STATEMENT ACCOMPANYING REQUEST TO MODIFY EXPERIMENTAL AUTHORIZATION WG2XVN OF AEROVIRONMENT, INC.

1. **Introduction**

By this application, AeroVironment, Inc. (AeroVironment), requests that the Commission grant a modification to call sign WG2XVN to operate facilities within the 1670-1675 MHz band to provide authorization at 16 sites. These proposed sites are detailed in the attached Form 442. The experiments involve power transmission facilities, railway infrastructure and agriculture. There are no modifications to the technical elements of the technology. In this statement, we explain the purpose of the modification and why this application is within the Commission's experimental authorization rules.

This application also proposes to delete sites currently authorized by WG2XVN where experiments have been completed.

2. **Purpose**

Background

The purpose of these experiments is providing analysis and information to further aerial surveillance in support of the operational aspects of the power grid railway infrastructure and agriculture. The ability of real-time full motion video via small unmanned aircraft system (SUAS) technologies to assist in monitoring on a regular basis contributes to better supervision, cost efficiencies and and improved maintenance. Real time information and imagery allows more informed assessment and faster corrective action. Data captured by cameras is typically far more accurate than the human eye and provides lengthier opportunity to scrutinize the challenge. For nighttime operations, a SUAS can be fitted with an infrared (IR) camera to enhance visibility.

The aerial monitoring and inspections proposed relate to critical infrastructure of power grid and railway bridge facilities. The objective is to show that the technology can make a meaningful contribution to monitoring and maintaining these facilities. An important element of this these experiments is ability of the transmitted video technology to discern variations and changes over short and longer time increments.

These SUAS experiments will also pursue efficiencies in farming, including planting, fertilizing and harvesting. The technology seeks to demonstrate how it can assist in a farm adapting to seasons, weather or crop growing cycles.

Each proposed site presents a unique environment to test the radio transmissions directing the command and control and payload features of the SUAS and the quality and detail of the data transmissions from the aircraft. The research and information that results from this work is provided to the Federal Aviation Administration (FAA) and is critical to the FAA's congressionally mandated project to integrate SUAS into civilian airspace.

The experiments at the proposed sites will contribute to the research portfolio surrounding SUAS radio technology. A critical facet of this research is the effectiveness of the SUAS datalink behavior and performance in varied environments while engaging in representative mission sets. The work is an important facet of AeroVironment's investment in a platform of SUAS commercial uses and upon which future investment relies.

The detailed results from AeroVironment's experiments are documented and submitted for FAA review on a monthly basis. The Commission's authorization is critical to developing a record demonstrating the safety and effectiveness of commercial small unmanned aircraft. Commercial use is contingent upon unmanned aircraft systems operating safely within assigned flight areas and causing no harm to the public. How the aircraft is able to function to deliver specific objectives within a sector's institutional protocols and other variables is only revealed when the SUAS is tested in an actual mission environment. The FAA examines how a system is designed, constructed and manufactured; including the engineering processes, software development and control, configuration management, and quality assurance procedures supporting the aircraft.

The Experiments' Involving Electric Grid and Railway Bridge Inspections

Inspecting transmission lines is critical to maintenance and improvements associated with reliable electric supply to residential and industrial customers. Inspection obtains valuable information addressing line conditions that assist engineers in monitoring, repairing or replacing grid infrastructure. Reliable energy supply requires performing live line inspections. The SUAS radio technology affords a flexible means to survey and also obtain data from grid sensors, its positioning is not dependent on the infrastructure. The experiments with SUAS's radio technology will determine how it detects the physical characteristics of the lines and associated fixtures and equipment, obtain data for analysis. It will also test how the radio technology performs in the electric line environment in varied weather and climate. SUAS presents meaningful cost and safety efficiencies to high power transmission lines inspections.

Railway bridge and related infrastructure by SUAS presents similar efficiencies in more pervasive and frequent inspections, resulting in costs reductions. The ability of the aircraft to navigate within the confined space under and around the bridge will be tested in both water and culvert environments. A bridge's height, length, adjacent infrastructure, the depth and strength of the water's current, as influenced by weather conditions, affects reliability and vulnerability. The ability of the SUAS technology to discern the interaction of the bridge's structural systems of bridge will be tested. The testing seeks a template that gathers information reflecting reliability and vulnerability from the data gathered from the aircraft as part of the bridge management system.

Railway bridge and power grid testing will also gauge multipath radio propagation challenges. As the Commission knows, radio signals not only travel by the direct line of sight path, but as the transmitted signal does not leave the transmitting antenna in only the direction of the receiver, but over a range of angles. The transmitted signals spread out from the transmitter and they reach other objects such as infrastructure or reflective surfaces such as water. A core purpose of the proposed tests is to gauge in varied environments the multipath propagation resulting from the

variety of signal paths that may exist between the transmitter and receiver and give rise to signal distortion, data loss, fading or other interference.

The Experiments Involving Farming

The experiments present a challenged radio environment, particularly in Santa Barbara County, California. Sites in Lompoc and Santa Ynez are in the Santa Ynez Valley, which lies between the Santa Ynez Mountains to the south and the San Rafael Mountains to the north. The Santa Ynez River flows through the valley from east to west. The Santa Ynez Valley is separated from the Los Alamos Valley, to the northwest, by the Purisima Hills, and from the Santa Maria Valley by the Solomon Hills. The ability to use the radio spectrum in such an environment, which are replicated in farm areas throughout the US, will provide insight as to the technology's performance.

Additionally, encompassed within the experiments addressing a particular sector, such as agriculture, is whether the SUAS radio technology is capable, via applications designed to provide specific data or other information relating to that sector, images that provide meaningful and more efficient solutions in areas that are currently labor intense and/or logistically difficult. The experiments will provide insight to the value and risks associated with integrating the applications into the core SUAS technology.

3. **Technology Use**

The experiments embrace a model using a band segment aligning with technology and equipment currently available. AeroVironment reiterates its commitment to operations respecting other users of the band and those in adjacent segments. The limited power levels proposed are part of this commitment. AeroVironment believes the compelling purpose of bringing these advanced services to the electric utility and railway sectors serves the public interest. The 1670-1675 MHz channels provide SUAS control and video and telemetry transmission from the SUAS to the ground. Slots are dedicated for uplink data and a downlink.

At each individual site, there will be only one SUAS airborne at any time. Operations will be limited to 500' (152.4 meters) AGL and below. The SUAS will remain within the radius of the exercise center points, which range from to .5 km to 8.94 km.

The proposed locations of operations relating to the power grid are as follows:

- Daggett, San Bernardino County, California, Southern California Edison facilities within 3.21869 km (2 miles) of the center point
- Sherrills Ford, Catawba County, North Carolina , Duke Energy facilities within 8.94 km (5 miles) of the center point

The proposed locations of operations relating to the railway bridges are as follows:

- Hannibal Bridge, Missouri River, Kansas City, Missouri, BNSF Railway, within .5 km of center point
- Sibley Bridge, Missouri River, between Jackson County and Ray County Missouri, BNSF Railway, within 1 km of center point.
- Gassman Bridge, Trestle Valley, Ward County, North Dakota, BNSF Railway, within 1 km of center point
- Bismarck Bridge, Missouri River, Burleigh County, North Dakota, BNSF Railway, within 1.852 km of center point
- Valley View Bridge, Sheyenne River, Valley City, Barnes County, North Dakota, BNSF Railway, within 1 km of center point
- Lake Ashtabula Bridge, Sheyenne River, Luverne, Steele County, North Dakota, BNSF Railway within 1 km of center point
- Sandpoint Bridge, Lake Pend Oreille, Sandpoint, Bonner County, Idaho, BNSF Railway within 1.25 km of center point
- Canyon Diablo Bridge, Canyon Diablo, West Canyon Diablo, Coconino County, Arizona, BNSF Railway within 5 km of center point.
- Memphis (Frisco) Frisco Bridge, Mississippi River, Memphis, Shelby County, Tennessee and Crittenden County, West Memphis, Arkansas, BNSF Railway, within 1 km of center point.
- Java Bridge, Middle Fork Flathead River & Java Creek, West Java, Flathead, Montana, BNSF Railway, within 1 km of center point
- Two Medicine Bridge, Two Medicine Creek, East Glacier Park, Glacier County, Montana, BNSF Railway, within 1 km of center point

The proposed sites relating to agriculture are:

- Lompoc, Santa Barbara County, California, within 3.52 km of center point
- Santa Ynez, Santa Barbara County, California, within 1.5 km of center point
- Modesto, Stanislaus County, California, within 1 km of center point

Maps of each site and the parameters of operations are provided in the Contour Attachment.

