Boundary Retracement Survey of Cal Poly’s Serrano Ranch

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ABSTRACT

A boundary retracement survey of Cal Poly’s Serrano Ranch was performed to mark a property line that had been lost due to fire. Research for this survey involved the review of documents used in the conveyance of the property, finding record maps of the project area and its surrounding properties, and a field review of the site. Static GPS was used to establish coordinates for monuments that were required to establish the position of the boundary line.
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INTRODUCTION

**Background**

A boundary retracement survey on the Serrano Ranch area of California Polytechnic State University in San Luis Obispo, California was performed to relocate a portion of the boundary along the property. Boundary retracement surveys are performed to establish property lines based on monuments found in the field and acceptable retracement practices. The general steps were to research the existing legal deeds and record maps of the project area and its surroundings to gain information regarding how the location of the boundary lines and monuments were determined. Then field research was done to locate record monuments. Finally, the area was resurveyed according to the data from the previous surveys in order to determine boundary line locations.

**Justification**

Due to fire damage the monuments marking the boundary line of the area were lost. The fence line was destroyed and no boundary monuments for the property had been found. A boundary retracement survey was necessary in order to allow a fence line to be replaced in the correct position. The fence must be placed properly so that the neighboring land (owned by the City of San Luis Obispo) is not infringed upon. It is important to construct this fence as soon as possible as there is viable grazing land in this area that cannot currently be used.

**Objectives**

The objective of the boundary retracement survey was to find sufficient monuments from previous surveys of the area in order to determine and mark the boundary location using acceptable standards of practice so a fence line can be reconstructed in the correct location.
LITERATURE REVIEW

To perform a proper boundary retracement survey, the surveyor must “follow in the footsteps of the original surveyor” (Hermansen, 1991). The aim of a boundary retracement survey is to “resurrect evidence of the location of a once established property corner” (Griffin, 1960). In order to be successful in a boundary retracement, the surveyor must understand how the boundary was established and research the possible operating legal documents (deeds, records of survey, boundary line agreements, etc.) of the project area. Recently, many documents have been made available electronically from city level up through federal public lands (Hermansen and Brown 2006). However it is possible that the surveyor may need to contact former surveyors or landowners of the area in order to locate undocumented survey records.

Public Land Survey System

The Public Land Survey System (PLSS) is used to describe all lands originally owned by the Federal government of the United States of America. The PLSS began after the Revolutionary War when the federal government “wished to both distribute land to Revolutionary War soldiers in reward for their service, as well as to sell land as a way of raising money for the nation” (nationalatlas.gov). The land was documented using a series of surveys that started at a point of origin and established six mile-square townships which were divided into 36 one mile-square sections. Sections subdivided into quarter sections, quarter-quarter sections, or irregular government lots depending on the land value and terrain. Monuments were placed at each section corner, the quarter-section corners, and other important locations (nationalatlas.gov). Figure 1 shows the breakdown of the PLSS from a grid of townships down to how a township section is subdivided. Early surveys used inconsistent measurement tools such as the tape and chain that caused many inaccuracies such that measurements were not held in high regard (Hermansen, 1999). Rules of construction have been adopted by courts to resolve the differences between what was monumented and what was measured. These state that the boundary set by the original surveyor remains the boundary despite how imperfectly it was set (Hermansen, 1999). This creates a problem for the surveyor charged with retracing the boundary as witness marks on trees or lines of occupation (such as fences or hedges) become more important than precise field measurements (Hermansen, 1999). The current official procedures for a PLSS survey are found in the 2009 edition of Manual of Surveying Instructions available from the Bureau of Land Management. Because most of these public land surveys were done long ago, much of the land has transferred into private ownership and a new set of operating legal documents.
Figure 1: This figure shows how the PLSS is organized. A grid of townships (top right) is shown and a particular township is zoomed in upon (middle), a section of this township is zoomed in on (bottom left) to show how sections are divided. This figure was taken from www.nationalatlas.gov.

