MITIGATION MONITORING REPORT
FOR
SMALL-LEAVED ROSE (YEAR 3)
CALIFORNIA TERRACES AND
OTAY CORPORATE CENTER

Prepared for

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Introduction

This document presents the results of the Year 3 (December 1999 to November 2000) monitoring for the translocation of small-leaved rose (*Rosa minutifolia*) on the California Terraces and Otay Corporate Center North and South development projects. The development project impacted the only known population of small-leaved rose in California and the United States; therefore, a translocation and management plan was designed and implemented upon approval by the California Fish and Game Department (CDFG) and U.S. Fish and Wildlife Service (USFWS). In this document, third-year growth, survivorship, and reproduction data are presented and compared with baseline data and past annual results for Years 1 and 2.

History

The small-leaved rose (Photographs 1, 2, and 3) is a perennial plant species which was found at one location in the United States, on Otay Mesa. Here it grew as a large patch covering several hundred square feet at the edge of the mesa. Other than the specimen on Otay Mesa, the population ranges from Ensenada south to the red clay hills near Aguajitos, Baja California (Hickman 1993; Shreve and Wiggins 1964). In Baja California it grows on rocky to heavy clay soil on hillsides and valley floors. The small-leaved rose differs from other native rose species in California by having leaflets that are less than one centimeter long and having a hypanthium (the cup-shaped enlargement of the receptacle on which the calyx, corolla, and often the stamens are inserted) that is densely prickly (Hickman 1993). Small-leaved rose was originally identified on the property by Jack Reveal in 1985 (Reveal 1986). Prior to its discovery on Otay Mesa, its discovery in Baja California and its history of cultivation in the United States was summarized from correspondence and documents from 1882 to 1971 (Lenz 1982).

The reproductive biology of the small-leaved rose has not been specifically studied, but based on observations of the rose plant on Otay Mesa over the last few years, some generalizations about the reproductive biology of the plant can be inferred. Flowering observed on the rose plant is very unpredictable but appears dependent on the amount and distribution of rainfall. Seed production is tied to flower production and the availability of pollinators. Potential pollinators, such as bees, have been observed on the small-leaved rose on Otay Mesa. Seeds collected from *Rosa minutifolia* plants in Baja California, Mexico, in general, germinated slowly and in low percentages (Evans 1995).

A. Project Background

The California Terraces and Otay Corporate Center North and South project sites cover 864 acres of land on Otay Mesa located in the northwestern portion of the Otay Mesa

PHOTOGRAPH 1

Small-leaved Rose Patch on Otay Mesa

PHOTOGRAPH 2

Small-leaved Rose in Flower on Otay Mesa

PHOTOGRAPH 3

Close-up of Small-leaved Rose Flowers

community planning area in the city of San Diego, between Interstate 805 and Heritage Road (Figures 1 and 2). The California Terraces project (665 acres) will be predominantly for residences and associated improvements (e.g., schools, parks, open space, habitat preserves, and commercial centers). The Otay Corporate Center North project (179 acres) is to the east of the California Terraces project, while Otay Corporate Center South project (20 acres) is to the south of Otay Corporate Center North. Both Otay Corporate Center projects will consist of industrial development, open space, and habitat preserves, including vernal pool preserves. The entire small-leaved rose patch on Otay Mesa was impacted by construction of the project.

B. Mitigation Requirements and Success Criteria

Specific mitigation measures were outlined in the California Endangered Species Act (CESA) Memorandum of Understanding (CESA 2081-1996-071-5) issued by CDFG for the project. The mitigation measures included translocation trials, salvage, and propagation of the rose plants, transplantation into the vernal pool preserve, and a five-year maintenance and monitoring program. The initial translocation trial and final translocation of the donor plant was discussed in the first-year monitoring report (RECON 1999a).

Transplant success criteria over the five-year period shall include: (1) survivorship of a minimum of 100 plants, each which have shown measurable annual increase in cover over the final two years of the monitoring program, without the benefit of supplemental irrigation; and (2) flowering of 50 percent of the small-leaved rose plants during a minimum of one flowering season within the final three years of the monitoring program.

