

**Rifle Range Monitoring for
Willow Monardella (*Monardella viminea*)
in San Clemente Canyon
(N68711-02-LT-C2005)**

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Background

In 2002, Marine Corps Air Station (MCAS) Miramar constructed a new rifle range in San Clemente Canyon along a tributary of the ephemeral drainage that runs through the canyon. One of the conditions for approval of the Rifle Range was that the Federally listed Endangered Species, willowy monardella (*Monardella viminea*), be monitored for one mile downstream of the rifle range construction. The monitoring was to determine if the altered hydrology from the rifle range construction had any measurable negative impacts to the listed species.

The rifle range was built to minimize impacts to the tributary ephemeral drainage of the San Clemente Canyon drainage. During construction the majority of the ephemeral drainage was left intact, however there were places where berms and fences had to cross the drainage and in these spots drainage was culverted.

The San Diego Natural History Museum was at the time working on developing a long term willowy monardella monitoring program for MCAS Miramar and was asked to provide monitoring for the requirements of the rifle range that would be compatible with the overall monitoring effort.

The dual purpose of this study is:

- To see if construction of the rifle range had any negative impacts to the occurrences of willowy monardella downstream
- To supplement the data for monitoring willowy monardella on the station as a whole.

The project followed the same counting methodology as was used in the larger overall willowy monardella monitoring effort, so demographic data between the two studies is comparable. There are three recent studies of willowy monardella at MCAS Miramar in addition to this one. The largest most comprehensive study is (*Long-Term Monitoring Plan and Baseline Survey of Willowy Monardella at MCAS Miramar, San Diego, CA*, Rebman and Dossey, 2006). Two smaller related studies are (*Willowy Monardella Monitoring Survey 2005*, Tierra Data Inc., 2005 and *2006 Willowy Monardella Census and Long-term Monitoring Program Status Review*, Dossey and Rebman, 2006). A generalized discussion of how this study relates to those studies and a comparison of conclusions is provided at the end of this document.

Methodology

Study Area Description

The study area being monitored is a one mile length of flood plain in San Clemente Canyon. It extends downstream from the eastern end of Rifle Range Road for a mile ending at one of the nameless dirt roads that cross the flood plain (Figure 1, tan colored area on the map).

Originally, the predominant habitat was broom baccharis scrub. After the fire, the area began recovering, but there is more coastal sage scrub intermixed with the broom baccharis and an increased number of exotics as well. There are also areas of riparian woodlands within the study area. The riparian woodlands are dominated by mulefat, Sycamores and willow species. The elevation ranges from approximately 230 feet Above Mean Sea Level (AMSL) to approximately 650 feet AMSL. The soils are classified as Visalia gravelly loam throughout the study area (Bowman). The ephemeral creek in San Clemente Canyon runs along the northern portion of the flood plain study area.

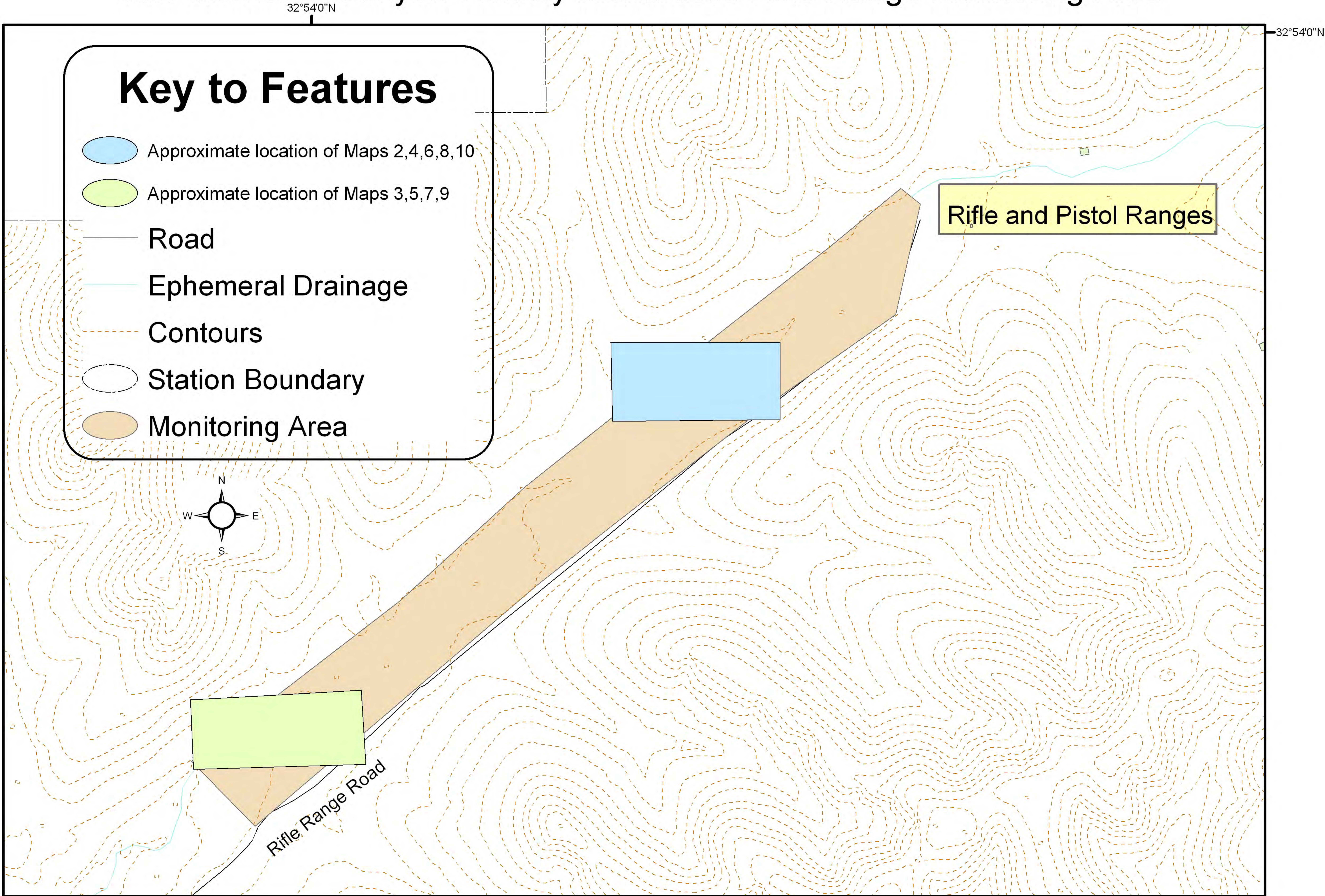
Demographic Data

The study area has been monitored for four years, 2003-2006 (Table 1). The locations of all individuals of willowy monardella were mapped as specifically as practical using a submeter accurate Global Positioning System (GPS) machine. In some situations, due to population density, it was not possible to map individuals so clusters were mapped and described by the surveyor. It also was not possible to separate individuals that appear as multiple plants due to rhizomatous underground connections. All counts are based on the estimated surface individuals (ramets) not the absolute number of genetically unique individuals (genets). The numbers of individuals were estimated within large clusters by measuring the length and width in meters of the cluster at their longest/widest points. These two measurements were then multiplied together and divided by the value 0.785 square meters. This value was derived as an estimate of the largest observed surface area an individual willowy monardella plant occupies (A 1m diameter plant was observed during a different project in Sycamore Canyon.). This number should conservatively estimate the population number since most plants are smaller than 1 meter in diameter.

Table 1
Dates Data Collected

	2003	2004	2005	2006
Date	May 9,10	July 20,21,27	August 9	August 26

San Clemente Canyon Willowy Monardella Rifle Range Monitoring Area



Survey dates 2002 - 2006
Produced by Dossey & Associates

Each year the following data was collected for all individuals within the study area:

1. number of estimated surface individuals,
2. each individual's current phenology (flowering, seeding, vegetative)
3. each individual's growth stage (seedling, juvenile, mature, adult)

Four growth stages are used for assessing life stage: seedling; juvenile; mature, and adult. Seedlings are defined as individuals less than four inches tall and lacking multiple stems. Juveniles are defined as lacking multiple stems but being over four inches tall. Mature plants are those with twenty or fewer stems and over four inches in height. Adult plants have more than 20 stems and over four inches tall.

There were five phenological stages: flowering; vegetative, seeding, budding, dormant/dead. Flowering plants were those that had one or more flowers on them when observed. Budding plants had one or more floral buds and no flowers open. Seeding plants were those that were no longer flowering, but still had one or more seed heads on the plant. Vegetative were those plants that had no buds, flowers, or seed heads when observed in the field. Dead/dormant individuals lacked any living leaves (green) or other features that demonstrated the plant was not dead or dormant. Dead/Dormant plants were counted since any dormant plants are still alive and can still contribute to the viability of the population. No effort was made to determine if plants in this final category were dead or dormant as that would have required additional take permits from the US Fish and Wildlife Service.

An important aspect to understanding the survey values is that the Cedar Fire burned the entire study area in October of 2003. This changed the dynamic of counting the plants. The problem for counting the plants was no longer estimating how many different individuals were in the same large clump. The problem became how many of the numerous little sprouting individuals were distinct individuals and not resprouts of one plant from different portions of the same root system. This led to the creation of the 6-inch rule. If 6 inches or more separated two resprouting vegetative willowy monardella, they were counted as separate individuals. The 6-inch value was an arbitrary number that seemed appropriate in the field. The importance is that it was used consistently throughout all the monitoring areas of willowy monardella and is referred to as the six-inch rule for this and related studies.

Additionally in 2007, as a way of integrating this monitoring program with the other willowy monardella monitoring being done in West Sycamore Canyon, two monitoring plots were established using the same methodologies as West Sycamore Canyon (SSC12003A, SSC12003B). To differentiate from the study area these will be called monitoring plots. The two monitoring plots were

established using 50m reaches of San Clemente Canyon. A reach for the purpose of this study is the distance from upstream to downstream along the bottom of the largest drainage in the canyon. Blue metal stakes were placed at the limits of willowy monardella habitat at both the down stream and upstream ends to show the width of the monitoring plot on the flood plain. These points were mapped using GPS for future reference (Appendix B).

