Chamizal National Memorial Master Plan

Renewing a Conservation Ethic

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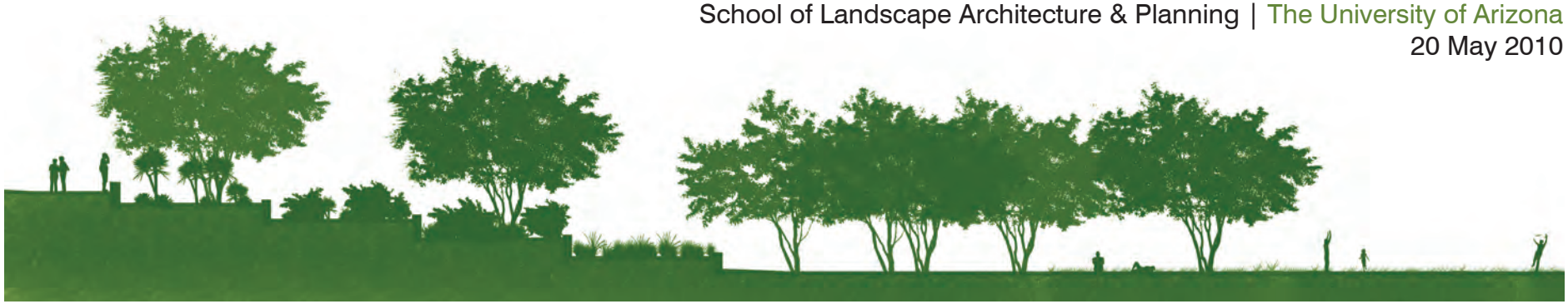

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INTRODUCTION

This section presents an overview of the project, starting with some of the key issues CHAM managers are facing in the near future. These site issues are also discussed in terms of their relevance to broader regional issues. The project goal and objectives offer a more specific outline of the issues addressed by the project, followed by a brief discussion of project parameters and methods.

Project Origin

Broader Problem

Overall Project Goal

Objectives

Study Parameters + Methods

Project Origin

This project is a cooperative agreement between the National Park Service (NPS) and The University of Arizona. The research team was asked to develop a new master plan for Chamizal National Memorial (CHAM) in El Paso, Texas. Some of the key concerns regarding site performance that were initially highlighted by CHAM staff were related to water-use, maintenance, and historic and regional interpretation. These site issues emphasized some broader, regional problems that the new master plan might be able to address, including habitat loss in urban cores, high use of fresh water sources, and the disconnect between people and the natural systems that we depend on.

Broader Problem

There are several critical issues that CHAM draws attention to, but this project mainly focuses on water conservation. Concern about availability of fresh water sources is widespread; news headlines from all over the world describe communities fighting over water rights. The arid southwest is no exception. The Rio Grande River supplies the water that helps support the livelihood of many communities. For decades, it has been the center of both domestic and international disputes *(p.8)*. These issues point to the need for us to reevaluate the ways we use our fresh water sources. There are many ways to address water conservation; from improving household practices, to improving agricultural irrigation techniques, to improving the design and maintenance of our urban landscapes. This issue will only become more and more prominent if we do not begin to make changes to our water-use practices. CHAM is in a great position to become a model for responsible water use in an urban park, serving as an example of how a high-water-use landscape can be converted to a low-water-use landscape while maintaining its aesthetic appeal and its ability to accommodate a variety of different user groups and activities. This project provides a method for transforming an existing site to represent a more regional context while minimizing disruption to site users during the process.

Overall Project Goal

The ultimate goal of this project is to craft a new vision for CHAM that guides the direction of transformations to enhance the image and function of the park for a variety of users and for CHAM managers. Much of the uniqueness of this national memorial relates to its accommodation of a wide variety of users and their needs in a relatively dense urban setting. The designs should illustrate conservation elements and principles that could be implemented on other sites in the surrounding community, including residential and commercial sites. The master plan should be realistic and attainable so that it will retain its relevance through many generations of CHAM managers and will be a document that CHAM staff can refer back to over time as project funds become available.

Objectives

During the UA research team's site visits in December of 2008 and June of 2009, a number of issues and needs related to the Memorial and its users were brought to our attention that we thought should be addressed by the master plan. They are organized into four overarching objectives.

Objective 1: Guide Memorial Toward More Sustainable Practices

Water Conservation + Habitat Creation

One of the dominant objectives of this master plan is to explore and offer solutions to the water issues that the NPS staff at CHAM face. Currently, water for the landscape comes from a private well and the Memorial also has the option to access reclaimed water. However, current water-use practices cannot be sustained indefinitely. There is truly a need to explore other landscape options that will reduce water use on the site as well as add to the habitat value of the site. This includes the replacement of some of the turf with regionally appropriate plants. This idea would not only reduce water use but would provide an opportunity to showcase some natural ecosystem concepts that are more in sync with NPS goals. The key to success will be to provide realistic, attainable phasing options for this transition as well as to create a clear, simple list of suggested species.

Maintenance

Another key issue regarding the needs of the Memorial and its staff is grounds maintenance. Not only does the large expanse of turf require a lot of water but it also demands high maintenance input, including labor and fertilizer, incomparison to plant that are native to the area. The park staff is limited in their responses to the high demands of such a large site. Making certain that new designs are low maintenance will help ensure the long-term success and viability of this master plan even through changes in management personnel in the future.

Objective 2: Enhance Opportunities for Education and Interpretation

Ecological + Historic

There is the need to enhance the image of the site as a national memorial so that people are more aware of the historical and ecological significance of the site. Enhancing opportunities for education and interpretation is critical for CHAM to effectively commemorate conflict resolution as well as to become a model of conservation practices appropriate to the region.

Objective 3: Enhance Opportunities for Recreation and Entertainment

CHAM is well-loved by community members for its entertainment and recreation opportunities. These site users account for a large percentage of the total park users. It is imperative that existing recreation and entertainment opportunities are maintained, even amidst some dramatic changes to the landscape. The design will also offer simple suggestions for how these leisure opportunities might be enhanced.

Objective 4: Blend Distinct Uses within the Park

Based on an examination of the different user groups, it is clear that this master plan needs to address some distinct needs. While the Memorial needs should take precedence, the user groups that use the site more like a city park make up a huge percentage of the total users, and their needs are considered important by NPS staff. It is very important for the end product to be a cohesive blending of different uses. The design will also address the need to blend current landscape aesthetic with proposed landscape aesthetic in order to maintain a sense of unity throughout the site.

Study Parameters + Methods

Methods of investigation used in the design process included: CHAM staff and public meetings, site visits for inventory and analysis of site conditions, theory/ literature review, and case reviews of sites with similar context and design needs.

Information gathered was used to inform design decisions, which are represented in several end products. End products include a master plan, conceptual designs for focus areas, plant lists, and a species replacement plan.

Literature Review

The review involved an exploration of existing literature related to the key issues needing to be address at CHAM. Areas of research include water conservation (turf removal, water harvesting, xeriscaping, and habitat creation) erosion control, and interpretation.

Site Assessment

This part of the design process included inventory and analysis of significant site history, current circulation, site users, and natural systems.

Case Reviews

The end products were influenced by a review of various built works that were examined based on their relevance to the key issues addressed by the literature review; they include: Rio Vista Natural Resource Park, Shady Hollow Nature Area, Arizona Cancer Center, Advanced Micro Devices Corporate Campus, Arizona-Sonora Desert Museum, Mueller Redevelopment, Lurie Garden, and Lost Creek Golf Course.

Final Master Plan

This represents a new vision for the image, maintenance, interpretation, and visitor experiences of CHAM.

Focus Areas

These are site specific designs for smaller areas of the site including the pollinator courtyard, theater plaza, memorial node, overview plaza, erosion mitigation, medians, and entrances.

Plant Lists

These are alternative plant combinations for various areas of the Memorial. They allow for variety of plant composition while maintaning a sense of unity.

Species Replacement Plan

This includes GPS data showing existing tree locations as of January 2010. Since many of the existing exotic species on the site are showing signs of decline, this end product also includes suggestions for appropriate replacement species based on location on the site.

LITERATURE REVIEW

This literature review focuses on the following five topics due to their relevance to the issues that need to be addressed by the master plan for CHAM. Water conservation and habitat representation are the central issues; sections on NPS turf classification, turf removal, erosion control, and interpretation provide supporting information. Each section contains three sub-sections as needed: definitions of uncommon terms, relevant background information about the issue and how it relates to the goals of the project, and design approaches that would be appropriate to incorporate into the final design suggestions for CHAM.

Water Conservation

Habitat Creation

NPS Turf Classification + Turf Removal

Erosion Management

Interpretation

WATER CONSERVATION

The Issue

In arid regions, such as the one CHAM is located in, water-use practices are a dominant issue facing local residents. "In a region where water constitutes the lifeblood of both urban and rural existence, it is not surprising that the flows of major regional rivers and subsurface aquifers became a source of lasting conflict between Mexico and the United States" (Ganster 2008). The Rio Grande/Rio Bravo River separates New Mexico and Texas from one another and separates them from the Mexican states of Chihuahua, Tamaulipas, Nuevo Leon, and Coahuila. Misuse of valuable water resources occurs on both sides of the border. "All along the border, upstream water users take actions that hurt downstream users. California and the other U.S. states that share the water of the upper Colorado River basin use huge quantities of water to support growing urban populations and irrigated agriculture, leaving only about 10 percent of the Colorado River's poor quality waters to reach Mexico and only a trickle to reach the Gulf of California" (Ganster 2008). Likewise, "farmers in the Conchos Basin in Coahuila use excessive amounts of water, much of it wasted through inefficient irrigation practices, so that not enough water flows downstream into the Rio Grande, causing shortages and economic hardship for Texas farmers" (Ganster 2008). It is imperative that water users in this area establish more sustainable water-use practices. A 1997 World Bank report estimated that "the aquifer underlying Ciudad Juarez-El Paso was being drained unsustainably at twenty times the rate of recharge; at that pace, the water supply would be exhausted by 2025" (Ganster 2008). Hydrologic studies of the groundwater in this area also indicate that over-pumping has changed underground water flows and has caused brackish waters to invade fresh groundwater sources (El Paso Water Utilities 2007). This means that some of the wells in the area have been shut down and others cannot contribute to the drinking water supply without treating the water (El Paso Water Utilities 2007). It seems that a reduction of pumping from this aquifer is critical. One major way to cut down on water use in the public sector is to replace turf with lower water use landscapes. Parks like CHAM simply cannot continue to maintain large expanses of turf in a sustainable manner.

Water issues are "more likely than ever to continue to plague U.S.-Mexican relations at the border" (Ganster 2008). Making a serious effort to conserve water use at CHAM could be perceived as a very strong gesture of respect for its neighbors in the US as well as for its neighbors in Mexico. Water conservation efforts at CHAM could become a model for responsible, sustainable water use. What we do with water here affects millions of people in Mexico and other US states, and how people in Mexico use water affects the lives of people in the US. By taking steps toward water conservation at CHAM, perhaps we can inspire other people to do the same. In a region where water is scarce, steps toward water conservation can be perceived as steps toward collaboration and peace along the US-Mexico border.

Appropriate Approaches

There are many ways to conserve water. Two of the methods that relate to landscape architecture are rainwater harvesting and xeriscaping. Brief reviews of these strategies are presented in the following sections.

Rainwater Harvesting

One method for water conservation that has been regaining popularity in recent years is rainwater harvesting. Rainwater harvesting is not a new theory; it is an old tradition. For thousands of years people all over the world have recognized and capitalized on the value of rainwater (Lancaster 2006). Rainwater has the "lowest salt content of natural fresh water sources," making it a valuable resource for landscapes with salt-affected soils (Lancaster 2006). Salt-affected soils are common in arid regions, where there is not enough rain to leach the salts out of the root zone. Certain irrigation practices in these regions make the problem worse, including shallow irrigations and using water sources high in salts. "Rainwater can dilute these salts and flush them out of the root zone," allowing for better water infiltration and plant growth (Lancaster 2006). Furthermore, rainwater is a natural fertilizer, containing sulfur and plant-usable forms of nitrogen, key elements critical to plant growth (Lancaster 2006). Lancaster (2006) suggests that in theory rain should be our landscapes' primary water source, graywater the second source, and municipal water or groundwater from private wells should be a supplemental source of water only used in times of need.

There are two types of rainwater harvesting, passive and active. Active water harvesting involves the use of water storage units such as cisterns, allowing water to be stored for longer term use. Passive water harvesting involves sculpting the land with various earthworks to minimize water runoff and maximize its effect on-site by directing it toward planted areas. Holding water on a site not only reduces potable water use and related costs but also reduces potential of flooding and erosion (Waterfall 2004). Earthworks slow the flow of water and promote infiltration. Types of earthworks include berm + basin, terrace, French drain, infiltration basin, diversion swale, imprinting, and check dams (Lancaster 2006) *(Figures 1.1 + 1.2)*. "The surface should be manipulated to create pools for water and provide a diversity of vegetation for feeding a variety of wildlife. These wet areas can be created on those materials that occur in low topography and/or exhibit poor drainage (low infiltration and permeability)" (France, 2008). Ideally, with these systems, plants survive on natural rainfall and require little to no supplemental irrigation and fertilization.

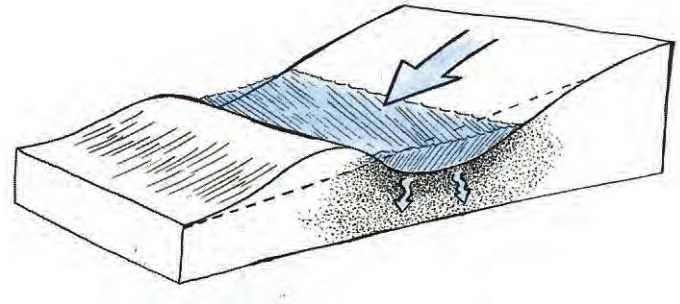


Figure 1.1 A berm+basin earthwork slows the flow of water across a slope and collects water, allowing it to infiltrate.

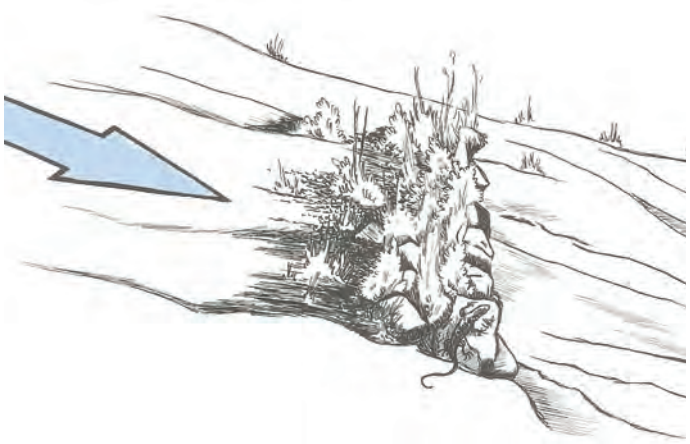


Figure 1.2 A berm+basin or rocks on contour create a place for seeds and water to collect.

In Rainwater Harvesting for Drylands, Lancaster (2006) outlines eight water harvesting principles/steps for designing a water harvesting system:

1. Start with long, thoughtful observation.
2. Start at the top (high point) of the watershed and work with the slope of the land.
3. Start small and simple to reduce construction and maintenance costs.
    a. Many small water harvesting strategies are usually more effective than one large one.
4. Spread and infiltrate the flow of water.
    a. Provide for slower movement of water; "make water stroll, not run, through the landscape."
    b. This practice reduces erosion, flooding, drought, and cost for irrigation.
5. Always plan for an overflow route and manage the overflow as a resource.
6. Maximize living and organic ground cover.
    a. Vegetation helps water infiltrate and improves soil structure.
    b. Place plants where water collects to reduce the time water sits above ground.
7. Maximize beneficial relationships and efficiency by "stacking functions."
    a. This refers to the placement of harvesting structures and plants as well as plant species selection.
    b. One solution should serve multiple functions.
8. Continually reassess your system.
    a. This is the "key to long-term maintenance of a water harvesting system."
    b. Landscapes are not static, and it is unreasonable to expect a no-maintenance landscape. Necessary changes will be minor if the original design is well thought out.
    c. "Balanced maintenance should not be feared or neglected; it is an opportunity to learn and to improve."

It seems that passive rainwater harvesting would be an appropriate design tool for CHAM because is addresses many of issues currently needing attention, including high water use, soil salinity, and poor infiltration. In addition, earthworks generally require low initial cost and labor input and low long-term maintenance.

Xeriscaping

Xeriscaping is a popular landscaping technique in arid regions. 'Xeros' is a Greek word meaning dry (Stinnett 2000). Xeriscaping is a landscape approach that was trademarked by the Denver Water Department and the National Xeriscape Council (Thompson 2000). The system employs a set of seven principles to minimize landscape water use and maintenance. The seven xeriscape principles are as follows:

1. Comprehensive planning and design
2. Soil analysis and improvement
3. Appropriate/low-water-use plants
4. Practical areas of turf
5. Efficient irrigation
6. Mulching
7. Proper maintenance

(Stinnett 2000; Thompson 2000)

The key concepts for xeric design is grouping of plants with similar water requirements and reserving water-intensive plants for key areas where they will have the most impact. There are three basic planting zones: mini oasis, transition, and desert/natural (Cochise 2009). The mini oasis zone is located closest to structures so that the time, energy, and water put into this area are most visible and accessible to people. The water-intensive plants that are reserved for focal

areas near buildings would be included in the mini oasis zone. The transition zone could include plants that need minimal supplemental irrigation. Finally, the desert/natural zone contains plants that can survive on only rainfall with no supplemental irrigation after establishment. Thompson (2000) suggests that "on larger properties, only a reasonably sized garden would contain plants requiring irrigation; outside that zone, the native landscape would predominate". Utilizing these design principles "reflects sensitivity to local environment and its climate" (Stinnett 2000). Additionally, these types of landscapes offer the opportunity to encourage a new attitude toward native plants by showing people that they can look beautiful, not just weedy or unkempt (Thompson 2000).

Not only does xeriscaping reduce the need for supplemental irrigation, but it can reduce the need for maintenance. The mini oasis zone might need the most maintenance, followed by the transition zone, and the desert/natural zone would need the least amount of care. Stinnett (2000) suggests that people should prune sparingly; to remove dead or weak branches that could be hazardous, to keep high-traffic areas clear, to remove crossing branches, and to direct growth. Allowing native plants to take their natural form reduces the need for maintenance and offers people a more realistic perspective of a natural plant community.

Figure 1.3 An aesthetically appealing xeriscape design in Corinth, TX.

HABITAT CREATION

Definitions

Habitat Creation: "The creation of habitats on sites that are either bare or have a very low wildlife value" (Gilbert 1998).

Habitat Restoration: "The improvement of degraded habitats; frequently achieved by altering the management regime" (Gilbert 1998).

The Issue

As urban development continues, more and more of our cities see the need for open space and viable wildlife habitat. Habitat creation and repair is one way to enhance the educational experience of a site for its users as well as enhance connectivity between existing habitat patches. It is especially valuable in urban areas where residents might otherwise have little contact with nature. Most ecologists prefer habitat preservation over habitat creation, but "habitat creation still has an enormous role to play in areas where the natural environment has already been extensively damaged by deforestation, agriculture, land drainage, mineral extraction, or civil engineering projects" (Gilbert 1998). The need for habitat creation versus habitat repair is based on an evaluation of existing conditions. Sites that are devoid of vegetation, support only a simple community of vegetation, or where the topography has been changed dramatically are great candidates for habitat creation (Gilbert 1998). Habitat repair is appropriate for site where natural ecologies are still somewhat intact and only require minor intervention to be restored to full health. CHAM fits into the former category; it currently supports a very simple plant community with low richness and diversity, and the topography of the site has been manipulated drastically from its original state. CHAM requires a focus on habitat creation, not just habitat repair, in order to achieve native habitat representation.

Appropriate Approaches

The design process for creating new habitat includes conducting a site survey. According to Gilbert (1998), the site survey should identify the following features:

1. Topography, slope
2. Hydrology
3. Local climate
4. Existing plants and animals
5. Soil and water characteristics
6. Adjacent habitat types
7. Site constraints

Gilbert and Anderson (1998) suggest that there are four types of habitat creation:

1. Natural Colonization: Without human intervention, natural processes are allowed to determine the habitats that develop on an unmodified site.
2. Framework Habitats: Engineering restoration on topography, soils, and drainage provide a framework within which natural colonization can take place. This may or may not include some planting.
3. Designer Habitats: A complete landscape based on a design. All plants are planted and maintained according to a precise plan.
4. Political Habitats: "These are colourful, interesting and attractive habitats created for people in urban areas. They have an education and propaganda role and do not attempt to reproduce any particular target habitat" (Baines 1989).

"In practice it is often best to employ several design approaches on a site to produce habitat mosaics" (Gilbert 1998). Habitat creation at CHAM could include a combination of all four techniques discussed above, but the most relevant techniques would be designer habitat and political habitat. Designer and political habitat types result in spaces that look like they are meant to be there. Gilbert (1998) states that "looking attractive" is one of the major factors of success for created habitats. If the space looks too wild, people assume that it is not being maintained properly and are less likely to be receptive to educational opportunities. "They [created habitats] must, in addition, satisfy nature conservation objectives and be ecologically sound so they do not fail or necessitate high management costs" (Gilbert 1998). A well-designed habitat should be relatively low maintenance once the plants are established; our natural habitats get along just fine without us. Initially there is often a need for more intensive efforts to establish new plants and control weedy species, but in the long term, native plant communities are fairly self-sufficient. Created habitats in public spaces should require no pruning, except minimal pruning along pedestrian walkways, and they should require no supplemental fertilization.

NPS TURF CLASSIFICATION + TURF REMOVAL

The Issue

As mentioned in the Water Conservation section of this literature review, one of the ways to reduce water use is to plant local plant species that are adapted to surviving on natural rainfall with little to no supplemental irrigation. In the desert Southwest, "turf is the highest water use landscape component. It is also the most labor intensive" (Cochise 2009). As CHAM is comprised of nearly 35 acres of turf, one way to dramatically reduce water use at the Memorial is to cut back on the area of turf that is maintained.

The NPS has outlined a system for classifying turf areas based on their intended purpose. Management action items are associated with each turf class. CHAM has yet to make use of this classification system. Doing so will help determine which areas of turf are most critical to preserve and will aid in management decisions regarding the upkeep of those areas.

Appropriate Approaches

Turf Classification

The National Park Service has outlined a turf classification system that divides areas of turf into three classes.

