
MANAGEMENT VISION FOR ELEPHANT HILL

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CONTENTS

1. Background	4
2. Methodology	8
2.1 Review Existing Info.....	8
2.2 Draft Products.....	9
2.3 Client Feedback and Product Refinement.....	10
2.4 Synthesize Material	11
3. Categories	12
3.1 Accessibility.....	14
Subcategories	14
3.2. Recreation Potential.....	23
Subcategories	23
3.3 Vegetation.....	29
Subcategories	29
3.4 Fuel Management Cost.....	32
4. Value Matrix.....	33
4.1 Accessibility.....	33
4.2 Recreation Potential	34
4.3 Vegetation.....	35
4.4 Fuel Management Cost.....	35
5. Results	37
5.1 Accessibility.....	37
5.2 Recreation Potential.....	37
5.3 Vegetation.....	37
5.4 Fuel Management.....	37
5.5 Sum Weighted Value	38
6. Discussion	44
6.1 Accessibility.....	48
6.2 Public Recreation	53
6.3 Vegetation Restoration Potential.....	57
7. Land Management Recommendations.....	62
7.1 LA County Fuel Modification Guidelines	64
7.2 Discing Alternatives	67

7.3 Community Restoration Opportunities..... 70

Works Cited..... 73

Appendix 1 77

Appendix 2 77

1. BACKGROUND

Elephant Hill is a 110-acre heavily disturbed and undeveloped pocket of land located in the east Los Angeles neighborhood of El Sereno, just 7 miles from downtown Los Angeles (Figure 1). Its rolling hills are covered in non-native annual grasses and other exotics, with a smattering of remnant native vegetation and hiking trails leading to native oak-walnut woodlands in patches throughout the site (Cooper 2008). It has been sited for the construction of condominiums several times over the past decade and the nearby El Sereno residents protested each proposal, defending Elephant Hill is one of the few natural retreats in the middle of the busy industrial city. On November 21, 2012, the Los Angeles City Council voted to preserve 19 of the 110 acres of Elephant Hill as an open space, and, in June 2013, sold five of these acres to the Mountain Restoration and Conservation Authority (MRCA). The MRCA aspires to transform these five acres of open space into a public park with restored native vegetation, developed trails, and new park infrastructure for public recreation. However, five acres of land does not serve as a substantial natural space, and more land acquired from Elephant Hill would help create a better park. One of the main focuses of this project is in the strategic acquisition of this additional land.

Outside of the 19 acres reserved for open space, the remaining 91 acres on Elephant Hill is divided into many privately owned parcels. There are hundreds of landowners in possession of the over 400 parcels present on Elephant Hill, and each parcel is unique in its contents. The high number of parcels with their varied characteristics necessitates a thorough assessment of each parcel regarding its vegetation type, topography, location, and recreational features in order for the MRCA to identify which parcels are the most valuable for the creation of the park, and which therefore should be the first to be targeted for acquisition. Parcels in strategic locations with favorable restoration potential and recreational features should be acquired to ensure that native vegetation is protected and given a chance to expand, important recreational features are reserved for use in the public park, and Elephant Hill is unattractive to developers.

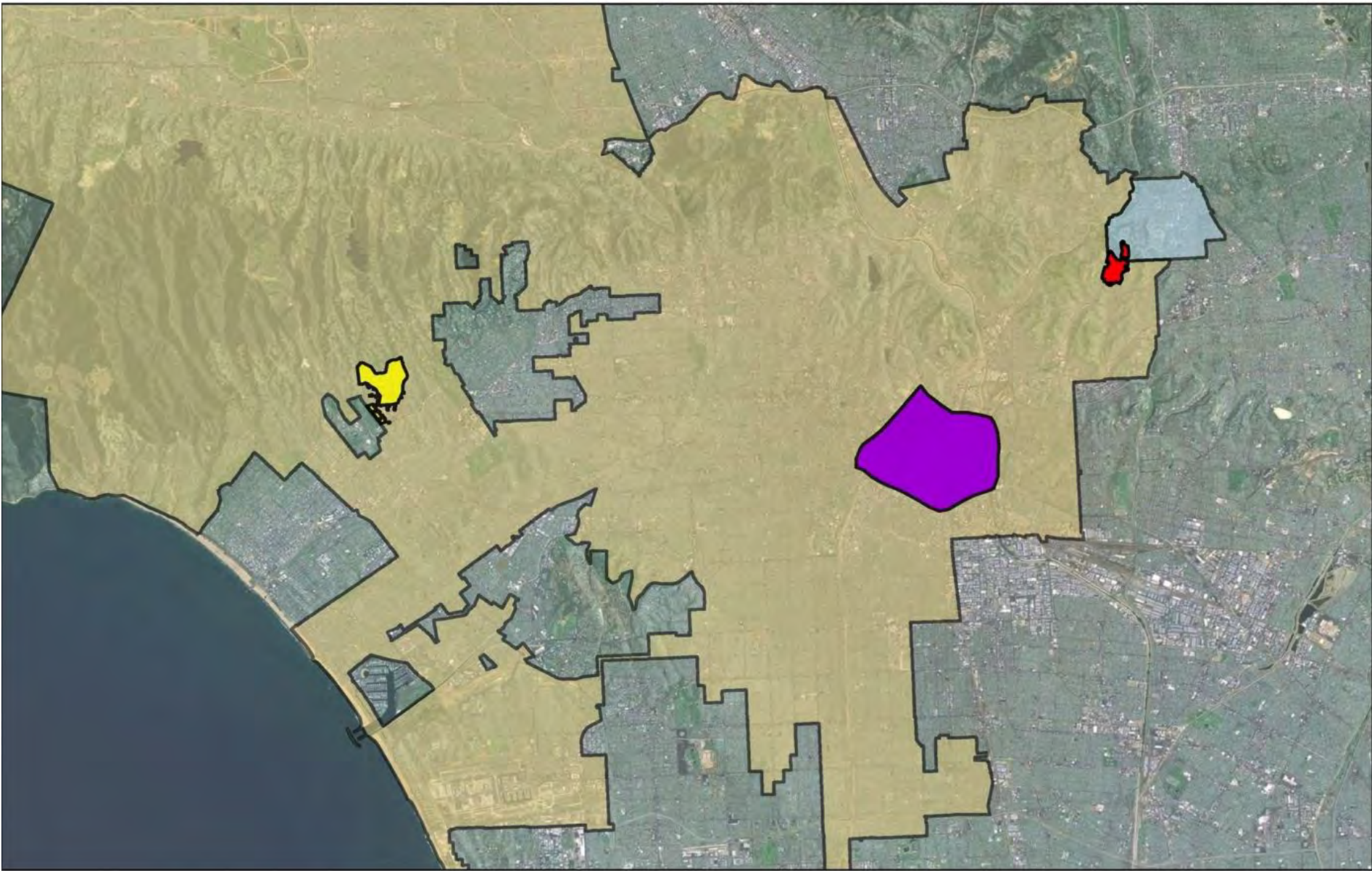
When the MRCA acquires land on Elephant Hill, the responsibility of fuel management comes with every parcel. The existing non-native vegetation must be managed due to the high fire risk it poses to the surrounding communities. The current land management practice used by the City of Los Angeles on Elephant Hill is discing, which uses a tractor and plow to churn up the soil and keep plants from taking root. This technique is cheap and effective for quelling fires, but leads to a host of other problems. The constant disturbance of the soil prevents native vegetation from establishing, resulting in only quick-growing invasive grasses surviving on the landscape. These grasses are highly flammable, drying up annually in the summer and requiring further discing. This creates a vicious cycle of the dominant fire-prone vegetation being treated with discing, which only sustains the dominance of the same vegetation. The grasses also have shallow roots that do not stabilize hillsides. Combined with the regular mechanical disturbance from discing, the soil has poor stability and serious erosion issues, clogging the sewers during rainy seasons. While discing is a reliable strategy in preventing fires, an alternative fuel management technique is needed in order to reduce the cover of the invasive grasses, increase the cover of the more fire-resistant native vegetation, and stabilize the soil.

Our project focuses on two issues: the strategic acquisition of parcels and alternative fuel management practices. In order to achieve this, our goals were the following:

- Assess the present resources at Elephant Hill, including vegetation, trails, points of public access, and destination points.
- Rank each parcel on Elephant Hill for future acquisition based on the resources it currently possesses.
- Make recommendations for park and land management. These include: ultimately replacing discing with another less ecologically harmful method of fuel management; restoring native vegetation, which is less likely to burn; developing the existing trail system; and installing park infrastructure.

This project aims to assist the MRCA in the acquisition, restoration, and management of Elephant Hill to facilitate the establishment of a public park for the residents of El Sereno. In order to make the most useful recommendation for which parcels are the best for acquisition, we analyzed the current characteristics of each parcel on Elephant Hill and ranked them based on their recreational use, accessibility to the public, and need for the protection of native vegetation. The top parcels were then identified (with some tweaking for logical planning) for the most

immediate acquisition. We have also produced fuel management and restoration suggestions using knowledge acquired through literature and site visits to Elephant Hill and other nearby parks to aid the MRCA in maximizing the safety and recreational benefit for future visitors.



Location of Elephant Hill

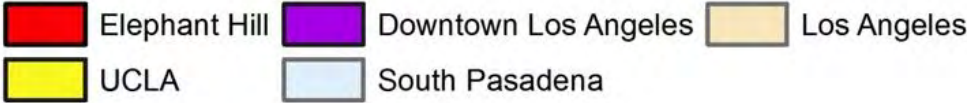
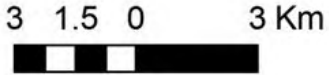


FIGURE 1: THE LOCATION OF ELEPHANT HILL WITH RELATION TO UCLA, DOWNTOWN LOS ANGELES, AND SOUTH PASADENA.

2. METHODOLOGY

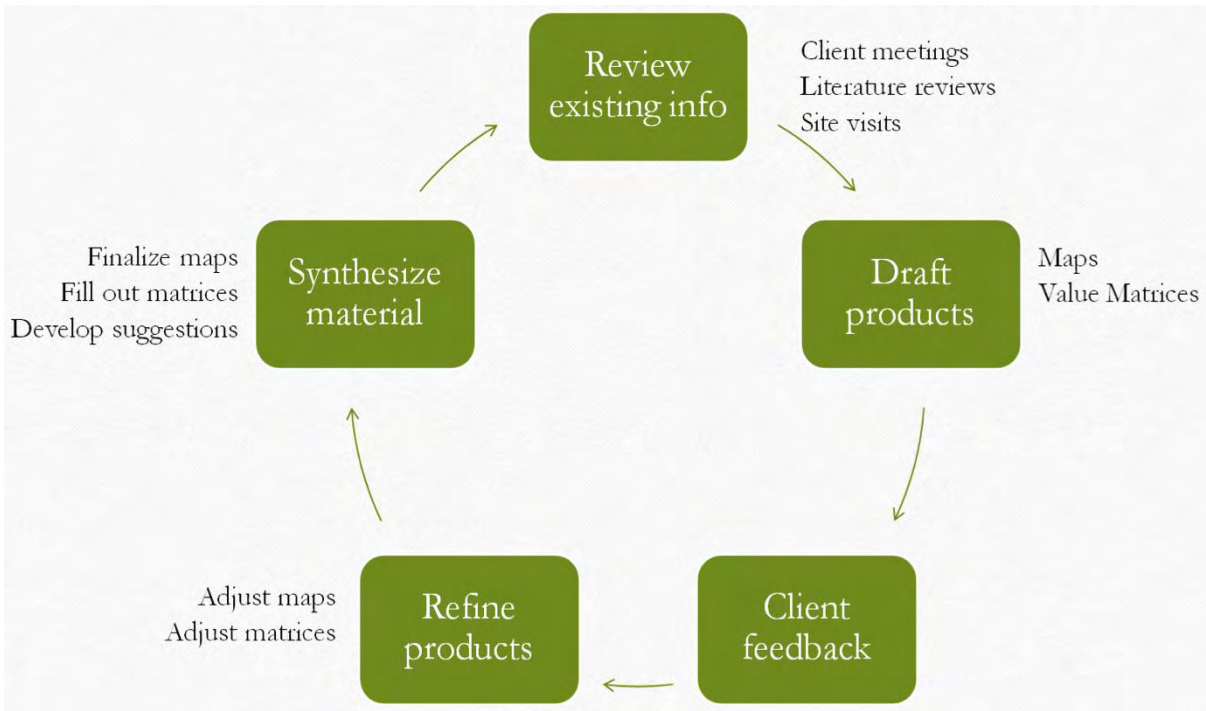


FIGURE 2: DEPICTION OF METHOD USED TO CONTINUALLY RECEIVE FEEDBACK AND ADJUST PRODUCTS ACCORDINGLY.

2.1 REVIEW EXISTING INFO

Our method can be broken down into the five areas shown in Figure 2. Our method relied on the basic scientific method of observation (site visits, reviewing literature), investigation (maps, client feedback), and refining of our initial questions and products. Before visiting Elephant Hill, we reviewed literature on a variety of related topics, including fire management methods, trail design, recreation, park infrastructure, and land restoration techniques to re-establish the coastal sage scrub (CSS) and walnut woodland found on site. Our first site visit to Elephant Hill was with the MRCA on January 18, 2013. On this trip, we walked some of the trails and familiarized ourselves with the layout of the vegetation and hillsides. We also discussed the MRCA's vision of Elephant Hill as an open space park and what they wanted from our research. Our second meeting on January 25 was with a resident of the area and the MRCA. We learned about the history of Elephant Hill and the community's involvement and

interest in its preservation as an open space. Using what we understood of the needs of the MRCA and the community, and considering what was present on Elephant Hill, we chose to focus on four particular categories of features: accessibility, recreation potential, vegetation, and fuel management need.

2.2 DRAFT PRODUCTS

After our second visit, we began the mapping process and data collection. We received an ownership map, a public map, a historic aerial map, and a rough strategic plan for Elephant Hill from the MRCA. Using these, we produced maps of the existing vegetation, access points, and trails. We conducted two more site visits February 22 and March 1 during which we confirmed our mapping of the current vegetation, all access points into the park, and any nearby community centers. We used a Garmin eTrex GPS to record specific locations. The new GIS layers that we created can be viewed in Table 1.

Table 1. GIS layers that we created:

I. Custom Shapefiles		
A. Accessibility	1. Access Points	a. Major Access Points b. Minor Access Points
	2. Outline of El Sereno Elementary School	
	3. Local Roads and Connections	a. Paper Trails within Elephant Hill b. Minor Roads c. Major Roads d. Local Connections
	4. Parks and Open Spaces	a. Via Marisol b. Guardia Park c. FlatTop Park and Other d. Debs Park e. Ascot Park f. Arroyo Park
	5. Surrounding Neighborhood	a. West Neighborhood b. South Neighborhood c. East Neighborhood d. Other Urban Areas
B. General	1. Outline of Downtown Los Angeles	
	2. Outline of Elephant Hill	

	3. Outline of UCLA	
C. Recreation	1. Destination Points	a. Public Vistas b. Ridges
	2. Importance of Trail	a. Major Trail b. Minor Trail
	3. Quality of Trail	a. Path of Desire b. Poorly Defined Trails c. Well Defined Trails d. Suggested Trail
D. Vegetation	1. Vegetation Type	a. Grassland/Non-Native b. Other Trees c. Walnut Woodland d. CSS/Non-Natives e. Walnut Trees w/ Other Non-Natives

After creating maps of the existing resources on the land, we produced a value matrix that we used to rank each land parcel for acquisition by the MRCA. The value matrix is organized into four different categories:

- Accessibility
- Recreation Potential
- Vegetation Preservation
- Fuel Management Cost

Under each category are subcategories describing a particular kind of resource we examined. Within the subcategories, there are sets of parameters used to assign points to the parcel using mutually exclusive clauses applied to each parcel. Within our group, one or two people chose to specialize in one of the categories and evaluate each parcel based on the parameters within their category. Each completed category was then normalized to a value between 0 and 1. We mapped the ranking results of each category using ArcGIS.

2.3 CLIENT FEEDBACK AND PRODUCT REFINEMENT

After ranking each parcel in each of the four categories, we met again with the MRCA and our community contact on April 12. We presented our client with our draft value matrix and discussed each category and subsequent parameter. Both the MRCA and our community contact expressed a strong interest in public access and recreation potential. Based on their interest, we chose to put a stronger emphasis on specific categories in the value matrix that aligned with their

input. We chose to weight each category different, assigning 0.4 for accessibility and 0.3 for recreation potential since the MRCA was more interested in those categories, while vegetation received a 0.2 and fuel management received a 0.1, due to the special status of the native vegetation. We adjusted the matrix result maps to the new weighted values. We also changed our public access map to focus on only one entrance for each side of Elephant Hill, based on the MRCA's requests. We brainstormed potential recreational uses and design plans that would envelop the MRCA's design plan and our own research.

2.4 SYNTHESIZE MATERIAL

With the final weightings and finalized individual category rankings in place, we determined our weighted summed values for each parcel in Elephant Hill, which were later used to create parcel rankings for acquisition. These raw results were mapped and colored in groups with similar values. We strategically selected 40 parcels that, if acquired, would help the MRCA make Elephant Hill a functional open space park to be enjoyed by the community. The parcels were selected based mostly on the weighted values, but in order to have the fully functioning park (access points, major trails, vistas), we chose some parcels with lower scores. We also used this map and a site visit to Debs Park on April 19 to compile restoration and fuel management recommendations that can be used on Elephant Hill. These recommendations will help in improving the degraded state of Elephant Hill and maximize the quality of the visitor experience. With restoration, we focused on how to establish walnut woodland and CSS by engaging the community. Debs Park was used as a case study to see how woodlands and scrub recruited and where they would be most successful. With fuel management recommendations, we reviewed literature focusing on alternative methods to discing and researched different management strategies to be employed by landowners and the MRCA.

3. CATEGORIES

There are many different kinds of resources that can be evaluated for use in the creation of a public park, such as strength of foot traffic, water, wildlife, and slope. For the purpose of this project, the following categories were selected following a review of existing literature, site visits, and a consultation with the MRCA:

- Accessibility
- Recreation Potential
- Vegetation
- Fuel Management

While the value of some of these characteristics can be directly estimated by observation, others cannot, which is why we developed the value matrix. The purpose of the value matrix is to assign an objective and quantifiable score for each land parcel representing its priority for acquisition or attention by the MRCA. The value matrix categories describe different important aspects of Elephant Hill, their subcategories examine different facets of each category, and each subcategory contains specific parameters supported by the literature under which parcels will earn points. If a land parcel positively has the characteristics described in a clause within a parameter, it will receive the designated amount of points for that parameter.

After assigning each parcel points based on the clauses in each parameter, we normalized the parameter points within each category so that the sum of each parameter within a category fell between 0.0 and 1.0, minimizing bias by putting each category on the same footing. However, from meeting with our client and making personal observations, we determined that some categories were more important than others and we needed to weigh them according to importance. Our client stated that Accessibility was the most important consideration because their overall vision is for the community to use and enjoy Elephant Hill, and they will do so if they have easy access. We therefore awarded Accessibility a 0.4 weighting factor, or 40%. For the same reason, Recreation is the next most important category, and it received a 30% weighting factor. Vegetation and Fuel Management are not as heavily weighted in whether our client will acquire land, because they can develop restoration and fire management strategies in response to the requirement of the specific parcels they choose to purchase. Vegetation (20%) is weighted slightly higher than the Fuel Management category (10%) because of the special status

of walnut woodland, a native and increasingly threatened vegetation community in southern California. The value of the weighting factors for each category can easily be changed if the planning process or priorities of the MRCA changes.

We then added the weighted value of each parcel in each category to find its sum weighted value - a number between 0.0 and 1.0 - and identified those above a certain threshold value as the most valuable parcels. Additionally, we have provided two value matrices based on current and future conditions. Scores for future conditions represent the value the land parcel would have if it were to be improved using the management suggestions provided in the report.

3.1 ACCESSIBILITY

The Accessibility category covers parameters signifying Elephant Hill’s relationship to the local community. Accessibility focuses on parcels along the perimeter of Elephant Hill, with a predominant focus on land parcels surrounding access points, as shown in Figure 3. Interior parcels that lie within one “Parcel Length” of access points will also be ranked. A “Parcel Length” is defined as the length of the average parcel, or the width of 3 parcels. All other parcels that are not on or adjacent to major roads, minor roads, open paths, or access points will receive an automatic zero. This does not include interior paths.

SUBCATEGORIES

I. CURRENT TRAIL ACCESS

The sub-category Current Trail Access refers to the connection of perimeter parcels to local roads and paths, as well as the usability of perimeter parcels as determined by slope. Large streets may attract a larger number of pedestrians, as it provides more visible and easy access. Parcels that lie on top of or are adjacent to large streets therefore received more points than parcels that lie on top of or adjacent to minor streets and open paths. Figure 4 displays the distribution of major and minor roads surrounding Elephant Hill.

The running grade of an entry point is the vertical distance traveled over the horizontal distance traveled. For a trail to be accessible in conjunction with the Americans with Disabilities Act (ADA), the running grade should be no higher than 5% (Tennessee 2007). While Elephant Hill is not required to abide by ADA’s outdoor trail requirements, acquiring entry points that have a 0-8% grade will increase access for those with disabilities. The 0-8% interval was selected in consultation with MRCA based on their experience with urban parks. When analyzing trail effectiveness the team will use the 10% rule. In this scenario the uphill and downhill portion of the trail should have a maximum running grade close to 10% (Tennessee 2007). Grades much higher than 10% have much higher levels of erosion and they should not be used for long distances (Tennessee 2007). Entry points that have a deep soil layer can create switchbacks, at which point a 20% grade can be supported (Tennessee 2007). A large portion of Elephant Hill has a grade greater than 12%. Considering this, in addition to client feedback, the *Entry Point Grade* parameter was given fewer points than other parameters. Parcels that have a

lower grade will be given higher points, due to greater ease of use in addition to less restoration work. Entry points with a maximum grade of 8% will receive substantially higher points as it allows individuals with disabilities to access the site. If a parcel contains several slope values, points will be awarded based off of the slope that covers a majority of the parcel. Figure 5 displays the slope distribution within Elephant Hill.