Results

The following are the results of the data collection from the Rifle Range Monitoring Project for the years 2003-2006. Maps showing the distribution of the willowy monardella for each year and combined for all years are provided in Appendix A. Appendix A shows all individuals occurring within a mile downstream of the rifle range for each year of the survey. Maps 9 and 10 in Appendix A show the comparison of year one to year four of the monitoring. Appendix B shows two subsections of the plants found. These are monitoring plots like those used in the West Sycamore Canyon monitoring. Each plot is shown for each year of the monitoring.

Table 2
Summary of Monitoring Results for entire survey area for 2003-2006

	2003	2004*	2005	2006
Estimated Number of Individuals	92	391	91	75
Points Mapped	64	196	83	62
Adults	62	174	71	70
Mature	27	198	17	3
Juvenile	0	13	2	2
Seedling	2	6	1	0
Flowering	1	330	32	4
Budding	0	0	0	0
Seeding	87	61	36	61
Vegetative	1	0	2	10
Dead/dormant	3	0	21	0

*Cedar Fire occurred between 2003 and 2004 monitoring activities.

The data below is specifically for each of the two monitoring plots established in San Clemente Canyon for 2003-2006.

Table 3
Summary of Monitoring Results for Plot SSC12003A from 2003-2006

SSC12003A	2003	2004*	2005	2006
Estimated Number of Individuals	18	90	14	16
Points Mapped	15	41	14	13
Adults	11	28	9	13
Mature	5	59	3	3
Juvenile	0	3	0	0
Seedling	0	0	0	0
Flowering	1	80	6	0
Budding	0	0	0	0
Seeding	14	7	6	14
Vegetative	1	0	0	2
Dead/dormant	2	0	2	0

*Cedar Fire occurred between 2003 and 2004 monitoring activities.

Table 4
Summary of Monitoring Results for Plot SSC12003B from 2003-2006

SSC12003B	2003**	2004*	2005	2006
Estimated Number of Individuals	0	50	26	13
Points Mapped	0	34	18	13
Adults	0	28	22	13
Mature	0	21	4	0
Juvenile	0	1	0	0
Seedling	0	0	0	0
Flowering	0	47	15	2
Budding	0	0	0	0
Seeding	0	2	8	9
Vegetative	0	1	1	2
Dead/dormant	0	0	2	0

*Cedar Fire occurred between 2003 and 2004 monitoring activities.

** 2003 pre-fire no individuals were observed in this area, some may have been obscured by vegetation but not likely the number observed after the fire.

Discussion

There is no direct or indirect evidence of the changes upstream by the rifle range having a negative impact downstream on willow monardella from this study. There was a major fire with erosion conditions maximized after the fire. There was little or no direct evidence of impacts from erosion.

Several things stand out about the results table numbers.

- The increase in individuals from 2003-2004.
- The change in population structure from 2003 to 2006
- The drop off of the numbers from 2005 to 2006.

Each of these points shall be addressed. The spike in the number of individuals highlighted in the first bullet is most likely due to the fire. Large clumps and large individuals, which in 2003 were counted as a few individuals or a single individual, were counted as multiple individuals in 2004 when resprouting after the Cedar Fire. This is evidence supporting the observations that willowy monardella is rhizomatous (spreads underground by stems that resemble roots) (Elvin, Pers comm..). Over counting due to rhizomatous spreading likely explains the pattern in 2005 of a large decrease as the parts of individuals grew together becoming single individuals under the six-inch rule.

In 2003, seventy percent of the willowy monardella population was in the adult lifestage (Table 1). In 2006, ninety-three percent of the population was in the adult lifestage (Table 1). As noted in bullet two, during the four years of monitoring the percentage of adults in the overall population grew substantially, conversely the non-adult plants declined. Since willowy monardella are perennial plants known to live more than four years, it seems notable that the population structure changed substantially within the four year study period. The most likely explanation for the change in population structure is a lack of new recruitment causing the occurrences to age. The reason for the lack of recruitment is not clear. It may be directly due to the fire in 2003. The fire destroyed all the individuals above ground stems and leaves. Therefore, the entire population had to regrow from the surviving root structures. This re-growth may have diverted resources from reproductive efforts.

The only disturbing observation in the data, as emphasized in bullet three, is a small drop from 91 to 75 individuals from 2005-2006. This is most likely explained, at least partially, by counting methodology. The pre-fire counting often included large clusters in which the numbers of individuals were estimated. The post-fire counting likely included multiple small plants that were counted separately and were actually the same individuals. As those small groups get larger they eventually will hit a point where they are too large to be counted separately at which point they will be counted as a single individual until they grow together with other plants and become large enough to be estimated by large cluster sampling.

The six-inch rule while not a perfect methodology, as it appears to over count individuals, is currently the best standardized method available for counting willowy monardella. Changing the six-inch rule may not change the accuracy of the count and could make future datasets unable to be compared to these early

studies. Any mitigation based upon counts using the six-inch rule should take into account the potential for over counting.

Comparisons with other Studies.

All the other MCAS Miramar studies have primarily been focused in the West Sycamore Canyon Area. The results from those studies have shown an extreme decrease in the numbers of willowy monardella in West Sycamore Canyon area. The cause of the decrease has not been established with certainty, though there are several potential contributing factors including: erosion, exotic grasses, fire damage, drought, etc. .

This data supplements the data from West Sycamore Canyon very well. The same counting methods were used for all willowy monardella mapped in both canyons. This rifle range study area does not show the decline that was observed in West Sycamore Canyon.

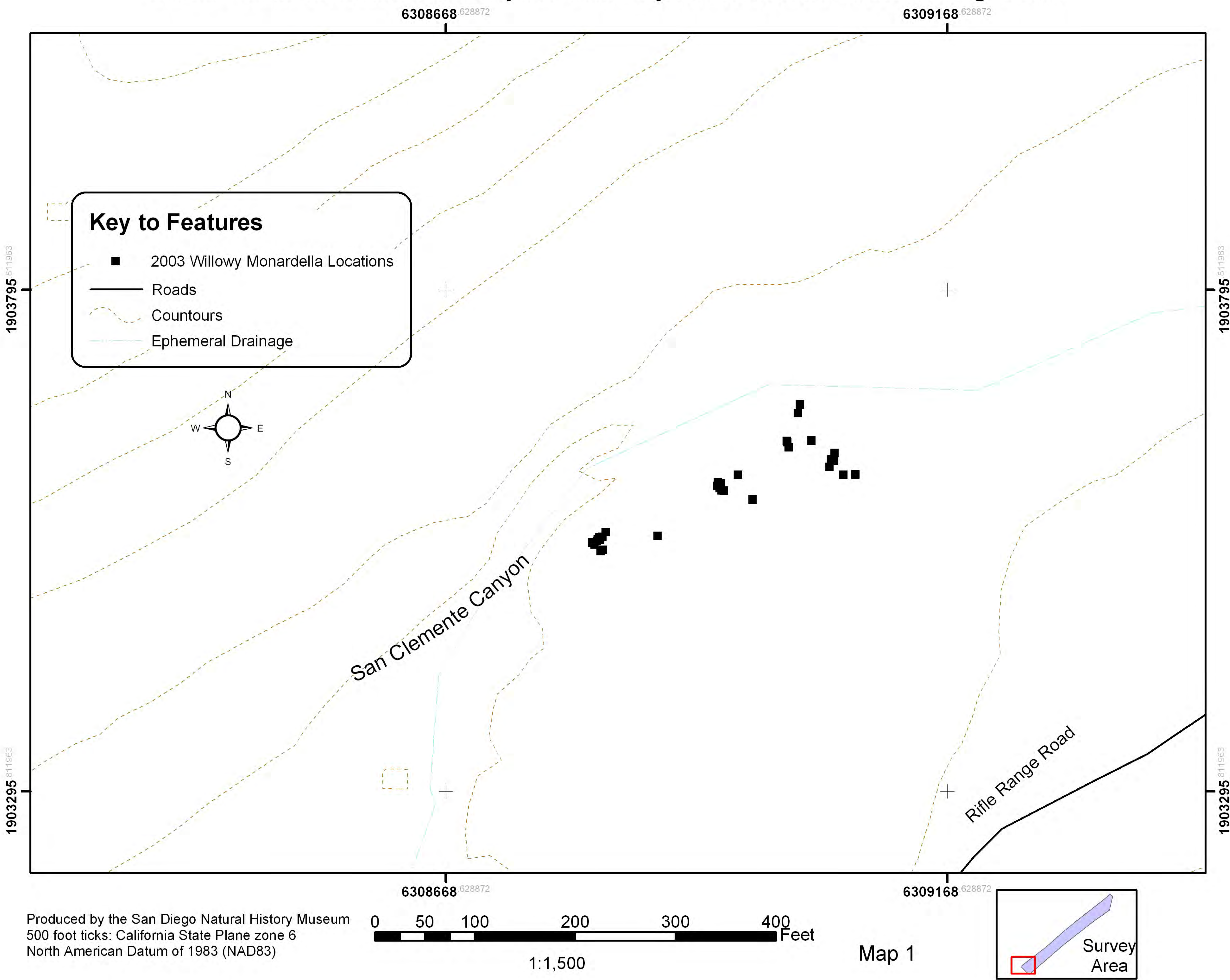
The fire damage was comparable between the sites and there is a similar lack of observable recruitment in the San Clemente canyon occurrences. The pressure from exotic grasses and erosion appears to be much lower at the rifle range study site than in West Sycamore Canyon (personal observation). This may explain the lack of a decline, similar to the one West Sycamore Canyon, in the willowy monardella numbers in San Clemente Canyon.

