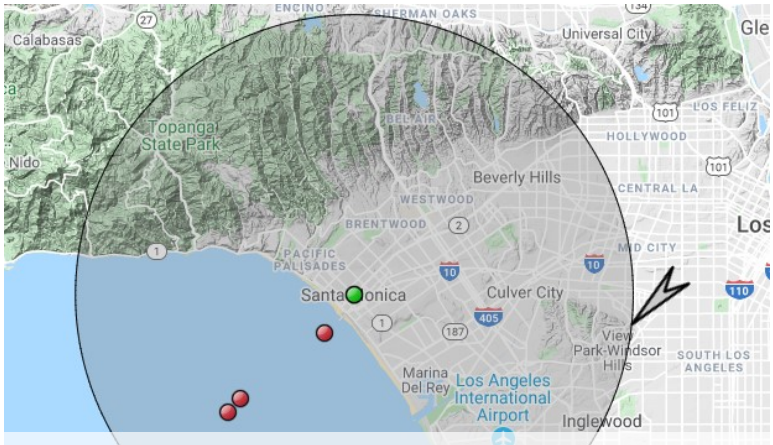
Coordinates

Determine the coordinates as either a BOUNDED AREA or UNDEFINED AREA, as appropriate.

Error radius

Determine the distance as either a Bounded area or Undefined area, as appropriate. Be generous in the size of this error radius (i.e., err on the side of making it larger than usual) since "near" and "vicinity" indicate a high level of uncertainty.

Example: "near Santa Monica"



Because this is a very vague locality description, we have to be very careful about how we indicate our uncertainty, which might require some extra research. From the record label, we found that the specimen was collected in 1891 and that the specimen was collected on "grassy hills". Looking at the terrain map, we see some hills outside the bounded area of Santa Monica. Combined with this and the fact that the surrounding named places might not have existed in 1891, we will be generous with our error radius here.

MOUTH/HEADWATERS OF RIVER, CONFLUENCE OF WATERWAYS, TRAILHEAD

Examples:

- "headwaters of the Missouri River "
- "Triangle Lake Trailhead"

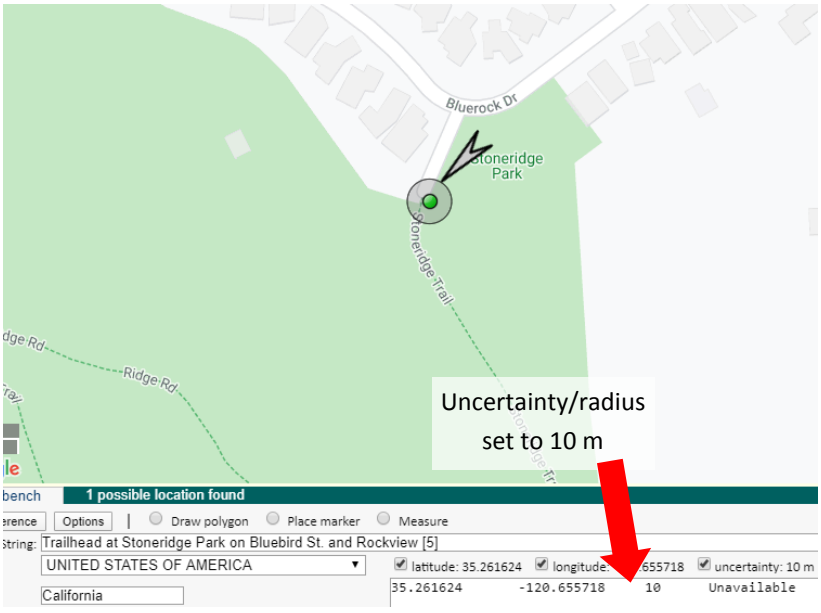
Coordinates

For a river mouth or confluence of waterways, select the midpoint of the line connecting the opposite shores where the waterways meet. For a river source, select the point of highest elevation on the river or create a boundary around the multiple streams contributing to the river and find the geographic center of that bounded area. For a trailhead, select the point where the trail begins.