Class A – Ornamental Turf

- Highest visual quality objective
- Uniform in color and texture
- Highest maintenance
- Minor foot traffic
- Should be restricted to minimum area necessary to achieve visual objective

Class B – Recreational Turf

- Uniformity of color and texture less critical than Class A
- Presence of some weed infestation tolerable
- Medium maintenance
- Visitor use common
- Passive and active recreation activities

Class C – Greenspace Turf

- Aesthetic objective achieved simply by presence of grass rather than quality
- Minimal maintenance other than occasional mowing
- Large expanses
- Large picnic areas, informal recreation areas, parkway medians, and roadsides

(National Park Service 2010)

Turf Removal

Bermudagrass is a very aggressive plant. It has three ways of reproducing and spreading: stolons, rhizomes, and seeds. Many sources indicate that the only effective way to remove bermudagrass is through chemical application (Cochise 2009; Hills 2004; Desert Botanical Garden n.d.). Glyphosphate is the most effective chemical to use. It is a foliar herbicide that inhibits the production of amino acids needed for plant growth (Cochise 2009). This chemical is found in common products such as Roundup, Doomsday, and Kleenup. One of the positive aspects of glyphosphate is that is does not leave residue in the soil, so areas where the chemical has been applied can be reseeded or planted within 24 hours of application (National Park Service 2010).

The Cochise County Cooperative Extension (2009) and the Desert Botanical Garden (n.d.) outline the following tips for turf removal:

1. The temperatures should be above 70 degrees.
2. If rain is expected within eight hours of application, wait for a dry period because the effectiveness of glyphosphate is greatly reduced by rain.
3. One week prior to applying glyphosphate, irrigate the lawn area to get the grass actively growing, 30-40 minutes/day. Do not mow.
4. Do not exceed the recommended rate on the herbicide label, and apply the herbicide evenly. It is not necessary to saturate the grass with the herbicide.
5. After one-two weeks, repeat the treatment. This time it is only necessary to water for 3 days prior.
6. Two or three applications are normally required to achieve full control of bermudagrass.
7. Two weeks after the last spraying, scalp the lawn with a mower set very low, or use a power rake. Take off as much grass as possible.
8. Once a month, spot treat any areas that show living grass.
9. Care should be taken to avoid spraying chemical on existing plants that are intended to remain in the landscape. Do not spray on a windy day.

NOTE: Cochise County Cooperative Extension (2009) points out that soil sterilizers should not be used because they prevent seeds from germinating and can be absorbed by roots of nearby plants, causing them harm.

EROSION CONTROL

Definition

Erosion is "a type of weathering in which surface soil and rock are worn away through the action of glaciers, water, and wind" (Dictionary.com 2005).

The Issue

As relatively large areas of turf are removed from the Memorial, the potential for erosion rises. Especially on sloped areas, it will be important to employ a variety of erosion control techniques.

Appropriate Approaches

As mentioned in the section on water conservation, earthworks are not only effective for harvesting water but they also reduce erosion potential by slowing the flow of water across the surface of the land (Lancaster 2006; Pretty 1995; Roose 1996). Earthen banks (berms) constructed perpendicular to the slope are the simplest approach and are suitable for slopes less than 32.5% (Lancaster 2006; Pretty 1995). In addition, plants are important for reducing erosion potential on slopes. Plant roots aid in water infiltration, so there is less water running across the soil surface. In addition, plant roots help to anchor surrounding soil, preventing it from eroding. Planting trees or grasses along the berms helps to reinforce them, as does placing rocks on the downhill side of the berms (Pretty 1995).

Terraces with retaining walls are more costly to construct but would be necessary on slopes greater than 32.5% (Lancaster 2006; Pretty 1995) *(Figure 1.5)*. Terracing involves the re-grading of a hill to create a series of wide steps/benches. The Natural Resources Conservation Service (NRCS) points out that "terraces prevent erosion by shortening the long slope into a series of shorter, more level steps. This allows heavy rains to soak into the soil rather than run off and cause erosion." Terrace retaining walls can be constructed out of loose stacked rock, gabions, or masonry. Gabions "consist of wire mesh baskets filled with cobble or small boulder material. The fill normally consists of rock material but other materials such as bricks have been used to fill the baskets" (Freeman 2000) *(Figure 1.4)*.

Figure 1.4 An example of a gabion.

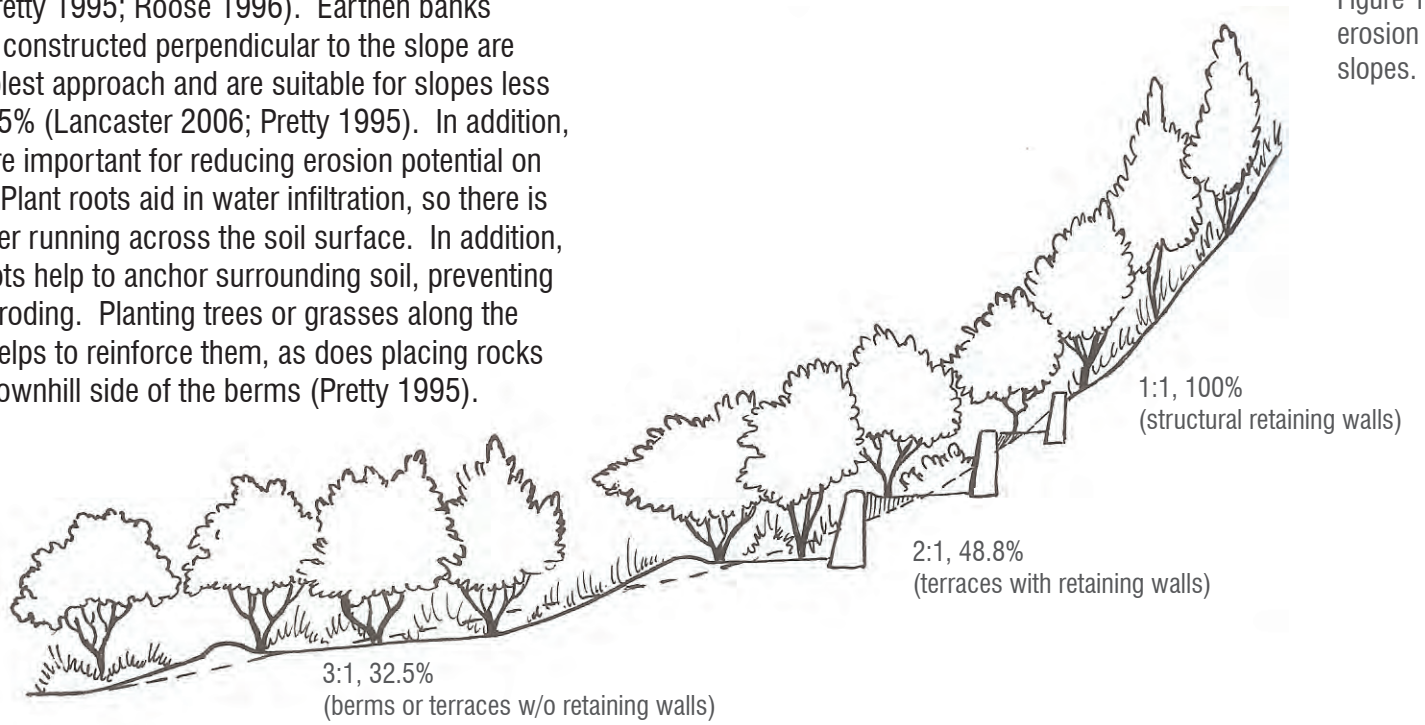


Figure 1.5 A section illustrating erosion measures needed at various slopes.

INTERPRETATION

Definition

Interpretation is "the work of revealing…the beauty and wonder, the inspiration and spiritual meaning that lie behind what the visitor can with his senses perceive" (Tilden 1977).

Interpretation is the creation of a whole picture from seemingly unrelated pieces of information (Tilden 1977).

"Interpretation is the revelation of a larger truth that lies behind any statement of fact" (Tilden 1977).

Tilden's full definition is as follows:

> An educational activity which aims to reveal meanings and relationships through the use of original objects, by firsthand experience, and by illustrative media, rather than simply to communicate factual information. (1977)

The Issue

Interpretation is a major component of the NPS mission. The NPS has six objectives related to interpretation that are meant to support the agency as well as enhance visitor experience:

1. Information and orientation: Provide easy access to information needed for a safe and enjoyable park experience.
2. Understanding and appreciation: Foster deeper understanding of resources and values of the park, its regional context, and the national park system.
3. Protection: Offer a variety of opportunities to interact safely with and enjoy park resources while protecting the resources from overuse, damage, vandalism, and theft.
4. Participation and skill development: Aid and motivate development of recreational skills.
5. Dialogue: Provide a means for communication of thoughts among the public, neighbors, and park managers.
6. Education: Provide interested users and educational groups with information needed to develop a thorough understanding of a park's resource, its regional context, and the entire national park system's significance and values.

(Jacobson 1999)

Some of the changes being proposed at CHAM will be rather dramatic, and it will be important to communicate their purpose and significance to people who visit the Memorial.

Appropriate Approaches

Interpreting Our Heritage, by Freeman Tilden (1977), is a seminal work on the topic of interpretation and is referenced by many other works on the same topic. "The purpose of interpretation is to stimulate the reader or hearer toward a desire to widen his horizon of interest and knowledge". The aim of interpretation is not to send the visitor away with a list of facts, but to send the visitor away with a greater understanding of and connection to objects, events, people, and places that he previously had little awareness of.

Tilden (1977) outlines six principles for effective interpretation:

1. Any interpretation that does not somehow relate what is being displayed or described to something within the personality or experience of the visitor will be sterile.
2. Information, as such, is not Interpretation. Interpretation is revelation based upon

information. They are entirely different things. However, all interpretation includes information.

3. Interpretation is an art, which combines many arts, whether the materials presented are scientific, historical or architectural. Any art is in some degree teachable.
4. The chief aim of Interpretation is not instruction, but provocation.
5. Interpretation should aim to present a whole rather than a part, and must address itself to the whole man rather than any phase.
6. Interpretation addressed to children (say up to the age of twelve) should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best it will require a separate program.

The tone of interpretive material is very important. The visitor "does not so much wish to be talked at as to be talked with" (Tilden 1977). Tilden also suggests that each visitor's primary interest is in something that concerns himself (1977); we are interested in being able to relate our lives to a greater whole. What Tilden indicates through various examples is that interpretive material should attempt an informal conversational tone that relates facts to a visitor's own life. One aspect of interpretation that isn't mentioned in the literature relates to language. Since many of CHAM's visitors are from Mexico, one way to relate interpretive material more effectively is to offer bilingual versions in both English and Spanish. Also, Tilden bases his discussion on the premise that all visitors consider the site a destination, that they are there to be there and that they are therefore in a receptive mood. However, this is not the case will all of the CHAM user groups. Some CHAM visitors are using the site as a circulation route rather than a destination. That is to say, they are on the site only because it happens to lie between them and their true destination. So how can interpretative materials pique the interest of these types of visitors? Jacobson (1999) suggests that interpretation that is fun and can be viewed as a recreational activity is more likely to reach visitors whose main objective is not education. Jacobson (1999) also discusses many methods of interpretation:

1. Guided walks
2. Public presentations
3. Publications
4. Self-guided activities
5. Audio/visual media
6. Signs
7. Exhibits

Jacobson's book, *Communication Skills for Conservation Professionals*, is a useful source for more specific information, regarding the design of interpretive elements, that is not included in the text of this literature review.

For this particular site, appropriate approaches include signs that are placed to intersect with routes of all site users, self-guided plant walks, pollinator species brochures, ranger talks, and interpretive/interactive sculptures. *(For imagery related to other examples of appropriate interpretation strategies see p.32-33.)*

CASE REVIEWS

This chapter contains reviews of various built works that were selected for examination based on their relevance to the key issues addressed by the literature review. Each review contains some basic site information, a more in depth review of key issues addressed by the design, and relevant design ideas for Chamizal National Memorial.

Rio Vista Natural Resource Park

Arizona Cancer Center

Shady Hollow Nature Area

Advanced Micro Devices Corporate Campus

Mueller Redevelopment

Lost Creek Golf Course

Arizona-Sonora Desert Museum

Lurie Garden

Figure 2.1 A tensile shade structure over a gathering area that is surrounded by native vegetation.

Figure 2.2 A tensile shade structure over the play equipment.

Figure 2.3 The park offers users a variety of seating types and areas. These include picnic tables, masonry cubes, large boulders, and concrete seat walls.

Rio Vista Natural Resource Park

Location: Tucson, Arizona
Size: 40 acres
Site Elements: ramadas, tables, sand pit with play equipment, paved sidewalks, turf, natural trails, tensile shade structures, restrooms, equestrian staging area

Site Description:
Diverse User Needs

Overall this site is an example of a park that is fairly successful at blending traditional park features with native park areas. The traditional park area includes turf and play equipment. The turf is concentrated in one area for ease of maintenance rather than located in several sites throughout the park. This zone is located adjacent to parking for ease of access.

Native areas are more removed from the parking lot, allowing them to be more serene and making the native areas more inviting to wildlife. The natural areas of the park include a system of unpaved trails that traverse acres of native vegetation. The natural trails are very popular for recreation such as jogging and dog walking. Users also enjoy observing a variety of wildlife in their native habitat.

The park includes three methods of shading visitor gathering areas; tensile shade structures, metal ramadas, and trees *(Figures 2.1 + 2.2)*. The tensile structures are visually interesting and placed well, so as not to obstruct beautiful views of the mountains to the north of the site. They also offer a softer look compared to the metal structures. The location of ramadas is interesting; they are placed on the edge of the traditional and natural park areas to be enjoyed by all users. Seating varies from rocks to concrete seating *(Figure 2.3)*.

Water harvesting + Erosion Management

The parking lot medians are slightly below the grade of the parking lot *(Figure 2.4)*. This allows them to collect some runoff to help support the low-water use plants that are planted in these areas. The concept of collecting water from the paved surface of the parking lot in vegetated medians is appropriate for consideration at CHAM, but would require a slightly different technique as the parking lot medians at CHAM are raised above the grade of the parking lot by a six inch curb.

Some of the trails in the native desert zone consist simply of native soil at grade; they appear to function well for a variety of users. Other sections of trail are slightly raised and consist of fine decomposed granite. There is no hard edge to contain these sections of the path, so there are signs of erosion at the edges.

There is little change in elevation across the site. The most dramatic slopes are reinforced with loose rock riprap *(Figure 2.5)*. This seems to be effective for erosion mitigation. Aesthetically, the color of rock chosen for riprap blends very well with nearby rammed earth walls and the rock is accented by native plants.

Native Plants

Areas near the traditional park zones are planted with native species in informal arrangements. The plant composition seems like a random scattering of plants and has low aesthetic appeal. The plant composition seems to be lost between a naturalistic composition and a formal composition; there is definitely room for improvements that would enhance the effect of these spaces on visitor experience. However, this is still an example of a simple way for traditional park users to be introduced to native vegetation without having to venture into the native desert zone.

Figure 2.4 Parking lot medians are slightly below the grade of the lot to collect runoff.

Figure 2.5 Large rock is used to reduce erosion potential on slopes.

Figure 2.6 A concrete sidewalk is the only physical barrier between turf and native desert.

Figure 2.7 One of the informational panels that is repeated in one other location in the park.

Maintenance

Concrete sidewalk defines the edge between turf and native areas, helping to contain the turf *(Figure 2.6)*. It is a rather abrupt transition between the two zones, but in a way, it is an interesting juxtaposition, allowing people using the traditional park features to get a taste of the natural habitat that surrounds the park. This physical barrier helps prevent turf from spreading into the native desert areas that surround the turf areas.

Interpretation

There is minimal interpretive signage, consisting of about three panels that are repeated in a couple areas of the park *(Figure 2.7)*. Too much educational signage in the natural desert area may actually detract from the visitor experience; however, some more extensive informational signage in a transition zone might be appreciated by people using the natural area as well as people using the traditional park area.

Design Ideas for Chamizal National Memorial:

- Use tensile shade structures as a softer, more artistic alternative to traditional metal ramadas.
- Surround ramadas by native vegetation to introduce “city park users” to regional vegetation.
- Vary seating types based on location in park.
- Collect water from parking lot in vegetated medians.
- Physically separate turf and native habitat to prevent turf from spreading where it is not wanted.
- Use minimal barriers between traditional park areas and native/natural park areas.
- Locate high activity zones closest to parking.
- Place interpretive material in transition zone to be experienced by all types of site visitors.
- Use loose riprap to control erosion on minor slopes, accented by native plants to avoid visual monotony.

Arizona Cancer Center

Location: Tucson, Arizona
Size: 10 acres
Site Elements: outdoor dining areas, patios, meditation path, arroyos, ramada, fountains

Site Description:

This semi-public landscape was designed with the intent of healing patients and the site itself.

Water Harvesting + Erosion Management

A series of constructed arroyos capture water from the building and the parking lot, allowing the runoff to help support a rich variety of native plants *(Figures 2.8 + 2.9)*. The plants help stabilize the soil of the arroyos, minimizing erosion. Additionally, the arroyos are top dressed with coarse rock, which also seems to minimize erosion on the slopes.

Native Plants

The meandering arroyos are planted with a variety of native and near-native species. Plants are grouped in natural arrangements. The main arroyo runs parallel to the parking lot and serves as a nice buffer between the parking lot and the building. Closer to the building, there are paved patios with strong geometry. Surrounding these patios, masses of native plant species are planted in formal rows.

Maintenance

There appears to be minimal maintenance needed. The native plants take their natural form in both the natural and formal areas of the landscape. Some debris is allowed to remain in the arroyo; whereas, it is removed in the more formal areas.

Interpretation

As this is a place emphasizing healing rather than education, there is no interpretational signage.

Design Ideas for Chamizal National Memorial:

- Use native species in natural and formal compositions.
- Construct earthworks to capture water for plant use; concentrate plants where water collects.

Figure 2.8 The natural path that runs along the arroyo. Native plants offer bursts of color in each season of the year.

Figure 2.9 The water harvesting arroyo.

Figure 2.10 A view into the nature area from the road.

Figre 2.11 Playground equipment is slightly hidden from view by vegetation.

The entry, marked by three metal poles, could use enhancement.

Figure 2.12 A looped path takes visitors through a variety of spaces, both open areas of native grasses and secluded areas of native shrubs and trees.

Shady Hollow Nature Area

Location: Austin, Texas
Size: 20 acres
Site Elements: paved trails, benches, play equipment

Site Description:

In 2000, the Lady Bird Johnson Wildflower Center began a project to restore 20 acres of savanna parkland in the Shady Hollow community. The nature area is tucked within a housing development and offers a mix of wildlife habitat and recreation opportunities. The entrance is slightly understated, marked only by three metal poles to prevent vehicular access, but the site appears to be well-used *(Figure 2.11)*. Even on a rainy day, there are joggers and dog walkers using the site. The play equipment is nicely sited among native vegetation that somewhat screens it from view from the road, minimizing any negative impact on viewsheds that it might have.

Native Plants

A paved path makes a short winding loop through an open meadow of native grasses as well as through a more enclosed, wooded area *(Figure 2.12)*. There are a few benches at various points along the path that offer people a chance to sit and enjoy the plants and animals that abound *(Figure 2.14)*. Planted areas have a very natural look; a person would hardly know this place was designed.

Water Harvesting

There is no active water harvesting on the site. It relies on a more natural system, simply keeping rainfall on the site. The central meadow area is slightly depressed, serving as a place for water runoff to collect.

Interpretation

The only signage on site was a low sign that mentioned the possible presence of snakes *(Figure 2.13)*. A few more educational signs would be nice to promote awareness of urban habitat and the use of native plants. Community members were offered the chance for an educational experience through volunteer work days and educational field days to help with the restoration.

Maintenance

A three-foot strip of the native grass area is mowed adjacent to the path. Otherwise the area seems to require minimal maintenance. It appears that there is little to no pruning. Deadfall is allowed to remain in place, adding to the habitat value of the site.

Design Ideas for Chamizal National Memorial:

- Use passive water harvesting techniques for a more natural system.
- Leave as much deadfall as possible to maximize habitat value.
- Utilize volunteer labor to aid in installation and maintenance, also offering members of the community educational opportunities.

Figure 2.13 This sign is repeated several times throughout the park and is the only verbal form of interpretation.

Figure 2.14 A bench along a wooded section of the curving path offers a comfortable place for relaxation and contemplation.

Figure 2.15 Many of the structures are buffered from view from the road.

Figure 2.16 Gabions are used to create water retention areas and slow the flow of water across the site, reducing erosion potential.

Figure 2.17 At entrances and near buildings, native plants are used in formal compositions.

Advanced Micro Devices Corporate Campus

Location: Austin, Texas
Size: 58 acres
Site Elements: AMD buildings, native vegetation planters, native vegetation on natural topography

Site Description:

This landscape restoration project was a part of the new construction of a corporate campus on land that had been degraded by decades of ranching. From off site, a person would hardly know the campus exists; the landscape effectively hides the site structures *(Figure 2.15)*. Aside from the roads that surround the campus, the site seems to be a seamless part of its surroundings. Despite intentions to restore native vegetation communities and minimize water runoff, the project was controversial because the land is a key part of the local aquifer (Novak 2005).

Water Harvesting + Erosion Management

The goal was to harvest 100% of the rainwater that fell on the structures and reuse it to water the landscape as well as to supply the campus's evaporative cooling system. Aside from the use of cisterns for water collection, a portion of the site serves as a stormwater redistribution system (Smith 2005). Gabions and natural berms are used on slope to create terraces that allow water to infiltrate *(Figure 2.16)*. These structures also minimize erosion potential along those slopes. The gabions have a nice feel as opposed to masonry walls because they blend effectively with their context.

Native Plants

Some of the plants used include Texas mountain laurel, oak, juniper, prickly pear, and a variety of

grasses. The campus landscape blends well with its surroundings, which consist of similar vegetation communities. Areas of the site that are not intended for use by people maintain natural topography and have natural plant compositions; whereas, in high-use areas the same plants are used in more formal arrangements and as mono-cultural masses in planters. At the entrances, for example, native plants are massed in planting islands *(Figure 2.17)*.

Maintenance

Where natural grassland areas meet sidewalks and roadways a three-foot strip of grass is mown *(Figure 2.18)*. The natural form of the grasses spilling slightly over the edge of the sidewalk might actually have a nice feel, but for a more formal kept look, mowing a narrow strip works well. Other than this, there seems to be little or no maintenance of the natural areas. Higher maintenance areas are located adjacent to buildings, where they are easily accessed by maintenance personnel and most visible to site users.

Interpretation

As this is a corporate campus, closed to the public, there is no interpretation on the site.

Design Ideas for Chamizal National Memorial:

- Create Natural and formal plant compositions using the same species.
- Use gabions and berms to reduce erosion potential on bare slopes and retain rainwater on the site.
- Locate highest maintenance areas nearest to the visitor center and other high visitor activity areas.