Appendix A

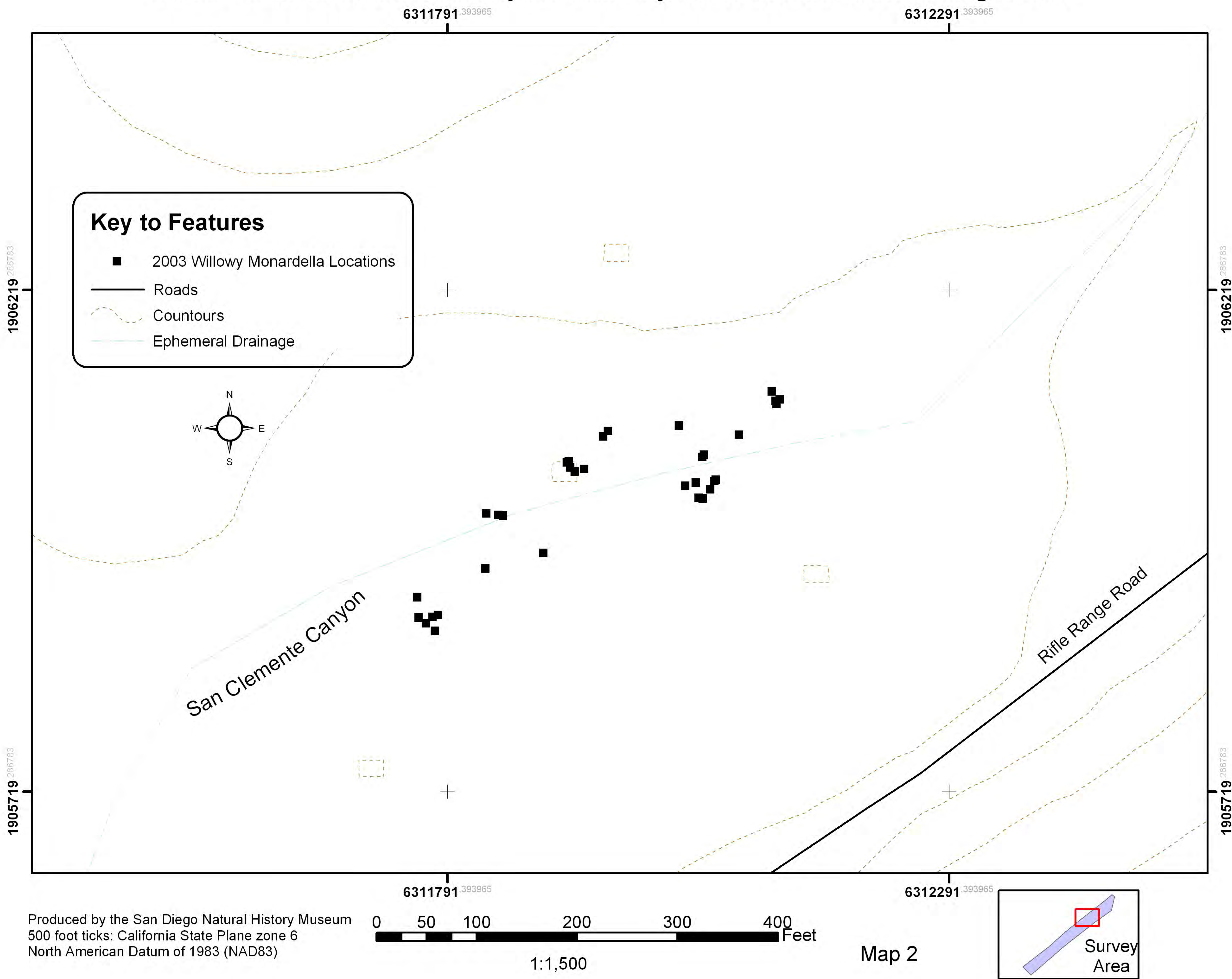
Maps of Willowy Monardella Within the Entire One-mile Rifle Range Monitoring Area by Year.

(The tan colored area indicated on Figure 1, Methodology, Study Area
Description.)

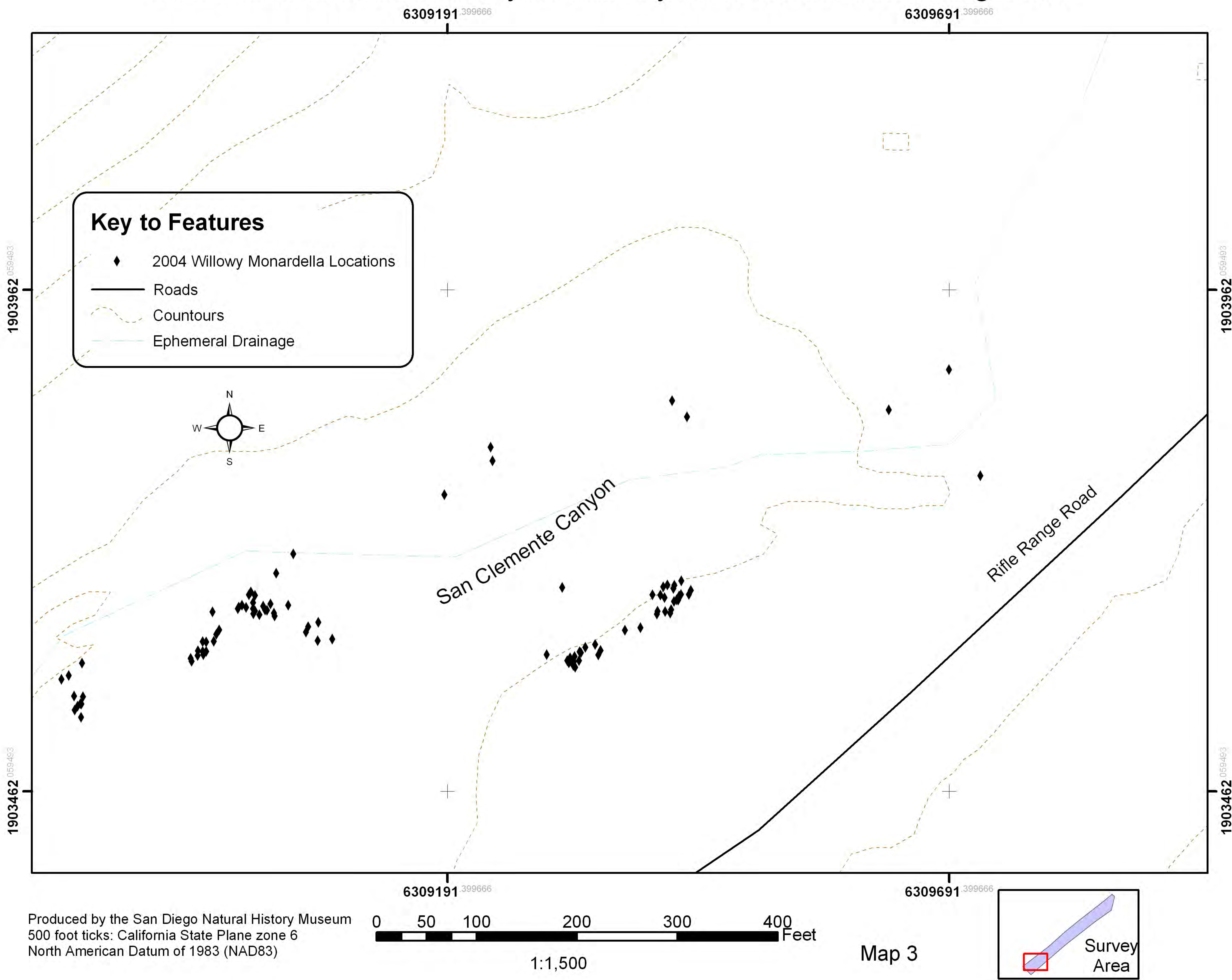
2003 San Clemente Canyon Willowy Monardella Monitoring Data