Private Land Record Research

When land is held in private ownership, research into the legal documents controlling the boundary must be done in order to properly retrace a boundary and offer an opinion on the boundary’s location. Inadequate records research is often a shortcoming when performing a boundary retracement and can lead to an incorrect recommendation of the location of the boundary followed by lawsuits. Usually the first step is to pull up on-line tax records using the landowners name and the general location of the project area. This gives the surveyor the Assessor’s Parcel Number of the property so that it can be located on the tax assessor’s map. At this point the parcel numbers of the adjoining properties can be recorded so that their deeds can be found in the County Surveyor’s Office. Once the property deeds of the area have been acquired, the surveyor must understand and organize the chain of records in order to get an idea of how the boundary of the area has changed over time. Figure 2 shows an example of a flowchart being used to organize the chain of records for a certain project area. Once the project area and adjoining properties have been traced back to a common grantor, the surveyor usually has enough information to perform the search for evidence of the boundaries location in the field (Hermansen, 2009).
Figure 2: This figure shows a flow chart being used to organize the boundary conveyance of the project area. The landowner’s name, record citation, date of survey, and property conveyance are organized according to the deed’s date of
Boundary Research in the Field

Once the surveyor has performed adequate research into the history of the project area’s ownership, the next step in a successful boundary retracement survey is to go to the field to “retrace the footsteps of the original surveyor” in order to find evidence of the boundary’s location (Hermansen, 1999). The legal text of the controlling legal document must be deciphered to understand the “controlling calls” that were used for the boundary calls and the evidence the original surveyor left to mark the location of the boundary (Buckner, 1997). The information given in the text of the deed contains “informative calls” and “controlling calls.” The controlling calls often include the word “to” and a location. The informative calls give distance and bearing that are used in an effort to locate the controlling call. Sometimes there are conflicting calls in which case “courts invariably look for the one that is most specific and raises fewest questions” (Foresburg, 1991). When the surveyor enters the field in his attempt to search for evidence of the boundary, the first step is to retrace the township subdivisional work or the controlling calls of the deed within the project area to find plain evidence of the original boundary survey. Proportionate calculations are then performed for the locations of the lost corners so that a second and more thorough search for evidence of the boundary can be found. If more evidence is found in this second search, another proportionate calculation can be performed and the location of corners that still could not be recovered can be temporarily marked and described as “obliterated” (Wilson, 2008). These temporary points must be evaluated by comparing them to maps of adjoining properties to look for evidence of how the original survey was performed. Sometimes there is enough evidence that a corner that would have been lost can be determined using control from well-identified natural features. If additional evidence of the corner cannot be found, the temporary points can become a “local point of control” with “all the authority and significance of an identified original corner.” The field notes of the retracement survey should describe the reasons to accept the temporary locations as local points of control. If a new monument must be established for permanent marking, it must be constructed so as not to destroy any other boundary evidence (Bureau of Land Management, 1973). There are numerous problems that a surveyor may discover when performing a retracement. A common problem is discovering a monument but not being able to determine whether it is an original monument or a monument set after the original survey because it is not included in plats of the project area. Another problem is recovering two monuments that claim to mark the same location. These monuments may be so close that they touch one another. Experience in the field of surveying is the only way to determine how to solve problems such as those mentioned above (Rose-Nailn, 2008). Once the field portion of the retracement survey has been completed, the surveyor is ready to make his recommendation for the location of the client’s boundary.
PROCEDURES AND METHODS

Research Procedure

The first step in performing this project was to research the history of the boundary. This was done by obtaining the Assessor's Parcel Number (073-291-002) from the ranch managers. This was then used to pull up the Assessor’s Parcel Map of the project area from the San Luis Obispo County Assessor webpage (Appendix B). The assessor map was then examined to determine if record maps were referenced to get increased detail of the boundary of the project area and neighboring properties. A record of survey was then obtained from the San Luis Obispo County surveyor website. This record of survey was submitted by Cannon Corporation and documented a boundary retracement of the project area as well as the rest of Cal Poly’s ranch land. The documents of an ALTA survey that was performed for Cal Poly and reference manuals were also obtained from Cal Poly’s facility planning department with the aid of Rex Wolf. These documents were reviewed to determine where useful monuments would be located in the field. Once all of these documents were compiled and examined, the fieldwork could commence.