Figure 2.18 A three to four foot wide strip of the native grasses are mowed along the roads and sidewalks.

Figure 2.27 Native plants are used in more formal plant compositions to illustrate their versatility in the urban landscape.

Figure 2.28 A variety of seating is offered, from picnic tables to large, flat rocks.

Figure 2.29 Signs are positioned such that the user has a real life view of the topic being discussed on the sign.

Mueller Redevelopment

Location: Austin, Texas
Size: 117 acres
Site Elements: native-plant mono-culture garden, native meadows, pond, paths, interpretational signs, benches, sculptures

Site Description:

The Southwest Greenway of the Mueller Redevelopment is an effective, beautiful example of the use of native plants and habitat creation in urban environments that is well interpreted for the benefit of the people who use the space.

Native Plants

There is a formally arranged mono-culture garden that uses native plants in masses *(Figure 2.27)*. People can wind their way through this area on a variety of path types and have several seating options *(Figure 2.28)*. Surrounding the formal mono-culture garden are naturalesque planting zones which are more unkempt than the core of the garden *(Figure 2.31)*. People experience these natural areas mainly from the perimeter *(Figure 2.32)*.

Interpretation

In the formal garden area, numerous signs discuss ways that people can design their own yards to become a part of the network of wildlife habitat in the city. Signs also discuss and illustrate specifics about native species and the wild life that they attract *(Figure 2.30)*. This part of the garden also includes sculptures and accompanying signs as another form of interpretation about natural systems.

The more natural areas have signs at their

perimeters that discuss the native ecologies that people are viewing *(Figure 2.29)*.

The key design idea of using comprehensive signage really makes this site a successful blend of informal, natural looking habitat with formal landscape elements in a public place. Also, the use of the same plants in a formal and informal composition illustrates to visitors that native plants can be used to create a manicured landscape while still serving as habitat.

Maintenance

The formal, higher maintenance areas are located at the core of the garden, while more natural areas that require little maintenance are located on the perimeter. Concentrating high maintenance areas in one zone seems to add to the ease of maintenance.

Design Ideas for Chamizal National Memorial:

- Use native species in both naturalistic and formal arrangements.
- Introduce interpretive material that discusses ways people can use native plants to create habitat in their own yards.
- Locate highest maintenance areas at the core, near the visitor center.

Figure 2.30 Small pullouts, located just off of the main path, serve as small gathering places from visitors to enjoy, and signs offer information about the plants that are planted in the area.

Figure 2.31 Natural areas surround the more formal core of the garden, allowing visitors to see how native plants can be used in natural and formal compositions.

Figure 2.32 Benches are positioned to give visitors a view from the more formal core of the garden to a natural meadow area beyond.

Figure 2.33 A native plant island carved out of the turf.

Figure 2.34 Turf mounds without native plant islands.

Figure 2.35 Turf mounds with native plant islands.

Lost Creek Golf Course

Location: Austin, Texas
Size: 2.5+ acres
Site Elements: planting islands where turf has been removed and replaced with native plants, native meadow areas

Site Description:

In an effort to reduce water consumption, maintenance, and herbicide use on the course, the Lady Bird Johnson Wildflower Center was called in to design and install wildflower meadows in some of the out-of-play areas of the golf course (LBJ, Lost Creek Country Club). Aditionally, golf course staff have designed and installed native plant islands throughout the course *(Figures 2.33 + 2.35)*.

Turf Removal

Turf was removed through a combination of physical and chemical means. Someone involved in the project recommended initial physical removal of the turf along with several inches of soil in the root zone and following this process with application of herbicide as needed. It was noted that since bermudagrass is so invasive, there has been a problem with it creeping back into the native plant areas, posing a long-term maintenance issue.

Native Plants

These areas add nice variety to a landscape that otherwise lacks diversity. Native plants are grouped naturally, and the presence of deer tracks and the sounds of birds calling indicate that they are popular places for wildlife. However, the native planting islands, in the context of a highly manicured golf course, may

appear unfinished and out of place *(Figure 2.36)*. Since these planting islands are located in such a manicured environment they might blend better if they had a more formal edge as well as some sort of soil top dressing to give a slightly more finished appearance. It might even be effective to use the same native species in more formal compositions.

Maintenance

It was noted that there has been a problem with bermudagrass creeping into native plant areas. It seems that a factor contributing to this issue is that there is no edging between the turf and the native plant islands *(Figure 2.37)*. Continual weeding of bermudagrass has been necessary.

It seems that for the most part, the native species have been pruned minimally, allowing them to take their natural forms. Even in a formal context, this seems to be effective in terms of visual quality.

Interpretation

There is no interpretation of these native plant islands. Although the main use of the site is for recreation, some people might be interested in interpretive signs about these designs. They could be minimalistic so as not to detract from the visual quality of the landscape. Something as simple as plant identification signs might be effective.

Design Ideas for Chamizal National Memorial:

- Use a physical barrier between turf and native plant areas to prevent turf from invading other plantings.
- Plant composition should match surrounding context.
- Minimal to no pruning of native species, even in a formal context, can be effective.

Figure 2.36 A lack of soil top dressing results in a slightly unfinished look.

Figure 2.37 A lack of physical barrier between turf and native plant areas is another reason for the slightly unfinished look of the native plant islands and also results in turf invading the native plant areas.

Figure 2.19 An interactive sign that poses a question on the front and reveals the answer when a visitor lifts the panel.

Figure 2.20 A sign with fun facts about an animal with a moveable sculptural element attached.

Figure 2.21 A docent holding a conversation about the live subject that accompanies him.

Arizona Sonora Desert Museum

Location: Tucson, Arizona
Size: 100 acres
Site Elements: signs, demonstrations, guided tours, interactive stations, sculptures

Site Description:
Interpretation

The Arizona Sonora Desert Museum (ASDM) offers many interpretive elements within the landscape and offers a wide range of educational opportunities for people of all ages.

There is a variety of sign content and style. Some are geared toward adults and older kids, while others are geared toward young children. Information on signs includes fun facts about animals, identification of plants, information about biotic communities, and descriptions of significant views from lookout points. Not only is there a wide range of information presented, but it is presented on a variety of sign types depending on the information being presented. The ASDM appears to be consistent about what information goes on what type of sign.

In addition to informational signs, interpretation at the ASDM includes demonstrations by volunteer docents. Docents give talks and answer questions about plants, animals, and geology that are associated with the Sonoran Desert. They often have live examples of the subject they are discussing *(Figure 2.21)*. Docents also offer guided tours of the Museum.

Another way that various elements have been interpreted is through sculpture and interactive stations that offer people a tactile learning opportunity.

The ASDM is also host to performances and art exhibits that serve as yet another form of interpretation.

Design Ideas for Chamizal National Memorial:

- Use different markers/sign types for different themes, but maintain an element of unity.
- Offer interpretation that relates to all ages.
- Offer self-guided tour maps.
- Offer take-home brochures that outline how people can put conservation practices to use at home.

Figure 2.22 An interactive sign depicting various types of lizards that can be seen in the enclosure.

Figure 2.23 (left) A sign to identify a biotic community.

Figure 2.24 (right) Sculptures of native wildlife.

Figure 2.25 (left) A sign to identify and describe a native plant that is planted nearby.

Figure 2.26 (right) Hummingbird charts for a self-guided hummingbird walk.

Figure 2.38 The wild look of the native plants is welcomed and enjoyed by visitors.

Figure 2.39 The natural forms of the native plants contrast the straight, hard lines of the planters that contain them. The raised beds are a visual cue that the wild look of the plants within them is intentional.

Lurie Garden

Location: Chicago, IL
Size: 5 acres
Site Elements: raised planters with perennials and bulbs, grasses, shrubs, and trees

Site Description:

Native Plants

The Lurie Garden is a part of Millennium Park in Chicago, on the southern edge of downtown. The design team for this project seems to have found a successful way to introduce native plants into a very urban context. The native species of this garden are artistically arranged in harmonious swaths of color and texture. The masses of native plants are contained by retaining walls, which give the loose forms of the plants a clean formal edge, making it clear that this space is intentional and designed *(Figures 2.38 + 2.39)*.

Interpretation

This space does not seem to be primarily intended for educational purposes; as such, there is limited interpretational signage (used to present seasonal highlights). It seems that the site works well without additional information. Signs might actually detract from the visual quality of the site.

Maintenance

For the most part, plants are allowed to take their natural form; this is a nice contrast to the hard lines of the planters that contain them *(Figures 2.38 + 2.39)*.

Design Ideas for Chamizal National Memorial:

- Use interpretational signs only in key areas, leaving some areas uninhibited.
- Use some formal elements in natural/habitat areas as a way to indicate intentional design.

SITE ASSESSMENT

This chapter contains information on the inventory and analysis of existing site and contextual features and conditions. Each topic of discussion also includes a list of design ideas for CHAM gleaned from the research conducted for that section.

Significant History

National Park Service Mission Statement

Chamizal National Memorial Mission Statement

Mission Achievement

Site Users

Context + Climate

Wildlife

Regional Biotic Communities

Circulation

Topography

Hydrology

Park Water Use

Soil + Plant Health

Turf Classification

Views

Existing Trees

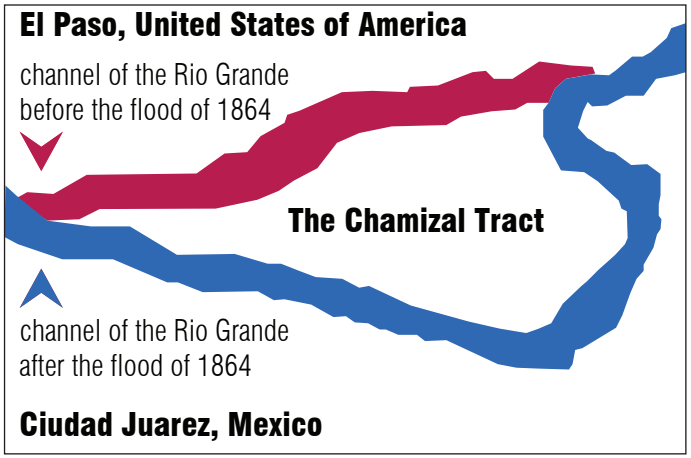


Figure 3.1 A diagram depicting the disputed Chamizal tract.

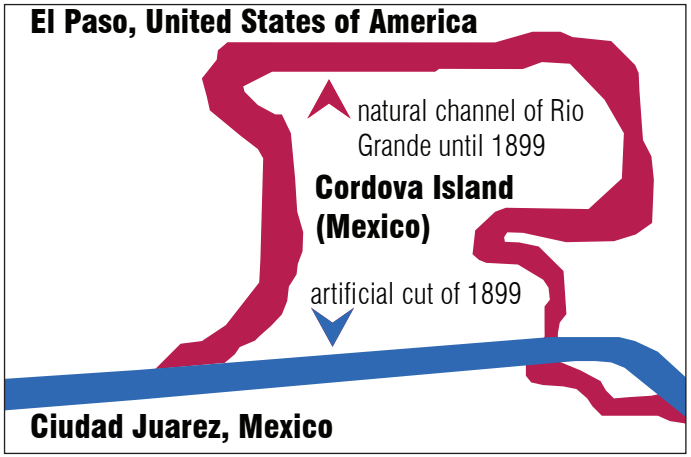


Figure 3.2 A diagram showing Cordova Island, the tract of land that CHAM is now located on. It is located just east of the Chamizal Tract.

Significant History

The following discussion relates to the creation of Chamizal National Memorial.

Contrary to what many people may think, CHAM is not actually located on what was known as the Chamizal Tract; rather, it lies on a piece of land that was referred to as Cordova Island and was located just east of the Chamizal Tract (National Park Service 2009c) *(Figures 3.1 + 3.2)*. Problems involving both areas of land became known as the Chamizal Dispute.

The Rio Grande River played a major role in shaping not only the land but the history of the El Paso - Ciudad Juarez region. The Rio Grande starts in the mountains of Colorado, where it receives water from snow melt. It flows quickly along a relatively steep slope through New Mexico. When the river reaches Texas and Mexico the terrain levels out, causing the flow of the river to slow tremendously. This condition created high potential for flooding in the El Paso - Ciudad Juarez area. In 1864 and 1897 there were major floods that changed the course of the river and of the border relations between the US and Mexico.

After much conflict in the area, Texas senator Lyndon B. Johnson tried to form the Special Chamizal Advisory Board in 1954 to address the possible shifts in the border between the two countries, but the legislation was rejected (National Park Service 2009b). By 1960, 5600 US citizens were living on the Chamizal Tract (National Park Service 2009b). In 1962, the Mexican president, Adolfo Lopez Mateos invited US president John F. Kennedy to meet with him in Mexico City (National Park Service 2009a). President Lopez Mateos suggested that the Chamizal Dispute be resolved to improve US – Mexico relations. As JFK was driving down to Texas in 1963 he was assassinated, so Lyndon B. Johnson took over the Chamizal resolution

(National Park Service 2009a). "In July of 1963 US Ambassador Thomas Mann and Mexican Foreign Minister Manuel Tello signed the Chamizal Convention in Mexico City" (National Park Service 2009a). The convention was signed by LBJ in Washington D.C. (in January of 1964), and in April the US Congress passed Public Law 88-300, the "Chamizal Convention Act" (National Park Service 2009a). On September 25, 1964 (Chamizal Day) Presidents Lyndon Baines Johnson and Adolfo López Mateos met in the middle of the international bridge between El Paso and Ciudad Juarez to officially approve the Chamizal Convention of 1963 (National Park Service 2009a) *(Figure 3.3)*.

The Chamizal Convention accomplished five things: 1) it gave El Chamizal back to Mexico, 2) a ten-mile section of the Rio Grande River was converted to a concrete channel, 3) Mexico gave approximately 200 acres of the northern part of Cordova Island to the US in exchange for 200 acres down river, 4) it improved the relationship between the United States and Mexico, and 5) it called for the establishment of a peace park that is known today as Chamizal National Memorial, which opened to the public in 1973 (National Park Service 2009a).

Design Implications

- Offer opportunities to interpret more of the significant site history.
- Use the river as a theme for design elements.
- Interpret the border as a place that joins people rather than a place that divides people.

Figure 3.3 President L.B. Johnson and President A.L. Mateos met in 1964 to official approve the Chamizal Convention of 1963.

National Park Service Mission

On August 25, 1916, President Woodrow Wilson signed the act creating the NPS. The "Organic Act" states the fundamental purpose of the NPS "is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service n.d.).

Chamizal National Memorial Mission

The purpose of CHAM is to commemorate the peaceful settlement of a century-long border dispute between Mexico and the United States. The Memorial finds voice in the celebration of share culture through education, the exchange of conservation ethic, heritage, cultural diversity, and human determination. (Chamizal National Memorial 1986; Chamizal National Memorial 2009; [Chamizal National Memorial?] n.d.)

Figure 3.4 A group gathering at the ramadas (an example of *occasional users*).

Mission Achievement

According to Texas Parks and Wildlife (2008) El Paso, TX is ranked among the worst in the state in terms of open space per capita and is well below the national average for park acreage per capita. The 35-acres of turf at CHAM are well liked by community members, who use the site more like a city park than a national memorial. While this is a great resource for the community, it is neither in line with the mission of the NPS nor meeting the needs of other users. The Memorial staff would like to increase interpretation of the significant history of the site as well as introduce landscaping and maintenance practices that demonstrate the "conservation ethic" mentioned in the Memorial's mission statement. It is important that this be a sustainable multi-use site, serving the needs of a variety of users in the most efficient way possible.

Design Implications

- Explore ways to meet diverse needs on a single site through thoughtful design of the landscape.
- Maintain as many of the existing uses as possible.
- Emphasize ecological and historic significance of the site.

Site Users

The following three groups of users have been identified based on information from CHAM staff and observations made by the design team on site visits.

Daily Users:

- Local students, faculty, staff, and business people walk through the Memorial on their way to and from school and work and use the Memorial on their lunch breaks.
- Mexican Nationals walk through the Memorial on their way to and from the border each day.
- Community members use the Memorial for recreation such as walking and jogging.

Occasional Users:

- People in the community use the Memorial for occasional gatherings such as barbecuing and holiday celebrations *(Figure 3.4)*.
- People visit the Memorial for performances at the theater and at the outdoor amphitheater.

One-Time Users:

- Tourists visit specifically to see CHAM for its historic significance.

Design Implications

- New gathering spaces should be designed to be multi-use spaces to be enjoyed by a variety of users for various activities.
- Maintain and enhance as many of the existing uses as possible in order to retain the large user base.

Context + Climate

Context

El Paso, Texas is located on the western edge of the state at an elevation of about 3,800 feet. CHAM is set in a very urban context. The south side of the site is bound by the channelized Rio Grande River, which indicates the US-Mexico border. On the east side of the site, there is a major port of entry and border patrol station. On the west side of the site, there is a US high school. To the north of the site is the residential and commercial community of El Paso, TX. *(Figure 3.5)*

Climate

Low temperatures in the area are in the low 30s, and high temperatures are in the mid 90s (rssWeather.com 2007).

Monthly precipitation is highest in the summer months. Average yearly precipitation is between 8 and 9 inches (rssWeather.com 2007).

Overall, El Paso is very sunny, recording 302 sunny days per year on average and about 83% of daylight hours are sunny (rssWeather.com 2007).

In the summer easterly winds prevail, and in the winter westerly winds prevail (rssWeather.com 2007).

Design Implications

- Address the needs of diverse urban context.
- Specify plants that will thrive on little rainfall with minimal or no supplemental irrigation.
- Offer both open sunny places and shaded places for people to gather, creating a variety of microclimates and extending the outdoor usable season.

Figure 3.5 An aerial photo of CHAM and its surroundings.

LEGEND

site boundary
channelized Rio Grande River
border patrol
Bridge of the Americas
Bowie High School

Wildlife

There are dozens of fish, reptile, amphibian, invertebrate, bird, and mammal species found in the region *(Appendix B, Table 1.1)*. In particular, the Memorial is used as a stopover for migrating hummingbirds and is a potential resource for various other urban wildlife species *(Appendix B, Table 1.2)*.

Design Implications

- Include design elements that would encourage use of the site by a broader range of wildlife; this includes offering sources of water, food, and protection for a variety of species.

Local Biotic Communities

CHAM lies in the Desert Scrub subregion of the Trans Pecos region. Some of the surrounding biotic communities of the region that may be appropriate to represent at CHAM are Tobosa-Black Grama Grassland, Mesquite-Sandsage Shrubland, Creosote-Lechuguilla Shrubland, and Four-Wing Saltbush-Creosote Shrubland.

Design Implications

- Represent the four biotic communities mentioned above. (Since associated plants are adapted to the conditions of the region and are likely to grow well in the climate and soil conditions at the Memorial. They will require minimal irrigation and maintenance after establishment in comparison to non-native species.)
- Representing these biotic communities will promote both plant and wildlife diversity at CHAM.

Mesquite-Sandsage
sandy soils
Other Associated Plants
Atriplex canescens
Bouteloua eriopoda
Bouteloua gracilis
Bouteloua ramosa
Dasylirion wheeleri
Ephedra sinica
Gutierrezia sarothrae
Proboscidea althaeifolia
Sporobolus cryptandrus
Sporobolus flexuosus
Sporobolus contractus
Yucca elata

Fourwing Saltbush-Creosote
saline soils
Other Associated Plants
Aristida purpurea
Bouteloua eriopoda
Caesalpinia jamesii
Flourensia cernua
Gutierrezia sarothrae
Haplopappus heterophyllus
Hilaria mutica
Opuntia engelmanii
Opuntia leptocaulis
Prosopis glandulosa
Prosopis pubescens
Sporobolus airoides
Sporobolus flexuosis
Sporobolus wrightii
Trichloris crinite

Creosote-Lechuguilla
lower slopes, intermountain valleys
Other Associated Plants
Acacia constricta
Acacia greggii
Aloysia gratissima
Bouteloua ramosa
Bouteloua eriopoda
Condalia warnockii
Echinocereus engelmannii
Erioneuron pulchellum
Flourensia cernua
Fouquieria splendens
Guaiacum angustifolium
Koeberlinia spinosa
Krameria parvifolia
Leucophyllum frutescens
Opuntia engelmannii
Opuntia leptocaulis
Parthenium incanum
Prosopis glandulosa
Prosopis pubescens
Viguiera stenoloba
Yucca baccata
Yucca elata
Ziziphus obstusifolia

Tobosa-Black Grama
basin bottoms with excessive runoff
Other Associated Plants
Acacia constricta
Bouteloua curtipendula
Bouteloua gracilis
Bouteloua hirsuta
Bouteloua ramosa
Buddleia lindleyana
Condalia warnockii
Cylindropuntia imbricata
Digitaria californica
Gutierrezia sarothrae
Larrea tridentata
Menodora scabra
Muhlenbergia porteri
Scleropogon brevifolius
Yucca elata

Current Circulation

For the most part, the site is pedestrian oriented. The Memorial has a fairly extensive system of trails that traverse the site. They are stabilized decomposed granite (DG) with concrete curbs to stabilize the edges. The system is mostly effective for travelling throughout the site; however, there are some locations that seem to be popular areas to leave the established paths to take an informal, more direct route through the grass. One of the major flaws of the circulation system is that it, for the most part, neglects foot traffic to and from the border. Another issue of concern is that people tend to walk through the maintenance area, which is considered unacceptable by NPS staff.

Design Implications

- Address entrances and paths utilized by people who travel through the site to and from the border.
- Enact measures to deter people from walking through the maintenance area.
- Extend trails through the graded lot.

