Land Management Tasks

[I] Treat catclaw vine throughout. High priority

[R] Maintain and expand wetland restoration project at mouth of Blunn Creek. High priority

[R & I] Maintain plantings near Boardwalk and keep free of invasive species. High priority

[R] Install sediment capture structures and plant aquatic species to increase aquatic plant diversity. Medium priority

[R] Increase diversity of existing woodland. Medium priority

[I] Control invasive plants on steep slopes using caution not to create erosion problems. Medium priority

Figure 4.45 (Above, left): The exposed rock cliffs in this unit are unique within the study area. Figure 4.46 (Above, right): Many plantings have recently been added to the wetland surrounding the mouth of Blunn Creek. Figure 4.47(Below, left): Invasive species, erosion issues, and recommended restoration work in the The Cliffs Unit. Sources: COA, NAIP. Figure 4.48 (Below, right): The largest infestation of catclaw vine in the study area is found in The Cliffs.

SOUTHCENTRAL SHORE UNIT

The Southcentral Shore Unit is bound by the Lake on the north, the western end of the Boardwalk on the east, the Austin American Statesman and apartments on the south, and the 1st Street Bridge on the west (Figure 4.49). It includes the viewing area for the bat colony at the Congress Avenue Bridge, and portions of the unit are part of Auditorium Shores at Lady Bird Lake Metro Park. The study area is 3.3 acres, with recommendations here for 3 acres. Recommendations are also made for an additional 2.8 acres that are adjacent to the study area and 0.7 acres of aquatic restoration (Figure 4.53).

Ecology

The Southcentral Shore Unit is currently an extremely narrow unit that encompasses a thin shoreline woodland running its length. This narrowness is due to the fact that this section of the Trail runs through an easement on private property rather than through public parkland (Figure 4.50). Though it is narrow, the woodland makes up 2 acres. Bald cypress is the dominant overstory tree, making up over half of the trees surveyed. The vast majority of the trees in the unit are considered shoreline trees, for a total of 6.8 trees per 100 ft of shoreline. Though the number of trees in the area is comparable to other units, the basal area is relatively high due to the high number of large bald cypress. The understory in the woodland is variable. There are pockets of comparatively intact native understory and groundcover, consisting of yaupon holly, trumpet vine, and native grasses and sedges. In most areas, however, native understory is lacking except for the ubiquitous presence of poison ivy. The eastern end of the management unit has good natural tree regeneration with live oak, Spanish oak, and bald cypress trees all becoming established.

West of Congress Avenue, the Trail runs alongside a lawn maintained by the Hyatt, and the narrow strip between the Trail and the armored bank is primarily occupied by palms and common chaste tree. This

Table 4.14: Tree summary for all trees ≥8" diameter in the Festival Beach Unit.

Tree Summary

Unit area	3.3 acres
Total trees	276
Trees/acre	83
Basal area	190 ft²/acre
Average diameter	19"
Protected tree count	118
Heritage Tree count	62
Trees/100' of shoreline	6.8
Canopy cover	66%
Shaded trail	69%
Woodland area	2.0 acres
Trees/acre in woodland	120
Non-woodland area	1.4 acres
Trees/acre non-woodland	29

Figure 4.49: Southcentral Shore Management Unit Boundaries. Sources: CAO, NAIP.

area is one of the largest bottlenecks along the Trail, with the width reducing to 6ft and containing numerous congestion-inducing turns.

Invasive Species

Ligustrum, golden rain tree, Chinese lacebark elm, and Chinaberry are concerns in this area. Ligustrum and golden rain tree both form near monocultures in portions of the understory. Both golden rain tree and Chinese lacebark elm are abundant in several management units on the northern shore, but are uncommon on the southern shore other than in this unit. Chinaberry is present throughout, but is most abundant in the eastern portion of the unit. Common chaste tree is also abundant along the shoreline in the eastern portion of the unit. Sweet autumn clematis is also found in patches throughout much of the unit, especially in the section between Congress Avenue and South 1st Street.

Figure 4.50: In this unit, the Trail runs through a narrow easement on private property.

Disturbance

There are several major areas of granite deposition into the riparian area between Congress Avenue and the Boardwalk, like the one shown in Figure 4.51. Informal trails and concrete slabs are scattered throughout the area, with major issues near Congress Avenue, where severe trampling is leading to sheet erosion.

Management Recommendations

Though the area is narrow, changes to the hardscape and the vegetation would make substantial improvements to the aesthetics and functionality of the Trail. This is especially true near the Hyatt, where congestion can be alleviated with relatively minor changes in some cases and more substantial changes in others. From Congress to the Boardwalk, underutilized mowed areas like that in Figure

Figure 4.51: Trail erosion is damaging the thin strip of vegetation between the Trail and Lake.

4.52 can be converted to woodland by the City or by landowners. The live oak grove pointed out in Don Gardner's report near and to the east of the Austin American Statesman building should be pruned. Invasive species removal with a focus on Ligustrum, golden rain tree, and Chinaberry as well as planting and seeding are recommended. Trail stabilization is essential for the area from the Boardwalk to Congress.

Land Management Tasks

[E & U] Stabilize crushed granite trail to eliminate granite deposition off-trail. **High priority**

[I] Remove Ligustrum, golden rain tree, and Chinaberry. **High priority**

[U & R] Work with landowners and city planners to expand riparian woodland and reduce hardscape bottlenecks for Trail users. **High priority**

[R] Prune live oak grove designated by Don Gardner. **High priority**

[R] Expand woodland throughout. **Medium priority**

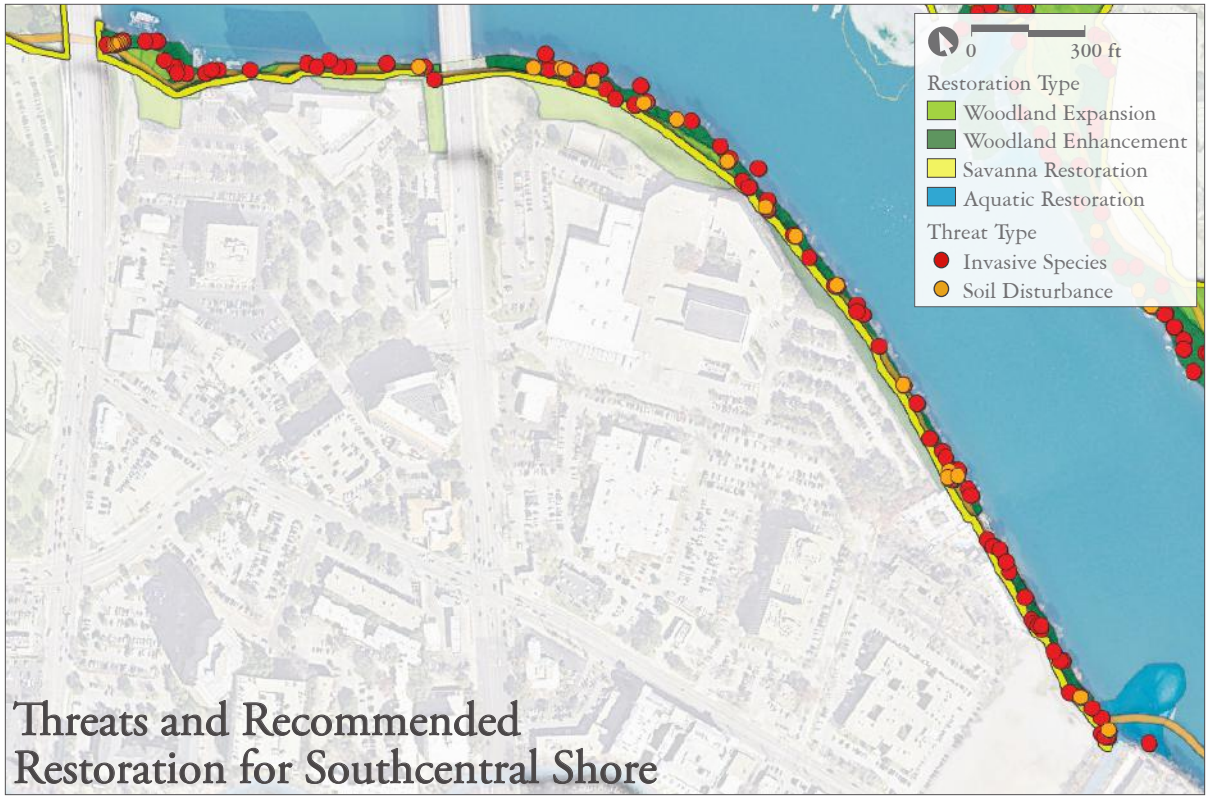
[R] Increase understory and herbaceous layers throughout. **Medium priority**

[E & U] Decommission informal trails and informal water access points with a combination of brushing, soil decompaction, and planting of tree seedlings. **Medium priority**

[U & E] Coordinate with Watershed Protection Department to determine need for and proper location of water access. **Medium priority**

Figure 4.52: The woodland can be expanded into mowed areas.

Figure 4.53: Invasive species, erosion issues, and recommended restoration work in Southcentral Shore. Sources: COA, NAIP.



AUDITORIUM SHORES UNIT

The Auditorium Shores Unit stretches from South 1st Street to the Mouth of West Bouldin Creek, with the Lake on the north side (Figure 4.54). The unit consists of 3.7 acres with recommendations for 1.2 acres (Figure 4.57). The unit contains only the narrow riparian strip between the Trail and the Lake, as numerous improvements are being made to the area through the implementation of the Auditorium Shores Master Plan.

Ecology

None of the area being evaluated is currently woodland. The far western end of the unit contains bald cypress, American elm, and hackberry, but is so small that it is not classified as a woodland. The area also contains elderberry and smooth horsetail, both of which are relatively uncommon in the study area. There are only 3.1 trees per 100 ft of shoreline in the unit, a relatively low density of trees.

Invasive Species

Chinaberry is present throughout much of the unit, but at relatively low density. There are several patches of Johnsongrass and sweet autumn clematis along the shoreline, and elephant ear is present at the eastern end of the unit.

Disturbance

Trampling and informal trails are substantially impacting much of the unit, causing major erosion and compaction issues throughout. The frequently used dog water access point shown in figure 4.55 is one of the most heavily trampled areas. Additionally, runoff from the mowed upland areas is causing extreme erosion of trail material despite recent resurfacing of the Trail (Figure 4.56). Several portions of the Trail are poorly drained and hold water after rain events, causing users to create informal trails around the water.

Tree Summary

Unit area	3.7 acres	Heritage Tree count	9
Total trees	99	Trees/100' of shoreline	3.1
Trees/acre	26	Canopy cover	40%
Basal area	46 ft²/acre	Shaded trail	25%
Average diameter	16"	Non-woodland area	3.7 acres
Protected tree count	27		

Table 4.15: Tree summary for all trees ≥8" diameter in the Auditorium Shores Unit.

Figure 4.54: Auditorium Shores Management Unit Boundaries. Sources: CAO, NAIP.

Management Recommendations

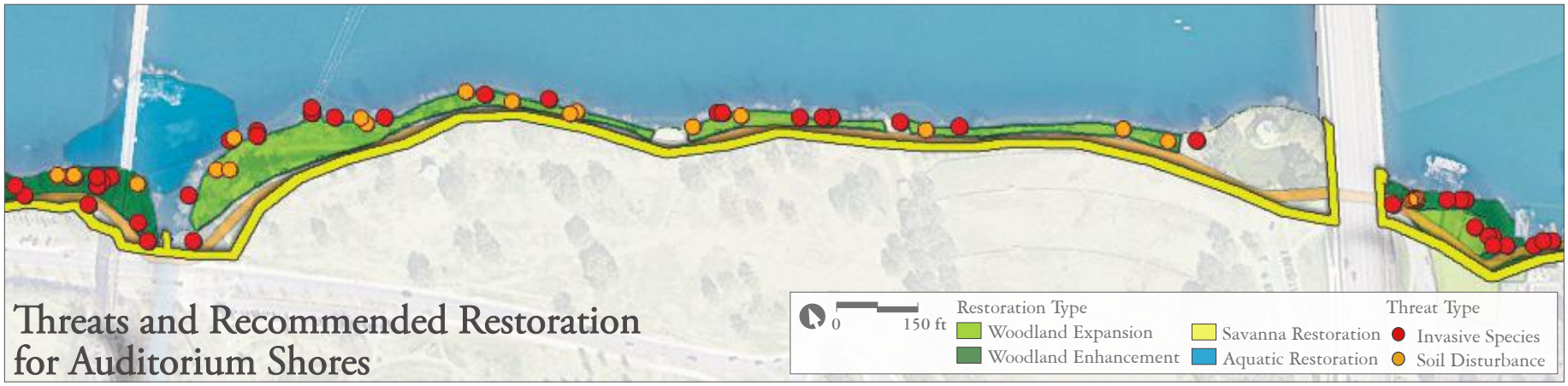
This management unit and the adjacent lawn are currently undergoing a significant renovation through the implementation of the Auditorium Shores master plan. Management activities for this area should complement the master plan implementation. Special attention should be paid to the shoreline, formalized water access, and plantings that will mitigate and prevent trampling issues. Ongoing monitoring, woodland enhancement, and woodland expansion in this unit should be equivalent to those mentioned throughout these guidelines.