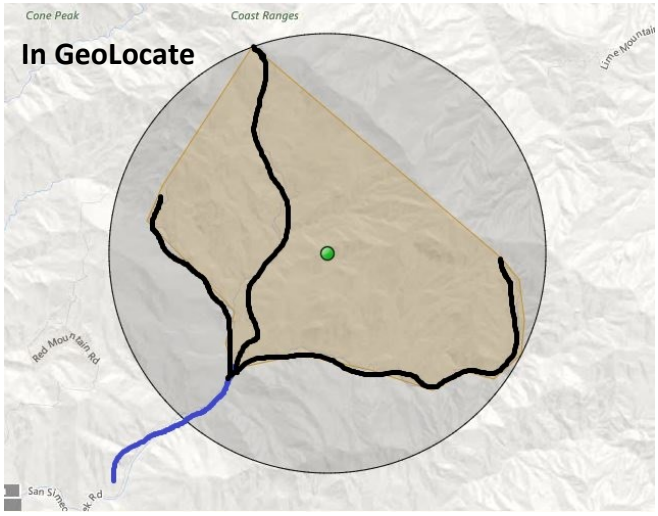
Error radius

For a river mouth or confluence of waterways, use the distance from the chosen point to the shore. For a single river source or trailhead, use 10 m.

Example 1:"Trailhead at Stoneridge Park on Bluebird St. and Rockview"

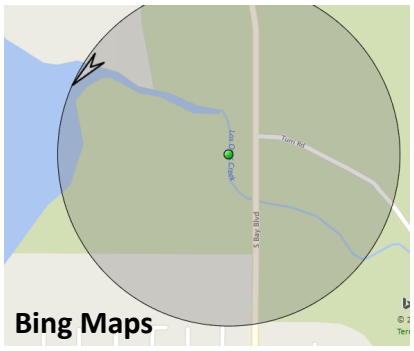


Example 2: "at headwaters of San Simeon Creek"



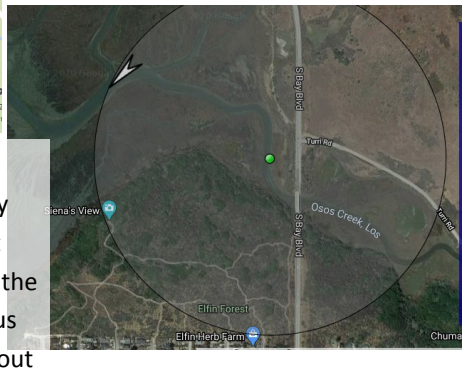
The blue line is San Simeon Creek, but the black lines are named forks of the San Simeon Creek. Since we don't know which one is referred to here, we draw a polygon to encompass all of the forks and adjust the radius accordingly. The marker is placed at the midpoint of the polygon.

Example 3: "mouth of Osos Creek"



Here's a case in which the reality is more complicated than the protocol makes it out to be. It's easy to pinpoint the mouth of the creek on a street map....

Google Satellite



...but not so much on a terrain map. Because the creek drains to a marshy area, here we chose to place the dot close to the "street maps" mouth of the creek, then use the uncertainty radius to indicate how uncertain we are about the collector's true meaning.