II. ACCESSIBILITY TO PERIMETER TRAILS

This subcategory analyzes the connection between entrances of interior trails and our access points (e.g. Figure 6). It is important to look at this connection because many of our access points do not connect to interior trails. If our client were to acquire an access point that contains an entrance to an interior trail, they would be able to increase access with less economic costs. Ranking of these connections under the *Trail Connection* parameter was done in a similar way to the *Neighborhood Connection* parameter. Parcels that are on top of these connections would receive more points than parcels that are only adjacent to the connections. Nodes of connection were also considered in this subcategory. Parcels that contain a node were given a point.

III. CONNECTIVITY TO LOCAL PARKS, OPEN SPACES, AND SCHOOLS

Another subcategory revolves around a parcel's potential connectivity to open spaces, parks, and schools located outside of Elephant Hill's border. In the area surrounding Elephant Hill there are two viable open spaces: Guardia Park and Via Marisol. For these parameters, points were allocated based off of an individual parcel's distance to these open spaces. These parameters are meant to reflect pedestrian walking distances from Elephant Hill to these open spaces, so distances were calculated using street paths. GIS mapping and online mapping tools were used to verify the distance between parcels and the open space destinations. Research shows that if an individual is located more than 1 km from a greenspace, use of the greenspace drops to between 2.8 and 8.5% (Schipperijn *et al.* 2010). This is worsened as a majority of greenspace users want to come by foot and will only do so on a regular basis if the park is within 3–5 minutes walk of their home or workplace (Thompson 2002). We considered this research when allocating points within this parameter, giving parcels more points if they are within 1 km of other parks and open spaces. The highest points were given to distances between 0 - 0.5 km,

as the shorter traveling distance will likely increase use. Fewer points were given to individual parcels that were 0.5 - 1 km away, and zero points were given if the individual parcel was farther than 1 km from the open space. Figure 7 displays the location of open spaces, Via Marisol and Guardia Park, in relation to Elephant Hill.

Connections to local schools are vital for both the promotion of local open space and in providing educational opportunities for the students. This parameter was given the most points within the subcategory because of client feedback. The main focus of this parameter is distance to El Sereno Elementary School, as it is the only school within feasible walking distance to Elephant Hill. Similar to the *Connectivity to Open Space* parameter, a 0 - 0.5 km distance from an individual parcel to the school was allocated the most points. Distances were calculated using major and minor roads, as this parameter is focused on pedestrian accessibility. GIS mapping and online mapping tools were used to verify the distance between parcels and the El Sereno destinations. Figure 8 shows the location of El Sereno Elementary School in relation to Elephant Hill.



Elephant Hill Access Points

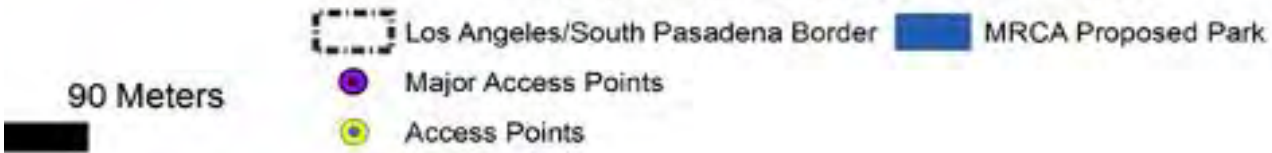








FIGURE 3: MAJOR AND MINOR ACCESS POINTS WITHIN ELEPHANT HILL. THESE WERE LOCATED THROUGH MULTIPLE SITE VISITS AND RECORDED USING GPS DEVICES. MAJOR ACCESS POINTS WERE ASSOCIATED WITH MAJOR ROADS OR TRAILS.



Major and Minor Roads surrounding Elephant Hill

-  Los Angeles/South Pasadena Border
-  Major Access Points
-  Access Points
-  MRCA Proposed Park
-  Minor Roads
-  Major Roads

140 Meters



FIGURE 4: THE DISTRIBUTION OF MAJOR AND MINOR ROADS SURROUNDING ELEPHANT HILL. THESE WERE DETERMINED THROUGH GIS AND ONLINE MAPPING TOOLS.



Slope Designated for Access

- 0-8%
- 9-11%
- 12-20%
- 20-90%

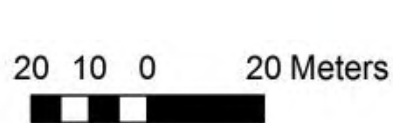


0.1 0.05 0 0.1 Km

FIGURE 5: THE SLOPE (GRADE) OF ELEPHANT HILL. THESE INTERVALS WERE DESIGNED SPECIFICALLY FOR RANKING ACCESS POINTS. THE INTERVALS ARE BASED OFF OF CLIENT RECOMMENDATIONS AND PREVIOUS LITERATURE.



Entrance to Trails







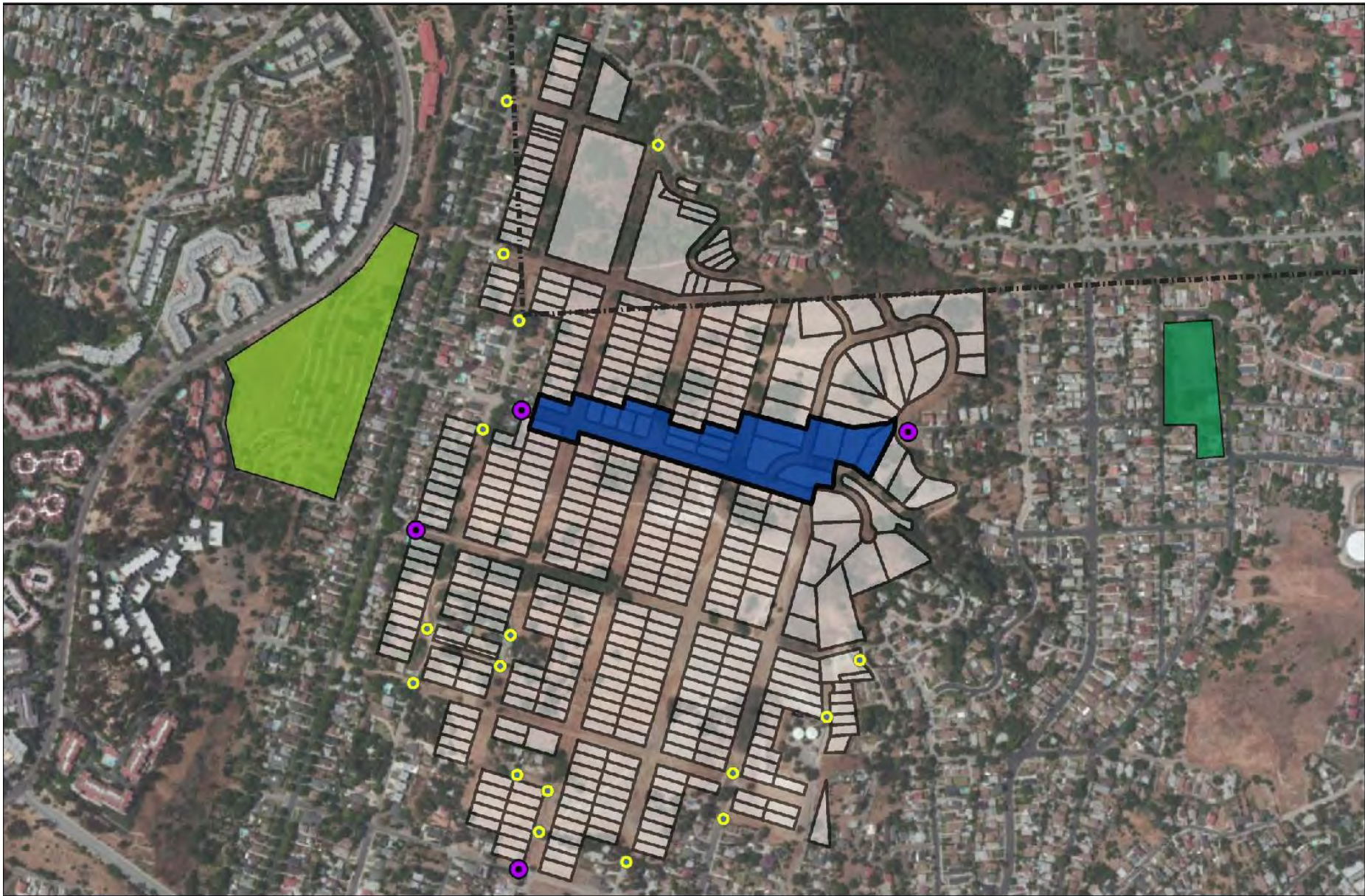
-  Los Angeles/South Pasadena Border
-  MRCA Proposed Park
-  Important Trails
-  Trails and Paths



FIGURE 6: AN EXAMPLE OF THE CONNECTION BETWEEN ACCESS POINT PARCELS AND THE ENTRANCE TO INTERIOR TRAILS



Open Space and Park Connections

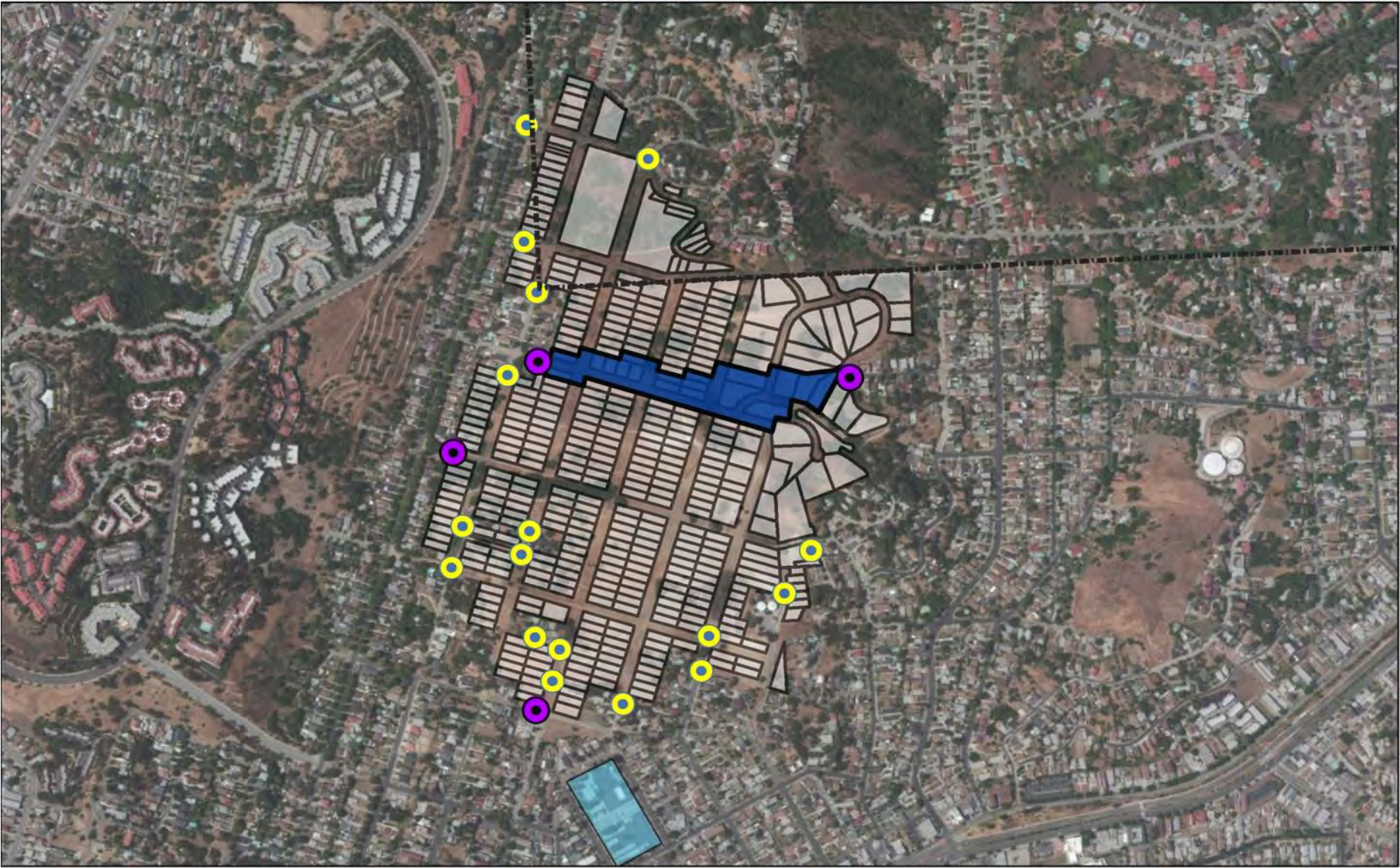
110 55 0 110 Meters

Los Angeles/South Pasadena Border
 Major Access Points

Access Points
 Via Marisol
 Guardia Park
 MRCA Proposed Park



FIGURE 7: THE LOCATION OF PARKS AND OTHER OPEN SPACES IN RELATION TO ELEPHANT HILL. GUARDIA PARK AND VIA MARISOL WERE THE ONLY VIABLE OPTIONS



El Sereno Elementary School Connection



- Los Angeles/South Pasadena Border
- Access Points
- Major Access Points
- MRCA Proposed Park
- El Sereno Elementary



FIGURE 8: THE LOCATION OF EL SERENO ELEMENTARY SCHOOL IN RELATION TO ELEPHANT HILL.

3.2. RECREATION POTENTIAL

The landscape features that make Elephant Hill valuable for recreational use by the public are what determine a particular parcel's recreation potential. For Elephant Hill, recreational uses are confined to walking, hiking, and other non-motor vehicle use.

The Recreation Potential category assigns value to parcels based on their current features and potential improvements that will enhance public benefit and recreational use of Elephant Hill. The characteristics considered in this report are destination points and trail connectivity.

SUBCATEGORIES

I. DESTINATION POINTS

Destination points such as vistas and mesas are rated highly since they are likely to be common destinations. This has been confirmed by observations from site visits. The existence of trails within parcels is also rated highly as it offers safer means of travel for people from one section of Elephant Hill to another (Luymes and Tamminga 1995). The value of parcels is assigned by considering the length of trail existing within them, and well-defined trails are distinguished from traveled paths that are poorly defined. Points are also given for nodes of connection between trails. Parcels have been analyzed to determine potential locations for future trails based on path of desire, proximity to destination points, and the necessity of trails to connect existing features. This analysis will be discussed in this report but were not factored into the matrix in any quantitative way.

Destination points have been defined as ridges and vistas for their desirability of travel. Vistas were identified on Elephant Hill as being areas with elevation higher than 800 feet, which fell within the Los Angeles part of Elephant Hill. Such vistas provide a good view of the mountain range to the northeast and downtown Los Angeles to the southwest. Because of the good views from Elephant Hill, vistas above 800 feet are likely to be popular destination points for the public. Vistas that lie on existing trails were valued higher because they do not require the creation of a trail for the public to enjoy them. Parcels containing vistas on existing trails were given two points. Parcels containing vistas that do not lie on existing trails were given one point. Parcels that do not contain a vista get zero points for this parameter.

Parcels located on ridges are given higher point values since traveling on a ridge offers viewing opportunities that traveling in a valley does not, making ridges more desirable to hikers. Parcels containing ridges were awarded points in a similar manner. To receive points, a parcel must contain a ridge higher than 700 feet in elevation, a reasonable elevation from which significant views around Elephant Hill become available. Parcels containing a ridge on an existing trail receive two points while parcels with a ridge not on an existing trail receive one point. This point difference follows the same reasoning as vistas, namely that these features require a trail to be enjoyed by the public without risking damage to the ecosystem and as such, features that occur on preexisting trails are more valuable. Parcels that do not contain a ridge are given zero points for the parameter.

See Figure 9 for a map of ridges and vistas.

II. TRAILS/ROADS

The trail network existing on Elephant Hill is shown in Figure 10. This map was used in assigning values to parcels in the matrix based on their proximity to trails and roads. Parcels containing well-defined trails or minor roads that extended more than 15 meters through the parcel – the length of the average parcel – are awarded 3 points. Parcels containing the same trails extending less than 15 meters receive two points. Parcels that lie directly next to a well defined trail or minor road are given one point. Parcels that contain any length of poorly defined trail are also given one point. If a particular parcel contains multiple lengths of multiple trail types it is given a single value for the most valuable trail that runs through it. Parcels are also given an additional point if any existing trails converge or fork within the parcel (nodes of connection). These trail junctions are valuable for creating a trail network on Elephant Hill, hence the additional point. Point values for trails were assigned to keep simplicity when comparing trails while also favoring well-defined trails much above poorly defined ones. Well-defined trails are 2-6 meters wide on Elephant Hill and are well traveled. As such they are likely to persist and be used by the public even in the event of trail closure. Poorly defined trails however are more difficult to discern from surrounding vegetation and could easily be closed off and returned to a vegetated state.

Elephant Hill contains several areas that may benefit largely from the addition of trails depending on the parcels that MRCA acquires in the future. Potential or proposed trails are shown in Figure 11 in blue and are numbered. Proposed trail 1 is a switchback trail which begins

in the middle of the MRCA property on a minor ridge, runs down into the valley, and up again to the larger ridge connecting to the north-south backbone trail of Elephant Hill. At this time there is no clear trail connecting these two ridges and the slope and vegetation present make traversing from one ridge to the other potentially dangerous. To get the most out of the MRCA land, the west entrance should be connected to the east entrance by at least one easily traversable trail.

Trail 1 is an example of what such a trail might look like.

Trail 2 begins shortly after the west entrance to the MRCA land and winds up the hill to the ridge immediately south. While not currently owned by the MRCA, this ridge is a likely path of travel for visitors of Elephant Hill due to its scenic value and well-established trail. If the MRCA were to acquire property on the ridge, it would be beneficial to connect them via a trail. Switchbacks are suggested for this trail due to the steepness of the slope. Examples show switchbacks wherever the slope exceeds ten degrees.

Trail 3 would better establish a poorly defined trail that currently exists near a high priority access point to the west. The switchback section would provide a safe path where the current trail cuts straight up the hill. The straighter part of the proposed trail is a poorly defined trail that cuts beneath a thick walnut grove in the area. The improvement of this section of trail would offer a valuable scenic and personal view of one of Elephant Hill's thickest and largest walnut groves.

Trail 4 connects an access point to the south-east to the main ridge that runs from north to south through Elephant Hill. If MRCA were to acquire this entry point, its value would be improved if a trail connected it to the main backbone trail of Elephant Hill.



Destinations

-  Vista
-  Access Points
-  Ridge
-  Ownership Parcels

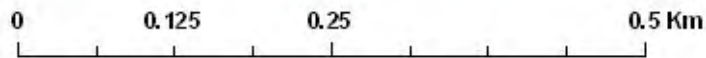


FIGURE 9: MAP DEPICTING ACCESS POINTS TO THE SITE, RIDGELINES THAT INDICATE POSSIBLE TRAIL ROUTES, AND VISTAS.

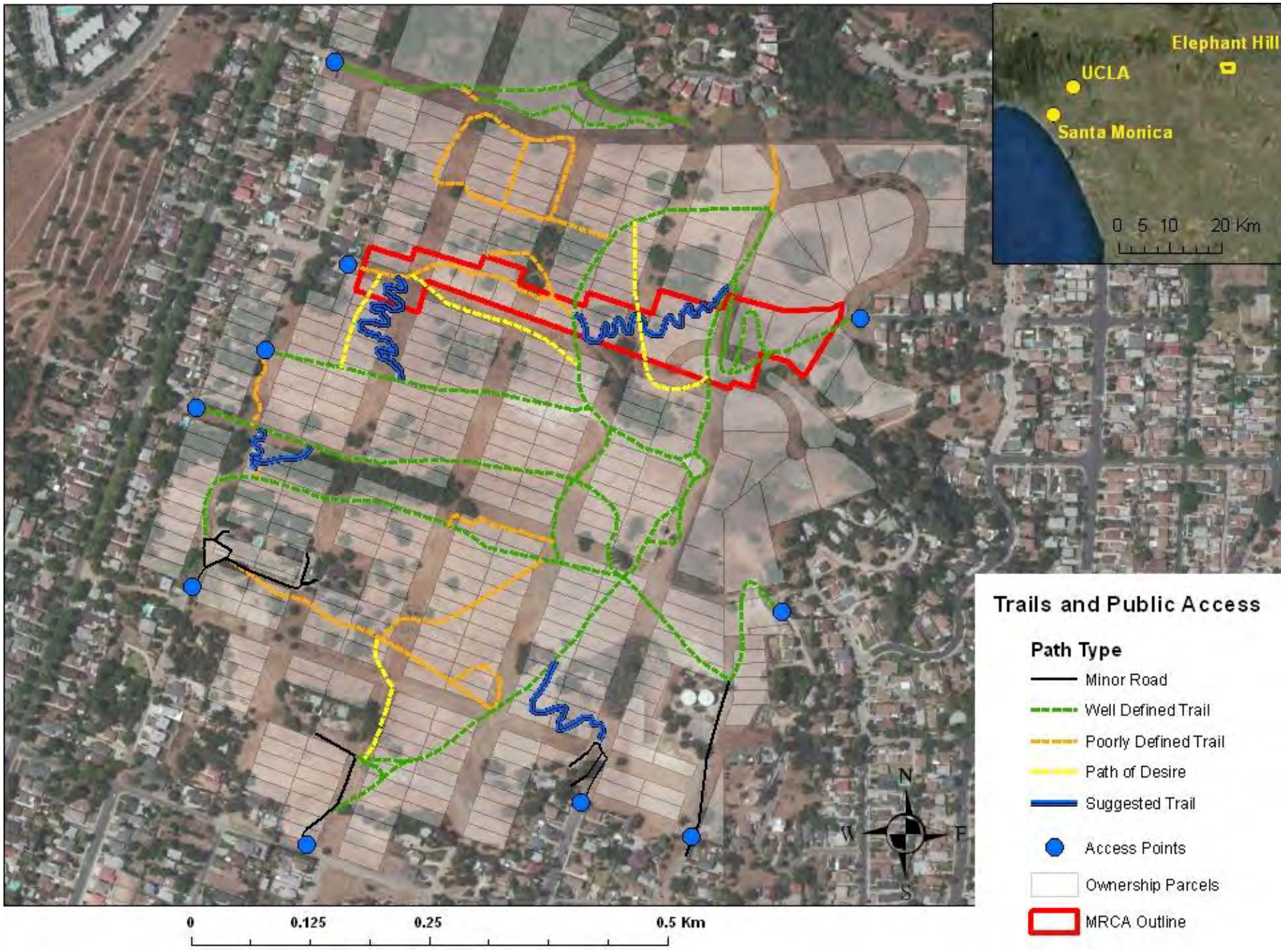


FIGURE 10: MAP OF ALL EXISTING ROADS AND TRAILS AT THE SITE AS WELL AS POTENTIAL TRAILS.