Monitoring Methods

A monitoring program has been initiated for the translocated roses to track the progress of their growth. Monitoring may also provide new biological information (i.e., seed production, growth, pollinators) about the small-leaved rose. Biological information will be discussed in the annual reports as it becomes available during the five-year monitoring period. The monitored rose locations are depicted in Figure 3.

Monitoring for the small-leaved rose mitigation began in January 1998 and will continue through December 2002. The five-year monitoring program is scheduled as follows:

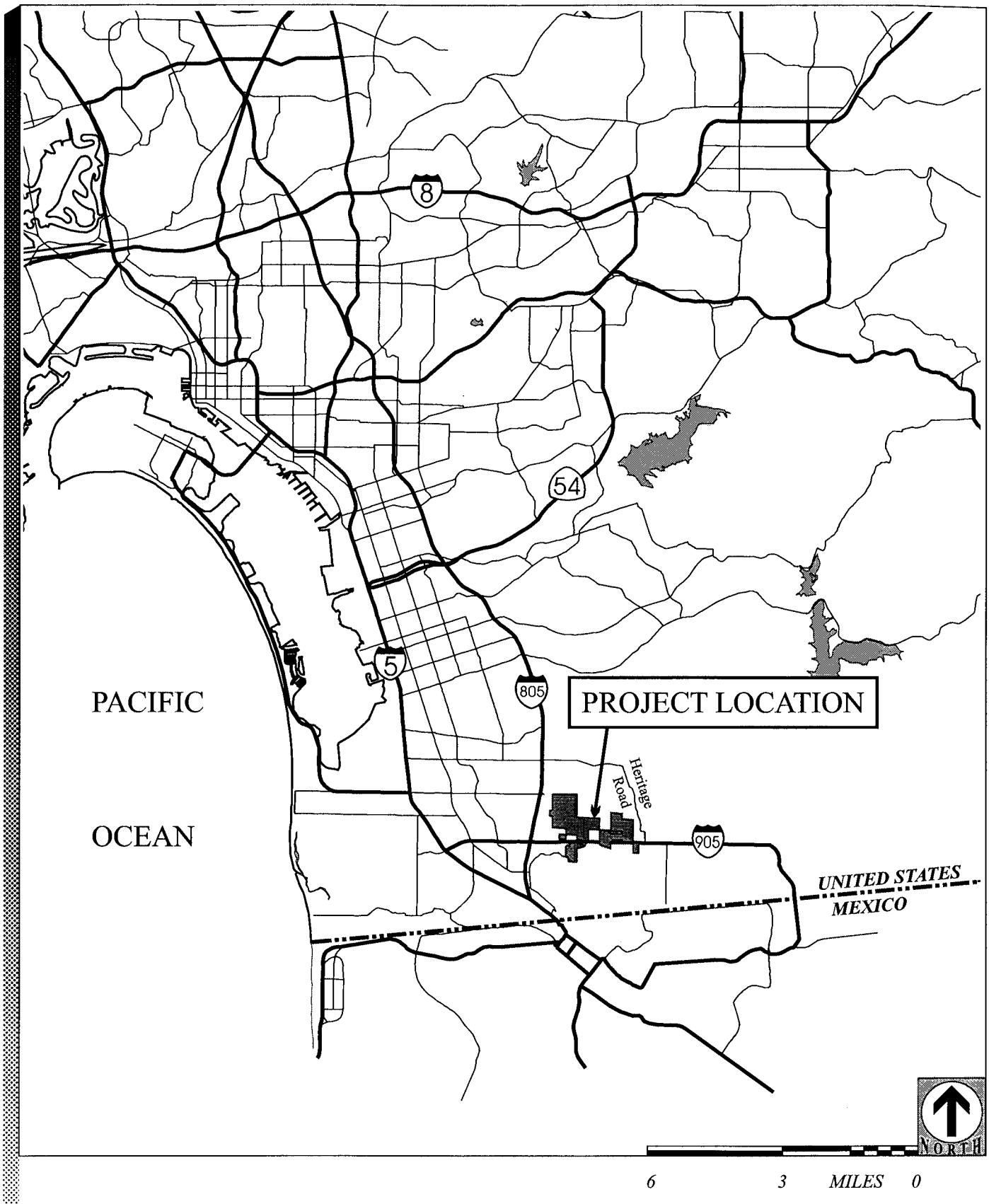

FIGURE 1

Regional Location of the Project

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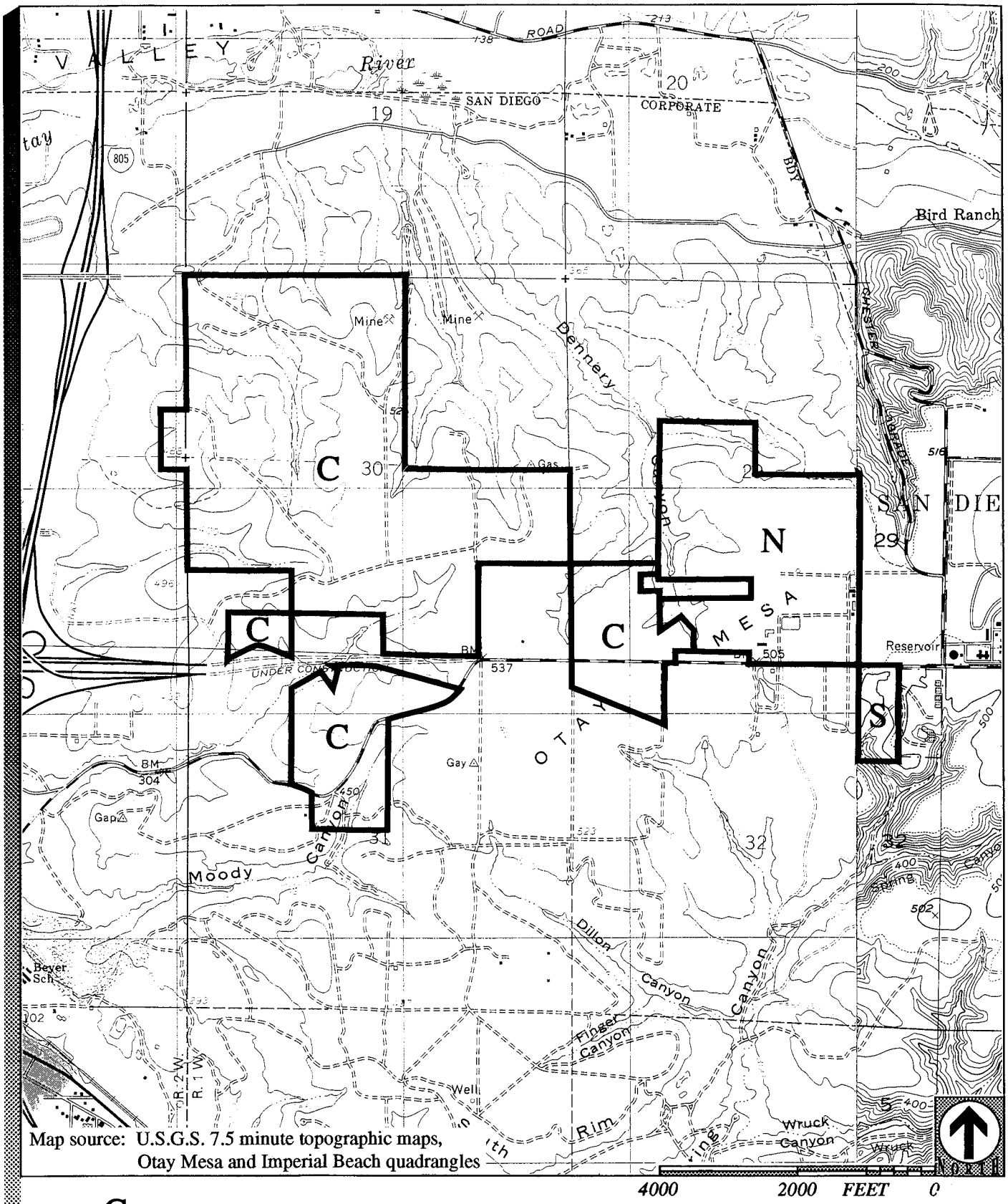

