

Cactus Baseline Survey Report

San Diego Management and Monitoring Program (SDMMP)

October 13, 2022

Prepared for:

San Diego Management and Monitoring Program (SDMMP)
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Background and Introduction

In 2016, the North Coast Cactus Nursery (Nursery), located in Escondido, California, was established to provide native plant materials to support restoration projects of coastal cactus wren (*Campylorhynchus brunneicapillus*) habitat in San Diego County (County). Establishment of the Nursery was led by the San Diego Association of Governments (SANDAG), San Diego Management and Monitoring Program (SDMMP), and the City of San Diego, with the focus of providing a source population for propagation of *Opuntia littoralis*. Since the establishment of the Nursery through 2018, over 8,000 *O. littoralis* were supplied to out-planting sites in the County (SD Zoo 2018). In 2021, AECOM was tasked with implementing renovations for the Nursery (e.g., replacement of existing weed barrier, repair and expansion of the irrigation system, and replacement of shade structure on site). During the onsite kick-off meeting in April 2021, AECOM ecologists observed *O. littoralis* expressing signs of stress and speculated that these were due to a disease uncommon to the species. Initial observation photographs and samples were collected and sent to the University of California Davis's (U.C. Davis) Fruit and Vegetable Plant Pathology Lab (U.C. Davis Lab), where *Fusarium brachygibbosum*, a fungal pathogen, was recovered. This was the first time this specific pathogen-host relationship had been documented, which raised concerns by County land managers that observed similar symptoms in cacti populations on their lands. These findings led to the development of the pathogen pilot study (study) discussed in this report.

Because of the important ecological role that southern California cacti populations play in coastal cactus wren habitat, and concern of potential fungal pathogen spread, the study was developed to investigate the distribution of affected cacti. The goal of the study is to support a large-scale observation and testing effort for cacti populations that are either out-plantings sourced from the Nursery, original collection points for the establishment of the Nursery, or native populations unassociated with the Nursery that are speculated to have similar symptoms. In spring and summer 2022, AECOM identified survey areas and conducted surveys throughout the County to document *O. littoralis* population health and collect samples of potentially affected plants. This report documents the methodology and results of the surveys conducted by AECOM in spring and summer 2022. To that end, this report includes the following sections and information:

- A summary of the **Survey Methodology** discussing site selection rationale of **Survey Areas**;
- A synopsis of the **Survey Results** discussing area-specific observations;
- Closing commentary with recommendations for **Subsequent Actions**;
- The detailed Cactus Pathogen Survey Protocol included as **Appendix A – Cactus Pathogen Survey Protocol**;
- Representative photographs included as **Appendix B – Representative Photographs**.
- The plant disease forms submitted to U.C. Davis with each collected cactus as **Appendix C – Plant Disease Forms**; and
- Survey areas illustrated in **Appendix D – Survey Area Maps**.

Survey Methodology and Survey Areas

Methods

All surveys were conducted by ecologists trained in the identification of the relevant cactus species and fungal pathogen symptoms. General best management practices (BMPs) were developed and implemented to prevent the movement of potential fungal pathogens and to minimize disturbances to habitat and biological resources associated with the surveys. These BMPs detailed phytosanitary and environmental sensitivity measures that were implemented while conducting surveys. Phytosanitary measures included the removal of all dirt from boots and vehicle tires and spraying of boots and tires with

a 10% bleach solution prior to entering and upon leaving survey areas. Disposable equipment used to collect symptomatic cactus was disposed of in sealed contractor bags and nondisposable metal equipment used to collect symptomatic cactus was sterilized with a 70%–90% isopropyl alcohol solution. To avoid disturbing coastal cactus wren and California gnatcatcher individuals or nests, AECOM ecologists scanned suitable habitat for nests or activity indicating active nesting prior to conducting surveys in these areas. Survey methods are summarized below and detailed further in Appendix A – Cactus Pathogen Survey Protocol. The following AECOM ecologists conducted surveys: Derrick Mathews, Natasha Foti, Ninfa Negrete Alcaraz, Claire Jorgensen, and Ryan Erpelding.

Surveys involved walking meandering transects throughout cacti populations within the designated survey areas (survey areas are discussed further, below). Ecologists focused on visual recognition of potential symptoms and signs of infection similar to infected individuals observed at the Nursery. If potential symptoms were observed, ecologists mapped the extent of the infection, collected and georeferenced infected cactus pads, described the severity of infection observed in the sample, and collected representative georeferenced photographs of the infection. Survey data was collected using the integrated electronic data form in ArcGIS Field Maps. A four-tiered symptom ranking system was developed to document the severity of the infection (detailed in Table 1) and representative photographs are included in Appendix B – Representative Photographs. Survey “tracks” were recorded (georeferenced) to document actual on-the-ground survey pathways. Between one and six samples were collected from symptomatic populations, with the number of samples depending on the extent of symptomatic individuals. For each collection, AECOM ecologists assigned a unique sample number, filled out a U.C. Davis Plant Disease Form (Appendix C – Plant Disease Forms), and mailed the sample directly to the U.C. Davis Lab. To prevent degradation, collected samples were only shipped Monday through Wednesday or stored in a refrigerator for up to 5 days until a shipment could be made.

Table 1: Symptom Ranking System

Rank	Severity of Infection
1	Infection observed on <10% of plant
2	Infection observed on >10% but <50% of plant
3	Infection observed on >50% plant but no signs of rot/cankers
4	Infection causing rot/cankers

Survey Areas

Eleven survey areas, including the Nursery, were identified for surveys of *O. littoralis* populations. All survey areas occur within conserved lands of the County. Most survey areas are located in the San Pasqual Valley. Other survey areas are north of Rancho Peñasquitos and within Oceanside, Lakeside, and along the coast in La Jolla. Most survey areas were selected based on their association to the Nursery. These sites were identified as either original source locations for the *O. littoralis* grown in the Nursery (Source) or as out-planting locations with *O. littoralis* grown from the Nursery (Out-planting). Survey areas associated with the Nursery included Bernardo Mountain, Lake Hodges, Bandy Canyon, Woodridge Preserve, Whelan Ranch Preserve, Safari Park Biodiversity Preserve (Safari Park), Lusardi Creek County Preserve, and Ysabel Creek Road Staging Yard (Ysabel Creek). Survey sites that are not associated with the Nursery are referred to as Wildland sites and were selected based on expressed concerns by land managers, such as the San Pasqual Battlefield State Historical Park (Battlefield SP) or based on observations made by biologists during other SDMP environmental surveys, such as Torrey Pines State Natural Reserve (Torrey Pines). Refer to Appendix D – Survey Area Maps for a complete set of figures illustrating each survey area.