4. N**ature of Operations**

Surface Based and Airborne Transmission

As noted in our original application, AeroVironment's communications module, Digital Data Link (DDL), will use the 1670-1675 MHz band segment for purposes of sending ground based command and control data to and from the SUAS and to transmit video and telemetry to the ground control station. The technology, capable of operating within 1625-2390 MHz, requires 4 MHz for full motion video and a 1 MHz channel for video at 15 frames per second. Emission Designators are 4M68G7W and 1M56G7W, respectively, with a transmit power at 10W. Transmission control will be from the surface control station to the SUAS via a laptop or

console. AeroVironment's DDL system has been adopted by the US Army as the standard communications architecture for all small unmanned systems, including ground robots.

5. **Stop Buzzer**

Andy Thurling, Chief Test Pilot, Director, Product Safety and Mission Assurance, will be available by telephone at 805.581.2198, extension 1892, Cell Phone 805.368.6351 and will act as a "stop buzzer" if any matters involving interference arise during the testing.

6. **Transmitting Equipment**

The transmitting equipment is unchanged. It is AeroVironment Transreceiver Model 50280, with 2 units at each location. It is not experimental.

7. **Antenna**

The Antenna details have not changed from the current authorization and are as follows:

Antenna	**Gain** (Nominal)	**Polarization**	Orientation in Vertical Plane	Oriental in Horizontal Plane
GCU Antenna ASY AeroVironment Stack Patch	9dbi*	Vertical	30	85
1670-1675 MHz Tailboom ASSY AeroVironment Dipole	2dbi	Vertical	78	360

*Major Side Lobe

- E-Plane
    - Gain: -2 dbi
    - 120 deg
- H- Plane
    - Gain: -2 dbi
    - 179 deg

8. **Restrictions on Operations and Interference Protection**

AeroVironment understands that experimental operations must not cause harmful interference to authorized facilities. Should any interference occur, AeroVironment will take immediate steps to resolve the interference, including, if necessary, discontinuing operations.

9. **Waiver of Station Identification Requirements**

AeroVironment requests a waiver of the station identification requirements stated in Section 5.115 of the Commission's rules.
The experiments proposed by AeroVironment are an integral element of the investment in SUA radio technology and its broader commercial use.

11. **Federal Aviation Administration (FAA) Certificate of Waiver Authorization (COA)**

AeroVironment has or will file applications for a Certificate of Waiver or Authorization with the FAA detailing the areas where the SUAS will be flying during the proposed operations.

AeroVironment understands that no operations will be pursued until FAA approval of the COA and that any operations will be within the COA parameters.

11. **Diagram**

A diagram and referenced maps of the proposed operations are provided in the Attachment.

Conclusion

AeroVironment appreciates very much the Commission's consideration of this modification application for an Experimental Authorization. Please call upon us if we can respond to any questions.

Attachment

Operations Diagram

Small Unmanned Aircraft-

Video and Telemetry

1670-1675 MHz

Aircraft Command and Control Main and

1670-1675 MHz

CONTOURS OF PROPOSED SITES

1. DAGGETT, CALIFORNIA - N34º 52’18” W116º 49’ 49”/ 3.2189 km Radius

2. MARSHALL STEAM STATION, Sherrills Ford, North Carolina- N35º 35’ 56”W80º 57’ 59”/8.94 km Radius

3. HANNIBAL BRIDGE, Kansas City, Missouri- N39º 6’46”W94º35’9”/.5 km Radius

4. SIBLEY BRIDGE, Jackson/Ray County, Missouri- N39º 10’ 47”W94º10’46”/1 km Radius

5. GASSMAN COULEE TRESTLE, Harrison, North Dakota, N48º13º45”W101º23’7”/1 km Radius

6. BISMARCK BRIDGE, Bismarck, North Dakota, N46º 49’ 5”W100º49’35”/1.852 km Radius

7. VALLEY CITY BRIDGE, Valley City, North Dakota, N46º56’19”W97º59’27”/1 km Radius

8. LAKE ASHTABULA BRIDGE, Broadview, North Dakota, N47º15’55”W98º0’37”/1 km Radius

9. SANDPOINT BRIDGE, Sandpoint, Idaho, 48º15’34”W116º31’49”/1.5 km Radius

10. CANYON DIABLO BRIDGE, Coconino County, Arizona, N35º10’0”W111º 7’ 37”/ 5 km Radius

11. MEMPHIS FRISCO BRIDGE, Shelby County, Tennessee, Crittenden County, Arkansas, N35º 7’ 44”W90º4’33”/ 1km Radius

12. JAVA BRIDGE, Flathead County, Montana, N48º14’27”W113º34’16”/1 km Radius

13. TWO MEDICINE RIVER BRIDGE, East Glacier, Montana, 48º 27’ 15”W113º 12’37”/1 km Radius

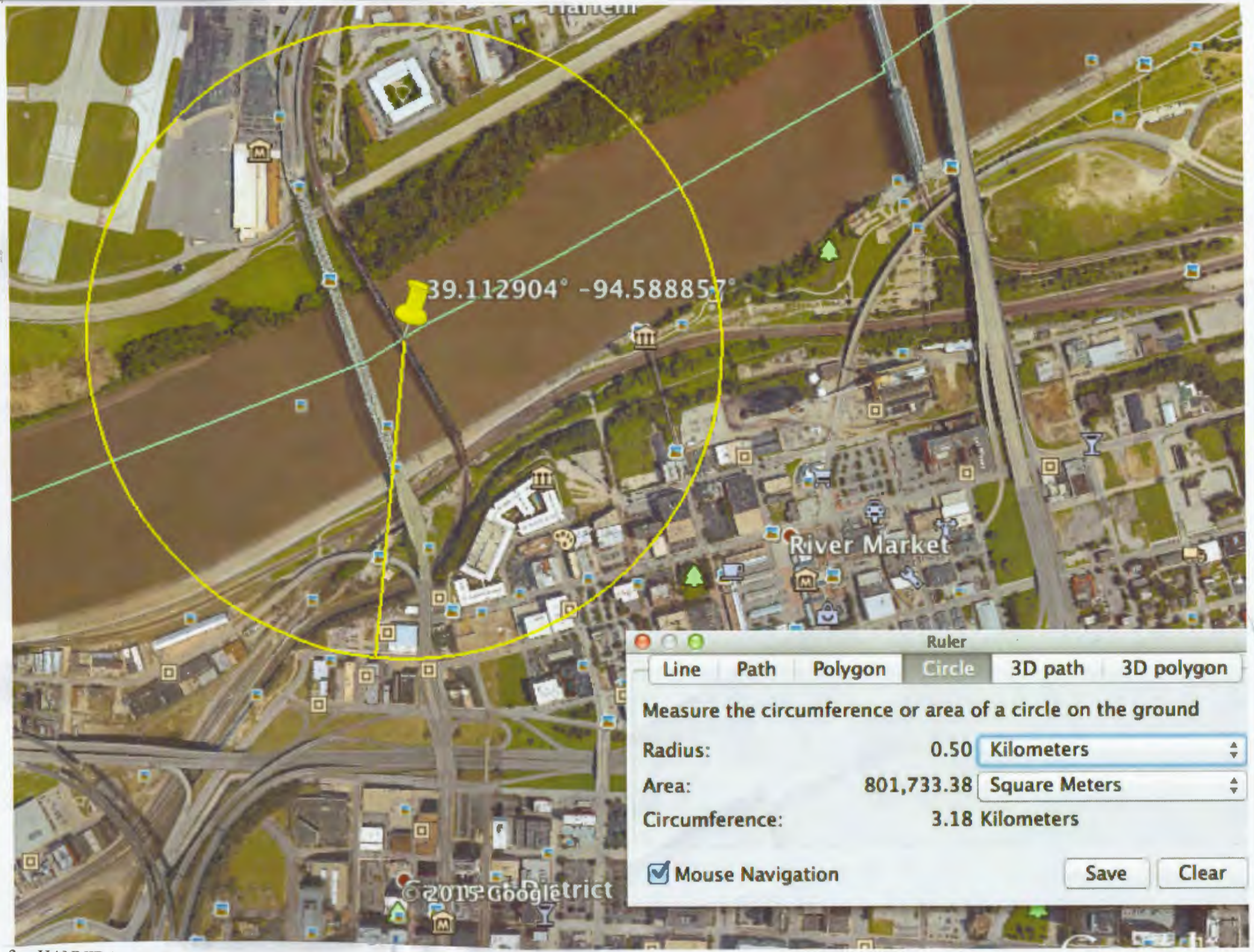
14. LOMPOC AGRICULTURE, Lompoc, Santa Barbara County, California, N34º35’38”W120º20’21”/ 3.52km Radius