Map source: U.S.G.S. 7.5 minute topographic maps, Otay Mesa and Imperial Beach quadrangles

C California Terraces

N Otay Corporate Center North

S Otay Corporate Center South

FIGURE 2

Location of The Composite Projects on Otay Mesa

Monitored rose locations
Vernal pool preserve boundary
Open space
Project limits

FIGURE 3

Locations of Small-leaved Rose Translocation Areas

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Year 1	1998
Year 2	1999
Year 3	2000
Year 4	2001
Year 5	2002

Four formal monitoring visits were conducted in spring 2000 to collect qualitative and quantitative data: March 28, April 10, May 3, and June 13. Informal monitoring visits were conducted from January through August to identify general growth patterns and blooming periods.

Data on the following factors is collected during each monitoring year by the project biologist: growth, survivorship, establishment rate (i.e., recruitment of seedlings or vegetative spread), flower and seed production, presence of non-native weeds, effects of herbivores and pathogens, and environmental factors such as drought, hydrology, and disturbance. In addition, community structure and species diversity at the small-leaved rose mitigation sites shall be assessed. Techniques for conducting these assessments are given in more detail in Attachment 1.

Year 3 Monitoring Results

The results of the third-year monitoring program for the small-leaved rose on the mitigation site are discussed below. Third-year data collected for the translocated rose plants and a comparison to growth and reproductive data from previous years is presented.

A. Year 3 Growth Results

Growth data, including height, width, and breadth, was collected in April 2000. This information is presented in Table 1. Overall, the plants have maintained their structure and have grown moderately since the 1999 growing season. Average volume increased approximately 14 percent. As shown in Figure 4, average volume has increased steadily since the baseline data was collected in early 1998. The most significant growth occurred during Year 2. Year 3 analysis indicates relative stability in the plant's growth.

Photographs of five individuals have been provided in previous annual reports to depict growth. These same individuals are shown in Photographs 4 through 13 which were taken in 1998 and 2000.

TABLE 1
GROWTH DATA SUMMARY FOR TRANSLOCATED SMALL-LEAVED ROSE

Growth Measurement	Baseline January 1998	Year 1 May 1998	Year 2 April 1999	Year 3 April 2000
Height (cm)				
Mean	35.67 cm	32.81 cm	35.83 cm	38.82 cm
Minimum	7.0 cm	5.0 cm	10.0 cm	17.78 cm
Maximum	80.0 cm	71.2 cm	77.0 cm	111.76 cm
Canopy Area (cm^2)				
Mean	1,942.52 cm^2	2,168.38 cm^2	7,608.81 cm^2	8,552.45 cm^2
Minimum	6.45 cm^2	2.0 cm^2	72.0 cm^2	670.96 cm^2
Maximum	8,399.98 cm^2	8,580.63 cm^2	60,720.0 cm^2	26,799.95 cm^2
Canopy Volume (cm^3)				
Mean	323,152.3 cm^3 (0.32 m^3)	335,410.8 cm^3 (0.33 m^3)	1,569,917.79 cm^3 (1.57 m^3)	1,795,464.21 cm^3 (1.79 m^3)
Minimum	960.99 cm^3	83.78 cm^3	6,031.86 cm^3	49,971.36 cm^3
Maximum	1,844,910.76 cm^3 (1.84 m^3)	2,087,827.08 cm^3 (2.09 m^3)	16,023,630 cm^3 (16.02 m^3)	7,852,641.73 cm^3 (7.85 m^3)