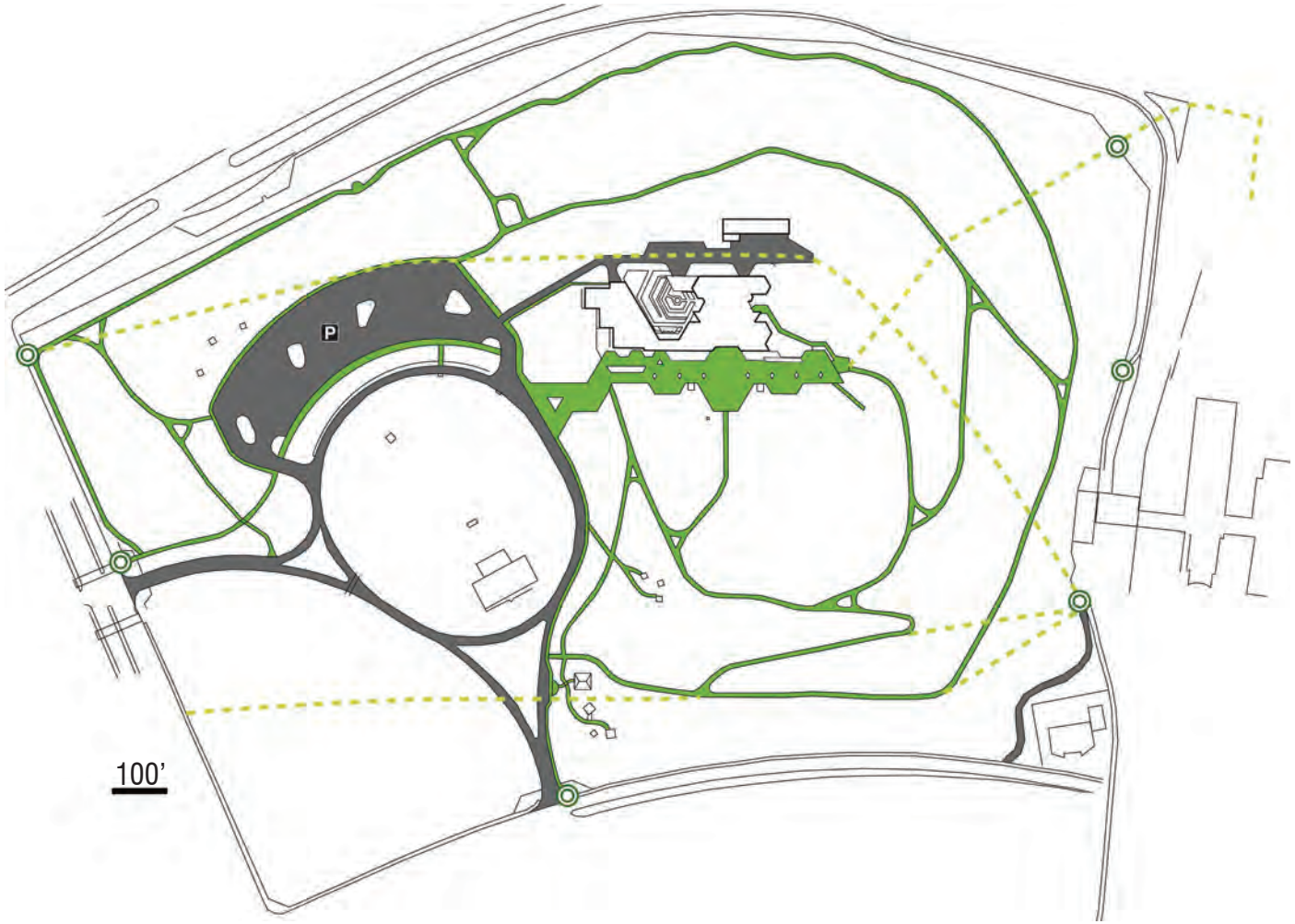


Figure 3.9

LEGEND

pedestrian access point

pedestrian cow path

pedestrian path

vehicular circulation

Topography

When the Memorial was first built, many tons of fill was brought onto the site, transforming a relatively flat landscape into rolling hills. There is now about a 20 foot change in elevation from the site's low point to its high point.

The slope map *(Figure 3.10)* was created in ArcMap using topographic contours and elevation data from a hard-copy map provided by CHAM. Slope categories and corresponding erosion control measures were calculated based on information gathered during the literature review. The areas in orange and red are where more substantial erosion control structures would be needed should turf be removed from those areas.

Design Implications

- Very minor erosion control measures are needed for most of the site.

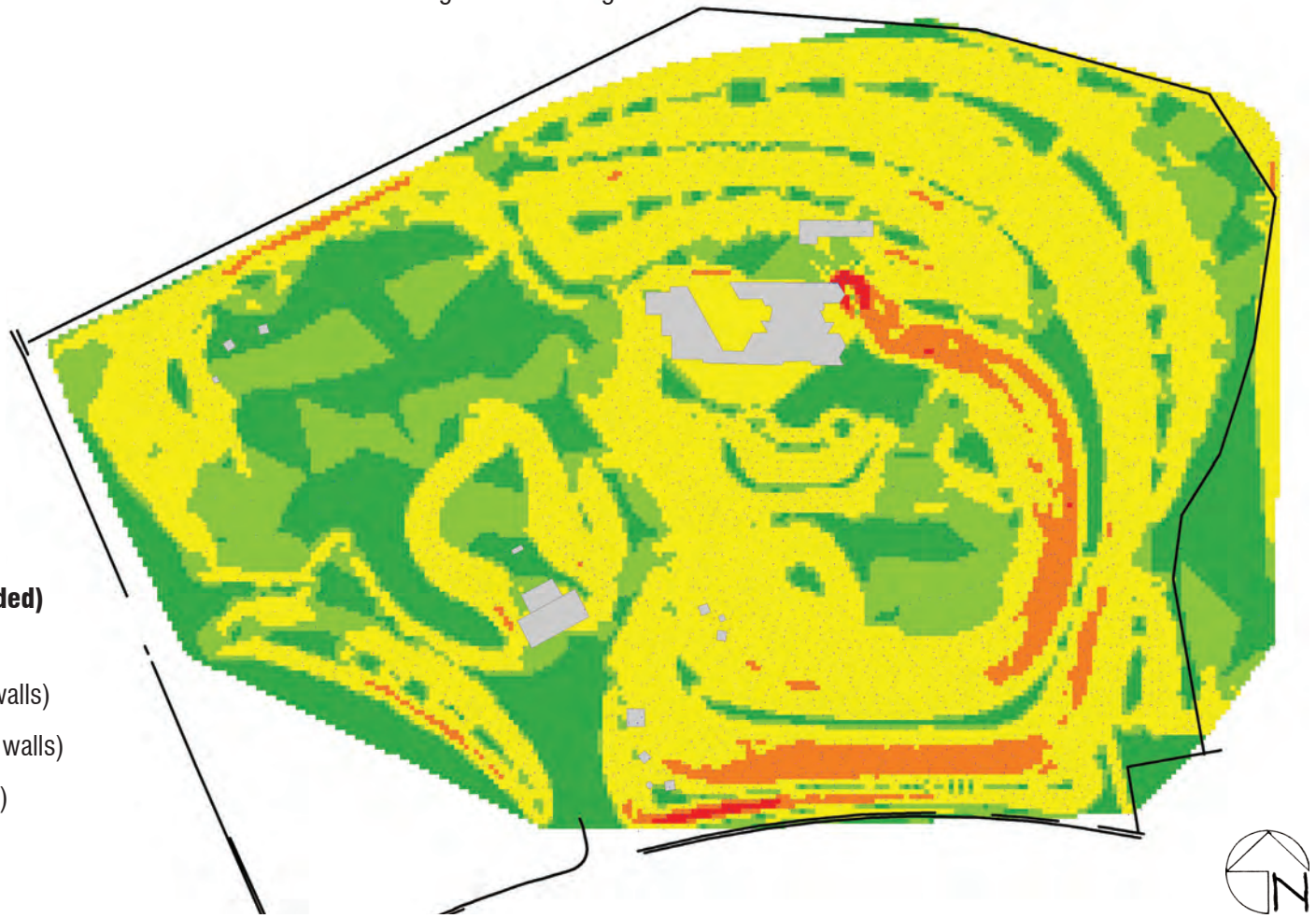


Figure 3.10

LEGEND

site boundary

% slope (erosion control measure needed)

- 0-2 (none)
- 2-7 (terraces/berms w/o retaining walls)
- 7-32 (terraces/berms w/o retaining walls)
- 32-48 (terraces with retaining walls)
- 48-100 (structural retaining walls)

Hydrology

Surface

The surface hydrology map *(Figure 3.11)* was also created in ArcMap using topographic contours and elevation data from a hard-copy map provided by CHAM. The dark blue areas are the low points where water naturally collects. The light blue areas are high points.

Subsurface

There are several water studies conducted by El Paso Water Utilities that indicate well drawdown, brackish water intrusion, and loss of well function. These studies indicate the importance of renewing our conservation ethic with regard to our use of fresh water sources. *(Appendix C)*

Design Implications

- Low areas could be planted with plant communities that have slightly higher water demands.
- High points can be places to create new focal areas with significant views through and from the site.

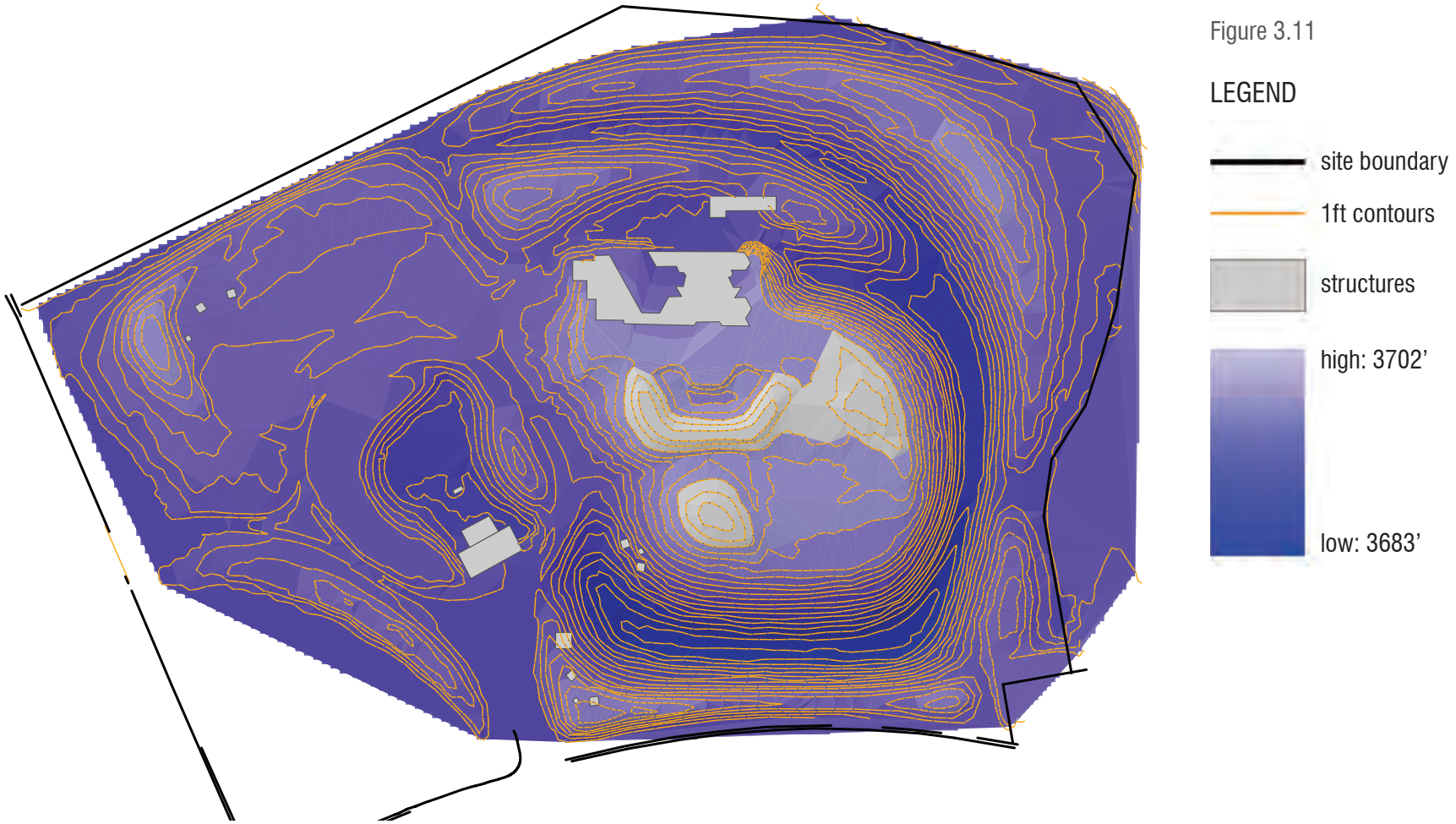


Figure 3.11

Figure 3.12 Bare areas with crusty white residue are evidence of salt accumulation at soil surface and resulting dieback of turf.

Figure 3.13 A large area of turf dieback.

Figure 3.14 Existing turf is of relatively low quality with low uniformity and high occurrence of weedy species.

Memorial Water Use

As previously mentioned, a major issue facing El Paso residents and CHAM staff is the availability of ground water. El Paso, TX and Ciudad Juarez, Mexico share an aquifer (Ganster 2008). Use of this groundwater as well as surface water from the Rio Grande and its tributaries is outlined by the 1944 Water Treaty. The International Boundary and Water Commission is the organization charged with upholding the provisions of the 1944 Treaty, but it is really up to the communities that share this water resource to use it responsibly in order to ensure the continued availability of that resource into the future. CHAM currently irrigates the grounds with potable water, pumped from a private well. CHAM uses 45 million gallons of water each year to irrigate the turf and trees on the site (Acosta 2003). Managers of the site are now at a point where they are forced to consider purchasing reclaimed water for irrigation due to a dwindling supply of water from their private well. There are two issues that this poses. First, having to purchase reclaimed water for irrigation will result in a huge increase in Memorial spending. If current water usage continues, 45 million gallons per year, it would cost the Memorial about $55,800/year to purchase that amount of reclaimed water. Second, reclaimed water tends to be high in salts. Since there are already problems with saline soils on the site, using reclaimed water for irrigation would only compound the problem. CHAM is in a great position to become a model for change in water use practices.

Design Implications

- Suggest ways to reduce overall water use.
- Suggest alternative plant palettes consisting of low-water-use species.
- Keep rainwater on site through harvesting methods.

Soil + Plant Health

As mentioned previously, during the creation of CHAM, tons of fill was brought in to create the rolling hills now present on the site. Unfortunately the fill that was brought on site was poor quality. As a result of the soil structure, most of the site has poor infiltration. Furthermore, the fact that most of the site is planted with turf means that site irrigation consists of shallow watering, which does not allow for leaching of salts out of the root zone. Poor soil structure in addition to shallow watering practices with water high in dissolved particles (630 ppm) has resulted in the accumulation of salts near the soil surface. There is visual evidence of this throughout the site. There are areas where turf has died and a white crust of salts is visible on the soil surface *(Figures 3.12 + 3.13)*. A report by Leo Acosta (2003) indicated that as of 2003, soil EC readings at different areas of CHAM ranged from 2.1 to 27.3 dS/m. Many common exotic species used in urban landscapes are sensitive to soil EC of 8 dS/m or less (Miyamoto et al. 2004). Soil and water in the arid Southwest tends to be naturally higher in salts that other parts of the country due to a higher rate of weathering of earth materials and high rates of evaporation and transpiration (WateReuse 2007). Native plants are adapted to local climate, soil and water conditions and have mechanisms for coping with extreme conditions. When we introduce non-native plants into our landscapes, we often find that in order for them to survive they require a modification of microclimate, water and soil conditions; they require increased input of time, labor, money, and other resources. Even with increased input, we often see that over time these exotic species begin to decline in health and appearance. Such is the case with non-native species at CHAM.

The plant community at CHAM is mainly comprised of turf and trees. There are few to no understory shrub species. A cursory GPS survey indicates that there are 700+ trees on the site. Unfortunately, many of these trees are non-native and are beginning to show signs of decline. Likewise, the turf is in poor condition in many areas of CHAM *(Figure 3.14)*. Decline in plant health is most likely due to the unfavorable water and soil conditions as well as a lack of adequate maintenance needed to make these exotic species thrive.

Design Implications

- As part of a tree species replacement plan, specify native species to replace declining exotic species.
- Prescribe native species that will be more tolerant of site conditions.
- Replace turf with native grassland and shrubland species.
- Native plants will require less frequent irrigations than turf, reducing overall water input.
- Native plants will require deeper irrigations than turf, promoting the leaching of salts from the soil surface.

Turf Classification

Based on its quality, existing turf at CHAM it would probably be classified as Class C, Greenspace Turf. It has low consistency of color and texture, there are large bare areas, and there is significant infestation of weed species. This seems to be due to a lack of maintenance manpower. If CHAM does decide to replace areas of turf with native vegetation, the remaining turf might be designated as Class B, Recreational Turf. Decreasing the overall area of turf would allow maintenance personnel to focus their efforts on smaller areas, resulting in higher quality

Figure 3.15 The Franklin Mountains are highly visible from many areas of CHAM.

Figure 3.16 The Mexican flag flown in the sister park across the border is a great visual connection between the two parks. The flag pole is 104.5 m tall, and the flag measures 28.5 m x 50 m.

turf in those areas. CHAM does not appear to have a need for Class A turf areas based on the Memorial's Mission Statement, which focuses on honoring conflict resolution, cultural heritage and conservation principles. These can be achieved without expanses of high-maintenance turf. The Class C designation might be best utilized for the grassland community (Tobosa-Black Grama) that would be a part of the "Transition" water zone. These areas would require low maintenance, but visual quality objectives would easily be achieved by the presence of native grass species.

Design Implications

- Do not designate any areas as Class A turf.
- Designate remaining turf areas as Class B turf.
- Designate new grassland communities as Class C turf.
-

Views

There are some significant views through and from the site. The Franklin Mountains are highly visible from various points *(Figure 3.15)*. The Mexican flag flown in the Chamizal sister park in Mexico is also highly visible from various vantage points *(Figure 3.16)*. Another visual connection that is important to the significance of the site is the view to the Bridge of the Americas, as it signifies a sharing of culture, work ethic, and intellect.

There are also some views that are less attractive and meaningful, including the large expanses of concrete used to construct the freeway system.

Design Implications

- Maintain and enhance interesting and attractive views through and from the site.
- Buffer views that detract from the visual experience of the site.

Existing Trees

Part of the site inventory involved the mapping of existing trees on site with a GPS unit. The design team spent two full days mapping over 700 trees on site. This data was used in the development of the species replacement plan *(Figure 4.6).*

A digital version of this data can be viewed in greater detail on the CD that is included with this document.

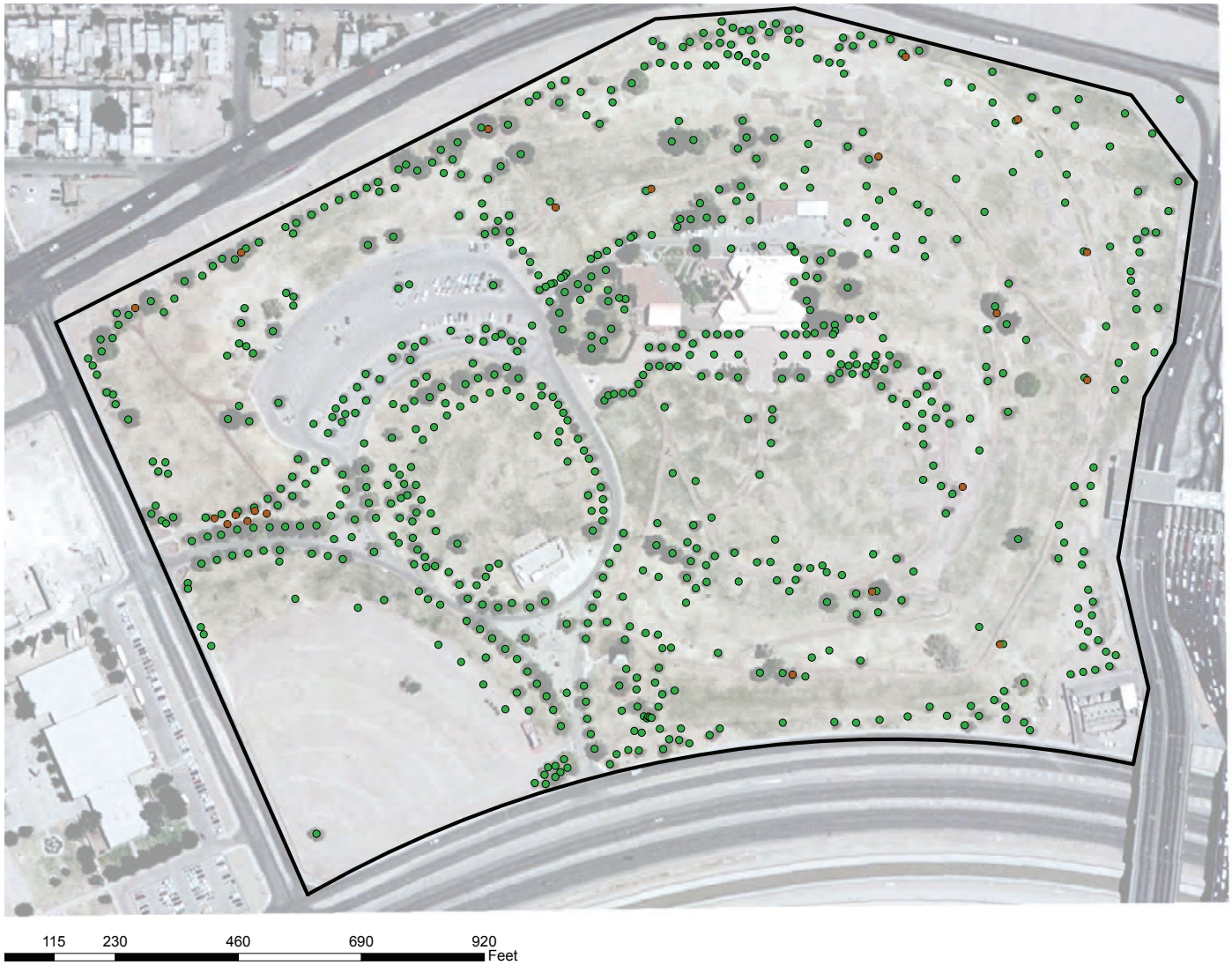


Figure 3.16

LEGEND

site boundary

existing tree

DESIGN

This chapter contains design suggestions related to the master plan, organized according to the objectives they will achieve. In addition, graphic representations of specific design ideas are identified as a series of management plans and focus areas; these are referenced within the objectives. In some cases focus areas include multiple design alternatives.

