

EVOLUTION OF ZOO DESIGN

eople began to vote for

alth of zoo animals

se in concern with animal welfare

nd the conservation movement

ing of San Deigo Zoo - 1915

in artwork

Animals seen tron

single vantage poir

Omate architecture- organized by species

Zoos are

seen as a

the entertain

ment indust

crete, glass, and

First American

Zoo-Philadelp

Entertainment

for the wealthy

and prestigious

and social outlet

present

OBJECTIVES

CONTRIBUTE to conservation efforts through a movement in zoo design that generates a feeling of animal appreciation for enclosed species

DESIGN an aesthetic enclosure that has a balance for zoo care operation, viewer appreciation, and benefits animal welfare

DISCOVER a connectivity system between enclosures suitable for large cats which allows migration between exhibits

Education through story lines

culture education revi

Central Park Z

display the anima

Growing viewe

demand requir

Vienna zoo founded as

an imperial menagerie i

1752, and is current

Encouraged bond between

oo desianers visited habitats to

Artificial rock

and trees cre-

Improved husbandry with

Popular moat barrier

bits, geographic (non-

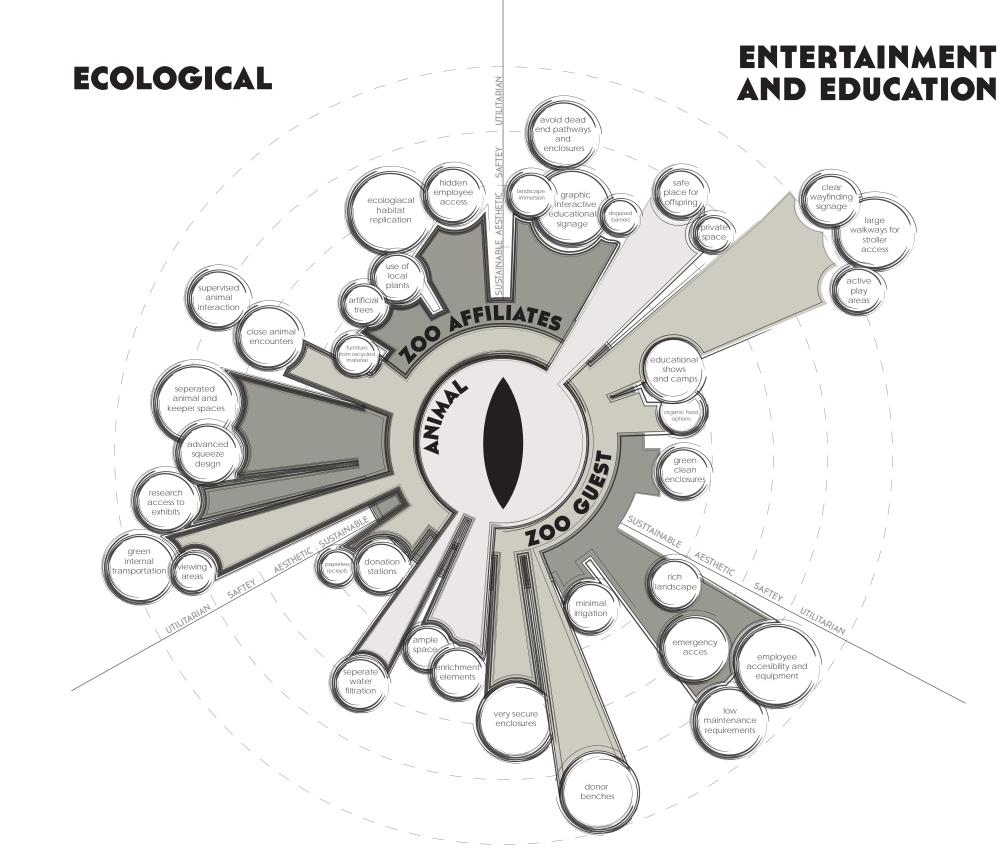
the research in animal

INCORPORATE successful exhibit enrichment elements as well as introduce advanced models for animal stimulation and welfare

CREATE stimulating exhibits for the cats at the San Diego zoo that helps mitigate abnormal behaviors

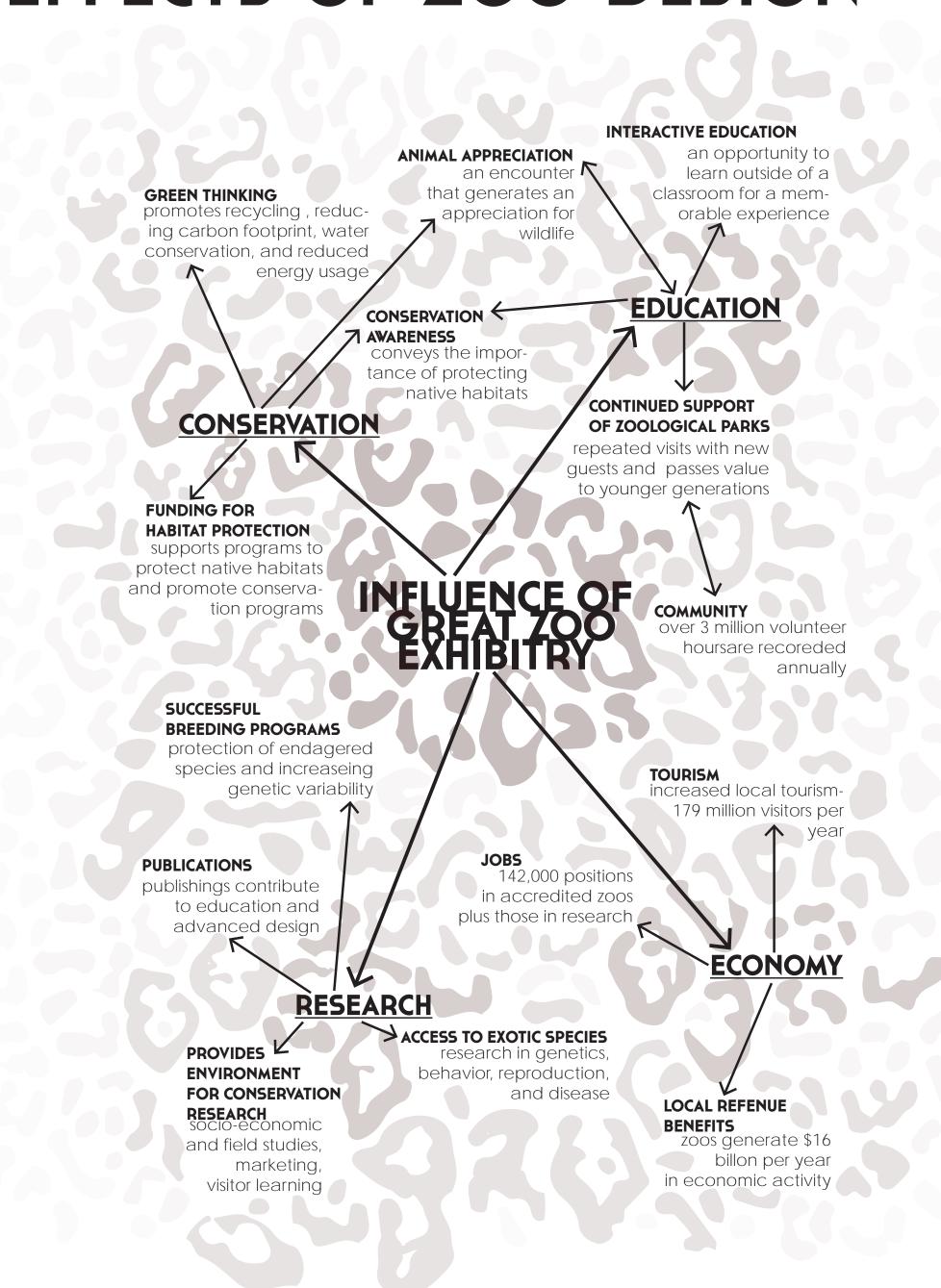
PROVIDE viewers with new and exciting ways to experience large cats through innovative landscape immersion

EYE FOR DESIGN



ECONOMIC

EFFECTS OF ZOO DESIGN



HABI-CATS



northern Europe. There's little left of Britain's ancient wildwood, but mixed deciduous and evergreen woodands are scattered across the continent, and dictate its



hese forests in temperate regions undergo warm summers and cool winters. The species are not exclusively conifers, but are include a few broadleaf varieties. Giant trees like redwoods of the Americas are often a feature, particularly where there is higher



than roughly 10 inches of rainfall a year. Along with the sand dune areas it includes arid areas in temperate regions. Plants DESERT are well adapted to conserving water and often have to survive extremely hot days and cold nights. Deserts may seem to have very little life in them, however, a deeper inspection can reveal high biodiversity.

Desert and dry scrubland refers to areas that receives less

Flooded grasslands are composed of half grassland, half



ally flooded. Plant species must be tolerant. to this flooding. This type of wetland area is of particular value to bird life, so bird populations are often high in

wetland. They may be permanently or season



nese forests grow near tropical coasts with soft soils and are flooded twice daily by the tide. The notable feature about these ecosystems is the complex root system that serves as protection for wildlife also prevent the erosion from the tide.



ground surface for significant part of the year. This results in a waterlogged environment that stays saturated even if there are no pools of standing water. These can be features or zones along the margin of a lake or a river's edge. Salt marshes can also form or arise in the intertidal areas along

Marshes form where water is very close to, or above, the

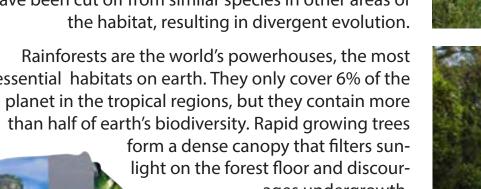


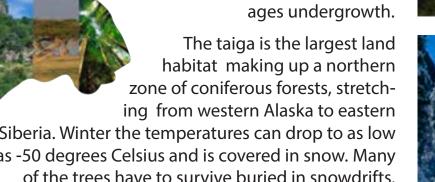
Characterized by hot, dry summers, contrast with much milder, wetter winters. Wild fires are a common occurrence, so many of the plants are adapted to surviving this natural cycle. Some species depend on fire to clear out competitors or to germinate their seeds. Mediterranean ecoregions are found at the fynbos of South Africa, the matorral of Chile and the some forests of California.

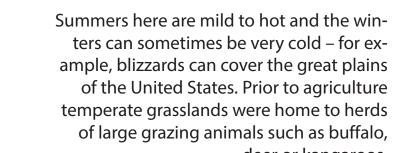


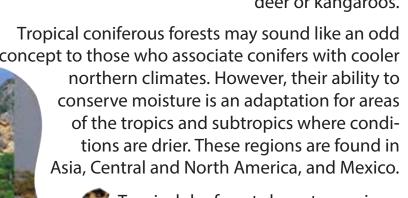
These zones are tougher place to life than equivalent lowland habitats, partly due to the lower temperatures and extreme weather. The lack of oxygen and carbon dioxide in the air at the higher elevations make life difficult for both animals and plants. Soils are thin or non-existent on steep mountain slopes, which restricts the types of plants that can grow, often areas are barren of plant life.

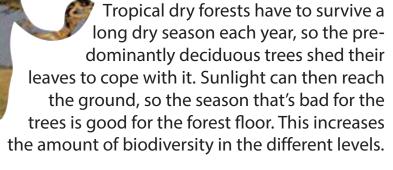
Mountain grasslands include the grasslands below treeline, as well as the alpine tundra above the it These extremely elevated grasslands often exist as isolated pockets within other habitat types. Consequently, the animals and plants species inhabiting these areas have been cut off from similar species in other areas of the habitat, resulting in divergent evolutio Rainforests are the world's powerhouses, the most

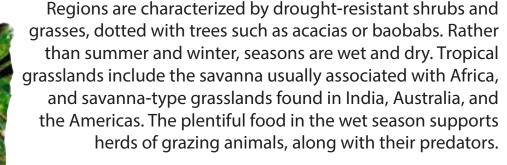


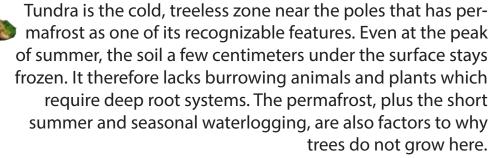




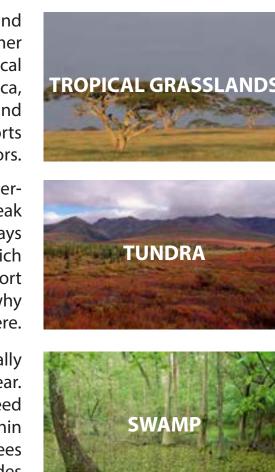








Swamps are wetland regions where the vegetation is totally or partially submerged in water, for some or most of the year. Swamp waters flow very slowly, and there are often reed beds or sedges populating the edges. The raised areas within a swamp, are likely to be drier and may therefore have trees surviving in patches. Swamps include the Florida Everglades and the Okavango Delta.



MPERATE GRASSLAN

SNOW LEOPARD



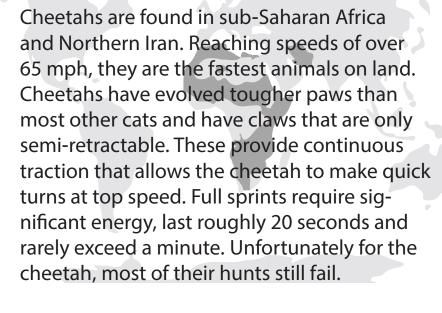
making huge leaps over ravines, are highly adapted to their harsh environment in the mountainous areas of central Asia. Their long, thick body hair, and enlarged nasal cavities which heat inhaled cold air keep them comfortable. These cats can bring down prey three times their own size, but on average only kill one large animal twice a month. They are critically endangered due to fur trade and their natural prey declining.

Snow leopards, prime athletes capable of

CLOUDED LEOPARD



In proportion to their body size, the clouded leopard has the longest canines of any cat, similar to the extinct sabre-toothed tiger. They are top forest predators thriving amongst the trees. Running head-first down tree trunks, climbing around on the underside of branches and hanging upside down by their hind legs are no challenge for these creatures. Clouded leopards are widely, but very thinly, spread throughout southeast Asia.



The powerful tiger, largest of the big cats, is a heavily muscled, forceful predator that stalks and ambushes large prey, camouflaged by its striped coat. Unlike other cats, tigers are impressive swimmers and often cool off in lakes and streams during the heat of the day. Unfortunately, they have been pushed to the edge of existence through hunting and habitat loss with three of the eight subspecies already extinct, and the other subspecies at extreme

THE CATS







Jaquars are excellent stealth predators and eat a wide variety of prey, from large mammals to fish and small birds. Their common name derived from the native Indian "yaguara" meaning, "beast that kills its prey with one bound", since these remarkable cats typically attack their prey by leaping on them from a concealed spot. Jaguars are the largest cats of

the Americas, however, they vary enormously

in size within different regions despite there

being no record of subspecies.

Lions are predatory carnivores with females

performing most of the hunting at night; the majority of the prey being antelope, zebra

and wildebeest. They are the only truly social

cats, with related females living together in

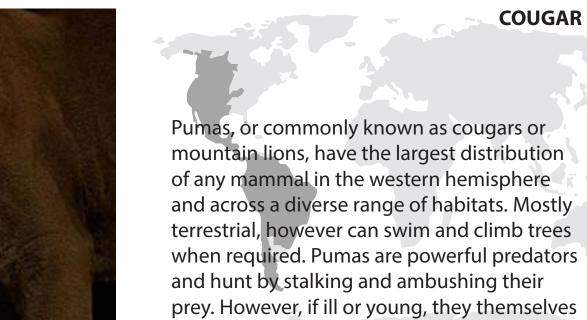
prides overseen by male coalitions that com-

sub-Saharan Africa, and there is also a small

isolated population of Asiatic lions can be

found in the Gir Forest of western India.

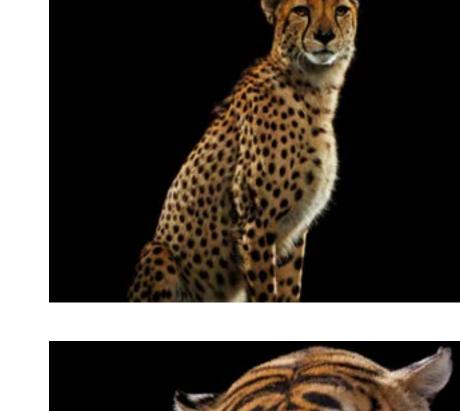
pete for possession. Populations are found in

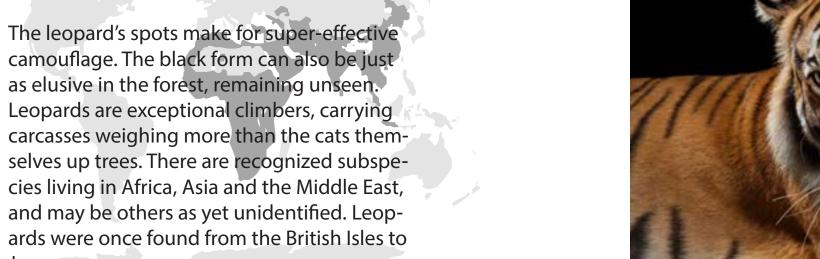




The leopard's spots make for super-effective camouflage. The black form can also be just as elusive in the forest, remaining unseen. Leopards are exceptional climbers, carrying carcasses weighing more than the cats themselves up trees. There are recognized subspecies living in Africa, Asia and the Middle East,

can become lunch for hungry wolves or bears.