Fieldwork Procedure

The field work consisted of locating monuments set to mark the location of the lost boundary line. During the initial trip to the field, one such monument was located (D3) but no data was taken. This monument was a one and one-quarter inch iron pipe capped and marked “LS 5139.” This was located at the top of a hill near an old fence post and stake with faded construction ribbon (Figure 3). Other monuments in the area were searched for but were not located. Following the initial trip to the project area, documents of the ALTA survey which had the boundaries drawn up in CAD and overlaid upon aerial photographs of the project area were examined to determine where another suitable monument may be found. During the next trip to the field, another monument (D4) along the lost line was found. This was also a one and one-quarter inch iron pipe capped and marked “LS 5139.” It was located on the railroad side of a barbed wire fence near a stake with faded construction tape (Figure 3). This monument was occupied by a dual-frequency Ashtek Z-Extreme GPS unit set-up in static mode (Figure 4). Monument D4 was occupied by the rover station of the dual-frequency Ashtek Z-Extreme GPS set-up in static mode. The two GPS units collected data simultaneously so a vector relationship between the monuments could be determined. This allows the distance and direction between the monuments and the coordinates of each monument to be determined. The boundary line of the property was staked using RTK GPS. A base station GPS unit and radio were positioned so that a rover GPS unit could be taken along the boundary line while maintaining radio communication with the base station. A Carlson data collector was used to establish and verify communication between the units. The rover unit was set-up over Monument D4 and point data was taken. The rover unit was then taken to Monument D3 so that point data could also be taken over it. Once these points were stored, the data collector and “Stake a Line” feature in the SurvCE software was
used so that the rover’s position relative to the line between the points was being calculated continuously. The line was staked by using a line-of-sight interval. This means that a stake was set such that the stake previously set along the line is visible. When it was determined that a stake was to be set, the rover GPS unit was moved until the data collector indicated that it was within 0.02 feet of the line between Monuments D4 and D3. This point was marked in the ground and a stake was driven so that it was as flush as possible to the ground surface. Then a lath marked “Fence” and flagged with orange construction ribbon was set next to the stake. Once these were in the ground, the GPS unit was set over the stake and its point data was taken in order to determine if it was within an acceptable distance from the boundary line between Monuments D4 and D3 (Table 1).

Figure 3: This figure shows the record of survey map for the project area. The locations where monuments D3 and D4 were set are shown along the boundary line that is to be located.
**Office Procedure**

The data for the static GPS survey was downloaded from the GPS units to a computer in order to process the data and get the distance and bearing between the two monuments. This data was then uploaded to OPUS (Online Positioning User Service) from the National Geodetic Survey. This is a free service that takes GPS coordinate data and references it to a high-accuracy National Reference Spatial System (NRSS) to give state plane coordinates and Universal Transverse Mercator coordinates. The state plane coordinates were obtained for Monument D3, however OPUS was unable to process the data for Monument D4 because the epoch time of the static GPS unit was set at 20 seconds instead of 5 seconds. This forced the use of propriety global navigation satellite system (GNSS Solutions by Ashtech) software to determine a precise vector between GPS units and provide positions of the monuments in state plane coordinates. The software used a weighted least squares adjustment to determine the coordinates from the raw measurement data. The GNSS solution was then translated to the OPUS coordinate system by solving for the difference between the GNSS coordinates for Monument D3 and the OPUS coordinates for Monument D4 and adding this difference to GNSS coordinates for Monuments D4 (Table 1). The distance and direction of the line was then calculated using both the OPUS coordinates, GNSS coordinates and coordinates.