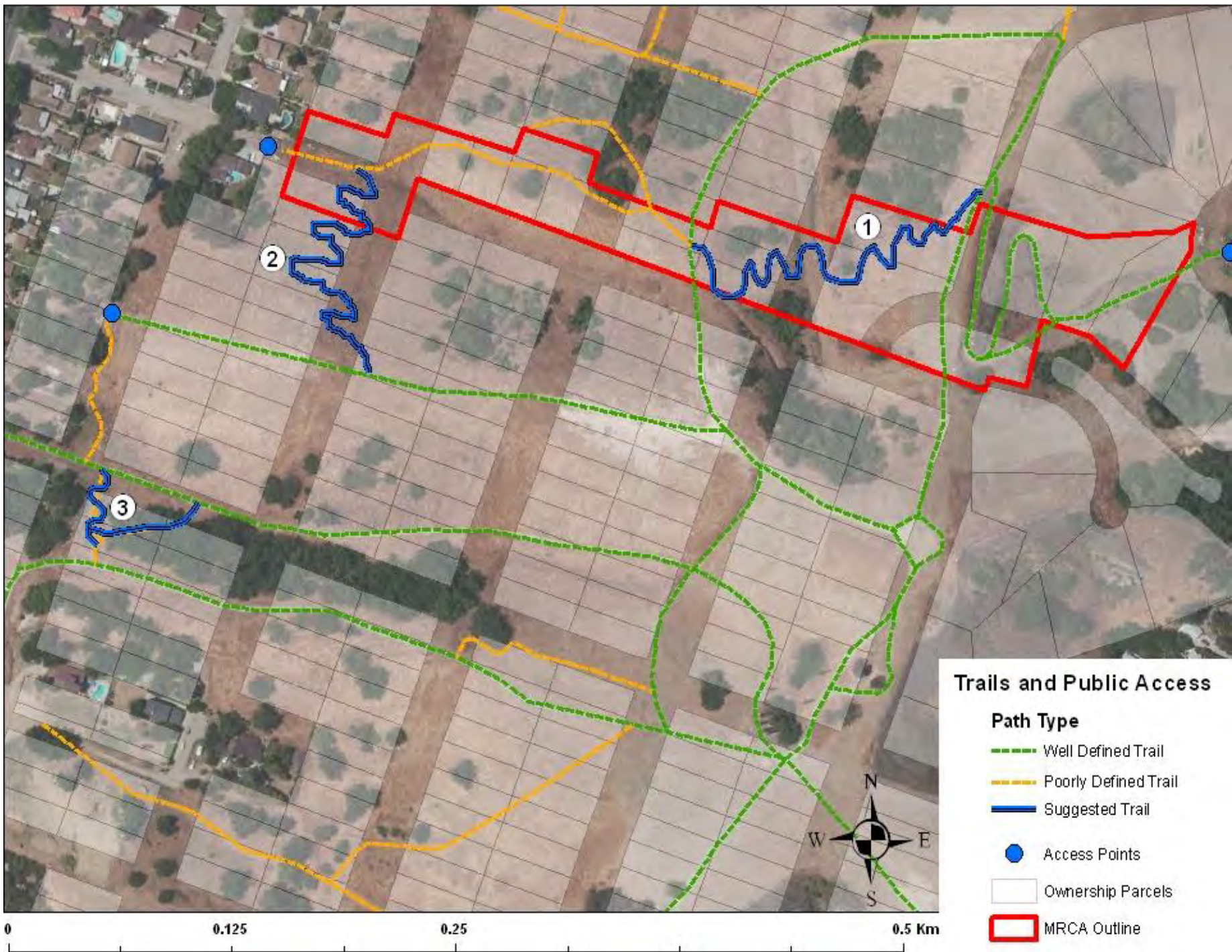


FIGURE 11: NUMBERED SUGGESTED TRAILS.

3.3 VEGETATION

The purpose of this category is to rate parcels based on their current containment of native vegetation, including walnut woodland and CSS. High rankings are given to parcels in order to reflect their aesthetic and intrinsic value for the California ecosystem. Parcels that contain any number of the protected walnut or oak trees receive at least one point, with those with greater percent cover receiving two or four. Points are also given to parcels containing CSS mixed with non-native and invasive species, as determined by observation during site visits. The designation that parcels with a third or more cover of the relevant vegetation should acquire more points was chosen to help distinguish parcels with significant cover as more valuable than parcels with less, though there is a lack of evidence that a whole parcel (about 0.173 acres) is more valuable than anything less, as studies on habitat fragmentation did not examine fragments smaller than 0.125 hectares (0.309 acres) (Soule *et al.* 1992; Crooks *et al.* 2008). The map used to assign points can be found in Figure 12.

SUBCATEGORIES

I. OAK/WALNUT WOODLAND COVER

Walnut woodland, an endemic vegetation community in California, is often found in association with oak woodland, chaparral, CSS, and an understory of annual grasses, but stands have becoming increasingly rare. It also provides habitat for birds and small mammals. The U.S. Forest Service database describes California walnut woodland as highly threatened by urban development over the past century. It is identified as “one of California’s rare and imperiled natural communities.” The California Department of Fish and Wildlife, Natural Diversity Database lists the southern California black walnut (*Juglans californica*) as a “plant of limited distribution” of which its distribution must be closely monitored, and the species is considered “vulnerable” to both extinction on a global scale and extirpation on a statewide scale (California 2013). Because of this special status, the value matrix awards points to parcels with any varying amount of walnut cover, with greater amounts of cover receiving more points. While the presence of a native understory of the woodlands is important for biodiversity (Tewksbury and Lloyd 2001), for this category, it was not considered for the ranking. This is based on

observations made during site visits to Elephant Hill, in which the biodiversity of existing native understories of the woodland were not considered abundant or significant enough to warrant another parameter. Assigning points for the quality of the understories would not be an adequate nor useful measure of their value, as the invasive grasses are ubiquitous enough to exclude most native plants under woodland canopies, except for in parcels located in South Pasadena.

II. COASTAL SAGE SCRUB AND NON-NATIVE COVER

We considered CSS as another notable native California habitat on Elephant Hill. Most scrub on Elephant Hill is observed close to the South Pasadena parcels of land. The value matrix assigns points for CSS and other non-native scrub types based on cover, as the presence of scrub is important for biodiversity; it does not distinguish between native and nonnative cover because they are both relevant to biodiversity value.

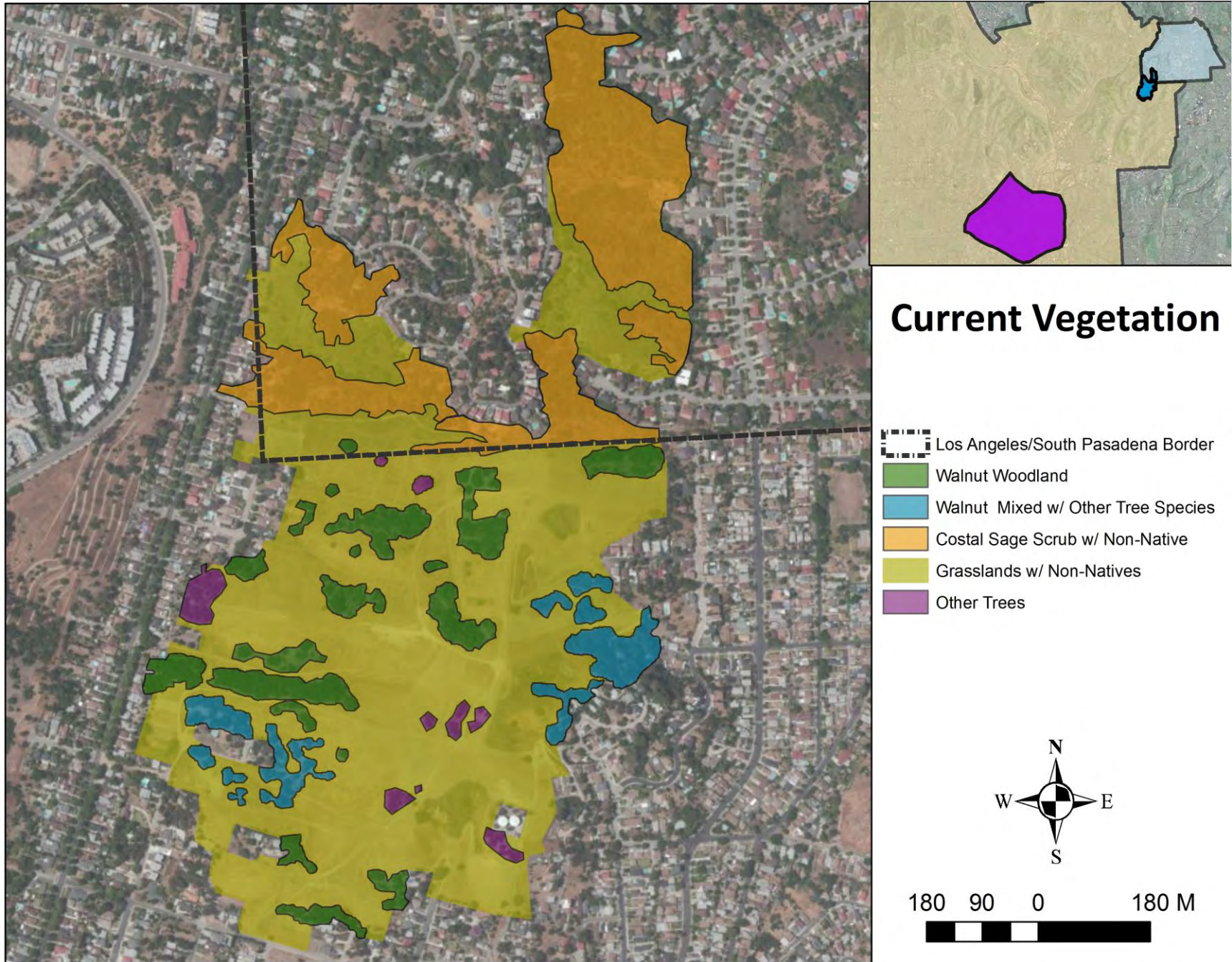


FIGURE 12: VEGETATION MAP USED WHEN ASSIGNING POINTS TO PARCELS. THESE AREAS WERE DETERMINED THROUGH USE OF AERIAL PHOTOS AND THEN CONFIRMED BY SITE VISIT OBSERVATIONS.

3.4 FUEL MANAGEMENT COST

A parcel's need for fuel management is based predominantly on its proximity to buildings, structures, roads, and flammable fencing. The City of Los Angeles has a set of guidelines for reducing fire risk in what is called the "defensible space" surrounding buildings and structures. These guidelines require the removal of vegetation or flammable material within 30 feet of buildings (up to 200 feet if a forest ranger deems necessary) and within 10 feet of roads and flammable fences. They also require vegetation beyond 30 feet to be cut to less than 18 inches of height up to a distance of 200 feet from buildings and structures (County of Los Angeles Fire Department 2011). Since we do not have a ranger's assessment regarding the size of defensible space surrounding the homes located on Elephant Hill, we assumed that all land within 200 feet of buildings and structures or within 10 feet of roads and fencing will require some type of fuel management.

Fuel management is also based on vegetative cover, as flammability, method for removal, and habitat value all differ by vegetation type. Invasive weeds and grasses are more flammable than CSS or chaparral, and both oak and walnut woodland are considered to have low flammability and are acceptable to plant within the defensible space (County of Los Angeles Fire Department 2011). Table A in the Appendix provides a full list of flammable plant species and a list of plant species that are acceptable to plant in defensible space according to the Orange County, Ventura County, and Los Angeles County Fire Departments. Certain vegetation types, such as shrubby woodland or mixed CSS, require more energy-intensive methods for removal and thus cost more to remove. Furthermore, a web search of tractor requirements revealed that most tractors cannot be used on slopes greater than approximately 45°, although the slope limit depends on the tractor brand and technique used. However, slopes on Elephant Hill do not exceed 45° except for a few inconsequential land patches, so we assumed that everything could be mowed if needed.

As dictated by our research, a higher score given to a parcel signifies that it requires less effort and is less expensive to manage in the short term, while lower scores indicate parcels that require more expensive and intensive fuel management.

4. VALUE MATRIX

4.1 ACCESSIBILITY

I. CURRENT TRAIL ACCESS

1. *Neighborhood Connection*

- a) Parcel lies on top of an entrance of a major street (6 points)
- b) Parcel lies on top of an entrance of a minor street or open path (4 points)
- d) Parcel lies adjacent to the entrance of a major or minor street or open path (2 points)
- e) Not connected or adjacent to any street, trail or pathway (0 points)

2. *Grade (Slope) of Entry Point*

- a) Small grade (0-8%) (3 points)
- b) Medium grade (9-11%) (2 points)
- c) Large grade (12-20%) (1 point)
- d) Very large grade (>20%) (0 points)

II. ACCESSIBILITY TO PERIMETER TRAILS

3. *Trail Connection*

- a) Parcel lies on entrance of important trail (12 points)
- b) Parcel lies adjacent to important trail (6 points)
- c) Parcel lies on the entrance of other interior trail (6 points)
- d) Parcel lies adjacent to other trail (3 points)
- e) Parcel lies on the entrance of an interior “path of desire” trail (2 points)
- f) Parcel lies adjacent to the entrance of a “path of desire” (1 points)
- g) Not on or adjacent to an existing trail (0 points)

4. *Nodes of Connection*

- a) Trails meet/split in parcel (well-defined trails or minor roads only) (1 point)
- b) Trail does not conform to clause above (0 points)

III. CONNECTIVITY TO OPEN SPACES AND SCHOOLS

5. *Guardia Park*

- a) Parcel is within 0.5 km to Guardia Park (3 points)
- b) Parcel is 0.5-1 km to Guardia Park (1 points)
- c) Parcel is farther than 1 km to Guardia Park (0 points)

6. *Open Space West of Collis Ave*

- a) Parcel is within 0.5 km (0.3-0.6 miles) to Via Marisol (3 points)
- b) Parcel is 0.5-1km (0.3-0.6 miles) to Open Space (1 points)
- c) Parcel is farther than 1 km to Open Space (0 points)

7. *Connectivity to El Sereno Elementary School*

- a) Parcel is within 0.5 km to El Sereno Elementary School (10 points)
- b) Parcel is 0.5-1 km to El Sereno Elementary School (5 points)
- c) Parcel is farther than 1 km to El Sereno Elementary School (0 points)

4.2 RECREATION POTENTIAL

I. DESTINATION POINTS

1. *Vistas*

- a) Parcel contains vista on an existing trail (2 points)
- b) Parcel contains vista not on a trail (1 point)
- c) No significant views, not on existing trails (0 points)

2. *Ridges (elevation > 700 feet)*

- a) Parcel contains ridge on an existing trail (2 points)
- b) Parcel contains ridge not on a trail (1 point)
- c) No significant views, not on existing trails (0 points)

II. TRAILS/ROADS

3. *Proximity to an Existing Trail*

- a) Parcel contains well defined trail / minor road >width of parcel (15 meters) (3 points)
- b) Parcel contains well defined trail / minor road <width of parcel (15 meters) (2 points)

- c) Parcel directly next to well-defined trail or minor road (1 point)
- d) Parcel contains poorly defined trail (1 point)

4. *Node of Connection*

- a) Trails meet/split on parcel (well-defined trails or minor roads only) (1 point)
- b) Trail does not conform to clause above (0 Points)

4.3 VEGETATION

I. OAK/WALNUT WOODLAND COVER

1. *Oak/Walnut Woodland (has special protection status)*

- a) Parcel contains no oak/walnut trees (0 points)
- b) Parcel contains less than one third cover (1 point)
- c) Parcel contains between 1/3 and 2/3 cover (2 points)
- d) Parcel contains more than 2/3 cover (4 points)

II. COASTAL SAGE SCRUB AND NON-NATIVE COVER

2. *California Sage Scrub/Non-Natives*

- a) Parcel contains no CSS (0 points)
- b) Parcel contains a third or less CSS/non-native cover (1 point)
- c) Parcel contains more than a third CSS/non-native cover (2 points)

4.4 FUEL MANAGEMENT COST

1. *Distance from Infrastructure*

- a) Parcel is not within 200 ft. of building/structure or within 10 ft. of road/flammable fencing (2 points)
- b) Parcel is within 200 ft. of building/structure or within 10 ft. of road/flammable fencing (0 points)

2. *Flammable Vegetation*

- a) Parcel contains no vegetation (2 points)
- b) Parcel contains oak or walnut woodland (1 point)
- c) Parcel contains flammable plant species (listed in Table X) or dry annual grasses (0 points)

3. Management Method

- a) Parcel requires little to no fuel management (contains restorable woodland, isolated trees not near structures, no vegetation) (2 points)
- b) Parcel can be managed using tractors or tillers (contains slope < 30 degrees) (1 point)
- c) Parcel requires hand-clearing with tools or machinery (contains steep slopes, trees near homes, CSS) (0 points)

5. RESULTS

Matrix values were normalized to a value between 0.0 and 1.0, and mapped to cartographically show the relative value of parcels by category. Parcels that received a score of zero are white, while three other groupings of values representing low, moderate, and high values for each category are colored. Break values between groups were chosen using natural breaks as a guide, which allows for parcels with the most similar values to be displayed together with the same symbol or fill color in the map. The natural breaks between groups are different across the four categories.

5.1 ACCESSIBILITY

The Accessibility category resulted in zero values for many of the interior parcels because they were too far from potential entrances to earn points. Dark blue parcels represent the most valuable. The majority of the highest value parcels occur near the key access points, especially near El Sereno Elementary School (See Figure 13).

5.2 RECREATION POTENTIAL

Highly ranked parcels for Recreation Potential occur along the ridges, trails and vistas with the most valuable occurring where these features intersect (See Figure 14).

5.3 VEGETATION

Parcels with the highest cover value of existing native vegetation, especially parcels containing walnut woodland or coastal sage scrub, were valued highly. Dark blue parcels occur where these vegetation communities have the highest cover (See Figure 15).

5.4 FUEL MANAGEMENT

Cost of fuel management represents the relative cost of managing fuel for a given parcel. Parcels near structures and containing certain vegetation types, such as only

invasive grasses, are much more expensive because of higher fire danger and are thus considered less valuable for acquisition because of cost of management. In contrast, parcels further from structures or containing walnut woodland acquired more points for being less expensive to manage and are thus shown as more valuable (See Figure 16).

5.5 SUM WEIGHTED VALUE

In order to calculate the overall weighted value of each parcel, the normalized value for each of the categories was multiplied by the following weighting factors:

- 0.4 for Accessibility
- 0.3 for Recreation Potential
- 0.2 for Vegetation
- 0.1 for Fuel Management Cost

The weighting factor reflected the MRCA's relative priority for each category. The parcels were grouped using natural breaks in Figure 17 to depict relative value based upon the calculated value. These values can be used to guide prioritization of privately held parcels for acquisition by public entities, including the MRCA, for the purpose of preserving the open space for public recreational and native habitat use. It should be noted that these calculated parcel values should be used as a guide based upon the assumptions stated in Sections 3 and 4 (Categories and Value Matrix) of this report, and if existing conditions or priorities change, the value matrix can be updated to recalculate new values to guide planning and land management efforts.