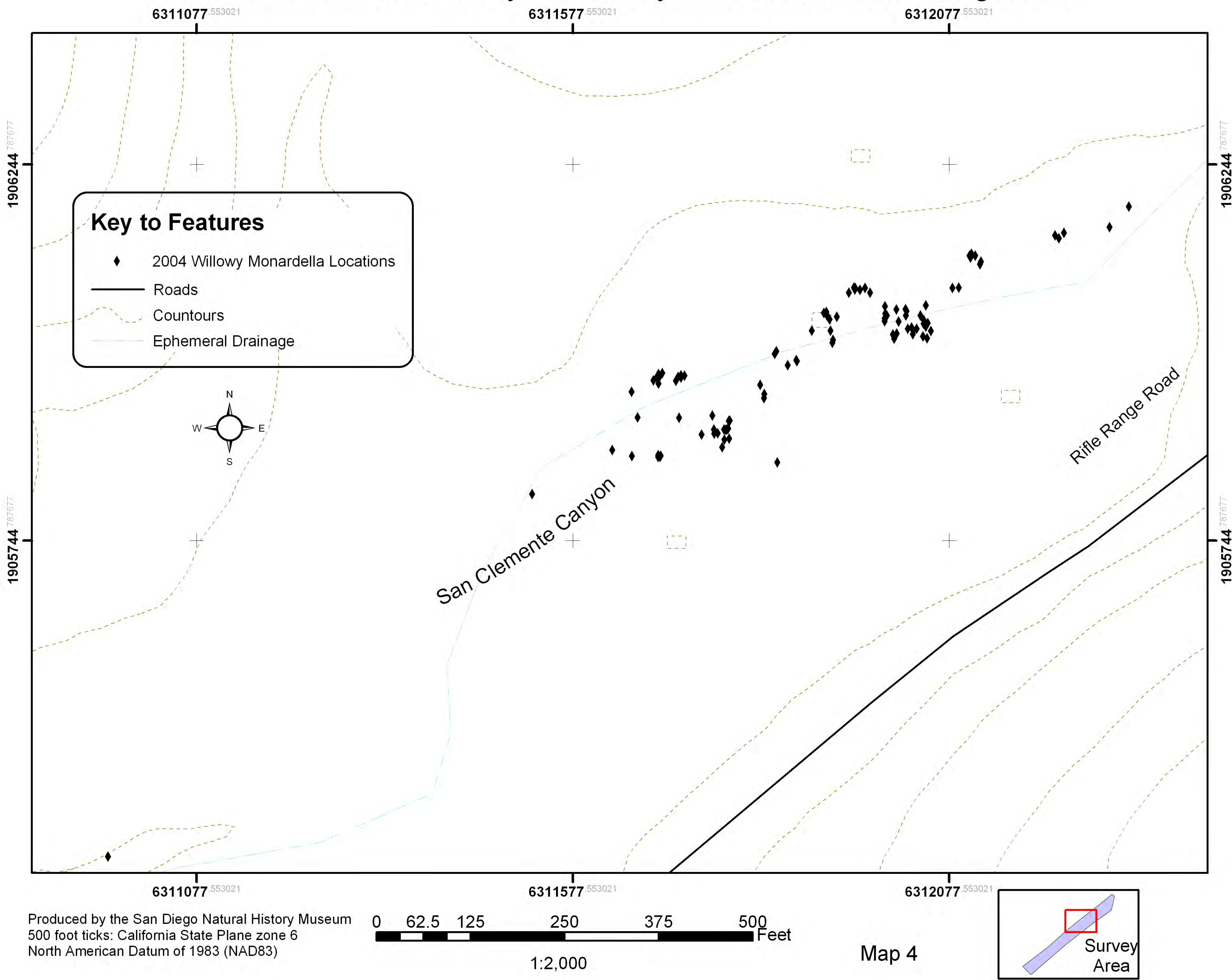
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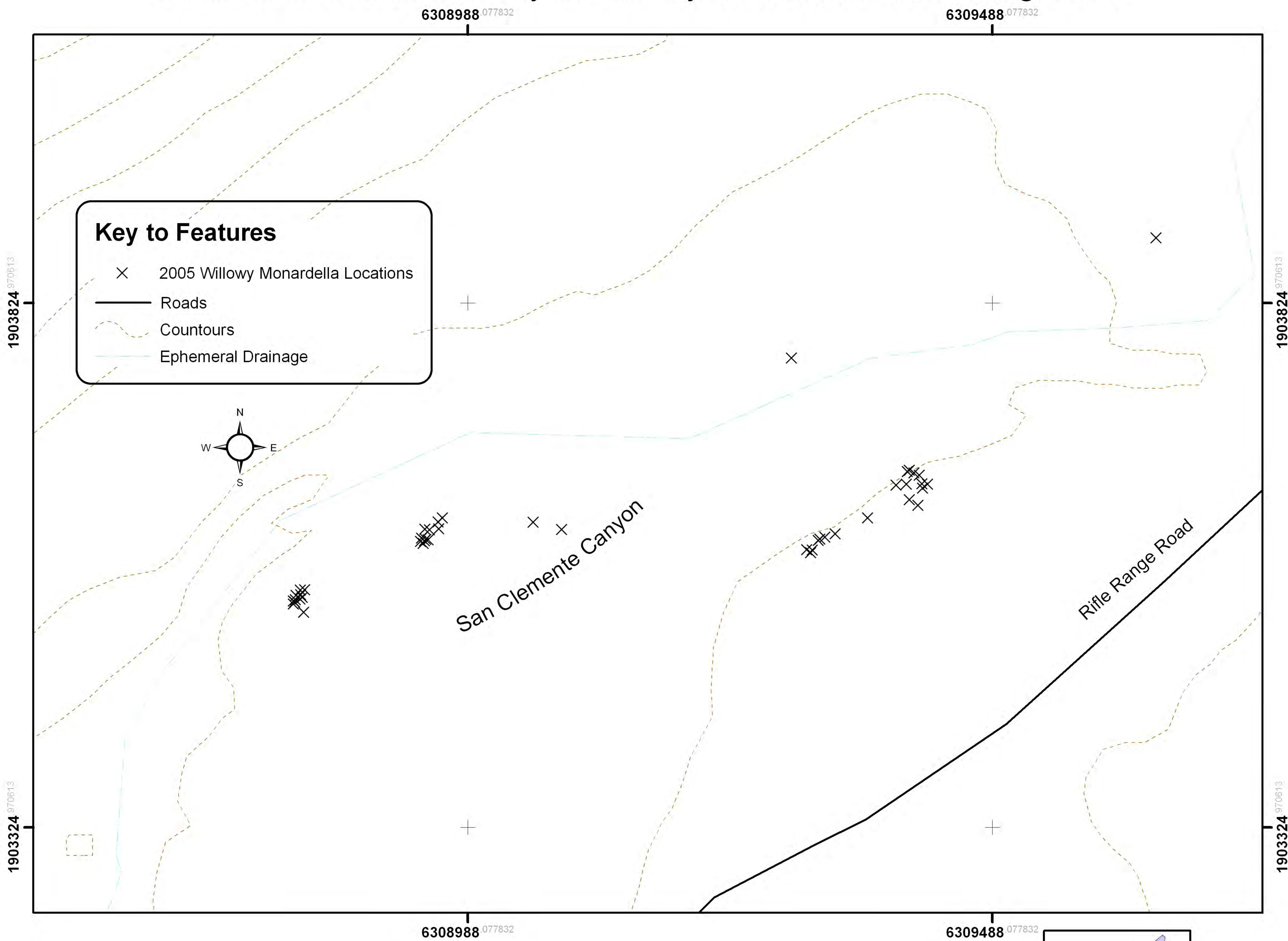
2004 San Clemente Canyon Willowy Monardella Monitoring Data