PRECEDENT STUDIES

INTENT

OBSERVATIONAL STUDY

This proposal seeks to further explore an exemplary method for additional habitat enrichment. The objectives of this research are to collect and compare habitat and behavioral correlation data in order to create a successful design for "animal migration" in zoos that may serve as a design model in the future. Three zoos were selected as precedent studies.

The first is the Philadelphia zoo which has a large cat animal migration exhibit. The San Diego Zoo, in which the lions and jaguars swap inclosures. Lastly, the San Diego's Safari Park has a new tiger enclosure currently under construction that demonstrates new trends in zoo design.

During these zoos were visits, information was collected from the the zoo architects and lead keepers. Observations consisted of physical habitat design concepts and characteristics along with descriptions of animal behav-

The information gathered from these sites and additional published articles, is by which inspiration came to create a successful habitat immersion and enrichment model for large cats. The goals of observations were to collect this information and produce a design that encompasses findings and expands on different opportunities for habitat enrichment. The site location selection determined for this project



PHILADELPHIA ZOO

EXHIBIT DESIGN

Zoo exhibit design has incorporated habitat immersion and habitat enrichment since the 1980s. Studies of animal welfare to the overall success of a zoo indicate that enriched habitats can help reduce abnormal behaviors in captive animals. The best zoo design now incorporates areas for specific activities such as resting, water features, and play objects. The Philadelphia Zoo, for example, allows their large cats to move freely through exhibit spaces, allowing them the opportunity to explore new areas and smell the previ-

ANIMAL BEHAVIOR

An animal's behavior is a clear indicator of welfare, however a good comparison and careful consideration in typical behavior deviations should be analyzed. Providing stimulating conditions for a captive animal can help an animal fulfill its natural needs and specific behaviors, which can lead to better physical and physiological health. Abnormal behaviors in animals can be unpleasant for zoo goers and the animal caretakers. They can lead to indicate serious health problems, such as self mutilation (Laule 2003).





The purpose of zoological parks are to educate and raise awareness about conservation of wild ecosystems that are the home to many of these animals. When a visitor is left with a feeling of admiration for an animal instead of pity, it will bring about a more positive attitude toward zoos and conservation (Hill

These notes were taken by phone interview and during a behind

the scenes tour of the Big Cat Falls exhibits in Philadelphia, Penn-

Big changes occurred since the 1950s for the zoo. The back pri-

yards and one satellite yard which is connected to the bedroom

to the building. The typical pattern for animal migration in zoos

are yard A -bedroom A -yard A. However, this model allows for a cat to be in the "Lion yard", move to the bedroom, then " Jaguar yard."The zoo publicly opened the new habitats in 2006. In 2007 the exhibit won the National exhibit award for it rotation exhibit. COO Dr. Andrew Baker presented the rotation concept nationally

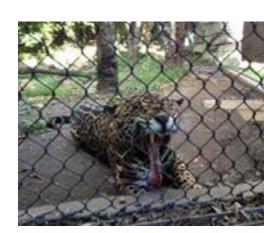
and internationally in Kansas City and in China.

house through a tunnel. The tunnel system connects each exhibit





PHILADELPHIA ZOO



Tiger pool and stream; gunite, stone, and water

FREEDOM OF CHOICE

lion exhibit, especially the heated rock feature.

behaviors, or behaviors related to boredom.

enture through the



destrian pathways



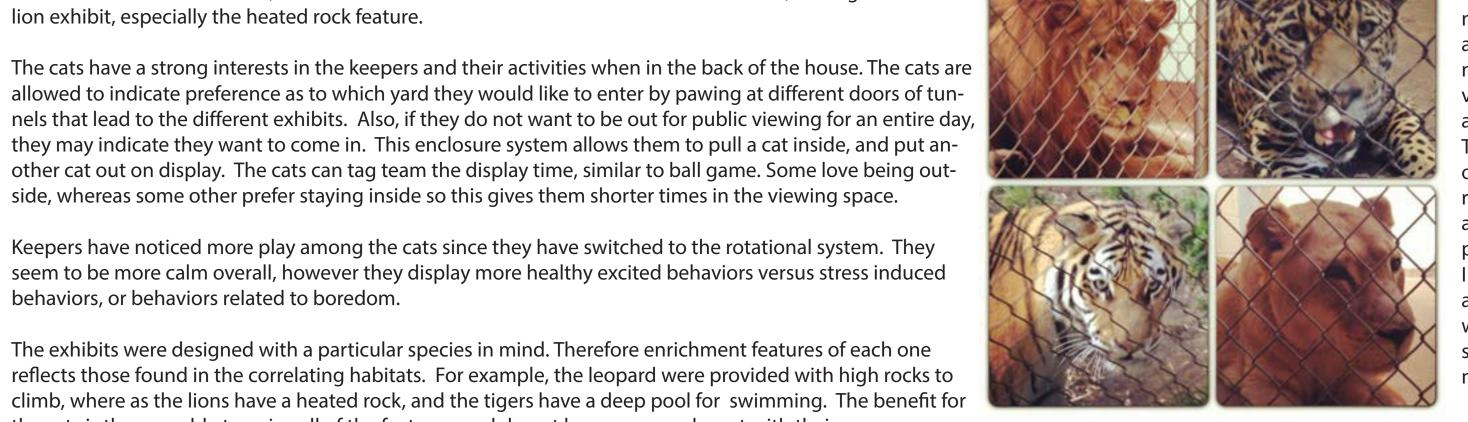




vate space keepers use called, "bedrooms" use to be open to the public. The bedroom floors are elevated about 2 feet. Elevated floors in the bedrooms allows for easier access for the keepers to the cats. The original building was maintained because it was still functional and a very large structure. From 1950-2004 this space was open to the public for viewing. However, sick cats and young cubs had no private space. In 2004, the building was renovated with a new plan from MESA Architects, and they added 5 exhibit

Safety is number one when working with large cats because they are very sneaky and they are made to silently attack prey, so you can never turn your back to a cat. Keepers must always be alert when working with the cats. New staff must always be aware of their surroundings and actions when working with cats. Safety would be a priority in keeper driven design. A very strict program for care is also recommended for exhibits with rotation abilities. At the Philadelphia Zoo, each keeper is in charge of a specific space, so they do not have to worry about a door being open by another keeper, or a cat being fed twice. This helps eliminate some variables that could disrupt normal behaviors. It eliminates confusion and miscommunication. The keepers plan the cat rotations in advance, and do it together. When the cats move, the keeper is in charge of whatever cats are in their designated bedrooms.





CONCEPT SPREADING This concept is spreading across the zoo. They now have overhead net tunnels that stretch across the zoo between the treetops in which monkeys and lemurs venture through. The viewer experience is heightened because animals are seen in unexpected locations. The next addition to the design is to top the open air cat exhibits in order to provide more rotation options. Currently some cats are not allowed in certain yards because they could potentially jump and escape the enclosure. In the future, the zoo would like to provide an overhead access tunnel for the cats all the way to the gorilla exhibit because this outdoor space is unused during Philadelphia's winter

B:The original 1950s bed-

rooms with connection doors



Currently they have 17 cats total. Each keeper is in charge of at least 8 cats at any given time. They do not

move the cats on a daily bases because they like to settle into a space. The schedule is flexible, and accom-

modates the mood of the cat; different needs call for different movements. For instance, the Jaguar loves the

The cats have a strong interests in the keepers and their activities when in the back of the house. The cats are

allowed to indicate preference as to which yard they would like to enter by pawing at different doors of tun-

they may indicate they want to come in. This enclosure system allows them to pull a cat inside, and put an-

other cat out on display. The cats can tag team the display time, similar to ball game. Some love being out-

Keepers have noticed more play among the cats since they have switched to the rotational system. They

The exhibits were designed with a particular species in mind. Therefore enrichment features of each one

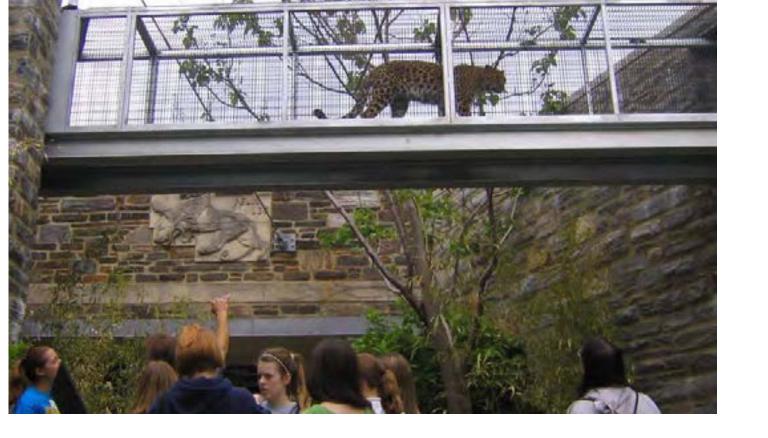
reflects those found in the correlating habitats. For example, the leopard were provided with high rocks to

climb, where as the lions have a heated rock, and the tigers have a deep pool for swimming. The benefit for

seem to be more calm overall, however they display more healthy excited behaviors versus stress induced

side, whereas some other prefer staying inside so this gives them shorter times in the viewing space.

BENEFITS The initial goal was to provide a way to for each cat to go to the satellite yard when needed. The nontraditional Philadelphia zoo Big Cat Falls exhibit offers choice to animals through animal migration through exhibits which results in healthier animal behaviors. Cats have been spending more time with cubs that previously witnessed in zoo captivity, which models natural behaviors found in the wild. The exhibit design offers multiple public and active spaces and quiet private spaces for the cats. It was not the original intent of the design to shuffle the cats on a regular basis.



HABITAT ENRICHMENT

RECOMMENDATIONS FOR HABITAT DESIGN

Dr. Lance Miller Interview Behavioral Biology Scientist San Diego Zoo Global

CATS IN CAPTIVITY

Putting conspecifics in close proximity with out direct interaction causes more stress and abnormal behaviors. It is best to limit or reduce visibility when the cats are not able to interact. However, smelling a conspecific could be stimulating, and could be helpful.

Currently, cats are fed on a schedule, however if we could incorporate an automatic feeding system that randomized feeding times this could reduce some of the abnormal behaviors that are associated with the excitement from feeding time, such as pacing.

Not only do preferences in enrichment vary by species, but also by individual. Rotation of enrichment objects and activities every three weeks could also help retain stimulation in the large cats. Surprisingly, the diversity of substrate in an

enclosure is a very important factor in enrichment. Creating flexible enclosures that can be modified to offer different elements of enrichment based or individual could positively impact normal and healthy behaviors. Keepers are only there during daylight hours, usually for about 8 hours. Another interesting program would be a system that offered or rotated enrichment during the night when keepers are not available. A great number of large cat species are more active at night and could benefit from new activities during the night.

Remember that not all stress is bad. In fact, acute stress is stimulating. Chronic stress on the other hand can lead to health problems. It is important for the cats to have a variety of places to hide, not only from the public view, but also from conspecifics.

When it comes to offering animals a choice in activities or location, it is very important to maintain that control. Once you take away choice, it could lead to problems. In the eye of a researcher, it is better to not offer enrichment, than it is to offer it and take it away.

Enclosure design, feeding devices, novel objects, appropriate socia grouping, and other sensory stimulating objects contribute to habitat enrichment (Claxton 2011). Studies have observed more active behaviors in captive animals when habitat enrichment is present. Animals have been recored spending increased time interacting with non-food-related enrichment objects. Adding complexity to an enclosure has been done with the introduction of simple enrichment devices. This complexity has indicated a benefit the animals' welfare which in turn and enhances the viewer's experience (Smith). A study involving bobcats revealed that abnormal repeating behaviors such as pacing, locomotion, grooming, and vigilance were reduced overall after habitat enrichment elements were installed. The bobcats were able to successfully breed for the firs time after their enrichment program as well (Mollá 2011). Anothe study involving Indian leopards revealed a positive correlation be tween the activity levels and the time spent in the enriched portion of the enclosure. Increased activity indicates that habitat design influences the welfare of the leopards in captivity (Mallapur 2002).







SAN DIEGO SAFARI PARK

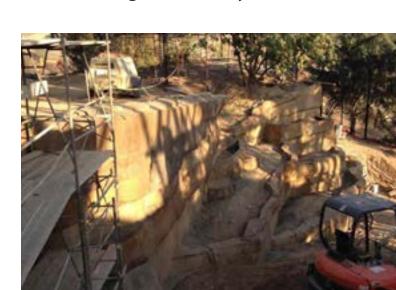


Tiger Trail is going replace the existing canyon enclosure that was not optimally designed for animal viewing. The new 5-acre exhibit will provide the tigers with a spacious, wooded area that would also give visitors a more intimate, closeup experience with the tigers.

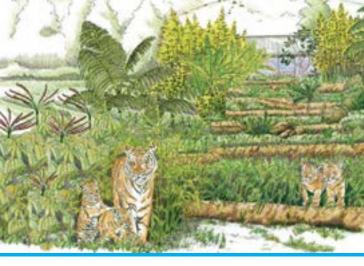
The plan involves saving many of the mature trees existing on the site.



Sumatra architecture conveys the region where the tigers naturally reside.



One portions features a cascading landscape for climbing.



This habitat's enrichment will contain deadwood for scratching.



Tiger Trail can accommodate as many as a dozen of the animals, as well as cubs.



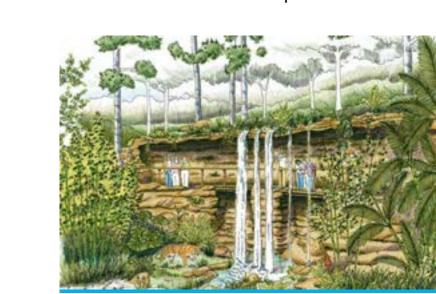
Nearly 40 feet high, water falls down into a pool where tigers can bathe.





Tiger entry into bedrooms as well as a

heated rock feature on top near viewers.



and can touch the water for immersion.

Below are some habitat design recommendations

from the keepers and architects at the San Diego Zoo

-Make sure there are no dead ends, create 2 ways in

and out. This important for animal and keeper safety

-Utilize vertical space because horizontal space is al-

-Be good a retrofitting because animals are always

being shuffled around, be able to transform a bird

EXHIBIT DESIGN

Landscape immersion is created by dense ly vegetated pathways. Innovative ways to transport people creates new connectivity

The hippo exhibits have underwater view-

ing opportunities. Drift wood creates a

more naturalistic pool

SAN DIEGO ZOO











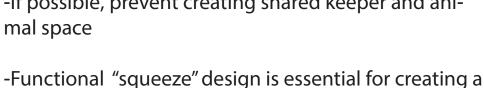
The lion and jaguar have roof access that serves as a semi-private space. They are also able to swap exhibits and utilize the enrichment elements in the other side



exhibit into a clouded leopard exhibit -Use unconventional spaces, be creative with ways in increase usable areas -If possible, prevent creating shared keeper and ani-

in case one entrance becomes blocked.

ways limited.



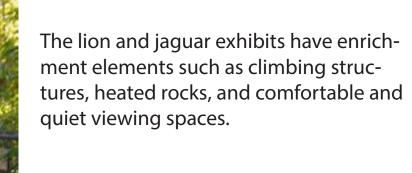
cess to animals for the keepers and veterinarians -For better landscape immersion hide necessary

could potential grow in different dimensions for habi-

Doors are located on at least of two walls of the building. There is also access into the bedrooms from the roof.



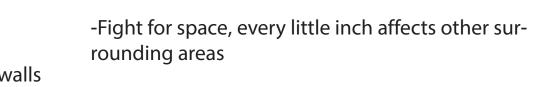








comfortable space for animals and safe and easy ac--The more flexibility the better, design spaces that tat enrichmen







The jaguar and lion exhibits are capped

with a fine mesh. The mesh is draped in-

stead of creating a cage like enclosure.