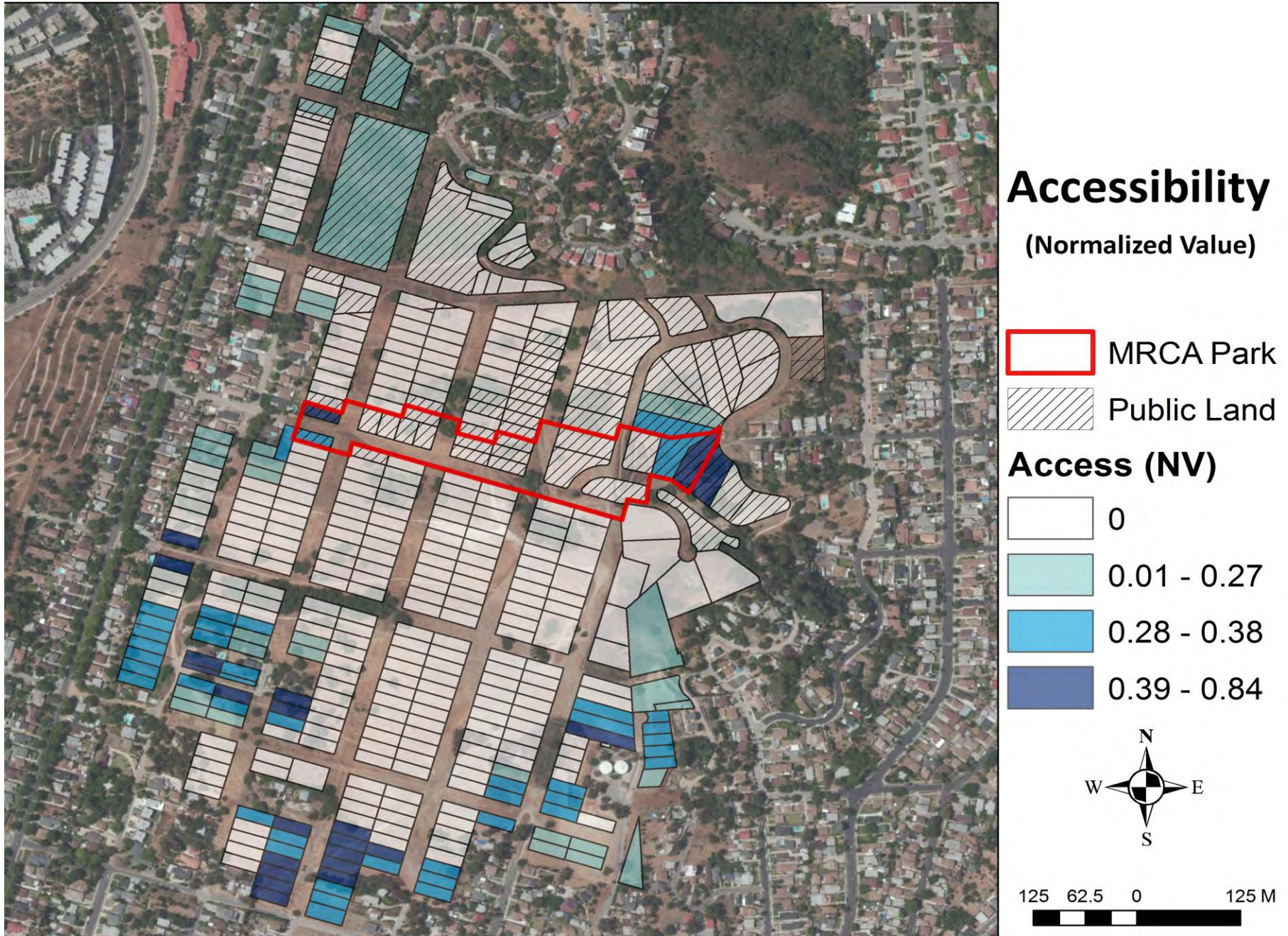


FIGURE 13: ACCESSIBILITY CATEGORY VALUE BY PARCEL.

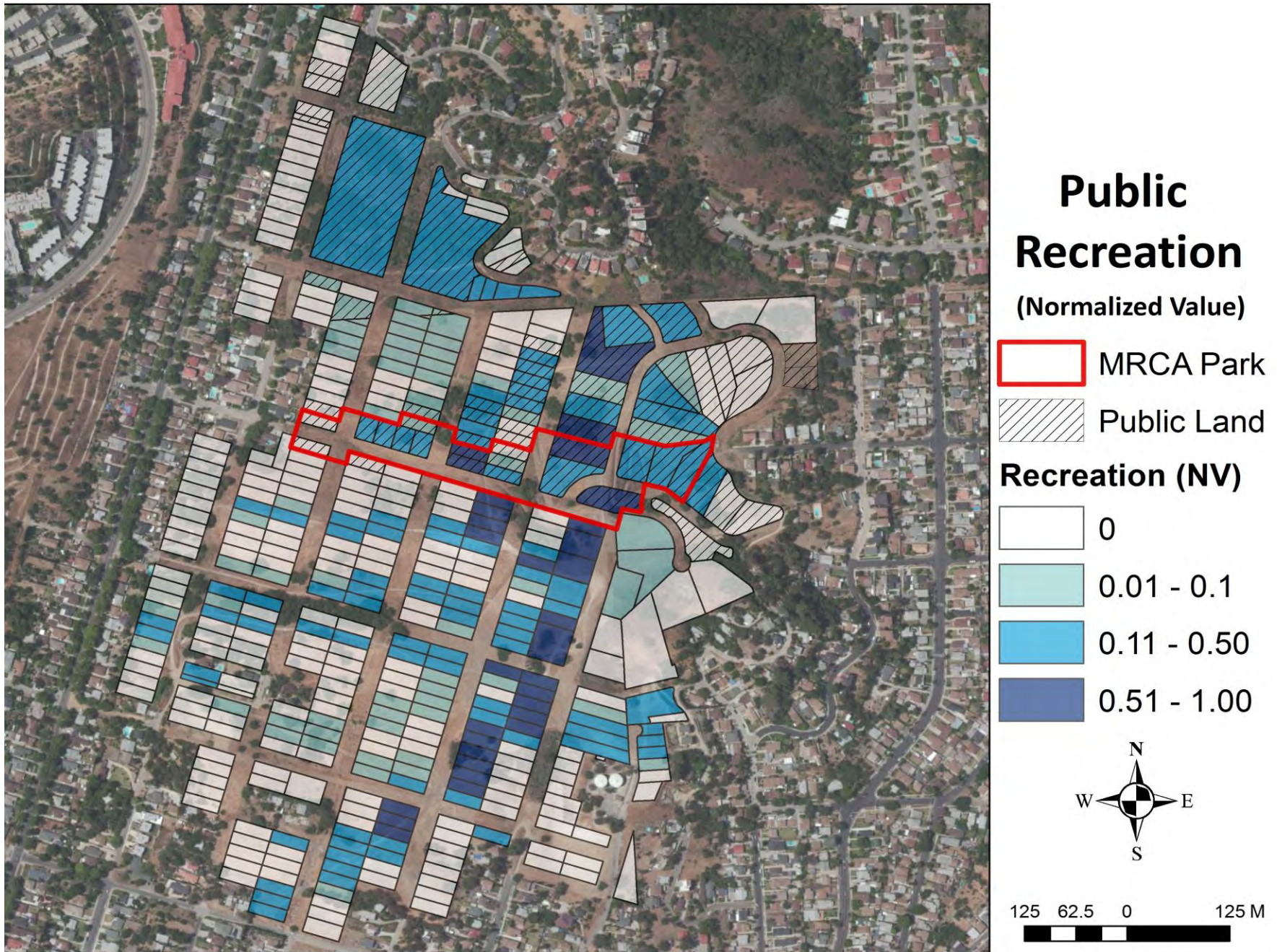
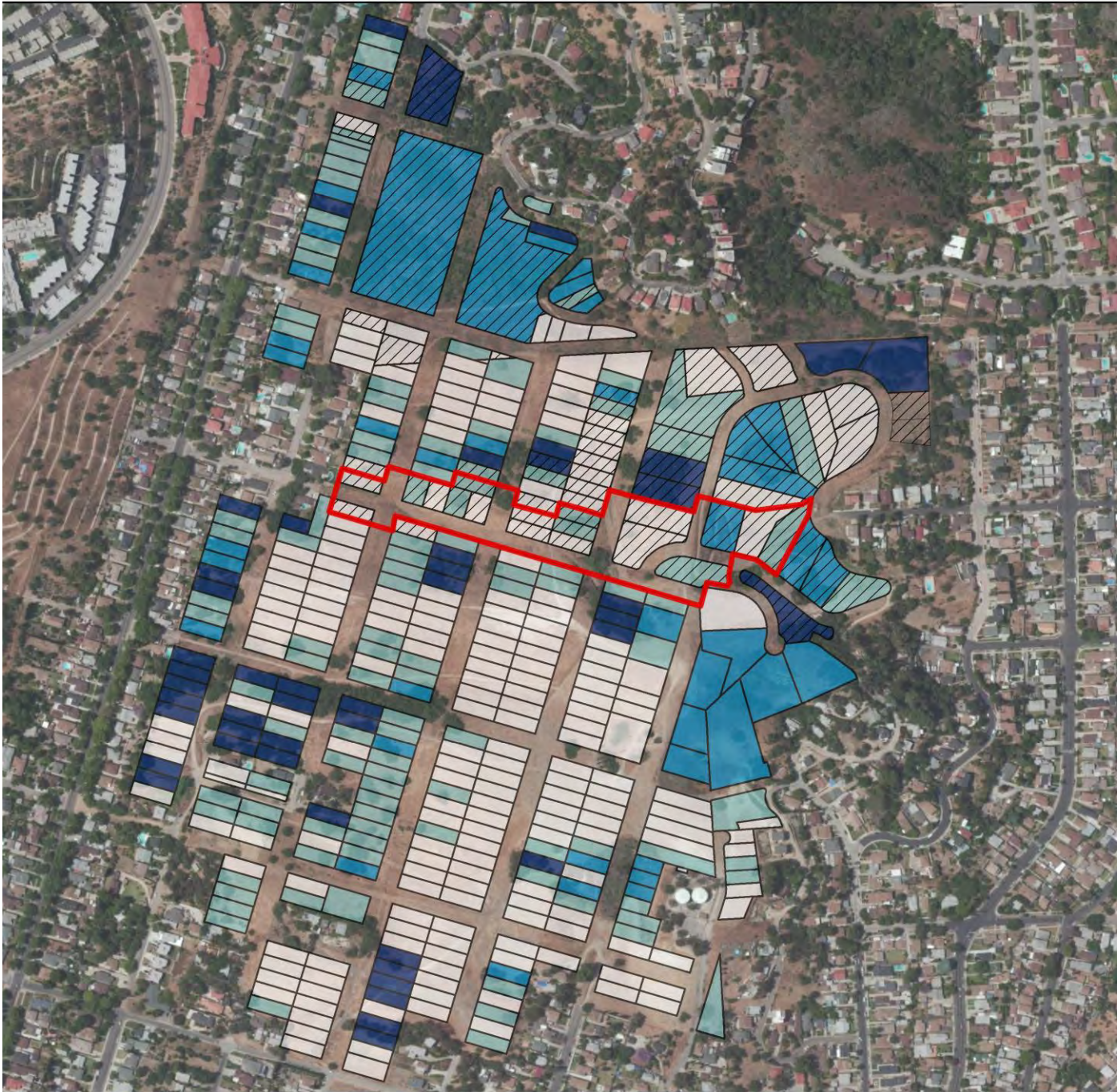


FIGURE 14: RECREATION POTENTIAL CATEGORY VALUE BY PARCEL.







Vegetation

(Normalized Value)

-  MRCA Park
-  Public Land

Vegetation (NV)

0.00	
0.01 - 0.17	
0.18 - 0.50	
0.51 - 1.00	

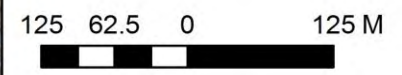


FIGURE 15: VEGETATION CATEGORY VALUE BY PARCEL.

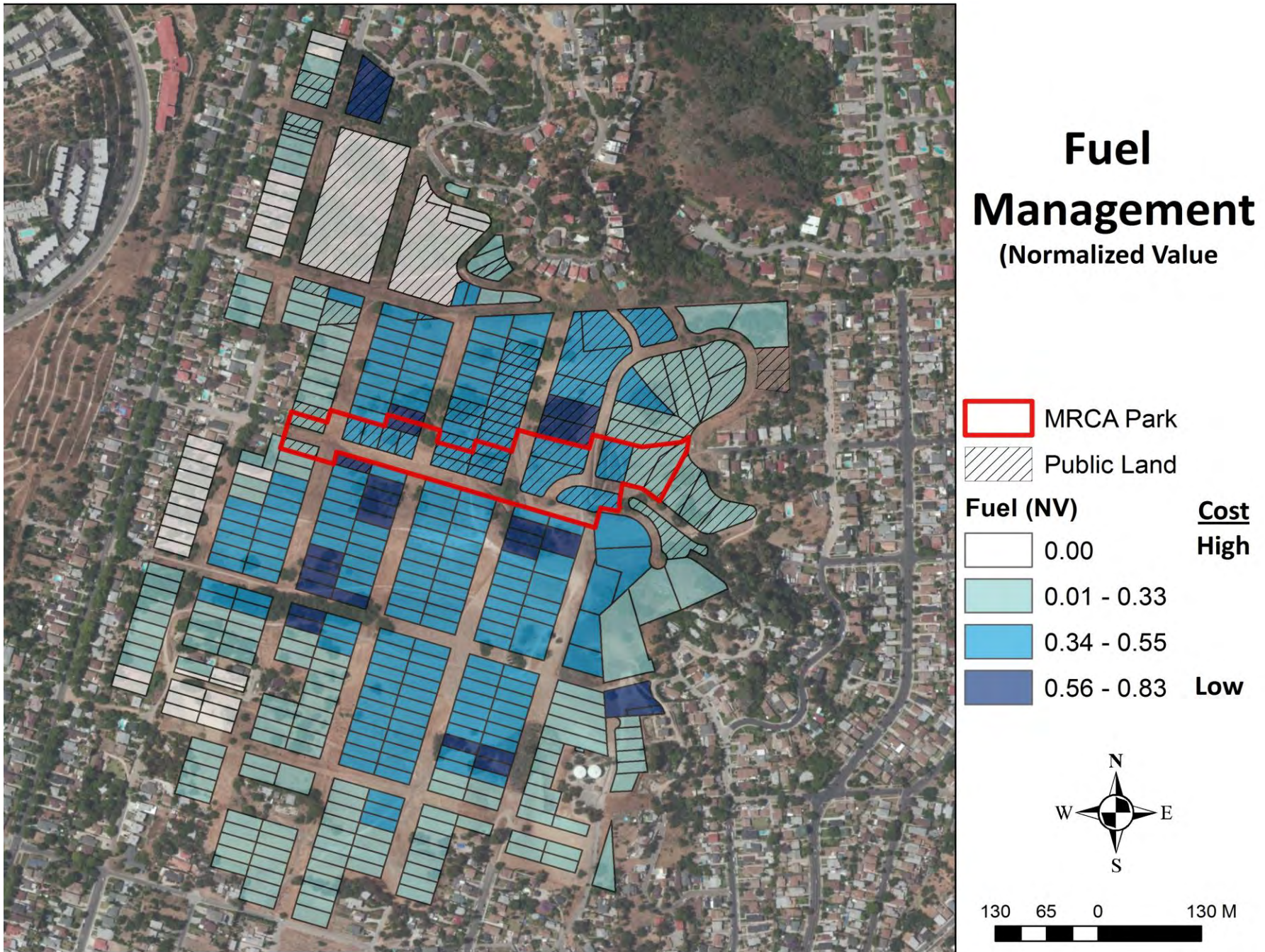


FIGURE 16: FUEL MANAGEMENT COST CATEGORY VALUE BY PARCEL.

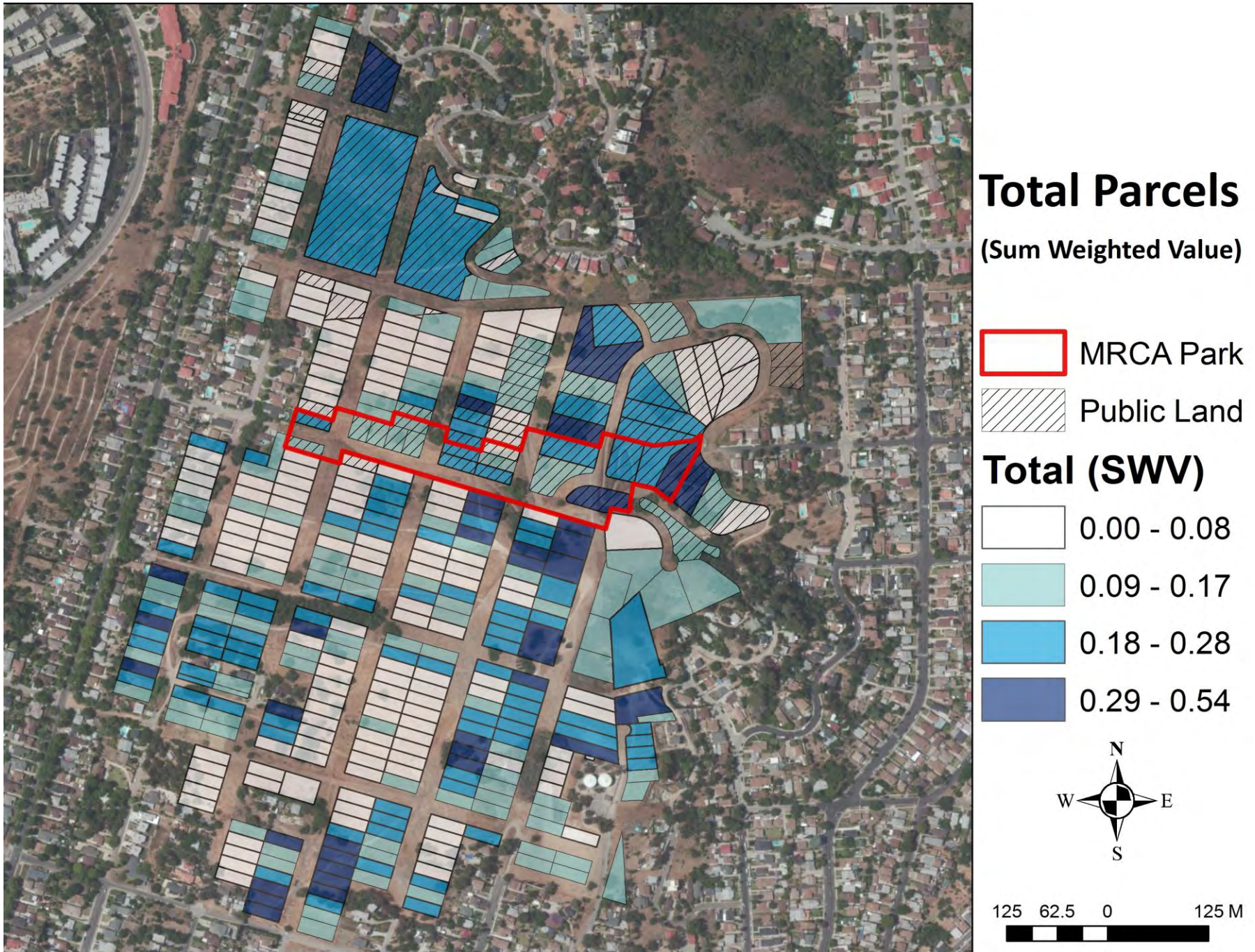


FIGURE 17: SUM WEIGHTED VALUES BY PARCEL.

6. DISCUSSION

In order to evaluate the resulting sum weighted values of the parcels as a tool for guiding future acquisition by MRCA, we created a scenario in which one million dollars would be spent for land acquisition at Elephant Hill. We did not include publicly held parcels in this scenario, although it should be noted that not all of the publicly held land on Elephant Hill may currently be protected as open space. Based upon an estimate of current market prices, we estimated that approximately 40 parcels could be acquired for one million dollars in funds.

The 40 parcels we chose were largely based on the Total Sum Weighted Value map in Figure 17. Rather than simply recommending the top 40 parcels directly from our “Total Sum-Weighted Value” map, we decided it would be more useful to recommend clusters of related parcels with similar characteristics, as some highly ranked parcels were found in otherwise low-value areas. These parcels were included in the highest score grouping in our “Total Sum-Weighted Value” map but did not appear to benefit MRCA’s long-term acquisition and restoration goals for Elephant Hill, and hence were excluded from our 40-parcel recommendation and replaced with other parcels. As seen in Figure 18, the parcel within the black circle is one example of one of the top ranked parcels not included in our 40-parcel recommendation. Looking at this parcel individually, it is valuable because it is adjacent to a minor road, a minor access point, and to walnut trees. If one were to look at the Elephant Hill as a whole, however, this parcel does not significantly increase the utility of Elephant Hill, as it is far away from major access points or major trails. A major priority for replacement parcels was to aid in further acquisition of important trails. In Figure 18, the parcels within the red circles are examples of parcels not among the top ranked parcels but are included in our 40-parcel

recommendation. Each of these parcels are included because they create a more comprehensive system within Elephant Hill. The red circle in the southeast corner of Elephant Hill is included because it is located on top of an important trail leading to the interior of Elephant Hill. The parcels within the large red circle near the center of Elephant Hill similarly helps to create a continuous connection through the major trails. The parcel located within the red circle on the western side of Elephant Hill helps to secure the other side of a major access point.

Our Value Matrix provides a complete analysis of individual parcels within Elephant Hill. As we demonstrated above, it is also necessary to look beyond individual parcel scores to create a more comprehensive, integrated, and logical plan for Elephant Hill. Our Matrix provides the starting platform to create this plan and can easily be modified in the future should priorities change. The 40-parcels recommended, as seen in Figure 19, represent only one analysis of the data. With additional funding, any of the omitted highly ranked parcels from this plan would still be considered desirable for later acquisition.