Master Plan

Objective 1: Guide Memorial Toward More Sustainable Practices

Objective 2: Enhance Opportunities for Education + Interpretation

Objective 3: Enhance Opportunities for Recreation + Entertainment

Objective 4: Blend Distinct Uses Within the Memorial

Management Plans

- **Proposed Circulation**
- **Path Themes + Rest Stop Locations**
- **Turf + Non-turf**
- **Water Zones**
- **Biotic Community Representation**
- **Species Replacement Plan**

Focus Areas

1. **Pollinator Courtyard**
2. **Theater Plaza Planters**
3. **Theater Plaza + Monument Plaza**
4. **Amphitheater Viewing**
5. **Overview Plaza**
6. **Entrances**
7. **Rest Stops**
8. **Erosion Mitigation**
9. **Medians**

Master Plan


pollinator courtyard
gate
maintenance area
visitor center + gallery
berm+basin erosion mitigation
stabilized DG trail
northeast welcome plaza
northwest pedestrian entrance
northeast pedestrian entrance
rest stop
theater
theater plaza
parking
west entrance
border patrol
amphitheater
graded lot
100’
restrooms
monument plaza
future Cross-Cultural
Education Center
south entrance
ramadas
N

Objective 1: Guide Memorial toward More Sustainable Practices

Water Conservation

1. *Turf Removal + Xeriscape Practices*
   Replacement of some of the turf on site with species from regional biotic communities will not only conserve water and save money, but it will provide an opportunity to showcase some natural ecosystem concepts that are more compatible with NPS goals. *(p.60-62)*

2. *Re-grading to Prevent Erosion*
   Where turf is removed, various areas of the site would require slightly different design treatments based mainly on existing topography. Some areas of the site are relatively flat and would require no or minimal grading to prevent erosion. Some of these areas would be the first to be transitioned from turf to non-turf. In other areas of the site there are more substantial changes in elevation. These areas would require re-grading and possibly the creation of terraces to minimize erosion potential. *(p.84-85)*

3. *Rainwater Harvesting*
   In order to maximize the effect of what little rainfall the site receives, simple rainwater harvesting techniques can be employed. This includes curb cuts in medians and the creation of swales, berms, and micro-basins that direct and retain rainwater in areas where it will be of most benefit to the plants. Terracing is another possible technique for minimizing runoff that should be considered. *(p.84-87)*

4. *Species Replacement Plan*
   Another way to help transition the Memorial grounds to a more low-water-use landscape is to formulate a concise species replacement plan. There are currently many non-native tree species in the Memorial that are starting to decline. A species replacement plan would indicate which species to replace the existing trees with based on location in the Memorial and would suggest native plants that can be obtained locally and are appropriate for the setting. *(p.63)*

Maintenance

1. *Phasing Strategies*
   Phasing strategies could include dividing the site and implimenting designs based on the Biotic Communites Plan and Focus Area designs. *(p.62 + 64-87)*

2. *Simple Plant Composition*
   Plant composition should be relatively simple except for in a few key areas adjacent to the visitor center. Keeping the higher maintenance areas near the visitor center and using simpler plant compositions in remaining areas of the Memorial will make it easier for CHAM staff to maintain the Memorial.
   a. One of the areas that would benefit from a more extensive planting design is the central courtyard. The central courtyard should be a cohesive extension of the theater and the visitor center, serving as a place for performers and guests to gather before and after events. *(p.66-67)*
   b. Another place that would be appropriate to use a more elaborate planting design is in the

planters on the south side of the visitor center and theater. Existing overstory plants could remain and the plans could focus on a new understory composition. More specifically, the new understory design could have a sculptural quality to it, reflecting the arts taking place within the building. *(p.68-69)*

3. *Species Replacement Plan*
   This plan address the need to reduce maintenance by suggesting native species that will require minimal care. *(p.63)*

4. *Turf Removal*
   Removing some of the turf on site will allow CHAM managers to focus maintenance resources on smaller areas, reducing overall input of labor and fertilizers *(p.60).* Furthermore, turf at CHAM can be categorized based the NPS turf classification system. Remaining turf areas should be designated as Class B - Recreational Turf. New grassland communities could be classified as Class C - Greenspace Turf. One of the potential problems associated with using native grasses in public spaces is that they are usually overly maintained, which actually decreases their visual appeal. Designating native grass communities as Class C turf areas would limit the maintenance for those areas, which would benefit the plant community and reduce maintenance required of NPS staff.

Objective 2:
Enhance Opportunities for Education and Interpretation

Ecological

1. *Entrances + Medians*
   Some of the first areas people see upon entering the Memorial are the planting areas at the entry points as well as the medians along the road and in the parking lot. These seemingly insignificant spaces have the potential to enhance the image of the Memorial and play an interpretive role. A focus on aesthetic appeal as well as demonstration of Chihuahuan Desert plants are emphasized. *(p.78-81 + 86-87)*

2. *Guided Plant Walk*
   There is a significant start to a guided plant walk around the visitor center. It will be enhanced by the replacement of non-native plant species with Texas natives in the courtyard, in the visitor center planters, and throughout the grounds as previously mentioned. The change in plant palette will enable CHAM staff in charge of interpretation to extend the guided walk to other parts of the Memorial grounds, showcasing a variety of plants native to the region. Furthermore, existing islands in the paths can be utilized as rest and interpretational stops. *(p.59 + 62-63 + 66-69)*

Historic

1. *Interpretive Plazas*
   a. The plaza to the south of the visitor center does little to address aesthetic appeal of the space, interpret the significant history of the site, or showcase one of the original

boundary markers. Redesign of this area focuses on enhancing the theater plaza as well as locating a new space for an inspirational monument and interpretive signage that emphasizes the historic and current significance of the Memorial. Redesign of this area considers the relationship between CHAM and its sister park located in Mexico; it is sensitive to the visual connection to the large Mexican flag flown there. It is suggested that the existing stucco walls be removed. They currently serve little function to the theater plaza and are aesthetically displeasing. One of the specific suggestions for this plaza is the use of tensile shade structures to create a more pleasant microclimate. *(p.70-73)*

b. Another area that should be enhanced as an interpretive plaza is the area that was originally intended to be the site of a statue just off the southeast corner of the main promenade. Introduction of some signs and more extensive plant composition would go a long way toward making this forgotten area very functional. *(p.76-77)*

2. *Graded Lot*
See Appendix D: Cross-Cultural Education Center Proposal.

Objective 3:
Enhance Opportunities for Recreation and Entertainment

Trails

While the trails that circulate through the Memorial may be used by all types of visitors, they seem to be most heavily used for recreational purposes. These should be preserved as much as possible amidst any re-grading that takes place. Furthermore, this master plan proposes a continuation of the trail system through the graded lot in the southwest corner of the Memorial. In addition, it seems that many people tend not use designated paths at various points *(Figure 3.9, p.43)*. As many areas of the site are transitioned to regional biotic communities, which may be more sensitive to foot traffic than existing ground cover, some additional sections of trail have been proposed in areas where improvised trails seem to occur most frequently. *(p.58-59)*

Mile Markers

The Memorial is also a popular place for joggers. The extension of the trail through the graded lot in the southwest corner creates a one-mile loop through the site. This should be indicated on an orientational map, which could be located where the trail meets the west end of the existing parking lot. In addition, adding 1/8 or 1/4 mile markers along the existing trails is a simple project that would enhance the recreation experience for these users. *(p.58-59)*

Turf + Seating Areas

Bowie High School is directly across the street from the west end of the Memorial, so this area is a popular place for high school students to spend their lunch breaks. In addition to students, others seem to

enjoy this area as well for their mid-day siestas in the shade. Students utilize the benches along the path and the ramadas for lounging, and they use the turf area for playing soccer and football. The turf at the west/northwest end of the Memorial should be some of the last areas to be transitioned to xeric landscaping if at all. However, if these zones are transitioned to xeric landscaping, students will still be able to find a grassy refuge in the amphitheater bowl. Perhaps the amphitheater area could even be slightly developed with some hardscape elements that would serve as seating for both casual lounging and organized events. *(p.60)*

Gathering Areas

CHAM is also used used for large gatherings and for various occasions. The existing ramadas and BBQs are frequently used and should be preserved.

Amphitheater Viewing

During performances at the amphitheater, spectators spill out into the surrounding areas. Some of these areas will remain as turf. Others can be partially transitioned to native vegetation. In these areas it is important that there be some sort of physical barrier between remaining turf and native vegetation areas. Two options are suggested to divide these spaces: 1) use sections of path or 2) create a minor change in elevation. In one area in particular the change of elevation technique is suggested because it would serve dual purposes, serving as a physical barrier to the invasive nature of turf species and as a seat wall for amphitheater viewing. *(p.74-75)*

Objective 4:
Blend Distinct Uses within the Memorial

Memorial Entrances

It is important to consider the relationship between where people cross the border and where they enter/exit the Memorial. Perhaps more established entry/exit points and routes could guide pedestrians along a safer course. *(p.78-80)*

Multi-Use Design of Graded Lot

See Appendix D: Cross-Cultural Education Center Proposal.

Clean Transitions Between Turf and Native Planting Areas

In terms of appearance and maintenance, it is important to determine effective ways of transitioning between different planting zones.

1. *Water Zones*
   The site is divided into different water-use zones. Remaining turf is designated as the *oasis zone*. In many cases an area designated as *transition zone* lies between the *oasis zone* and the *desert zone*. The *transition zone* could include native grasses from the Tobosa - Black Grama biotic community *(Appendix E)* to create a more gradual visual transition between the *oasis zone* and the *desert zone*. *(p.61)*

2. *Turf Barriers*
   One issue to consider is the physical separation between turf areas and native areas. As was discussed in the Case Reviews, if there is no physical barrier between turf areas and native areas, aggressive turf species will invade native plant areas, creating a maintenance problem. A

change in elevation or a wide hardscape buffer are two ways of creating a barrier between turf and other plantings. Some of the existing paths can already serve as the wide hardscape buffers. In a few key areas, new sections of path would enhance circulation as well as serve as hardscape buffers to prevent the spread of turf species. In other areas a slight terracing effect could effectively prevent spread of turf as well as function as seating for viewing performances in the amphitheater. *(p.58 + 74-75)*

Circulation Loops

This master plan suggests that design of different sections of trail be based on two themes, recreation and interpretation. Recreation and amenities such as mile markers can be concentrated along the outermost loop of the trail, and interpretation can be focused on the inner trails closest to the visitor center. (p.58-59)

Interpretation that Intersects with Daily Users

It would be useful to place interpretive materials in areas where people frequnetly walk through the Memorial on their way to various destinations. Hopefully this would enrich their experience of the Memorial and make more people aware of the significance of the Memorial. While most of the interpretational material may be concentrated along the inner loops of the trail, some interpretive stops in the master plan are located along the outer recreational loops as well as along new sections of path. *(p.59)*

Maintenance Gate

A unique phenomenon resulting from the Memorial's proximity to the border, high school, and businesses is the extensive traversing of the site by Mexican Nationals who come across the border for school and work on a daily basis.

One of the safety/security issues is that people often walk right through the maintenance area, and some people have been seen entering the maintenance facilities. This could be ameliorated by installing a gate on the west side of the area that would direct pedestrians around the maintenance area and still allow maintenance personnel to access the grounds with their equipment. A dense planting of native species on the east end of the maintenance area would further deter people from walking through this area.

Unifying Elements

1. *Plants*
   The simplified, native plant palette will serve as a unifying element for the site. *(p.42 + Appendix E)*

2. *Architectural Elements*
   Architectural elements, based on existing geometries of the site, are repeated throughout the Memorial and serve as another unifying force. These include tensile shade structures, interpretative arches, and mounts for interpretative signs. (*p.70-73 + 79)*

Proposed Circulation

This plan highlights a potential configuration for additional parking and new sections of path, and it identifies pedestrian access points.

The new parking area in the southwest corner would serve the future Cross-Cultural Education Center as well as visitors who go to the site to see performances in the theaters.

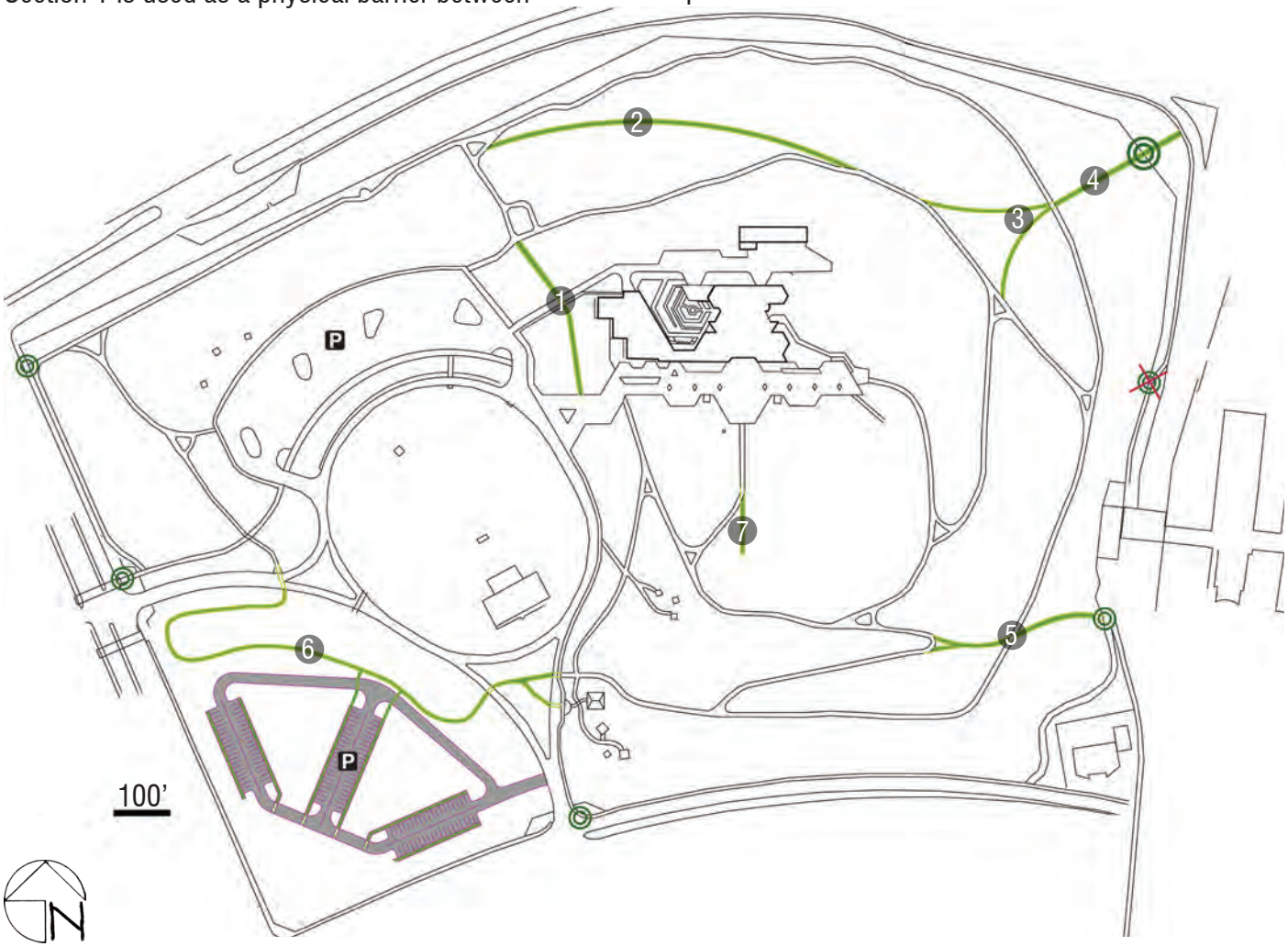
New sections of path serve various purposes. Section 1 is used as a physical barrier between remaining turf and future native plant communities. Sections 2-5 are placed in areas that seem to be popular for people wishing for a more direct route through the site. Once these areas have been transitioned to native plant communities, it would be best for people to have designated paths to travel. Sections 4 and 5 address pedestrian circulation to and from the border. Section 6 is an extension of the recreation trail through the graded lot, where it currently sops. Section 7 extends to a new focal area.

Figure 4.1

LEGEND

- remove access point (see note below)
- minor enhancements
- major enhancements
- new pedestrian path
- new vehicular path

NOTE: One way to deter people from entering in the middle of the east side of the Memorial is to alternate sections of denser plantings and decorative/artistic fencing along the northeast edge of the site.



Path Themes + Rest Stop Locations

This plan proposes design suggestions related to primary use of various sections of path and location of various amenities.

The outer-most loop is designated as the main recreation loop. With the path extension through the graded lot, this is a one-mile loop. Most of the rest stops along this loop would include amenities such as shade, benches, mile markers, and/or water. There are some interpretational rest stops along this loop as well to promote the intersection of interpretation with recreational site users.

The inner trails, closest to the visitor center, are where most of the interpretive material is located.

There are also sections of the recreational trail that have opportunities for interpretive stops such as the northern trail along the series of boundary markers and the southeast trail which offers significant views of the site and mountains.

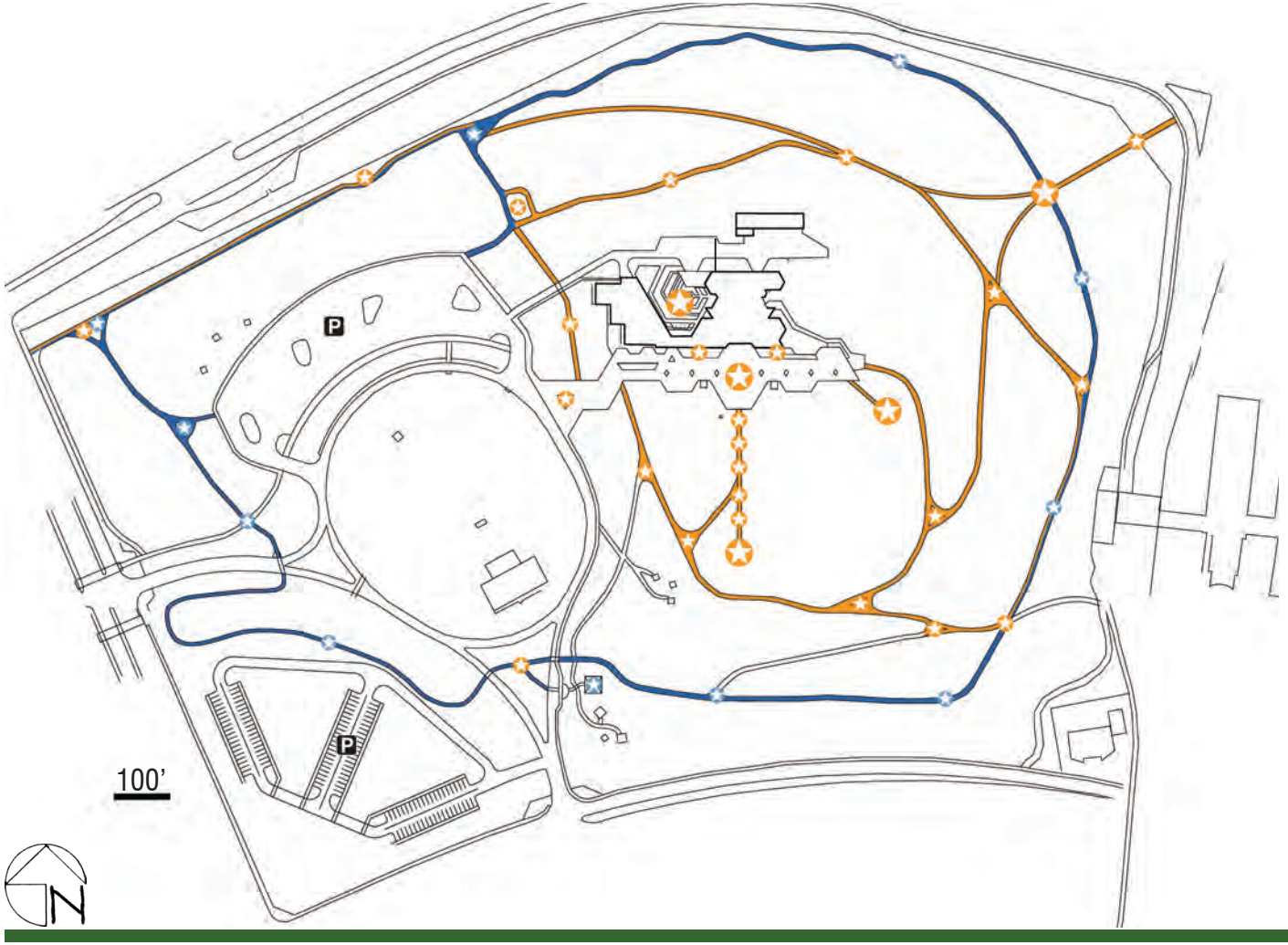


Figure 4.2

LEGEND

large interpretation stop

small interpretation stop

recreation rest stop

interpretation route

recreation route

Turf + Non-turf

This plan suggests a relatively large amount of turf conversion to low-water-use plant communities. This plan represents a long term view; it is intended that the Memorial will convert areas of turf as need is dictated by the necessity for increased water conservation and as project funds become available.

The 55-acre site currently has about 35 acres of turf to maintain. This plan proposes the removal of about 25 acres of turf. This represents roughly a 70% decrease in the amount of turf on site. This translates into a decrease in maintenance and water used for irrigation. It also represents an increase in opportunities for interpretation.

Figure 4.3

Water Zones

This plan takes into account the previous Turf + Non-turf plan and literature on Xeriscape principles (*p.8-9*). It suggests a strategy for transitioning from high-water-use to low-water-use areas. Remaining turf is designated as the *oasis zone*. The only non-turf area that is designated as *oasis* is the pollinator courtyard due to the fact that it may have some higher water use plants as well as a water feature. Since this area is close to the buildings it is still in keeping with Xeriscape principles. The non-turf areas are subdivided into *transition zones* and *desert zones*. *Transition zones* function to create a smoother visual transition between the *oasis zones* and the *desert zones*. *Transition zones* were also sited where surface water naturally collects. *Transition zones* can be planted with native plants that require or tolerate moderate amounts of water. The *desert zones* are the lowest-water-use areas.