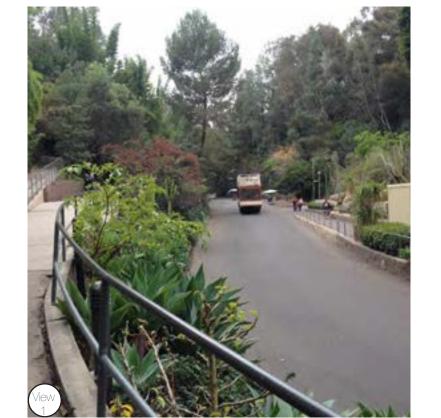


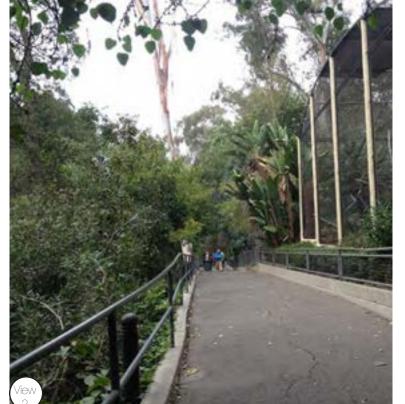






SITE ANALYSIS











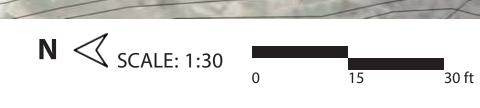


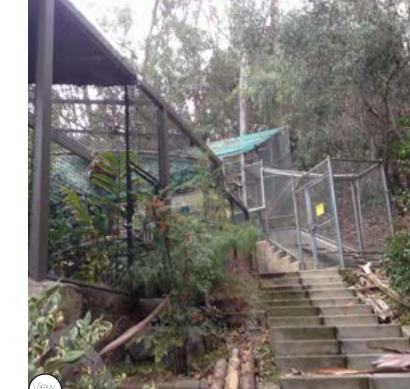


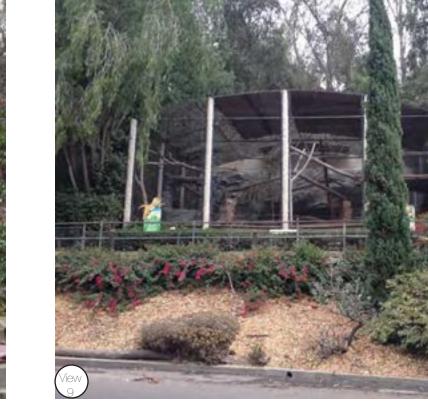


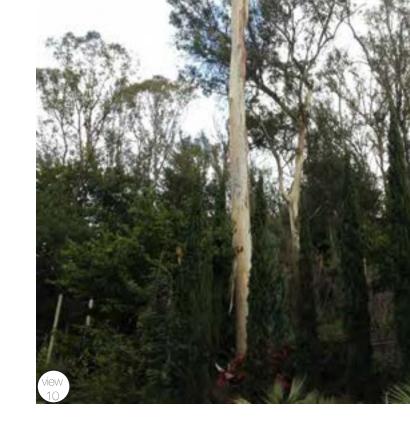
EXISTING CONDITIONS







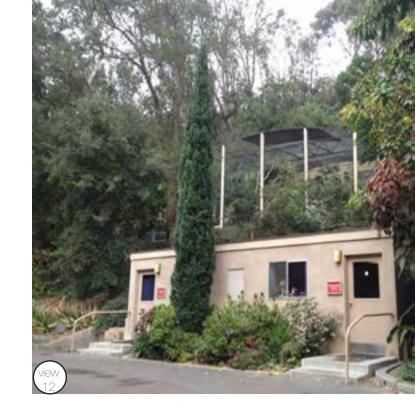


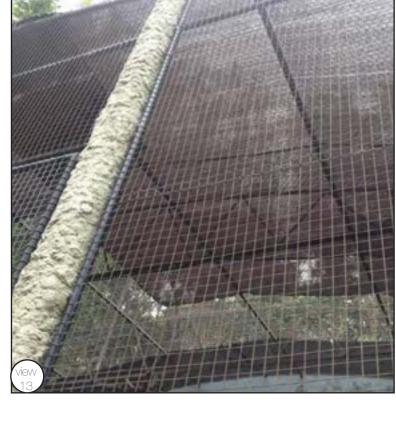














OBSERVATIONS

OPPORTUNITIES AND SUCCESSFUL ELEMENTS VIEW CONSTRAINTS AND UNSUCCESSFUL ELEMENTS Excessive space taken by bus route with large amounts of hardscape Bus route separated from pedestrian traffic with topography and landscape Wide sidewalks accommodate strollers and large crowds Large sidewalks prevent landscape immersion, strong cage like enclosure Non-organic enclosure form with limited viewing angles Clear signage with a close up viewing opportunity Attempted visual plant barrier to disguise facility buildings Poor planting density to serve as visual barrier

Poor planting density to serve as visual barrier Attempted visual plant barrier to disguise facility buildings Habitat recreation attempt, trees provide thin barrier between bus traffic 6 Limited planting design with poor views into the exhibit 7 Exit is directly in the bus route

8 Employee access is clearly visible and not aesthetic for viewer experience Facilities and back of house attached to exhibit with secure access Poor landscape planting with little maintenance and lacks canopy cover Clear signage for bus viewers and open visibility for the guests

Existing mature tree species may not match design intent Significant mature trees to incorporate into new design Old fencing and unattended landscape is visible from pedestrian pathway Unused old exhibit space is available for redesign

> Facility architecture does not blend with landscape Secured enclosure with top covering 13 Strong presence of shade screen instead of using tree canopy and fine mesh

Viewer is close to enclosure boundary 14 Disconnection between viewer and animal space Historic enclosures can educate guests about zoo history 15 Decrease in animal connection and appreciation due to harsh barrier

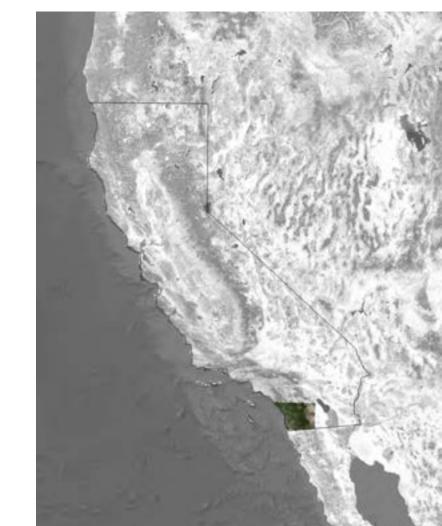
Cats are willing to spend time in close-up viewing space 16 Enrichment structures seem stagnant and under utilized Rich an diverse tree population 17 Mid-level landscape is sporadic and non-thematic

Paving types indicate separation from pedestrian and bus route 18 Visibility to dilapidated enclosure structure, bedroom space, and utility box

SITE SELECTION AND CONTEXT

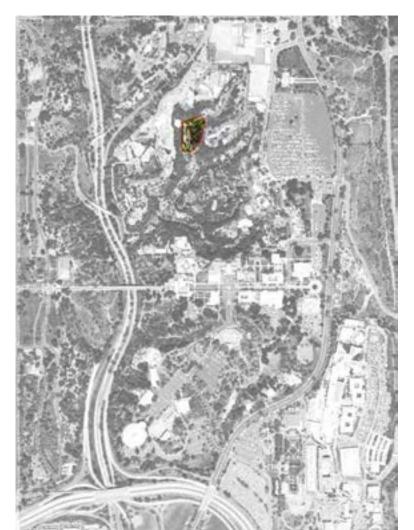


The San Diego Zoo is located within downtown San Diego. As a business, this zoo benefits greatly from the large amounts of tourist passing through the area. Also, the climate of San Diego is very mild, rarely freezing or reaching high temperatures, which makes growing most plant species very easy. Rain fall is very small, which increases need for irrigation, however this is why it's called "Sunny San Diego."



SELECTION FACTORS The San Diego Zoo is world famous, and is known for being one of the best in many categories. This site was initially selected this zoo for a precedent study. After visiting the zoo and learning about the Lion and Jaguar exhibit, I ventured to see the remaining feline exhibits. Surprisingly, The Big Cat Trail was very unimpressive and was in need of renovation. When digging further, it was revealed that a plan called Africa Rocks was already in the works to redefine the space. Designing for a real space with actual potential for renovation is exciting, which contributed to this site selection. Excellent communication with the Zoo staff made obtaining base information very accessible, and allowed for investigation for re-design.





Space was set aside for the San Diego Zoo in Balboa Park in 1921 after animals were abandoned after the Panama-California Exposition in 1915.

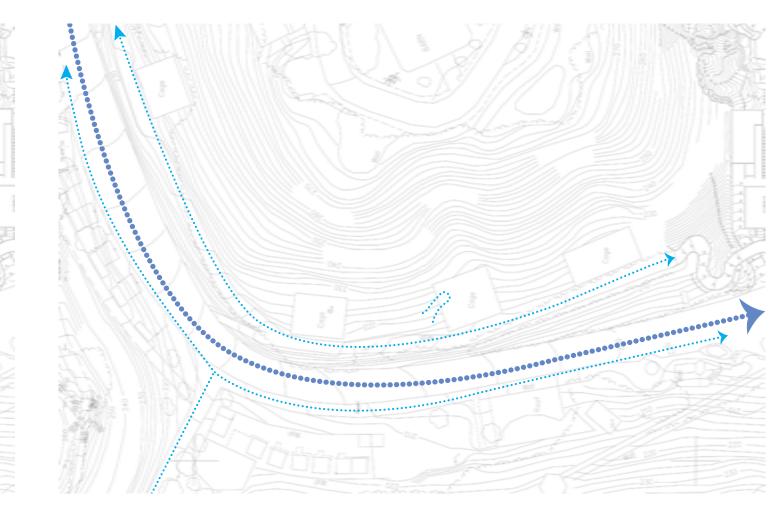
The zoo holds 4,000 animals with representation of over 800 species.



TOPOGRAPHY The existing topography posses some difficulty when searching for ways to expand the size of each exhibit, and relocating them for connectivity purposes. However, using the topography to aid in the creating of unique habitats with dynamic slopes could be easier with the steep slope already in place.



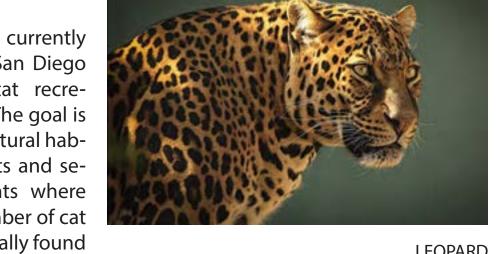
VIEWING OPPORTUNITIES During the site visit, it was evident that the viewing experience of the other zoo guest were not excellent. From observation, it was noted that guest would look for the cat for about 10 seconds and move on if there was no cat in obvious sight. Even when the cats were visible, they only stayed for a minute or less. This could be due to the limited angles available for animal viewing. Also there is a great disconnect between the viewer and the exhibit.

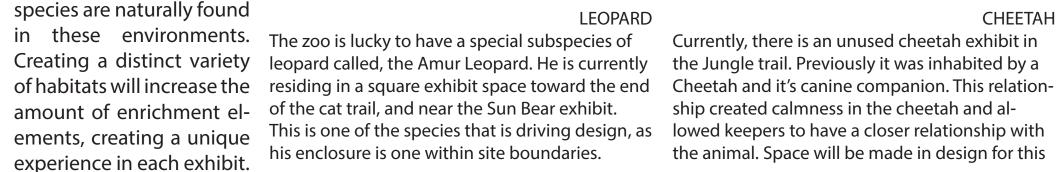


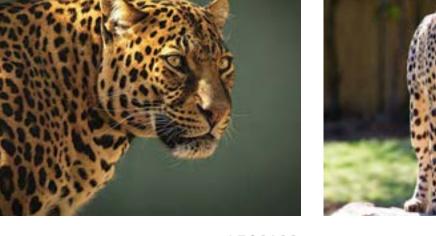
CIRCULATION Currently, a road is designated for zoo bus tours. For a portion of the trail, the pedestrian must share this road with the bus, causing some discomfort from noise, danger risks, and the odor emissions. The viewers experience could be negatively affected by this situation. The pedestrian only path lacks excitement and landscape immersion. This exhibit route seems to be very outdated as it is a single path with no connectivity to other areas.

SAN DIEGO CATS

The cats species currently residing at the San Diego drive the habitat recreation selection. The goal i to analyze the natural habitats of these cats and select environments where the highest number of cat species are naturally found







Currently, there is an unused cheetah exhibit in the Jungle trail. Previously it was inhabited by a ship created calmness in the cheetah and al-This is one of the species that is driving design, as lowed keepers to have a closer relationship with of the exhibit. the animal. Space will be made in design for this

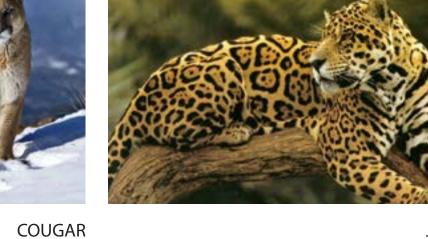


The Snow Leopard is also located along the trail of within the site boundary. Currently in a square one we are use to seeing, however this cat has enclosure with no topography change aside from a mutation making his fur darker in color. This an artificial wall with ledges along the back side due to renovation. His enclosure does contain a choice to move between a variety of recreated running stream for enrichment.



a similar box like enclosure. This cat lives in over 15 different habitats in its natural environment. species is also located along the main trail, and is It would be beneficial for this species to have the

habitats for a more stimulating life.



added enrichment.

The black Jaguar is the exact same species as the Another cat along the trail for redesign resides in The agile Jaguar recently moved into a new exhibit space located adjacent to the Lion exhibit. The habitat is unique because they are allowed access to the roof space of the bedroom building. They are also allowed to swap spaces for



The Lion pride resides next to the Jaguar, and the A distance away from the other cats, lives the exhibit allows for migration between the two. The designated lion side includes heated rocks for lounging and real redwood trunks for natural claw sharpening.



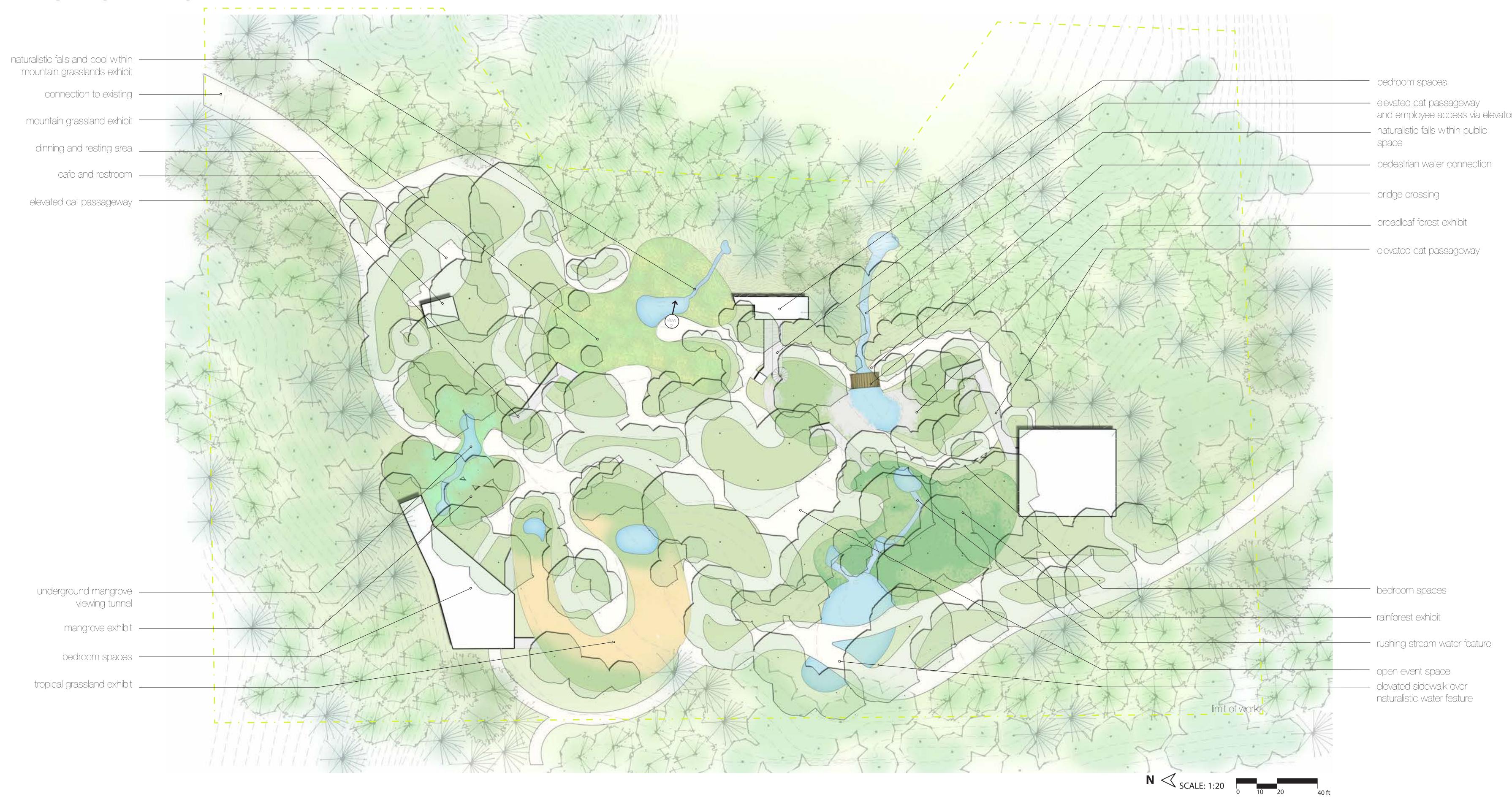
tiger. His exhibit is newer than the spaces located within the site boundary. It has many viewing opportunities and includes a large naturalistic water feature, as tigers are naturally frequent swimmers. They can also thrive in many habitats.