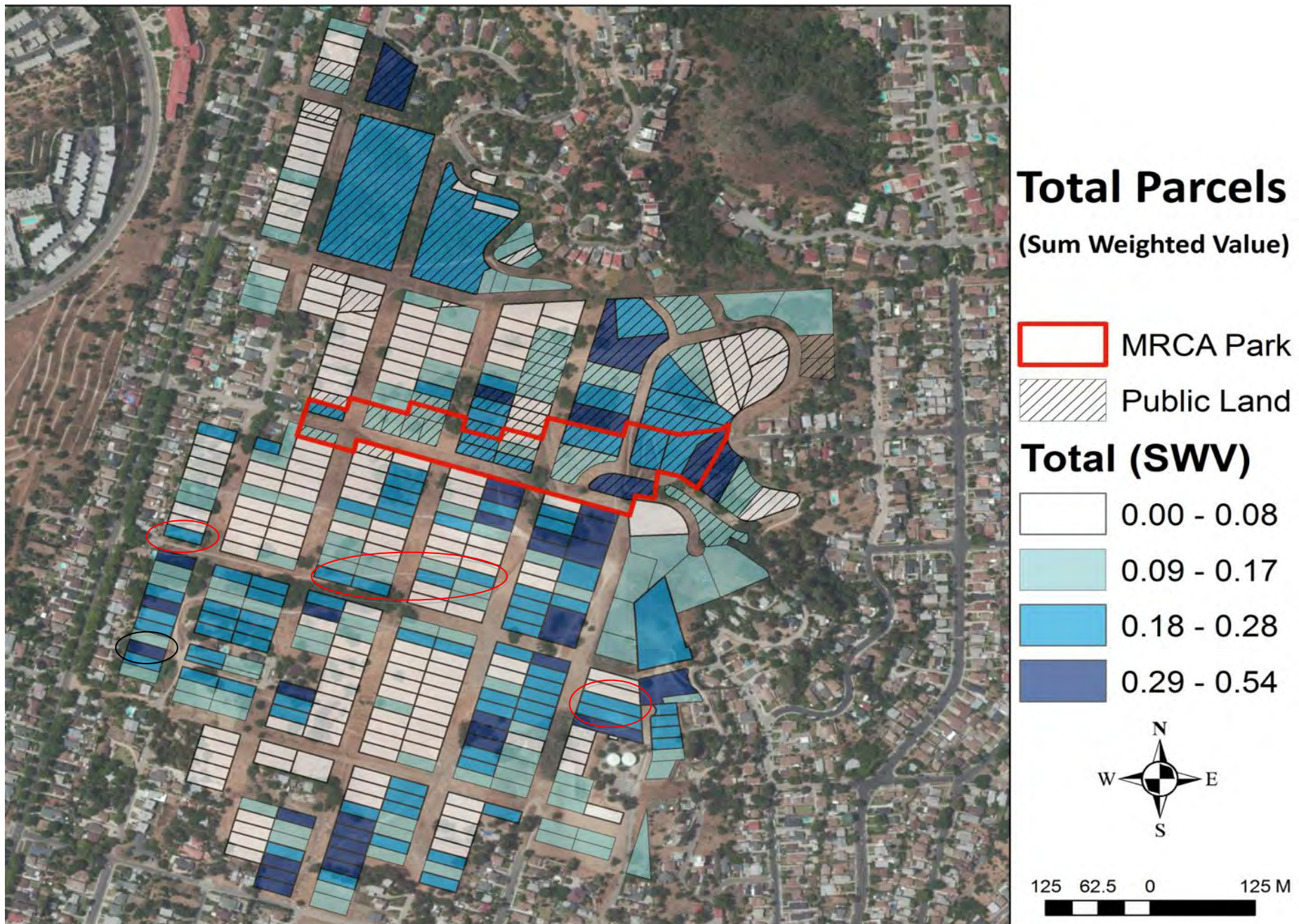


FIGURE 18: A MAP OF OR TOP RANKED PARCELS FROM OUR VALUE MATRIX. THE PARCELS WITHIN THE RED CIRCLES ARE EXAMPLES OF PARCELS THAT WERE ADDED TO THE MAP WHICH WERE NOT TOP RANKED. THE PARCELS WITHIN THE BLACK CIRCLES ARE THOSE THAT WERE HIGHLY RANKED BUT NOT INCLUDED IN OUR 40 PARCEL RECOMMENDATION.

40 Parcel Aquisition With All Characterizations















-  Los Angeles/South Pasadena Border
-  Major Access Points
-  Public Vista Points
-  Important Trails
-  Local Connections
-  Costal Sage Scrub mixed w/ Invasives
-  Walnut Woodland
-  Walnut Mixed w/ Other
-  Via Marisol
-  Guardia Park
-  MRCA Proposed Park
-  Public Land
-  40 Parcels
-  Paper Trails



FIGURE 19: 40 PARCEL ACQUISITION SCENARIO WITH THE CRITICAL RESOURCES DEPICTED FOR ELEPHANT HILL.

6.1 ACCESSIBILITY

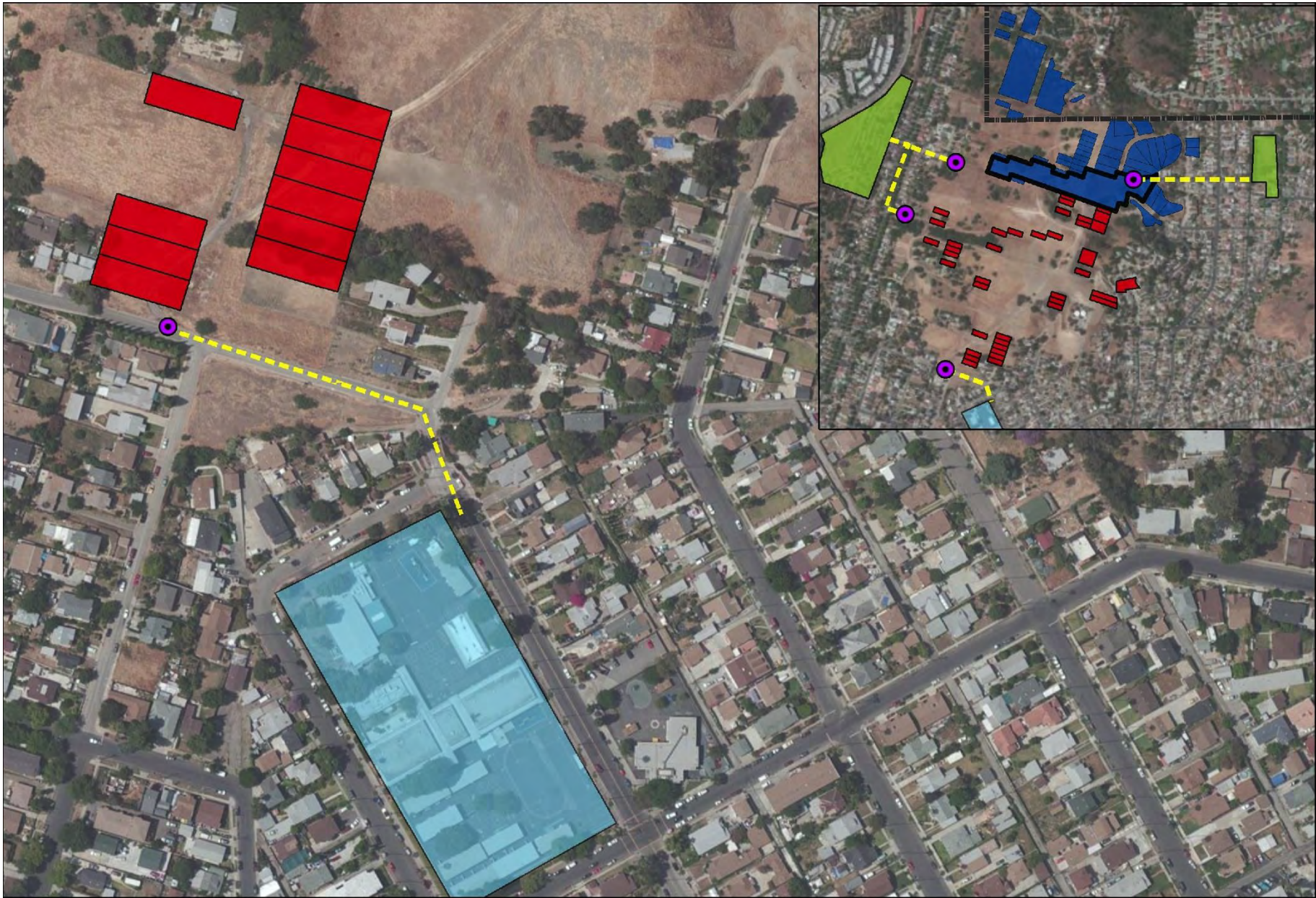
The 40 parcels we recommended would help the MRCA achieve their goal in promoting greater accessibility for the local community. These 40 parcels secure all of the major access points connected to privately owned parcels. Acquiring these access points directly accomplishes many of the goals set forth through our Accessibility category, most notably in creating a walkable connection to El Sereno Elementary School (Figure 20). The connection provides a short and direct path between El Sereno Elementary School and Elephant Hill. This connection is ideal as it lies on the entrance of a major trail, which connects to important public recreation resources. This connection is also important because it is the closest access point to El Sereno Elementary School. One can assume that children will not want to walk as far as older people would to reach Elephant Hill. To best target this population, we want the shortest connection possible. By acquiring these parcels and creating this connection, MRCA has the opportunity to provide highly accessible educational programs within Elephant Hill for these children.

The major access points contained within the 40-parcel acquisition are also connected to major streets, specifically Collis Avenue, Cudahy Street, and Lathrop Street. Creating entrances at major streets may provide easier and more visible access into Elephant Hill. To further this goal, the MRCA may also want to upgrade the paths directly outside of these major entrances to create a more visible entryway.

If the MRCA acquired and restored these parcels, they would also provide greater access to the different neighborhoods surrounding Elephant Hill. The distinction between the different neighborhoods and their respective access points is displayed in Figure 21. The major access points currently provide adequate access to the neighborhoods on the west and south side of

Elephant Hill. In contrast, the neighborhood on the southeast side of Elephant Hill is not adequately connected to Elephant Hill. The current trails and access points serving this area are designated as “Minor Trails” and “Minor Access Point” and are not clearly outlined. To provide adequate the southeast neighborhood increased access through these parcels, current trails and access points will have to be upgraded. If the MRCA were to acquire the recommended 40 parcels and made these upgrades, they would successfully provide access to all of the different neighborhoods surrounding Elephant Hill.

The major access points encompassed in our 40-parcel recommendation can also provide the necessary path to connect the MRCA’s proposed park at Elephant Hill with other local green spaces (Figure 22). This connection is vital in fulfilling the MRCA’s vision of creating a network of open green spaces that stretches throughout northeast Los Angeles. In this scenario, Via Marisol has the potential to connect to Debs Park. Debs Park then has the future potential to connect to open spaces such as FlatTop Park, Arroyo Seco Park, and even Ascot Park. This connection can then run through Elephant Hill and into Guardia Park.



- Major Access Points
- Local Connections
- El Sereno Elementary



FIGURE 20: ELEPHANT HILL'S CONNECTION TO EL SERENO ELEMENTARY SCHOOL THROUGH THE RECOMMENDED 40 PARCEL PURCHASE.

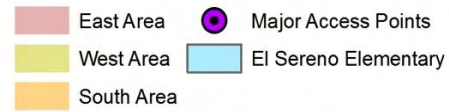
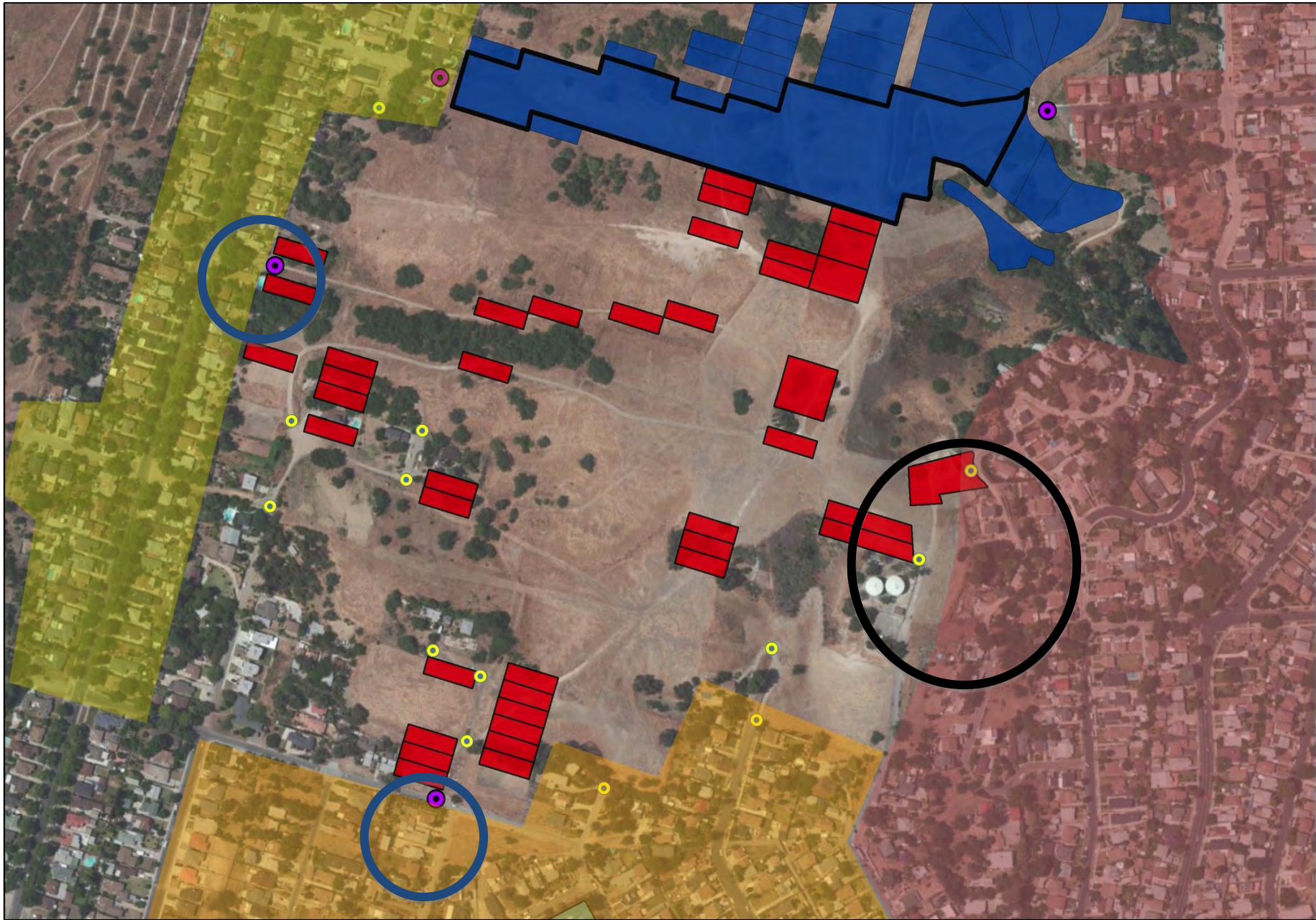
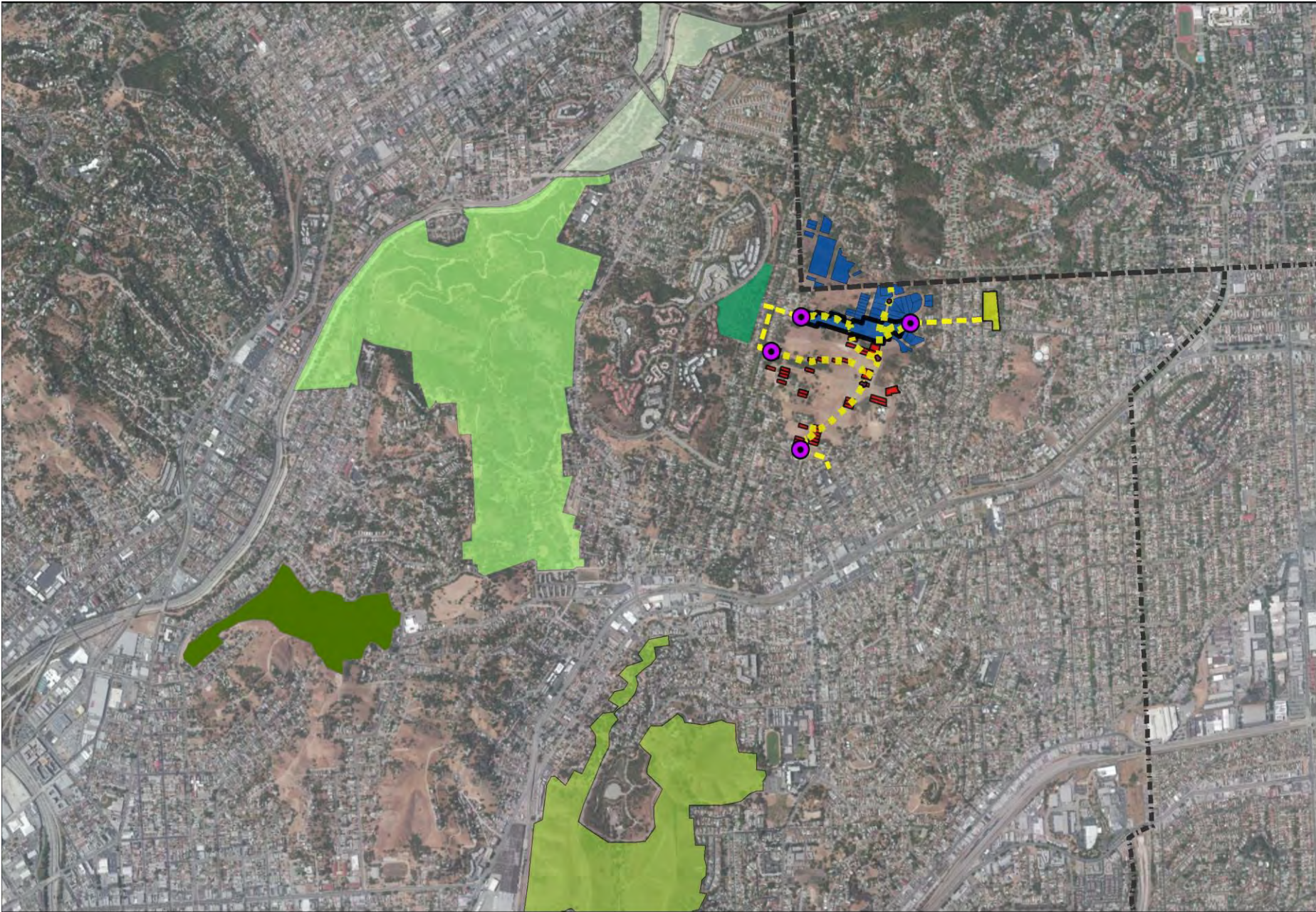


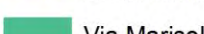


FIGURE 21: NEIGHBORHOOD ACCESS TO ELEPHANT HILL. SEEN WITHIN THE TWO BLUE CIRCLES ARE THE MAJOR ACCESS POINTS THAT PROVIDE A CONNECTION TO THE NEIGHBORHOODS ON THE SOUTH AND WEST SIDES OF ELEPHANT HILL. WITHIN THE BLACK CIRCLE ARE THE PARCELS THAT CAN PROVIDE ACCESS TO THE NEIGHBORHOOD ON THE SOUTHEAST SIDE OF ELEPHANT HILL. THESE SHOULD BE UPGRADED IN THE FUTURE.



- | | | |
|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
|  Arroyo Park |  FlatTop Park and Other Open Space |  Guardia Park |
|  Ascot Park |  Local Connections |  MRCA Proposed Park |
|  Debs Park |  Via Marisol |  Los Angeles/South Pasadena Border |

380190 0 380 Meters


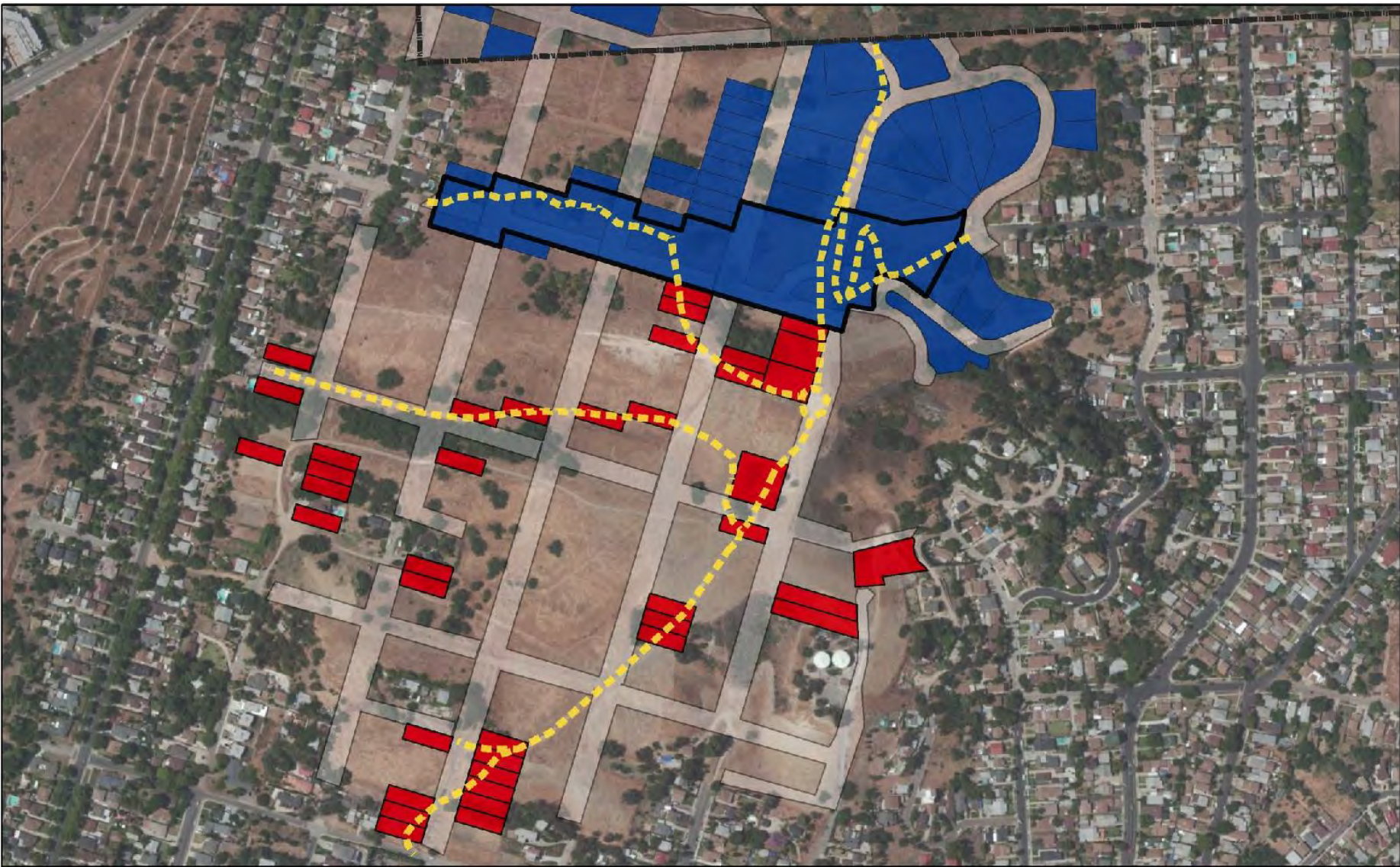


FIGURE 22: THIS MAP DISPLAYS THE POTENTIAL FOR A FUTURE NETWORK OF OPEN SPACES THROUGHOUT NORTHEAST LOS ANGELES.