Survey Results

Surveys were conducted over 18 days during June 1, 2022 through August 12, 2022. Overall fewer symptomatic cacti were observed than was anticipated with a total of 21 collections from 21 symptomatic cactus individuals collected and mailed to the U.C. Davis Lab. Survey information is detailed in Table 2. Ten of the 11 survey areas had at least one symptomatic cactus sample collected. The Safari Park was the only survey area where no collections were made. Conditions among the 10 survey areas with collections varied in terms of expressed symptoms from site to site. In general, when symptoms were observed, they tended to be on a single individual surrounded by a relatively healthy population. Observations of widespread symptoms were rare and only documented at Torrey Pines. At Ysabel Creek in particular, four samples were collected, each within a different part of the survey area. The Ysabel Creek survey area has out-plantings as well as native cactus populations on site, with three of the collections from out-plantings and one from a native stand. The four collections would suggest a widespread infestation; however, each symptomatic cactus occurred in isolation from the others and was surrounded by asymptomatic cacti.

Table 2: Survey Summary

Site Name	Land Manager/ Landowner	Site Type	Dates	Number of collections
North Coast Cactus Nursery	City of San Diego	Nursery	6/1/2022	2
Lake Hodges	City of San Diego	Out-planting	6/7/2022	2
Bernardo Mountain	San Dieguito Conservancy and River Park	Out-planting, Source, and Wildland	6/8/2022; 6/9/2022; 7/5/2022	1
Bandy Canyon	San Dieguito Conservancy and River Park	Out-planting	6/13/2022	2
Woodridge Preserve (Lakeside)	Center for Natural Lands Management	Source; Out-planting	6/15/2022	1
Whelan Ranch Preserve (Oceanside)	Center for Natural Lands Management	Source; Out-planting	6/20/2022	1
Safari Park Biodiversity Preserve	San Diego Zoo Wildlife Alliance	Source	6/21/2022; 6/22/2022; 6/23/2022	0
Ysabel Creek Road Staging Yard	San Dieguito Conservancy and River Park	Out-planting and Wildland	7/6/2022	4
San Pasqual Battlefield State Historical Park	California State Parks	Wildland	7/7/2022; 7/8/2022	1
Lusardi Creek County Preserve	County of San Diego	Out-planting	7/15/2022	2
Torrey Pines State Natural Reserve	California State Parks	Wildland	8/10/2022; 8/11/2022; 8/12/2022	5

Subsequent Actions

Upon receipt of collected samples, the U.C. Davis Lab began processing and performing analysis for pathogen isolation and identification to the species level. As of submittal of this report, final analysis of all submitted cactus is pending. Upon completion of the pathogen analysis, U.C. Davis will prepare an executive summary report describing the methodology and results of the analysis. Depending on these final results, U.C. Davis may request that asymptomatic samples be collected and submitted for analysis. Asymptomatic sample collections would be conducted similar to the methods implemented for symptomatic sample collections but will differ in that *O. littoralis* with no signs of infection will be collected from within the same survey areas and vicinity as symptomatic cacti.

Depending on the results from the U.C. Davis pathogen analysis and the preliminary determination of the extent of infection, infected *O. littoralis* populations at restoration and wildland sites may need to be addressed. A coordinated effort between land managers to develop and define an appropriate treatment plan could include the development of Pesticide Use Plans and the treatment and/or removal of infected cacti. Furthermore, depending on the results from the lab analysis, subsequent actions could include a general cleanup of the Nursery, including but not limited to the treatment of cacti and soil located at the Nursery and removal of infected cacti from the Nursery. Recommendations for follow-up actions will be guided by discussions and reporting from U.C. Davis.

Acknowledgements

This study would not have been possible without critical funding from SANDAG and support from agencies, property owners, and land managers, who provided access to their property for purposes of these surveys. These organizations include the City of San Diego, County of San Diego, San Diego Zoo Wildlife Alliance, San Dieguito Conservancy and River Park, Center for Natural Lands Management, and California State Parks.

Literature Cited

San Diego Zoo Global Institute for Conservation Research (SD Zoo). (2018). *San Diego Association of Governments North County Cactus Nursery and Coastal Cactus Wren Habitat Restoration Final Report*.

Appendix A

Cactus Pathogen Survey Protocol

Cactus Pathogen Survey Protocol

Baseline/Symptomatic Cactus Survey Protocol

Spatial data will be collected using a project-specific map created for use within the ArcGIS Field Maps application, with iPads connected to Trimble R1 units to provide for sub-meter accuracy of spatial data. AECOM Ecologists will survey each **Cactus_Survey_Area** and collect data as outlined below.

Environmental Sensitivity and Phytosanitary Measures

Surveys will be conducted by qualified ecologists with experience working around sensitive habitats, resources, and species. Vehicles will remain on existing roads and surveys will be conducted on foot, utilizing natural openings in the habitat and avoiding trampling of native plant species. In order to avoid impacts to nesting birds, particularly coastal California gnatcatcher and coastal cactus wren, ecologists will scan the habitat for nests and nesting activity prior to initiating cactus surveys, and will remain vigilant for sensitive species throughout the day. Should a nest, or activity indicating nesting in progress be observed, ecologists will leave the area immediately and maintain at least a 300-foot buffer from the observation. In order to avoid introducing or transferring invasive species seed, ecologists will make sure boots, snake chaps, and tires are free of mud and vegetative debris before entering project areas. Ecologists shall clean seed out of boots and snake chaps prior to leaving or when arriving home (and dispose of in the trash) so seed isn't transferred to other sites. Regarding rabbit hemorrhagic disease (RHDV2), ecologists will note any dead rabbits observed and report to the project manager if found. Ecologists shall avoid disturbing any potential cultural resources.

To prevent the movement of potential fungal pathogens and RHDV2 between sites, ecologists shall remove all dirt and spray boots and tires with a 10% bleach solution prior to entering and upon leaving survey areas. Ecologists shall limit number of sites visited within the same day, as feasible. Disposable equipment used in the collection of cactus pads shall be properly disposed in sealed garbage containers. Any non-disposable metal collection equipment will be sterilized using 70%-90% isopropyl alcohol and allowed to dry before and after each use. Ecologists will use disposable nitrile gloves over top of any leather or needle-stick resistant gloves when ever making contact with cactus. Collected cactus pads will be stored immediately into the designated storage material to prevent the spread of any airborne fungal spores.