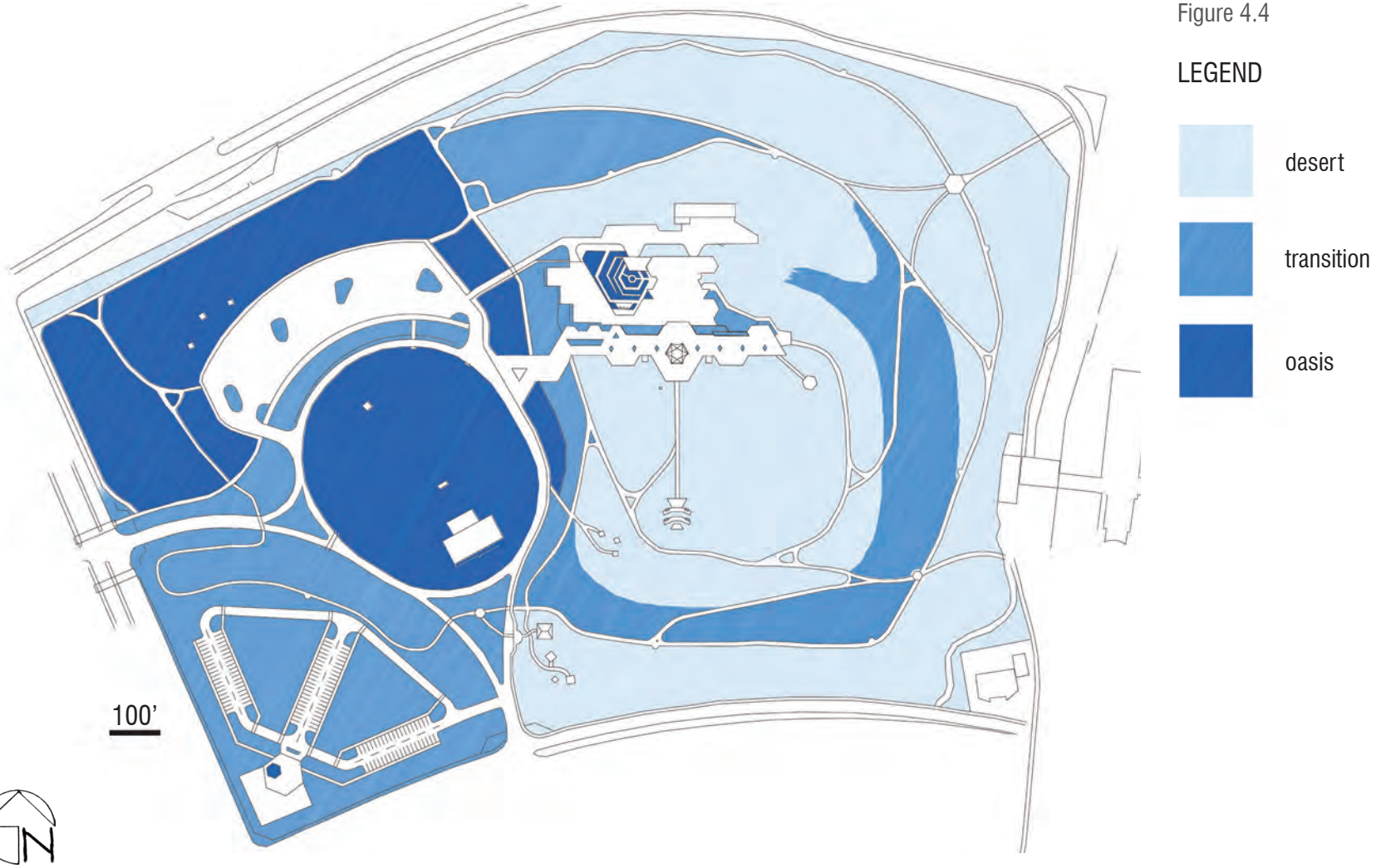


Figure 4.4

Biotic Community Representation

The location of biotic communities in this plan was based on the Surface Hydrology map in the Site Assessment, the Turf + Non-turf map, and the Water Zone map. *(p.45 + 60-61)*

The framework of biotic community zones should initially be established by planting species from the species list for each community. Overtime, plants may migrate and establish in other zones, resulting in a blending of the various biotic communities. For ease of maintenance, this should be allowed to happen. This transition can even become a topic for interpretation. *(For plant lists see p.42 + Appendix E)*

Figure 4.5

Species Replacement

This plan combines the tree survey map with the Biotic Community Representation plan on the previous page. In essence, trees are grouped into zones and species used to replace dead or significantly declined trees are based on the species list for the particular biotic community zone that tree is located in. *(p.42 + Appendix E)*

In addition this plan indicates trees that should not be replaced, in the event that they die. The selection of trees in this category was based on conflicts with new design elements as well as on positive viewsheds that should be left open.

Furthermore, the plan indicates placement of additional trees. These trees were sited based on the need for slope stabilization, visual screening, and shading of areas intended as points of interest where visitors might be likely to linger.

Figure 4.6

Focus Areas

1. Pollinator Courtyard
2. Theater Plaza Planters
3. Theater Plaza + Monument Plaza
4. Amphitheater Viewing
5. Overview Plaza
6. Entrances
7. Rest Stops
8. Erosion Mitigation
9. Medians

Focus Areas

Focus Area 1: Pollinator Courtyard

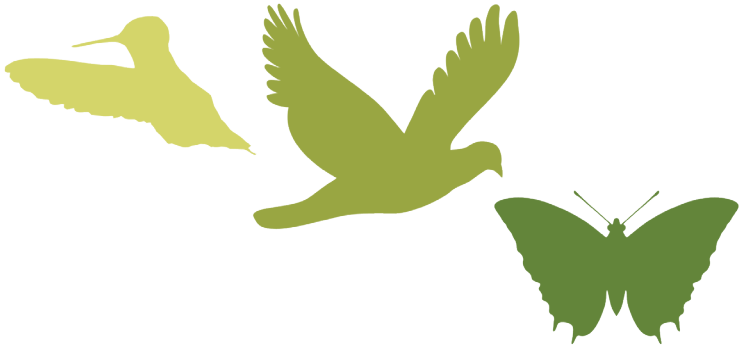
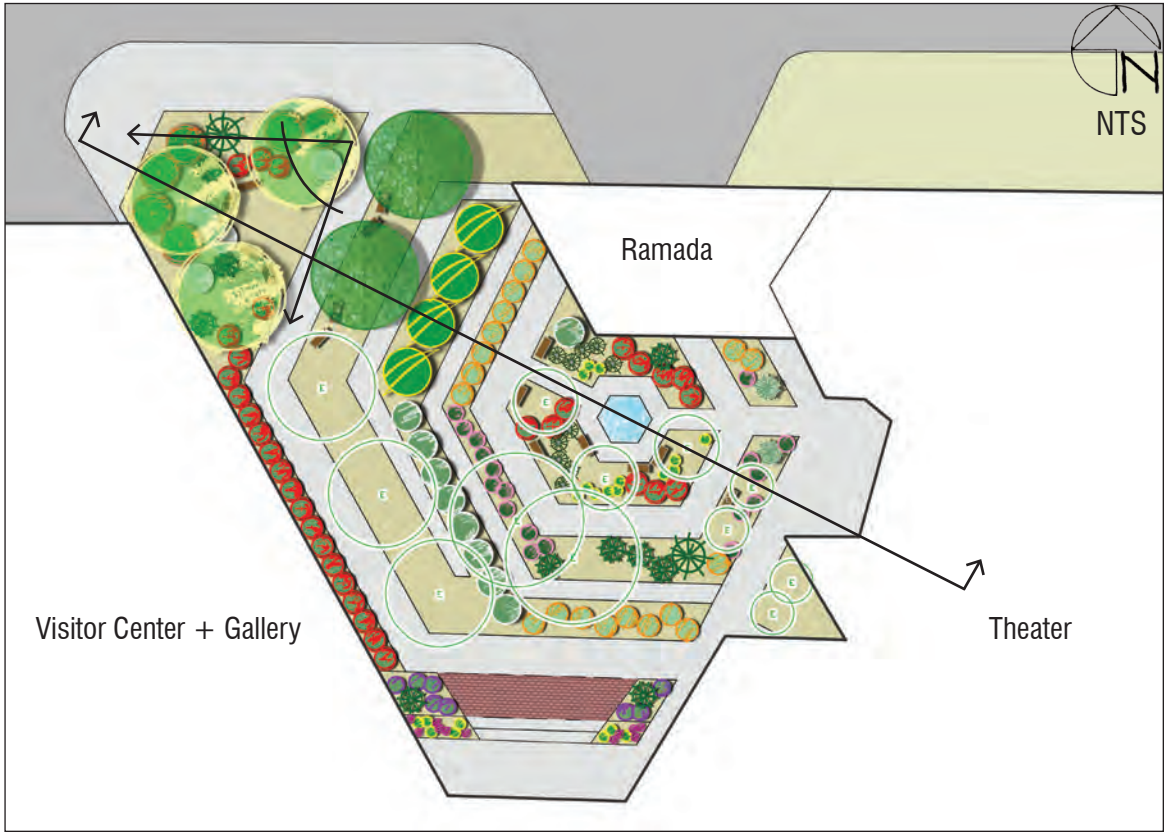


Figure 4.7

LEGEND

- *Prosopis glandulosa*
- *Celtis reticulata*
- existing
- *Acacia farnesiana*
- *Celtis pallida*
- *Fouquieria splendens*
- *Aloysia gratissima*
- *Bauhinia lunarioides*
- *Anisacanthus q. var. wrightii*
- *Hesperaloe funifera*
- *Yucca elata*
- *Buddleia marrubifolia*
- *Calliandra eriophylla*
- *Hesperaloe parviflora*
- *Dalea frutescens*
- *Chrysactinia mexicana*



Focus Area 1: Pollinator Courtyard

Since El Paso is a stop-over for hummingbird migration, one of the more specific ideas for this space is to create a pollination garden where the songbirds, hummingbirds, and butterflies that will frequent this spot become the actors on an outdoor stage *(Appendix B, Table 1.2)*. This central courtyard could become a vibrant place for discovery and be a peaceful place for relaxation and contemplation as well. Perhaps some of the existing plants (mainly trees) could remain, as they serve important functions (shade + mature anchors to the new design). New plants that are suggested are species that require minimal or no pruning to minimize maintenance.

Figure 4.8 CURRENT
The northwest corner of the courtyard.

Figure 4.9 PROPOSED
A view of the proposed seating area in the northwest corner of the courtyard.

Figure 4.10 A section drawing through the Pollinator Courtyard.

Focus Area 2: Theater Plaza Planters

Focus Area 2: Theater Plaza Planters

A mix of native and near-native plants that have sculptural qualities will add interest to these prominent planters that currently serve as one or more of the stops along the guided plant walk that has been initiated by CHAM staff. *(See Appendix E for plant lists.)*

Figure 4.11 CURRENT

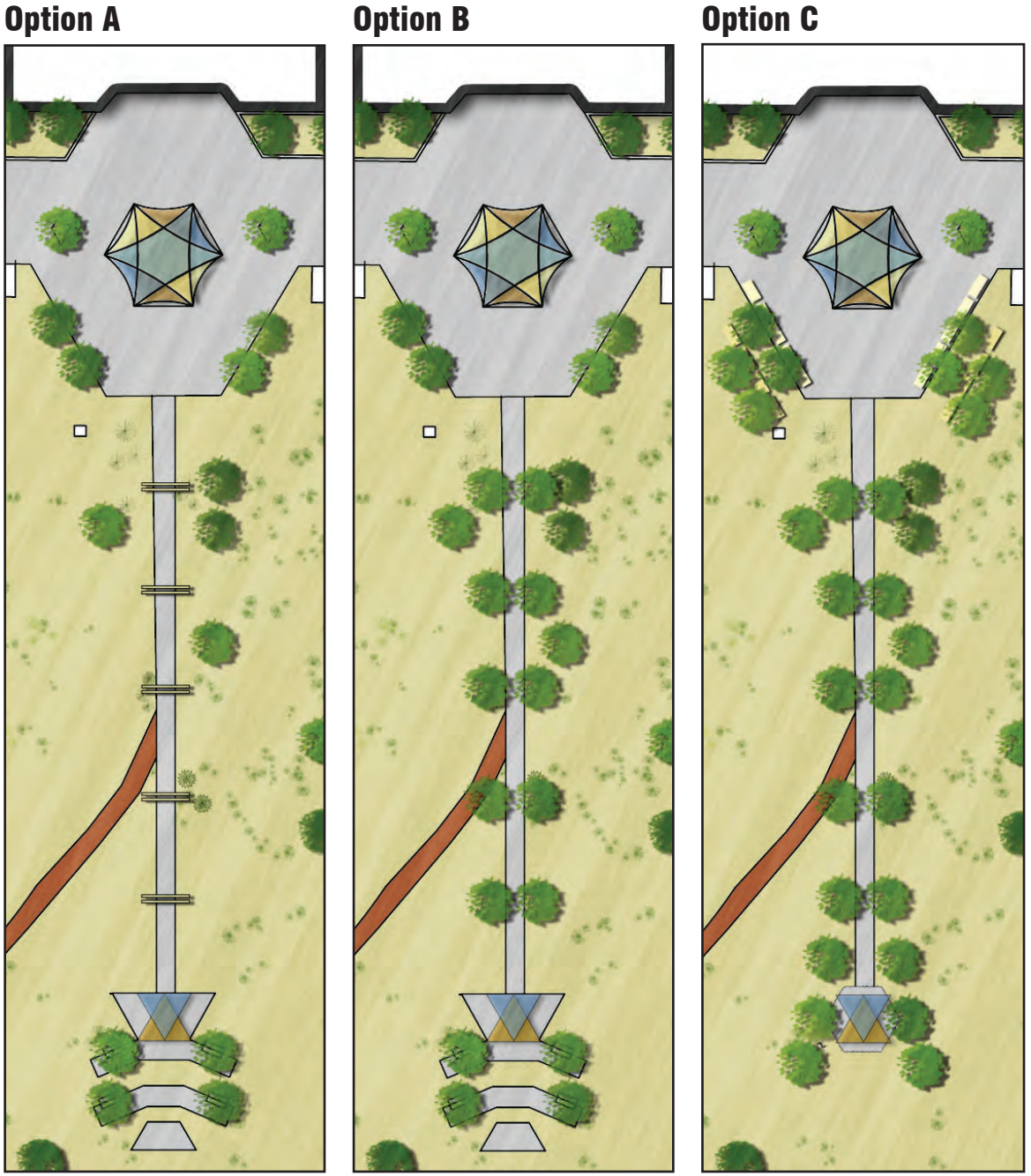
Figure 4.12 PROPOSED

Focus Area 3: Theater Plaza + Monument Plaza

Figure 4.13 **Option A**
This design proposes a series of interpretive arches along the walkway to a new monument plaza and amphitheater space.

Figure 4.14 **Option B**
This design proposes an allee of native trees along the walkway to a new monument plaza and amphitheater space.

Figure 4.15 **Option C**
This design proposes secondary rows of benches south of the theater plaza, which can then be ustilized as a small amphitheater space. An allee of native trees lines the walkway to a small monument plaza.



Focus Area 3: Theater Plaza

The existing plaza is currently underutilized. As it is, the space lacks shade, which deters many people from lingering. Furthermore, other than one of the original boundary markers that serves as a monument, there is no interpretational material to indicate the significance of the Memorial's history. The new design works to enhance the visitor experience by addressing both issues. A new tensile shade structure offers visitors a shady place to linger, and it also offers a place to mount informational signs or interpretational artwork.

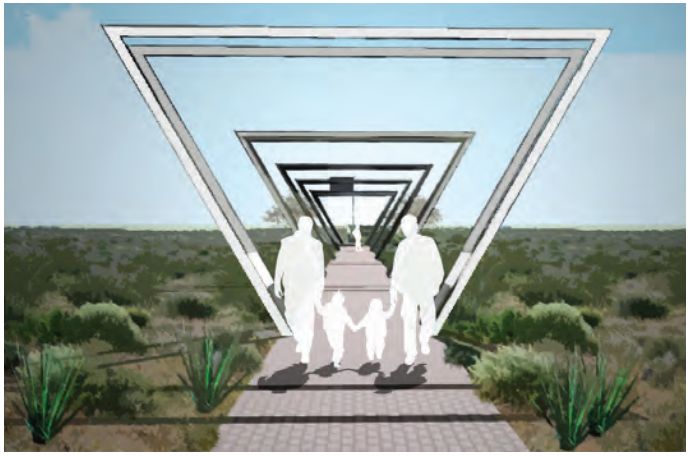
Figure 4.16 CURRENT

Figure 4.17 PROPOSED
The new design maintains existing seating around perimeter of plaza as well as existing monument.

The design of the proposed shade structure is based on the geometries that currently exist in the plaza pavement. The design of the structure is also intended to frame a view to the south, toward a new amphitheater area.

Figure 4.18 Option A
The arches frame a view to the Mexican flag flown in CHAM's sister park. They also offer a place to mount informational signage.

The arch structures mimic the geometry of the new shade structure and the pavement pattern in the theater plaza. There is a series of five arches widely spaced along a new 8-10' wide path at 40+ feet apart.



Focus Area 3: Interpretive Walkway

As a visitor moves south, away from the redesigned plaza, a series of trees and informational signs line a new 8-10' hardscape path. They create a prominent walkway through one of the four regional biotic communities represented on the site to the new focal area to the south. By providing shade and intrerpretive material, the new promenade can enhance visitors' experience and understanding of the site as a national memorial.

Figure 4.19 Option B + Option C
An allee of trees and free standing signs are proposed as an alternative to the arches.

Focus Area 3: Monument Plaza

A new plaza is the end point to the new journey created by the combination of the new promenade and redesigned theater plaza. Shade is offered by another tensile structure that mimics the geometries of the theater plaza and other new structures as well as by native tree species. There is no more informational signage at this point, allowing it simply to offer visitors a pleasant place to contemplate the information taken in along their journey. A local artist could be involved in the design of a new monument or the existing monument in the theater plaza could be relocated to this new monument plaza. A possible amphitheater structure is oriented such that visitors' view is focused on the Mexican flag that serves as the visual connection to CHAM's sister park in Mexico. This space is located at one of the high points in the site, so it also offers visitors great views of the regional biotic communities that surround them. This space would also be a great place for CHAM staff to give talks or presentations to small groups of visitors. It could also function as a space for informal events such as small performances by school groups or other community members.

Figure 4.20 A view through the tensile shade structure to the flag in CHAM's sister park.

Figure 4.21 Option B + C
In this section drawing the dashed line represents existing grade. What this section indicates is that only a relatively minor amount of regrading would be necessary to achieve a dramatic change that would really enhance the visitor experience of the Memorial.

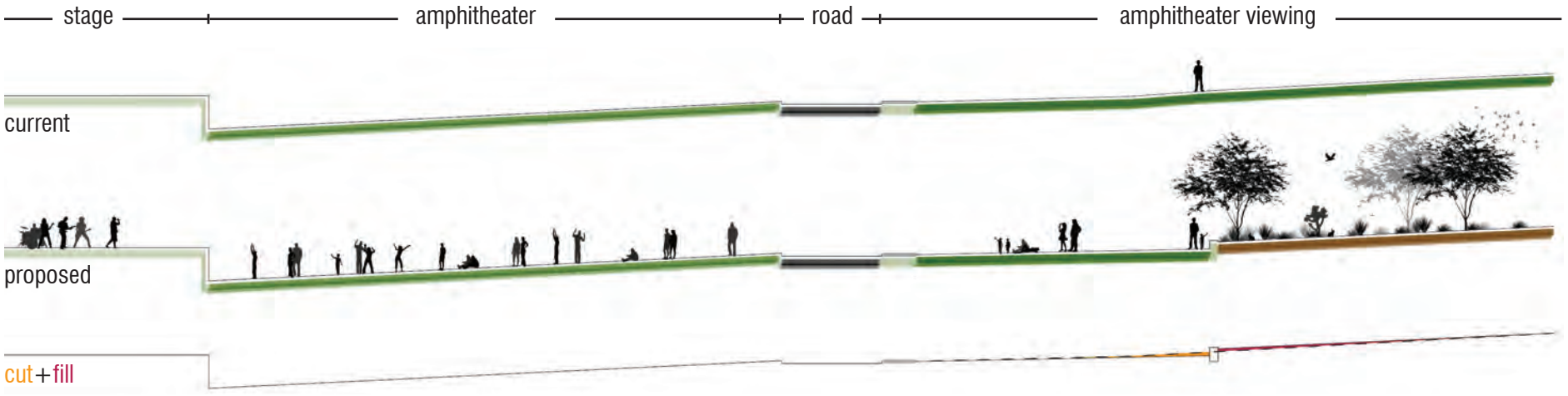
Focus Area 4: Amphitheater Viewing

Focus Area 4: Amphitheater Viewing

One intent of the turf removal plan is to transition most of the areas surrounding the core interpretation area to native vegetation communities. Some of these areas are also adjacent to the existing amphitheater, and Memorial staff indicated that it was important to maintain their use as overflow amphitheater viewing areas. Based on case reviews it became apparent that it is necessary to physically separate turf areas from native plant areas to avoid turf invading other areas. Two options proposed by the master plan are to use a path with defined edges or to create a change in elevation. In this case, a minor change in elevation serves dual purposes. It allows turf and native plants to exist in close proximity, and it serves as a seat wall for amphitheater viewing, as depicted by both graphics. Furthermore, the lower-most section drawing indicates the minimal cut and fill needed to accomplish this condition.

Figure 4.22

Figure 4.23



Focus Area 5: Overview Plaza

Focus Area 5: Overview Plaza

This space already has the start of a plaza in the form of a clearing and an area of stabilized DG. From this area, visitors have clear views to the Bridge of the Americas and to areas of the site that will be transitioned to regional biotic communities. The design ideas for this area include the planting of native plant species and the installation of some informational signs that could discuss issues related to transformations occuring at CHAM or issues related to social dynamics of borderlands.

Figure 4.24 CURRENT

Figure 4.25 PROPOSED

Focus Area 6: Entrances

Focus Area 6: Northeast Entrance

The northeast corner of the site is where most people coming from Mexico enter the site; however, there is currently no formal entrance for these site users. The design of this area suggests a minimal but more prominant entrance. Since the city owns the area of land that is currently covered by the expanse of rocks seen in both images, the change suggested for this area is to remove the rocks to form an informal path that is easier to navigate. A small section of the existing wall would be removed and an interpretive arch structure would welcome people into the Memorial.

Figure 4.26 CURRENT

Figure 4.27 PROPOSED
This design creates the opportunity for CHAM to offer interpretational material that intersects with the paths of users who generally just use the site as a route to school or work. An arch, similar to those portrayed from the monument plaza, forms a gateway into the Memorial.

An allee of trees could be used as an alternative to the arch.

Figure 4.28 The shaded walkway to the northeast plaza.

Focus Area 6: Northeast Welcome Plaza

The northeast plaza can function as an informal welcome center for people who are entering the Memorial from the east. It will be a shady respite from the border crossing. This plaza, and the path leading to it from the new northeast entry, could include orientational and interpretational signs. This will help achieve the objective of intersecting informational signage with the routes of people who generally just use the site as a travel route and may not understand the site's significance.

Figure 4.29 The northeast plaza.

Focus Area 6: West + South Entrances

It is important that the entrances of the Memorial be visually appealing and that the elements create an image that reflects the site's purpose and significance. Without changing entrance signage, one of the most effective ways to enhance these areas of the site is through a more consciously designed planting plan.

NOTE: These design ideas could also be applied to the proposed new entrance in the northeast corner of the site.

Figure 4.30 CURRENT
Some of the existing vegetation is inappropriate for the space, requiring heavy pruning to keep it from obscuring the signs.