15. SANTA YNEZ AGRICULTURE, Santa Ynez, Santa Barbara County, California, N34º35’0”W120º3’15”/1.5 km Radius

16. MODESTO AGRICUTURE, Modesto, Stanislaus County, California, N37º39’33”W120º52’24”/1 km Radius

1. DAGGETT, CALIFORNIA - N34° 52'18" W116° 49' 49"/ 3.2189 km Radius

2. MARSHALL STEAM STATION, Sherrills Ford, North Carolina- N35° 35' 56"W80° 57' 59"/8.94 km Radius



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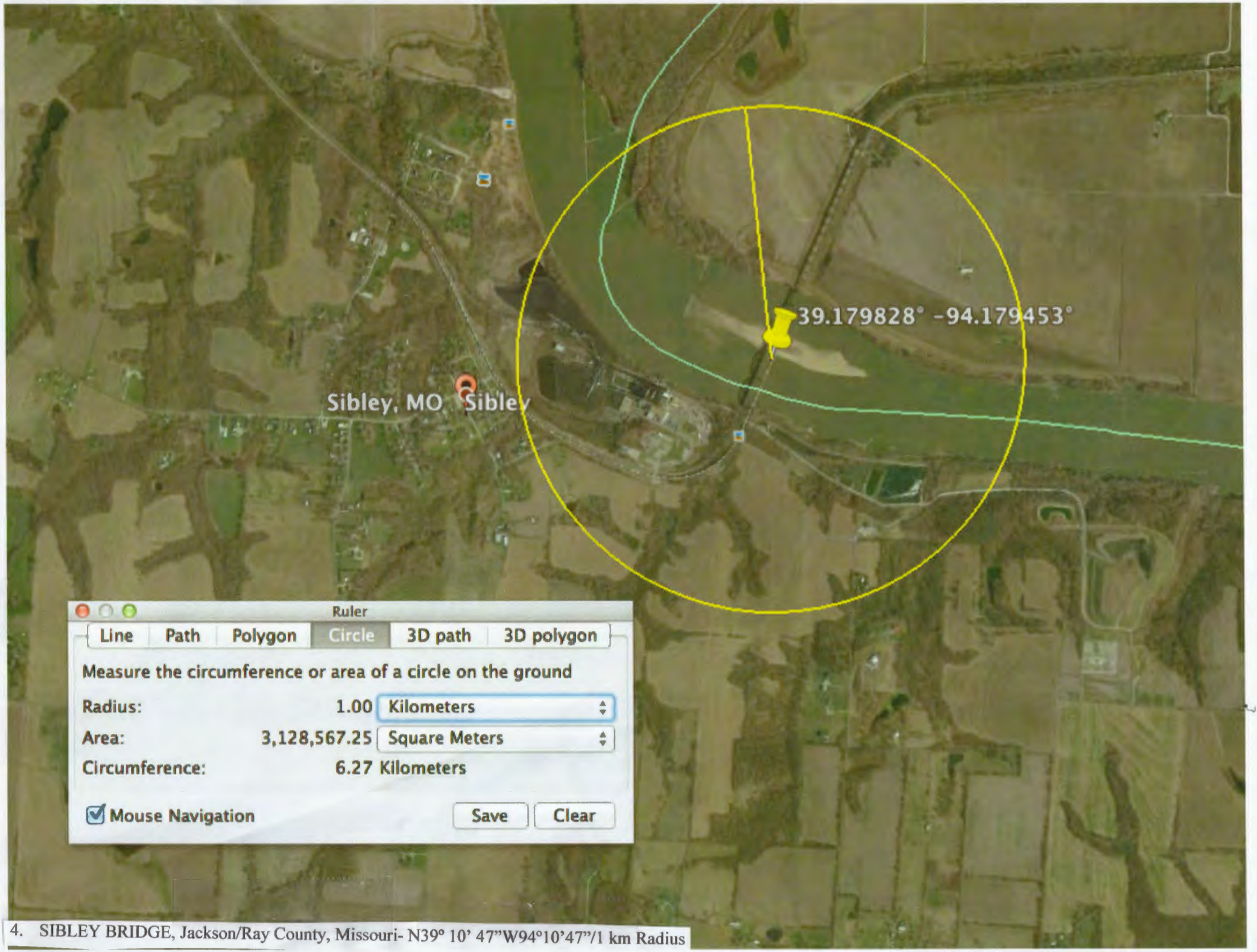

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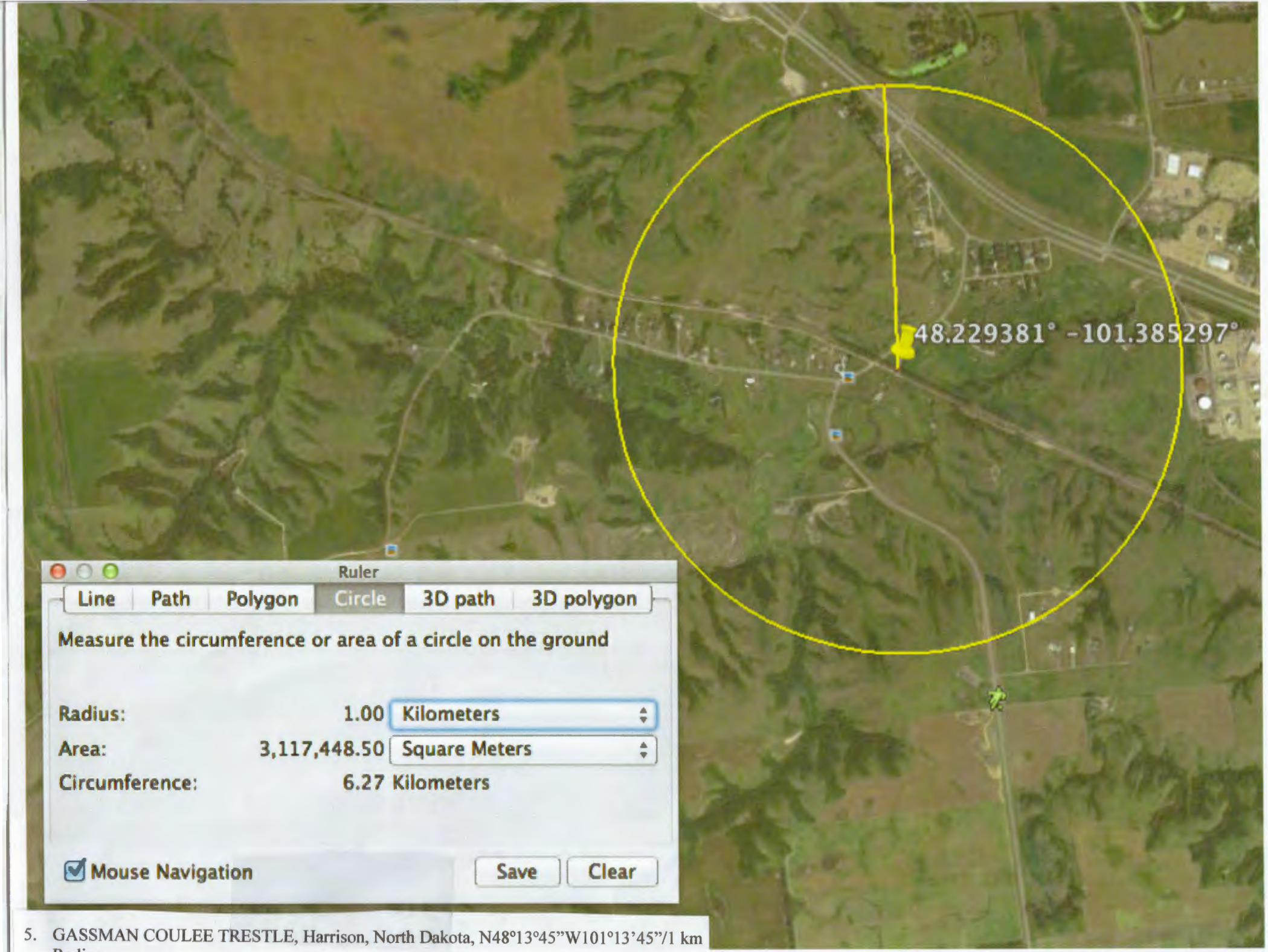