6.2 PUBLIC RECREATION

The 40 parcels we are recommending that the MRCA acquire will also further their efforts in turning Elephant Hill into an open space that the surrounding community can use and enjoy recreationally. This is completed through the acquisition of parcels that lie on top of major trails or important public vistas. If the MRCA were to acquire the recommended 40 parcels, they would be able to begin restoring and protecting a portion of the “Important Trail” path, which serves as the backbone for Elephant Hill’s larger trail network (Figure 23). Through these parcels, the MRCA would be able to protect the major path serving as a connector between the different neighborhoods surrounding Elephant Hill. The “Important Trail” path also provides many connections to other minor paths and trails (Figure 23). While some of the existing minor trails could be maintained, many of these minor trails and paths should be eliminated. Eliminating unnecessary trails will provide for the protection and expansion of the native habitat, such as walnut woodlands.

The recommended parcels contain two important public vista points (Figure 24). These public vistas are located at the center of Elephant Hill. They provide views of downtown Los Angeles to the southwest and mountains to the north. The vistas could become an important gathering point for small groups and educational programs, and would certainly be a major destination point for any visits to the park. Gazebos similar to one currently used in Debs Park (Figure 25) could house educational material about the history and ecology of Elephant Hill, in addition to providing shade and a place to rest for the park users.



Important Trail with 40 Parcels

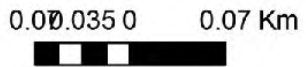
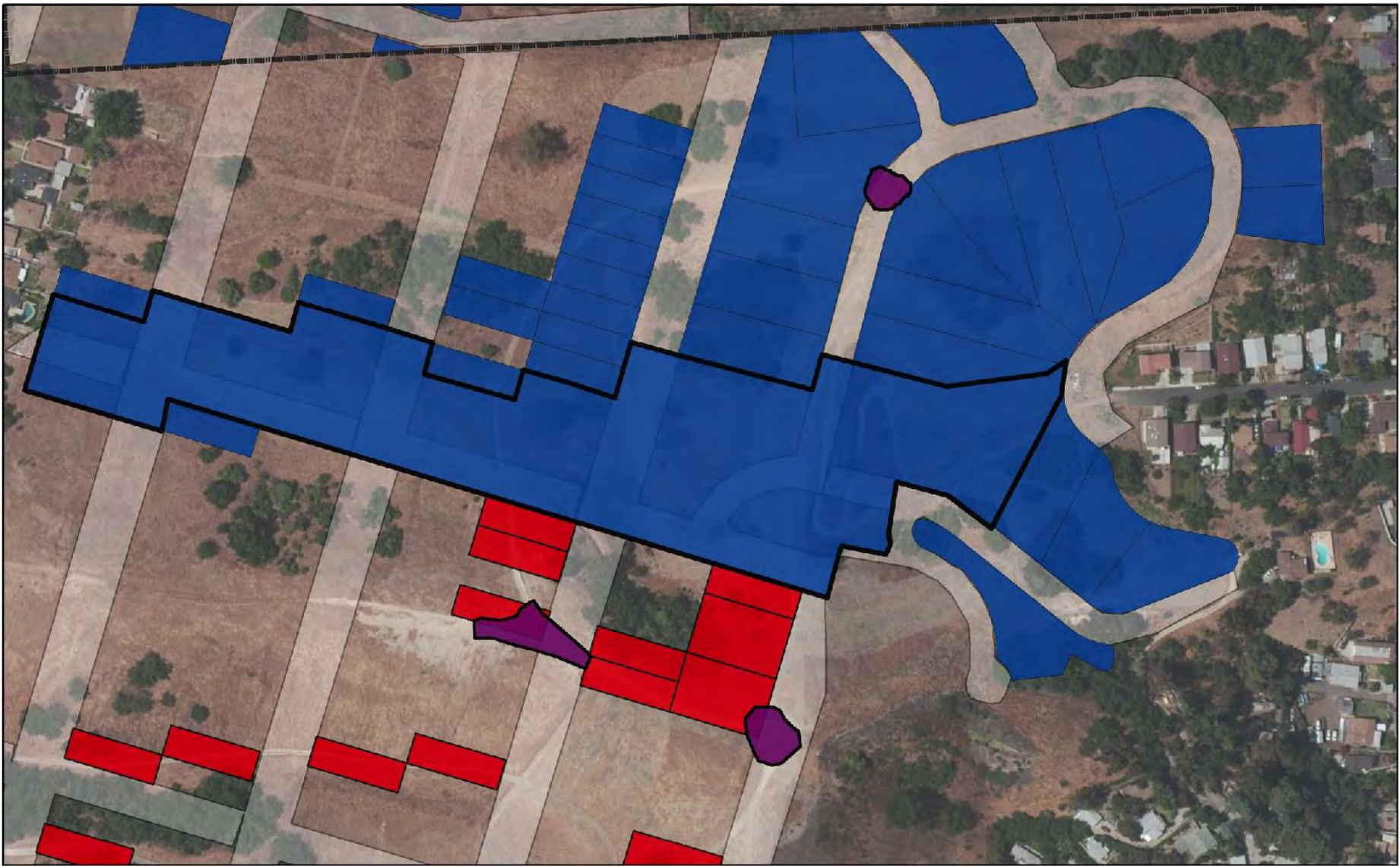


FIGURE 23: THE DISTRIBUTION OF IMPORTANT TRAILS WITHIN ELEPHANT HILL. THESE TRAILS WERE CHOSEN BASED OFF OF CLIENT INPUT, THE WIDTH OF THE TRAIL, AND THE CONNECTIONS THAT THE TRAIL CREATE. THEY WERE LOCATED USING GIS MAPPING TOOLS.



Public Vistas with 40 Parcels

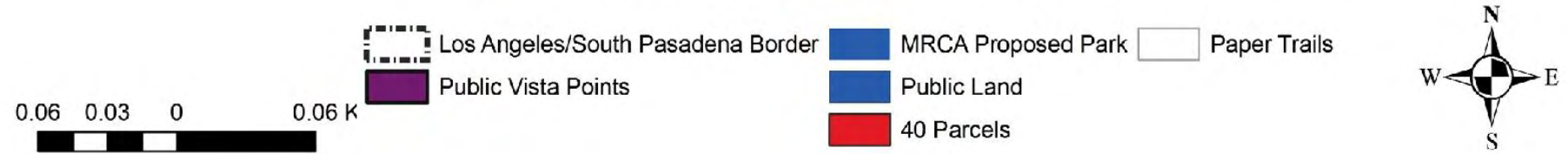


FIGURE 24: THE LOCATION OF IMPORTANT PUBLIC VISTAS WITHIN ELEPHANT HILL. THESE CAN BE USED FOR EDUCATIONAL AND PUBLIC GATHERINGS.



FIGURE 25: (*LEFT*) CURRENT STATUS OF AREA NEAR PUBLIC VISTA IN ELEPHANT HILL. THERE IS A LACK OF SHADE, BENCHES, AND OTHER RECREATIONAL OPPORTUNITIES. (*RIGHT*) GAZEBO ON TOP OF PUBLIC VISTA IN DEBS PARK. IT PROVIDES SHADE AND BENCHES.

6.3 VEGETATION RESTORATION POTENTIAL

The 40 parcels recommended for future acquisition also provides the opportunity to begin protecting and restoring native vegetation, specifically walnut woodland, in addition to walnut trees interspersed with other species. Our project also considered the importance of protecting any native CSS, but the distribution of CSS was primarily not near our recommended 40 acquisition parcels. Most of the current CSS lies within South Pasadena's public property, which is not subject to discing for fuel management. CSS therefore is not a prominent vegetation type within the recommended parcels. There were also large patches of walnut woodland within and adjacent to public parcels owned by the City of Los Angeles, and hence was not included in the acquisition scenario. There are several areas within our 40 parcel recommendation with walnut woodland preservation and expansion opportunities. The biggest of these areas lies within the southwest area of Elephant Hill (Figure 26). In this section, there is a close split between parcels dominated by walnut woodland and parcels dominated by walnut trees mixed with other species. As stated earlier, it is recommended that some of the minor trails be removed, and in this particular area, removing excess trails may be particularly helpful for walnut woodland restoration and potential expansion. While our 40 recommended parcels do not include all walnut woodland areas, many of our recommended parcels lie adjacent to these areas, containing land that may provide suitable habitat for walnut woodland restoration.

While the parcels in the southwest area of Elephant Hill provide for large-scale preservation and potential for restoration, there are other important small groupings of walnut trees. One of these groupings are close to major streets and houses within the southeastern portion of Elephant Hill (Figure 27). If the MRCA were to acquire these parcels, they would be

able to protect these fragmented walnut woodland habitats from further residential encroachment. The 40-parcel recommendation also contains a section of vital walnut woodland located in the center of the park (Figure 28). These parcels would be extremely valuable for the MRCA to acquire due to the fact that these parcels not only contain and surround walnut woodland habitat, but also contain an Important Trail and lie adjacent to the MRCA's proposed 5-acre park. Acquisition of these parcels are a logical next step considering the proximity to the land that MRCA currently owns, and expanding park creation efforts to these nearby parcels is mitigated by distance.



30 15 0 30 Meters

- Coastal Sage Scrub mixed w/ Invasives
- Walnut Mixed w/ Other
- Walnut Woodland
- 40 Parcels
- MRCA Proposed Park
- Public Land



FIGURE 26: OUR 40-PARCEL RECOMMENDATION IN RELATION TO WALNUT WOODLAND DISTRIBUTIONS.



25 12.5 0 25 Meters

- Costal Sage Scrub mixed w/ Invasives
- Walnut Mixed w/ Other
- MRCA Proposed Park
- Walnut Woodland
- 40 Parcels
- Public Land



FIGURE 27: DISTRIBUTION OF WALNUT WOODLAND IN SOUTHEASTERN SECTION OF ELEPHANT HILL.



20 10 0 20 Meters

- Costal Sage Scrub mixed w/ Invasives
- Walnut Mixed w/ Other
- MRCA Proposed Park
- Walnut Woodland
- 40 Parcels
- Public Land



FIGURE 28: DISTRIBUTION OF WALNUT WOODLAND IN CENTER OF ELEPHANT HILL.

7. LAND MANAGEMENT RECOMMENDATIONS

In order for Elephant Hill to become an ecologically valuable, educational, beautiful, and inviting public park for the community, it must be managed in a way that promotes the growth of native vegetation while also reducing the risk of fire on site. Controlling these two factors will enhance the habitat value of the landscape and provide visitors with safe recreational opportunities, including hiking and wildlife viewing. There are numerous studies that provide insight as to how to effectively restore native habitats, such as walnut woodland and coastal sage scrub. However, restoration techniques are site-specific and a large habitat restoration plan is outside the scope of this project. Thus, in this report we will not go into detail about extensive restoration plans for native vegetation at Elephant Hill. We will instead discuss how to effectively manage the open space for fire risk in accordance with the MRCA's vision for Elephant Hill as an urban wildlands park, and how to engage the surrounding community in small restoration projects in order to improve rapport for Elephant Hill and increase awareness of the project.

We recommend the following steps be taken to manage Elephant Hill:

- 1) Stop discing for weed abatement.
- 2) Mow biannually in the winter and spring instead (specific timing is dependent on weather events and thus, should be at the direction of a restoration ecologist).
- 3) Utilize targeted applications of herbicide and hand-pulling, as necessary.
- 4) Involve the community in focused restoration efforts in accessible areas, such as entrances or along the public trails.

Fire is a natural part of the Mediterranean southern California landscape. The native vegetation is composed of assemblages of plants that are adapted to resprout and germinate after fire events. However, the natural fire regime has been impacted greatly due to anthropogenic influences over the past century (Naveh & Dan 1973; Naveh 1975; Minnich 1983; Moreno & Oechel 1993, 1994, 1995; Keeley *et al.* 1999; Pausas 1999; Franklin *et al.* 2001; Duren & Muir 2010). Fires have been suppressed due to the dangers they present to urban residents (Conard &

Weise 1995; Piñol *et al.* 2007; Fernandes 2013), and suppression practices have altered the naturally occurring composition of vegetation and increased the opportunity for the establishment of non-native annual grasses and forbs (Zedler 1995; Syphard *et al.* 2006; Cooper 2008). On Elephant Hill in particular, it is the disturbance caused by repeated discing for the Los Angeles City Weed Abatement Program that has prohibited the recruitment of native vegetation into historically disturbed soils.

For open spaces such as Elephant Hill, fires can have disastrous consequences. Fires cause significant impacts by burning vegetation, reducing wildlife habitat, and harming regional air and water quality. While the native vegetation communities that historically occurred on Elephant Hill, including coastal sage scrub and walnut woodlands, have fire-adapted traits and naturally re-establish following fire, the contemporary composition of vegetation on Elephant Hill is dominated by non-native trees, annual grasses, and mustards. After fire events, soil is left more vulnerable to colonization by invasive species than it would have been otherwise; water and sediment runoff also greatly increase, which reduce nutrient availability for any native plants attempting to grow (Keeley *et al.* 1999, and references therein; Cooper 2008). In urban open spaces, there are additional dangers produced by fire events. Fires can burn nearby homes and structures, potentially injuring residents and causing serious property damage, and soil erosion can cause damage to roads and homes as well (Barro 1991). The lack of deeply rooted native vegetation caused by past land use practices and likely short-return interval fire events have converted much of Elephant Hill into annual vegetation with shallow roots. As a result, the slopes are highly erosive, and during high rainfall events it is common for sediment to flow into city streets. This damage requires cleanup, which is a cost paid for by the city. These funds would be better spent stabilizing the soils to prevent future mudflows by improved weed abatement methods and restoration of the native habitat.

Climate change has and will continue to increase the likelihood of wildfires (Flannigan *et al.* 2000; Brown *et al.* 2004; Fried *et al.* 2004; Westerling *et al.* 2006; McKenzie *et al.* 2004; Soloman 2007; Miller *et al.* 2009), which spells disaster for a fire-prone landscape like that of southern California. Furthermore, many urban homeowners do not accurately perceive the level of fire risk where they live, nor do they understand its potential negative consequences (Gardner 1987). This means that homeowners on the edges of Elephant Hill may not be

effectively managing their property for fire risk at all, making fire risk management an even more important task.

There are many problems regarding fire risk and fuel management on Elephant Hill that need to be addressed. To tackle the negative consequences of discing, we have compiled research that highlights several alternative methods for fuel management as well as where and when they might be used on Elephant Hill. We have also created a simple and straightforward guide to fuel management for homeowners that own land on the edges of Elephant Hill so that they can actively participate in its restoration and help protect native vegetation on site. Finally, in order to engage the local community and maintain support for the project, we have outlined several ways that the community can help turn Elephant Hill into a native wildlands park.

7.1 LA COUNTY FUEL MODIFICATION GUIDELINES

When managing fire risk on site, there are guidelines set by the County of Los Angeles that must be followed. These guidelines have designated an area of “defensible space” surrounding roads and structures that is supposed to have little flammable vegetation, reducing the opportunity for direct sources of ignition and to provide fire fighters with room to protect structures during a fire. Flammable vegetation must be removed within 30 feet of buildings and within 10 feet of roads or fences, and it must be cut to less than 18 inches from the ground beyond the 30-foot mark until the 200-foot mark. Property owners must also trim trees up to 200 feet from structures so that no vegetation is within 6 feet of the ground. If the trees lie within 100 feet of any buildings or structures they must be spaced at least 18 feet apart. These distances, especially the outer 200-foot mark, are all subject to review by a fire marshal or forest ranger and can be modified if deemed necessary (County of Los Angeles Fire Department 2011). The guidelines also provide a list of plant species that are acceptable to plant in this “defensible space” that are less flammable, as well as a list of unacceptable species that should not be planted near homes or structures. Table 1 in Appendix 1 lists these unacceptable (or target) species, and Figures 1-3 in Appendix 2 show the acceptable plant species, both of which have been taken directly from the County of Los Angeles Fire Department guidelines. The target species that are present on Elephant Hill are the following:

- California sagebrush (*Artemisia californica*)

- Buckwheat (*Eriogonum fasciculatum*)
- Sage (*Salvia sp.*)

According to the guidelines, it is the responsibility of individual property owners to manage their land in accordance with these rules. For the MRCA 5-acre park, this means that any land within 10 feet of trails and roads would need to be cleared so that it is free of flammable vegetation. The MRCA would also be wise to eliminate any plants that are listed as target species, even if they are not within 200 feet of any buildings or structures, as these plants increase the overall fire risk on Elephant Hill. Yet much of the land that falls under the weed abatement requirements is privately owned. This land is supposed to be managed by the owner, but homeowners are not always knowledgeable about what to clear and how, especially when trying to incorporate the preservation of native vegetation. There are several homes located just south of a large patch of walnut woodland that is ideal for restoration, and it might be safer to place this land under the supervision of a trained restoration ecologist rather than several individual homeowners.

Some homeowners may not clear any flammable vegetation from their property at all, which could threaten Elephant Hill as a whole. Figure 30 shows a rough flyer we have put together for homeowners that own land on or adjacent to Elephant Hill. It contains simple steps for clearing vegetation and a list of plants that should be removed from their property with pictures so that homeowners can easily identify them. Homeowners with land on the edges of Elephant Hill will be able to use this guide to effectively reduce fire risk on their own, allowing the MRCA to focus their attention on their land parcels. For land that is near sensitive habitat, such as the walnut woodland patch in the southwest of Elephant Hill, the MRCA might try to contact homeowners and arrange a contract that gives them authority to manage their parcels for vegetation management. In general, urban homeowners prefer public resource managers to manage wildfire risk (Gardner 1987).

WHAT YOU NEED TO DO:

Clear any large plants, brush, or flammable materials within 30 feet of your home or any structures on your property
 → you can do this using a lawn mower or by hand
 → small shrubs from the LA County approved species list are acceptable

Remove large trees within 30 feet of your home
 Trim trees so that no leaves or branches are within 6 feet of the ground
 Space large trees at least 18 feet apart beyond 30 feet

Remove all target plant species and plant approved species instead
 → common target plant species with pictures shown below



Sagebrush

Buckwheat

Black Sage & White Sage

You can find a link to the LA County's list of approved plant species at the following link:
<http://fire.lacounty.gov/forestry/FuelModificationPlan.asp>

Contact MRCA at (555) 555-5555 if you have any questions or would like arrange a fuel and land management plan.

FIGURE 30. GUIDE TO FUEL MANAGEMENT AND VEGETATION REMOVAL FOR HOMEOWNERS THAT OWN PROPERTY ON OR NEAR ELEPHANT HILL.

7.2 DISCING ALTERNATIVES

In order to promote the native vegetation of Elephant Hill and reduce the erosion hazard, discing needs to be eliminated as a technique for fuel modification. Discing is currently the main method of fuel management used by the County of Los Angeles. Unfortunately, although discing is a commonly used method of controlling annual grasses, it has several unintended negative consequences. Discing overturns the soil and leaves the slopes vulnerable to erosion and colonization by invasive species, which reduces the native habitat cover each year (Cooper 2008; Keeley *et al.* 1999, and references therein). Annual grasses and mustards are the most common fire prone vegetation on site, which is typically disced twice per year in the spring. Some alternative methods to discing include prescribed fires, mowing, solarization, hand clearing strategies like weed whipping and herbicides, livestock use, and mulching. Each of these methods will be reviewed with regard to Elephant Hill.

Options that can be immediately eliminated for use on Elephant Hill are prescribed fires and solarization. Prescribed fires cannot be used because of their proximity homes and the dangers it poses (Potts & Stephens 2009). While solarization is effective at reducing weed cover in Mediterranean habitats, it is not a practical method of widespread weed removal for Elephant Hill due to the amount of equipment and labor required (Stapleton and DeVay 1986; Linke 1994; Tjamos *et al.* 2000). Table 2 provides estimated cost projections for three methods of weed removal, discing, mowing, and weed-eating.

TABLE 2. COMPARING THE COST OF DISCING, MOWING, AND WEED-EATING AS POSSIBLE METHODS TO REMOVE FLAMMABLE ANNUAL GRASSES.

Method	Non-prevailing wage	Prevailing wage
Discing	\$75 per acre	\$110 per acre
Mowing	\$85 per acre	\$135 per acre
Weed-eating	\$1,000 per acre	\$1,865 per acre

Mowing is the most practical replacement for discing. Unlike discing, mowing does not compromise soil integrity, which means that it is possible for more trees to recruit and grow in the area (Cooper 2008). If Elephant Hill is mowed, the soil root system would still be intact and restoration efforts would yield better results. The cost of mowing is also comparable to discing, which makes it an especially viable replacement. Mowing, like discing, may need to be done biannually in order to reduce non-native annual plant growth. Depending on the timing of rainfall in spring and the relative composition of grasses and broadleaf weeds each year, two rounds of mowing will likely be required. The two mowing events must be timed specifically to the growing cycle of the non-native plant species. Ideally, mowing would take place in early winter before annual grasses reach the “milk stage” – when viable seeds can form even if cut – and then again in late spring or early summer to manage new growth of grasses and broadleaf weeds. Due to current standards for reducing erosion, tractors cannot be used on slopes greater than 30° (Safford *et al.* 2009). The slopes in Elephant Hill are all less than 45°, which means that a flail mower can be used on most of the site when the equipment is driven by a qualified operator.

Hand clearing or weed-whipping have a high labor cost, but they are invaluable techniques on the steepest slopes and where cutting natives is to be avoided. While herbicides, such as glyphosate, can be used effectively to manage weeds, overspray can prevent native plants from flourishing (Cooper 2008). Therefore, herbicide use should be limited to management of areas dominated by non-native weeds without special status plant species that may be affected, or in targeted applications to control invasive species.