Figure 4.31 PROPOSED
A mix of low-growing, native and near-native species that offer seasonal color or have unique forms can be used to add focal interest and draw attention to the Memorial entrance. Use of native plant species will likely reinforce the perception of the site as a national memorial. *(See Appendix E for plant lists.)*

Focus Area 7: Rest Stops

Focus Area 7: Rest Stops

There are two types of rest stops identified on the Path Themes+Rest Stop Locations plan (*p.55*). Recreational stops would include amenities appreciated by people using the trails for exercise. These amenities could include benches or water fountains. Interpretational stops could include benches, signs, demonstrative exhibits, or artwork. The image below presents the general concept that the rest stops be areas where the path widens to accommodate various amenities and lingering visitors without disrupting the flow of people on the path.

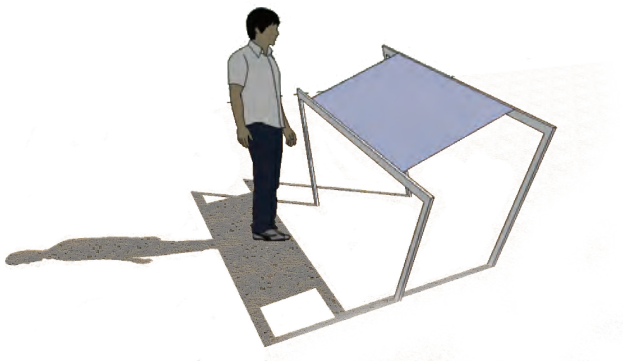


Figure 4.32 An informational sign based on the forms of the proposed tensile structure and interpretational arches.

Figure 4.33 PROPOSED
The informational sign in this image could also be replaced with a bench, art, or other amenities.

Focus Area 8: Erosion Mitigation

Focus Area 8: Erosion Mitigation

As turf is removed from various areas of the site *(as indicated in the Turf+Non-turf plan on p.60)* it is necessary to consider the increased potential for erosion until the native plant communities become dense enough to hold soil on the slopes. However, there are relatively few areas that have slopes steep enough to warrant major erosion control measures *(p.44)*. Two techniques of managing erosion on slopes, depicted below, include the berm + basin technique and terracing.

Figure 4.34 (top) Berm+Basin
Shallow basins are dug; the soil is placed down slope to form a berm. The berm is reenforced with native stones. This slows the flow of water across the slope and creates a place for water to pool and infiltrate.

Figure 4.35 (bottom) Terracing
On steeper slopes 32%-48% (*see slope map on p.40*) gabion or masonry walls are used to create terraces. Each terrace can be flat or slightly sloped in either direction.

Focus Area 9: Medians

Focus Area 9: Medians

This focus area demonstrates an idea for the implementation of rainwater harvesting principles in the road and parking lot medians. The general idea is to make curb cuts that allow water to drain off of paved surfaces into the median area. The soil elevation within the median is then lowered 0.5'-2' to accommodate a slightly higher volume of water. In a sense, the median becomes a shallow basin. The water collected during storm events can then help support a richer, denser community of plants. This adds to the visual appeal of the vehicular facilities that almost all visitors use.

Figure 4.36 (above) A curb cut and basin along a residential road in Tucson, AZ collecting water during a storm.

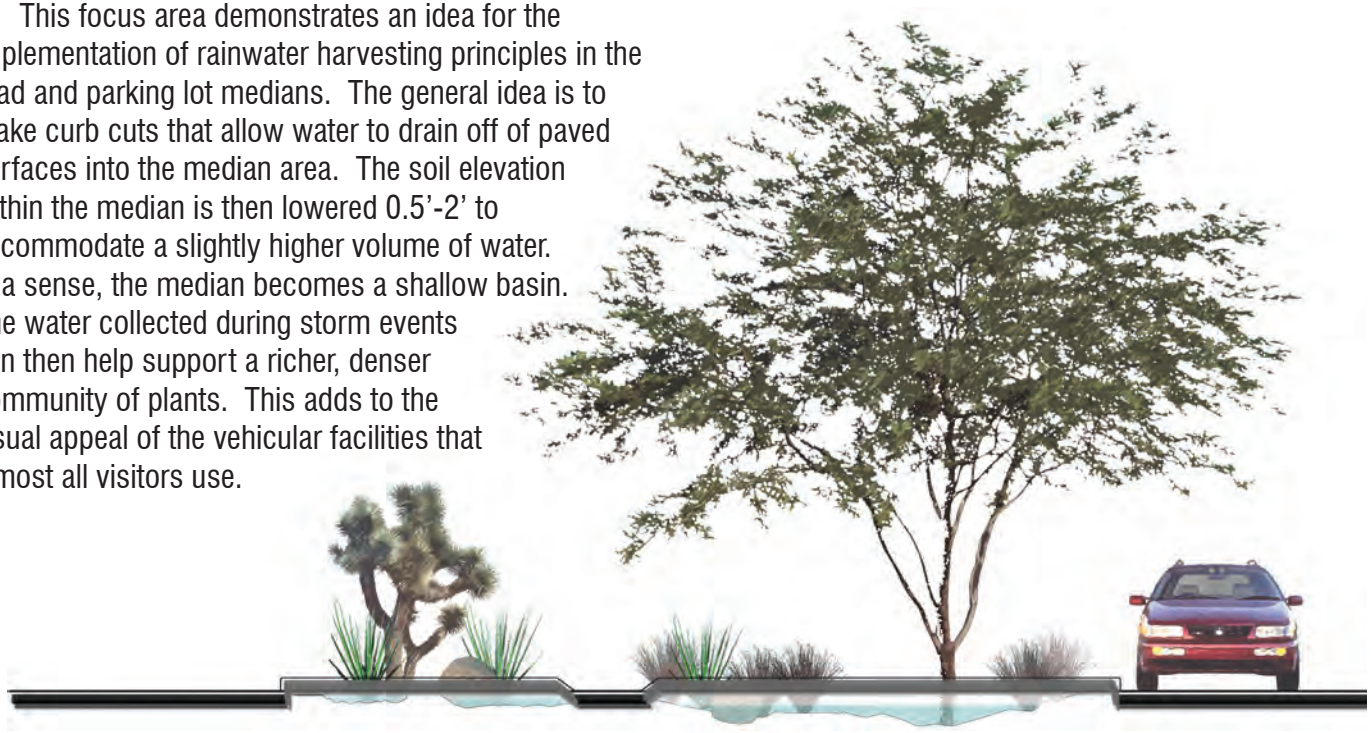


Figure 4.37 (left) A section drawing showing a median curb cut.

Figure 4.38 The dashed line in this section drawing represents existing grade. Soil can be removed from the medians such that there are higher and lower points within the basin. Plants are then placed according to water need. *(See Appendix E plant lists.)*

CONCLUSION

While envisioning the renewal of a conservation ethic at CHAM it was important to be realistic, considering ease of implementation and maintenance as well as cost. The preceding research and design represent a mindful effort to offer attainable means of enhancing CHAM's role as a model of resource conservation. Research and design efforts focused on outlining simple, yet effective, means of conserving water. These include passive rainwater harvesting, xeriscaping, turf removal, and habitat creation. These water conservation techniques also support the effort to create more opportunities for interpretation at the park. Addressing water conservation and interpretation at CHAM helps ensure that many generations of visitors will be able to enjoy and learn from the many ecological, historic, and cultural lessons the Memorial has to offer.

APPENDICES

This section includes information that was referred to but not included in the body of the document.

Appendix A: Master Plan Development + Review Participants

Appendix B: WIldlife Lists

Appendix C: Subsurface Hydrology

Appendix D: Cross-Cultural Education Center Proposal

Appendix E: Plant Lists

Appendix A

Master Plan Development + Review Participants

Stakeholders

City of El Paso
El Paso Independent School District
El Paso Water Utilities
Los Paisanos de El Chamizal, Friends Organization

National Park Service Staff

Larry Norris | NPS Southwest Research Coordinator
Laura Joss | Deputy Regional Director, Intermountain Region
Pat O'Brien | Cultural Resource Specialist, Desert Southwest CESU
Suzy Stutzman | Lead Planner, Intermountain Region
Lila Walker | former Acting Superintendent, Chamizal National Memorial
Richard Harris | Northeast Region Associate Director for Natural Resources
Leo Acosta |Biologist, Midwest Regional Office

Chamizal National Memorial Staff

Catherine Light | Superintendent
Jerome Flood | Chief Ranger
Michael Groomer | Chief of Interpretation
Caleb Waters | Acting Chief of Maintenance
Connie Hufford | Administrative Officer
+ Special thanks to all staff input and suggestions!

University of Arizona Affiliates

Oscar Blasquez, MLA | Senior Lecturer, School of Landscape Architecture & Planning
Elizabeth Scott, MLA | Associate Professor, School of Landscape Architecture & Planning
Olivia Alicea | Graduate Student, School of Landscape Architecture & Planning

Appendix B

Table 1.1 : Regional Wildlife Species

Amphibians typically are "cold-blooded" vertebrates which change from an aquatic, water-breathing, limbless larva (or tadpole) to a terrestrial or partially terrestrial, air-breathing, four-legged adult.
This group includes: frogs and toads, salamanders and newts, and caecilians (limbless amphibians).

Barred Tiger Salamander (Ambystoma tigrinum mavortium)
Barton Springs Salamander (Eurycea sosorum)
Black-spotted Newt (Notophthalmus meridionalis)
Blanco Blind Salamander (Eurycea robusta)
Bronze Frog (Rana clamitans clamitans)
Cascade Caverns Salamander (Eurycea latitans)
Comal Blind Salamander (Eurycea tridentifera)
Houston Toad (Bufo houstonensis)
Marbled Salamander (Ambystoma opacum)
Mexican Burrowing Toad (Rhinophrynus dorsalis)
Mexican Treefrog (Smilisca baudinii)
San Marcos Salamander (Eurycea nana)
Sheep Frog (Hypopachus variolosus)
South Texas Siren (large Form) (Siren sp. 1)
Southern Leopard Frog (Rana sphenocephala)
Texas Blind Salamander (Eurycea rathbuni)
White-lipped Frog (Leptodactylus labialis)

Birds are warm-blooded, air-breathing vertebrates. Their body is covered with feathers. Birds have beaks, wings and scale covered legs. All birds lay eggs that are covered with a calcium carbonate shell.

American Avocet (Recurvirostra americana)
American Kestrel (Falco sparverius)
American Oystercatcher (Haematopus palliatus)
American Peregrine Falcon (Falco peregrinus anatum)
Arctic Peregrine Falcon (Falco peregrinus tundrius)
Attwater's Prairie Chicken (Tympanuchus cupido attwateri)
Bald Eagle (Haliaeetus leucocephalus)
Black-capped Vireo (Vireo atricapilla)
Black-chinned Hummingbird (Archilochus alexandri)
Black-crowned Night-heron (Nycticorax nycticorax)
Black-necked Stilt (Himantopus mexicanus)
Blue Jay (Cyanocitta cristata)
Buff-bellied Hummingbird (Amazilia yucatanensis)
Bufflehead (Bucephala albeola)
Burrowing Owl (Athene cunicularia)
Chimney Swift (Chaetura pelagica)
Downy Woodpecker (Picoides pubescens)
Eastern Bluebird (Sialia sialis)
Eastern Brown Pelican (Pelecanus occidentalis)
Eastern Screech-Owl (Megascops asio)
Elf Owl (Micrathene whitneyi)
Eskimo Curlew (Numenius borealis)
Ferruginous Hawk (Buteo regalis)
Golden-cheeked Warbler (Dendroica chrysoparia)
Inca Dove (Columbina inca)
Interior Least Tern (Sterna antillarum athalassos)
Long-billed Curlew (Numenius americanus)
Mexican Spotted Owl (Strix occidentalis lucida)
Mississippi Kite (Ictinia mississippiensis)
Muscovy Duck (Cairina moschata)
Northern Aplomado Falcon (Falco femoralis)
Northern Cardinal (Cardinalis cardinalis)
Northern Flicker (Colaptes auratus)
Northern Harrier (Circus cyaneus)
Northern Mockingbird (Mimus polyglottos)
Painted Bunting (Passerina ciris)
Pied-billed Grebe (Podilymbus podiceps)
Pine Warbler (Dendroica pinus)
Piping Plover (Charadrius melodus)
Red-bellied Woodpecker (Melanerpes carolinus)
Red-cockaded Woodpecker (Picoides borealis)
Red-shouldered Hawk (Buteo lineatus)
Reddish Egret (Egretta rufescens)
Rock Pigeon (Columba livia)
Roseate Spoonbill (Platalea ajaja)
Ruby-throated Hummingbird (Archilochus colubris)
Scissor-tailed Flycatcher (Tyrannus forficatus)
Swainson's Hawk (Buteo swainsoni)
White-faced Ibis (Plegadis chihi)
Whooping Crane (Grus americana)
Yellow-billed Cuckoo (Coccyzus americanus)

Invertebrates are "cold-blooded" animals with no backbone. They may live on land or in water, and may be covered by a shell or exoskeleton.

Atlantic Bay Scallop (Argopecten irradians amplicostatus)
Bee Creek Cave Harvestman (Texella reddelli)
Blue Crab (Callinectes sapidus)
Bone Cave Harvestman (Texella reyesi)
Coffin Cave Mold Beetle (Batrisodes texanus)
Common Green Darner (Anax junius)
Eastern Oyster (Crassostrea virginica)
Fiddler Crab (Uca rapax)
Giant Floater (Anodonta grandis)
Hellgrammite (Dobsonfly Larvae) (Corydalus cornutus)
Kretschmarr Cave Mold Beetle (Texamaurops reddelli)
Lightning Whelk (Busycon perversum pulleyi)
*Monarch (Danaus plexippus)
Stone Crab (Menippe mercenaria)
Tooth Cave Ground Beetle (Rhadine persephone)
Tooth Cave Pseudoscorpion (Tartarocreagris texana)
Tooth Cave Spider (Neoleptoneta myopica)

Mammals are warm-blooded air-breathing vertebrates. Their body is covered with hair. All mammals feed their young milk. Most mammals give birth to miniature versions of themselves. This group includes: Monotremes - duckbilled platypus, echidnas, Marsupials - opossums, kangaroos, and
Placentals - most other mammals. For more information and additional species, see The Mammals of Texas.

Atlantic Spotted Dolphin (Stenella frontalis)
Badger (Taxidea taxus)
Big Brown Bat (Eptesicus fuscus)
Big Free-tailed Bat (Nyctinomops macrotis)
Black Bear (Ursus americanus)
Black-footed Ferret (Mustela nigripes)
Black-tailed Jackrabbit (Lepus californicus)
Black-tailed Prairie Dog (Cynomys ludovicianus)
Blue Whale (Balaenoptera musculus)
Bobcat (Lynx rufus)
Bottlenose Dolphin (Tursiops truncatus)
Brazilian Free-tailed Bat (Tadarida brasiliensis)
California Myotis (Myotis californicus)
Cave Myotis (Myotis velifer)
Common Raccoon (Procyon lotor)
Coues' Rice Rat (Oryzomys couesi)
Coyote (Canis latrans)
Cuvier's Beaked Whale (Ziphius cavirostris)
Desert Cottontail (Sylvilagus audubonii)
Dwarf Sperm Whale (Kogia simus)
Eastern Fox Squirrel (Sciurus niger)
Eastern Pipistrelle (Pipistrellus subflavus)
Eastern Red Bat (Lasiurus borealis)
Elk (Cervus elaphus)
Evening Bat (Nycticeius humeralis)
False Killer Whale (Pseudorca crassidens)
Fin Whale (Balaenoptera physalus)
Fringed Myotis (Myotis thysanodes)
Gervais' Beaked Whale (Mesoplodon europaeus)
Ghost-faced Bat (Mormoops megalophylla)
Gray Wolf (Canis lupus)
Hairy-legged Vampire Bat (Diphylla ecaudata)
Hoary Bat (Lasiurus cinereus)
Jaguarundi (Herpailurus yaguarondi)
Killer Whale (Orcinus orca)
Little Brown Myotis (Myotis lucifugus)
Long-legged Myotis (Myotis volans)
Mexican Ground Squirrel (Spermophilus mexicanus)
Mexican Long-nosed Bat (Leptonycteris nivalis)
Mexican Long-tongued Bat (Choeronycteris mexicana)
Mountain Lion (Puma concolor)
Mountain Sheep (Ovis canadensis)
Nine-banded Armadillo (Dasypus novemcinctus)
Northern Myotis (Myotis septentrionalis)
Northern Right Whale (Eubalaena glacialis)
Northern Yellow Bat (Lasiurus intermedius)
Ocelot (Leopardus pardalis)
Pallid Bat (Antrozous pallidus)
Palo Duro Mouse (Peromyscus truei comanche)
Piñon Mouse (Peromyscus truei)
Pocketed Free-tailed Bat (Nyctinomops femorosacca)
Pronghorn (Antilocapra americana)
Pygmy Killer Whale (Feresa attenuata)
Pygmy Sperm Whale (Kogia breviceps)

Rafinesque's Big-eared Bat (Corynorhinus rafinesquii)
Red Wolf (Canis rufus)
Ringtail (Bassariscus astutus)
River Otter (Lutra canadensis)
Rough-toothed Dolphin (Steno bredanensis)
Seminole Bat (Lasiurus seminolus)
Short-finned Pilot Whale (Globicephala macrorhynchus)
Silver-haired Bat (Lasionycteris noctivagans)
Southeastern Myotis (Myotis austroriparius)
Southern Yellow Bat (Lasiurus ega)
Sperm Whale (Physeter macrocephalus)
Spotted Bat (Euderma maculatum)
Striped Skunk (Mephitis mephitis)
Swift Fox (Vulpes velox)
Texas Kangaroo Rat (Dipodomys elator)
Townsend's Big-eared Bat (Plecotus townsendii)
Virginia Opossum (Didelphis virginiana)
West Indian Manatee (Trichechus manatus)
Western Mastiff Bat (Eumops perotis)
Western Pipistrelle (Pipistrellus hesperus)
Western Red Bat (Lasiurus blossevillii)
Western Small-footed Myotis (Myotis ciliolabrum)
Western Yellow Bat (Lasiurus xanthinus)
Yuma Myotis (Myotis yumanensis)

Reptiles are "cold-blooded" air-breathing vertebrates. A tough leathery skin that has embedded scales covers their body. Most reptiles lay eggs, though some give birth to fully-formed young. This group includes crocodiles, alligators, turtles, snakes, lizards, and tuatara.

American Alligator (Alligator mississippiensis)
Black-striped Snake (Coniophanes imperialis)
Brazos Water Snake (Nerodia harteri)
Bullsnake (Pituophis catinefer sayi)
Concho Water Snake (Nerodia paucimaculata)
Eastern Box Turtle (Terrapene carolina)
Green Anole (Anolis carolinensis)
Green Sea Turtle (Chelonia mydas)
Gulf Salt Marsh Snake (Nerodia clarkii)
Hawksbill Sea Turtle (Eretmochelys imbricata)
Indigo Snake (Drymarchon corais)
Kemp's Ridley Sea Turtle (Lepidochelys kempii)
Leatherback Sea Turtle (Dermochelys coriacea)
Loggerhead Sea Turtle (Caretta caretta)
Louisiana Milk Snake (Lampropeltis triangulum amaura)
Louisiana Pine Snake (Pituophis ruthveni)
Mexican Lyre Snake (Trimorphodon vilkinsonii)
Mountain Short-horned Lizard (Phrynosoma hernandesi)
Northern Cat-eyed Snake (Leptodeira septentrionalis)
Northern Earless Lizard (Holbrookia maculata maculata)
Ornate Box Turtle (Terrapene ornata)
Red-eared Slider (Trachemys scripta elegans)
Reticulate Collared Lizard (Crotaphytus reticulatus)
Reticulated Gecko (Coleonyx reticulatus)
Scarlet Snake (Cemophora coccinea)
Smooth Green Snake (Liochlorophis vernalis)
Southern Copperhead (Agkistrodon contortrix contortrix)
Speckled Racer (Drymobius margaritiferus)
Texas Diamondback Terrapin (Malaclemys terrapin littoralis)
Texas Horned Lizard (Phrynosoma cornutum)
Texas Tortoise (Gopherus berlandieri)
Timber Rattlesnake (Crotalus horridus)
Trans-Pecos Black-headed Snake (Tantilla cucullata)
Western Cottonmouth (Agkistrodon piscivorus leucostoma)
Yellow Mud Turtle (Kinosternon flavescens flavescens)

Fish are scaled, "cold-blooded" vertebrates found in water environments. They fall into three main groups: agnatha or jawless fish, chondrichthyes or cartilaginous fish and osteichthyes or bony fish. Most fish lay eggs, though a few species give birth to live young. This group includes: Agnatha- lampreys and hagfish, Chondrichthyes - sharks, skates and rays, and Osteichthyes - all other fish.

Alligator Gar (Atractosteus spatula)
American Eel (Anguilla rostrata)
Atlantic Croaker (Micropogonias undulatus)
Atlantic Cutlassfish (Trichiurus lepturus)
Big Bend Gambusia (Gambusia gaigei)
Bigmouth Buffalo (Ictiobus cyprinellus)
Black Buffalo (Ictiobus niger)
Black Bullhead (Ameiurus melas)
Black Crappie (Pomoxis nigromaculatus)
Black Drum (Pogonias cromis)

Blacktail Shiner (Cyprinella venusta)
Blue Catfish (Ictalurus furcatus)
Bluegill (Lepomis macrochirus)
Bowfin (Amia calva)
Chain Pickerel (Esox niger)
Channel Catfish (Ictalurus punctatus)
Clear Creek Gambusia (Gambusia heterochir)
Cobia (Rachycentron canadum)
Comanche Springs Pupfish (Cyprinodon elegans)
Common Carp (Cyprinus carpio)
Common Snook (Centropomus undecimalis)
Crevalle Jack (Caranx hippos)
Fathead Minnow (Pimephales promelas)
Flathead Catfish (Pylodictis olivaris)
Flier (Centrarchus macropterus)
Florida Pompano (Trachinotus carolinus)
Fountain Darter (Etheostoma fonticola)
Freshwater Drum (Aplodinotus grunniens)
Gafftopsail Catfish (Bagre marinus)
Gizzard Shad (Dorosoma cepedianum)
Golden Shiner (Notemigonus crysoleucas)
Grass Carp (Ctenopharyngodon idella)
Greater Amberjack (Seriola dumerili)
Green Sunfish (Lepomis cyanellus)
Guadalupe Bass (Micropterus treculii)
Hardhead Catfish (Arius felis)
Lane Snapper (Lutjanus synagris)
Largemouth Bass (Micropterus salmoides)
Leon Springs Pupfish (Cyprinodon bovinus)
Longear Sunfish (Lepomis megalotis)
Longnose Gar (Lepisosteus osseus)
Paddlefish (Polyodon spathula)
Pecos Gambusia (Gambusia nobilis)
Pigfish (Orthopristis chrysoptera)
Pinfish (Lagodon rhomboides)
Rainbow Trout (Oncorhynchus mykiss)
Red Drum (Sciaenops ocellatus)
Red Shiner (Cyprinella lutrensis)
Red Snapper (Lutjanus campechanus)
Redbreast Sunfish (Lepomis auritus)
Redear Sunfish (Lepomis microlophus)
Redfin Shiner (Lythrurus umbratilis)
Rio Grande Cichlid (Cichlasoma cyanoguttatum)
San Marcos Gambusia (Gambusia georgei)
Sheepshead (Archosargus probatocephalus)
Sheepshead Minnow (Cyprinodon variegatus)
Shortnose Gar (Lepisosteus platostomus)
Smallmouth Bass (Micropterus dolomieu)
Smallmouth Buffalo (Ictiobus bubalus)
Southern Flounder (Paralichthys lethostigma)
Spotted Bass (Micropterus punctulatus)
Spotted Gar (Lepisosteus oculatus)
Spotted Seatrout (Cynoscion nebulosus)
Striped Bass (Morone saxatilis)
Striped Mullet (Mugil cephalus)
Tarpon (Megalops atlanticus)
Texas Shiner (Notropis amabilis)
Threadfin Shad (Dorosoma petenense)
Tripletail (Lobotes surinamensis)
Vermilion Snapper (Rhomboplites aurorubens)
Walleye (Sander vitreum)
Warmouth (Lepomis gulosus)
White Bass (Morone chrysops)
White Crappie (Pomoxis annularis)
Yellow Bass (Morone mississippiensis)
Yellow Bullhead (Ameiurus natalis)

Table 1.2 : Common Urban Wildlife Species

These are some of the more common urban wildlife species that could potentially exist in the Memorial and that community members may be interested in creating habitat for in their yards, neighborhood parks, and schools.