Land Management Tasks

[R, I, E, & U] Work with City of Austin to ensure the implementation and ongoing maintenance of the Auditorium Shores master plan is successful and natural area management is aligned with these guidelines to the extent feasible. High priority

[R] Plant shoreline that is not being utilized for recreation at a density that will discourage informal access and prevent erosion. May need tree cages or some other structure to protect them. High priority

Figure 4.55 (Above): This popular water access point for dogs is badly trampled. Figure 4.56 (Middle): Poor trail drainage leads to visitors taking alternative routes, generally in the mulch around tree roots in the upper-left corner of this photo. Figure 4.57 (Below): Invasive species, erosion issues, and recommended restoration work in the Auditorium Shores Unit. Sources: COA, NAIP.



BUTLER SHORES WOODLAND UNIT

The Butler Shores Woodland Unit is bound by West Bouldin Creek to the east, Riverside Drive, Butler Shores Park, and Barton Springs Road to the south, Barton Creek to the west, and the Lake to the north (Figure 4.59). The portion east of Lamar is part of Auditorium Shores at Lady Bird Lake Metro Park, while the remainder is within Butler Shores at Lady Bird Lake Metro Park. The site is 8.2 acres, with recommendations for 7.8 acres within the unit, 2.7 acres outside of the unit boundaries, and an additional 0.9 acres of aquatic restoration (Figure 4.60). South Lamar Boulevard bisects the unit, and the PARD headquarters are immediately adjacent to the unit.

Figure 4.58: Numerous large pecan trees create a cathedral-like canopy and provide shade along the Butler Shores Woodland section of the Trail.

Ecology

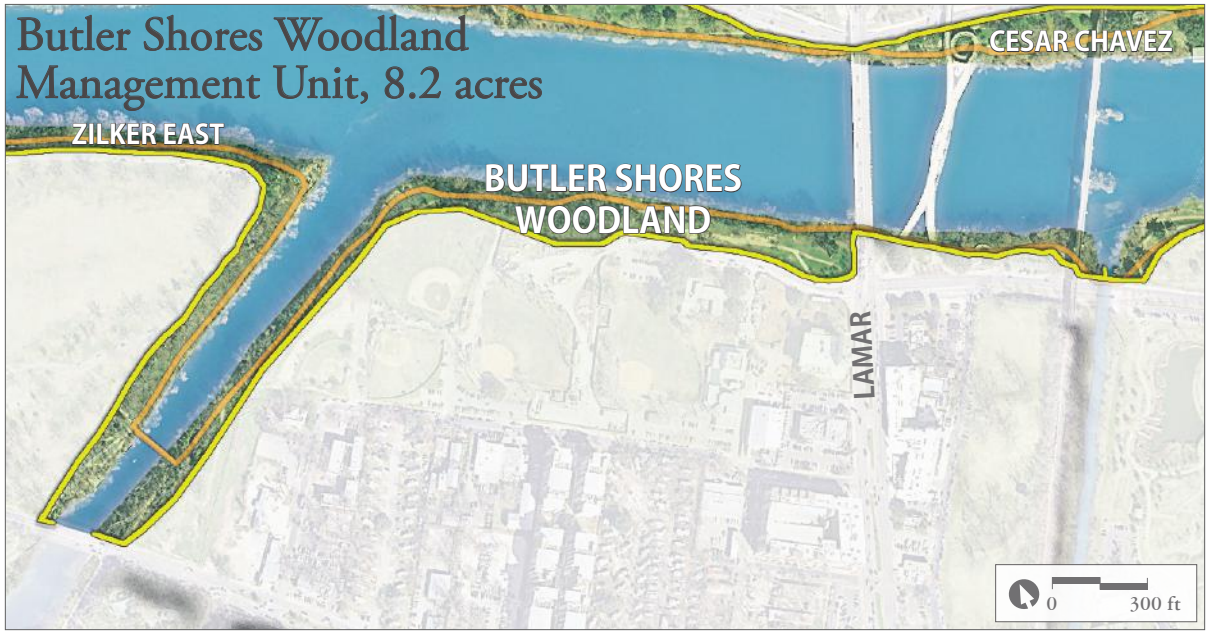
The unit contains relatively little mowed lawn. A dense-canopied mix of native and non-native trees and shrubs covers 6 acres of the unit. Slopes are steep and discourage off-trail recreation. Pecan is the dominant overstory tree, making up 39% of woodland trees surveyed. Many of the pecans are impressive individuals including 43 Heritage Trees, 9 of which are over 40" in diameter (Figure 4.58). Box elder, American elm, sugar hackberry, and green ash are common. Bald cypress is present along the lakeshore, but less abundant here than in many areas. Though the number of trees in the woodland is lower than many other portions of the study area, the basal area is comparable. The understory and

Tree Summary

Unit area	8.2 acres
Total trees	403
Trees/acre	49
Basal area	99 ft^2/acre
Average diameter	17"
Protected tree count	108
Heritage Tree count	59
Trees/100' of shoreline	6.1
Canopy cover	77%
Shaded trail	82%
Woodland area	6.0 acres
Trees/acre in woodland	59
Non-woodland area	2.2 acres
Trees/acre non-woodland	23

Table 4.16: Tree summary for all trees ≥8" diameter in the Butler Shores Woodland Unit.

Figure 4.59: Butler Shores Woodland Management Unit Boundaries. Sources: CAO, NAIP.



groundcover layers are variable. There are pockets in good condition, with abundant roughleaf dogwood, inland sea oats, and Turk's cap, but invasive shrubs and young trees dominate the understory in many areas. Poison ivy is a major component of the understory and groundcover in much of the woodland, and is encroaching on the Trail in several areas.

Invasive Species

The eastern banks of Barton Creek have an extreme invasive species problem with giant reed patches and bamboo (some of which was recently treated) entering from private property near the footbridge. English ivy is abundant in many locations along Barton Creek as well as western portions of the unit. Chinaberry is pervasive in the upland along the Trail near Barton Creek and Chinese tallow forms several dense patches on the lakeshore in western portions of the unit. The largest infestation of paper mulberry seen in the study area is near the PARD parking lot. The shoreline in the central section of the unit is not greatly impacted by invasives, with the exception of elephant ear. Bradford Pear is scattered throughout and forms a dense thicket near the Lamar Bridge.

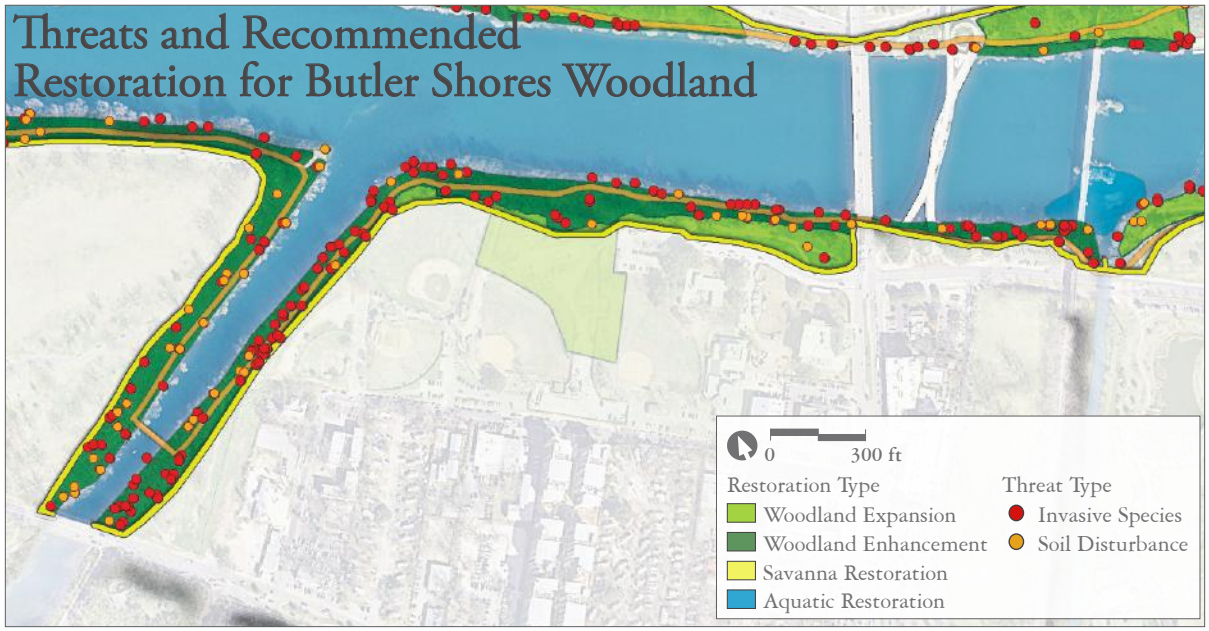
Disturbance

Erosion issues within the unit stem from user traffic and stormwater. There is a broken culvert that is causing a serious erosion issue on the southeast bank of Barton Creek. In addition, there are multiple informal trails from various parking locations to the Trail. Water access issues include staircases descending to the water's edge without supporting infrastructure as well as water access points without sufficient hardscape to prevent decomposed granite deposition into the water, such as the one shown in Figure 4.61. Trail stabilization and trail material deposition is a problem throughout this unit because of its steepness and/or the Trail's proximity to the shore.

Management Recommendations

Management activities in this unit will be varied, addressing invasive species, erosion, and user experience issues. Erosion issues should be handled throughout the unit, with special attention to nonfunctional infrastructure. Conversion of underutilized portions of Butler Shores Park to woodland with supporting green infrastructure can alleviate numerous erosion problems within the unit while expanding the overall natural areas (Figure 4.62). Problematic invasive species not commonly found in other units need to be addressed, including Bradford Pear, bamboo, and paper mulberry.

Figure 4.60: Invasive species, erosion issues, and recommended restoration work in Butler ShoresWoodland Unit. Sources: COA, NAIP.



Land Management Tasks

[E] Repair broken culvert in bank of Barton Creek. High priority

[E] Stabilize large gully near Barton Creek footbridge with armored banks/gabions if necessary. High priority

[E & U] Stabilize crushed granite trail to eliminate granite deposition off-trail. High priority

[I & R] Remove giant reed along shoreline. This action will necessitate bank stabilization, planting, and seeding in the following years. High priority

[U & R] Trim poison ivy back from the Trail. High priority

[U & R] Incorporate green infrastructure into Butler Shores Park under-utilized areas to reduce stormwater coming into the unit and expand the woodland canopy into these areas. High priority

[U & R] Coordinate with Watershed Protection Department to determine need for and proper location of water access. Remove dilapidated access points and associated infrastructure. High priority

[R] Increase diversity of existing woodland. Medium priority

[R] Actively restore wetland and emergent aquatic plantings on sediment bar at the mouth of West Bouldin Creek. Medium priority

[I] Remove paper mulberry. Medium priority

[I &R] Follow up on recent bamboo clearing east of Barton Creek with additional treatment (as necessary), planting, and seeding. Medium priority

[E & U] Decommission informal trails with a combination of brushing, soil decompaction, and planting of tree seedlings. Medium priority

[I] Remove chinaberry, Chinese tallow and other invasive woody plant species. Medium priority

[U] Formalize a trail between athletic fields and Trail. Low priority

[I] Remove Bradford Pear near Lamar Bridge. Low priority

Figure 4.61 (Above): A well used formal water access point has stairs leading users to the shore, the surface below is heavily trampled and eroding into the Lake. Figure 4.62 (Below): The underutilized lawn near PARD offices is recommended for woodland expansion.