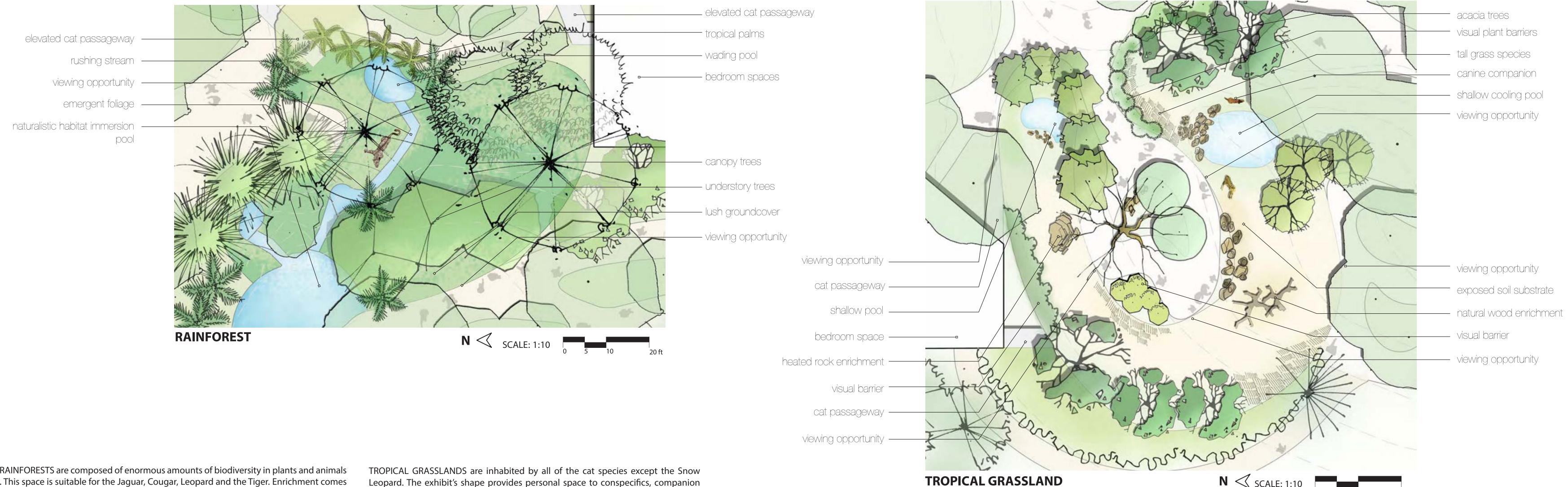
ZOO MAP AND CAT EXHIBIT LOCATION

The layout of the zoo has evolved along with zoo trends. Phases of ecological, biological, and geographical organization have all been demonstrated at the San Diego Zoo. The current relationship between the cat exhibits is spread out based on different themes. With such great distances in physical space, it limits the possibility animal migration between exhibits. However, cats in satellite exhibits may still be able to occasionally be relocated to a connected system. Cat distribution throughout the zoo may draw zoo guests to that region of the zoo.

BIG CAT CRAWL MASTERPLAN



PLAN ENLARGEMENT



RAINFORESTS are composed of enormous amounts of biodiversity in plants and animals

. This space is suitable for the Jaguar, Cougar, Leopard and the Tiger. Enrichment comes
from the plant material and rushing stream with live fishing. Small pools of swirling water create a challenge for the cats, provoking a healthy level of acute stress.

TROPIC

Leopar

species

TROPICAL GRASSLANDS are inhabited by all of the cat species except the Snow Leopard. The exhibit's shape provides personal space to conspecifics, companion species sharing the space, and unique viewing opportunities. A variety in substrate and enrichment elements meet the differing preferences of the individual cats.

HABITAT ENRICHMENT



Snow leopards, prime athletes capable of making huge leaps over ravines, are highly adapted to their harsh environment in the mountainous areas of central Asia. Their long, thick body hair, and enlarged nasal cavities which heat inhaled cold air keep them comfortable. These cats can bring down prey three times their own size, but on average only kill one large animal twice a month. They are critically endangered due to fur trade and their

natural prey declining.



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DESIGN ANALYSIS

DESIGN RESULTS

CONTRIBUTED to conservation efforts through a movement in zoo design that generates a feeling of animal appreciation for enclosed species by bringing people closer to active and stimulated animals and immersing them into the endangered habitats.

DESIGNED an aesthetic enclosure that possesses balance in zoo care operation, viewer appreciation, and benefits animal welfare by provided amenities for each member in a beneficial distribu-

DISCOVERED a circulation system between enclosures suitable for large cats which allows migration between exhibits that safely accommodates keepers and the cat species.

INCORPERATED successful exhibit enrichment elements and introduced advanced models for animal stimulation and welfare by a connectivity system which allows access to a variety of enrichment elements and habitats.

CREATEED stimulating exhibits for the cats at the San Diego zoo that helps mitigate abnormal behaviors by increasing activity levels and providing programmed enrichment opportuni-

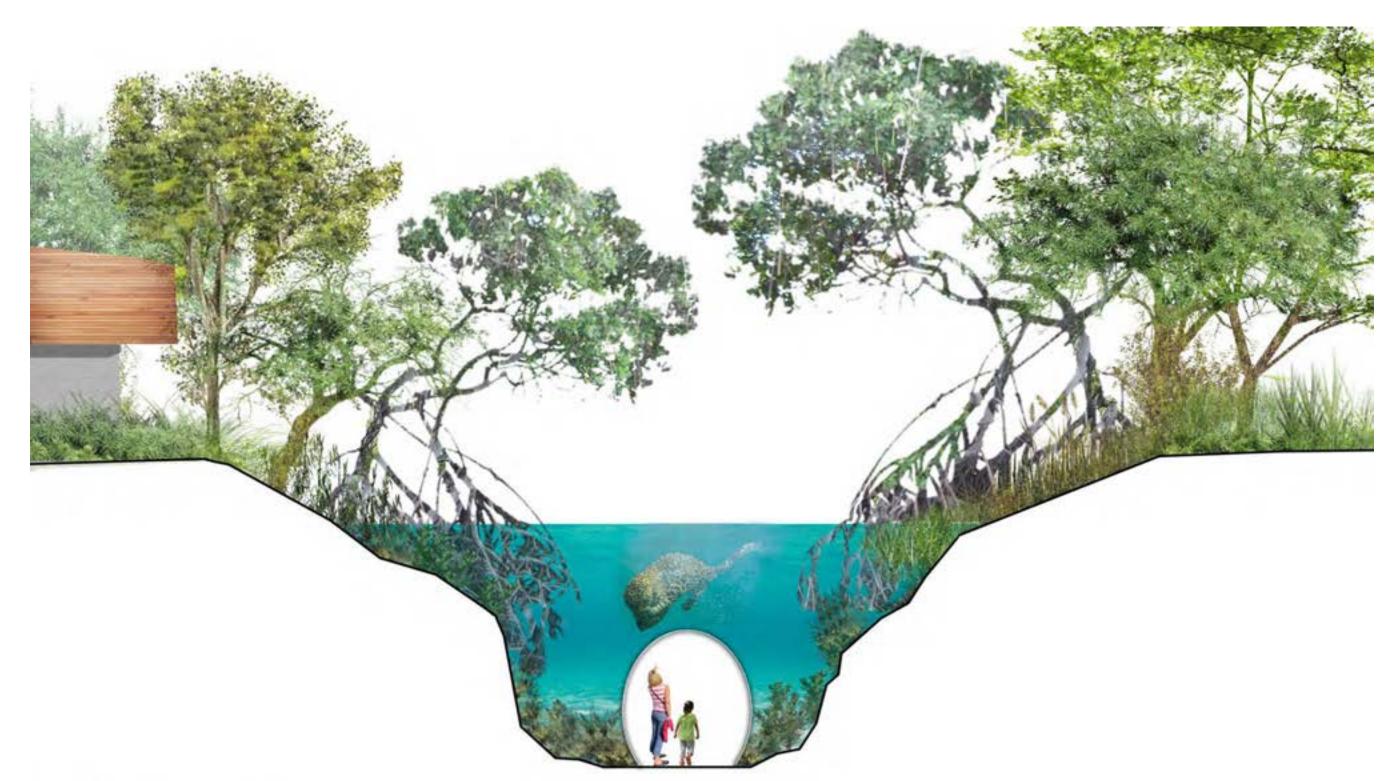
PROVIDED viewers with new and exciting ways to experience large cats through innovative landscape immersion by use of specific plant species and multiple viewing opportunites

BROADLEAF FOREST



Broadleaf forests, unlike many forests, are have plentiful immature trees and undergrowth resulting in abundant life on the forest floor. A lush landscape of oak, maple, birch, beech, and conifers provide plenty of canopy cover and prowling spaces for the large cats. The species know to inhabit this biome include the Puma, Cougar, Leopard, Snow Leopard, Clouded Leopard, and Tiger. This was selected for the significant species distribution in this environment. An elongated enclosure separated by mountain stream provided very different viewing opportunities, but also allocates private space from conspecifics if they desire.

MANGROVES



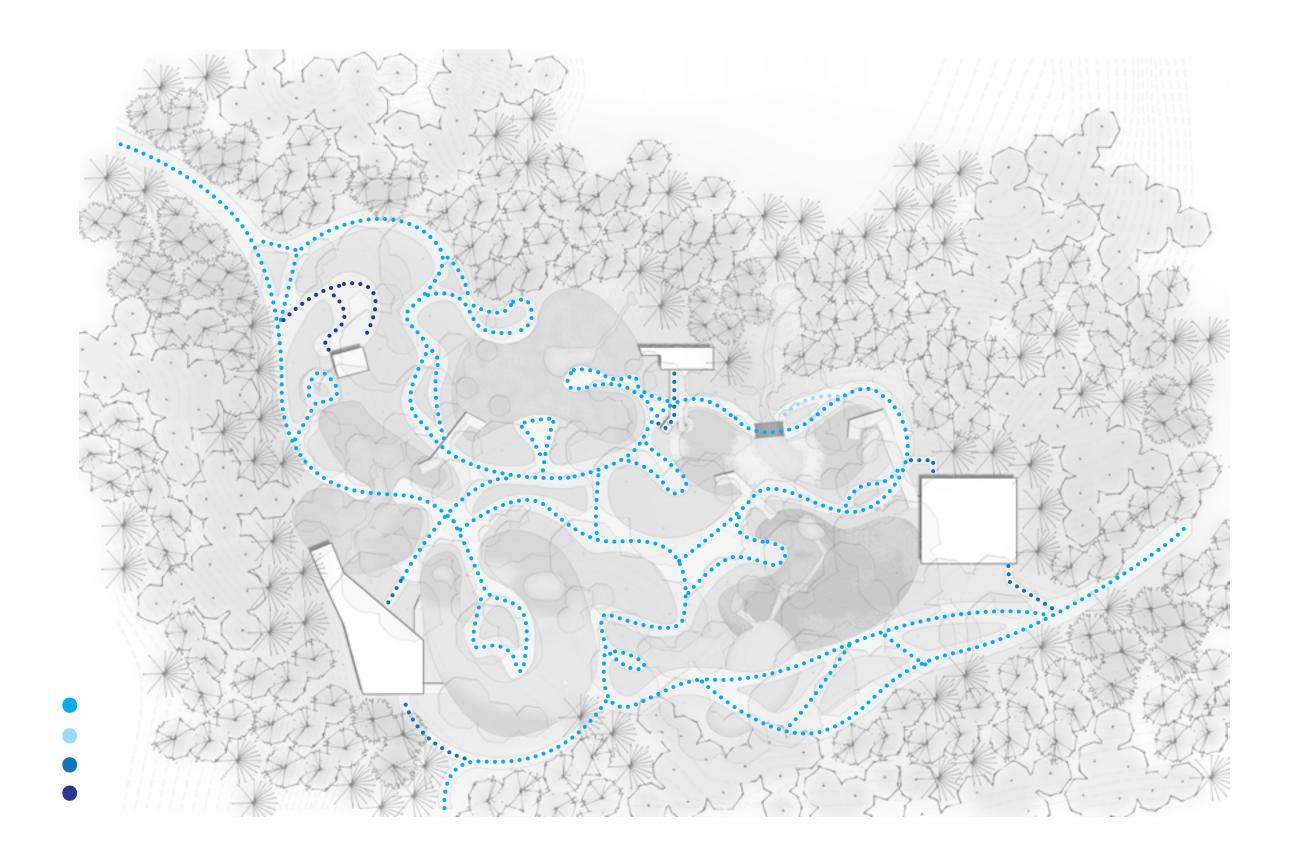
This enclosure presents an exciting and educational experience for zoo guests. An underground passage way leads viewers below the water level of the exhibit that shows the habitat from a unique and memorable viewpoint. Viewers are able to learn about the ecosystem and potentially could catch a big cat going for a swim. Unlike the common house cat, the majority of the cat species are excellent swimmers and it is a normal activity for individuals in the wild. This exhibit also demonstrates how a mixed species exhibit can work by including many ornamental fish species and other small marine life, as the root system of the trees provide them with protection. Viewers are also able to view the exhibit from the ground level. One key to successful zoo exhibitory is the access to unforgettable animal encounters, which this exhibit provides.





Cougars, Snow, Leopards, and Lions thrive in these cool grasslands on the sides of mountains. This habitat is accentuated by a tall cascading waterfall and a steep rocky incline for cats to demonstrate their acrobatics. A lush canopy in the backdrop provides privacy for cats from other vantage points and creates an intimate landscape immersion experience for the viewer. The water feature may include addition enrichment with live fish feeding, and an excellent opportunity to bring the cat clos-

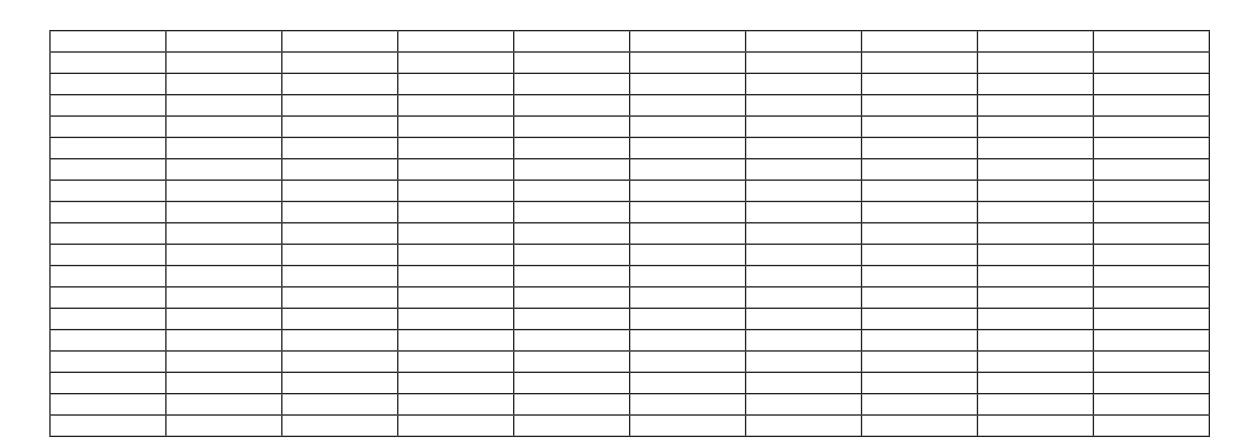
SCALE: 1"=6'-0"



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HABITAT SELECTION

TROPICAL GRASSLANDS are inhabited by all of the cat species except the Snow Leopard. The exhibit's shape provides personal space to conspecifics, companion species sharing the space, and unique viewing opportunities. A variety in substrate and enrichment elements meet the differing preferences of the individual cats.