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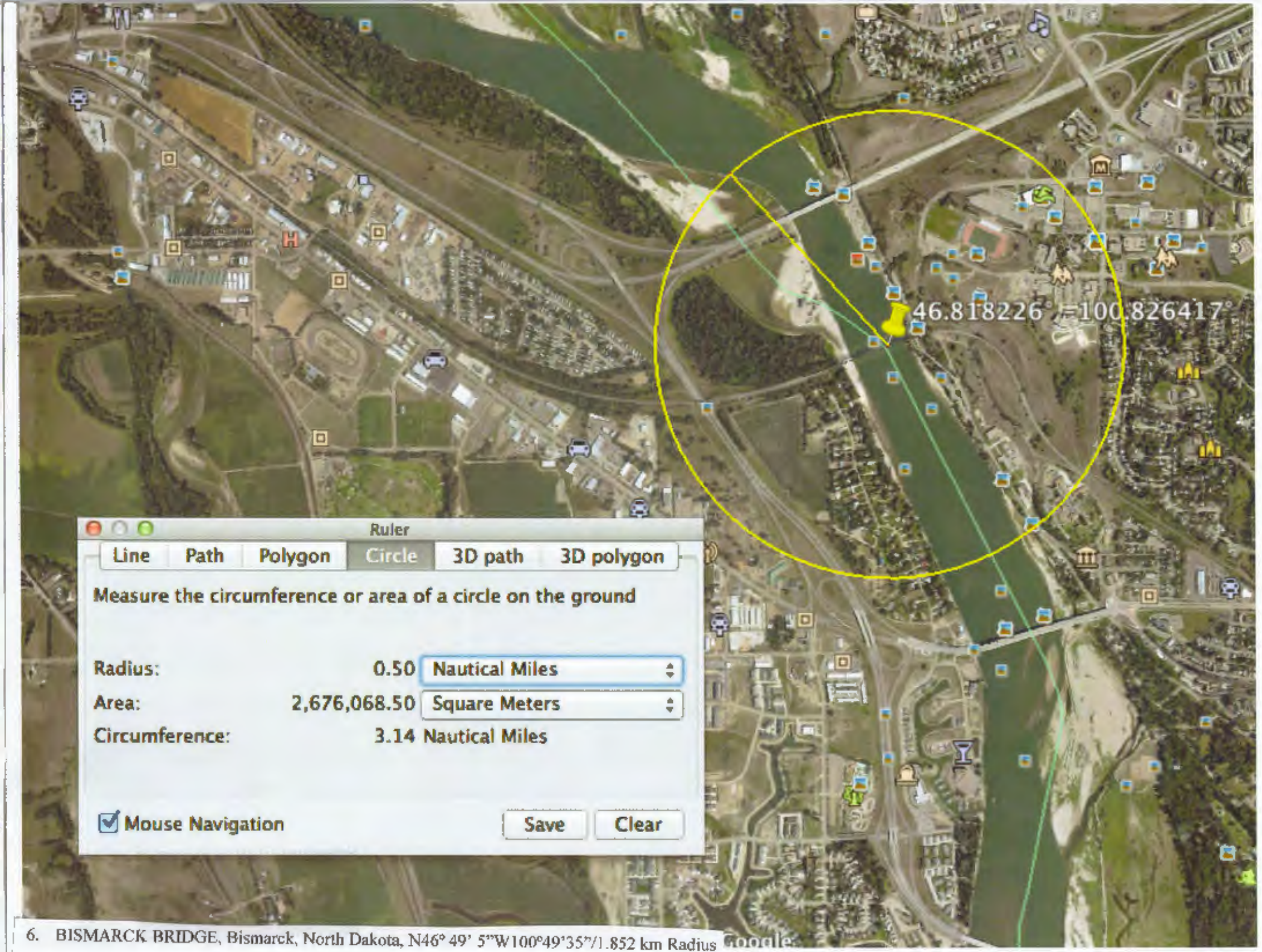

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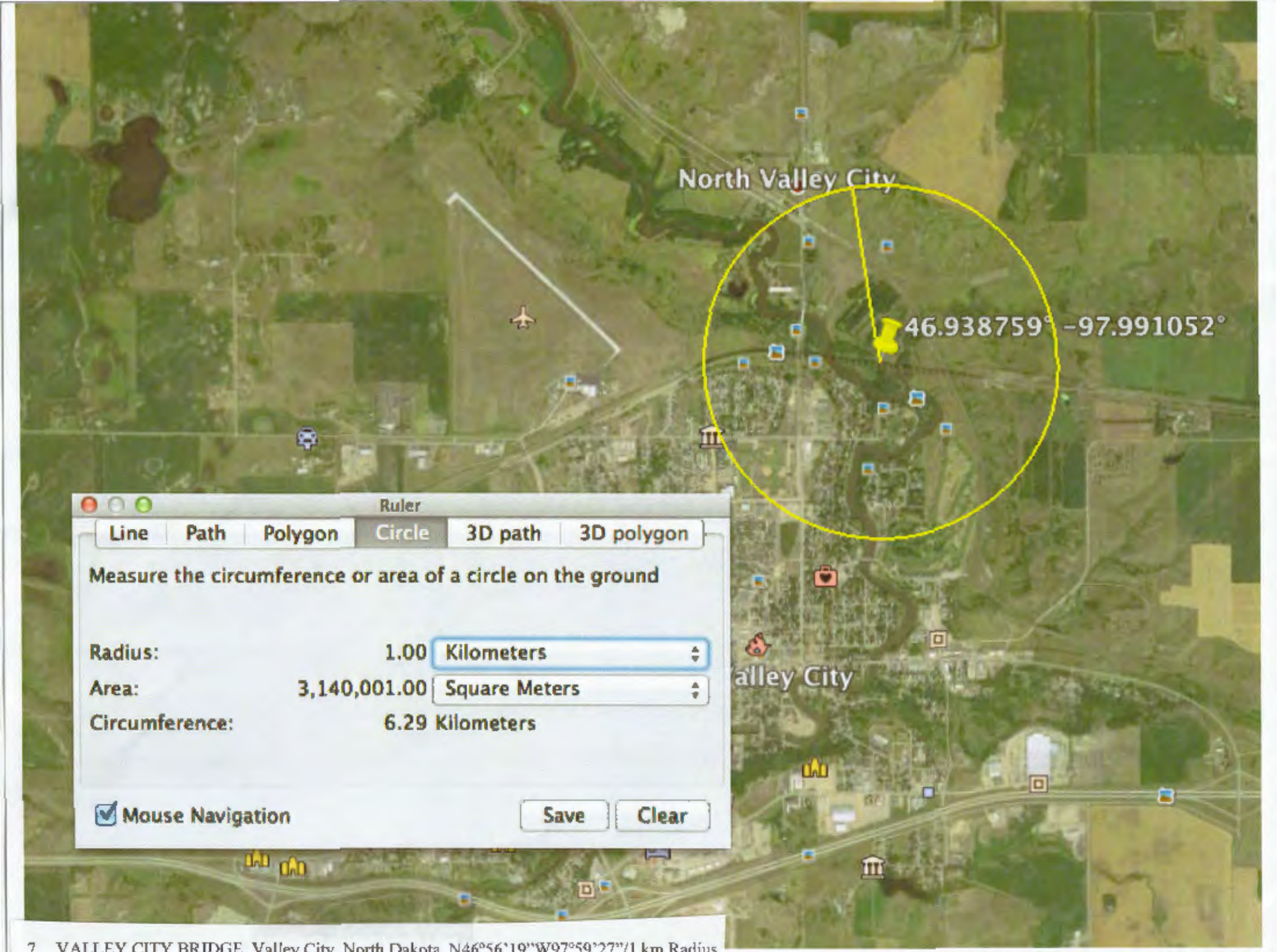