2004 San Clemente Canyon Willowy Monardella Monitoring Data

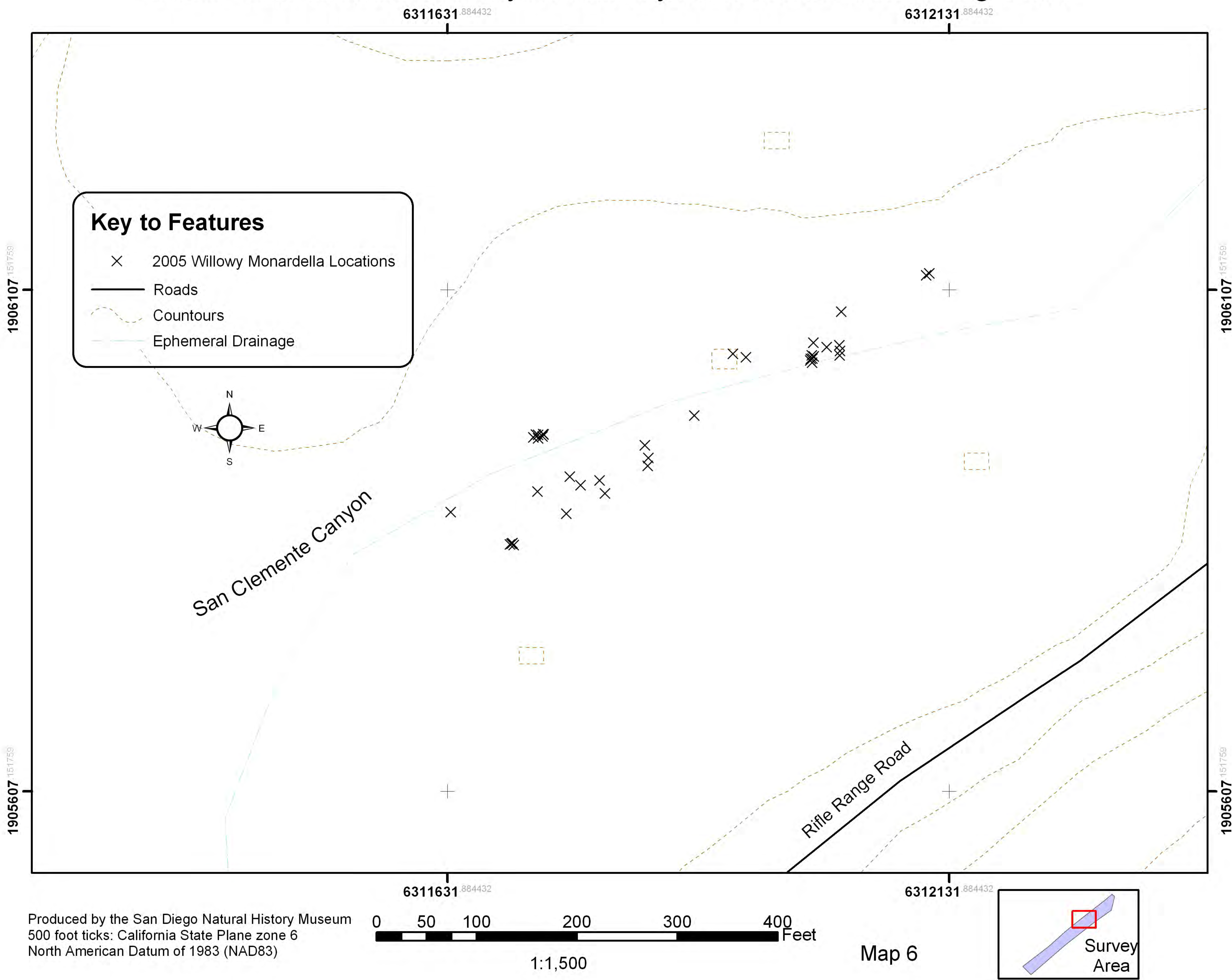


2005 San Clemente Canyon Willowy Monardella Monitoring Data

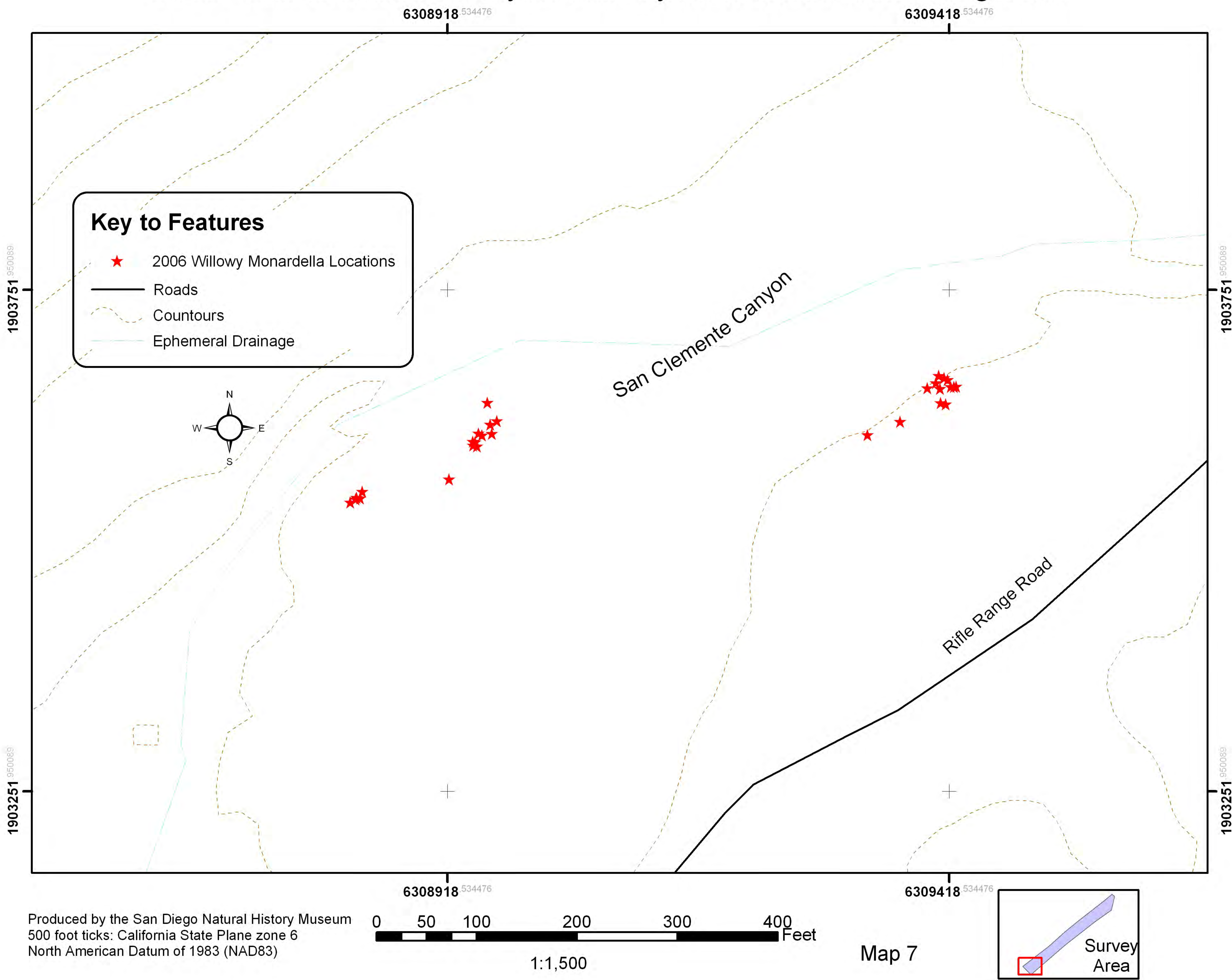


Produced by the San Diego Natural History Museum
500 foot ticks: California State Plane zone 6
North American Datum of 1983 (NAD83)

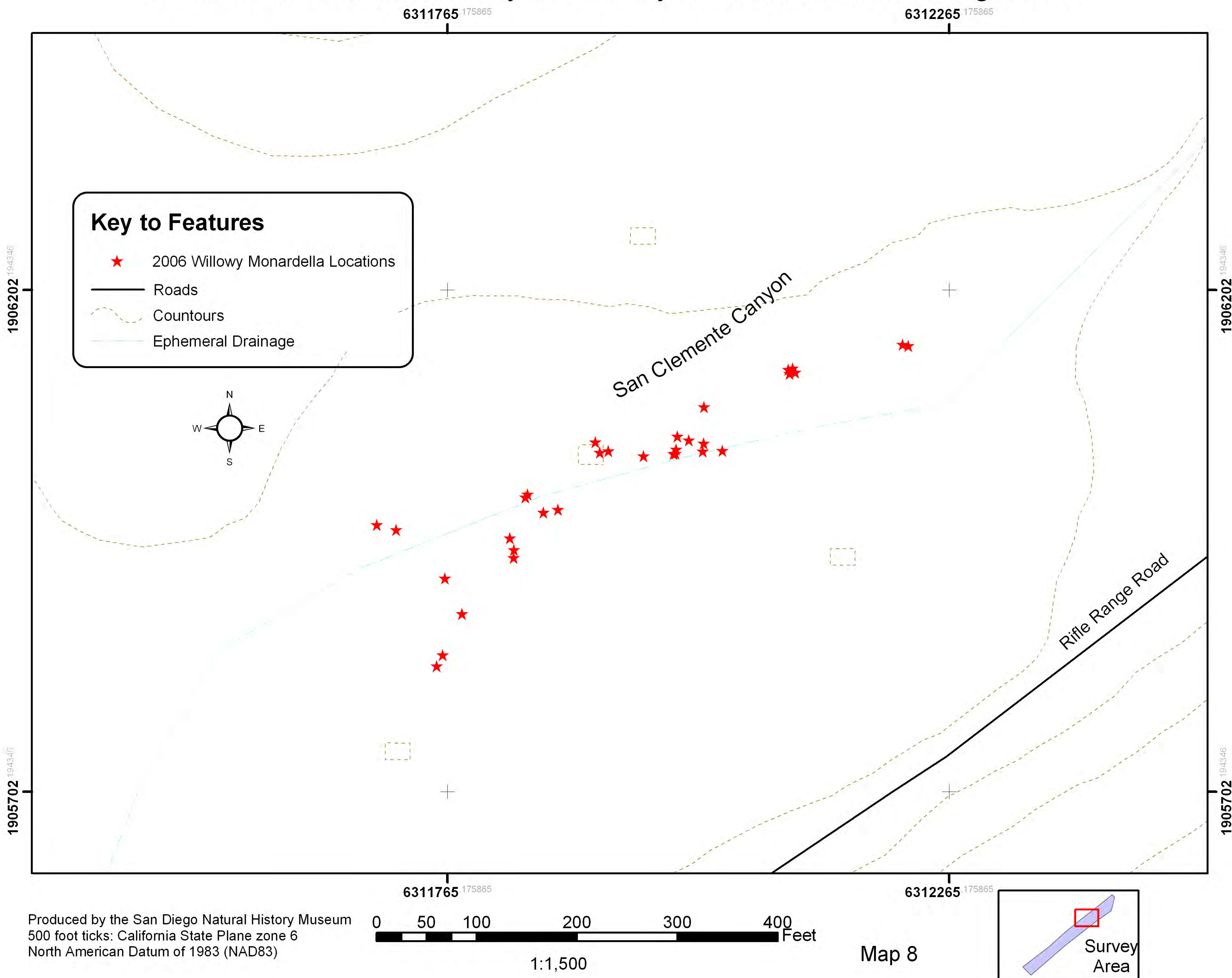
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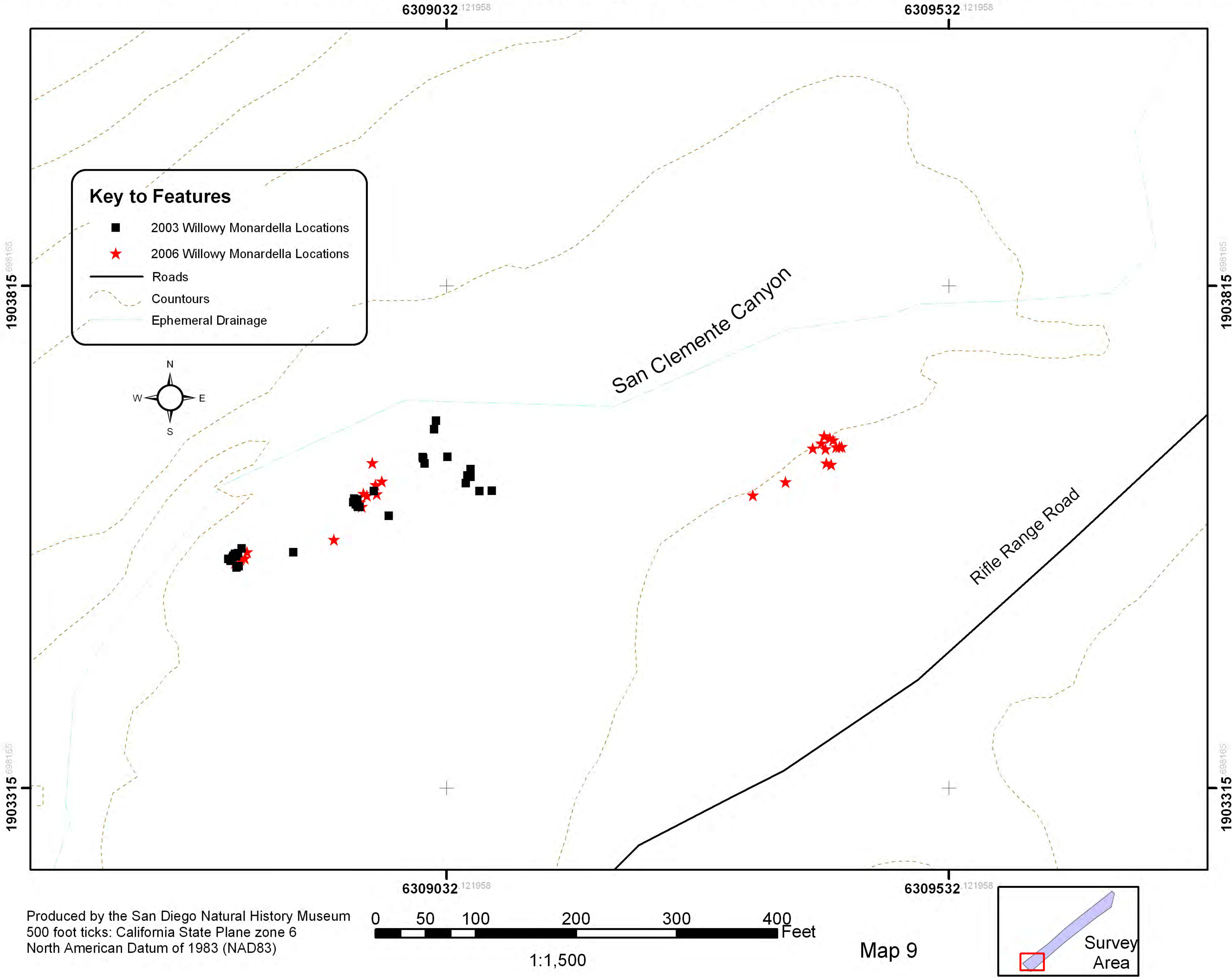
2006 San Clemente Canyon Willowy Monardella Monitoring Data