ZILKER EAST UNIT

The Zilker East Unit is bound by Barton Creek to the east, Barton Springs Blvd and Lou Neff Road to the south, Zilker West to the west and the Lake to the north (Figure 4.63). The entire unit is part of Zilker Metro Park. The pedestrian bridge over Barton Creek connects this unit to the Butler Shores Woodland Unit. Lou Neff Point sits at the confluence of the Lake and Barton Creek, and the Zilker Zephyr Train runs through upper portions of the unit. It is 6.1 acres, with recommendations for 5.9 acres (Figure 4.66). The upper portions of the site are adjacent to Zilker Park and are influenced by park uses.

Ecology

Extremely steep topography and large bald cypress characterize this management unit. Almost no lawn is present except along the edge of the Zilker Zephyr Train tracks. Woodlands make up 5.3 acres of the unit. Pecan is the most abundant overstory tree, especially in the upland area along the western bank of Barton Creek. This unit has the largest trees in the study area, including 3 bald cypress over 90" in diameter, one of which is shown in Figure 4.64. There are 59 Heritage Trees, including 40 pecans, 32 bald cypress, and 1 live oak. Hackberry (primarily upland of the Trail as shown in Figure 4.65), American elm, and eastern sycamore are common. Similar to the Butler Shores Woodland Unit, the number of surveyed trees in the woodland is comparatively low (53 per acre), but the large size of many of the trees makes the basal area higher than many other units in the study area. The number of shoreline trees is lower than comparable areas. Throughout much of the unit there is an intact ground layer dominated by inland sea oats and Turk's cap. Poison ivy and greenbrier are also dense throughout the majority of the woodland. The Trail Foundation has removed invasive species in the upland stretch between Barton Creek and Zilker Park in the past, which has resulted in a richer groundcover than much of the study area.

Invasive Species

This management unit has relatively low amounts of invasive species. There are scattered Chinese tallow, Chinaberry, and Ligustrum, but no dense stands. There are also several tree of heaven individuals, which are not common in the study area.

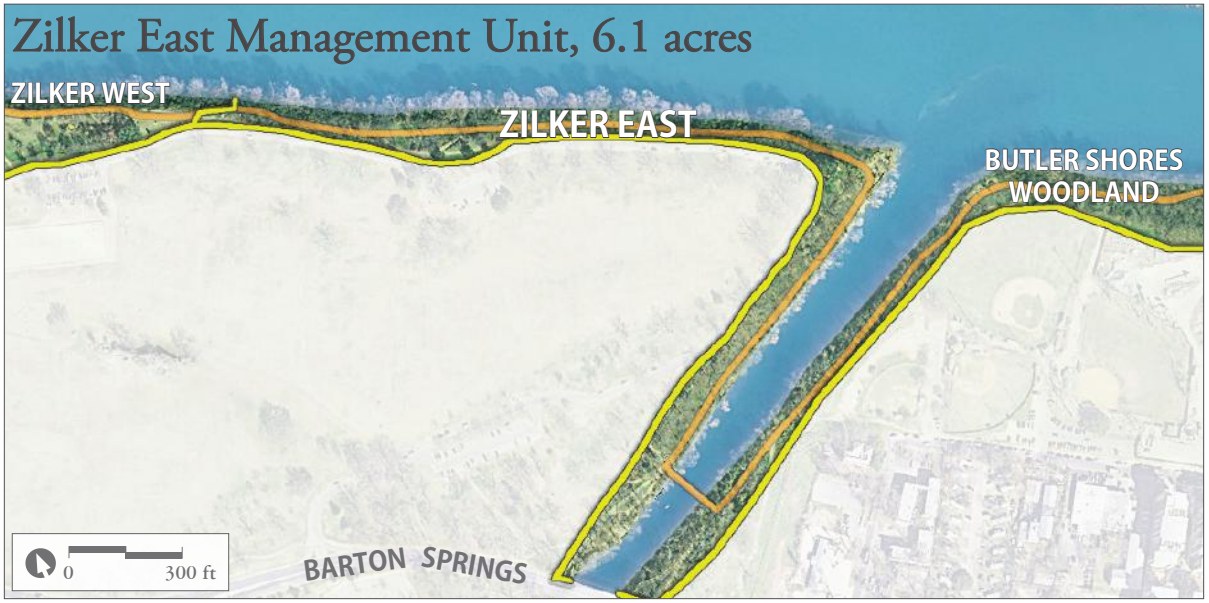
Disturbance

Along the slopes and banks of Barton Creek, there is trampling and erosion due to informal trails and off-trail recreation at the water's edge. Granite deposition on the Lake side of the Trail is resulting in major parts of the slope being covered in trail material. There is a dilapidated staircase from the Trail to the shore that should be removed.

Management Recommendations

Management objectives for this unit include stabilizing the formal trail, mitigating damage from off-trail recreation, and formalizing and/or improving water access points along with restoration planting and seeding, with a focus on future generations of canopy trees. Special attention should be given to protecting heritage trees throughout the unit.

Figure 4.63: Zilker East Management Unit boundaries. Sources: COA, NAIP.



Tree Summary

Unit area	6.1 acres
Total trees	316
Trees/acre	52
Basal area	156 ft²/acre
Average diameter	19”
Protected tree count	116
Heritage Tree count	73
Trees/100’ of shoreline	5.3
Canopy cover	76%
Shaded trail	55%
Woodland area	5.9 acres
Trees/acre in woodland	53
Non-woodland area	0.3 acres
Trees/acre non-woodland	12

Table 4.17: Tree summary for all trees ≥8” diameter in the Zilker East Unit.

Land Management Tasks

[E & U] Stabilize crushed granite trail to eliminate granite deposition off-trail. High priority

[E & U] Decommission informal trails with a combination of brushing, soil decompaction, and planting, especially in area between the Creek and Zilker Park. High priority

[R] Increase diversity of existing woodland. High priority

[I] Remove tree of heaven. High priority

[U] Improve water access near Barton Creek footbridge and duck feeding area. Medium priority

[I] Remove Chinaberry, Chinese tallow, and Ligustrum close to the Trail where feasible. Low priority

[U] Remove dilapidated staircase down to the Lake. Low priority

Figure 4.64 (Above, left): This bald cypress in Zilker East is one of the largest trees in the study area and in Austin. Figure 4.65 (Above, right): Young hackberry trees dominate the woodland upland of the Trail along Barton Creek. Figure 4.66 (Below): Invasive species, erosion issues, and recommended restoration work in the Zilker East Unit. Sources: COA, NAIP.

ZILKER WEST UNIT

The Zilker West Unit is bound by the Zilker East Unit to the east, Lou Neff Road, Zilker Auxillary Parking, and a utility yard adjacent to Stratford Drive to the south, Eanes Creek to the west, and the Lake to the north (4.67). The majority of the unit is part of Zilker Metro Park, but the portion west of MoPac is part of the Zilker Nature Preserve. The unit is 13.2 acres with recommendations for 11.0 acres within the study area. Recommendations are also made for 3.0 adjacent acres and for 0.2 acres of aquatic restoration (Figure 4.70). The unit is bisected by MoPac.

Ecology

This unit is characterized by rich riparian woods in relatively good condition between the Trail and the Lake and broad mowed areas in the central upland portion. Woodland makes up 7.6 acres of this unit. The eastern end of the study area is narrow and has steep slopes similar to those of the Zilker East Unit. Moving west, the area between the Trail and Lake broadens to include a flat, low area that includes several small islands. Hackberry, box elder, American elm, sycamore, and black willow are the most common canopy trees. This woodland has diverse micro-topography and some of the most intact understory and herbaceous layers in the study area with large amounts of Canada wildrye and other native species (Figure 4.68). West of MoPac, the areas north of the utility yard are relatively intact. There is a young huisache woodland in the more disturbed area adjacent to the yard.

There are more trees per acre in the woodlands of this unit than in Zilker East, but the trees are smaller, leading to a much lower overall basal area. The shoreline has 7.8 trees per 100 ft, more than any other management unit.

Two plants uncommon in Travis County, blackbristle greenbrier and anglefruit milkvine, were identified by Bill Carr in this management unit. Neither are rare plants globally, but Travis County is the western edge of their ranges.

Invasive Species

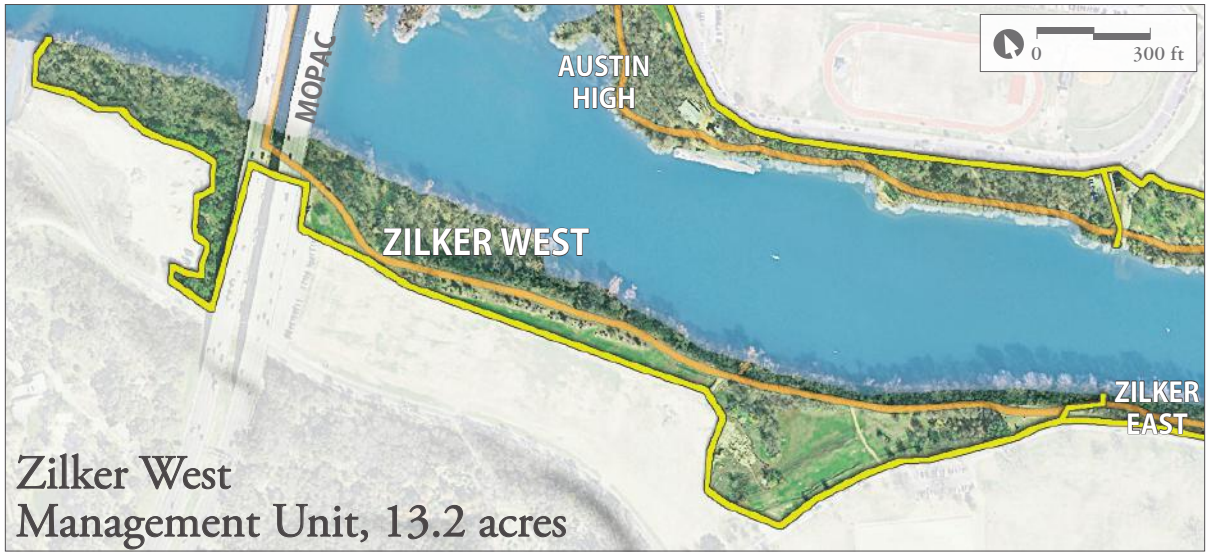
There are two catclaw patches, one just east and one just west of MoPac (Figure 4.69). Both are currently limited in area, but very dense. Two patches of sweet autumn clematis were found right along the Trail 850 ft east of MoPac. This species is abundant in many units but is not currently common in Zilker East or West. Silverberry, *Elaeagnus macrophylla,* was

Table 4.18 Tree summary for all trees ≥8" diameter in the Zilker West Unit.

Tree Summary

Unit area	13.2 acres
Total trees	660
Trees/acre	50
Basal area	59 ft^2/acre
Average diameter	13"
Protected tree count	86
Heritage Tree count	31
Trees/100' of shoreline	7.8
Canopy cover	54%
Shaded trail	22%
Woodland area	7.6 acres
Trees/acre in woodland	83
Non-woodland area	5.6 acres
Trees/acre non-woodland	6

Figure 4.67: Zilker West Management Unit boundaries. Sources: COA, NAIP.



found here and has not been observed naturalizing in the past. It should be controlled as a preventative measure. Elephant ear and Chinese tallow are abundant near the islands, but notably absent in the eastern half of the unit. Chinaberry is ubiquitous at the Trail's edge, but less common within the woodland itself. Over all, invasive occurrence was lower in the eastern portions of this unit as compared to other units. West of MoPac, however, Ligustrum and heavenly bamboo are becoming problematic.

Disturbance

This unit has more gully erosion than any other. There are two large gullies west of MoPac. One has been armored with large rocks and appears stable, but the other is not. There are numerous gullies starting underneath MoPac Bridge to approximately 300 ft east of the bridge. Dense vegetation and some minor upper slope armoring hide the problem from the Trail, but large amounts of soil are being lost. Numerous informal trails crisscross the lower portions of the management unit, but the steep topography of the majority of the woodlands appears to limit off-trail recreation.

Management Recommendations

Significant erosion control efforts are needed in this area, both on the Trail itself and downslope from it. To the extent possible, moving the Trail away from the steep slope and stabilizing the crushed granite is recommended. Green infrastructure with a focus on retention is needed between the trail and parking areas with a focus on the compacted overflow parking. Invasive species removal, especially of the aggressive catclaw vine, should occur as soon as possible. Savanna restoration and woodland expansion are recommended in the upland areas along with enhancement of the existing woodlands.