Gear and materials needed include:

- iPad/phone with R1
- External backup battery and charging cord
- Binoculars
- U.C. Davis Plant Disease Forms (paper copies)
- Paper bags (for samples)
- Sharpie (for labelling samples)
- Tongs
- Needle-stick resistant gloves
- Disposable nitrile gloves

- 10% bleach solution in spray bottle
- 70%-90% isopropyl alcohol solution in spray bottle
- Knife/loppers
- Packaging materials in car for storing/shipping after survey: plastic/paper padding, boxes

Surveys will involve walking meandering transects throughout the survey area, focusing on areas with cactus stands, with ecologists directly inspecting plants for signs of infection similar to those previously observed at the Cactus Nursery (Attachment A), as safely feasible. Surveys may be conducted from vantage points with binoculars, as necessary and appropriate. Survey “tracks” will be documented by collecting **Cactus_Survey_Points** in order to document where survey efforts occurred. When symptoms are observed, ecologists will map the extent using the **Symptom_Polygon** feature. The ecologist will provide photo-documentation using the **Photo_Point** feature and taking the photographs within the Field Maps application. Photographs will generally be taken of Collected symptomatic cacti, symptomatic cacti (population-scale), general landscape/survey area, collected asymptomatic cacti, and any other notable observations.

Each **Symptom_Polygon**, whether a small cluster of individuals or a large widespread population, will be ranked based on observed infection severity. Table 1 details the ranking system that will be used to monitor the progression and spread of the mapped populations over time, should findings of the analysis and funding provide for future monitoring efforts.

Table 1: Symptom Ranking System

Rank	Severity of Infection
1	Infection observed on <10% of plant
2	Infection observed on >10% but <50% of plant
3	Infection observed on >50% plant but no signs of rot/cankers
4	Infection causing rot/cankers

Additionally, ecologists will collect samples within the infected population, with sample locations documented using the **Collection_Point** feature (see below for more details). For each sample collected, ecologists will assign a sample number and fill out an associated U.C. Davis Plant Disease Form (Attachment B) to be mailed with the specimen. The sample numbering will follow the following format: initials of Ecologist, date, number (i.e. DM20220601-001).

The **QAQC_Point** feature is available to ecologists to use as needed, to document QAQC items for future incorporation into the final spatial data, and as a contingency should an additional data field be deemed necessary during surveys. This feature will not be included in the final spatial data, as notes from any of these features would be applied to other or new features for the final data.

Symptomatic Sample Collection Protocol

AECOM Ecologists will collect representative samples of symptomatic cacti at sites with affected cacti, concurrently with baseline surveys. Approximately one to six samples will be collected from each site with affected cacti, with the final number of samples dependent on the extent of symptomatic individuals. Up to six

samples will be collected from various locations within the population, with the number of samples dependent on the size and continuity of the symptoms. Each sample will consist of one to two cactus pads. Specific data to be recorded for collection points and photo-documentation is outlined below.

During sample collection, ecologists will collect fresh cactus pads that are living and not completely affected, based on guidance from Dr. Johanna Del Castillo Múnera from the Fruit and Vegetable Pathology Lab at U.C. Davis. Collected pads will be placed in paper bags without adding any additional moisture, and each will be clearly labeled with the sample number tying it to its associated Plant Disease Form. Packaged samples will be placed in paper or plastic, well padded, and mailed in a sturdy container. A Plant Disease Form will be included with each sample in the package and a photo of each symptomatic sample will be emailed to Dr. Johanna Del Castillo Múnera at jdcastillo@ucdavis.edu. Collected cactus samples will be shipped to the lab between Monday and Wednesday via FedEx Ground to the following address:

Johanna Del Castillo
Hutchison Hall Rm. 252
Department of Plant Pathology
University of California, Davis
1 Shields Ave
Davis, California, 95616

If collected cactus samples are collected on Thursday or Friday, samples are to be stored in a refrigerator for no more than five days.

Asymptomatic Sample Collection Protocol

Asymptomatic sample collections will be conducted in a similar way as symptomatic sample collections, but will come from cactus with no signs of infection within the same survey area as symptomatic cactus collections. This will be conducted upon request from U.C. Davis after analysis of symptomatic cactus has been implemented.

Cactus Pathogen Survey Data – Collection Methods and Deliverable Format

Survey Feature	Description	Field Maps Feature Setup	Spatial Deliverable: GIS Feature Layer and Associated Attributes
Miscellaneous Reference Layers (see description for list)	<p>NCountyCactusNursery_ProvenanceTable NCountyCactusNursery_PlantingsSites Master_SE_Mapped Cactus Conserved_Land_20210928 Parcels_int_cactusSurvey</p> <p>Field Methods: Ecologists to use these layers to help guide and focus survey efforts within the Survey Area.</p>	<i>n/a – reference layers only</i>	<i>None – do not include in final deliverable.</i>
Survey Area	<p>This feature layer represents the overall survey area boundary drawn prior to surveys with the intent of encompassing conserved lands of known source and out-planting sites, wildland sites with reported symptoms, and the Cactus Nursery site.</p> <p>Field Methods: Ecologists to remain within Survey Area boundaries during surveys.</p>	<i>n/a – reference layer only</i>	<p>Cactus_Survey_Area Survey Area ID</p> <ul style="list-style-type: none"> • Bandy Canyon • Bernardo Mountain • San Pasqual Battlefield State Historical Park • Lusardi Creek • Whelan Ranch Preserve (Oceanside) • Safari Park Biodiversity Preserve • Woodridge (Lakeside) • Lake Hodges South – Bernardo Bay, South Shore Point, North Glider Hill, Glider Hill West, Glider Hill South • Cactus Nursery
Cactus Survey Point	<p>This feature layer documents actual on the ground survey efforts within the overall survey area.</p>	<p><i>Date</i> <i>User account</i> <i>Latitude/Longitude</i></p>	<p>Cactus_Survey_Point</p> <ul style="list-style-type: none"> • <i>Date</i> • <i>User Account</i>

	<p>Field Methods: Ecologists to map points as they survey to document their survey path.</p>	Notes – text field	<ul style="list-style-type: none"> • <i>Latitude/Longitude</i> • Notes
Symptom Polygon	<p>This feature layer documents the extent of symptomatic cacti observed during surveys.</p> <p>Field Methods: When symptoms are observed, Ecologists to map polygons approximating the extent of symptomatic cacti.</p>	<p><i>Date</i></p> <p><i>User account</i></p> <p>Cactus Species – dropdown</p> <ul style="list-style-type: none"> • <i>Opuntia littoralis</i> • <i>Opuntia oricola</i> • <i>Opuntia phaeacantha</i> • <i>Opuntia sp.</i> • Other <ul style="list-style-type: none"> ○ Text field <p>Severity of Infection – dropdown</p> <ul style="list-style-type: none"> • 1. Infection observed on <10% of plants • 2. Infection observed on >10% but <50% of plants • 3. Infection observed on >50% plants but no signs of rot/cankers • 4. Infection causing rot/cankers <p>Sample Collected?</p> <ul style="list-style-type: none"> • Yes • No <p>Reason not collected – dropdown</p> <ul style="list-style-type: none"> • N/A • No permission to collect from land owner. • Already collected adequately from elsewhere in survey area. • Other <ul style="list-style-type: none"> ○ Notes – text field <p>Notes – text field</p>	<p>Symptom_Polygon</p> <ul style="list-style-type: none"> • <i>Date</i> • <i>User Account</i> • Cactus Species • Severity of Infection • Notes • Sample Collected?
Photo Point	<p>This feature layer documents the location from which a photograph was taken. Generally, photographs will be of symptomatic cacti, though</p>	<p><i>Date</i></p> <p><i>User account</i></p> <p><i>Latitude/Longitude</i></p>	<p>Photo_Point</p> <ul style="list-style-type: none"> • <i>Date</i> • <i>User Account</i>