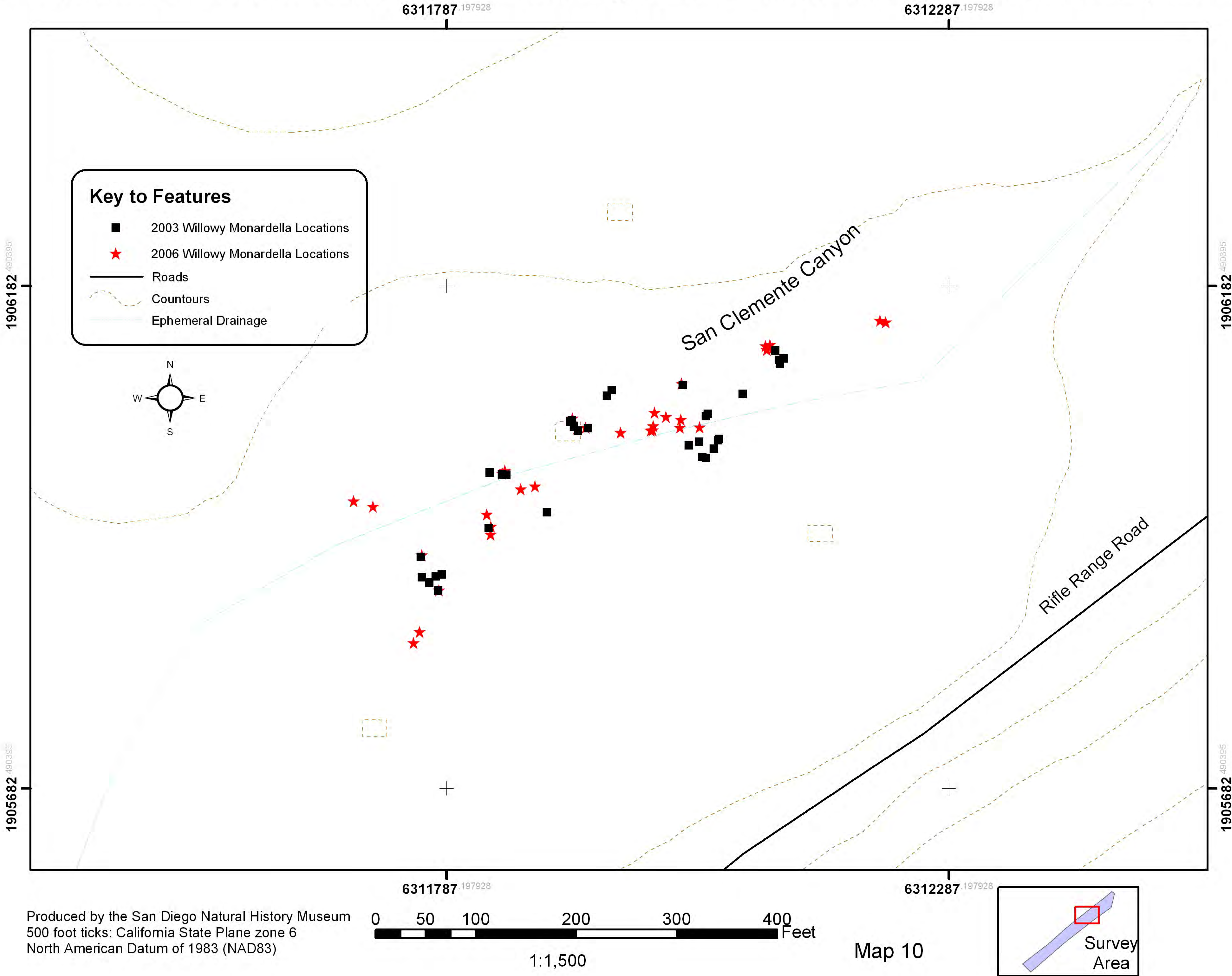
2006 San Clemente Canyon Willowy Monardella Monitoring Data



2003 and 2006 San Clemente Canyon Willowy Monardella Monitoring Data for Comparison



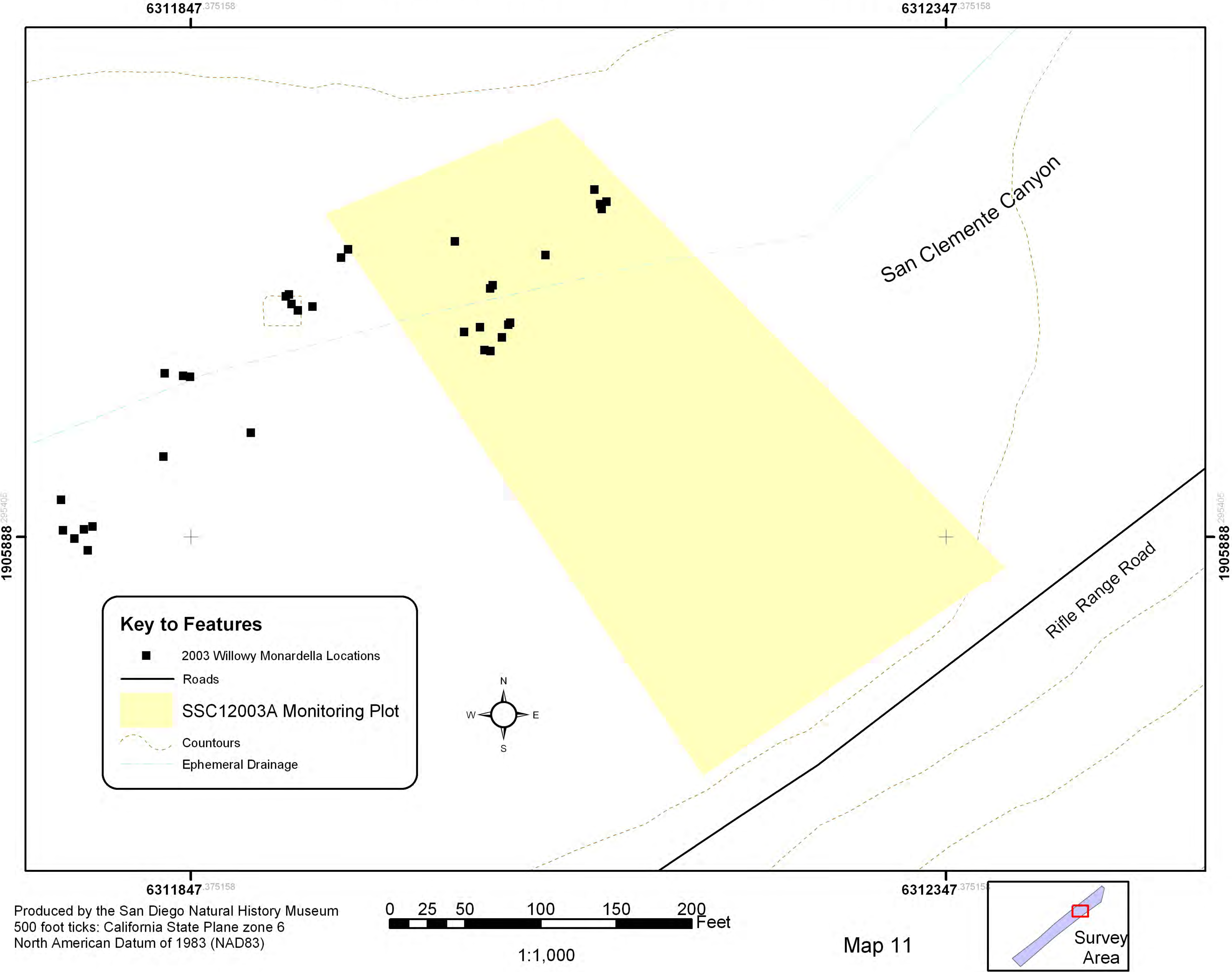
2003 and 2006 San Clemente Canyon Willowy Monardella Monitoring Data for Comparison



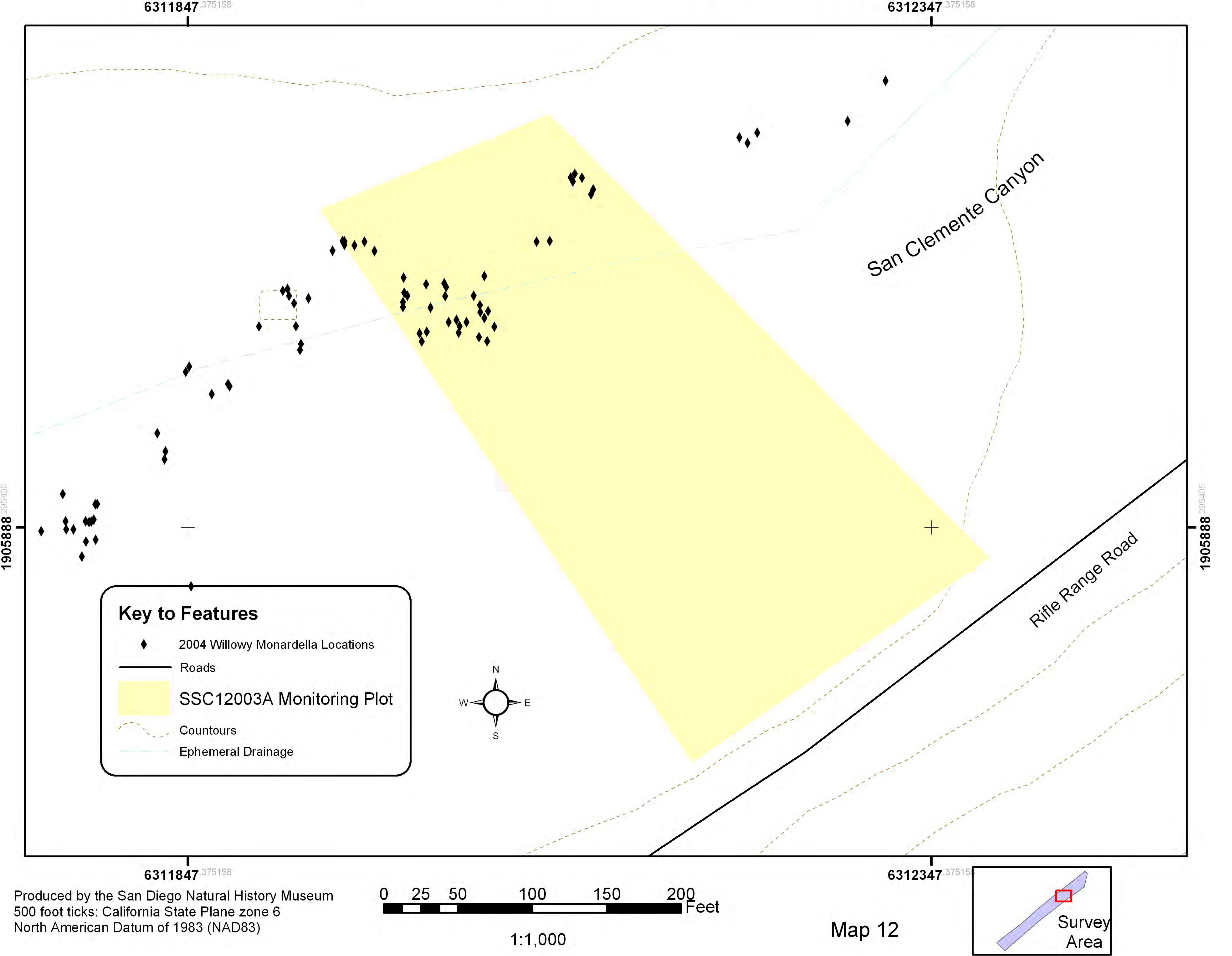
Appendix B

Maps of Willowy Monardella in the Long-Term Monitoring Plots by Year.