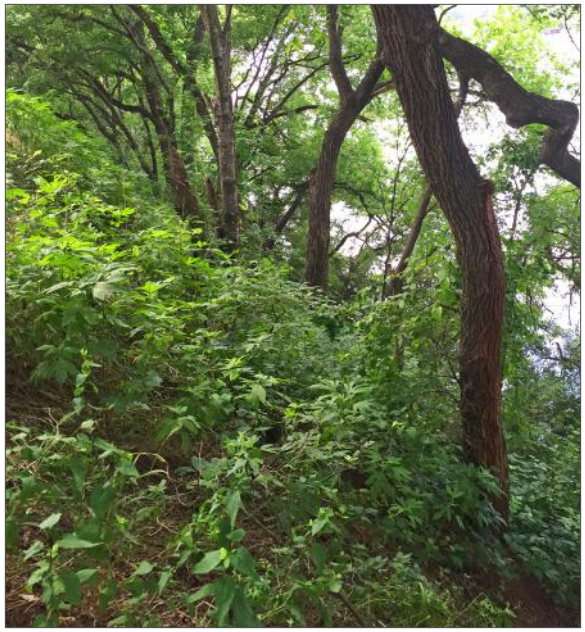


Figure 4.68: Sloping woodlands of the Zilker West unit have some of the most intact understory and herbaceous layers found in the study area.

Figure 4.69: Invasive catclaw vine in Zilker West.

Figure 4.70: Invasive species, erosion issues, and recommended restoration work in the Zilker West Unit. Sources: COA, NAIP.

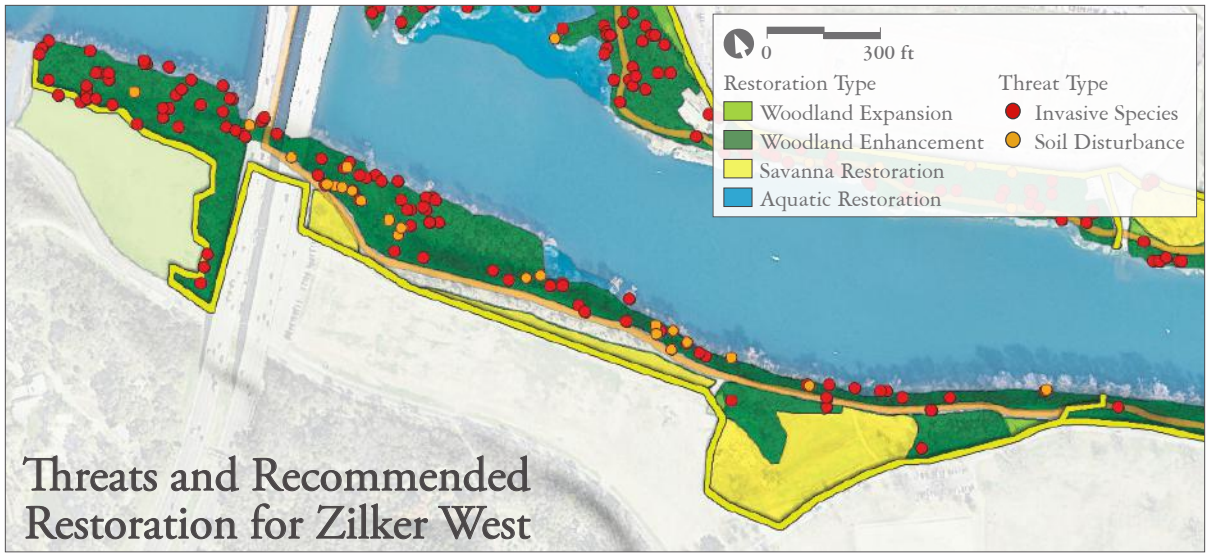


Figure 4.71: The wide Trail throughout much of Zilker West should be narrowed to allow more space between the Trail and the slope.

Land Management Tasks

[E & U] Stabilize crushed granite to eliminate deposition off-trail. High priority

[E, U, & R] Move trail towards bermed landscaping to the south and reduce width to allow for greater buffer between trail edge and steep slopes. This will require planting and seeding along the downslope side as well as temporary barriers to prevent trampling. High priority

[E] Install green infrastructure at the northern edge of the overflow parking to reduce the amount and velocity of stormwater entering the natural areas. High priority

[E] Repair gully erosion east of MoPac. Where repair is not feasible, armor areas to minimize damage to surroundings. High priority

[I] Remove catclaw vine on both sides of parking area under MoPac. High priority

[R] Convert areas recommended for savanna restoration to wildflower meadow management to begin transition towards savanna. High priority

[R] Increase diversity of existing woodland. Medium priority

[E] Install green infrastructure, armoring, and/or diversion/dispersal structures at downslope end of culverts shunting water under trail to control erosion downslope. Medium priority

[R] Restore woodland and savanna in underutilized lawn areas. Medium priority

[I & R] Remove giant reed, Ligustrum, heavenly bamboo, and Chinaberry west of MoPac with additional treatment as necessary, planting, and seeding. Medium priority

[I] Remove Chinaberry at edge of existing woodlands. Low priority

Toward Implementation

To sustain the benefits we receive from the natural areas around Lady Bird Lake, active management is necessary in the coming years. The Toward Implementation sections build upon the guidelines and concepts in this document with a focus on the practical elements needed to complete tasks, including: professional and volunteer services, scheduling and coordination, documentation and monitoring, and metrics to evaluate success.

PROFESSIONAL AND VOLUNTEER SERVICES

The implementation of this project and the setup of its tasks will require trained oversight in all cases. The work is configured such that a team of professionals can complete all tasks or professionals can take on some tasks in coordination with volunteer efforts. The difference between these two approaches are overall costs, professional accountability, length of time before completion, and the outcome quality of some tasks. Professional services are regularly used throughout Austin to complete all tasks associated with land management and restoration, as exemplified by the current projects at Shoal Creek in Pease Park and the Waller Creek restoration project associated with the University of Texas at Austin Dell Medical School. These projects are resource intensive, have a high level of accountability, and a relatively short time frame to contractual satisfaction. With limited funds and the ongoing need for land management, many parks and preserves have turned to trained volunteers. At Blunn Creek Preserve and Mayfield Park, "friends of the park" groups have been used to remove substantial amounts of invasive species and replant with trained and professional oversight. There are limits to what volunteers can do based on safety and complexity of task, so professionals must be used to complement the work of volunteers. This process has the advantages of lower cost, the creation of interested parties that can keep the project going for numerous years, and the ability to treat persistent problems and new problems as they arise. It is likely that the tasks laid out within this report will fall between these examples, with both professional and volunteer services working together to create a more robust natural area around Lady Bird Lake.

Figure 5.1: Underutilized lawn area in the Southeast Shore Management Unit appropriate for woodland expansion.

The Trail Foundation and the City have an established relationship with the Texas Conservation Corps (TxCC). Their experience with similar restoration projects makes them an ideal group for implementation of many of the tasks listed here. TxCC crews are trained in many management activities including: invasive plant removal, trail building, soil remediation, planting, and seeding. TxCC can also work with professionals on other tasks including: installing and repairing culverts, some components of tree care, constructing bioswales, decompacting soils, stabilizing banks, constructing sediment capture structures, removing concrete, and installing gabions. Some of the tasks recommended here will require the specialized experience of arborists, landscape architects, engineers, heavy equipment operators, and/or concrete contractors.

The Trail Foundation has used volunteers and coordinated the work of other non-profit organizations within the natural areas. Several organizations already offer programming that would be beneficial for The Trail Foundation's volunteers, including:

- Invasive plant identification and treatment training with the Invaders of Texas Program at the Lady Bird Johnson Wildflower Center, http://www.texasinvasives.org/invaders/
- Capital Area Master Naturalists training, http://camn.org/
- Native Plant Society in Central Texas for educational programming and native plant material sources, http://npsot.org/wp/austin/
- Travis Audubon for bird identification and habitat restoration, http://travisaudubon.org/

These organizations are known places for interested volunteers to gain knowledge that will be helpful in accomplishing many of the ongoing tasks called out

in this document, though the work itself will be coordinated and overseen by The Trail Foundation.

The recommendations and tasks laid out in this document will be completed by a combination of professional and volunteer services, with the assumption that the Texas Conservation Corps or an equivalent organization will play a key role. Professional efforts are needed for their knowledgebase and specialty skills. Volunteers are needed for their long-term knowledge and dedication. The combination of efforts will result in the most efficient and effective use of resources.

Table 5.1: Four Year Area Work Schedule. See Appendix 1 for the detailed task list.

Four Year AreaWork Schedule

Fall 2015 to Summer 2016

Entire Site Tasks
Deep Eddy Primary Treatment
Austin High Primary Treatment
City Hall Primary Treatment
Waller Creek—Discrete Task
Rainey Primary Treatment
Holly Shores Primary Treatment
Southeast Shores Primary Treatment
Cliffs Treatment—Discrete Task
Southcentral Shore Primary Treatment

Fall 2016 to Summer 2017

Entire Site Tasks
Cesar Chavez Primary Treatment
Hotel Slope Primary Treatment
Waller Creek—Discrete Tasks
Festival Beach Primary Treatment
Cliffs- Discrete Tasks
Auditorium Shores—Discrete Tasks
PARD Woodland Primary Treatment
Zilker East Primary Treatment
Zilker West Primary Treatment

Fall 2017 to Summer 2018

Entire Site Tasks
Deep Eddy Secondary Treatment
Austin High Secondary Treatment
City Hall Secondary Treatment
Rainey Secondary Treatment
Holly Shores Secondary Treatment
Southeast Shore Secondary Treatment
Southcentral Shore Secondary Treatment

Fall 2018 to Summer 2019

Entire Site Tasks
Cesar Chavez Secondary Treatment
Hotel Slope Secondary Treatment
Waller Creek—Discrete Tasks
Festival Beach Secondary Treatment
Cliffs Secondary Treatment
PARD Woodland Secondary Treatment
Zilker East Secondary Treatment
Zilker West Secondary Treatment

SCHEDULE AND COORDINATION

Restoration and land management are not discrete events, but ongoing processes. A four year land management schedule can be seen in Appendix 1, with a simplified version in Table 5.1. It is a dynamic schedule that can be altered based on shifting priorities, management successes, degradation concerns, and available funding. The schedule serves as a baseline of important tasks that should be considered for completion in the coming years. In 2019, it is recommended that the entire document be revised to look forward an additional four years.

To ensure all efforts are being coordinated between the many City departments and organizations working in the study area, it is recommended that The Trail Foundation hold quarterly work plan meetings with key personnel from TTF, TxCC, COA-PARD, COA-Forestry, COA-WPD, and other appropriate entities. In these meetings work plans associated with the tasks in these guidelines, new priorities, as well as documented efforts described below can be discussed. Through this coordination, complementary actions and resource allocations can be aligned for more efficient and successful implementation. Before work begins in an area, these guidelines and/or equivalent plans should be reviewed by The Trail Foundation, the City, TxCC, and any other parties involved in the work. It is also critical that plans be in place for follow-up treatments, restorations, and resource allocations before work is started in an area. This allows for scheduling coordination between entities and ensures treatments work effectively.

DOCUMENTATION, MONITORING & CITIZEN SCIENCE

It is critical that all efforts towards the completion of recommendations here are documented to gauge success, facilitate an adaptive management approach, track change, and allow the numerous entities working in the study area to be aware of each other's work. Either a City department or The Trail Foundation could take on this information management role—likely in the form of a database. Ongoing documentation can facilitate coordination by ensuring all entities working in the area are aware of what has been done, what was effective, what remains to be done, and how best to allocate resources.

Monitoring of the study area is recommended through geographic, photographic, and narrative descriptions that include annual photo points, early detection evaluation, land management documentation and evaluation, and biodiversity

observations. Records from this monitoring should be standardized and readily available. Over time these collective documents will serve to drive future management practices and to educate both professionals and volunteers working in the study area.

To ensure fidelity of monitoring information, documentation should take place at the time of monitoring. Example monitoring documents are in Appendix 2. It is recommended, however, that all monitoring documentation be done through smartphone or tablet devices using a field data application such as Fulcrum. Advantages of using such a program include immediate incorporation of the information into a database, reduced data errors, location tracking, association of photos and voice recordings with specific locations, and customizable datasheets that can meet the needs of the Trail Foundation and the City of Austin.