	<p>they may also be taken of an overall Survey Area, or other notable observations.</p> <p>Field Methods: When symptomatic cacti are observed, Ecologists shall take one or more photographs of the infected population and symptoms.</p>	<p>Direction – 0 to 360 degrees (integer) Photo type – dropdown</p> <ul style="list-style-type: none"> • Collected symptomatic cacti • Symptomatic cacti (population-scale) • General Landscape/Survey Area • Collected asymptomatic • Other <ul style="list-style-type: none"> ○ Notes – text field <p>Cacti Sample Number – text field Notes – text field</p>	<ul style="list-style-type: none"> • <i>Latitude/Longitude</i> • Direction • Photo Type • Notes • Embedded Photo
Collection Point	<p>This feature layer documents the location of cactus samples collections for analysis and includes sample collection details.</p> <p>Field Methods: When symptomatic cacti are observed, Ecologists shall collect a sample(s), complete a U.C. Davis Plant Disease Form(s), and mail the sample to U.C. Davis.</p> <p>Refer to written protocol for additional details on sampling.</p> <p>Sample Number = initials of Ecologist, date, number i.e. DM20220601-001</p>	<p><i>Date</i> <i>User account</i> <i>Latitude/Longitude</i> Sample Type – dropdown</p> <ul style="list-style-type: none"> • Symptomatic • Asymptomatic <p>Sample Number – text field Number of Pads Collected - # field 1-6 (integer) U.C. Davis Plant Disease Form Completed?</p> <ul style="list-style-type: none"> • Yes <p>Notes – text field</p>	<p>Collection_Point</p> <ul style="list-style-type: none"> • <i>Date</i> • <i>User Account</i> • <i>Latitude/Longitude</i> • Sample Type • Sample Number • Number of Pads Collected • Notes
QAQC Point	<p>Field Methods: Ecologists to use this feature as needed to document qa/qc items for future consideration and as a contingency if an additional field need is identified during surveys.</p>	<p><i>Date</i> <i>User account</i> <i>Latitude/Longitude</i> Notes – text field</p>	<p><i>None – do not include in final deliverable.</i></p>

Appendix B

Representative Photographs

Appendix B: Representative Photographs



Photograph 1. Representative photo of Lake Hodges healthy wild population.



Photograph 2. Representative photo of symptomatic cactus in Lake Hodges South Shore Point survey area.



Photograph 3. Representative photo of healthy Source population observed at Bernardo Mountain survey area.



Photograph 4. Representative photo of symptomatic cactus in Bernardo Mountain survey area.



Photograph 5. Representative landscape level photo of Bernardo Mountain survey area.



Photograph 6. Representative landscape level photo of Bandy Canyon survey area.



Photograph 7. Representative photo of symptomatic cactus observed at Bandy Canyon survey area.



Photograph 8. Cactus Nursery Out-planting population at Woodridge Preserve survey area.



Photograph 9. Representative photo of symptomatic cactus observed at Woodridge Preserve survey area.



Photograph 10. Cactus Nursery Out-planting population at Whelan Ranch Preserve survey area.



Photograph 11. Representative photo of symptomatic cactus observed at Whelan Ranch Preserve survey area.



Photograph 12. Representative landscape level photo of healthy Safari Park Biodiversity Preserve population.



Photograph 13. Representative photo of healthy but drought-stressed Nursery Out-planting population at Ysabel Creek Road survey area.



Photograph 14. Representative photo of symptomatic cactus showing advanced decay at Ysabel Creek Road survey area.



Photograph 15. Representative landscape level photo at San Pasqual Battlefield State Historical Park.



Photograph 16. Representative photo of symptomatic cactus at San Pasqual Battlefield State Historical Park.



Photograph 17. Symptomatic Individual showing discoloration and rust-colored spots observed at Lusardi Creek County Preserve.



Photograph 18. Representative photo of symptomatic cactus observed at Lusardi Creek County Preserve survey area.



Photograph 19. Symptomatic and discolored cactus patch at Torrey Pines State Natural Reserve survey area.



Photograph 20. Representative photo of symptomatic cactus observed at Torrey Pines State Natural Reserve survey area.

Appendix C

Plant Disease Forms

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
Assistant Project Scientist
University of California
Email: jdelcastillo@ucdavis.edu
Lab Phone: 530-752-3831

Sample # DM20220601-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered June 1, 2022

Grower/ Farm/ PCA name City of San Diego Cactus Nursery

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety _____ Date planted N/A

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other:

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: April 2021 **Number of years at present site:** N/A

% Affected: 2% **Acreage:** _____

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: N/A

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
Assistant Project Scientist
University of California
Email: jdelcastillo@ucdavis.edu
Lab Phone: 530-752-3831

Sample # DM20220601-002
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered June 1, 2022

Grower/ Farm/ PCA name City of San Diego Cactus Nursery

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety _____ Date planted N/A

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other:

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: April 2021 **Number of years at present site:** N/A

% Affected: 2% **Acreage:** _____

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: N/A

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
Assistant Project Scientist
University of California
Email: jdelcastillo@ucdavis.edu
Lab Phone: 530-752-3831

Sample # DM20220607-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/08/2022

Grower/ Farm/ PCA name Lake Hodges South - Glider Hill North

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 10/31/2016

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Nursery Outplanting

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/07/2022 **Number of years at present site:** 5.5 years

% Affected: _____ **Acreage:** _____

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
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Lab Phone: 530-752-3831

Sample # DM20220607-002
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/08/2022

Grower/ Farm/ PCA name Lake Hodges South - Glider Hill West

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 02/01/2017

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Nursery Outplanting

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/07/2022 **Number of years at present site:** 5.5 years

% Affected: _____ **Acreage:** _____

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220613-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/13/2022

Grower/ Farm/ PCA name Bandy Canyon

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 2016

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Nursery Outplanting

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/13/2022 **Number of years at present site:** 6 years

% Affected: 1 **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/13/2022

Grower/ Farm/ PCA name Bandy Canyon

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 2016

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Nursery Outplanting

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/13/2022 **Number of years at present site:** 6 years

% Affected: 1 **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220615-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/15/2022

Grower/ Farm/ PCA name Woodridge - Center for Natural Lands Management

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 11/27/2012

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Nursery Outplanting

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/15/2022 **Number of years at present site:** 10 years

% Affected: <1 **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220620-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 06/20/2022