cm = centimeter; m = meter

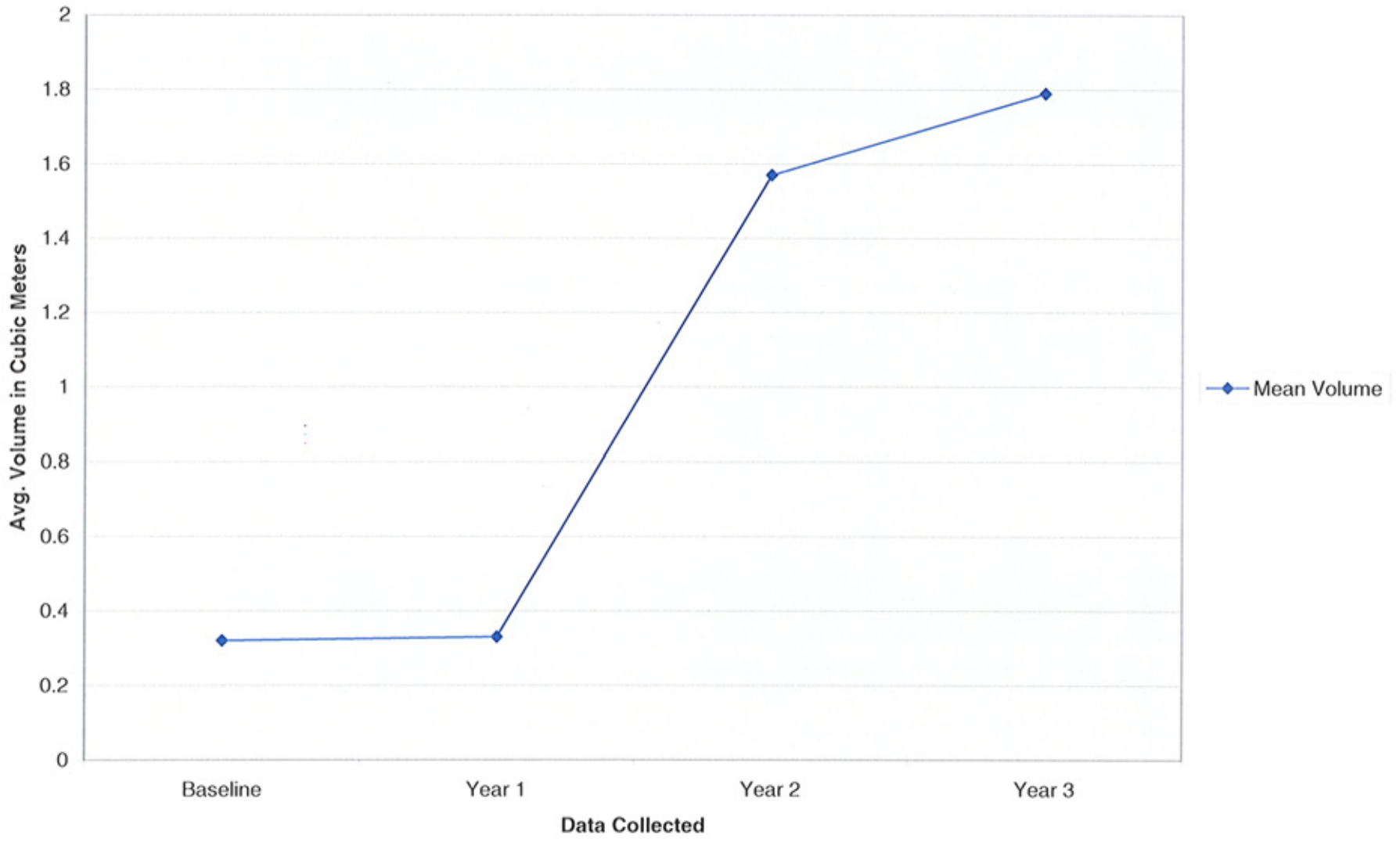

FIGURE 4
Comparison of Average Volume

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PHOTOGRAPH 4

Rose Number 105 in 1998

PHOTOGRAPH 5

Rose Number 105 in 2000

PHOTOGRAPH 6

Rose Number 161 in 1998

PHOTOGRAPH 7

Rose Number 161 in 2000

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PHOTOGRAPH 8

Rose Number 168 in 1998

PHOTOGRAPH 9

Rose Number 168 in 2000

PHOTOGRAPH 10

Rose Number 175 in 1998

PHOTOGRAPH 11

Rose Number 175 in 2000

PHOTOGRAPH 12

Rose Number 203 in 1998

PHOTOGRAPH 13

Rose Number 203 in 2000

B. Year 3 Survivorship Results

In June 2000, 83 percent (203 individuals) of the 245 translocated rose plants were alive. This indicates a 2 percent (5 individuals) increase in mortality from Year 2.