Photo points

Photo points are a fairly quick and easy way to perform qualitative monitoring. 68 photo points were established within the study area as seen in Figure 5.2. The photographs and descriptions are included in Appendix 3. GPS points were taken at each location so that they can easily be found, and the photos can be replicated. It is recommended that photos be taken once a year at each of these points. Comparing the photos over time will provide a sense of how areas are changing and guide future management decisions.

Early Detection Monitoring

Early detection monitoring is not designed to assess the effectiveness of management actions but rather to detect new threats at an early stage of development so that they can be addressed quickly. This is considered a best management practice and is called out in both the City's Urban Forest Plan and Invasive Species Management Plan. It is not tied to a specific photo point or vegetation plot, but requires a staff member, professional, or volunteer to periodically walk the entire study area and observe new invasive threats, expanding invasive plant issues, areas being overused and denuded, new informal trails, and new erosion issues. Once new threats are identified, staff or volunteers can quickly take action and prevent a small problem from becoming a larger one that takes more time and resources to control in the future. To be effective, early detection monitoring requires a staff member, professional, or volunteer who is:

- Adept at identifying invasive plants, even obscure ones;
- Very familiar with the natural areas around Lady Bird Lake and can ac-

Figure 5.2: Locations of photo points established around Lady Bird Lake. Sources: COA, NAIP.

Table 5.2: Priority areas for invasive species control. The point number does not indicate priority.

Priority Areas for Invasive Treatment

Point	Latitude	Longitude	Primary Invasives	Notes
1	30.277179	-97.773393	Catclaw vine	At entrance of Eiler's Park
2	30.27534	-97.771479	Catclaw vine	Just west of MoPac overpasses
3	30.265007	-97.751632	Chinaberry	Dense patch of Chinaberry near recent restoration project at Shoal Creek
4	30.263036	-97.745569	Golden rain tree	Abundant throughout the woodland between 1st St. and Congress Ave.
5	30.262415	-97.744651	Golden rain tree	East of Congress Ave.
6	30.258638	-97.740771	Chinaberry	Present throughout woodlands in Rainey Unit
7	30.255491	-97.740066	Giant reed	Along shoreline south of Rainey St.
8	30.2478	-97.726814	Johnsongrass	In Grow Zones along much of the shoreline of the Lake and the lagoon
9	30.249587	-97.727897	Tree of heaven	One of few patches in the study area, in the woodland near the pavilion at Festival Beach
10	30.250523	-97.717201	Giant reed	In many patches along the peninsula in the Holly Shores Unit
11	30.250411	-97.718584	Tree of heaven	Single tree at west end of the peninsula in the Holly Shores Unit
12	30.246281	-97.715751	Johnsongrass, giant reed, sweet autumn clematis	Found throughout much of the Grow Zone area and the shores of the Southeast Shores Unit
13	30.251323	-97.739623	Catclaw vine, sweet autumn clematis, Japanese honeysuckle	Abundant vines south of the Trail in the Cliffs Unit
14	30.260352	-97.744628	Ligustrum, golden rain tree, Chinaberry	Throughout much of the shoreline woodland of the Southcentral Shore Unit, particularly the western portion
15	30.266437	-97.761906	Giant reed	Along eastern banks of Barton Creek
16	30.26841	-97.764269	Tree of heaven	Scattered individuals within the Zilker East Unit
17	30.273271	-97.772427	Catclaw vine	Patches both east and west of the Mopac Underpasses

curately determine if change is occurring; and
- Willing to walk the grounds a minimum of 2 times a year looking for new threats.

It is recommended that field data be recorded electronically with the following variables: date, recorder, type of threat (species name, new invasive species, expanding invasive species, new or expanding erosion, new or expanding trampling, new or expanding informal trail, new or expanding stormwater flow), location (including latitude and longitude, along with general identifiers), size of issue (for invasive species should include patch size, percent cover, and if appropriate number of plants), and a narrative description of the problem and potential cause. If electronic recording is not feasible, a potential early detection monitoring form template can be found in Appendix 2.

Land Management Task Monitoring

The Trail Foundation, City of Austin, Austin Parks Foundation, and numerous other organizations have been actively managing and improving the natural areas around Lady Bird Lake through tree planting, soil amendments, trash clean up, and invasive species control. However, piecing together a narrative of their efforts currently relies heavily on the institutional memory of key individuals. To facilitate an ongoing record, it is recommended that electronic records be kept of all management activities that include the following variables: date, recorder, general activity, area treated, location of area, size of area, how it was treated, and resources used (including labor), along with photo documentation. A simple, standard stewardship action form can be found in Appendix 2. Once management has taken place in an area, the area should be placed on a list of areas to evaluate annually along with the existing photo points.

Tracking Biodiversity

Citizen Science is becoming a vital way to track biodiversity information, with numerous individuals in the Austin area actively recording biodiversity data through eBird, iNaturalist, Odonates of Texas, Fishes of Texas, and other online services. Individuals input data, which goes through a validation process that allows final users to understand the quality of the data. For the natural areas around Lady Bird Lake, the Trail Foundation has begun working with Travis Audubon to curate the biodiversity information. To this end "places" were cre-

ated in iNaturalist that include "East Lady Bird Lake" from Longhorn Dam to Congress, "Central Lady Bird Lake" from Congress to Mopac, and "West Lady Bird Lake" from MoPac to Tom Miller Dam. There are also existing hot spots around the Lake listed on eBird that park visitors can contribute to.

Travis Audubon is engaging its volunteers to serve as monthly spotters to encourage recording observations and to promote interest and participation by the general public. Wildlife observations can, if desired, also be dynamically linked to the Trail Foundation and Travis Audubon websites from iNaturalist and eBird.

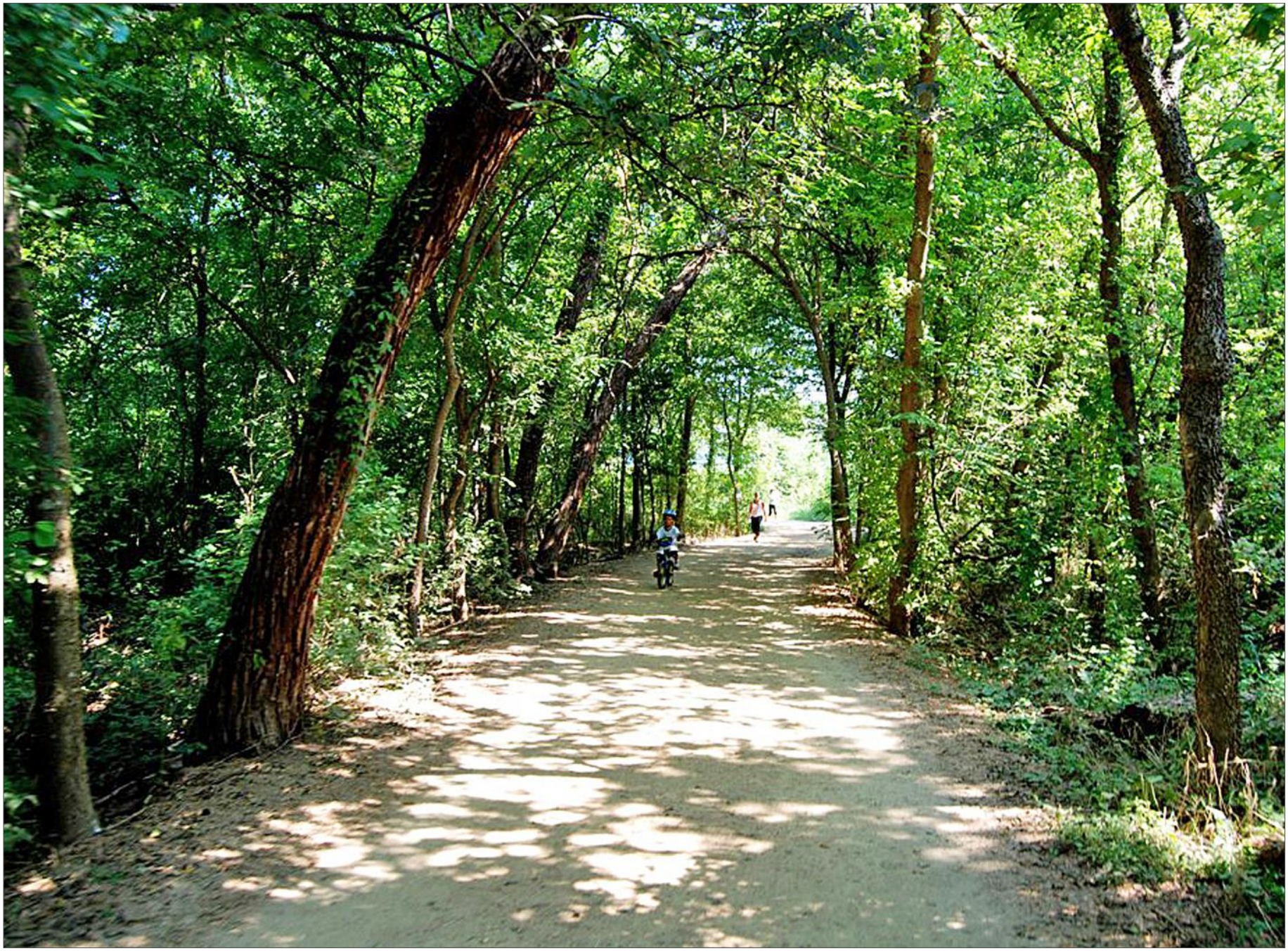
METRICS

The process of restoration in the natural areas around Lady Bird Lake will have successes and failures in the coming years, with an overall trend towards enhancing the natural areas. By following the recommendations here and maintaining an adaptive management approach, The Trail Foundation and its partners will see measurable changes. To evaluate these changes, we recommend the metrics below as measures of success. For our purposes, a metric is an element that can be measured with relative ease that indicates progress is being made towards the goals stated on page 2.

These metrics suggest a path towards success and provide a quick articulation of some of the overall reasons for the land management practices laid out in these guidelines. They also provide a motivation for people to become more familiar with and committed to the study area. For instance, the metrics associated with increased species numbers will motivate restoration and habitat enhancement efforts while at the same time motivating observations and record keeping. The metrics catalyze involvement and resource allocation while allowing for measurable, tangible outcomes.

Recommended Metrics

- Reduce the highest priority invasive species populations by 80% area occupied over 3 years (listed in Table 5.2).
- Plant 4,000 container trees over the next 4 years with a 75% survival rate at the end of 6 years.
- Plant 8,000 tree seedlings over the next 4 years.
- Increase overall canopy cover to 70% of the study area in 20 years (currently 49%).
- Increase native species confirmed observations for major taxa by 20% in 10 years including: mammals, reptiles, amphibians, fish, insects, and birds.
- Restore at least two acres of savanna on Gaddy soils in 10 years.
- Repair and restore 75% of off-trail erosion problems recorded in this document over 5 years.
- Increase shade over trail to 80% over 15 years (currently at 48%).
- Address 100% of critical tree care tasks outlined by Don Gardner within 6 months.
- Address 80% of all tree care tasks outlined in Don Gardner's assessment in 1 year.



Conclusions

The urban forest and natural areas of Lady Bird Lake and the Butler Trail are an irreplaceable part of Austin. They form an ecological and cultural nexus unmatched in the City and rarely matched in other places. 1.5 million people come to the site each year for relaxation in nature, beautiful views, and great recreation, making it the most used trail in Central Texas and one of the most used trails in the country. Beyond aesthetics and play, the site gives back to the community by cleaning the air, reducing urban temperatures, providing shade, cleaning water, building soil, reducing erosion, and providing habitat for over 800 species of plants and animals. It connects the Hill Country to the prairie, important riparian habitats up and downstream along the Colorado River, and numerous greenways and bikeways throughout the City. To maintain the current level of service and to move toward the site's full potential, the Trail Foundation, the City, and their partners can strategically allocate resources per the recommendations here to enhance the ecological function and improve the user experience in the urban forest and natural areas of Lady Bird Lake.