Grower/ Farm/ PCA name Whelan Ranch - Center for Natural Lands Management

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 06/20/2022 **Number of years at present site:** Native Population

% Affected: <1 **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
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Lab Phone: 530-752-3831

Sample # DM20220705-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/05/2022

Grower/ Farm/ PCA name Bernardo Mountain - Lake Hodges

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted N/A

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/05/2022 **Number of years at present site:** N/A

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
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Sample # DM20220706-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/06/2022

Grower/ Farm/ PCA name Ysabel Creek Rd Staging area - San Diegito River Park

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 2019

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Outplanting Site,
Source Unknown

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/06/2022 **Number of years at present site:** 3 years

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
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Sample # DM20220706-002
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1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/06/2022

Grower/ Farm/ PCA name Ysabel Creek Rd Staging area - San Diegito River Park

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 2019

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Outplanting Site, Source Unknown

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/06/2022 **Number of years at present site:** 3 years

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220706-003
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1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/06/2022

Grower/ Farm/ PCA name Ysabel Creek Rd Staging area - San Diegito River Park

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/06/2022 **Number of years at present site:** unknown

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
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Email: jdelcastillo@ucdavis.edu
Lab Phone: 530-752-3831

Sample # DM20220706-004
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/06/2022

Grower/ Farm/ PCA name Ysabel Creek Rd Staging area - San Diegito River Park

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted 2019

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Outplanting Site,
Source Unknown

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/06/2022 **Number of years at present site:** 3 years

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
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Sample # DM20220708-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/11/2022

Grower/ Farm/ PCA name San Pasquale Battlefield State Park - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/08/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220715-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/18/2022

Grower/ Farm/ PCA name Lusardi Creek County Preserve

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/15/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
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Lab Phone: 530-752-3831

Sample # DM20220715-002
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 07/18/2022

Grower/ Farm/ PCA name Lusardi Creek County Preserve

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 07/15/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
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Sample # DM20220810-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 08/10/2022

Grower/ Farm/ PCA name Torrey Pines State Natural Reserve - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 08/10/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
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Email: jdelcastillo@ucdavis.edu
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Sample # DM20220810-002
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 08/10/2022

Grower/ Farm/ PCA name Torrey Pines State Natural Reserve - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 08/10/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220810-003
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 08/10/2022

Grower/ Farm/ PCA name Torrey Pines State Natural Reserve - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 08/10/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

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Sample # DM20220810-004
Send to:
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Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 08/10/2022

Grower/ Farm/ PCA name Torrey Pines State Natural Reserve - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

Sample came from: Field/Farm Orchard
 Nursery Greenhouse Vegetable garden
 Christmas tree farm Other: Native Population

Soil characteristics: sandy clay loam
 organic hard pan soilless media
 other:

Symptoms: Root: Rot Lesions
Crown/stem/canopy: Rot Lesions Die back Wilt
 Vascular discoloration Canopy bleaching
Leaves: Speckled/ spots Marginal necrosis Mottle
 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 08/10/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: _____

Advisor's Tentative diagnosis _____

Comments

PLANT DISEASE FORM
GREENHOUSE AND NURSERY PATHOLOGY
UNIVERSITY OF CALIFORNIA, DAVIS

Johanna Del Castillo
Assistant Project Scientist
University of California
Email: jdelcastillo@ucdavis.edu
Lab Phone: 530-752-3831

Sample # DM20220812-001
Send to:
Dept. of Plant Pathology, Rm. 210
1 Shields Ave. UC Davis
Davis, CA, 95616

County of sample origin San Diego County Date mailed/delivered 08/15/2022

Grower/ Farm/ PCA name Torrey Pines State Natural Reserve - California State Parks

Submitted by (Farm Advisor) AECOM

If this is your first time: Phone (804) 840-3031 Email derrick.mathews@aecom.com

Sample information

Plant Opuntia littoralis Variety N/A Date planted Native Population

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 Chlorosis Deformed Mildew
Flowers: Rot Lesions Color break Deformed
Other symptoms _____

Exposure: full sun partial shade shade
 full shade windy protected

Irrigation type and frequency: None

Chemicals applied: None

Date damage first noticed: 08/12/2022 **Number of years at present site:** Native Population