One interesting option for fuel management is to let livestock graze on site and remove unwanted grasses. Most of the successful programs that use livestock to reduce fire risk are already found in California (Davison 1996). In some applications, livestock is not much more expensive than other methods of fuel management (Davison 1996). The two animals that would be considered for use on Elephant Hill would likely be goats and sheep. Goats were shown to reduce the fuel load from understory vegetation in coastal woodlands of California (Tsiouvaras *et al.* 1989), while sheep were shown to reduce sagebrush cover (Davison 1996), which is one of the target species listed in the L.A. County Fire Department guidelines for fuel management. Sheep may be helpful in getting rid of this flammable species, but sagebrush is also part of the native habitat. This means that the only useful place to use sheep would be near private property

within the defensible space, which may arouse protest from the residents. However, in an urban wildland open space the size of Elephant Hill, livestock grazing is not expected to be cost-effective, given the intensive labor required by the livestock herder to ensure they are grazing at the appropriate intensity within discrete fuel management areas.

In summary, discing for fuel management should be replaced with mowing before seeds set and target herbicide application as necessary. The timely application of mowing and herbicide treatments will reduce fire risk in accordance with Los Angeles County guidelines while reducing the weed seed bank over time. Currently the land management practices used at Elephant Hill reflect a short-term approach to mitigating fire risk. We recommend that the managers take a more balanced long-term approach to management. Over the long run, these recommendations will reduce the weed seed bank, and if the soil is not unnecessarily disturbed, they will also reduce the cover of the highly flammable non-native annuals. Correspondingly, these recommendations will allow for the natural recruitment of select deeply rooted native perennial species, as well as provide effective weed management for future native habitat restoration efforts.

7.3 COMMUNITY RESTORATION OPPORTUNITIES

Direct participation in the improvements of Elephant Hill by the local community will help ensure long-term stewardship by the citizens of Los Angeles for the park. Community restoration events such as weeding, mulching, and native planting events will give interested members of the community an opportunity to directly contribute to the success of the park. These community events can also be used as educational opportunities to teach people more about nature in their urban wildlands. Knowledge about the nature of Elephant Hill enhances public enthusiasm, understanding, and support for the restoration of native habitat. The following describes restoration and weed management efforts that can be performed by volunteers. Community restoration efforts should be focused in small accessible areas, with oversight by MRCA-designed restoration leaders to ensure success and a positive learning experience for participants.

Perhaps the best volunteer opportunity for the community is plantings. Planting and seeding sites can be instrumental in establishing native vegetation communities. Coastal sage scrub species have been shown to require seeding in order to maintain a presence in disturbed habitats like that on Elephant Hill (Cione *et al.* 2002). People of all ages can participate in plantings (from young children distributing food and drinks to other volunteers, to adults and teens helping to dig holes), though decisions concerning the selection of the plant specimens and planting locations should be left to experts. Community members can also be assigned for post-planting tree care, including weeding, mulching, and watering events. Such long-term care provides a greater investment in the project, leading to greater support for native habitat restoration of Elephant Hill.

In order to reduce the success of non-native species on Elephant Hill, changing the conditions of the environment may be necessary. Some environmental parameters include the relative proportion of available nutrients in the soil and the composition of vegetation cover. Many of the non-native species are adapted to higher growth rates than native plants in southern California when sufficient nutrients and moisture is available in the soils (Padgett & Allen 1999; Allen *et al.* 2000). In the inland areas of southern California, air pollution deposits large amounts of inorganic nitrogen onto the soil, far above the natural levels of California's granitic soils (Allen *et al.* 2000; Allen 2004). As a result, some non-native species can out compete the natives on soils that would otherwise be relatively low in available nitrogen (Brooks *et al.* 2004). Bark

mulch has been shown to work well in reducing the high nitrogen levels in soils while promoting large shrub growth through changing the carbon-nitrogen ratio from decomposing organic matter. (Allen 2004). Mulch in general was shown to immobilize the amount of nitrogen available for uptake by invasive grasses without reducing the success of native shrubs (Zink & Allen 2002), and volunteers can easily help with its application. Berms of mulch can be built around young trees and shrubs and scattered in restoration areas. However, this effect was not shown to be a permanent one, and should be monitored and applied consistently to ensure efficiency (Cione *et al.* 2002). Mulch for these types of projects can also be obtained from the plant clippings created through mowing the site, reducing the overall cost of the operation. Mulch may be an effective method for tree plantings, especially walnuts, elderberries, coast live oaks, and coffee berries; however, use of mulch in areas designated to be restored through seeding should be avoided, as undesirable changes in the carbon-nitrogen ratio may result. This could prevent the establishment of seeds from successional species, which are important in modifying the soil environment to promote the establishment of longer-lived perennial species from seed. The experimental application of mulch may be considered if included in an appropriately designed study to assess the effectiveness of mulch application in restoration. Perhaps a focus on the restoration of walnut woodland understory species would be an opportunity for the application of mulch to manage non-native annual grasses, mustards, and thistles.

In addition to volunteer events, regular patrons of Elephant Hill can also perform some types of weed control and data collection during their visit. For weeds that cannot be removed by mass mechanical mowing (such as those found within woodland), visitors to the park can be encouraged to remove these invasive species through play. Smartphone applications and simple flyers or signs available at various points in the park can provide public education and entertainment by making a game out of collecting bundles of the hard-to-reach invasive plants. A simple weed control technique - regularly removing the photosynthetic parts of a weed during its growing season - has been shown to be effective in reducing the presence of an invasive weed in the Santa Ana Mountains by 95% in 1 to 2 years (DeSimone 2006). However, trial programs may be necessary as visitors may mistakenly or purposely destroy other plants not indicated in these games, such as recruiting natives. A high level of supervision may be necessary. Volunteers and park visitors can also participate in citizen science to help monitor the state of

Elephant Hill during and after restoration efforts. Bird watchers, reptile enthusiasts, and insect lovers can help note the presence of native faunal species and all visitors can be educated on the identification of native plants, collecting data for evidence of a healing ecosystem. This information can be distributed and collected through smartphone applications. Not only will these programs help restoration efforts on Elephant Hill, but will also enhance the entertainment and educational value of the site experience.

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APPENDIX 1

TABLE 1. COMMON AND SPECIES NAMES FOR TARGET PLANT SPECIES THAT THE LOS ANGELES COUNTY FIRE DEPARTMENT RECOMMENDS EXCLUDING FROM THE DEFENSIBLE SPACE SURROUNDING BUILDINGS AND STRUCTURES.

Algerian Ivy (<i>Hedera canariensis</i>)	Eucalyptus (<i>Eucalyptus</i> sp.)
Blue Gum (<i>Eucalyptus globulus</i>)	Fountain Grass (<i>Pennisetum setaceum</i>)
Brazilian Pepper Tree (<i>Schinus teribinthifolius</i>)	Hottentot Fig (<i>Carpobrotus edulis</i>)
Broom (<i>Cytisus</i> sp.)	Italian Jasmine (<i>Jasminum humile</i>)
Buckwheat (<i>Eriogonum fasciculatum</i>)	Juniper (<i>Juniperus</i>)
California Pepper Tree (<i>Schinus molle</i>)	Mexican Fan Palm (<i>Washingtonia robusta</i>)
California sagebrush (<i>Artemisia californica</i>)	Pampas grass (<i>Cortadera</i> sp.)
Canary Island Date Palm (<i>Phoenix canariensis</i>)	Periwinkle (<i>Vinca major</i>)
Cape Plumbago (<i>Plumbago auriculata</i>)	Pine (<i>Pinus</i> sp.)
Cape Honeysuckle (<i>Tecoma capensis</i>)	Red shank (<i>Adenostoma sparsifolium</i>)
Chamise (<i>Adenostoma fasciculatum</i>)	Rosemary (<i>Rosmarinus officinalis</i>)
Cypress (<i>Cupressus</i> sp.)	

APPENDIX 2

The following figures have been included from the directly from the County of Los Angeles Fire Department guidelines. The list groundcover, shrub, and tree plant species acceptable to plant in defensible space surrounding structures. The zones refer to distances from structures. Zone A refers to anything within 30 feet of structures, zone B is from 30 to 100 feet within structures, and zone C is the thinning zone between 100 and 200 feet of structures. Water needs values are very low (VL), low (L), medium (M), or high (H). Heights are measured in inches.

FIGURE 1.1: GROUNDCOVER PLANT SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Abelia grandiflora</i> 'Prostrata'	Prostrate Glossy Abelia	B	M	1 - 2'
<i>Acacia redolens</i> 'desert carpet'	Desert Carpet Acacia	B-30	L	2'
A. r. 'Low Boy'	Low Boy Acacia	B-30	L	3'
<i>Achillea tomentosa</i>	Woolly Yarrow	A,B	L	6 - 10"
<i>Aeonium</i> species	NCN	A,B	L	varies
<i>Ajuga reptans</i>	Carpet Bugle	A,B	H	4 - 6"
<i>Arctostaphylos edmundsii</i>	Little Sur Manzanita	B-30	L,VL	1 - 2'+
A. 'Emerald Carpet'	Emerald Carpet Manzanita	B	L,VL	1'
A. <i>hookeri</i> 'Monterey Carpet'	Monterey Manzanita	B	L	1-2'
A. 'Pacific Mist'	NCN	B	L	1-2'
<i>A. uva-ursi</i>	Bearberry	B	L	6-12"+
<i>Artemisia californica</i> 'cultivars'	Sagebrush - Prostrate Forms	B-30	L,VL	varies
A. <i>caucasica</i>	Silver Spreader	A,B	L,VL	3-6"
<i>Baccharis pilularis</i> 'Pigeon Point'	Dwarf Coyote Brush	B	L,VL	12-24"
B.p. 'Twin Peaks'	Dwarf Coyote Brush	B	L,VL	12-24"
<i>Ceanothus gloriosus</i>	Point Reyes Ceanothus	B	L	1-2'
<i>Cerastium tomentosum</i>	Snow-In-Summer	A,B	M,L	6-8"
<i>Chamaemelum nobile</i>	Chamomile	A,B	M	6-8"
<i>Cistus salvifolius</i>	Sageleaf Rockrose	B	L,VL	1-2'
C. 'Sunset'	Rockrose	B	L,VL	1-2'
C. 'Warley rose'	Rockrose	B	L,VL	1'
<i>Coprosma kirkii</i>	NCN	B	M,L	-2'
<i>Coreopsis auriculata</i> 'Nana'	NCN	A,B	L,VL	5-8"
<i>Cotoneaster adpressus praecox</i>	Cotoneaster	B	M,L	-18"
C. <i>salicifolius</i> 'Emerald Carpet'	Prostrate Willowleaf Cotoneaster	B	M,L	12-15"
<i>Dalea greggii</i>	Trailing Indigo Bush	B	L,VL	12-16"
<i>Delosperma alba</i>	White Training Ice Plant	A,B	L	-12"
<i>Dichondra micrantha</i>	Dichondra	A,B	H,M	-6"
<i>Drosanthemum floribundum</i>	Rosea Ice Plant	A,B	L	-12"
<i>Duchesnea indica</i>	Indian Mock Strawberry	A,B	L	-8"
<i>Dymondia margaretae</i>	NCN	A,B	M,L	-3"
<i>Erigeron glaucus</i>	Seaside Daisy	A,B	M,L	10-12"
E. <i>karvinskianus</i>	Santa Barbara Daisy	B	M,L	10-20"
<i>Euonymus fortunei</i> 'Colorata'	Purple-Leaf Winter Creeper	B	M	1-2'
<i>Festuca glauca</i> (cinerea)	Blue Fescue	A,B	M,L	-12"
F. <i>rubra</i>	Red Fescue	A,B	M,L	-16"
<i>Fragaria chiloensis</i>	Wild Strawberry	A,B	L,VL	6-12"
<i>Gazania</i> Hybrids	Trailing Gazania	A,B	M,L	6-10"
<i>Geranium incanum</i>	Cranesbill	A,B	M,L	-12"
<i>Glechoma hederacea</i>	Ground Ivy	A,B	M	3-6"
<i>Helianthemum nummularium</i>	Sunrose	A,B	M	6-8"
<i>Herniaria glabra</i>	Green Carpet	A,B	M	2-3"
<i>Heuchera</i> Species	Coral Bells	A,B	M,L	6'-2'
<i>Hypericum calycinum</i>	Aaron's Beard	B	M,L	6-12"

FIGURE 1.2: GROUND COVER PLANT SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>H. coris</i>	St. Johnswort	B	M,L	6-12"
<i>Iberis sempervirens</i>	Evergreen Candytuft	A,B	M	6-12"
<i>Iva hayesiana</i>	Poverty Weed	B-30	L,V,L	2-3'
<i>Juniperus conferta</i> & cultivars	Shore Juniper	B	L	1'
<i>J. horizontalis</i> & cultivars		B	L	1'
<i>Laurentia fluvialifilis</i>	Blue Star Creeper	A	M	2-4"
<i>Lysimachia nummularia</i>	Moneywort	A	H,M	2-6"
<i>Liriope spicata</i>	Creeping Lily Turf	A,B	M	12"
<i>Mahonia aquifolium</i> 'Compacta'	Compact Oregon Grape	B	M,L	1-2'
<i>M. repens</i>	Creeping Mahonia	B	M,L	2-3'
<i>Myoporum</i> 'Pacificum'	Pacific Myoporum	B	M,L	2-3'
<i>M. parvifolium</i>	NCN	A,B	M,L	-6"
<i>M. p.</i> 'Putah Creek'	NCN	B	M,L	1'
<i>Oenothera berlandieri</i>	Mexican Evening Primrose	B	L,V,L	10-12"
<i>O. stubbel</i>	Baja Evening Primrose	A,B	L,V,L	5"
<i>Ophiopogon japonicus</i>	Mondo Grass	A,B	M	8-12"
<i>Pelargonium peltatum</i>	Ivy Geranium	A,B	M	-2'
<i>P. tomentosum</i>	Silver Spreader	A,B	M	-18"
<i>Persicaria capitata</i>	Pink Clover	A,B	M,L	-18"
<i>Phyla nodiflora</i> (<i>Lippia repens</i>)	Lippia	A,B	M,L	2-15"
<i>Potentilla tabernaemontani</i>	Spring Cinquefoil	A,B	M,L	2-6"
<i>Ribes viburnifolium</i>	Catalina Perfume	B	L,V,L	-3'
<i>Rosmarinus officinalis</i>				
R.o. 'Huntington Carpet (Blue)'	NCN	B-30	L	-18"
R.o. 'Prostratus'	Prostrate Rosemary	B-30	L	-24"
<i>Salvia sonomensis</i>	Creeping Sage	B	L	8-12"
<i>Scaevola</i> 'Mauve Clusters'	NCN	A,B	M,L	4-6"
<i>Sedum</i> species	Stonecrops	A,B	L,V,L	varies
<i>Senecio mandraliscae</i>	Chalksticks	A,B	M,L	-18"
<i>S. serpens</i>	Blue Chalksticks	A,B	M,L	-12"
<i>Soleirolia soleirolii</i>	Baby's Tears	A	H,M	3-6"
<i>Teucrium cossonii majoricum</i>	NCN	A,B	L	8"
<i>T. X lucidrys</i> 'Prostratum'	Prostrate Germander	A,B	M,L	4-6"
<i>Thymus praecox arcticus</i>	Mother of Thyme	A,B	M,L	2-6"
<i>T. pseudolanuginosus</i>	Woolly Thyme	A,B	M,L	2-3"
<i>Trachelospermum jasminoides</i>	Star Jasmine	A,B	M,L	-2'
<i>Trifolium fragiferum</i>	White Clover	A,B	M,L	6-15"
<i>Verbena X hybrida</i>	Garden Verbena	A,B	L,V,L	6-12"
<i>V. peruviana</i>	NCN	A,B	L,V,L	-8"
<i>V. pulchella gracilior</i>	Moss Verbena	A,B	L,V,L	12-15"
<i>Vinca minor</i>	Dwarf Periwinkle	A,B	M,L	12"
<i>Wedelia trilobata</i>	Wedelia	B	M,L	1-2'
<i>Zoysia tenuifolia</i>	Korean Grass	A	M,L	-6"

FIGURE 2.1: SHRUB SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Abelia grandiflora</i>	Glossy Abelia	A,B-10	M	8'
A. g. 'Prostrata'	Prostrate Glossy Abelia	A,B-5	M	2'
<i>Abutilon hybridum</i>	Flowering Maple, Chinese Lantern	A,B-10	M	10'
<i>Acanthus mollis</i>	Bear's Breech	A,B	H,M	4'
<i>Achillea filipendulina</i>	Fernleaf Yarrow	A,B	L,VL	4-5'
A. millefolium	Common Yarrow	A,B	L,VL	3'
<i>Aeonium</i> species	NCN	A,B	L	varies
<i>Agapanthus</i> species	Lily-Of-The-Nile	A,B	M	varies
<i>Agave</i> species	Agave	A,B	L,VL	varies
<i>Alocasia macrorrhiza</i>	Elephant's Ear	A,B	H	5'
<i>Aloe</i> species	Aloe	A,B	L,VL	varies
<i>Alyogyne huegelii</i>	Blue Hibiscus	A,B-5	M,L	5-8'
<i>Anigozanthos flavidus</i>	Kangaroo Paw	A,B	M,L	3-5'
A. manqlesii	NCN	A,B	M,L	3'
<i>Arbutus unedo</i> 'Compacta'	Dwarf Strawberry Tree	A,B-5	M,L	6-8'
A.u. 'Elfin King'	Elfin King	A,B-5	M,L	3-5'
A.u. 'Oktoberfest'	NCN	A,B-5	M,L	6-8'
<i>Arctostaphylos</i> species	Manzanita	B	L,VL	varies
<i>Artemisia</i> 'Powis Castle'	NCN	B	L,VL	3'
A. stelleriana	Beach Worm Wood	B	L,VL	3'
<i>Aspidistra elatior</i>	Cast-Iron Plant	A,B	M,L	30"
<i>Aucuba japonica</i>	Japanese Aucuba, Gold Dust Plant	A,B-5	M,L	6-15'
<i>Baccharis</i> species	Various	B	L,VL	varies
<i>Begonia</i> species	Begonia	A,B	H,M	varies
<i>Berberis thunbergii</i>	Japanese Barberry	B	M,L	4-6'
B. thunbergii 'cultivars'		A,B	M,L	varies
<i>Bergenia crassifolia</i>	Winter Blooming Bergenia	A,B	M,L	20"
<i>Bougainvillea</i> sp.	Bougainvillea	B	L	varies
<i>Buddleja davidii</i>	Butterfly Bush	B	M,L	10'
<i>Buxus microphylla japonica</i>	Japanese Boxwood	A,B-5	M,L	4-6'
B.m. koreana	Korean Boxwood	A,B-5	M,L	4-6'
<i>Caesalpinia gilliesii</i>	Bird of Paradise Bush	A,B	L,VL	10'
C. mexicana	Mexican Bird of Paradise	A,B	L,VL	10-12'
C. pulcherrima	Red Bird of Paradise	A,B	L,VL	10'
<i>Calliandra californica</i>	Baja Fairy Duster	B	L,VL	8'
C. eriophylla	Fairy Duster	B	L,VL	3'
<i>Callistemon citrinus</i> 'compacta'	Bottlebrush	B	L,VL	8'
C. viminalis "Little John"	NCN	A,B-10	L	5'
<i>Calycanthus occidentalis</i>	Spice Bush	B	M,L	4-12'
<i>Carissa macrocarpa</i> (grandiflora)	Natal Plum	A,B-10	M,L	7+
C. m. 'cultivars'	Natal Plum	A,B-10	M,L	varies
<i>Carpenteria californica</i>	Bush Anemone	A,B-10	L,VL	6-8'
<i>Cassia</i> (Senna) <i>artemisioides</i>	Feathery Cassia	A,B-10	L,VL	3-6'
<i>Ceanothus</i> species	Wild Lilac	B-30	L,VL	varies
<i>Cercocarpus betuloides</i>	Mountain Mahogany	B-30	L,VL	5-12'
<i>Choisya ternata</i>	Mexican orange	B	M	6-8'

FIGURE 2.2: SHRUB SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Cistus</i> species	Rockrose	A,B-10	L,VL	varies
<i>Clivia miniata</i>	Clivia	A,B	H,M	2'
<i>Colocasia esculenta</i> (caladium)	Taro, Elephant's Ear	A,B	H	-6'
<i>Comarostaphylis diversifolia</i>	Summer Holly	B	L,VL	6-10'+
<i>Convolvulus cneorum</i>	Bush Morning Glory	B	L	2-4'
<i>Coprosma petriei</i> (pumila)	NCN	B	M	-3'
<i>C. repens</i>	Mirror Plant	B	M	-10'
<i>Cotoneaster</i> species & cultivars	Cotoneaster	B	M,L	varies
<i>Cotyledon</i> species	NCN	A,B	L	1-3'
<i>Crassula</i> species	NCN	A,B	L	1-9'
<i>Cuphea hyssopifolia</i>	False Heather	A,B	M	2'
<i>Cycas revoluta</i>	Sago Palm	A,B	M	8'
<i>Cyrtomium falcatum</i>	Holly Fern	A,B	H,M	2-3'
<i>Dasyliion longissimum</i>	Mexican Grass Tree	A,B-10	L,VL	-10'
<i>D. wheeleri</i>	Sotol	A,B-10	L,VL	-6'
<i>Dendromecon harfordii</i>	Island Bush Poppy	B	L,VL	8-20'
<i>Diets bicolor</i>	Fortnight Lily, African Iris	A,B	M,L	2-3'
<i>Diets iridioides</i>	Fortnight Lily, African Iris	A,B	M,L	3'
<i>Dodonaea viscosa</i>	Hopseed Bush	B	M,L	12-18'
<i>D. v. 'Purpurea'</i>	Purple Hopseed Bush	B	M,L	12-18'
<i>Elaeagnus pungens</i> & cultivars	Silverberry	B	M,L	6-15'
<i>Encelia californica</i>	Coast Sunflower	A,B-10	L,VL	3-5'
<i>E. farinosa</i>	Brittle Bush	B	L,VL	3-5'
<i>Eriogonum giganteum</i>	St. Catherine's Lace	B	L,VL	- 8'
<i>Escallonia</i> species	Escallonia	A,B-5	M,L	2-15'
<i>Euonymus japonica</i> & cultivars	Evergreen Euonymus	A,B	M	2-10'
<i>Euphorbia</i> species	Varies	A,B	M,L,VL	varies
<i>Euryops pectinatus</i>	NCN	A,B	M,L	6'
<i>Fatsia japonica</i>	Japanese Aralia	A,B	M	5-12'
<i>Fouquieria splendens</i>	Ocotillo	A,B	VL	8-25'
<i>Fremontodendron</i> species & cultivars	Flannel Bush	B	L,VL	5-20'
<i>Gardenia augusta</i> (jasminoides)	Gardenia	A,B	H	3-6'
<i>Garrya elliptica</i>	Coast Silktassel	B	M,L	4-8'
<i>Grevillea</i> species & cultivars	Grevillea	B	L,VL	varies
<i>Grewia occidentalis</i>	Lavender Starflower	A,B-10	M	6-10'
<i>Hakea suaveolens</i>	Sweet Hakea	B	L	10-20'
<i>Hebe</i> species & cultivars	Hebe	A,B-10	M	3-6'
<i>Helictotrichon sempervirens</i>	Blue Oat Grass	A,B-15	M	2-3'
<i>Hemerocallis</i> hybrids	Daylily	A,B	M,L	1-6'
<i>Hesperaloe parviflora</i>	Red Yucca	A,B	VL	3-4'
<i>Heuchera</i> Species	Coral Bells	A,B	M,L	6"-2'
<i>Hibiscus rosa - sinensis</i>	Chinese Hibiscus	A,B-5	M	-15'
<i>Ilex</i> species	Holly	B	M	varies
<i>Iris</i> species & varieties/cultivars	Bearded Iris	A,B	M	-30"
<i>I. douglasiana</i>	Douglas Iris	A,B	M,L	-2'
<i>Juniperus</i> species	Juniper	B	M,L,VL	varies