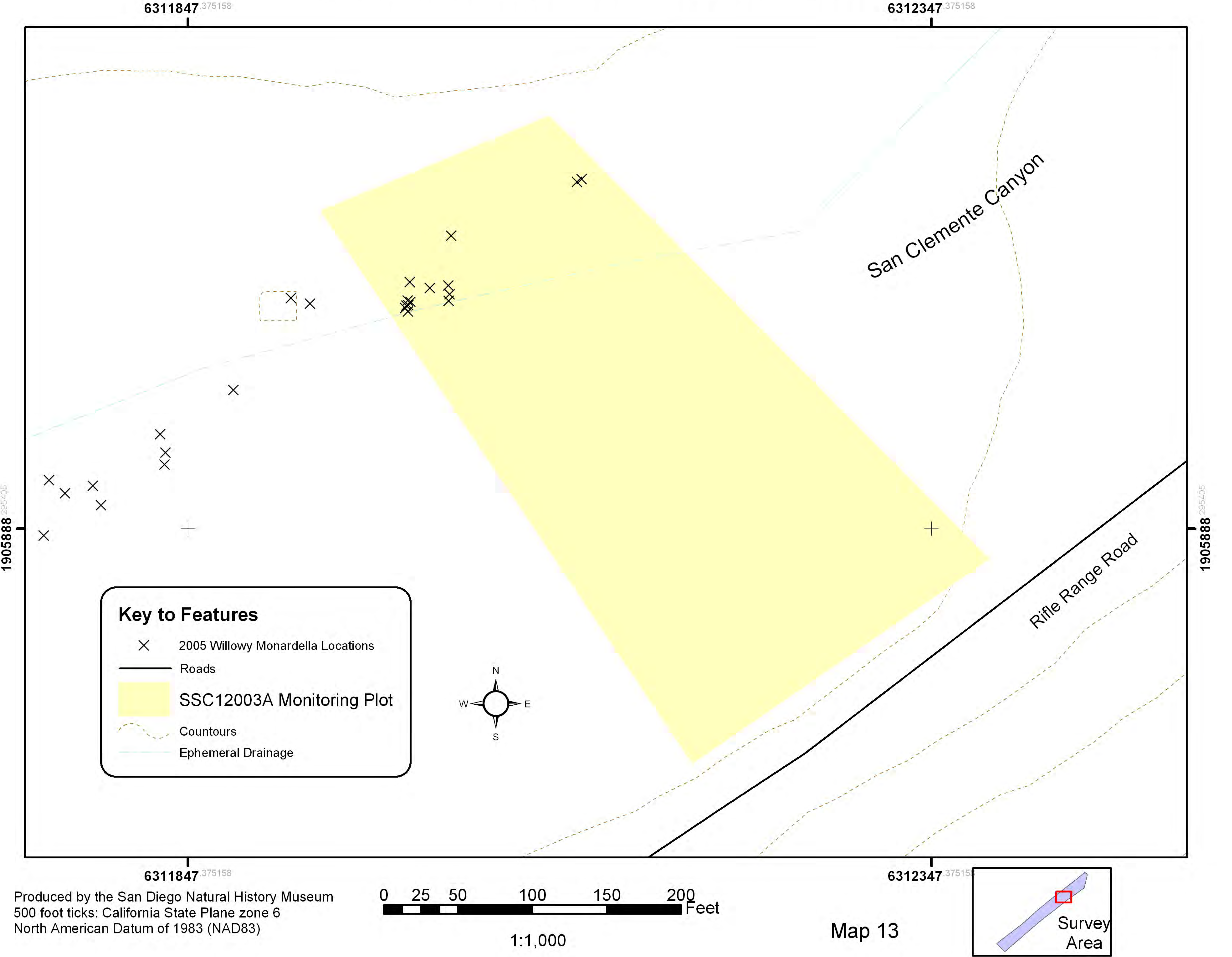
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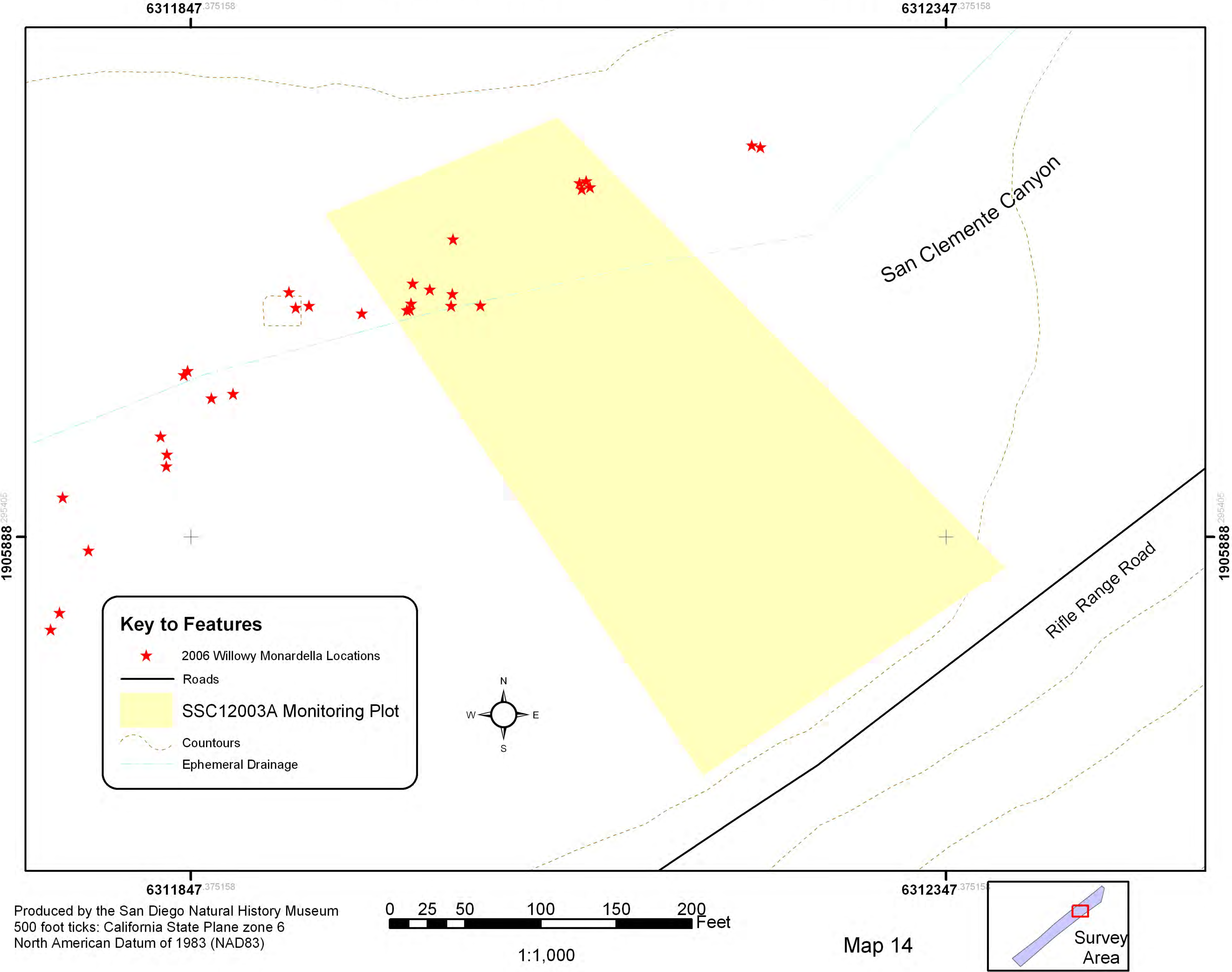
2004 Monitoring Plot Data SSC12003A