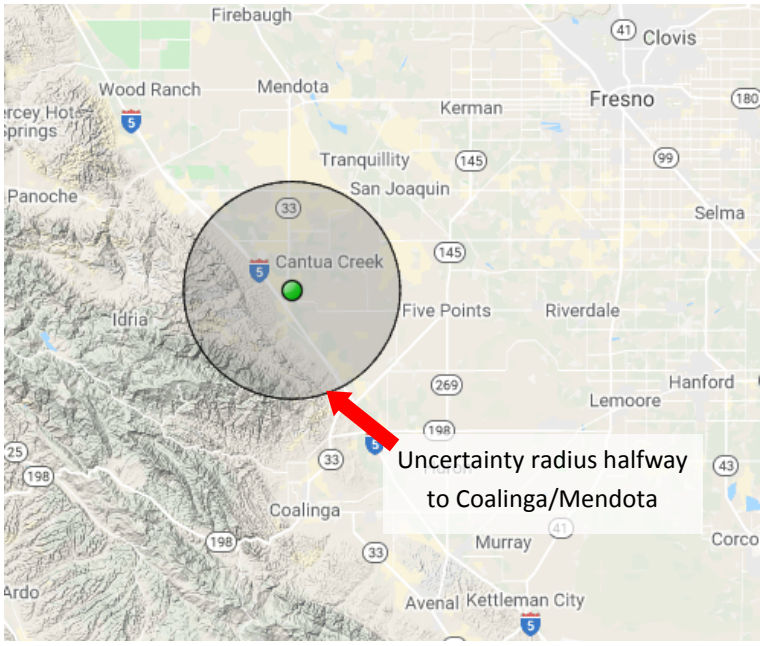
BETWEEN TWO PLACES

Examples:

- "between Atascadero and San Luis Obispo"
- "between Sacramento River and Main"

Coordinates	Use the midpoint between the centers of the two named places.
Error radius	Use half the distance between the centers of both named places.

Example: "between Mendota and Coalinga"



DIRECTION ONLY, NO DISTANCE

Examples:

- "N of Berkeley"
- "SW of Gainesville"

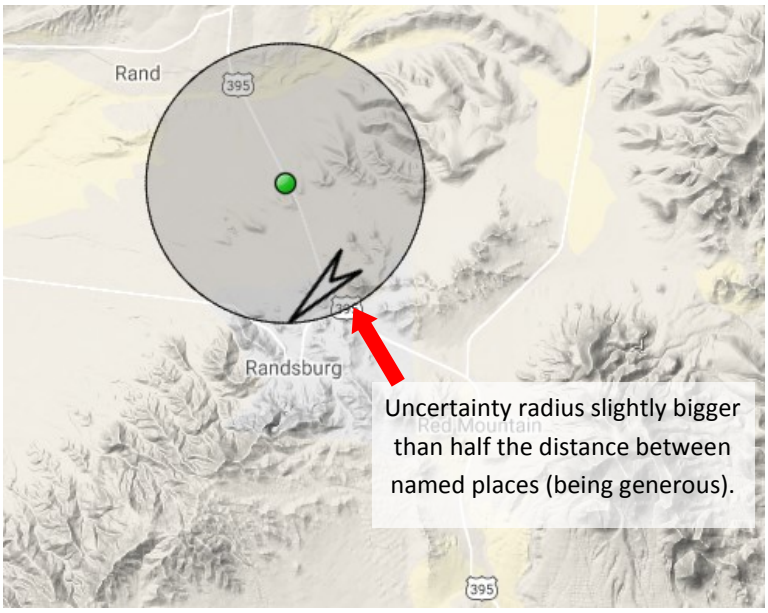
Coordinates

Use the midpoint between the centers of the specified feature and the nearest named feature, where the nearest named feature to use is in the specified direction. The nearest named feature should be, for the first example, the nearest named place somewhere between NW and NE of Berkeley.

Error radius

Use half the distance between the centers of both features. Be generous in the size of this error radius (i.e., err on the side of making it larger than usual) due to the high level of uncertainty.

Example: "N of Randsburg"



DISTANCE IN UNNAMED DIRECTION

Examples:

- "5 km outside Calgary "
- "2 mi from Cambria"