FIGURE 2.3: SHRUB SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Justicia brandegeana</i>	Shrimp Plant	A,B	M	3'
<i>J. californica</i>	Chuparosa	B	L,VL	2-5'
<i>Keckiella cordifolia</i>	Heart-Leaved Penstemon	B	L,VL	5-6'
<i>Kniphofia uvaria</i>	Red-Hot Poker	A,B	L	2-3'
<i>Lantana Camara & hybrids</i>	Lantana	A,B-10	M	varies
<i>Larrea tridentata</i>	Creosote Bush	B	VL	4-6'
<i>Lavandula angustifolia</i>	English Lavender	A,B-10	L	3-4'
<i>L. dentata</i>	French Lavender	A,B-10	L	3'
<i>L. intermedia</i>	Lavandin	A,B	L	1-2'
<i>L. stoechas</i>	Spanish Lavender	A,B-10	L	2-3'
<i>Lavatera assurgentiflora</i>	California Tree Mallow	B	L,VL	8-12'
<i>L. maritima</i>	Tree Mallow	A,B-10	M,L	8-12'
<i>Leonotis leonurus</i>	Lion's Tail	A,B-10	L	3-6'
<i>Leptospermum scoparium & varieties</i>	New Zealand Tea Tree	A,B-15	L,VL	10+
<i>L. s. varieties</i>	NCN	Varies	M-VL	varies
<i>Leucophyllum candidum</i>	Violet Silverleaf	A,B-10	L,VL	4-5'
<i>L. frutescens</i>	Texas Ranger	B	L,VL	6-8'
<i>L. laevigatum</i>	Chihuahuan Sage	A,B-5	L,VL	3-4'
<i>Ligustrum japonicum</i>	Wax-leaf Privet	A,B-10	M,L	10-12'
<i>Liriope muscari</i>	Big Blue Lily Turf	A,B	M	18"
<i>Lobelia laxiflora</i>	Mexican Bush Lobelia	A,B-5	M,L	2-3'
<i>Lupinus species</i>	Lupine	B	L,VL	varies
<i>Mahonia aquifolium</i>	Oregon Grape	A,B-10	M,L	6-8'
<i>Mahonia a. 'Compacta'</i>	Compact Oregon Grape	A,B	M,L	1-2'
<i>M. fremontii</i>	Desert Mahonia	B	L	3-12'
<i>M. 'Golden Abundance'</i>	NCN	A,B-5	M,L	5-6'
<i>M. lomariifolia</i>	Venetian Blind Mahonia	A,B	M,L	6-10'
<i>M. nevinii</i>	Nevin Mahonia	B-30	L	3-10'
<i>M. pinnata</i>	California Holly Grape	B	M,L	4-5'
<i>M. repens</i>	Creeping Mahonia	A,B	M,L	2-3'
<i>Malosma - See Rhus</i>				
<i>Malva species</i>	Mallow	A,B	L	varies
<i>Melaleuca nesophila</i>	Pink Melaleuca	A,B-10	L,VL	10-20'
<i>Mimulus species (Diplacus)</i>	Monkey Flower	B	L	1-4'
<i>Muhlenbergia rigens</i>	Deer Grass	A,B-10	L,VL	4'
<i>Myrica californica</i>	Pacific Wax Myrtle	B	M,L	10-15'+
<i>Myrsine africana</i>	African Boxwood	A,B-5	M	3-6'
<i>Myrtus communis 'compacta'</i>	Dwarf Myrtle	A,B-10	M	5-8'
<i>Nandina domestica</i>	Heavenly Bamboo	A,B	M	6-8'
<i>N.d. 'Compacta'</i>	NCN	A,B	M	4-5'
<i>N. d. 'Harbour Dwarf'</i>	Dwarf Heavenly Bamboo	A,B	M,L	1 1/2 -2'
<i>Nerium oleander</i>	Oleander	B	M,L	8-20'
<i>N.o. 'Petite Salmon'</i>	NCN	A,B-10	M	3-4'
<i>Opuntia species</i>	Prickly Pear, Cholla etc.	A,B	L,VL	varies
<i>Pelargonium species</i>	Geranium	A,B	M,L	varies
<i>Penstemon species</i>	Beard Tongue	A,B	L	varies

FIGURE 2.4: SHRUB SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Phlomis fruticosa</i>	Jerusalem Sage	A,B	M,L	3-4'
<i>Phoenix roebelenii</i>	Pygmy Date Palm	A,B	M,L	6-10'
<i>Phormium tenax</i>	New Zealand Flax	A,B	M	5-9'
P.t.'cultivars'	NCN	A,B	M	varies
<i>Photinia fraseri</i>	Photinia	B	M,L	10-15'
<i>Pittosporum tobira</i>	Tobira	A,B-10	M,L	6-15'+
P.t.'Variegata'	NCN	A,B-5	M	5-8'
P.t.'Wheeler's Dwarf'	Dwarf Pittosporum	A,B	M	1-3'
<i>Portulacaria afra</i>	Elephant's Food	A,B	L	5-12'
<i>Punica granatum 'Nana'</i>	Dwarf Pomegranate	A,B	L	3'
<i>Pyracantha species</i>	Firethorn	B	M	varies
<i>Rhamnus californica</i>	Coffeeberry	B	M,L	3-15'
R. <i>crocea</i>	Redberry	B	M,L	2-3'
R.c. <i>ilicifolia</i>	Hollyleaf Redberry	B	M,L	3-15'
<i>Rhaphiolepis indica</i>	India Hawthorn	A,B-5	M,L	4-8'
R.i.'cultivars'	NCN	A,B	M,L	varies
<i>Rhus integrifolia</i>	Lemonade Berry	B-40	L	3-10'+
R.(<i>Molosma</i>) <i>laurina</i>	Laurel Sumac	B-40	L	6-15'+
R. <i>ovata</i>	Sugar Bush	B-30	L	3-15'
<i>Ribes aureum</i>	Golden Currant	A,B-5	L	3-8'
R. <i>malvaceum</i>	Chaparral Currant	A,B-5	L	6-8'
R. <i>sanguineum</i> & cultivars	Red Flowering Currant	A,B-5	M,L	4-12'
R. <i>speciosum</i>	Fuchsia-Flowering Gooseberry	A,B-10	L	3-6'
R. <i>viburnifolium</i>	Catalina Perfume	A,B-10	L	3'
<i>Romneya coulteri</i>	Matilija Poppy	B	L	-8'
<i>Rosa species</i>	Rose	A,B	M	varies
<i>Rosmarinus officinalis</i> & cultivars	Rosemary	B	M,L	varies
<i>Salvia species</i> - native varieties	Sage	B	L,V,L	varies
<i>Salvia species</i> - ornamental varieties	Sage	A,B	M,L	varies
S. <i>greggii</i>	Autumn Sage	A,B	M,L	3-4'
S. <i>leucantha</i>	Mexican Bush Sage	A,B	L,V,L	3-4'
<i>Santolina chamaecyparissus</i>	Lavender Cotton	A,B	L	-24"
S. <i>rosmarinifolia</i> (<i>virens</i>)	Green Lavender Cotton	A,B	L	-24"
<i>Simmondsia chinensis</i>	Jojoba	B	L,V,L	3-8'+
<i>Strelitzia nicolai</i>	Giant Bird of Paradise	A,B	M	-30'
S. <i>reginea</i>	Bird of Paradise	A,B	M	5'
<i>Tibouchina urvilleana</i>	Princess Flower	A,B-10	M	5-18'
<i>Trichostema lanatum</i>	Woolly Blue Curls	B	L,V,L	3-5'
<i>Tulbaghia violacea</i>	Society Garlic	A,B	M	18'
<i>Viburnum species</i>	Viburnum	A,B-10	M	varies
<i>Westringia fruticosa</i>	Coast Rosemary	A,B-10	M,L	5-7'
<i>Xylosma congestum</i>	Shiny Xylosma	A,B-10	M,L	15'+
X.c. 'Compacta'	Compact Xylosma	A,B-5	M,L	8-12'
<i>Yucca species</i>	Yucca	B	L,V,L	varies
<i>Zantedeschia aethiopica</i>	Calla Lilly	A,B	H,M	2-4'
<i>Zauschneria californica</i>	California Fuchsia	B	L,V,L	1-3'

FIGURE 3.1: TREE SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Acacia farnesiana</i>	Sweet Acacia	A,B-15	L	15-20'
<i>A. greggii</i>	Catclaw Acacia	B	L,VL	15-25'
<i>A. salicina</i>	Willow Acacia	A,B-15	L	15-35'
<i>A. smallii</i>	NCN	A,B-15	L,VL	15-20'
<i>A. stenophylla</i>	Shoestring Acacia	A,B-15	M,L	20-45'
<i>Acer macrophyllum</i>	Bigleaf Maple	B	M	30-95'
<i>A. negundo</i>	Box Elder	B	M,L	-60'
<i>A. palmatum</i>	Japanese Maple	A,B	M	-20'+
<i>A. saccharinum</i>	Silver Maple	B-30	M	40-100'
<i>Aesculus californica</i>	California Buckeye	B	M,L	20+
<i>Agonis flexuosa</i>	Peppermint Tree	B	M,L	25-35'
<i>Albizia julibrissin</i>	Silk Tree	B	M	-40'
<i>Alnus cordata</i>	Italian Alder	B	M	40'
<i>A. rhombifolia</i>	White Alder	B	H,M	50-90'
<i>Arbutus 'Marina'</i>	NCN	A,B-15	M,L	-40'
<i>A. unedo</i>	Strawberry Tree	A,B-10	M,L	12-35'
<i>Archontophoenix cunninghamiana</i>	King Palm	A,B	M	50'
<i>Bauhinia variegata</i>	Purple Orchid Tree	B	M	20-35'
<i>Betula pendula</i>	European White Birch	A,B-10	M	30-40'
<i>Brachychiton acerifolius</i>	Flame Tree	B	L	60'
<i>B. populneus</i>	Kurrajong Bottle Tree	B	L	30-50'
<i>Brahea armata</i>	Blue Hesper Palm	A,B-10	L,VL	40'
<i>B. edulis</i>	Guadalupe Palm	A,B	L,VL	30'
<i>Butia capitata</i>	Pindo Palm	A,B-10	M,L	10-20'
<i>Callistemon citrinus</i>	Lemon Bottlebrush	B	M,L	-25'
<i>C. viminalis</i>	Weeping Bottlebrush	A,B-10	M,L	20-30'
<i>Calocedrus decurrens</i>	Incense Cedar	B	L,VL	75+
<i>Calodendrum capense</i>	Cape Chestnut	B	M	30'
<i>Carya illinoensis</i>	Pecan	B	M,L	70'
<i>Cedrus deodara</i>	Deodar Cedar	B-30	M,L	60-80'
<i>Ceratonia siliqua</i>	Carob	B-30	M,L	30-40'
<i>Cercidium floridum</i>	Blue Palo Verde	A,B	L,VL	30'
<i>C. microphyllum</i>	Littleleaf Palo Verde	A,B	L,VL	25'
<i>Cercis occidentalis</i>	Western Redbud	A,B-10	M,L	20'
<i>Chamaerops humilis</i>	Mediterranean Fan Palm	A,B	M	20'
<i>Chilopsis linearis</i>	Desert Willow	A,B-15	L	-35'
<i>Chionanthus retusus</i>	Chinese Fringe Tree	A,B	M	20'
<i>Chitalpa X tashkentensis</i>	Chitalpa	A,B	M,L	20-30'
<i>Chorisia speciosa</i>	Floss Silk Tree	B	M	30-60'
<i>Cinnamomum camphora</i>	Camphor Tree	B-30	M,L	50'+
<i>Citrus species</i>	Citrus	A,B	M	varies
<i>Cocculus laurifolius</i>	Laurel Leaf Snail Seed	B	M	25'
<i>Cordyline australis</i>	Giant Dracaena	A,B	M	30'
<i>Cupressus macrocarpa</i>	Monterey Cypress	B-30	M	40'+
<i>Cyathea cooperi</i>	Australian Tree Fern	A,B	M	20'
<i>Dicksonia antarctica</i>	Tazmanian Tree Fern	A,B	M	15'
<i>Dracaena draco</i>	Dragon Tree	A,B	M,L	20'
<i>Eriobotrya deflexa</i>	Bronze Loquat	A,B-10	M,L	20'
<i>Erythrina species</i>	Coral Tree	B	M,L	varies
<i>Eucalyptus citriodora</i>	Lemon-scented Gum	B	M,L	75-100'

FIGURE 3.2: TREE SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>E. maculata</i>	Spotted Gum	B-30	M.L	60-80'
<i>E. nicholii</i>	Willow Peppermint	B-30	M.L	-40'
<i>E. sideroxylon</i>	Red Ironbark	B	ML	35-60'
<i>E. torquata</i>	Coral Gum	A,B-15	M.L	-25'
<i>Feijoa sellowiana</i>	Pineapple Gusva	A,B	M.L	18-25'
<i>Ficus species</i>	Fig	B-	M.L	varies
<i>Fraxinus augustifolia</i>	Raywood Ash	B	M	25+35'
<i>F. dipetala</i>	Foothill Ash	B	L.VL	18-20'
<i>F. latifolia</i>	Oregon Ash	B	M	40-80'
<i>F. velutina</i>	Arizona Ash	B	M.L	20-50'
<i>F.v. Coriacea</i>	Montebello Ash	B	M.L	20-40'
<i>Geijera parviflora</i>	Australian Willow	A,B-15	M.L	25-30'
<i>Ginkgo biloba</i>	Maidenhair Tree	A,B-15	M.L	35-80'
<i>Gleditsia triacanthos</i>	Honey Locust	A,B-15	M.L	35-70'
<i>Grevillea robusta</i>	Silk Oak	B	M	60'+
<i>Heteromeles arbutifolia</i>	Toyon	A,B-15	L.VL	15-30'
<i>Hymenosporum flavum</i>	Sweetshade Tree	A,B	M.L	20-40'
<i>Jacaranda mimosifolia</i>	Jacaranda	B	M.L	25-40'
<i>Juglans californica</i>	Southern California Black Walnut	B	L	20-35'
<i>Koelreuteria bipinnata</i>	Chinese Flame Tree	B	M	20-40'
<i>K. paniculata</i>	Golden Rain Tree	B	M.L	20-35'
<i>Lagerstroemia indica</i>	Crape Myrtle	A,B	M.L	-30'
<i>Laurus nobilis</i>	Sweet Bay	B	M	20-40'
<i>Leptospermum laevigatum</i>	Australian Tea Tree	A,B-15	L.VL	10-30'
<i>Liquidambar formosana</i>	Chinese Sweet Gum	A,B-15	M	40-60'
<i>L. styraciflua</i>	American Sweet Gum	A,B-15	M	60'
<i>Liriodendron tulipifera</i>	Tulip Tree	B	M	60-80'
<i>Lithocarpus densiflorus</i>	Tanbark Oak	B	L	-60'
<i>Lophostemon(Tristania) confertus</i>	Brisbane Box	A,B-15	L.VL	30-60'
<i>Lyonothamnus floribundus</i>	Catalina Ironwood	A,B-15	M	20-35'
<i>Magnolia grandiflora</i>	Southern Magnolia	B	M	60-80'
<i>M. X soulangeana</i>	Saucer Magnolia	A,B	M	15-25'
<i>Maytenus boaria</i>	Mayten Tree	A,B-10	M.L	30-50'
<i>Melaleuca quinquenervia</i>	Cajeput Tree	A,B-15	M.L	20-40'
<i>Metasequoia glyptostroboides</i>	Dawn Redwood	A,B-15	H.M	-60'
<i>Metrosideros excelsa</i>	New Zealand Christmas Tree	A,B-10	L.VL	-30'
<i>Morus alba</i>	White Mulberry	B	M.L	20-60'
<i>Olea europaea</i>	Olive - Fruitless varieties only	A,B-15	L.VI	-35'
<i>Parkinsonia aculeata</i>	Jerusalem Thorn	A,B-10	L.VL	15-30'
<i>Phoenix dactylifera</i>	Date Palm	B	M.L	80'
<i>Pinus species</i>	Pine	B-75	L.VL	varies
<i>Pistacia chinensis</i>	Chinese Pistache	B	M.L	-60'
<i>Pittosporum phillyreoides</i>	Willow Pittosporum	A,B	L	15-25'
<i>P. rhombifolium</i>	Queensland Pittosporum	A,B	M	15-35'
<i>Platanus racemosa</i>	California Sycamore	B	L	50-100'
<i>Podocarpus gracilior</i>	Fern Pine	B	M	-60'
<i>P. macrophyllus</i>	Yew Pine	B	M	-50'
<i>Populus fremontii</i>	Fremont Cottonwood	B	M	40-60'
<i>Prosopis chilensis</i>	Chilean Mesquite	B	L	30-50'
<i>P. glandulosa</i>	Honey Mesquite	A,B-15	L.VL	25-30'

FIGURE 3.3: TREE SPECIES ACCEPTABLE TO PLANT IN DEFENSIBLE SPACE SURROUNDING STRUCTURES.

BOTANICAL NAME	COMMON NAME	ZONE	WATER NEEDS	HEIGHT
<i>Prunus cerasifera</i> 'Atropurpurea'	Purple-leaf Plum	A,B-10	M,L	25'
<i>P. ilicifolia</i>	Hollyleaf Cherry	A,B-15	L,VL	15-30'
<i>Punica granatum</i>	Pomegranate	A,B-10	L	12-18'
<i>Pyrus calleryana</i> & cultivars	Ornamental Pear	A,B-15	M	varies
<i>P. Kawakamii</i>	Evergreen Pear	A,B-10	M	15-30'
<i>Quercus agrifolia</i>	Coast Live Oak	B-30	L,VL	30-70'
<i>Q. chrysolepis</i>	Canyon Live Oak	B-30	M,L	30-60'
<i>Q. douglasii</i>	Blue Oak	B-30	M	50'
<i>Q. engelmannii</i>	Engelmann Oak	B-30	I	60'
<i>Q. ilex</i>	Holly Oak	B-30	M	40-70'
<i>Q. kelloggii</i>	California Black Oak	B	M	30-80'
<i>Q. lobata</i>	Valley Oak	B-30	L,VL	70'+
<i>Q. palustris</i>	Pin Oak	B-30	M	50-80'
<i>Q. rubra</i>	Red Oak	B-30	M	60-75'
<i>Q. suber</i>	Cork Oak	B-30	M	70-100'
<i>Q. virginiana</i>	Southern Live Oak	B-30	M,L	60'
<i>Q. wislizenii</i>	Interior Live Oak	B	M,L	30-75'
<i>Rhus lancea</i>	African Sumac	A,B-15	L	20-30'
<i>Robinia ambigua</i>	Locust	B	M,L	30-50'
<i>Sapium sebiferum</i>	Chinese Tallow Tree	B	M	-35'
<i>Schefflera actinophylla</i>	Queensland Umbrella Tree	A,B	H,M	20'+
<i>S. pueckleri</i>	Tupidanthus	A,B	H,M	20'+
<i>Sophora japonica</i>	Japanese Pagoda Tree	B	M	30-50'
<i>Stenocarpus sinuatus</i>	Firewheel Tree	A,B-10	M	30'
<i>Syagrus romanzoffianum</i>	Queen Palm	A,B	M	50'
<i>Tabebuia chrysotricha</i>	Golden Trumpet Tree	A,B-15	M	25-30'
<i>T. impetiginosa</i>	Pink Trumpet Tree	A,B-15	M	35'
<i>Taxodium mucronatum</i>	Montezuma Cypress	B	H-L	75'
<i>Tipuana tipu</i>	Tipu Tree	B	M	-50'
<i>Trachycarpus fortunei</i>	Windmill Palm	A,B	M	-30'
<i>Umbellularia californica</i>	California Bay	B	L,VL	30-75'
<i>Washingtonia filifera</i>	California Fan Palm	B-30	M-VL	60'
<i>Zelkova serrata</i>	Sawleaf Zelkova	B	M	60'
<i>Ziziphus jujuba</i>	Chinese Jujube	A,B-15	M,L	20-30'