The Trail Foundation commissioned this report to proactively look at opportunities and challenges within the 200 acres of natural area and urban forest tied together by Lady Bird Lake and the 10-mile Ann and Roy Butler Trail. The site is clearly loved, and numerous improvements have been made to the site in the last four decades. To maintain and improve it over time, however, additional management and investment is critically needed. To this end, management recommendations are made here based on the ecology of the site, restoration potential, and sustainable land management practices. Over 170 management recommendations are made, to be carried out over the next four years. The first tasks address degradation found throughout the site, including erosion, invasive species, unnecessary mowing, and trail alignments extremely close to the water. As these issues are addressed, restoration of the woodlands, savanna, and aquatic plant communities should be implemented to better meet the aesthetic and ecological potential of the site including:

- 60 acres of woodland enhancement,
- 80 acres of woodland expansion,
- 12 acres of savanna restoration, and
- Aquatic plantings at 23 sites.

Figure 6.1: The Lake, Trail, and natural areas (shown here near Austin High School) are an irreplaceable asset.

The implementation of the recommendations here will result in restored plant communities and wildlife habitat, improved ecological function, increased resiliency, and an enhanced user experience. In addition, the implementation will facilitate greater stewardship and involvement in the natural areas. Success of the project will rely on the use of the best management practices laid out here, regular maintenance and follow-up treatments, and ongoing monitoring as well as an adaptive management approach that recognizes land management and restoration as a dynamic process. Success will be measured by metrics looking at increases in overall canopy, increases in trail shade, number of trees planted, reductions in invasive plant populations, and mitigation of erosion issues.

Some key findings of this report are:

- The site is culturally and ecologically irreplaceable.
- The Butler Trail, Lady Bird Lake, and their associated natural areas and urban forest are an entity to themselves. Though portions of the study area are addressed in numerous plans and actions, strategic management and action addressing the entire area is needed.
- Historic land management of the site and limited resources have resulted in large expanses of underutilized lawn, incomplete plant communities, erosion issues, less shade, lower ecological function, and less habitat.
- The site provides tremendous recreational, ecological, and habitat value that can be substantially improved by the land management and ecological restoration recommendations here.
- Investments recommended here are small in comparison to the overall value of the urban

forest and natural areas of Lady Bird Lake and the Butler Trail.

- The recommendations here are aligned with City policies and work towards over 30 action items recommended in Imagine Austin and 15 performance measures in the Austin Urban Forest Plan.
- The recommendations build on the legacy set by Lady Bird Johnson, Ann and Roy Butler, and others of deeply appreciating and contributing to the aesthetic beauty and ecological function of Lady Bird Lake and the surrounding area.

The path forward for this vital part of the Central Texas cultural and natural environment is at a pivotal point. Through strategic allocation of resources as outlined in these guidelines, including defined management tasks, ongoing best management practices, and monitoring, the site's current value and services can not only be maintained but substantially increased. The end result is a heightened user experience and enhanced ecological function that breeds enjoyment, excitement, interest, and participation for current and future generations.

Figure 6.2: The guidelines build upon the substantial work, such as the addition of the Boardwalk, that has already been done to complete and enhance the Trail.

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Appendix 1

Four Year Management Schedule

The following schedule outlines the management priorities for the next 4 years, divided into the following categories:

{R} Restoration: This category includes activities such as converting an area from lawn to woodland and planting to increase diversity.

{I} Invasive species management: These actions actively or passively reduce a particular invasive species, and include: physical removal, the use of herbicides, out competing, and shading out.

{E} Erosion control and soil restoration: This category includes all activities designed to mitigate erosion impacts or repair damaged soil. Activities address the need for green infrastructure, hard infrastructure, and/or soil restoration and include: bioswale instillation, regrading, culvert instillation, soil decompaction, and mulching.

{U} User experience: This category encompasses a wide range of activities designed to enhance the experience of using the Trail, including: increased aesthetic appeal, improved access to the water, trail improvements, and increased safety.

Fall 2015 to Summer 2016

Entire Site

Type	Task	Priority
R	Mulch under trees in mowed areas that are currently without an herbaceous layer.	High
U & R	Remove any tree safety hazards.	High
U, E & R	Stabilize trail and eliminate crushed granite deposition off-trail.	High
I	Monitor entire site for invasive species	High
R & I	Where tree establishment is occurring, control invasives.	High
R	Initiate Grow Zone land management practices and eliminate mowing in all areas prioritized for woodland expansion and or enhancement.	High
R	Demarcate Grow Zones and ensure coordination of land management activities between PARD and Watershed Protection.	High

Deep Eddy Primary Treatment

Type	Task	Priority
R	Increase area and canopy cover of the woodlands in lower section of Eilers Park.	High
I	Remove catclaw vine at the entrance to Eilers Park.	High
U & R	Cut grape vines off some of the trees south of trail, use this as an opportunity to cut “windows” through the vegetation so that the Lake can be seen from Deep Eddy Pool area.	High
I & R	Remove giant reed along shoreline. This action will necessitate bank stabilization, planting, and seeding in the following years.	Medium
I	Remove Chinese Tallow and Chinaberry in woodland.	Low

Austin High Primary Treatment

Type	Task	Priority
U, E & R	Move edge of Trail inland several feet where feasible to create more habitat for riparian plants. This can be accomplished through a combination of reducing the width of the Trail and moving it inland.	High
E & U	Stabilize Trail and eliminate crushed granite deposition off-trail.	High
R	Plant riparian areas between moved trail and water's edge.	High
U, E & R	Formalize the two major informal trails leading from Veterans Drive to the Trail and restore others with a combination of brushing, soil decompaction, and planting tree seedlings.	High
I	Remove catclaw vine patches	High
I	Remove Chinaberry and Chinese tallow throughout area with special attention to those impacting native trees	Medium

City Hall Primary Treatment

Type	Task	Priority
I & R	Control golden rain tree, Chinese tallow, and Chinaberry. Initial treatment should focus on removal from around native trees. Secondary treatment should include the entire area. Treatment must be coupled with erosion control and restoration plantings due to the extent of the issue.	High
E & U	Stabilize Trail and eliminate crushed granite deposition off-trail.	High
R	Expand woodland throughout area, with species selection meeting height limits set by Austin Energy due to overhead powerlines. Aesthetics and seasonal color should also be considered.	High
E & R	Decompact soils used as a staging area in the western extent of the unit and plant and seed for woodland expansion.	High
E	Stabilize gully west of Congress Avenue Bridge	High
R	Convert areas recommended for savanna restoration to wildflower meadow management to begin transition towards savanna.	High
E & U	Where topography allows, move the Trail inland and allow riparian area expansion.	Medium
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium
I & R	Remove giant reed. This action will necessitate bank stabilization, planting, and seeding in the following years.	Medium

Waller Creek

Type	Task	Priority
R & I	Ensure island at mouth of creek is protected as plant and wildlife refuge and enhance by increasing plant diversity and managing invasives.	High

Rainey Primary Treatment

Type	Task	Priority
R	Convert underutilized lawn to woodland through planting and seeding west and southeast of the Mexican American Cultural Center and south of East Avenue.	High
E	Install green infrastructure in the western and eastern portions of the study area to retain and slow down stormwater as it moves through the unit.	High
R	Replace and enhance shade tree cover at terminus of Rainey Street.	High
U & E	Add formal water access from base of concrete stairs and restore areas affected by trampling and compaction.	High
I	Remove Chinaberry	High
E & R	Enhance the growing streamlets in the western and eastern portions of the management unit through rock placement and plantings appropriate for small ephemeral streams.	High
U, E & R	Decommission informal trails with a combination of brushing, soil decompaction, and planting tree seedlings.	High
I	Remove giant reed. This action will necessitate bank stabilization, planting, and seeding in the following years.	High
E & R	Stabilize the two principal gullies with green infrastructure that includes a combination of armoring, diversion, swales and retention upslope, and planting.	High

Holly Shores Primary Treatment

Type	Task	Priority
R	Expand woodlands through planting and seeding of canopy, understory, and herbaceous layers with special attention to those areas retired from the Holly Power Plant and lawn that are now planned for passive recreation and natural areas.	High
U, E & R	Reduce the existing trail width to less than 14 ft, stabilize surface, install connecting trail through former Holly Power plant Area and on to Festival Beach unit using standards described in management section.	High
E & R	Remove concrete embankments as feasible.	High
I & R	Continue removal of giant reed along with bank stabilization, planting, and seeding.	High
R & I	Plant canopy trees around giant reed invasion to shade out reed and enhance woodland canopy.	High
I	Remove tree of heaven	High
E	Utilize open areas to install green infrastructure such as swales and rain gardens where feasible to increase absorption and reduce erosion issues.	High
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium

Holly Shores Primary Treatment (continued)

Type	Task	Priority
E	Decommission informal trails with a combination of brushing, soil decompaction, and plantings with special attention to the steep areas near the Canterbury parking area.	Medium

Southeast Shore Primary Treatment

Type	Task	Priority
E & R	Stabilize eroding banks with erosion control fabric and plant additional trees and herbaceous material.	High
I	Treat Johnsongrass.	High
R	Expand woodland throughout much of the area, with special attention to the areas behind the hostel, the peninsula, the eastern shore, and the area parallel with Lakeshore Drive from the hostel eastward. Shorter species will be needed in some areas to accommodate the overhead powerlines.	High
I & R	Continue removal of giant reed along shoreline. This action will necessitate bank stabilization, planting, and seeding in the following years.	High
R & I	Plant canopy trees around giant reed invasion to shade out reed and enhance woodland canopy	High
E & R	Utilize grading in the upper portions of the unit to retain and slow down stormwater. Plant as appropriate.	High
E	Stabilize gully erosion using green infrastructure where feasible. Armoring may be necessary in some places.	High
R	Convert areas recommended for savanna restoration to wildflower meadow management to begin transition towards savanna.	High
R	Prune live oak groves designated by Don Gardner.	High
I	Remove sweet autumn clematis, with focus on the eastern woodland.	Medium
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium

The Cliffs Treatment

Type	Task	Priority
I	Treat catclaw vine throughout.	High

Southcentral Shore Primary Treatment

Type	Task	Priority
E & U	Stabilize crushed granite trail to eliminate granite deposition off-trail.	High

Southcentral Shore Primary Treatment (continued)

Type	Task	Priority
I	Remove Ligustrum, golden rain tree, and Chinaberry.	High
U & R	Work with landowners and city planners to expand riparian woodland and reduce hardscape bottlenecks for Trail users.	High
R	Prune live oak grove designated by Don Gardner.	High
R	Expand woodland throughout.	Medium
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium
R	Increase understory and herbaceous layers throughout.	Medium

Fall 2016 to Summer 2017

Entire Site

Type	Task	Priority
R	Mulch under trees in mowed areas that are currently without an herbaceous layer.	High
U & R	Remove any tree safety hazards.	High
U, E & R	Stabilize trail and eliminate crushed granite deposition off-trail.	High
I	Monitor entire site for invasive species	High
All	Monitor previous work, retreat where necessary, adjust new treatments as necessary.	High
R & I	Where tree establishment is occurring, control invasives	High

Cesar Chavez Primary Treatment

Type	Task	Priority
R	Expand woodland throughout the area.	High
E & U	Stabilize crushed granite trail to eliminate granite deposition off-trail.	High
U & R	Move sections of the Trail away from the shore to create more interesting trail, reduce granite deposition onto the sensitive shoreline area, and allow for a wider riparian zone.	High
I & R	Remove Chinaberry near Shoal Creek restoration project to reduce potential infestation in newly restored areas. May require tree planting and erosion control blankets.	High
R	Amend and decompact soil, plant, and seed areas that were formerly part of the Trail.	High
R	Convert areas recommended for savanna restoration to wildflower meadow management to begin transition towards savanna.	High
I & R	Remove Chinese Lacebark elm. Will require extensive lakeshore tree plantings and erosion control blankets.	Medium

Cesar Chavez Primary Treatment (continued)

Type	Task	Priority
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium

City Hall Primary Treatment

Type	Task	Priority
R	Expand riparian woodland upslope	High
I	Remove golden rain tree	High
I	Cut grape vine	High
I	Remove common chaste tree	Medium
E	Decommission informal trails with combination of brushing, soil decompaction, and restoration plantings	Medium
R	Add sediment capture structures near existing wetland to encourage its spread	Medium

Waller Creek

Type	Task	Priority
All	Complement restoration and bank stabilization efforts being planned by Waller Creek Conservancy, the City of Austin Watershed Protection Department, and their partners.	High