**Figure 4:** This figure is a photograph of the static GPS occupation of monument D4.
gathered during the RTK GPS survey (Table 2). The solution of the surveyed lines distance and direction was then compared with the distance and direction for the target boundary line on record maps. This served to verify that the monuments used for the survey were indeed the monuments that marked the boundary line of the project area. The difference between the calculated distance and direction of the surveyed line and the distance and direction of the Cannon Corporation record of survey line and the distance and direction of the Tax Assessor Map line were determined to check the quality of the survey data collected as well as to see how well the boundary line matched the legal description of the boundary line (Table 2).
RESULTS

The results summarized in Table 1 show the surveyed coordinates of Monuments D3 and D4. The GNSS coordinate result for monument D4 was transferred to the OPUS solution by taking the average value of OPUS solution coordinates for monument D3 and subtracting the GNSS coordinate solution for monument D3, this difference was then added to the GNSS result for monument D4. The results summarized in Table 2 display the record bearing and distance of the lost boundary line and the surveyed bearing and distance of the lost boundary line. The coordinates that were solved by the proprietary GNSS software were used to determine the distance and direction of the surveyed boundary line.

Table 1. Surveyed Coordinates

<table>
<thead>
<tr>
<th>Point Identification</th>
<th>Solution Method</th>
<th>Northing (Survey Feet)</th>
<th>Easting (Survey Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D4</td>
<td>GNSS</td>
<td>2,321,091.787</td>
<td>5,769,545.972</td>
</tr>
<tr>
<td>D3</td>
<td>GNSS</td>
<td>2,321,122.807</td>
<td>5,771,436.817</td>
</tr>
<tr>
<td>D3</td>
<td>OPUS</td>
<td>2,321,122.51</td>
<td>5,771,436.997</td>
</tr>
<tr>
<td>D3</td>
<td>OPUS</td>
<td>2,321,122.507</td>
<td>5,771,436.981</td>
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<tr>
<td>D4</td>
<td>GNSS Transferred to OPUS</td>
<td>2,321,091.488</td>
<td>5,769,546.136</td>
</tr>
<tr>
<td>D3</td>
<td>RTK Survey</td>
<td>2,321,125.982</td>
<td>5,771,427.625</td>
</tr>
<tr>
<td>D4</td>
<td>RTK Survey</td>
<td>2,321,094.874</td>
<td>5,769,536.790</td>
</tr>
</tbody>
</table>

The coordinates from the various methods of data collection were used to solve for the distance and direction of the boundary line. Equation 1 uses the Pythagorean’s Theorem relationship between sides of a triangle to solve for the distance of a line. Equation 2 solves for the bearing of the line using the arctangent trigonometric function.

\[
\text{Distance} = \sqrt{(\text{Northing}_2 - \text{Northing}_1)^2 + (\text{Easting}_2 - \text{Easting}_1)^2}
\]  
\[
\text{Direction} = 90^\circ - \tan^{-1} \left( \frac{\text{Northing}_2 - \text{Northing}_1}{\text{Easting}_2 - \text{Easting}_1} \right)
\]
<table>
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<tr>
<th>Source of Data</th>
<th>Distance (U.S. Survey Feet)</th>
<th>Bearing</th>
<th>Difference from Measured (U.S. Survey Feet)</th>
<th>Difference from Measured</th>
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<tr>
<td>Record of Survey Map Line</td>
<td>1890.95</td>
<td>N 89° 04' 12&quot; E</td>
<td>0.15</td>
<td>0° 00' 36&quot;</td>
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<tr>
<td>Tax Assessor Map Line</td>
<td>1624.92</td>
<td>N 84° 45' 00&quot; E</td>
<td>266.18</td>
<td>4° 20' 36&quot;</td>
</tr>
<tr>
<td>Calculation of Surveyed Line GNSS</td>
<td>1891.10</td>
<td>N 89° 03' 36&quot; E</td>
<td>N/A</td>
<td>N/A</td>
</tr>
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<td>Calculation of Surveyed Line OPUS</td>
<td>1891.10</td>
<td>N 89° 03' 36&quot; E</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Calculation of Surveyed Line RTK</td>
<td>1891.09</td>
<td>N 89° 03' 27&quot; E</td>
<td>0.01</td>
<td>0° 00' 09&quot;</td>
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DISCUSSION