Butterflies

Black Swallowtail (Papilio polyxenes)
Bordered Patch (Chlosyne lacinia)
Buckeye (Junonia genoveva)
Cloudless Giant Sulphur (Phoebis sennae)
Dogface (Zerene eurydice)
Giant Swallowtail (Papilio cresphontes)
Great Southern White (Ascia monuste)
Great Purple Hairstreak (Atlides halesus)
Gulf Fritillary (Agraulis vanillae)
Goatweed Butterfly (Anaea aidea)
Hackberry Butterfly (Asterocampa celtis)
Julia (Dryas iulia)
Long-tailed Skipper (Urbanus proteus)
Monarch (Danaus plexippus)
Painted Lady (Vanessa cardui)
Pipevine Swallowtail (Battus philenor)
Queen (Danaus gilippus)
Question Mark (Polygonia interrogationis)
Red Admiral (Vanessa atalanta)
Snout Butterfly (Libytheana carinenta)
Tiger Swallowtail (Papilio rutulus)
Variegated Fritillary (Euptoieta claudia)
Zebra (Heliconius charithonia)

Birds

Eastern Bluebird (Sialia sialis)
American Kestrel (Falco sparverius)
House Finch (Carpodacus mexicanus)
Screech Owl (Megascops kennicottii)
Tufted Titmouse (Baeolophus bicolor)
Bewick's Wren (Thryomanes bewickii)
House Wren (Troglodytes aedon)
Northern Cardinal (Cardinalis cardinalis)

Hummingbirds

Black-chinned Hummingbird (Archilochus alexandri)
Rufous Hummingbird (Selasphorus rufus)
Broad-tailed Hummingbird (Selasphorus platycereus)
Anna's Hummingbird (Calypte anna)

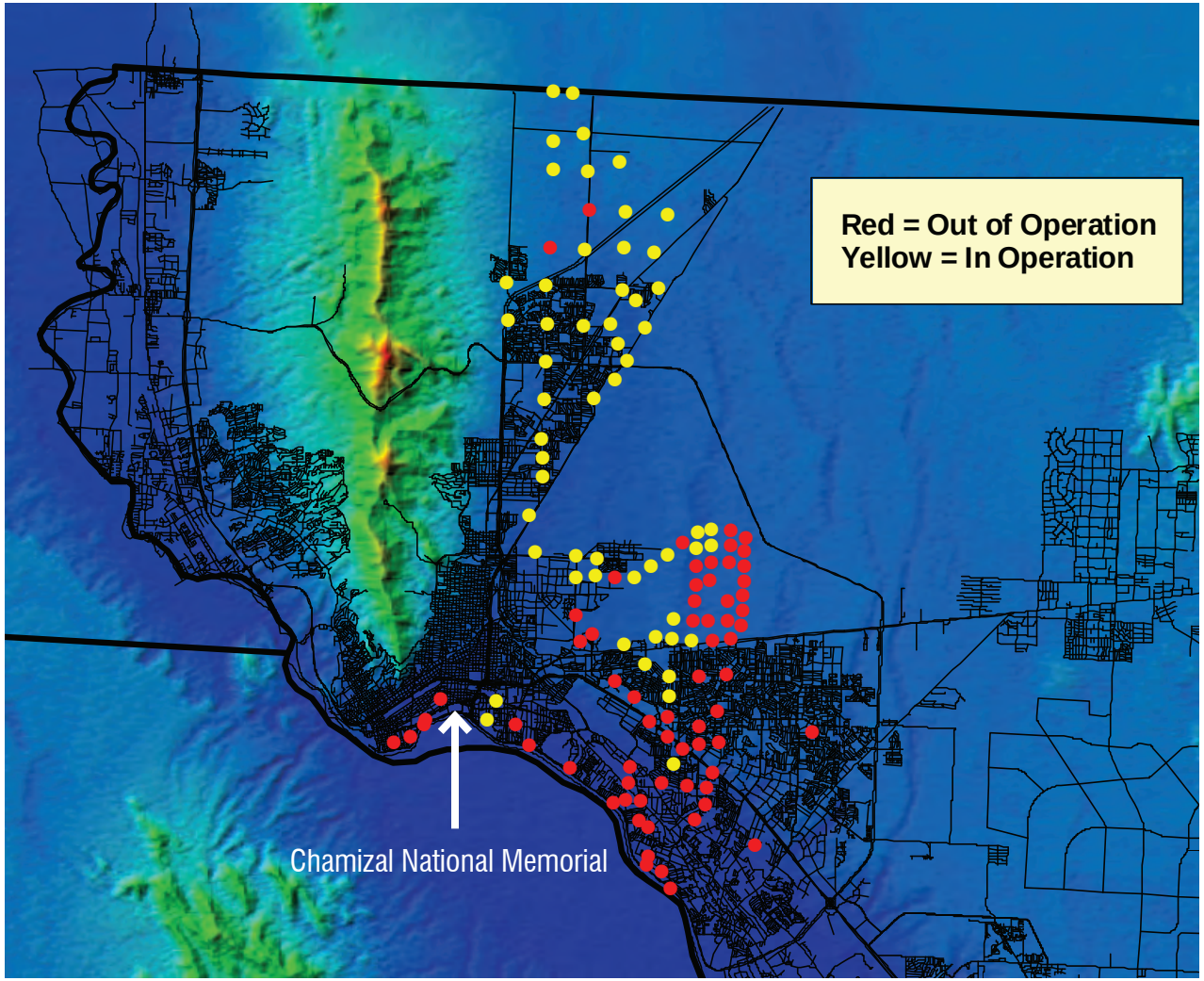


Figure 5.1 A map indicating loss of well function due to declining groundwater elevation and brackish water intrusion.

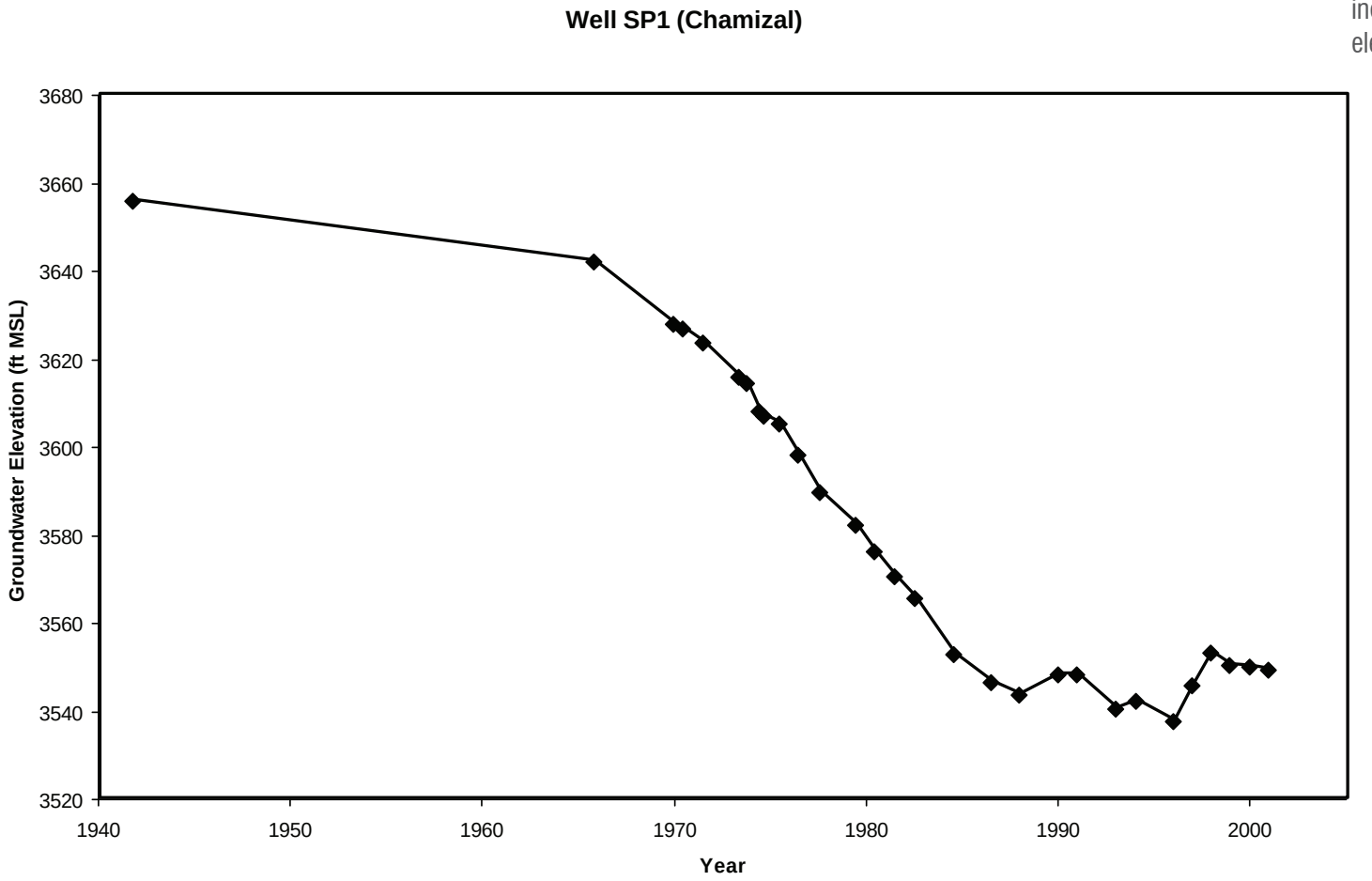


Figure 5.2 One of a series of graphs indicating decreases in groundwater elevations at various well locations.

United States Department of the Interior

CHAMIZAL NATIONAL MEMORIAL

800 South San Marcial
El Paso, Texas 79905-4123

IN REPLY REFER TO:

A64 (37)

July 17, 2009

Memorandum

To: Regional Director and Acting Deputy Regional Director

From: Superintendent, Chamizal National Memorial **/s/ Catherine F. Light**

Subject: Cross-cultural Education Center Vision

Background:
Chamizal was established to memorialize the resolution of a century old border dispute between the United States and Mexico. Its establishment demonstrated the ability of two neighboring countries to settle differences through negotiations.

Since its inception, the memorial was designed via the Chamizal Master Plan (1968) to serve as an cultural center for bilingual presentations and stage productions, which include theater, recitals, concerts, marimba and jazz groups, modern and classical dance, children's theater, film and art showcases.

The General Management Plan and the Foundation Plan both address the significance of the memorial serving as a place of international goodwill, friendship, trust and cooperation through an ongoing cultural exchange. They both emphasize that the memorial's establishment is based on conflict resolution between the two countries of Mexico and the United States.

The Comprehensive Interpretive Plan established four primary interpretive themes:

A — Chamizal National Memorial demonstrates that through the convergence of a favorable socio-political climate, charismatic leadership, and a spirit of cooperation and mutual respect, diplomacy can peacefully resolve a significant

international issue even after more than 100 years of ongoing, and sometimes violent, conflict.

B — Located on the former Cordova Island, Chamizal National Memorial offers opportunities to better understand and appreciate how actions deemed necessary for the greater good can have a wide range of effects on the lives of individuals, communities, and the land.

C — The Chamizal border dispute between Mexico and the United States offers opportunities to explore how individuals, societies, and nations use boundaries to create a sense of identity, ownership, and security.

D — Serving as a cultural center dedicated to fostering national friendship, understanding, and trust, Chamizal National Memorial's programs and urban landscape provide opportunities for people of Mexico and the United States to better understand and appreciate each other's diverse cultures and the many aspects of life that transcend nationality.

Currently, Chamizal National Memorial serves as an open door to increase visitor awareness to continually value cooperation, diplomacy and cultural values as a basic means to conflict resolution. Chamizal provides visitors with ample opportunity to better understand not only other cultures, but their own cultural roots as well.

Issue:

As a 55-acre urban open space site with walking trails and picnic areas, the memorial has come to represent one of few community public spaces to enjoy traditional park experiences. Most visitors and community residents come to use the memorial for walking, relaxing, and to attend special events without understanding the purpose and significance of the Chamizal story. Although the community is very aware of the Chamizal park, they do not see it as a part of the national park system and do not recognize the importance of its mission.

This project goal is to reconnect with our visitors: to enable them to enjoy the memorial's resources as they have traditionally done and yet be fully engulfed in the history and purpose of Chamizal National Memorial.

Mission:

The mission of the Cross-cultural Education Center is to provide youth with innovative, affordable and cooperative ways to resolve differences and transform relationships. This would be executed with less formal methods of resolving conflict through arts and education.

The Center will accomplish its mission by:

- Integrating Conflict Resolution education into youth arts programs;
- Increasing the awareness and use of alternative dispute resolution;
- Providing education and training on alternative dispute resolution and communication skills to youth;

- Promoting an atmosphere of tolerance, cooperation and acceptance;
- Promoting the acceptance of diversity and cultural exchange;
- Transforming conflicts into opportunities for understanding and growth.

Programming:
As guidance we would explore many existing programs to aid in the development of the interpretive/educational program. Listed below are current programs throughout the world in which we would seek guidance:

- *Partnership for Conflict Resolution Education in the Arts*-- The partnership consists of the National Endowment for the Arts, Office of Juvenile Justice and Delinquency Prevention and the National Center for Conflict Resolution Education. Their objectives are to advance the principles of conflict resolution education, and to help develop conflict resolution education programs within arts-based youth programs. Arts-based organizations benefit from such training by being able to provide youth with a program that helps build self-respect, respect of differences, and social responsibility, while also providing them skills and processes that help peacefully manage conflicts. Arts organizations already lay a foundation for peaceful conflict resolution by creating a safe environment that encourages the active and open expression of ideas. The Partnership seeks to build on this foundation by providing arts-based programs a collaborative framework to resolve conflicts peaceably.
- *The Art of Learning*—The National Endowment for the Arts, The Arts Endowment supports projects that provide children, beginning as early as the pre-school years, with the opportunity to learn by actual experience the techniques of music-making and the skills of drawing, painting, sculpting, and dance movement. Children should experience the techniques of writing poetry and the art of acting and play-making. This builds appreciation for the skill, discipline, and sacrifice necessary for achievement. It helps children develop admiration for the skills and hard work of others.
- *The Institute for Early Learning through the Arts*-- Wolf Trap Foundation for the Performing Arts—The Institute places professional performing artists in classroom residencies to work with children three to five years old through the disciplines of drama, music, and movement.
- *Youth for Peace program*-- prepares young people for solidarity, leadership and active citizenship by developing their capacity for decision-making, building a sense of responsibility, and empowering them to act.

The Collaboration: Potential partnerships
Partnerships could provide technical assistance with curriculum development, facility life cycle cost and construction, staff, grants, materials, instruments and sponsor special events & programs.
Office of Consulate General of the United States, Ciudad Juarez, Mexico
Office of Consul General de Mexico, El Paso, Texas
National Endowment for the Arts
The National Center for Conflict Resolution Education
Office of Juvenile Justice and Delinquency Prevention
Department of Education
U.S. Customs and Border Protection
Federal Council on Arts and Humanities
Texas Commission on the Arts
City of Juarez Mexico

City of El Paso
El Paso Art Association
El Paso County Dispute Resolution Center
El Paso Independent School District
El Paso Museum and Cultural Affairs Department
El Paso Music Community
Los Paisanos de El Chamizal

The Building Plan:
The proposed center will house such programs as art, music, drama and writing classes; foreign language classes; small meeting space; computer lab and offices. The memorials existing facilities will continue to support concerts, stage performances, art showings, and large forums.

The proposed facility should be flexible to allow multi-functional use and easy modification to respond to changing program needs. To accomplish this, classrooms can be grouped together to accommodate division or expansion needs; meeting spaces can be grouped together to create a large community/multi-purpose room; and instructional support spaces can serve as computer labs.

Building Location:
Proposed location will be in the southwest corner of the memorial grounds approximately 5 acres. This site was once used for a lienzo for the memorial.

Summary:
This proposal is only an idea shared with the Regional Director and Deputy Regional Director to establish a new direction or vision for Chamizal National Memorial. I currently seek your advice and comments. I recognize that this would be a huge undertaking and the memorial could start by testing the proposed interpretive programming in our existing facilities.

The memorial's intent is to combine federal, state and private funds to develop and manage this unique center. The center would provide an opportunity to share the history of Chamizal, enhance international relations, promote diversity and cultural appreciation and establish the seeds of corporation and goodwill for generations to come. The National Park Service's guiding principles of park planning and decision making will be implemented to pursue this proposal.

Appendix E
Plant Lists

Mesquite-Sandsage
sandy soils

Trees
Prosopis glandulosa
Prosopis pubescens

Shrubs
Artemisia filifolia
Atriplex canescens
Ephedra sinica
Gutierrezia sarothrae

Accents
Dasylirion wheeleri
Yucca elata

Grasses
Bouteloua eriopoda
Bouteloua gracilis
Bouteloua ramosa
Sporobolus cryptandrus
Sporobolus flexuosus
Sporobolus contractus

Wildflower
Proboscidea althaeifolia

Fourwing Saltbush-Creosote
saline soils

Trees
Prosopis glandulosa
Prosopis pubescens

Shrubs
Atriplex canescens
Caesalpinia jamesii
Flourensia cernua
Gutierrezia sarothrae
Haplopappus heterophyllus
Larrea tridentata

Accents
Opuntia engelmanii
Opuntia leptocaulis

Grasses
Aristida purpurea
Bouteloua eriopoda
Hilaria mutica
Sporobolus airoides
Sporobolus flexuosis
Sporobolus wrightii
Trichloris crinita

Creosote-Lechuguilla
lower slopes, intermountain valleys

Trees
Acacia constricta
Acacia greggii
Prosopis glandulosa
Prosopis pubescens

Shrubs
Aloysia gratissima
Condalia warnockii
Flourensia cernua
Larrea tridentata
Leucophyllum frutescens
Guaiacum angustifolium
Koeberlinia spinosa
Krameria parvifolia
Parthenium incanum
Viguiera stenoloba
Ziziphus obtusifolia

Accents
Agave lechuguilla
Echinocereus engelmannii
Fouquieria splendens
Opuntia engelmannii
Opuntia leptocaulis
Yucca baccata
Yucca elata

Grasses
Bouteloua ramosa
Bouteloua eriopoda
Erioneuron pulchellum

Tobosa-Black Grama
basin bottoms with excessive runoff

Trees
Acacia constricta

Shrubs
Buddleia lindleyana
Condalia warnockii
Larrea tridentata
Menodora scabra

Accents
Cylindropuntia imbricata
Gutierrezia sarothrae
Yucca elata

Grasses
Bouteloua curtipendula
Bouteloua eriopoda
Bouteloua gracilis
Bouteloua hirsuta
Bouteloua ramosa
Digitaria californica
Hilaria mutica
Muhlenbergia porteri
Scleropogon brevifolius

Pollinator Courtyard

Trees
Acacia farnesiana
Celtis reticulata
Prosopis glandulosa

Shrubs
Aloysia gratissima
Anisacanthus quadrifidus v. wrightii
Bauhinia lunarioides
Buddleia marrubifolia
Calliandra eriophylla
Celtis pallida
Chrysactinia mexicana
Dalea frutescens

Accents (small-medium)
Hesperaloe funifera
Hesperaloe parviflora

Accents (large)
Fouquieria splendens
Yucca elata

Plaza Planters

Trees
Celtis reticulata
Quercus virginiana

Shrubs
Chrysactinia mexicana
Menodora scabra

Accents (small-medium)
Dasylirion wheelerii
Euphorbia antisyphilitica
Hesperaloe funifera
Hesperaloe parviflora
Opuntia engelmanii
Opuntia violacea

Accents (large)
Fouquieria splendens
Yucca elata

Entrances

Trees
Acacia farnesiana
Prosopis glandulosa

Shrubs
Aloysia gratissima
Anisacanthus quadrifidus v. wrightii
Chrysactinia mexicana
Gutierrezia sarothrae

Accents (small-medium)
Cylindropuntia imbricata
Hesperaloe funifera
Hesperaloe parviflora
Opuntia violacea
Yucca baccata

Accents (large)
Fouquieria splendens
Yucca elata
Yucca torreyi

Medians

Trees
Acacia constricta
Celtis reticulata
Chilopsis linearis
Prosopis glandulosa

Shrubs
Anisacanthus quadrifidus v. wrightii
Buddleia lindleyana
Condalia warnockii
Gutierrezia sarothrae
Menodora scabra

Accents (small-medium)
Cylindropuntia imbricata
Hesperaloe funifera
Opuntia violacea
Yucca baccata

Accents (large)
Fouquieria splendens
Yucca elata

Grasses
Bouteloua curtipendula
Bouteloua gracilis
Bouteloua hirsuta
Bouteloua ramosa
Muhlenbergia porteri
Scleropogon brevifolius

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Figures + Tables

All photos and graphics are the property of the document author unless otherwise noted.

Figure 1.1 (modified from)
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Figure 1.3
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Figure 1.5 (modified from)
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Figure 3.1 (recreated from)
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Figure 5.1
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Chamizal National Memorial Master Plan

Renewing a Conservation Ethic