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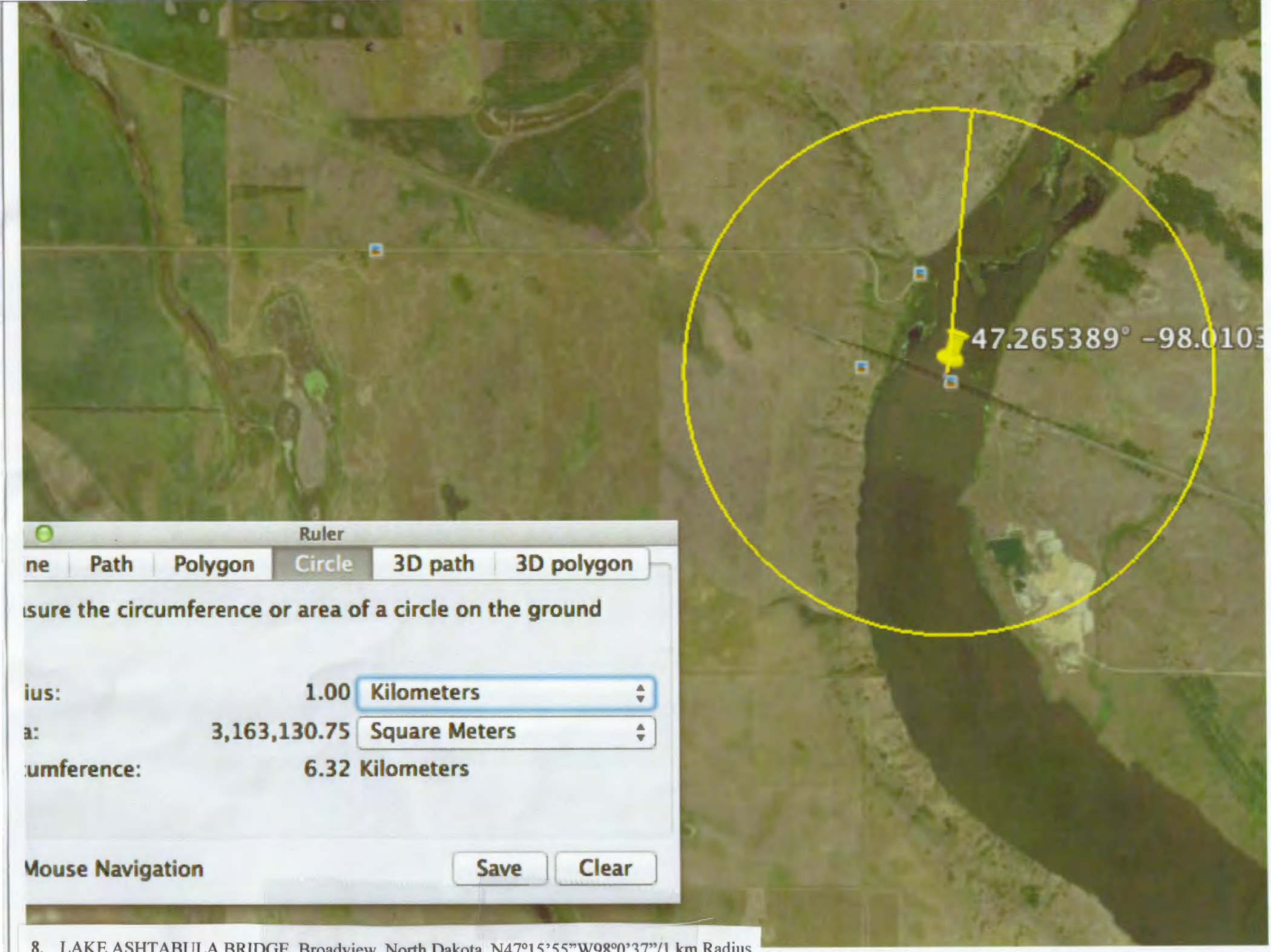

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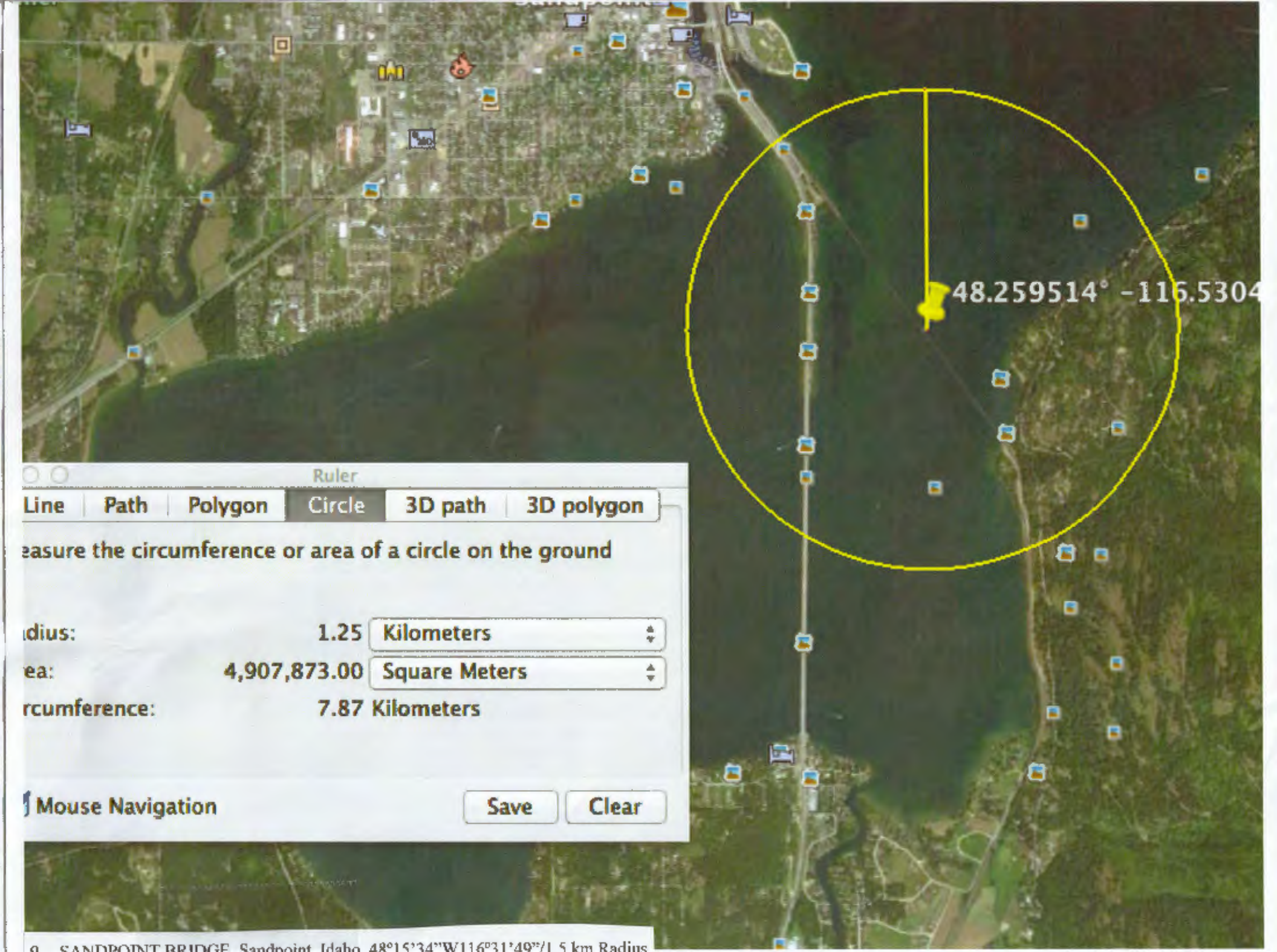