Festival Beach Primary Treatment

Type	Task	Priority
R	Convert underutilized lawn areas to woodland; leave more utilized lawn areas in current use.	High
I	Remove Johnsongrass.	High
R	Mulch and prune pecan trees near covered pavilion and prune live oak groves designated by Don Gardner.	High
U, E & R	Decommission informal trails and informal water access points with a combination of brushing, soil decompaction, and planting of tree seedlings.	High
I	Remove tree of heaven	High
U & E	Coordinate with Watershed Protection Department to determine need for and proper location of water access.	Medium
E & R	Install bioswales to increase water retention and eliminate numerous erosion issues throughout area while creating small-scale grading changes that increase the diversity of habitat.	Medium
I	Remove and replace Chinese Lacebark elm that has been planted in the mowed areas.	Medium

The Cliffs Treatment

Type	Task	Priority
R	Maintain and expand wetland restoration project at mouth of Blunn Creek.	High
R & I	Maintain new plantings near Boardwalk & keep free of invasive species.	High

Auditorium Shores Treatment

Type	Task	Priority
All	Work with City of Austin to ensure the implementation and ongoing maintenance of the Auditorium Shores master plan is successful and natural area management is aligned with these guidelines to the extent feasible.	High
R	Plant shoreline that is not being utilized for recreation at a density that will discourage informal access and prevent erosion.	High

Butler Shores Woodland Primary Treatment

Type	Task	Priority
E	Repair broken culvert in bank of Barton Creek.	High
E	Stabilize large gully near Barton Creek footbridge with armored banks/gabions if necessary.	High
E & U	Stabilize crushed granite trail to eliminate granite deposition off-trail.	High
I & R	Remove giant reed along shoreline. This action will necessitate bank stabilization, planting, and seeding in the following years.	High
U & R	Trim poison ivy back from the Trail.	High
U & R	Incorporate green infrastructure into Butler Shores Park underutilized areas to reduce stormwater coming into the unit and expand the woodland canopy into these areas.	Medium
U & R	Coordinate with Watershed Protection Department to determine need for and proper location of water access. Remove dilapidated access points and associated infrastructure.	High
I	Remove paper mulberry.	Medium
I & R	Follow up on recent bamboo clearing east of Barton Creek with additional treatment as necessary, planting, and seeding.	Medium
E & U	Decommission informal trails with a combination of brushing, soil decompaction, and planting of tree seedlings.	Medium
I	Remove chinaberry, Chinese tallow and other invasive woody plant species.	Medium
U	Formalize a trail between athletic fields and Butler Trail.	Low
I	Remove Bradford Pear near Lamar Bridge.	Low

Zilker East Primary Treatment

Type	Task	Priority
E & U	Stabilize crushed granite trail to eliminate granite deposition off-trail.	High
E & U	Decommission informal trails with a combination of brushing, soil decompaction, and planting of tree seedlings, especially in the area between Barton Creek and Zilker Park.	High
I	Remove tree of heaven	High
U	Improve water access near Barton Creek footbridge and duck feeding area.	Medium
I	Remove Chinaberry, Chinese tallow, and Ligustrum close to the Trail where feasible.	Low

Zilker West Primary Treatment

Type	Task	Priority
E & U	Stabilize crushed granite trail to eliminate deposition off-trail.	High
E, U & R	Move trail towards bermed landscaping to the south and reduce overall width to allow for greater buffer between trail edge and the steep slope to water's edge. This will require planting and seeding along the downslope side as well as temporary barriers to prevent trampling.	High
E	Install green infrastructure at the northern edge of the overflow parking to reduce the amount and velocity of stormwater entering the natural areas.	High
E	Repair gully erosion east of MoPac. Where repair is not feasible, armor areas to minimize damage to surroundings.	High
I	Remove catclaw vine on both sides of parking area under MoPac.	High
R	Convert areas recommended for savanna restoration to wildflower meadow management to begin transition towards savanna.	High
E	Install green infrastructure, armoring, and/or diversion/dispersal structures at downslope end of culverts shunting water under trail to end erosion downslope.	Medium
E	Restore woodland in underutilized area between Zilker Park and the Zilker overflow parking area.	Medium
I & R	Remove giant reed, Ligustrum, heavenly bamboo, and Chinaberry west of MoPac with additional treatment as necessary, planting, and seeding.	Medium
I	Remove Chinaberry at edge of existing woodlands.	Low

Fall 2017 to Summer 2018

Entire Site

Type	Task	Priority
R	Mulch under trees in mowed areas that are currently without an herbaceous layer.	High
U & R	Remove any tree safety hazards.	High
U, E & R	Stabilize trail and eliminate crushed granite deposition off-trail.	High
I	Monitor entire site for invasive species	High
All	Monitor previous work, retreat where necessary, adjust new treatments as necessary.	High
R & I	Where tree establishment is occurring, control invasives	High

Deep Eddy Secondary Treatment

Type	Task	Priority
E & U	Increase diversity of existing woodland	Low

Austin High Secondary Treatment

Type	Task	Priority
R	Increase woodland diversity with special attention to the more intact areas in the western portions of the management unit.	Medium
R	Plant aquatic species to promote greater aquatic plant diversity.	Medium
U, E & R	Formalize a portion of the trails on the peninsula and decommission other trails with a combination of brushing, soil decompaction, and planting of tree seedlings.	Medium
R	Add sediment capture structures near existing wetland to encourage its spread.	Medium
R	Remove homeless encampment debris on peninsulas.	Medium

City Hall Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland	Low
R	Add sediment capture structures near existing wetland to encourage its spread.	Low
R	Plant aquatic species to promote greater aquatic plant diversity.	Low

Rainey Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland	Medium
E	Use armoring, diversion and/or dispersal to address erosion caused by numerous small culverts that shunt water under trail.	Medium
U & R	Remove old wooden docks.	Low
R	Add sediment capture structures near existing cattail patch to encourage its spread.	Low
R	Plant aquatic species to promote greater aquatic plant diversity.	Low

Holly Shores Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland	Medium
R	Plant aquatic species to promote greater aquatic plant diversity.	Medium
R	Add sediment capture structures near existing cattail patch to encourage its spread.	Medium
I	Remove common chaste tree, Johnsongrass, Chinaberry, and Chinese tallow.	Low

Southeast Shore Secondary Treatment

Type	Task	Priority
R	Install sediment capture structures at edges of existing wetlands and install emergent aquatic plants, using exclosures as needed, as part of wetland expansion pilot project.	Medium
R	Create a pilot area of Gaddy soil savanna under powerlines in eastern part of unit.	Low
I	Remove Chinese tallow, Ligustrum, and common chaste tree.	Low

Southcentral Shore Secondary Treatment

Type	Task	Priority
E & U	Decommission informal trails and informal water access points with a combination of brushing, soil decompaction, and planting of tree seedlings.	Medium

Fall 2018 to Summer 2019

Entire Site

Type	Task	Priority
R	Mulch under trees in mowed areas that are currently without an herbaceous layer.	High
U & R	Remove any tree safety hazards.	High
U, E & R	Stabilize trail and eliminate crushed granite deposition off-trail.	High
I	Monitor entire site for invasive species	High
All	Monitor previous work, retreat where necessary, adjust new treatments as necessary.	High
R & I	Where tree establishment is occurring, control invasives	High

Cesar Chavez Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland	Medium
R	Restore savanna on Gaddy soils just east of baseball field.	Low
R	Restore savanna area under Mesquite grove southwest of the Austin High baseball field.	Low
E & U	Decommission informal trails near Seaholm with a combination of brushing, soil decompaction, and planting tree seedlings.	Low

Hotel Slope Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland	Low
R	Plant aquatic species to promote greater aquatic plant diversity.	Low

Waller Creek

Type	Task	Priority
I	Remove Mexican petunia and elephant ear where feasible.	High
R	Restore herbaceous and shrub layer throughout.	High
I & R	Remove giant reed on western banks of Waller Creek. This action will necessitate bank stabilization, planting, and seeding in the following years.	High
I	Remove woody invasives including Ligustrum, Chinaberry, heavenly bamboo, and common chaste tree on west side of Waller Creek.	Medium
U & E	Decommission informal trails with a combination of brushing, soil decompaction, and planting tree seedlings west of Waller Creek.	Medium

Waller Creek (continued)

Type	Task	Priority
R	Add sediment capture structures near existing cattail patch to encourage its spread.	Low
R	Plant aquatic species to promote greater aquatic plant diversity.	Low

Festival Beach Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland.	Medium
I	Remove Chinese tallow and Chinaberry.	Medium
R	Add sediment capture structures near existing wetland to encourage its spread.	Medium
R	Plant aquatic species to promote greater aquatic diversity.	Medium
E & R	Enhance streamlets in existing erosion channels.	Medium
U & E	Add hardscape around existing bench just east of I-35 to prevent continued erosion and provide a better view of the Lake.	Low

The Cliffs Treatment

Type	Task	Priority
R	Install sediment capture structures and plant aquatic species to increase aquatic plant diversity.	Medium
R	Increase diversity of existing woodland.	Medium
I	Invasive plant control on steep slopes using caution not to create erosion problems.	Medium

Butler Shores Woodland Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland.	Medium
I	Actively restore wetland and emergent aquatic plantings on sediment bar at the mouth of West Bouldin Creek.	Medium

Zilker East Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland inland from Trail	High
U	Remove dilapidated staircase down to the Lake.	Low

Zilker West Secondary Treatment

Type	Task	Priority
R	Increase diversity of existing woodland.	Medium

Appendix 2

Monitoring Forms

Early Detection Monitoring Datasheet

Date:_____ **Recorded by:**_____

Type of Threat:
☐ New Invasive Infestation; Species Name(s):_____
☐ Expanding Invasive Infestation; Species Name(s): _____
☐ New or expanding erosion or denuding of vegetation; describe: _____
☐ New or expanding informal trails; describe: _____
☐ Other; describe: _____

General Location (landscape character area or areas if known): _____

Specific Area: _____ latitude _____ longitude

Disturbance (circle applicable):
Flood Graded Mowing Recently cleared Recreational traffic Storm damage Roadside

Patch Type (circle applicable):
Point (one or few invasives or locations) Linear (erosion or invasives extending along a line) Polygon (of non-linear shape)

Abundance of Invasives if applicable (circle applicable):
Rare (hard to find, other plants more common)
Common (one of the common plants in area)

Notes:

The Trail Foundation Stewardship Activity Log

Date:_____ **Recorded by:**_____

General Activity:_____
(Example include: tree planting, invasive plant inventory or removal, seed sowing, trail maintenance, soil enhancement, monitoring of past activities, monitoring of trail conditions etc.)

General Location (landscape character area or areas if known): _____

Specific Area: _____ latitude _____ longitude

Photos Taken and Attached: Yes No

Activity and/or Monitoring Details:
(examples include: number of trees planted, method of removal, herbicides used, number of volunteers utilized, time spent, etc. For monitoring, examples may include tree mortality or qualitative description of success.)

Appendix 3

Photo Points

The table below shows the coordinates of the 68 photo points that were created with a GPS between July 2014 and April 2015. It is recommended that the photos shown in this section be replicated a minimum of once every two years as part of qualitative monitoring. Comparing the photos over time will show how the area is changing, and the staff can determine whether the changes are positive or negative, and adjust management strategies accordingly.