% Affected: <1% **Acreage:** N/A

Number of plants affected (for potted plants) _____

Distribution of affected plants: single plant grouped scattered edge of field

Previous crops: N/A

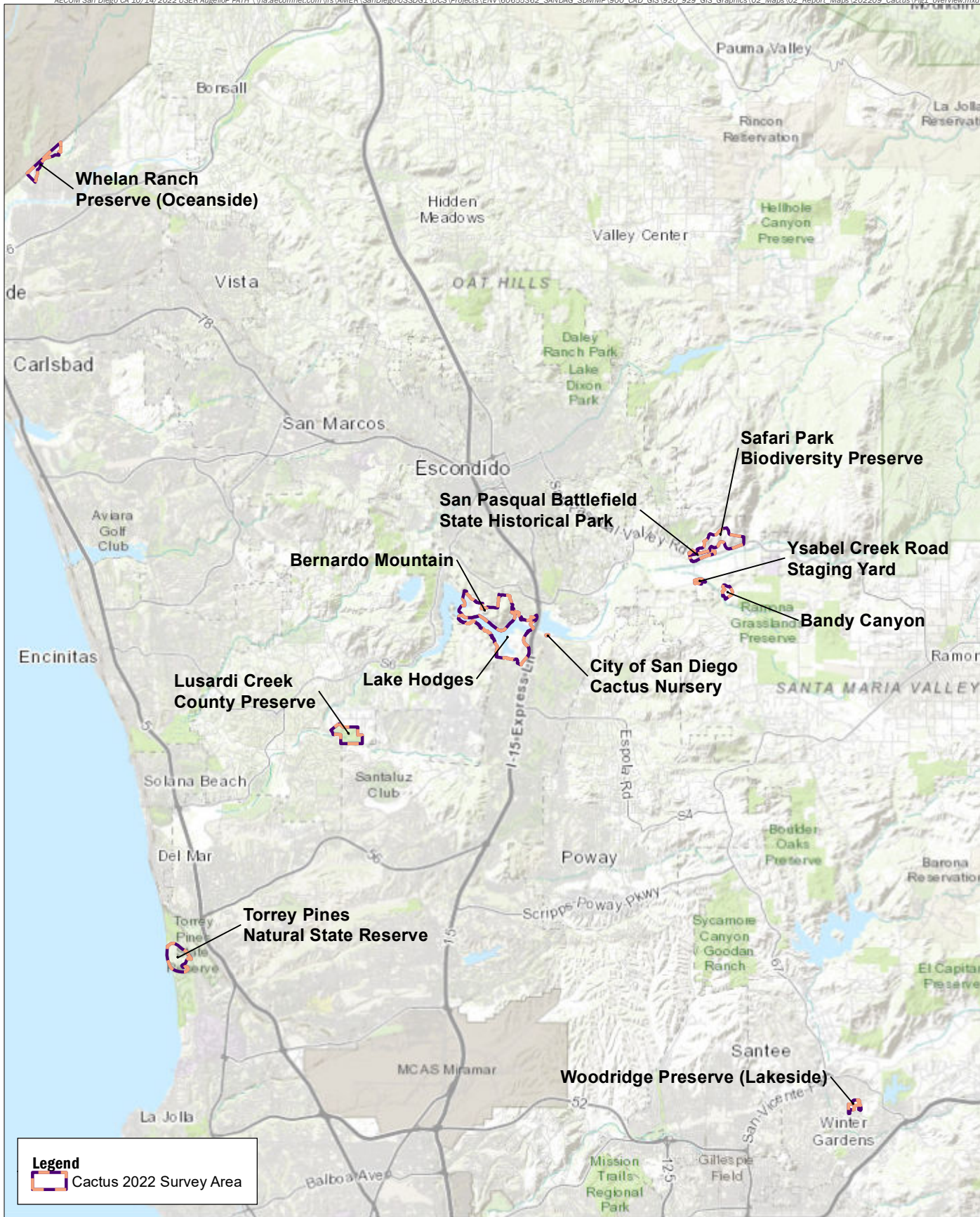
Advisor's Tentative diagnosis _____

Comments

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Appendix D