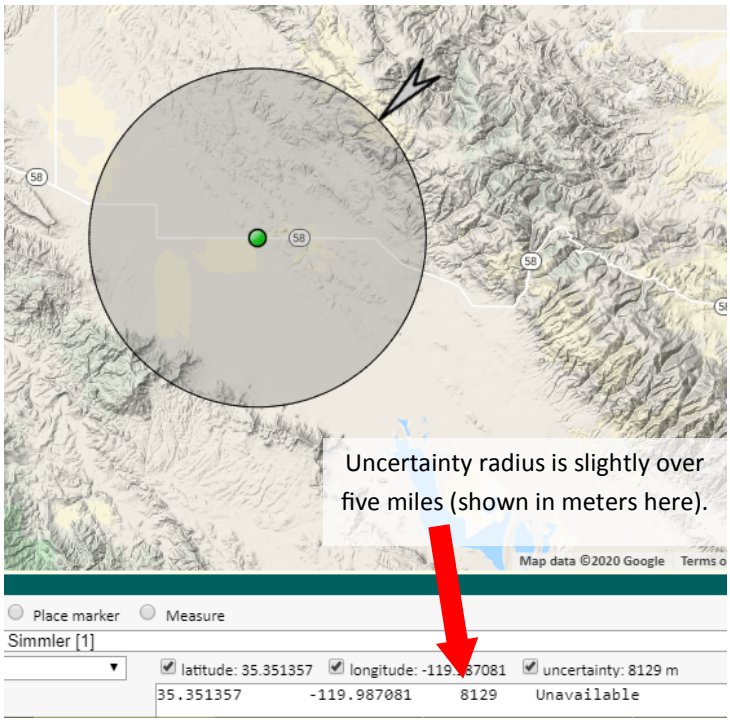
Coordinates

Determine the coordinates as either a BOUNDED AREA or UNDEFINED AREA, as appropriate.

Error radius

The length of the radius should be the same as the distance given in the locality description

Example: "5 mi from Simmler"



SPECIFIED DISTANCE IN A DIRECTION, NO PATH GIVEN

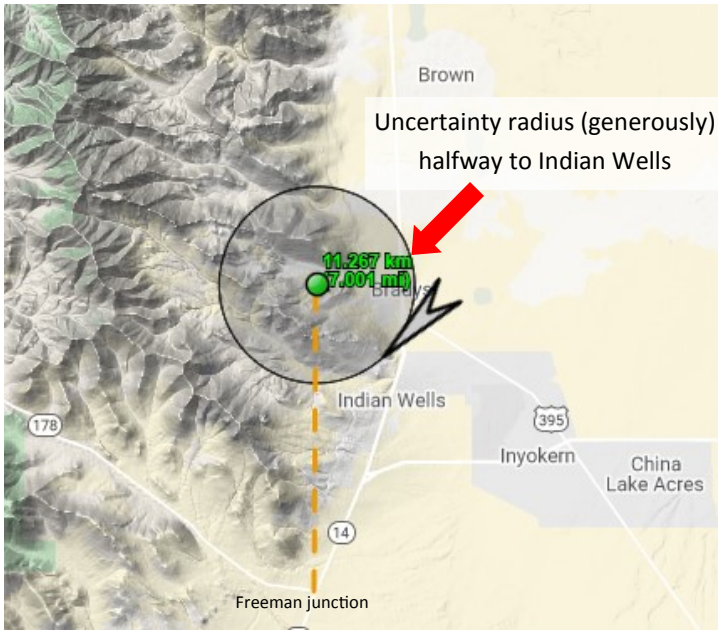
Examples:

- "50 miles W of Las Vegas"
- "3 km E of Sacramento"

Coordinates	Find the center of the named feature and measure the provided distance in the direction provided in the locality description.

Error radius	Use half the measured distance from the selected coordinates to the center of the nearest named feature. Make note of the named feature that you measured to in the "Georeference Remarks" or "Remarks" field.

Example 1:"7 mi N of Freeman Junction"



SPECIFIED DISTANCE IN A DIRECTION, PATH GIVEN

Examples:

- "7.9 mi N Beatty, on US 95"
- "7 mi. W Santa Barbara on 101 "

Coordinates	Find the geographic center of the named feature as either a Bounded area or Undefined area, as appropriate. Use the measuring tool to follow the specified route for the given distance. Use the end point as the coordinates.
Error radius	Use half the measured distance from the selected coordinates to the center of the nearest named feature. Make note of the named feature that you measured to in the "Georeferencing Remarks" or "Remarks" field.

Example 1:"Mt. Hough Rd, 6 mi N of Quincy Junction"