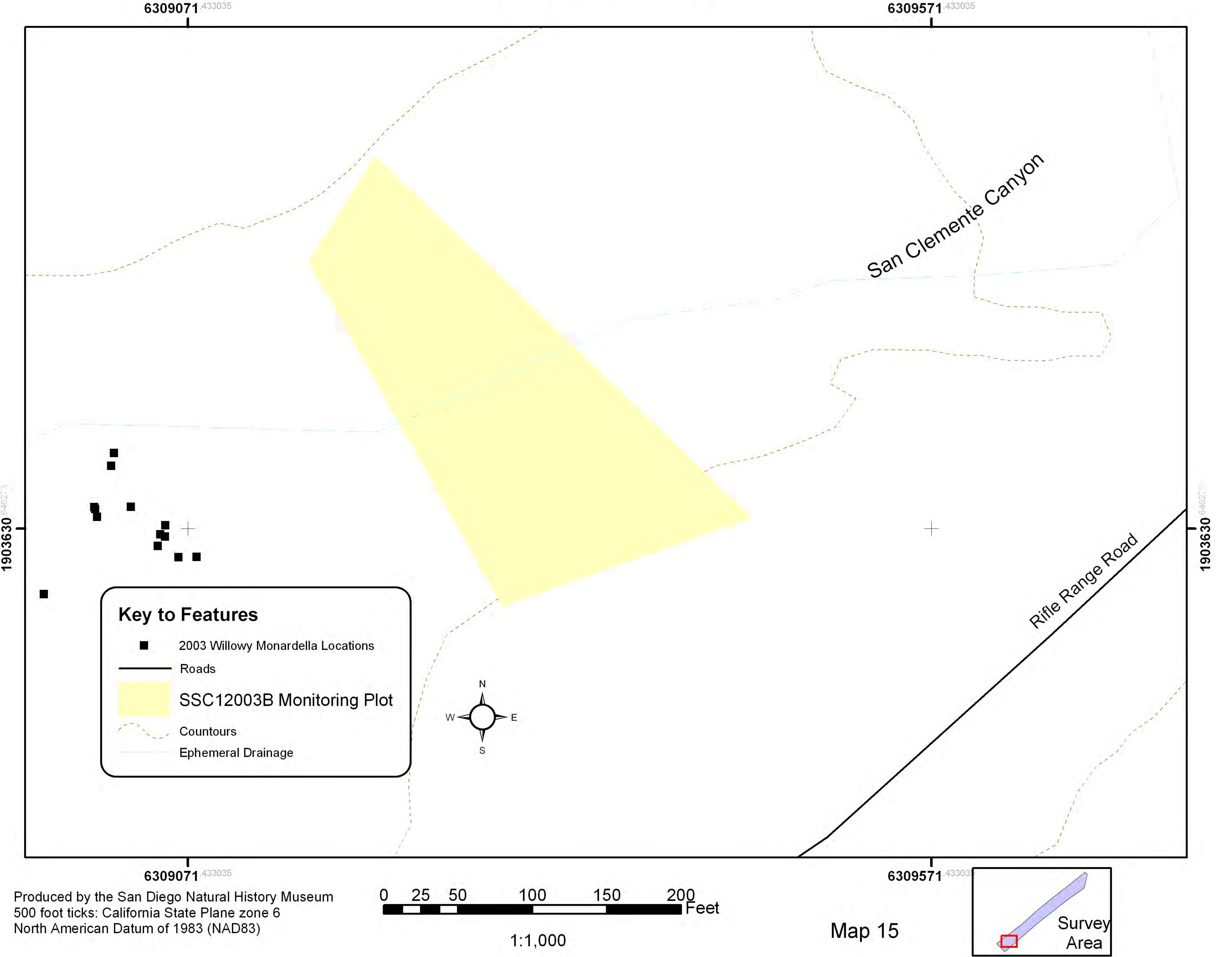
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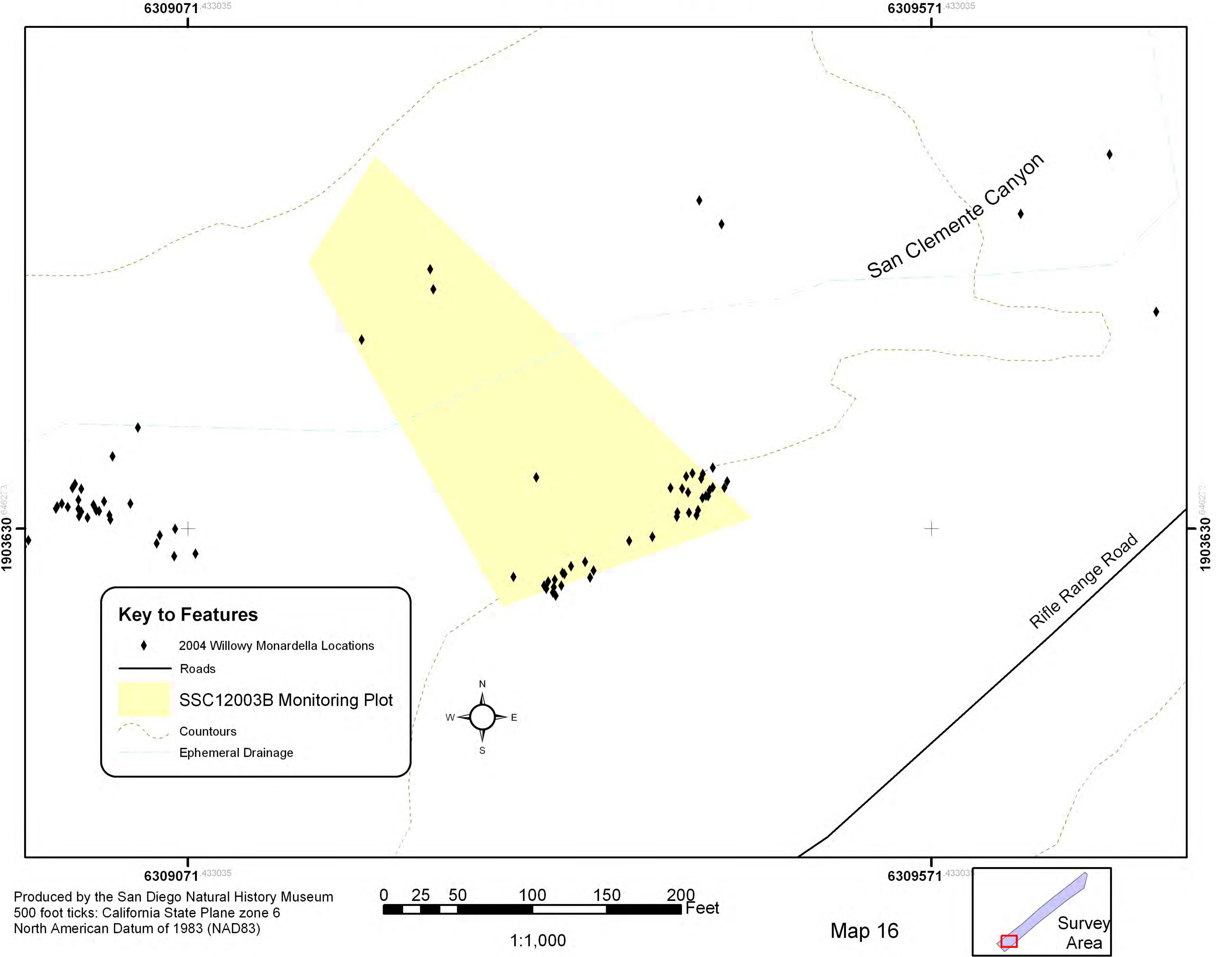
2006 Monitoring Plot Data SSC12003A



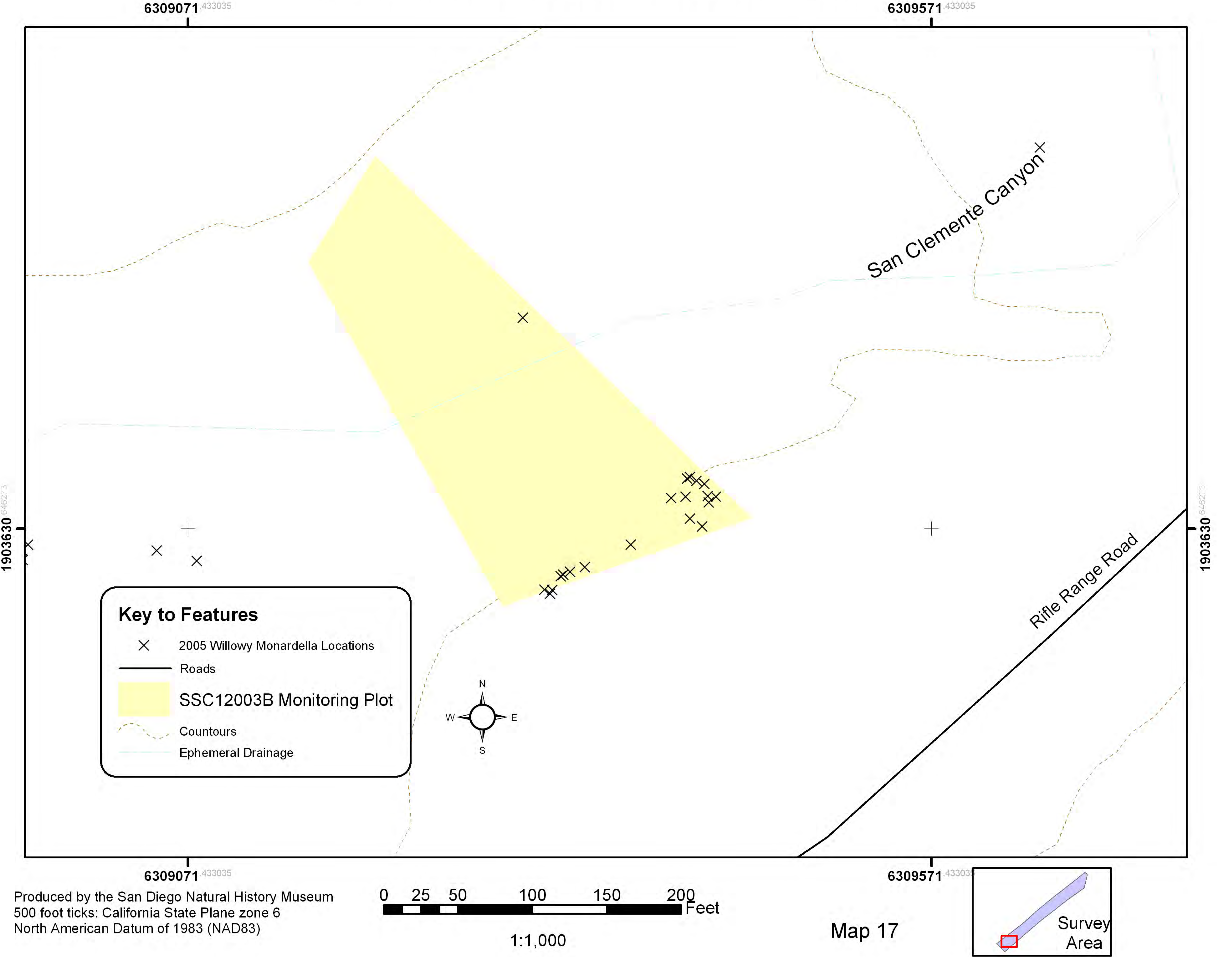
2003 Monitoring Plot Data SSC12003B



2004 Monitoring Plot Data SSC12003B



2005 Monitoring Plot Data SSC12003B



2006 Monitoring Plot Data SSC12003B