C. Year 3 Establishment Rate Results

The number of plants which have at least one stem rooted in the surrounding soil has increased significantly. As noted in the Year 2 monitoring report, 21 plants had stems which had rooted (i.e., layered). In April 2000, 171 (84 percent) of the plants had stems that had rooted.

D. Year 3 Flower and Seed Production Results

Reproduction data on the translocated small-leaved rose plants was collected during four monitoring visits in 2000: March 28, April 10, May 3, and June 10. Informal surveys continued into the summer months. The plants reached their growth peak in April and began entering dormancy in May. Hip production was highest in May, with a total of 190 hips observed. Few of these hips reached maturity. By June, the majority of plants had ceased flowering, had developed small hips, and had turned brown.

The survey season for the small-leaved rose transplantation program began in spring 2000. Plants were checked throughout the winter and early spring for the onset of bud and flower production. The season appeared to begin abruptly, going from dormancy to full flower production in a matter of weeks. The peak of flower production was reached in April. The production of buds decreased dramatically in the latter part of April. Although 190 hips were observed in May, the majority of these hips were immature. In late June and July, monitoring visits were conducted to look for mature hips. Few mature hips were observed and none were harvested due to the low numbers. A comparison of flower, bud, and hip production throughout the Year 3 monitoring period is provided in Table 2. Figure 5 provides a comparison of flower production throughout the growing seasons of Years 1-3.

TABLE 2
2000 FLOWER AND FRUIT PRODUCTION

Survey Dates	Flowers	Buds	Hips
March 28	2,516	27,544	0
April 10	15,253	21,913	57
May 3	1,834	827	190
June 13	157	53	110