Based on the research performed on the history of the property conveyance and previous survey work done on the project area, controlling documents for the boundary were located. The document referenced for monuments D4 and D5 was found in Book 33 Page 220 of Deeds, in the County Recorder Office of San Luis Obispo (Appendix C). Other monuments of the area were controlled by the unrecorded map “Map of the Partition of a Part of the Rancho Potrero de San Luis Obispo” which was filed with the Clerk of the Superior Court of San Luis Obispo County, Case # 640 on August 15, 1888 (Appendix B). These documents were in reference to the property adjacent to the project area. These documents referenced posts that had been set using a compass and chain to measure distance and direction. When the boundary line was re-monumented during the boundary retracement survey performed by Canon in August of 2009, these distances and directions were re-measured and used to establish the line. However, on the record of survey map, it states that the fence posts that were left from the fire were accepted as the boundary line. It may be worthwhile to contact the surveyor that performed this survey to determine if the measurements of the controlling survey were taken or if the existing fence line was accepted in lieu of this re-measurement.

After the calculations for the direction and distance of the boundary line were computed from the collected coordinates, it was found that there was about 0.15 feet of discrepancy between the Cannon Corporation recorded line distance and the measured line distance. This error could be due to a number of factors. The most likely cause was that when the static GPS units were set up over the monuments, they were not perfectly level. This is especially probable over monument D4 as it was located on a steep slope (Figure 4). Another possibility is that the data would have been better had longer observations been taken. This is true with the two observations that were taken over monument D5. The rover unit that was set over monument D5 experienced battery problems during the first observation and so a backup battery was used to perform a second observation. It is possible that had a longer observation been taken instead of two observations, the coordinates generated would have yielded a result that was closer to the record distance and direction of the boundary line.

Another issue with the survey was the epoch time (or time between GPS measurements) of the static GPS base station. Originally the epoch time was set at 5 seconds so that OPUS could be used to generate a state plane coordinate solution. However, when the unit was turned off, the epoch time was not saved and reverted to the default time of 20 seconds. When the unit was taken out to the field, this was not checked and the data was collected with the epoch time of 20 seconds. This caused the data to not be compatible with the OPUS solution. This is why monument D5 has state plane coordinates generated by OPUS while monument D4 does not. The OPUS coordinates would have been used as a check for the GNSS solutions. It is this type of redundancy that can identify errors that may have been
made as well as increase the confidence of measurements that are taken. Because this opportunity for redundancy was lost, there must be less confidence given to the measurements that were taken during this survey.

It may have been wise to use a total station to perform the line staking portion of the survey. This was due to the fact that the project area was accessible only by hiking in a distance. To perform the line staking via RTK GPS, much equipment needed to be carried into the project area. This caused the survey to take much longer than it should have. A staking survey using a total station would have required another person to help carry equipment into the project area. Also, only one tripod would have been needed instead of two so only one hike into the project area would be needed.
RECOMMENDATIONS

The most important issue that should be addressed is preserving the location of the monuments should either the staking for the fence line or the fence line itself be lost again. Currently the monuments are marked with a lath flagged with faded construction ribbon. This is not a permanent solution. A four inch by four inch post could be driven into the ground near the monuments. This would be visible from a distance allowing for the monuments to be easily located should further survey work be done in the area. The post would be much sturdier than a lath and would last for many years without the need for maintenance or replacement.

A surveyor is not needed to verify the staking of the fence line performed in this project. This is because the located monuments were set by a licensed land surveyor to mark the boundary line of Cal Poly’s land. The use of these monuments to mark a line between them is precisely the reason that the monuments were set. The land owner is able to assume that the monuments of his/her boundary were set correctly and create a partition along a line between the monuments. However, should the fence line be crooked and encroach upon the neighbor’s land, the neighbor could file a lawsuit. If this were to occur, professional land surveyors should be consulted by the neighbor and land owner to determine if the partition between the properties is fair or if it encroaches and must be relocated.