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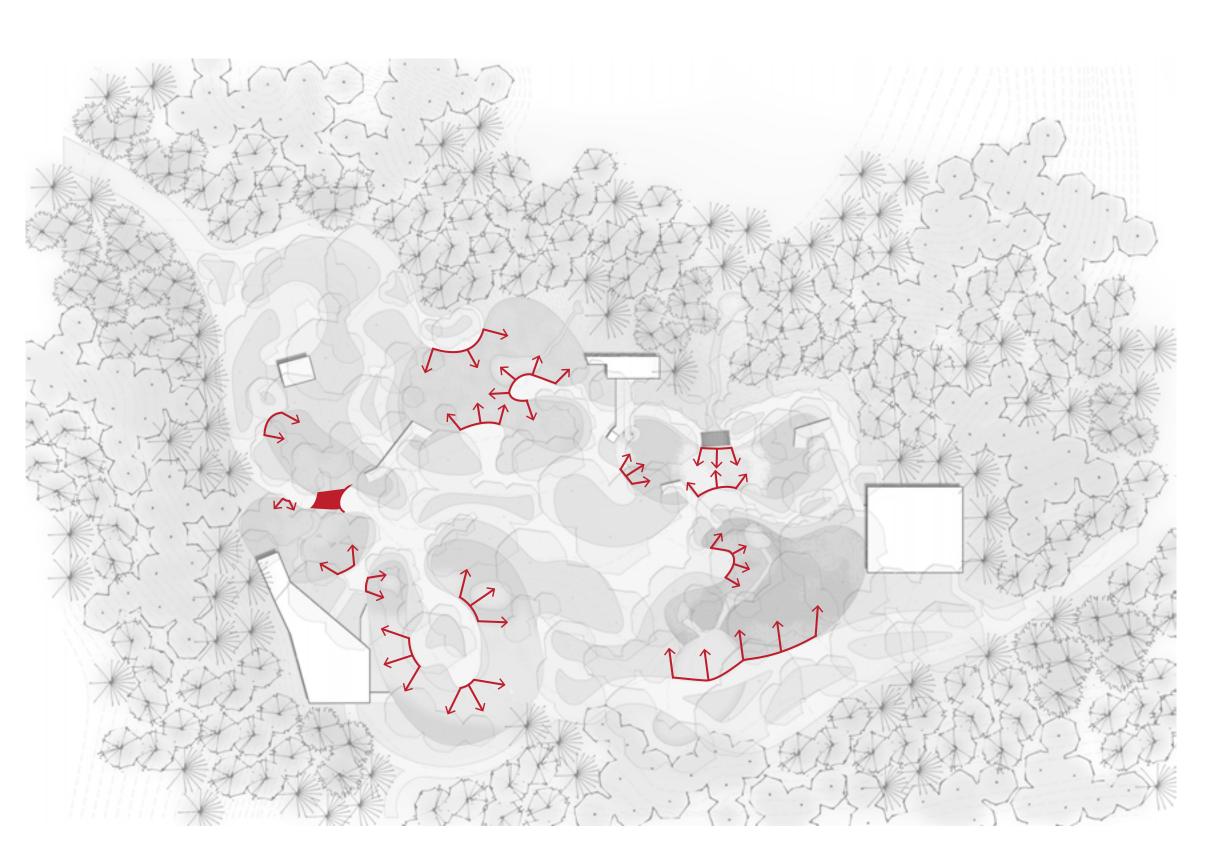




CONECTIVITY



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CONCLUSION

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educational biological

bat conservation and habitat revitalization efforts

locally, regionally, nationwide, and worldwide

nocturnal world INTRODUCTION

a

"When the sun sets and night approaches, we city-dwellers continue our activies only by making our own light...The country dweller knows better. Sunset, not sunrise, is the wake-up signal for much, if not most, of the planet's life."

- William G. Conway

project objectives

EDUCATE

The general public about the importance of nocturnal houses in our zoos and how the animals benefit from proper lighting conditions.

To relay the importance of bats to our environment and how they are vital pollinators. The fear of bats has been diluting their positive benefits for far too long.

CREATE

The creation of new bat caves and habitats in zoos around the world would contribute to the offsetting of human bat habitat destruction.

To create new homes is to create new opportunities for many of the endangered bat species around the world.

POPULATE

To repopulate bat species around the world through the new zoo bat exhibits would benefit our environment and general outlook on bats.

An increased population of bats would lead to an increased level of pollinators, and a decreased level of unwanted pests.

INNOVATE

Zoos have began to strive towards a more naturalistic design approach. The future of zoos lies in not only the physical realm of design, but in the biological realm as well.

The introduction of more substantial and functioning nocturnal exhibits that not only educate the public but also create useable habitats for species is vital in the future of our captive and wild animals alike.

project vision - nocturnal world at the tulsa zoo

Native plantings from Africa are found within the lion and giraffe's African savanna, as well as the humidity levels being increased to a maximum inside the howler monkey's rainforest jungle.

Although these attempts to recreate the savannas of Africa and jungles of Costa Rica are steps in the right direction, further implementations of design must be enforced in order to achieve these natural states.

This need in zoo design has pushed me into designing a functional and accurate nocturnal exhibit that is open in the night hours of the summer at the Tulsa Zoo.

The current state of zoos around the world is enhancing in their efforts to recreate the natural environments of those animals held captive inside exhibit spaces.

Nocturnal houses do currently exist in zoos around the world, with the numbers hovering around 20 exhibits. Nocturnal houses such as "The World of Darkness" that opened in 1969 in the Bronx Zoo have since then shut down to lack of funding and interest for the particular exhibit.

By increasing visitor's awareness at how important the night is for wildife and by also experiencing these animals at night, zoos could begin to receive sufficient funding for their nocturnal exhibits and habitats.

The driving concept for Nocturnal World was to recreate an environment that not only simulates a true natural state for the animals in the physical setting, but in a biological fashion as well. As the vast majority of animals are most active after the sunsets, it is difficult to show visitors and animals alike a true experience of the animal's actual character.



Nocturnal World will be divided into two main experiences: interior exhibits and exterior exhibits. The interior exhibits will simulate varying night habitats. From forests, swamps, tree tops, and below the ground, these exhibits will all mimic environments through feel, look, sound, and even smell.

Upon leaving the interior space, visitors will travel along a dimly lit boardwalk to experience lions, tigers, and snow leopards in rotating habitats through night vision goggles. There will also be an outdoor aviary that will be know as the "Flying Range". This will be a demonstration area for bats, owls, and flyings squirrels to soar from end to end and allow the visitors to view them doing so in the night skies.

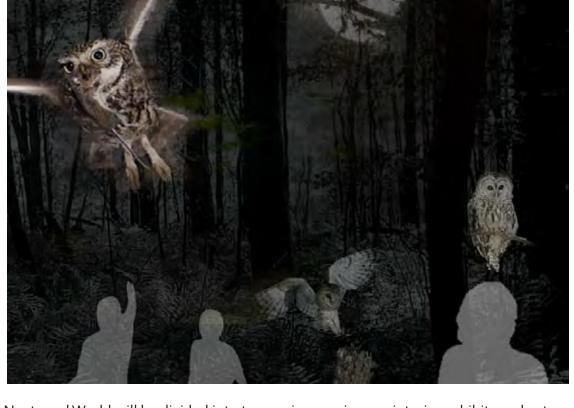
The outdoor experience ends as it leads into the World of Bats - a wildlife effort implanted in the middle of the Nocturnal World's exterior exhibit.

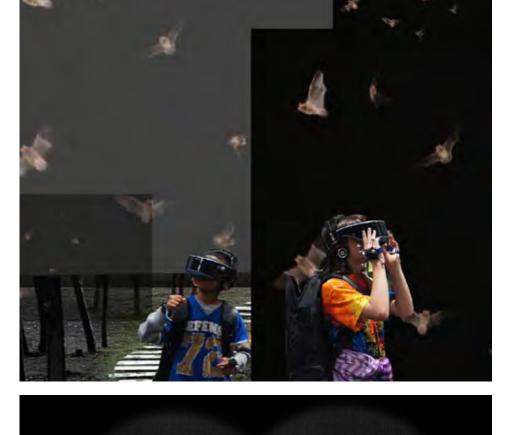














case study - "the world of darkness" - bronx zoo, new york

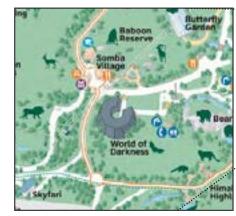
The World of Darkness as located in the Bronx Zoo in New York. Designed by Morris Ketchum, Jr. and Associates, this exhibit was the first Nocturnal Animal exhibit in the world.

The building itself was originally built as the Rocking Stone, which stood until 1942. It took over 20 years for the building to be reestablished as a part of the Zoo when it became the World of Darkness in 1969. The exhibit eventually shutdown in 2009 due to a stifling in funds to both the zoo and the Wildlife Conservation Society. The building remains unused today.

The building itself was a large, dark, windowless fortress on the southern portion of the zoo. A horseshoe shape allowed for one-way visitor circulation as well as optimal square footage and usage of interior space by avoiding corners. The exterior entrance was heavily vegetated and had an overgrown appearance.

The aesthetics alone allow for an erie feeling upon entering the exhibit, but also work fluidly with the functional goals of the nocturnal house. The simulation of true night-time environments was crucial to the enrichment of both the visitors and animals alike







The above image is an aerial view of the World of Darnkness. The horseshoe shape is very obvious and was an ideal structure for the designer's needs





The goals of the World of Darkness were to create an environment that essentially reversed day and night, thus allowing visitors to experience animals in their true nocturnal state.

Prior nocturnal exhibits tried to implement the strategy of using dim lighting or even moon-lighting effects, however the animals were still showing nocturnal habits while the zoo visitors just watched them sleep. The World of Darkness wanted to truly reverse the sleep cycle of these animals by lighting their holding cages at night, and then turning the lights off when the visitors arrived. This allowed the visitors to view the animals in their most active state.





Not all of the lights were turned off when the animals awoke... Joseph A. Davis, Jr., of the New York Zoological Society, tested a theory of using bright red visible light with nocturnal animals, and his experiments proved successful. This technique of using bright red visible light in nocturnal animal exhibits works due to the biological nature of nocturnal animal's rhodopsin (light sensitive pigment in retina of eye) absorbs all the visible light except red, which is reflected. (Conway 1969)

This discovery led to the basis for lighting in the World of Darkness and as the standard for nocturnal lighting throughout zoos across the world.







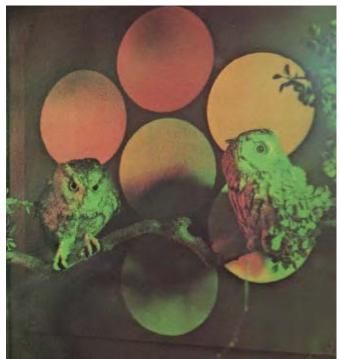
case study - "the world of darkness" - bronx zoo, new york

Visitors would enter the World of Darkness first through a light baffle to orient there vision into a drastic change of lighting. The first signage is then apparent, and it reads "Day and Night". Two models of a jungle with chipmunks and flying squirrels are displayed. They are identical in every single way but one... One is a night scene, the other a day scene.



This model set the theme for the entire building. Visitors then see an owl display titled "Colors at Night". This exhibit has different colored glass panes for the visitors to stand in front of, and informs the viewer that when standing behind the red pane, he or she is virtually invisible to the nocturnal owls.

The next experience is the "Life in the Tree Tops, Another Dimension in Living." The feel simulates that of being amongst the tops of the trees surrounded by tree-top vignettes and a variety of reptile, mammal, and bird exhibits. The visitor then enters a swamp-themed area where the chorus of frogs echoes throughout the misty room. Alligators and skunks are amongst a few of the species in this area.



"Colors at Night" Exhibit with Eastern Screech Owls



Swamp Exhibit



The next experience will take you through a "Wings in the Night" exhibit, showing owls and goatsuckers. One of the more intriguing displays was the 30 foot long enclosure where visitor's could witness bats swooping back and forth trying to scoop fish out of a small pond. The enclosure allowed for other flying animals (different species of bats, owls, flying squirrels) to be displayed and researched for future exhbit design implementation. The idea of allowing an optimal amount of flying space (in comparison with the average sized avairy enclosure) is an exponential step in enhancing animal exhibits.

The "Refuge Underground" is the final hall of the building, and it simulates the world beneath our feet. Burrowing insects and critters will be crawling around through their underground networks with aardvarks and badgers popping their heads up in their associated exhibits. The underground area ends with a small North American cave with a small family of bats above your head as you enter and blind salamanders accompanied by crickets in small pooled exhibits.

The final exhibit, and arguably the most experimental and innovative exhibit was the tropical cave. This cave mimicked the scenery of Trinidad, with stalactite covered ceilings and stalagmatie covered floors. A flowing stream split the exhibit and exited outside of the building. This stream entices bats to congregate and vocalize.

This exhibit had a large variety of animals on the forest floors as well as a number of species flying overhead. The variation in nocturnal species was tested regularly and the animals were observed in order to ensure zero or at least very low levels of hostility towards another.



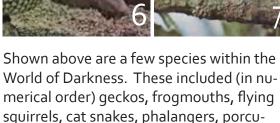








pines, and loris'.



The World of Darnkess unfortunately was shut down in 2009 due to a large budget cut by the city to zoos in the area. This trend of nocturnal houses closing has recently continued (Woodland Park Zoo, Los Angeles Zoo) and the importance of night for our animals must be reconsidered and expressed.

project vision - world of bats - habitat reformation

Centuries of folkore, myths, and misinformation have led to countless numbers of fears concerning bats. These fears have led to an increased threat to bat populations and habitats across the globe, thus a continuinging decrease in overall bat population.

These fears should be diluted with the natural benefits bats provide to our everyday life. Bats are crucial to the pollination cycle and are in charge of seed and pollen disperal for countless plants that cannot be accounted for by other pollinators in the animal kindgom.

My design will be an integrated bat cave within Nocturnal World that acts as a functional bat cave for migratory bats. This exhibit will be known as the World of Bats.

For my study, I have chosen three species of bats on which my design will be focused. Two of the three species are endangered, these being Myotis grisescens (Gray bat) and Myotis sodalis (Indiana myotis). The third is the common and highly abundant Tadarida brasiliensis (Mexican free-tailed bat).

The decisions to incorporate two endangered species and one abundant species was to evaulante and observe the differences and impacts that creating a habitat will induce on both present species and species that we are trying to reintroduce to the area.

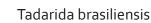
My goals and intentions of this project are to create a model for bat habitats that can be implemented into current and future zoos around the globe. Just as humans have decreased the bat habitat through fear and misinformation, humans can also recreate habitats through knowledge and proper design intent.

Proper research of bat caves will be necessary in order to successfully create a suitable habitat for bats to breed and utilize the provided shelter.











Myotis grisescens



Myotis sodalis

case study - congress ave. bridge - austin, texas

The summer nights in Austin are always full with evenings of live music, happy hours, art shows, and bat watching. The Congress Avenue Bridge in Austin, Texas, is home to nearly 1.5 million Mexican Free-Tailed bats. These bats live in crevices underneat the bridge that was reconstruced in 1980.

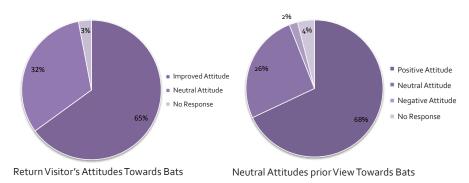
Located right in downtown Austin, the Congress Avenue bridge is right in the middle of the largest concentration of tourists and locals alike during the peak season of bats.

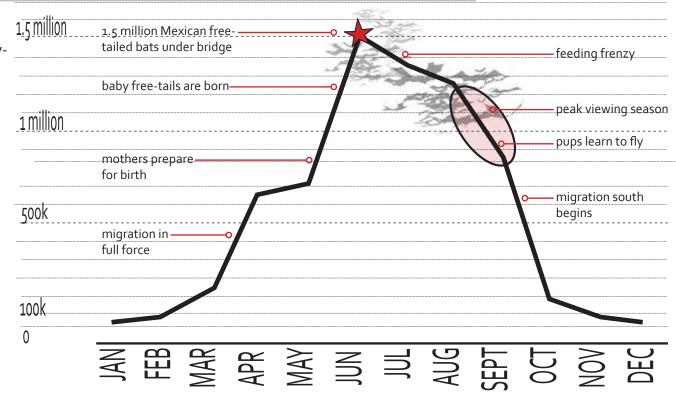
The public immediately begin to argue for a proper disposals strategy for the bat colony due to the proximity of the colony to the heart of downtown. After being informed about the true nature and benefits of our flyings furry friends, citizens of Austin slowly began accepting these bats as a part of their city as well.