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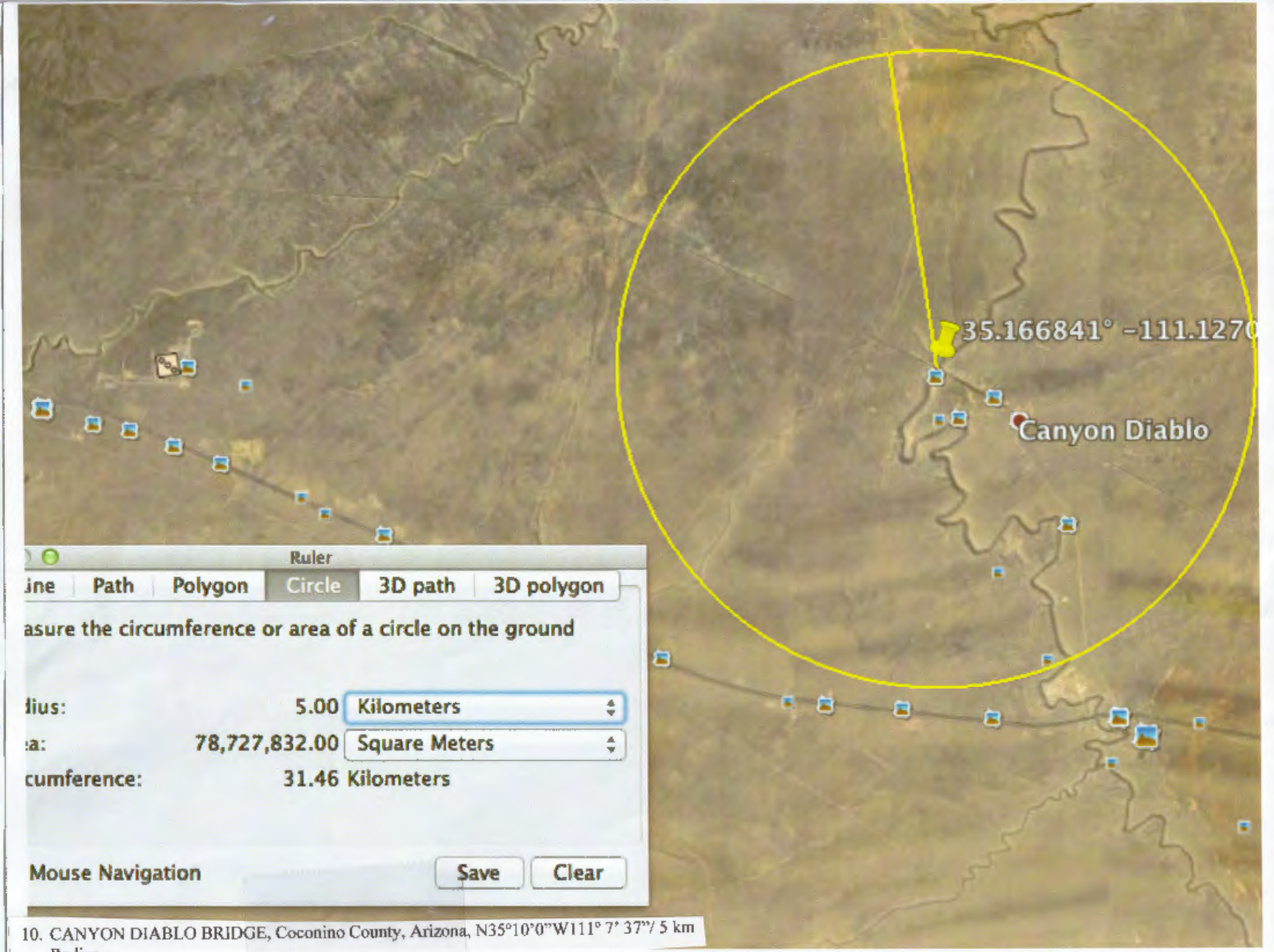

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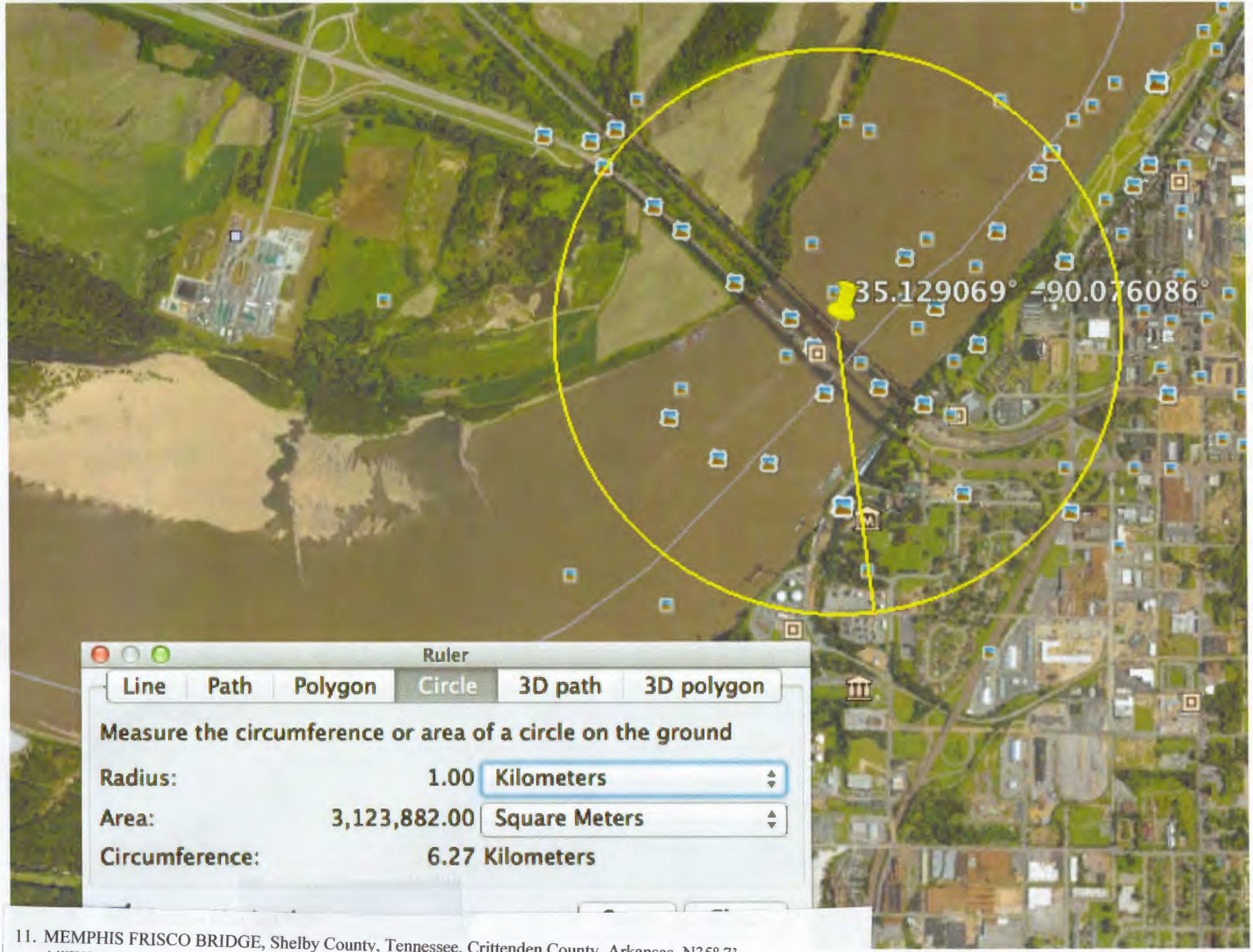

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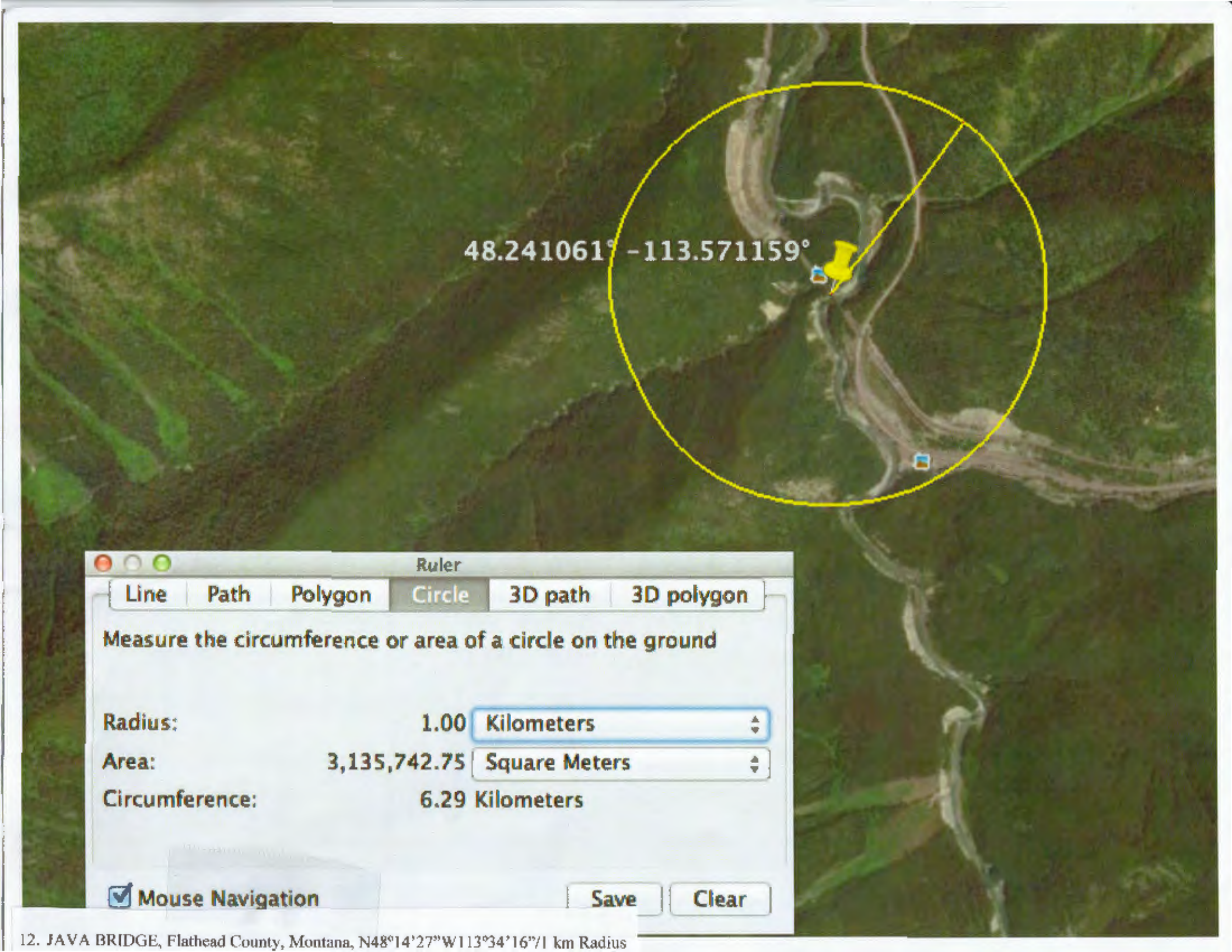