The fence line should be constructed as soon as possible. This is because there are acres of viable grazing land that are not being utilized. It would be beneficial to the Cal Poly herd if the area could be grazed because more heads could be raised. With a proper labor force the fence could be constructed in two to four days. This investment of time, money, and labor is worthwhile because a larger herd could be tended resulting in increased annual revenue for the animal science department and the university.

When work is done on the project area, a number of safety considerations should be made. An insect repellant with a high concentration of DEET should be worn due to a great number of mosquitoes and ticks in the area. Avoiding bites from these insects prevents future minor inconveniences such as itchiness but also can prevent the spread of serious infections such as Lyme disease or Malaria. Also, footwear that provides excellent traction on steep slopes must be worn. The steep and exposed terrain of the project area require care to be taken when moving throughout.
REFERENCES


APPENDIX A

HOW PROJECT MEETS REQUIREMENTS FOR A BRAE MAJOR
HOW PROJECT MEETS REQUIREMENTS FOR THE BRAE MAJOR

Major Design Experience

The BRAE senior project must incorporate a major design experience. Design is the process of devising a system, component, or process to meet specific needs. The design process typically includes the following fundamental elements. This project will address these issues as follows.

Establishment of Objectives and Criteria. Research into the public records and boundary monuments for CPSU’s Serrano Ranch area will be performed so as to retrace the boundary of Serrano Ranch.

Synthesis and Analysis. A boundary retracement survey will be performed and the results will be compared to previous surveys of the area. A least squares analysis of the survey will be performed and used for evaluation of the survey.

Construction, Testing and Evaluation. Technical survey equipment will be used to perform a boundary retracement survey of Serrano Ranch at CPSU. Redundant measurements and error analysis will be used to verify the quality of the survey.

Incorporation of Applicable Engineering Standards. County records will be used to determine the location of existing monuments and the quality of the performed survey will be evaluated against it.

Capstone Design Experience

The BRAE senior project must be based on the knowledge and skills acquired in earlier coursework.

Incorporates Knowledge/Skills from Earlier Coursework. Will require researching techniques learned while taking Advanced Surveying (BRAE 447) as well as the understanding and use of technical survey equipment gained in Engineering Surveying (BRAE 239).

Design Parameters and Constraints

This project addresses a significant number of the categories of constraints listed below.

Physical. A retracement of the boundary survey of a property will be performed and existing monuments will be located on the property of CPSU.

Economic. Any economic impacts resulting from the boundary retracement will be discussed in the report.

Environmental. N/A
Sustainability. N/A

Manufacturability. The performance of the survey will be evaluated and techniques to improve quality and speed of the survey will be determined.

Health and Safety. Safety hazards will be encountered when doing the field work for the survey. Proper safety measures and procedures will be discussed within the report and practiced when surveying the project area.

Ethical. Ethical issues may arise due to retracing the boundaries of land and comparing it to previous surveys of the area.

Social. N/A

Political. Legal documents will be examined and used to retrace the boundary of CPSU’s Serrano Ranch.

Aesthetic. N/A
APPENDIX B

RECORD MAPS
Aerial Photograph of Project Area with Boundary Lines Overlaid
NOTE: LOTS, L.E.S. SHOWN ON THIS MAP ARE AS SHOWN ON THE MAP ENTITLED "MAP OF THE PARTITION OF PART OF THE RANCHO POTRERO DE SAN LUIS OBISPO, SAN LUIS OBISPO COUNTY, CALIFORNIA" PARTITION BY ORDER OF THE SUPERIOR COURT OF SAN LUIS OBISPO COUNTY FILED FOR RECORD MAY 16, 1865 IN THE OFFICE OF THE COUNTY CLERK OF SAN LUIS OBISPO COUNTY, IN TOLEDO NO. 569 OF SUPERIOR COURT RECORDS.

COASTAL AQUEDUCT, REACH 3 DRAWING NO. 5-3A-80 B-31
RANCHO POTRERO DE SAN LUIS OBISPO, R.M. Bk. B, Pg. 58.
T. 30S; R. 12E; SECTION 1; M.D.B. & M.