These Mexican free-tailed bats migrate each spring from central Mexico to sites all across the southwestern U.S and southern U.S. states. While being active pollinators, these bats also consume around 10-20,000 pounds of insects on a nightly basis (batcon.org).

A fiscal impact survey was conducted for the city on the impact of the bat colony. The survey showed that 65% of returning visitors had a more positive outlook towards bats after seeing them emerge from the bridge. The viewers who had a neutral impact after their return for the most part (68%) already had a positive attitude towards bats (see graphs below).





Annual Bat Population and Significant Events

The majority of bats start arriving in March and April, and are settled in completely by June when the mothers give birth to nearly 750,000 pups. The next few months are excellent times to view the bats, with the peak season around late August to mid September.

Although this is not an annual sight-seeing event, and the peak season is just a mere 6-8 weeks, the fiscal impact survey also estimated that the bat colony has an average yearly direct impact of approximately \$3.2 Million dollars, and an overall impact of around \$8 million dollars.



The map to the left shows the proximity of the bridge to the heart of downtown Austin. This nearness to the citizens and tourists alike was the primary cause for the uproar, but also the primary cause for the fiscal and educational impact the bat colony has provided Austin.

This positive impact on the economy is just one reason that bat colonys should be established and protected, let alone the environmental benefits that a colony of bats this size provides the region.





Bat Conservation International (BCI) is a foundation based out of Austin, Texas that has three main goals relating to bats... to conserve, to research, and to educate.

BCI has educated thousands of people about the Congress Avenue Bridge bats during multiple programs and events they hold annually. This outreaches have shown very postive results, some of those including:

80% of survey respondents were from outside the Austin area, thus contradicting the perception of the bats only having being considered a local program

70% were visiting the bridge for the first time, indicating that BCI's efforts were reaching new audiences

99% of the audiences were not members of BCI, however 25% of them requested membership forms

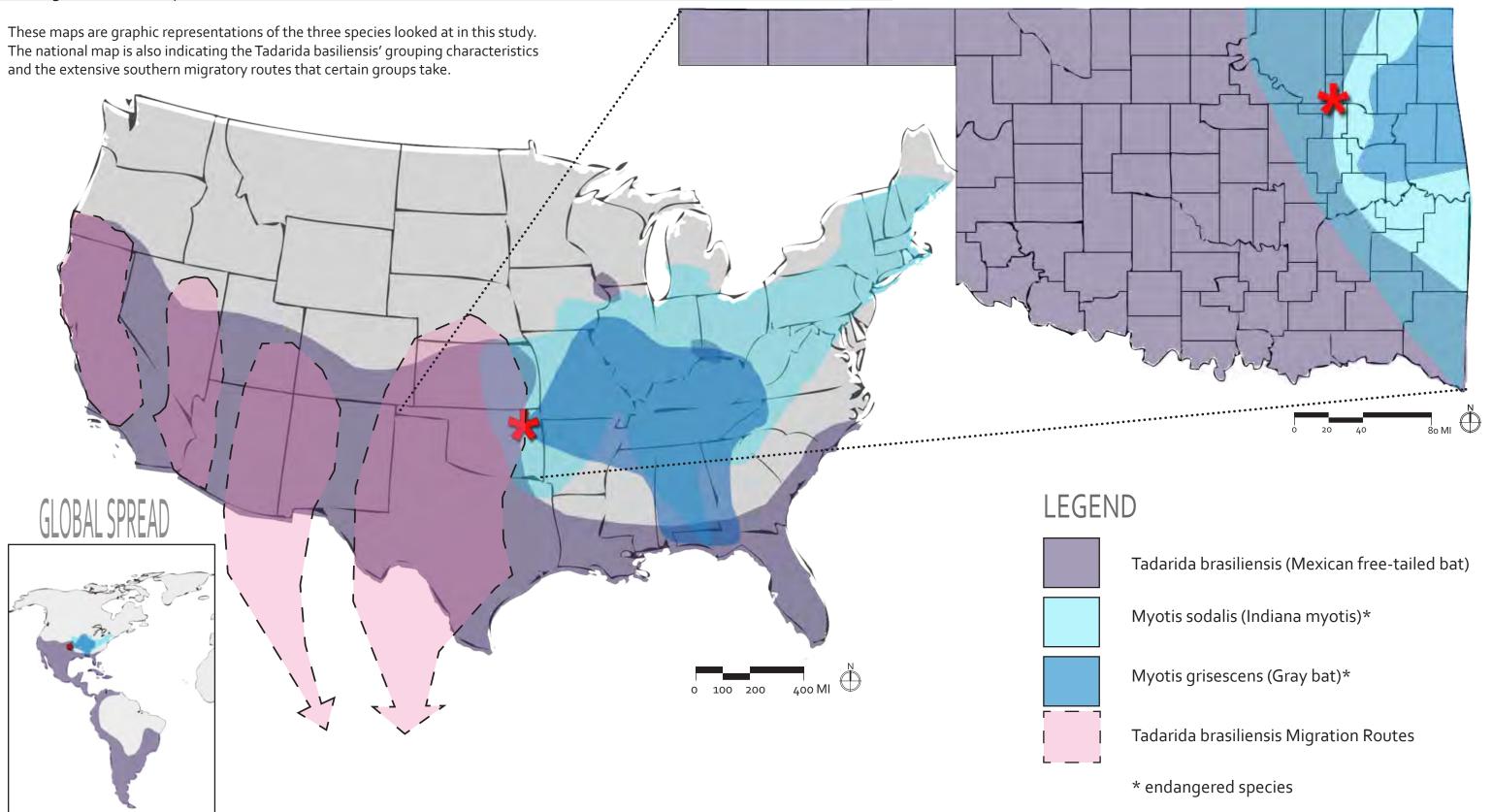
20% of the respondents had average annual incomes of over \$100,000, thus allowing for future potential of disposable income to support bats and the BCI

9:1 was the positive to negative ratio of the visitor's experiences with the bats

*data acquired from BCI's Environmental Education at the Congress Avenue Bridge - Final Report, Jan 2007



bat migration route maps



nationwide bat hubs to connect aza accredited zoos

The implementation of nation-wide bat hubs within AZA accredited zoos would allow for secure habitats along the bat's migratory routes and within our nation's top zoos. This system of bat caves across the nation could be used for environmental enhancements in the bat population as well as a variety of increased opportunity in bat research.

The shades of gray are the current habitat ranges of the three bat species listed in the previous section, and the location of these bat hubs was coordinated with those habitat ranges in order to promote efforts of repopulation in the areas in which shades of gray are not present.

These hubs will also act as additional shelters in habitat ranges that are populated with bats. Although migratory patterns will shift, and these current migratory paths will not always be the path most taken, this model is a start for an approach to the bat hub concept for future design implementation.



nocturnal world SITE ANALYSIS

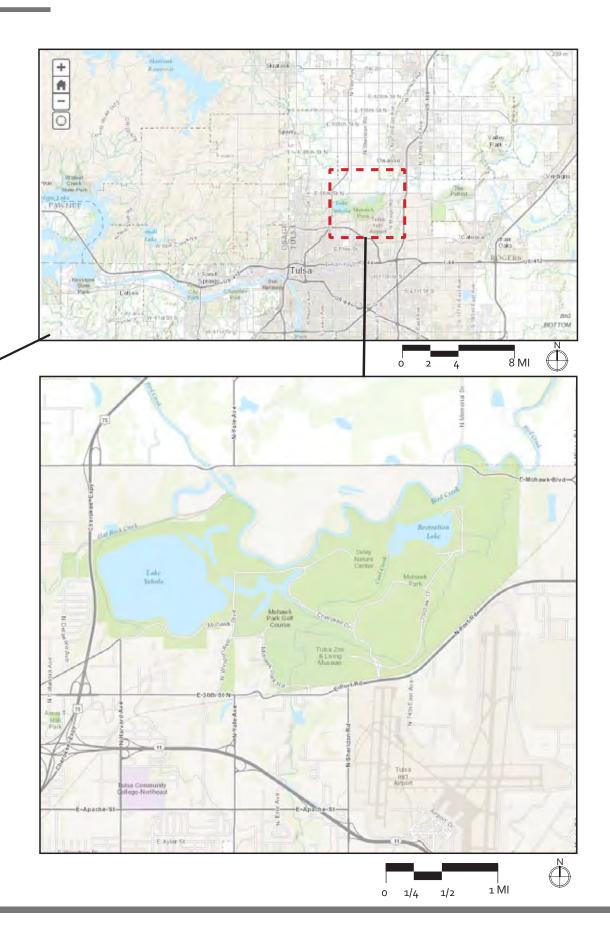


mohawk park

Located in one of Oklahoma's largest municipal parks, the Tulsa Zoo finds its home in North Tulsa with Mohawk Park.

Mohawk Park as a whole is a lush green landscape with numerous amounts of reservoirs, lakes, and streams. These copious amounts of water sources within the park along with the transitioning pattern of vegetation across the park, this site can be can considered an ecological playground.





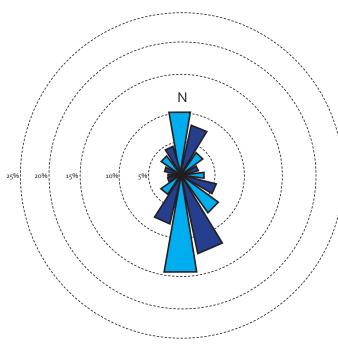
tulsa county

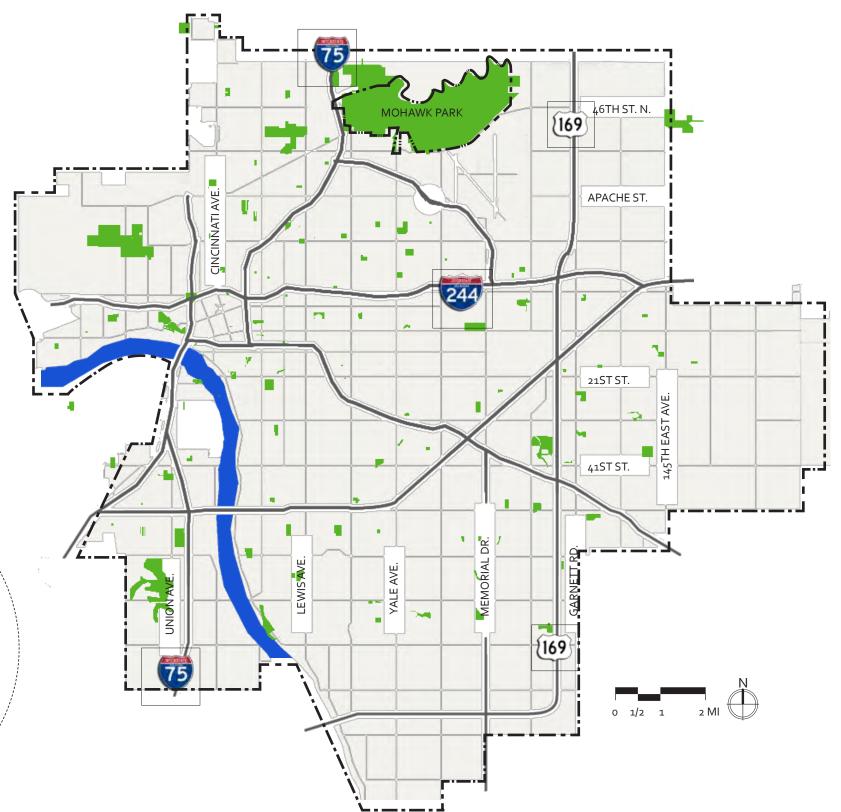
The City of Tulsa Park Department oversees 8,200 acres of park land and 140 parks (cityof-tulsa.org). The graphic to the left shows the distribution of major parks within the Tulsa area.

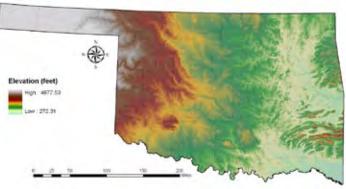
Mohawk Park can easily be identified as the largest park in the city, and by an expansive amount. The park is nearly 2,800 acres, and contains two large lakes (Lake Yahola and Lake Sherry)

Mohawk Park is situated about 10 miles from the central core of Downtown Tulsa. The park itself is in a low-income area of Tulsa, and this has caused for a somewhat increased level of loitering and criminal activity in and around Mohawk Park.

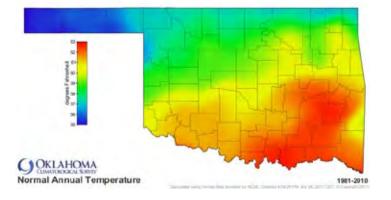
The wind rose below shows that nearly 15% of Tulsa County's wind comes from the South and South-Southest (12%), and the third strongest direction is blowing from the North at 10%.



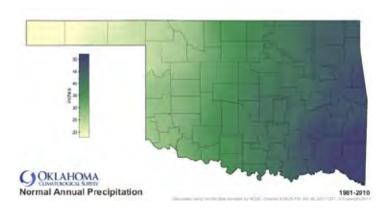




100 year flood plain



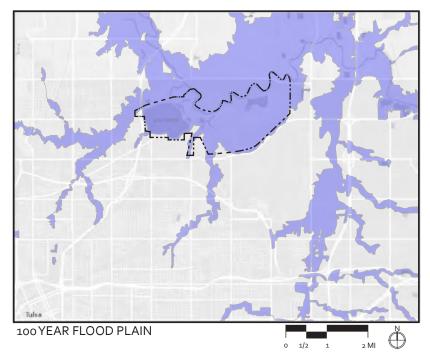




mohawk park existing master plan and programming

Mohawk Park is currently home to the Mohawk Park Golf Course, the 350 acre Oxley Nature Center, the Tulsa Zoo, a shooting range, equestrian riding trails, multiple wooded picnic areas, a reservoir with boating and fishing, and countless opportunities to explore nature. The Tulsa Zoo is the most visited site of all the site's programs combined.

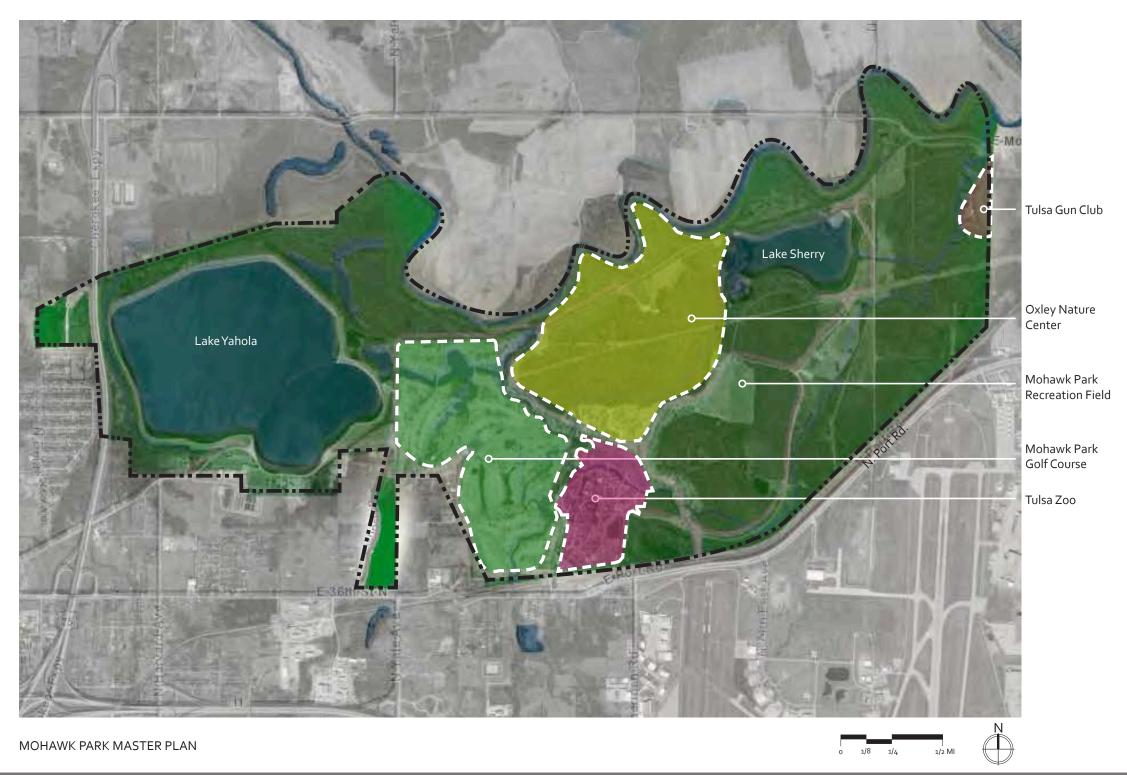
There is currently a design for a proposed master plan that will redefine the central area of the park, as well as provide for additional expansion opportunities for existing programs.