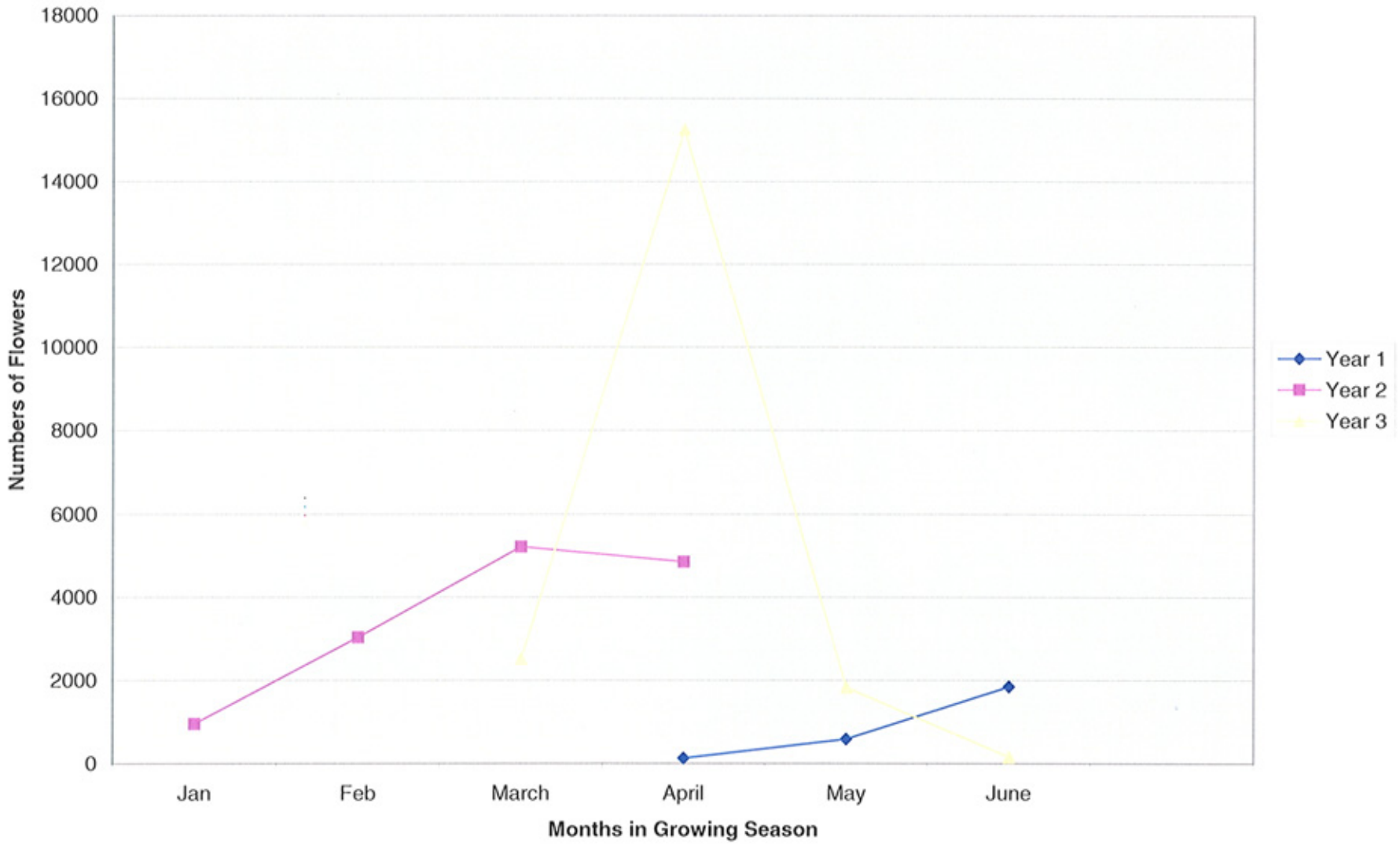

FIGURE 5
Comparison of Flower Production

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Potential pollinators were observed on the rose plants throughout Years 2 and 3. A list of species (or taxonomic affiliation) observed is provided in Table 3.

TABLE 3
POTENTIAL POLLINATORS OBSERVED ON THE SMALL-LEAVED ROSE PLANTS

Common Name	Taxonomic Affiliation/Species
Bumble bee	Tribe Bombini, subfamily Bombinae
Honey bee	*Apis mellifera*
Leaf hopper	Family Cicadellidae
Hover fly	Family Syrphidae
Argentine ant	*Iridomyrmex humilis*
Green lynx spider	*Peucetia viridans*
Aphids	*Macrosiphum rosae*
Wasp	Order Hymenoptera
California ringlet	*Coenonympha california californica*
Beetle	Order Coleoptera
Tussock moth	*Orgyia* sp., family Lymantriidae
Crane fly	*Tipula* sp.
California ladybird beetle (adults and nymphs)	*Coccinella californica*

E. Year 3 Non-native Weed Removal Results

Intensive weed control efforts continue to occur throughout the vernal pool preserve. Invasive species removed from around the roses include smooth cat's ear (*Hypochaeris glabra*), pin-clover (*Erodium botrys*), white-stemmed filaree (*Erodium cicutarium*), and non-native grasses.

F. Year 3 Herbivory and Pathogen Results

Desert cottontail rabbits (*Sylvilagus audubonii*) use the plants for cover; however, the health of the roses does not appear affected since no browsing damage has occurred. No pathogens or other disease symptoms have been observed on the translocated rose plants. Aphids have been observed on the roses; however, they seem to be under control and do not have a negative effect on the health of the plants.

G. Year 3 Environmental Factor Results

The shortened growing season is likely due to the below average rainfall of 6.35 inches for the 1999-2000 year. Average rainfall in San Diego County is 10 inches.

As in previous years, the plants in Area 4 remained greener and flowered longer than the other areas. Photograph 14 depicts the small-leaved rose plant habitat in Area 4 during 2000.

H. Year 3 Community Structure and Species Diversity Results

Detailed analysis of the development of coastal sage scrub and maritime succulent scrub within the vernal pool preserves where the small-leaved rose was translocated is provided in the Year 2 annual report for the vernal pool preserve (RECON 2001). In general, plant species diversity and percent cover is increasing throughout the preserve areas.

Conclusions

The results of the third year of monitoring of the translocated small-leaved rose plants indicate that the success criteria for the mitigation measures will be met by the end of the five-year monitoring program. Although the year 2000 growing season was shorter than expected due to the below average annual rainfall, the plants grew in average height, area, and volume. Survivorship remains high. Flower and hip production has increased; however, few hips reached maturity.