ASSessor's Map, County of San Luis Obispo, CA
BOOK 073 PAGE 29
“Map of the Partition of a Part of the Rancho Potrero de San Luis Obispo” Clerk of the Superior Court of San Luis Obispo County, Case # 640, August 15, 1888
APPENDIX C

DEEDS
LEGAL DESCRIPTION FOR PROJECT AREA

PARCEL 9: APN 073-341-026 (PTN)

THE SOUTHEAST 1/4 OF THE SOUTHWEST 1/4 AND THE SOUTHWEST 1/4 OF THE
SOUTHEAST 1/4 OF SECTION 15 AND THE EAST 1/2 OF THE NORTHWEST 1/4 OF SECTION
22, ALL IN TOWNSHIP 30 SOUTH, RANGE 12 EAST, M.D.M., IN THE COUNTY OF SAN LUIS
OBISPO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

ALSO COMMENCING AT THE NORTHWEST CORNER OF THE NORTHEAST 1/4 OF SECTION 22
IN THE AFORESAID TOWNSHIP AND RANGE AND RUNNING THENCE 1/4 OF SECTION 22 AND
THE SOUTHEAST 1/4 OF SECTION 15, IN SAID TOWNSHIP 474.00 FEET, THENCE IN A
SOUTHWESTERLY DIRECTION IN A STRAIGHT LINE TO A STAKE SITUATED ON THE LEFT
BANK OF THE CREEK, KNOWN AS "STENNER CREEK", SAID STAKE BEING DISTANT 8.00
FEET EAST OF THE DIVIDING LINE BETWEEN THE NORTHEAST 1/4 AND THE NORTHWEST
1/4 OF SECTION 22, IN SAID TOWNSHIP; THENCE WEST 8.00 FEET TO SAID DIVIDING LINE;
THENCE NORTH TO THE PLACE OF BEGINNING.

ALSO THAT OTHER TRACT OF LAND SITE ON THE RIGHT BANK OF SAID STENNER
CREEK, DESCRIBED AS FOLLOWS:

COMMENCING AT THE POINT OF INTERSECTION OF THE DIVIDING LINE BETWEEN THE
NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF SAID SECTION 22 WITH THE RIGHT BANK
OF STENNER CREEK; THENCE FOLLOWING THE RIGHT BANK OF SAID CREEK TO THE MOUTH
OF A GULCH SITUATE AT THE NORTHERLY BASE OF A RED HILL SITUATE BETWEEN THE
SAN LUIS OBISPO AND CAMBRIA ROADS AND SAID CREEK; THENCE UP THE NORTHERLY
SIDE OF SAID GULCH TO A SYCAMORE TREE SITUATE AT THE HEAD OF SAID GULCH;
THENCE NORTHWESTERLY TO THE LINE BETWEEN THE NORTHEAST AND THE NORTHWEST
QUARTER OF SAID SECTION 22; THENCE FOLLOWING SAID LINE NORTH TO THE PLACE
OF BEGINNING, SAID TRACT BEING FLAT AND IRREGULARLY SHAPED.

ALSO THAT PORTION OF THE WEST 1/2 OF THE NORTHWEST 1/4 OF SECTION 22, IN THE
TOWNSHIP AND RANGE AFORESAID THAT LIES ON THE RIGHT HAND LINE OR EAST SIDE
OF THE PUBLIC ROAD LEADING FROM THE CITY OF SAN LUIS OBISPO TO CAMBRIA, THE SAID
TRACT LYING IN THE SHAPE OF A TRIANGLE WITH THE BASE RESTING ON THE SAID ROAD.