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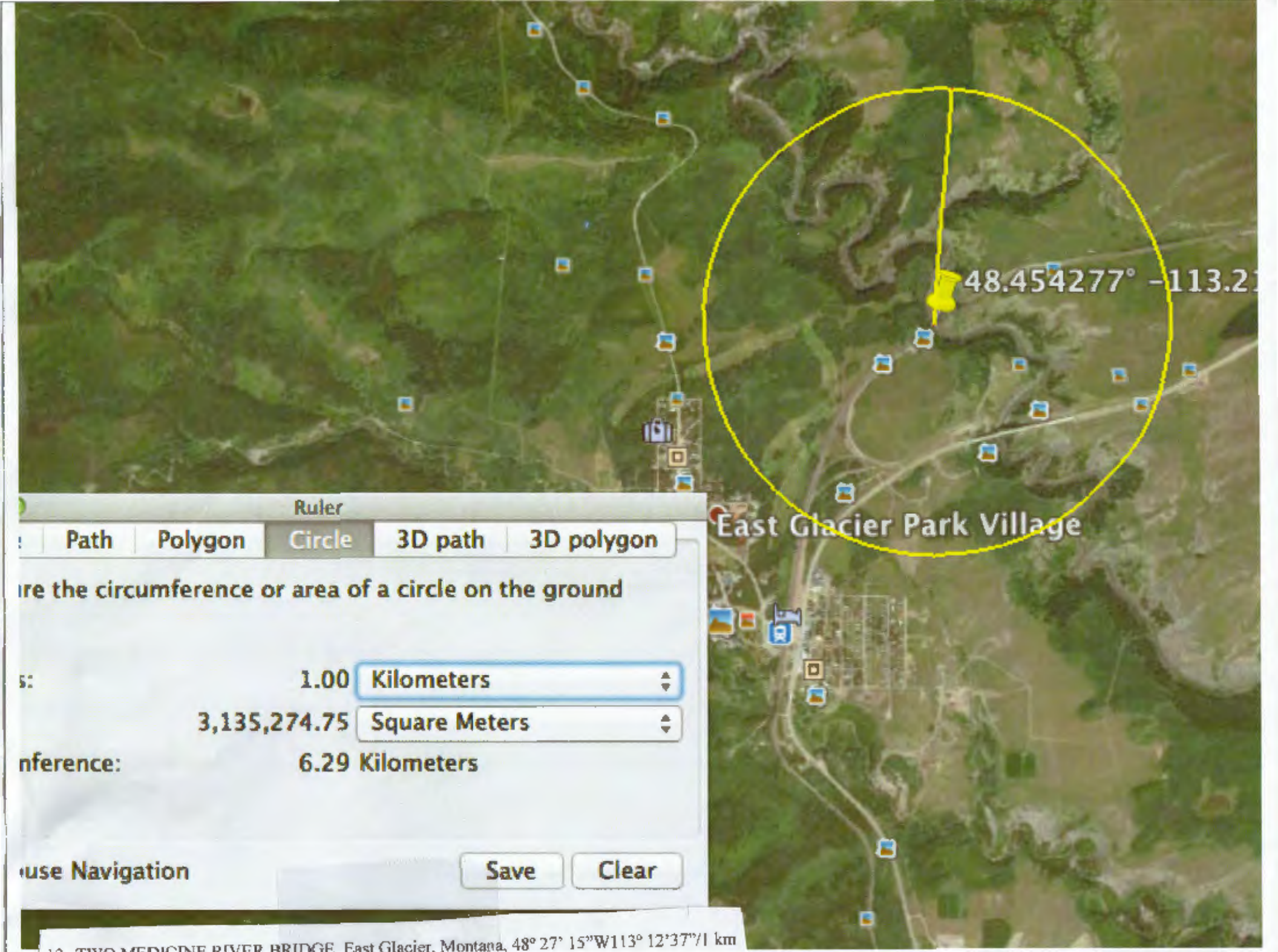

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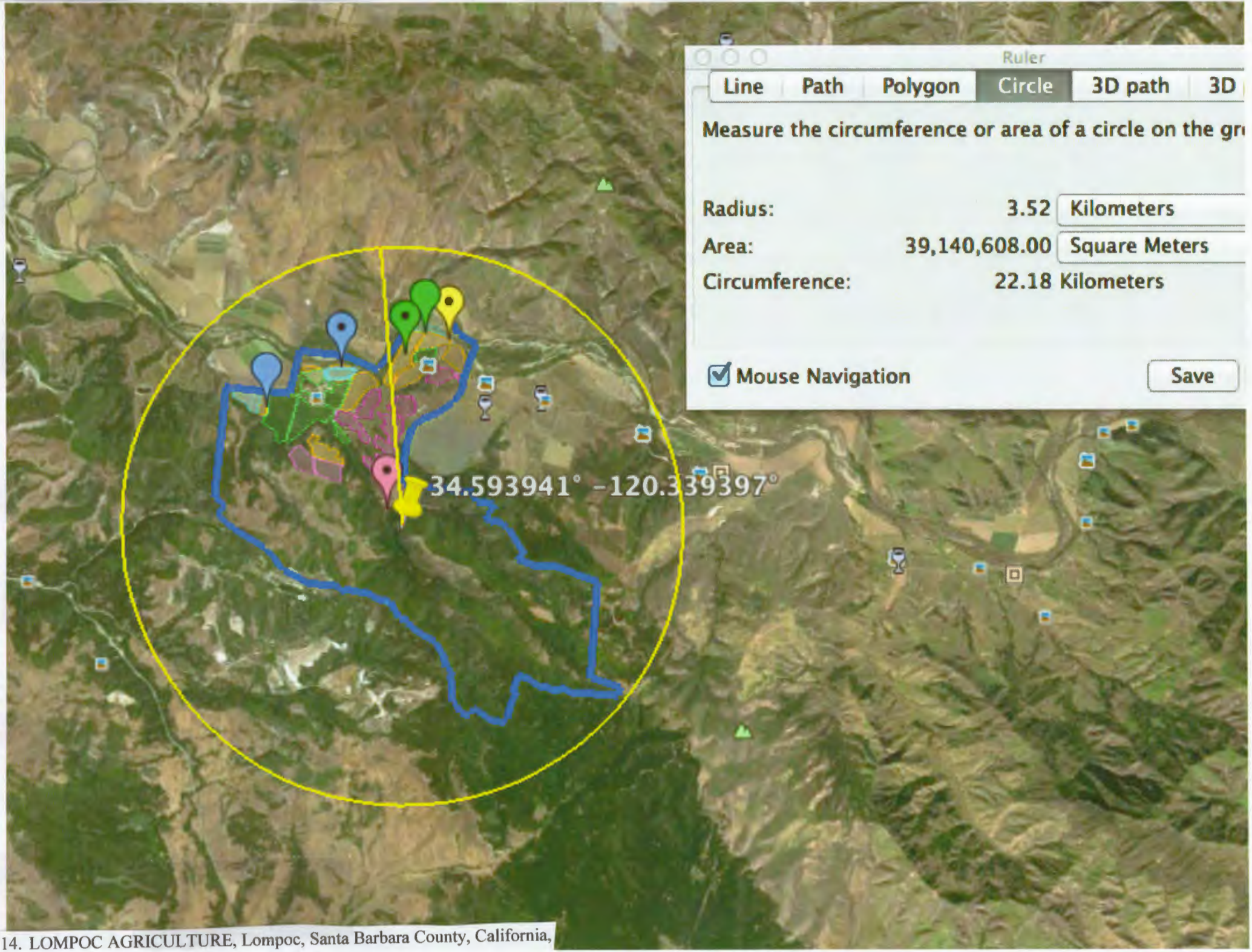