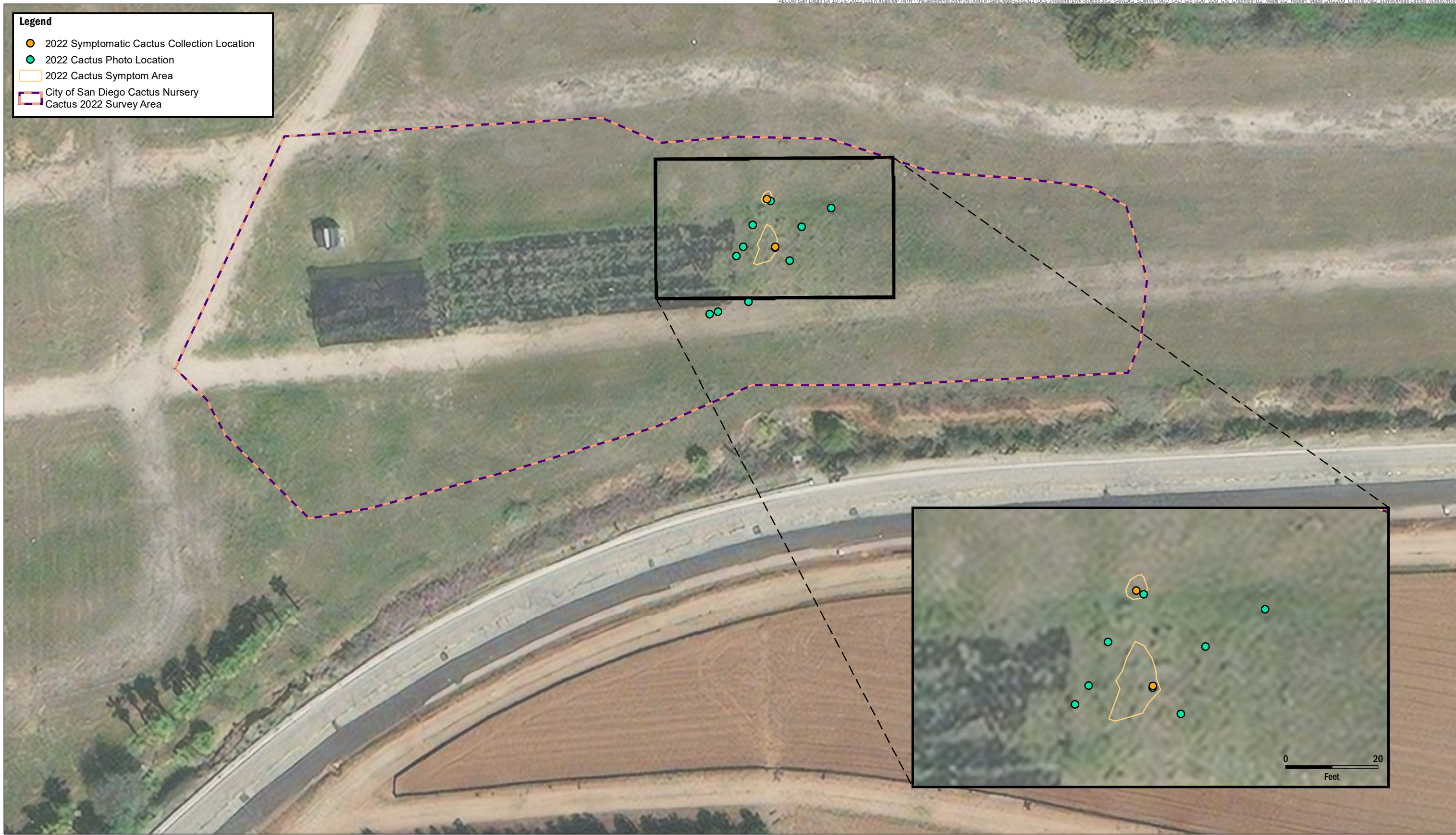
Survey Area Maps

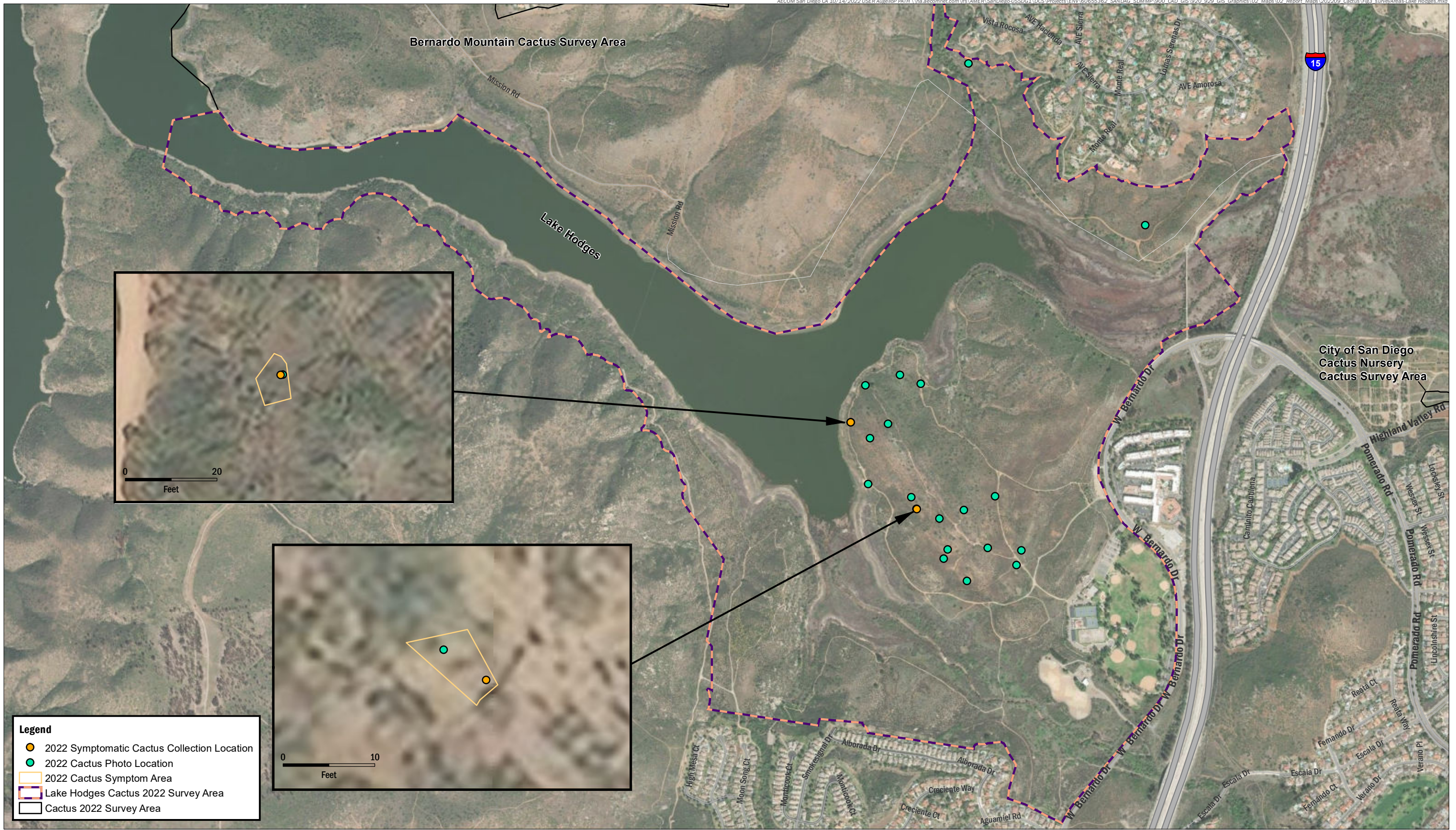


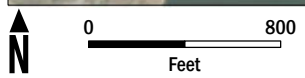
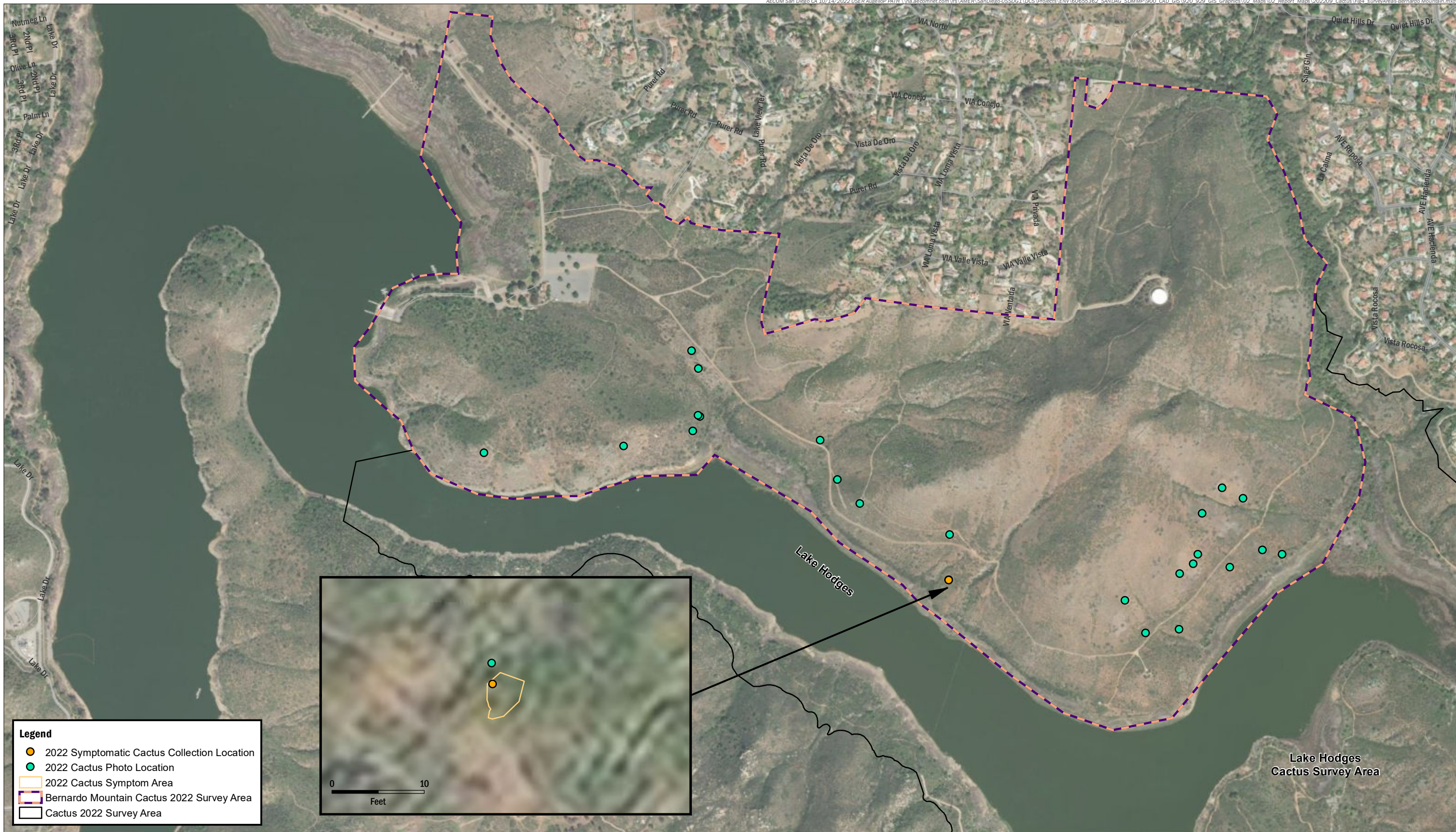
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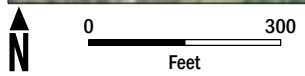
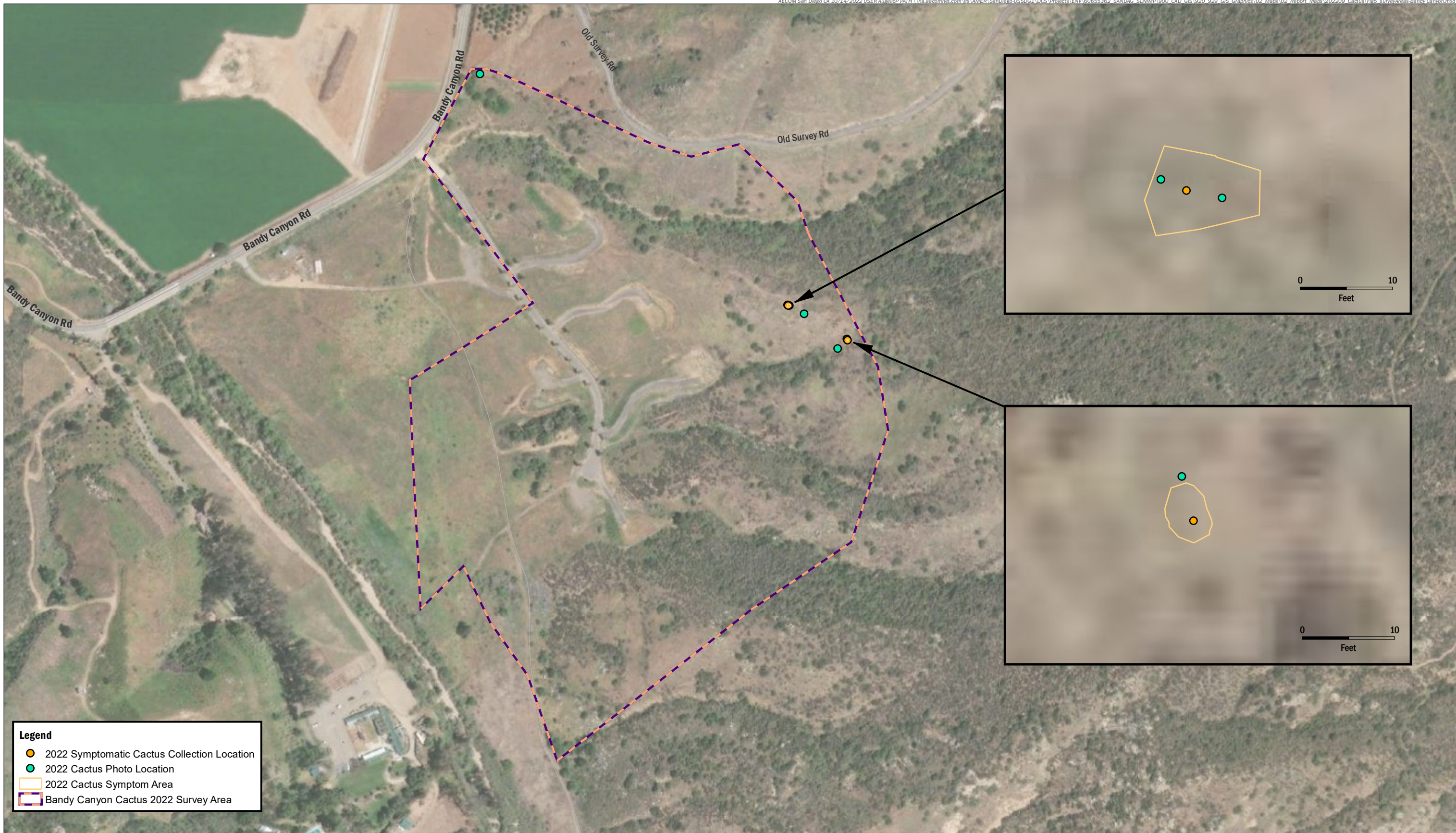
Legend