ALSO EXCEPTING THEREFROM A STRIP OF LAND 100.00 FEET WIDE LYING LONGITUDINALLY
UPON AND EQUALLY EACH SIDE OF A LINE DESCRIBED AS FOLLOWS:

COMMENCING AT THE POINT WHERE THE CENTER LINE OF THE SOUTHERN PACIFIC
RAILROAD COMPANY'S RAILROAD AS THE SAME IS NOW SURVEYED AND STAKED OUT UPON
THE GROUND INTERSECTS THE NORTH LINE OF THE SOUTHWEST 1/4 OF THE SOUTHEAST
1/4 OF SECTION 15, TOWNSHIP 30 SOUTH, RANGE 12 EAST, WHICH POINT IS KNOWN AS
ENGINEER'S STATION NO. 87844-74 OF SAID CENTER LINE; THENCE RUNNING
SOUTHEASTERLY ALONG SAID CENTER LINE TO THE POINT KNOWN AS ENGINEER'S STATION
87997-97 OF SAID CENTER LINE TO THE EAST LINE OF SAID SOUTHWEST 1/4 OF THE
SOUTHEAST 1/4 OF SAID SECTION 15, A DISTANCE OF 1333.00 FEET, MORE OR LESS.

ALSO EXCEPTING THEREFROM ALL THAT PORTION THEREOF CONVEYED TO THE STATE OF
CALIFORNIA FOR HIGHWAY PURPOSES IN DEED RECORDED JULY 10, 1942, IN BOOK 324
PAGE 187 OF OFFICIAL RECORDS.
APPENDIX D

OPUS RESULTS
Your data file spans less than 0.01 days (14.4 minutes). OPUS-RS recommends a minimum of 15 minutes of data to obtain accurate positions. OPUS-RS will not attempt to process datasets under 0.005 day (7.2 minutes).

---

**NGS OPUS-RS SOLUTION REPORT**

All computed coordinate accuracies are listed as 1-sigma RMS values. For additional information: [http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy](http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy)

USER: jlanfranki@gmail.com
DATE: April 30, 2013

RINEX FILE: 0102115v.13o
TIME: 15:37:17 UTC

SOFTWARE: rsgps 1.37 RS91.prl 1.87
EPHEMERIS: igr17374.eph [rapid]
NAV FILE: brdc1150.13n
OBS USED: 768 / 904: 85%

ANT NAME: ASH701975.01A NONE
QUALITY IND. 40.07/ 19.88
ARP HEIGHT: 2.04 NORMALIZED RMS: 0.271


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**ORTHO HGT: 398.483(m) 0.028(m) [NAVD88 (Computed using GEOID12A)]

**UTM COORDINATES** **STATE PLANE COORDINATES**

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NEAREST NGS PUBLISHED CONTROL POINT

| FV0377   | K 908 | N352014. | W1203917. | 668.5 |

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.
Warning - OPUS-RS was able to find a set of reference stations with data suitable for use with your dataset. However, your position does not fall within the polygon enclosing these reference stations. This means that the geographic interpolation algorithms performed within OPUS-RS must instead perform extrapolation.

Extrapolation, especially if your position is far from the reference stations, is prone to error. Use this solution with caution.

Your station is 5.9 KM outside the polygon enclosing the reference stations.

All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy
US NATIONAL GRID DESIGNATOR: 10SGE1357213480(NAD 83)

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**NEAREST NGS PUBLISHED CONTROL POINT**

FV0377  K 908  N352014.  W1203917.  668.5

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

---

**OPUS Results for the Second Observation of Monument D3**
APPENDIX E

BOUNDARY LINE STAKING DATA
Data Collected during Boundary Line Staking Survey

1,2307203.74790, 5767597.95190, 257.59820, testa
2,2307202.43960, 5767559.57310, 255.84730, testb
3,2307203.19470, 5767581.25696440, STA0+16.788 R0.019 CUT 0.132
4,2321125.98210, 5771427.62500, 1227.92730,
5,2321094.87400, 5769536.79030, 825.09640, cp2
6,2321095.34610, 5769566.29550, 826.59550, STA0+29.509 R0.013 FILL 4.787
7,2321102.65170, 5770020.99680, 924.96370, STA4+84.269 R0.188 FILL 3.289
8,2321107.51550, 5770295.39380, 966.19520, STA7+58.709 L0.161 FILL 20.518
9,2321118.21070, 5770951.54160, 1097.80190, STA14+14.944 L0.061 FILL 28.699
10,2321125.33420, 5771380.78440, 1218.95330, STA18+44.246 L0.123 CUT 1.005