Mohawk Park is right in the path of the 100 year flood plain, and considerations must be taken in the site design in order to provide positive drainage and maintain a higher elevation at the FFE than that of the flood plain.



WET CONDITIONS



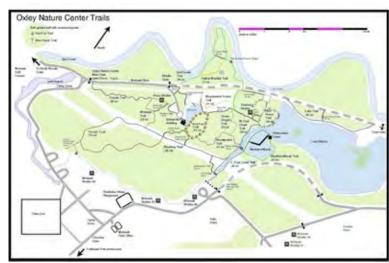
DRY CONDITIONS

oxley nature center

The 350 oxley nature center provides a variety of activities and programs for visitors.

Located in the center of Mohawk Park on the Northern edge, the center consists of nearly 9 miles of hiking trails which send visitors on loops around lakes and through forested areas of the park (a few of the main trails are highlighted below).

Along with the nature trails, Oxley Nature Center provides a spacious visitors center and observation deck. The attached observation deck allows for panoramic views of the surrounding area and offers a great spot for wildlife viewing and picnics.

















The interior of the Oxley Nature center is full of interpretive exhibits and signage to educate visitors about the natural wildlife and plant life in the park.

In 2001, a detached observation deck was built that allows for excellent views of the adjacent Lake Sherry. There is also an covered shelter that can be used as an outdoor classroom.

Interpretive exhibit design is crucial for the education of our youth and by creating a fun and interactive atmosphere in what could otherwise be just "another nature center", Oxley has provided a setting for natural learning and creativity.





GREEN DRAGON TRAIL, 0.5 MILES



An undeveloped trail that wanders through deep woods along Coal Creek

FLOWLINE TRAIL, 0.45 MILES



A trail following a buried waterline

PRAIRIETRAIL, 0.4 MILES



Trail winding among various prairie plants

RED FOX TRAIL, 0.3 MILES



rail designed for sensory awareness experience

BLUE HERON TRAIL, 0.3 MILES



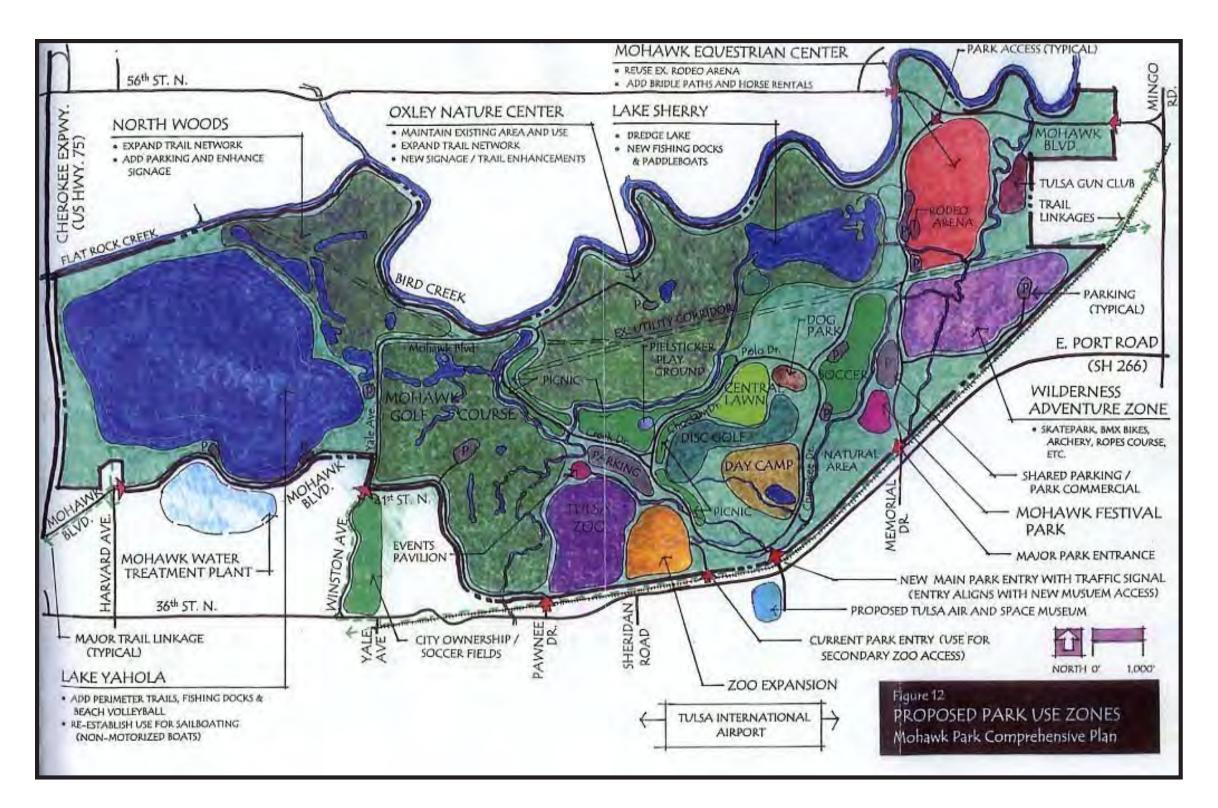
Self-guided trail with bird blinds overlooking Lake

mohawk park proposed master plan

The proposed master plan for Mohawk Park highlights areas that will be programmed towards specific events or activities. The map shows an additional 35 acre expansion for the Zoo which has yet to be discussed or programmed.

Also included in the master plan:

Day Camp Dog Park Disc Golf Central Lawn Events Pavilion Nature Area Soccer Fields



tulsa zoo existing master plan

Mohawk Park is currently home to the Mohawk Park Golf Course, the 350 acre Oxley Nature Center, the Tulsa Zoo, a shooting range, equestrian riding trails, multiple wooded picnic areas, a reservoir with boating and fishing, and countless opportunities to explore nature. The Tulsa Zoo is the most visited site of all the site's programs combined.

The current zoo map is shown below, and although the orientation is opposite of true north, the map does a good job of simplifying the zoo for the visitor's experience and ease of use.





nocturnal world site location

My direct site consists of a much smaller portion compared with that of Mohawk Park as a whole, however still rich with diversity.

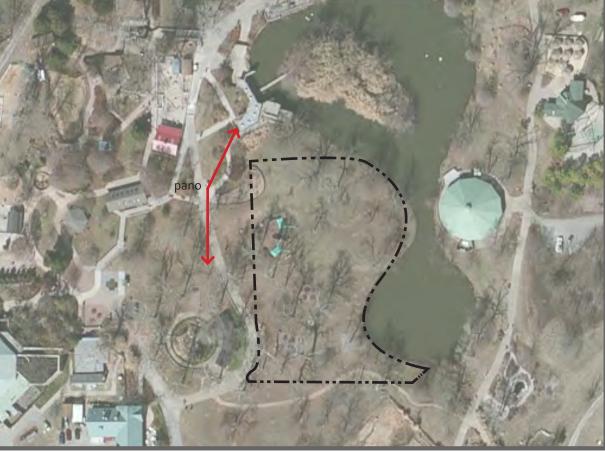
This site sits directly adjacent, and even on in some locations, the central man-made body of water that houses the Siamiang exhibit.

The existing trees are all decidious, and therefore will open up for brighter winter moonlighting conditions.

Centrally located, the site for Nocturnal World will allow visitors the opportunity to have access to reduced scaled exhibits while walking to the new night exhibit. It is also directly in the middle of the entrance and the Macaw Landing Grille as well as the new children's proposed play area. This will allow for additional opportunities that will be highlighted in the night programming section.

My site is fairly flat, however starts with an 8% slope directly fromt the sidewalk, and then levels out to a 3% slope flowing into the lake from West to East. The panaromic picture shown below is one taken from the Western edge of the site.





PROJECT SITE MAP



nocturnal world site location

12' Dual Flood Spotlight



These site photos were taken at 9:30 in the morning and show the condition of the project site towards the end of Oklahoma's winter season. The letter corresponds with the figure to left.



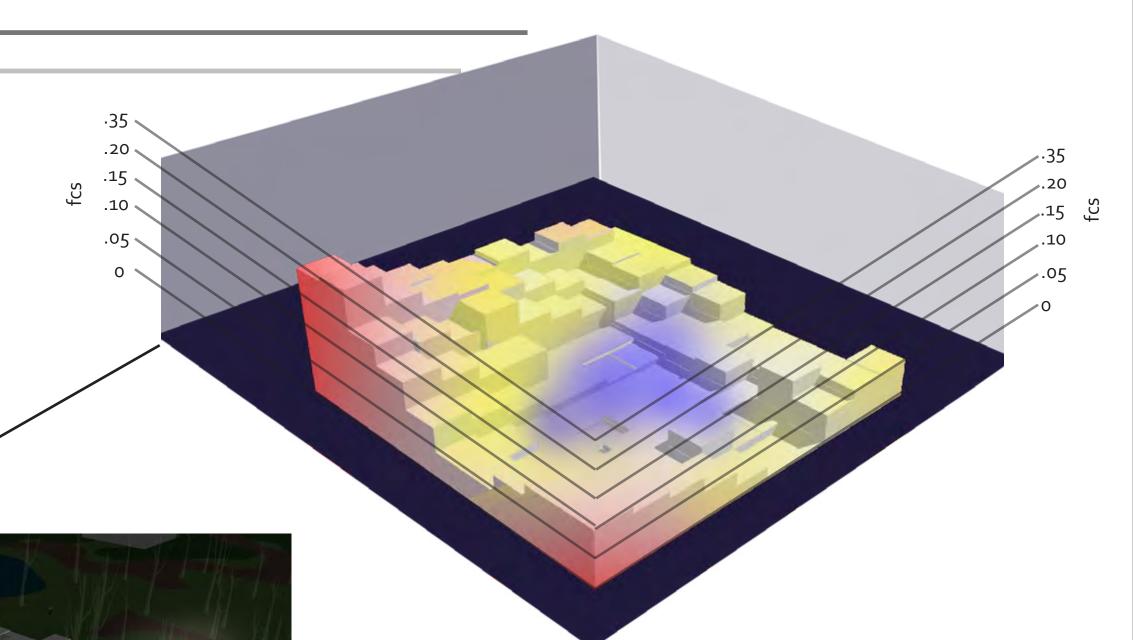
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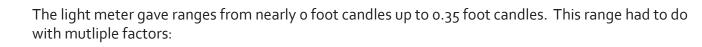
foot candle grid study

The two diagrams shown are representative of the 100' x 100' plot within our project site split in 10'x 10' cubes. The perspective below shows the foot candle grid in context after being extruded appropriately. This image also shows where the light sources are focusing their foot candles on the given area.

After taking the foot candle grid out of context and extruding into a three-dimensional model, color was added to enhance the graphic. Red for high-intensity light, yellow for medium-intensity light, and blue for low -intensity light. These colors are contextually related only within this 1000 sq. ft. site.

This grid was interpolated to acquire an average foot candle reading for each 10'x 10' grid





- Light source and distance from site
- Trees and vegetation diluting the light
- Cloud coverage was at nearly 50%
- Humidity was at 65%

Ideally for my project's purpose, the range of light within the site should be anywhere from o foot candles to no more than .05 foot candles in the animal areas, and 0.25 foot candle on the visitor's walkway.

nocturnal world SITE DESIGN

proposed zoo master plan

The proposed master plan for the Tulsa Zoo enhances visitor circulation by streamlining visitor paths and allowing a more natural flow of direction between exhibits. This master plan was layed out by PGAV, a zoo design firm based out of St. Louis. The master plan has seperated the zoo into 6 different regions. North America, The Lost Kingdom, Sheepy Hollow, Rainforest, Wild Islands, and African Plains.



Working with PGAV, I was able to determine the most appropriate location for my site for Nocturnal World. Key components in my sites location were:

- 1. Proximity to Body of Water
- 2. Adjacent to proposed cat exhibits
- 3. Centrally located in "Heart of Zoo"
- 4. Direct access to Restaurant and Play Area

These key components are critical for the success of a nocturnal exhibit with my desired programming at the Tulsa Zoo.

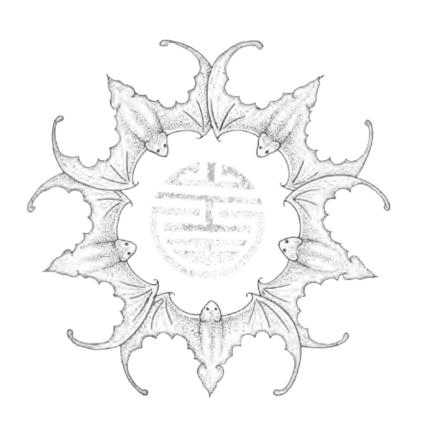


bat building concept

The concept for the shape of the building went through a variety of shapes and forms, and eventually came to it's final form with the inspiration of Chinese language and culture. In the Chinese language the word for bat is "fu", which is the name of the character that means "happiness". (Griffin 1969)

The figure of the bat then came to stand for good luck, or happiness, in the Chinese culture. Bats are still seen implemted into many Chinese designs and decor to represent good fortune/happiness and long life.

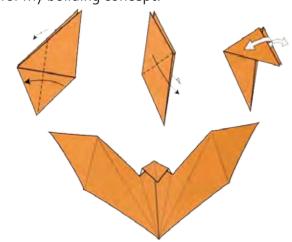
The term "Wu-Fu" means "Five Luck" in the Chinese language. It is represented by a talisman of five bats in a radial pattern. The five lucks, represented by five bats, include longevity, wealth, health and peace, good morals; and good death.





This discovery of the symbolic meaning of bats in Chinese history allowed me to interpret my building, and the overall them of bats, as a positive experience that brings happiness... contrary to the popular American standard fear of bats.

Although Japanese in origin, the art of Origami is representative of Asian cultures and I wanted to explore the art of origami in relation to bats for my building concept.



The final design uses the bat's body as the main portion of the building with a concrete base and structural exterior wall. The wings of the bat will be open-air canopies that will provide both exhibit space for the visitors as well as a shaded seating area during the day time when Nocturnal World is not open.

The canopy itself will be Foiltec in order to maintain a light yet structural composition, and allow for a moden look and feel for the new exhibit building.



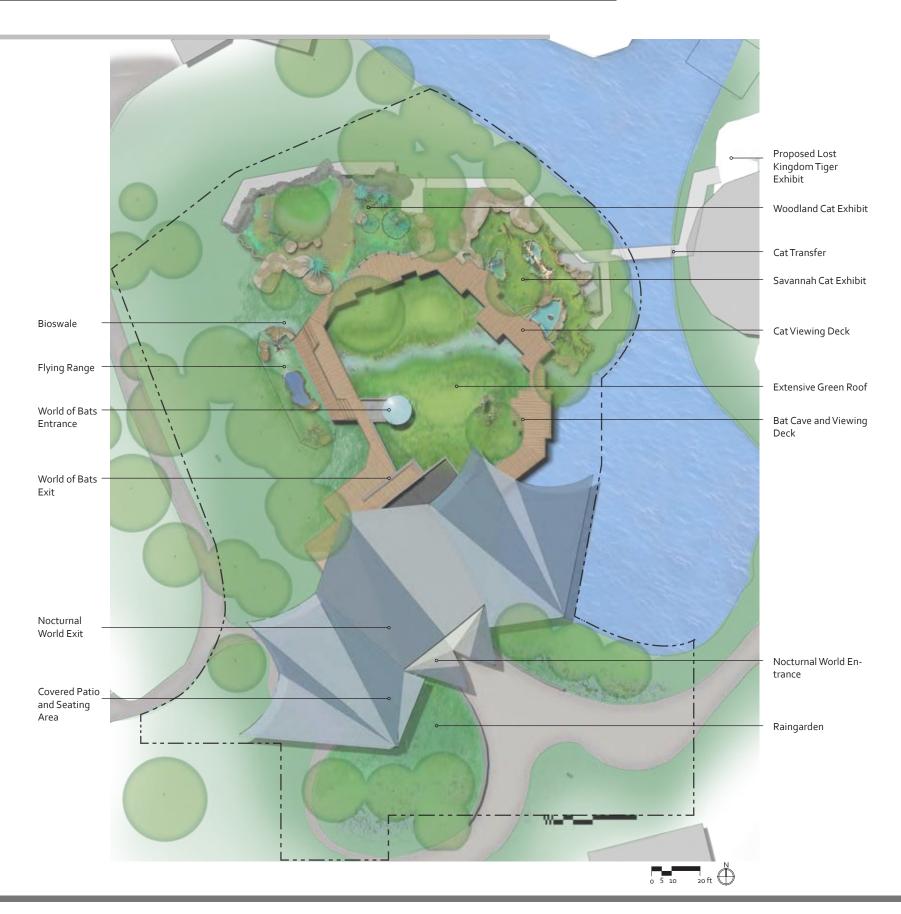


overall site plan

The overall site for Nocturnal World is approximately 2 acres. The design consists of three different regions for various visitor experiences. Visitors enter through the bat-shaped building and into the interior exhibits of Nocturnal World. After wandering through the interactive exhibits on the inside, the visitors then walk onto the exterior boardwalk.