Photo Point	Latitude	Longitude
1	30.276823	-97.773859
2	30.276647	-97.77379
3	30.276482	-97.773584
4	30.273795	-97.769674
5	30.273137	-97.769037
6	30.271644	-97.768212
7	30.271079	-97.766616
8	30.269509	-97.763732
9	30.265954	-97.755016
10	30.265894	-97.754047
11	30.2646	-97.751434
12	30.264394	-97.750212
13	30.265129	-97.751064
14	30.264365	-97.748961
15	30.263782	-97.746799
16	30.2629	-97.745151
17	30.262408	-97.744522
18	30.261416	-97.743213
19	30.260551	-97.742791
20	30.259696	-97.741109
21	30.260041	-97.740639
22	30.259534	-97.740693
23	30.259019	-97.741238
24	30.25748	-97.740601
25	30.256295	-97.740539
26	30.253316	-97.738317
27	30.251449	-97.735621
28	30.250615	-97.733614
29	30.251083	-97.732477
30	30.248405	-97.727203
31	30.247503	-97.725768
32	30.247864	-97.724933
33	30.247152	-97.725057
34	30.247669	-97.722065
35	30.250651	-97.715369
36	30.250648	-97.715044
37	30.249615	-97.713686
38	30.247785	-97.714625
39	30.245227	-97.716387
40	30.244819	-97.716624
41	30.243529	-97.717635
42	30.243736	-97.719768
43	30.245611	-97.722388
44	30.245341	-97.724848
45	30.245839	-97.726748
46	30.250727	-97.738376
47	30.252291	-97.740298
48	30.252653	-97.740689
49	30.2554	-97.742736
50	30.257451	-97.743023
51	30.257934	-97.743104
52	30.259792	-97.744052
53	30.261126	-97.746605
54	30.26307	-97.750635
55	30.26375	-97.752364
56	30.264236	-97.75508
57	30.26535	-97.757718
58	30.265635	-97.758264
59	30.266182	-97.75953
60	30.265951	-97.762771
61	30.265806	-97.764132
62	30.266559	-97.762964
63	30.267903	-97.76316
64	30.268264	-97.764181
65	30.269401	-97.769624
66	30.272125	-97.771309
67	30.273296	-97.772434
68	30.273522	-97.772447

Photopoint 1 **Direction: W**
Deep Eddy Management Unit

Photopoint 2 **Direction: S**
Deep Eddy Management Unit

Photopoint 3 **Direction: SW**
Deep Eddy managment unit

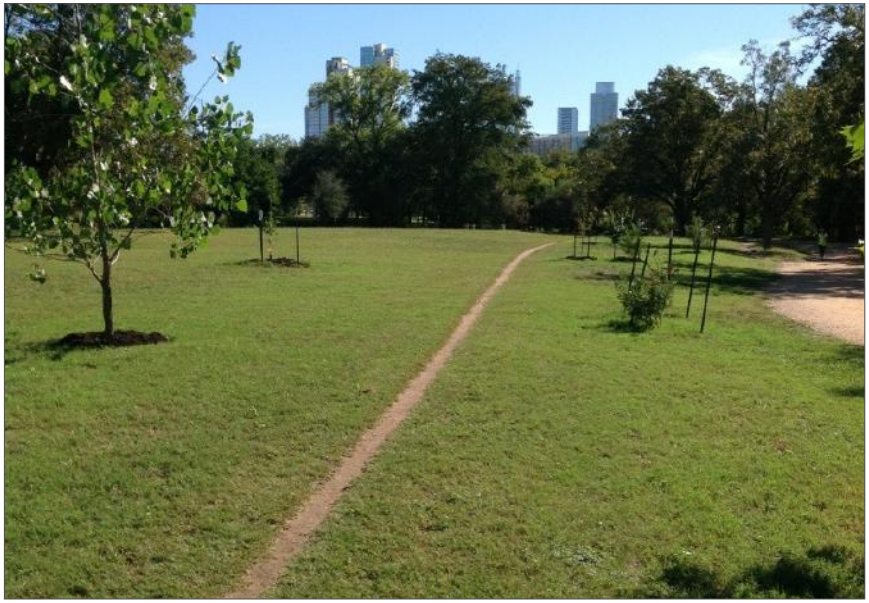
Photopoint 4 **Direction: NW**
Austin High Forest management unit.

Photopoint 5 Direction: NW
Austin High Forest managment unit

Photopoint 6 Direction: E
Austin High Forest managment unit

Photopoint 7 Direction: S
Austin High Forest managment unit

Photopoint 8 Direction: E
Cesar Chavez management unit



Photopoint 9 Direction: E
Cesar Chavez management unit

Photopoint 10 Direction: W
Cesar Chavez management unit

Photopoint 11 Direction: W
Cesar Chavez management unit

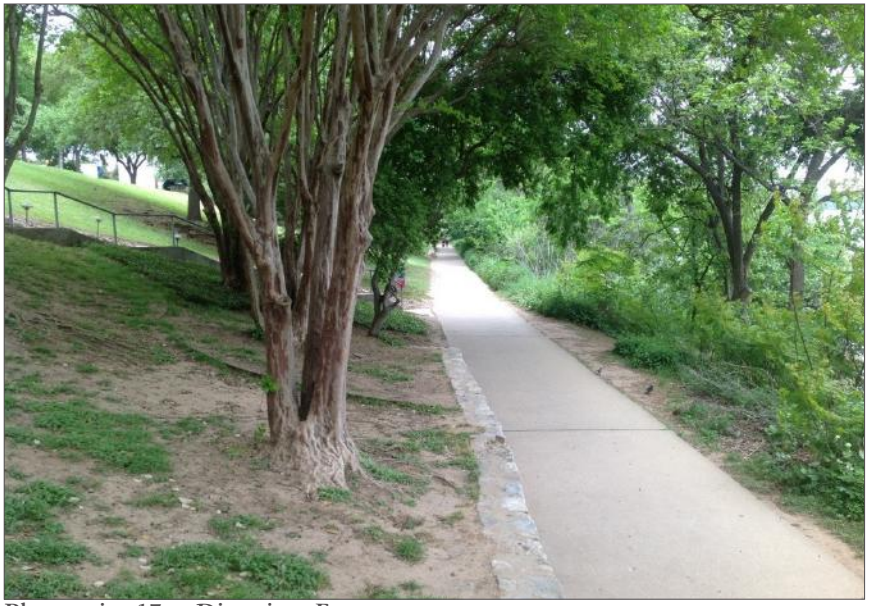
Photopoint 12 Direction: W
Cesar Chavez and City Hall management units

Photopoint 13 Direction: E
City Hall management unit

Photopoint 14 Direction: E
City Hall management unit

Photopoint 15 Direction: E
City Hall management unit

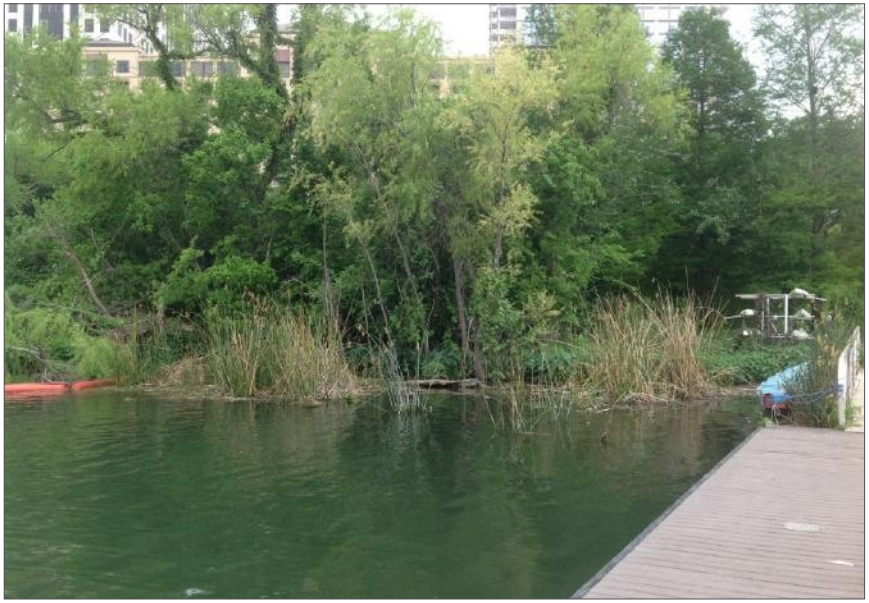
Photopoint 16 Direction: SW
City Hall management unit



Photopoint 17 Direction: E
Hotel Slope management unit

Photopoint 18 Direction: E
Hotel Slope management unit

Photopoint 19 Direction: NW
Hotel Slope management unit



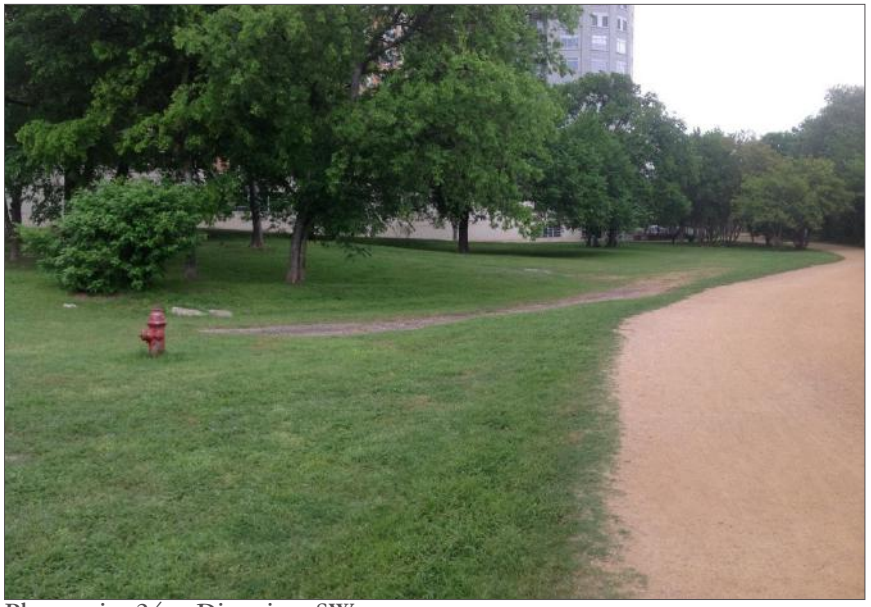
Photopoint 20 (1 of 2) Direction: S
Waller Creek management unit

Photopoint 20 (2 of 2) **Direction: N**
Waller Creek management unit

Photopoint 21 **Direction: S**
Waller Creek management unit

Photopoint 22 **Direction: S**
Rainey management unit

Photopoint 23 **Direction: SE**
Rainey management unit



Photopoint 24 Direction: SW
Rainey management unit

Photopoint 25 Direction: SE
Rainey management unit

Photopoint 26 Direction: W
Rainey management unit

Photopoint 27 Direction: SW
Festival Beach management unit

Photopoint 28 Direction: E
Festival Beach management unit

Photopoint 29 Direction: W
Festival Beach management unit

Photopoint 30 Direction: E
Festival Beach management unit

Photopoint 31 Direction: NE
Festival Beach management unit

Photopoint 32 (1 of 2) **Direction: SW**
Festival Beach management unit

Photopoint 32 (2 of 2) **Direction: SE**
Holly Shores management unit

Photopoint 33 **Direction: E**
Holly Shores management unit

Photopoint 34 **Direction: NE**
Holly Shores management unit

Photopoint 35 Direction: W
Holly Shores management unit

Photopoint 36 Direction: N
Holly Shores management unit

Photopoint 37 Direction: S
Southeast Shore management unit

Photopoint 38 Direction: S
Southeast Shore management unit

Photopoint 39 Direction: N
Southeast Shore management unit

Photopoint 40 Direction: N
Southeast Shore management unit

Photopoint 41 Direction: SW
Southeast Shore management unit

Photopoint 42 Direction: W
Southeast Shore management unit

Photopoint 43 Direction: N
Southeast Shore management unit

Photopoint 44 Direction: E
Southeast Shore management unit

Photopoint 45 Direction:E
Southeast Shore management unit

Photopoint 46 Direction: E
The Cliffs management unit

Photopoint 47 Direction: SW
The Cliffs management unit

Photopoint 48 Direction: N
The Cliffs management unit

Photopoint 49 Direction: SE
Southcentral Shore management unit

Photopoint 50 Direction: SE
Southcentral Shore management unit

Photopoint 51 Direction: SE
Southcentral Shore management unit

Photopoint 52 Direction:SE
Southcentral Shore management unit

Photopoint 53 Direction: E
Southcentral Shore management unit

Photopoint 54 Direction: E
Auditoruim Shores management unit

Photopoint 55 Direction: W
Auditoruim Shores management unit

Photopoint 56 Direction: W
PARD Woodland management unit

Photopoint 57 Direction: W
Auditoruim Shores management unit

Photopoint 58 Direction: S
PARD Woodland management unit

Photopoint 59 Direction: S
PARD Woodland management unit

Photopoint 60 Direction: SE
PARD Woodland management unit

Photopoint 61 Direction: NE
Zilker East management unit

Photopoint 62 Direction: N
Zilker East management unit

Photopoint 63 Direction: E
Zilker East management unit

Photopoint 64 Direction: S
Zilker East management unit

Photopoint 65 (1 of 2) Direction: NE
Zilker West and Southwest Woods management unit

Photopoint 65 (2 of 2) Direction: NW
Zilker West and Southwest Woods management unit

Photopoint 66 Direction: SW
Zilker West and Southwest Woods management unit

Photopoint 67 Direction: W
Zilker West and Southwest Woods management unit

Photopoint 68 (1 of 2) Direction: W
Zilker West and Southwest Woods management unit

Photopoint 68 (2 of 2) Direction: N
Zilker West and Southwest Woods management unit


The Trail Foundation
SIGLO GROUP