- 2022 Symptomatic Cactus Collection Location
- 2022 Cactus Photo Location
- 2022 Cactus Symptom Area
- ▭ City of San Diego Cactus Nursery
- ▭ Cactus 2022 Survey Area











Legend

- 2022 Symptomatic Cactus Collection Location
- 2022 Cactus Photo Location
- 2022 Cactus Symptom Area
- Whelan Ranch Preserve (Oceanside)
- Cactus 2022 Survey Area



APPENDIX D: FIGURE 7 WHELAN RANCH PRESERVE (OCEANSIDE)

Legend

- 2022 Cactus Photo Location
- ▭ Safari Park Biodiversity Preserve
- ▭ Cactus 2022 Survey Area
- ▭ Cactus 2022 Survey Area



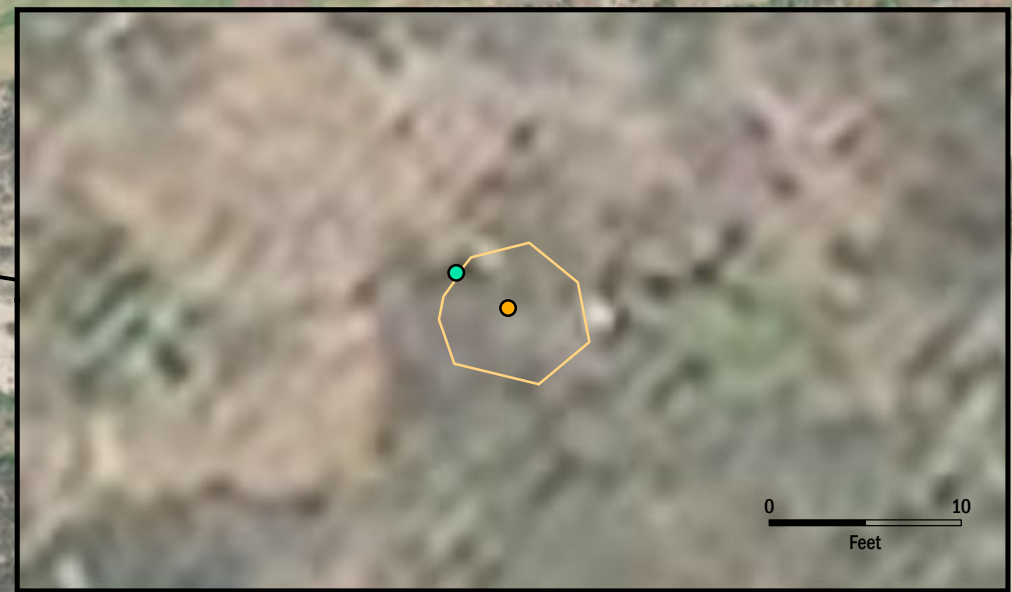




- Legend**
- 2022 Symptomatic Cactus Collection Location
 - 2022 Cactus Photo Location
 - ▭ 2022 Cactus Symptom Area
 - ▭ San Pasqual Battlefield State Historical Park Cactus 2022 Survey Area
 - ▭ Cactus 2022 Survey Area

Safari Park Biodiversity Preserve
Cactus Survey Area

Old Milky Way







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