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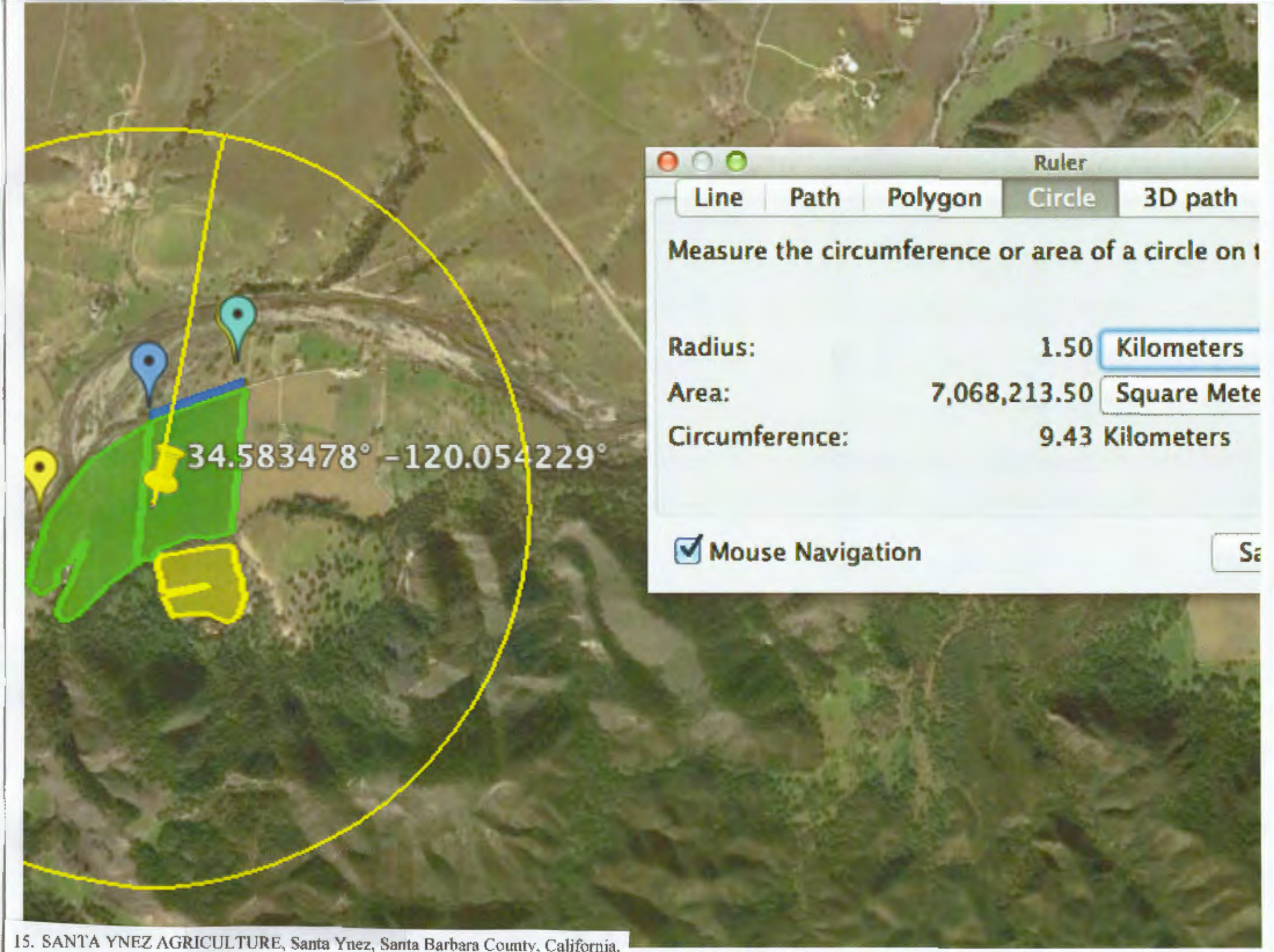

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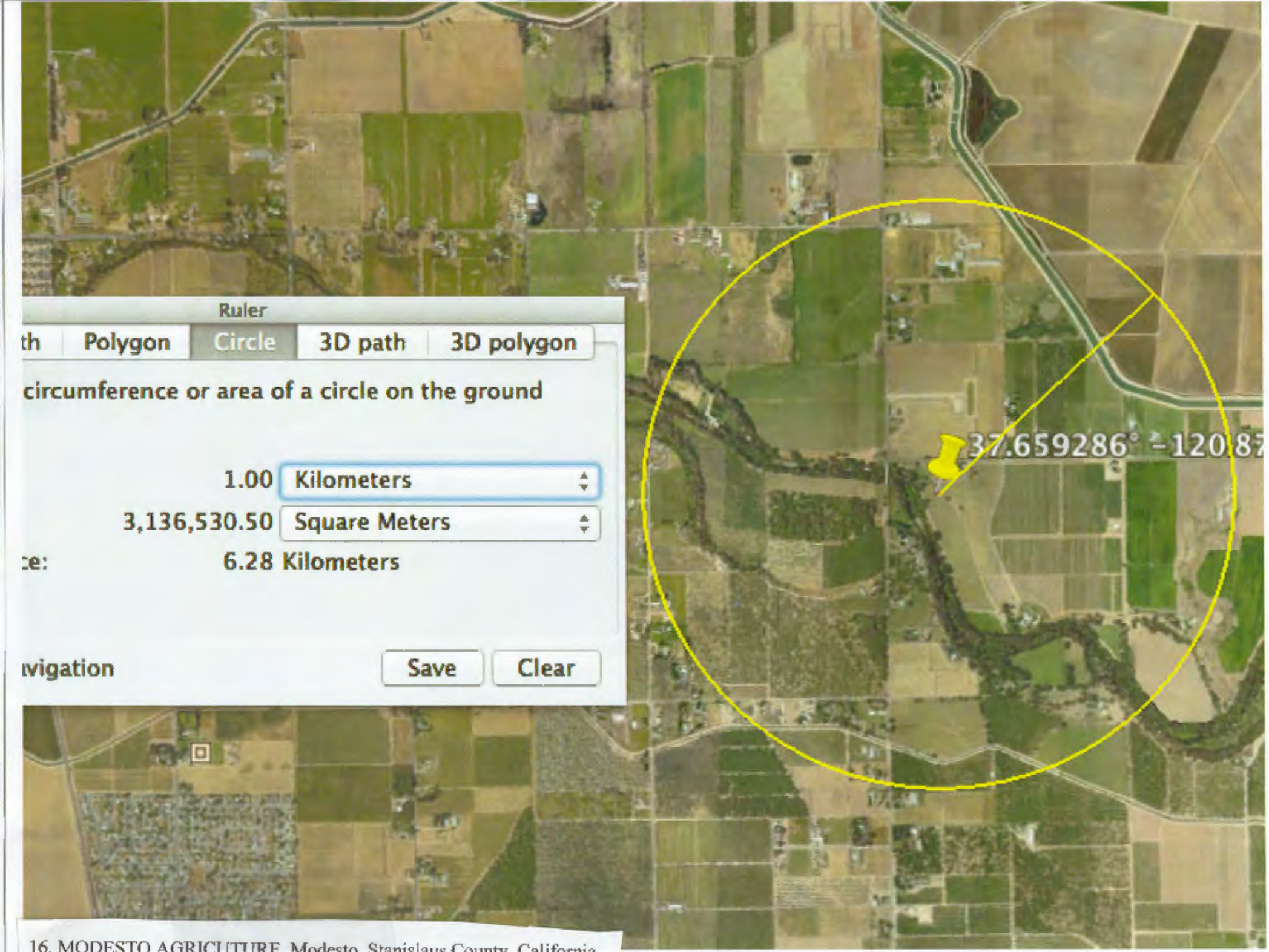

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