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PHOTOGRAPH 14

View of Area 4 Small-leaved Rose Habitat

RECON

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1999b Draft Year 1 Annual Report for Dennery Canyon Vernal Pool, Coastal Sage Scrub, and Mule Fat Scrub Restoration and Preservation Plan. April.

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ATTACHMENT 1

Attachment 1
Monitoring Methods

Data on the following factors is collected during each monitoring year by the project biologist: growth, survivorship, establishment rate (i.e., recruitment of seedlings or vegetative spread), flower and seed production, presence of non-native weeds, effects of herbivores and pathogens, and environmental factors such as drought, hydrology, and disturbance. In addition, community structure and species diversity at the small-leaved rose mitigation sites shall be assessed. Techniques for conducting these assessments are given separately below.

1. Growth

Growth of the translocated small-leaved rose plants is estimated from the canopy area and relative canopy volume of each plant. The plant area and volume was measured soon after translocation to achieve baseline measurements (post-planting dimension) for the 245 plants to be monitored. Heights were measured to the tallest live branch. Relative plant area and volume is estimated by measuring the widest and narrowest diameters of the plant crown and applying an appropriate formula for calculating plant areas and volumes. Plant crown area will be estimated by multiplying the width and breadth of the canopy while plant volume will be estimated by the following formula: volume = 4/3 *pi* (width x breadth x height) (Bonham1989).

During the late spring or early summer of each year of the monitoring period, the area and relative volume of each plant will be remeasured and compared to the baseline measurements and measurements made in previous years. The difference between the baseline area and relative volume measurements and the yearly measurements will give an indication of the amount of growth the plants have undergone since planting.

2. Survivorship

Each of the transplanted roses will be monitored for survivorship. Observations on plant vigor will be recorded on each individual rose plant being monitored during site visits made in a particular monitor year.

3. Establishment Rate

Observations will be made during the monitoring period to detect any recruitment of small-leaved rose seedlings or vegetative expansion of an individual plant.

4. Flower and Seed Production

Observations of flower and fruit production will be made during the growing season. The number of buds, flowers, and fruits (i.e., hips) produced on each of the 245 translocated small-leaved rose plants will be counted. The production of hips occurs late in the growing season prior to the summer dormancy period.

5. Presence of Non-native Weeds

At each site visit, the presence of non-native weeds near the rose plants will be noted. Any non-native plant species observed within a 12-inch radius of a planting hole of a small-leaved rose will be removed.

Undesirable plants will be removed by hand pulling and with the use of hand tools. Non-native species expected to be an issue include slender wild oat (*Avena barbata*), filaree (*Erodium* spp.), black mustard (*Brassica nigra*), and foxtail chess (*Bromus madritensis* ssp. *rubens*).

6. Effects of Herbivores and Presence of Pathogens

Each of the translocated small-leaved rose will be monitored for herbivory and the presence of pathogens which could affect the survival of the plants. If excessive herbivory or pathogens are observed, the cause of the damage will be determined (e.g., insects, small mammals, etc.). Once the herbivore or pathogen is identified, appropriate control measures will be implemented.

7. Environmental Factors

The effects that environmental factors such as drought, hydrology, and disturbance have on the small-leaved rose transplants will be documented during the monitoring period as part of the routine site visits.

8. Community Structure and Species Diversity

The translocation of the donor small-leaved rose plant within upland areas of the vernal pool preserves coincided with the restoration of coastal sage and maritime succulent scrub at these same locations. Small-leaved rose is one component species of the upland restoration effort within the vernal pool preserve. Therefore, all areas where the small-leaved rose was introduced will also have other native coastal sage or maritime succulent scrub plant species introduced. The development of community structure and species diversity (i.e., abundance) shall be monitored as the various native plants become established in the upland areas of the vernal pool preserve as required in the Biological Opinion.

The development of community structure will be determined qualitatively through the assessment of vegetation layers. The establishment of a herbaceous, small shrub, and large shrub layer will comprise the structural components. The percent of native and non-native plant species in the herbaceous layer will serve as an indicator of understory development. The relative density of the component small and large shrubs becoming established will give an indication of the development and diversity of vertical structure in the habitat. Species diversity will be determined as the number or abundance of different native species establishing in uplands on the preserve.