Along the boardwalk, visitors will pass 2 large cat exhibits as well as the flying range. The boardwalk also surrounds the rounded earth berm that has the bat's entrance into their shelter. This boardwalk is ideal for sunset views of the bats as the exit for the nightly feeding.

As the boardwalk exhibits come to an end, visitors will then have the option to enter the World of Bats underground exhibit. These exhibits will be further outlined in their specific sections to follow.



grading plan overall

The largest challenge for this site's grading is the ability to maintain positive drainage from the new nocturnal house building, as well as keeping a flow of water throught the interior bat cave and berm.

By creating a natural swale that begins just North of the flying range exhibit, the water will follow a directional path that leads in the existing pond. This swale will capture the majority water on the north part of my site.

I will be raising the FFE of my building three feet above the ground level in order to stay above the 50 year flood plain line. In doing this, a large retaining wall will need to be built at the foundation of the building, as well as some cantilevered construction for the part of the building extending over the pond.

The south face of the building will have a slight ramp up to the entrance, and the visitors will be walking over another swale that flows directly underneath the entrance ramp and into the pond.

Catch basins have been placed in areas where water may tend to pool on the site and in the exhibits. The exhibits will be primarily flat, but will still need areas for the keepers to wash the dirty water while cleaning the area.

The West face of the building has a 2% slope on the patio, which leads the water into two designed rain gardens. All plantings in these rain gardens, natural swales, and on the extensive green roof bat cave will be native to the area if possible. These plantings will also have filtering characteristics in order to help reduce runoff pollution from the roof and the pathways.





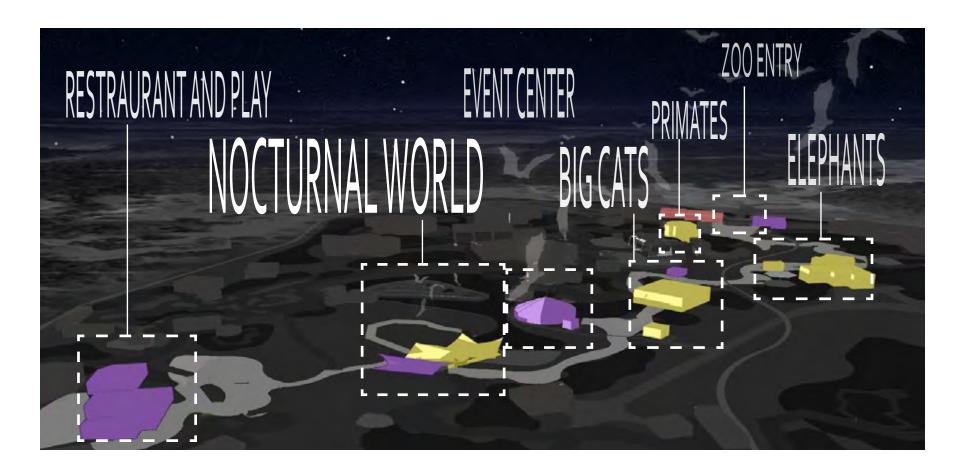
night circulation and programming

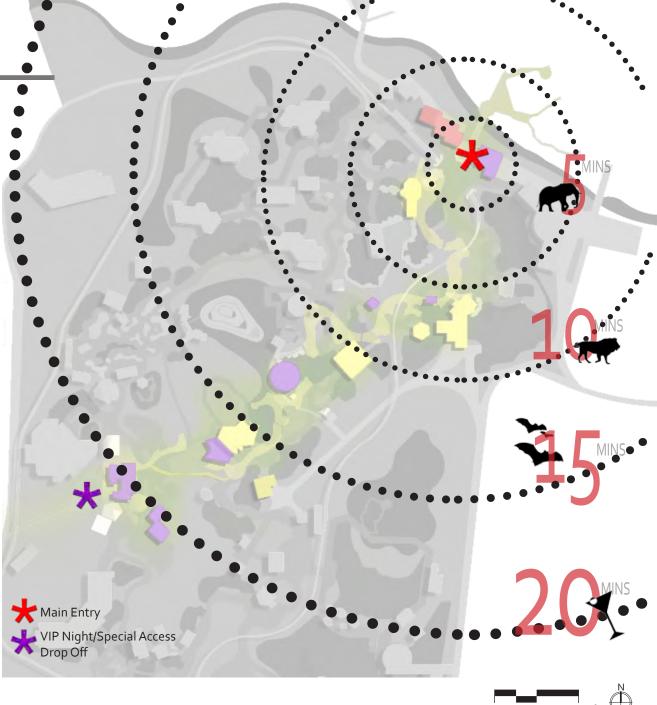
The night hours of the Tulsa Zoo start after Memorial Day and end around Labor Day and are open for the public's viewing Thursday through Sunday. These hours will extend normal operating hours from 5 PM until 9 PM, with the restaurant staying open until 10 PM. During the weekdays, the Nocturnal World will be available for special events and bookings only.

The alternative exhibit showing during evening hours will include a reduced scale exhibit in the chimpanzee, elephant, and lost kingdom exhibit. Visitor's will be able to walk through the park and experience these animals under night-lit conditions while on their way into the the Nocturnal World.

The circles on the diagram represent walking times with a stroller and children to certain exhibits during the evening hours. The design will accommodate the visitors by allowing no more than 3-5 minutes of walking time without experience an exhibit.

The ability to leave exising exhibits open will not only increase the experience during the night hours, but also allow for other animal exhibits to go through research and development with nocturnal exhibitry. The Zoo will maintain a minimum number of appropriate staff on hand to properly run and maintain the active parts of the zoo.





The evening hours will also accomodate season pass holders and special permission guests to have a Southern access into the Nocturnal World. This circular drop-off zone will allow for families and guests to be dropped off while either a valet or a member of the car goes and parks the car in the Southern staff parking lot.

This will allow much quicker access for repeat visitors coming to primarily eat or just view the Nocturnal World and the bat cave.

proposed lighting concept - overall plan

The current light conditions are good for proper night lighting conditions such as open events, concerts, and fundraisers, however for the purpose of my project, the current lighting will not be ideal.

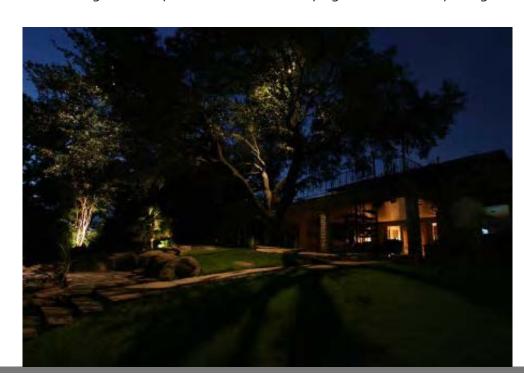
My project to design a night exhibit at the Tulsa Zoo, and help reduce animal's stress by reducing the amount of natural light in their environment. By reducing the flood lamp and single overhead lamp and adding low wattage path lights and two overhead wall lamps there will still be a greatly enhanced site.

The new site will feature a soft lit landscape with dim path lighting mimicking that of the moon. The exhibits will be lit purely by moonlight and the visitors will be offered night-vision goggles to obtain an "animals eye view" of the world at night.

Zoos will primarily shut their doors to the public for viewing around 5pm, 7 days a week. The lighting in zoos is put together as an effective, but more importantly, in an efficient design solution. As long as it passes code for visitor circulation safety standards, the permit will be passed.

The current site lighting proves more than adequate for safety purposes, but is also designed with nothing more than standards in mind.

Transitiong this site analysis to a potential redesign, there are a few particular images that represent the feel I am trying to achieve in my design.

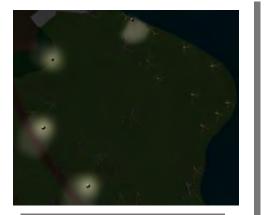






I would ideally like to capture enough light to enhance the artistic features of the natural beauty surrounding the site, however I do not want to emit large amounts of light pollution.

The feel of the area should remain natural and organic, but also intriguing and tempting as the lighting pulls you to a certain path. Experimenting with colorful LED's would be ideal interesting and create a thrilling effect open the viewers.

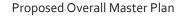






after







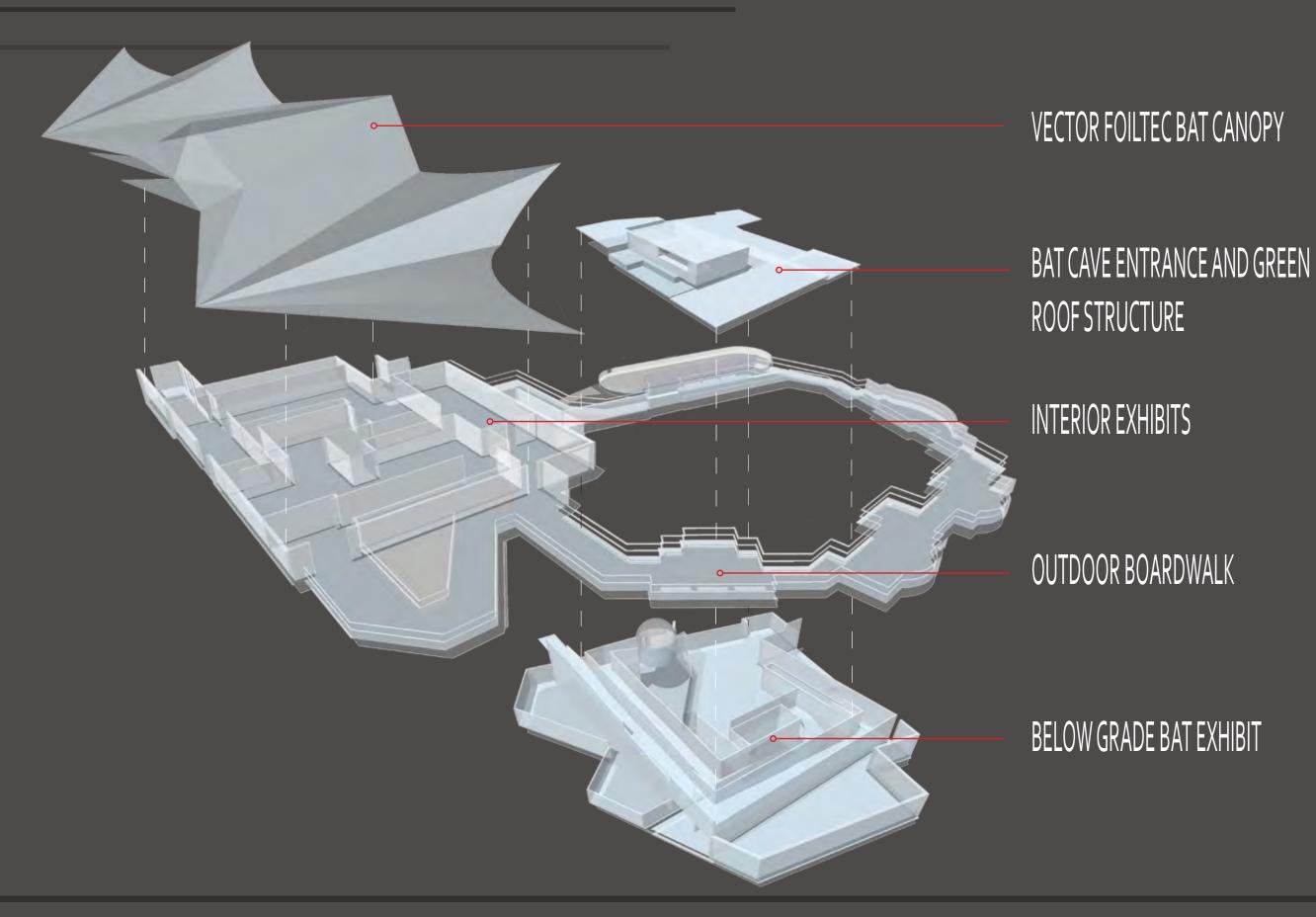


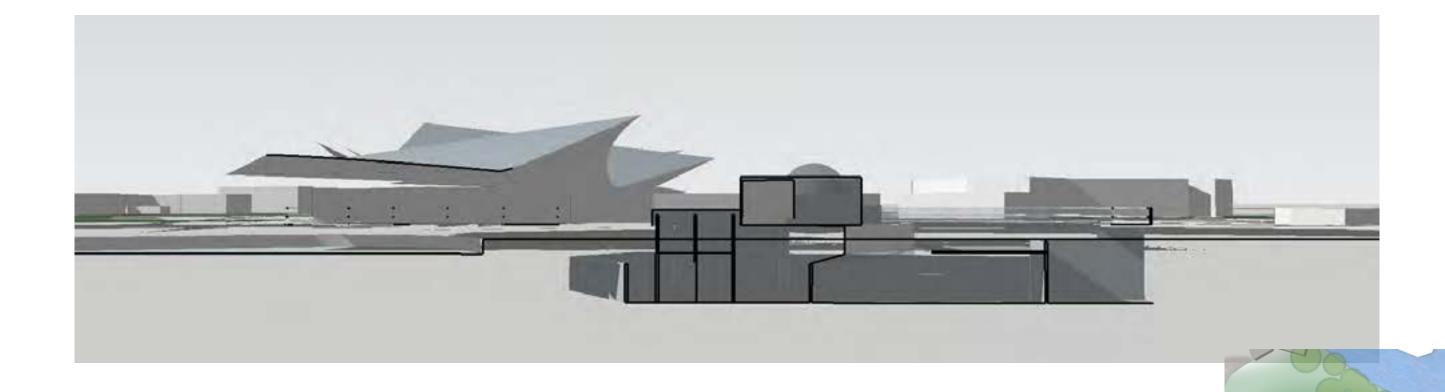
aerial night rendering of nocturnal world

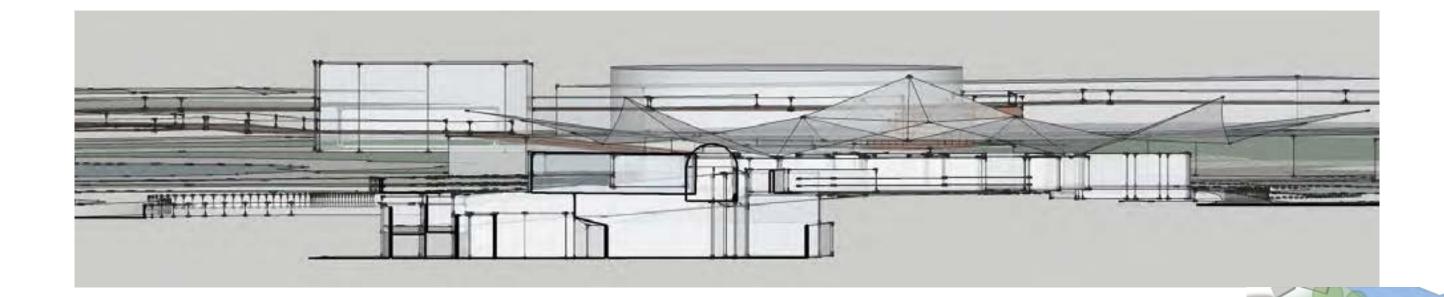


axonometric exhibit diagram

The three seperate areas are all constructed as one complete entity, pieced together with four major parts.







nocturnal world INTERIOR EXHIBITS

C.1

interior exhibits overall plan

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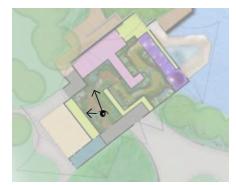




forest nights perspective

Visitors will be allowed to use spotlights only in the forest area to investigate the surrounding exhibits for critters and creepy crawlers. Species within these exhibits will be completely nocturnal and the majority of the species will have limited to no vision whatsoever, so as the spotlights will not harm them.





nocturnal world EXTERIOR EXHIBITS

C. 2

exterior exhibits overall plan

Entering the exterior exhibits, visitors will walk onto the wooden boardwalk that extrudes over the existing pond for a great view of the Lost Kingdom Exhibits as well as an ideal viewing deck for bats emerging from their cave.

Traveling along the boardwalk, visitors wil experience five different encounters.

- 1. The Bat Viewing Deck and Pond Overlook
- 2. The Savanna Exhibit
- 3. The Woodlands Exhibit
- 4. The Flying Range
- 5. Entrance to the World of Bats

All of these exhibits will introduce the visitors to animals in their nocturnal habitat, while not disturbing these animals with artificial lighting, but rather implementing Infrared Stands for the visitors.

Each section will be discussed in further detail in the sections to follow.



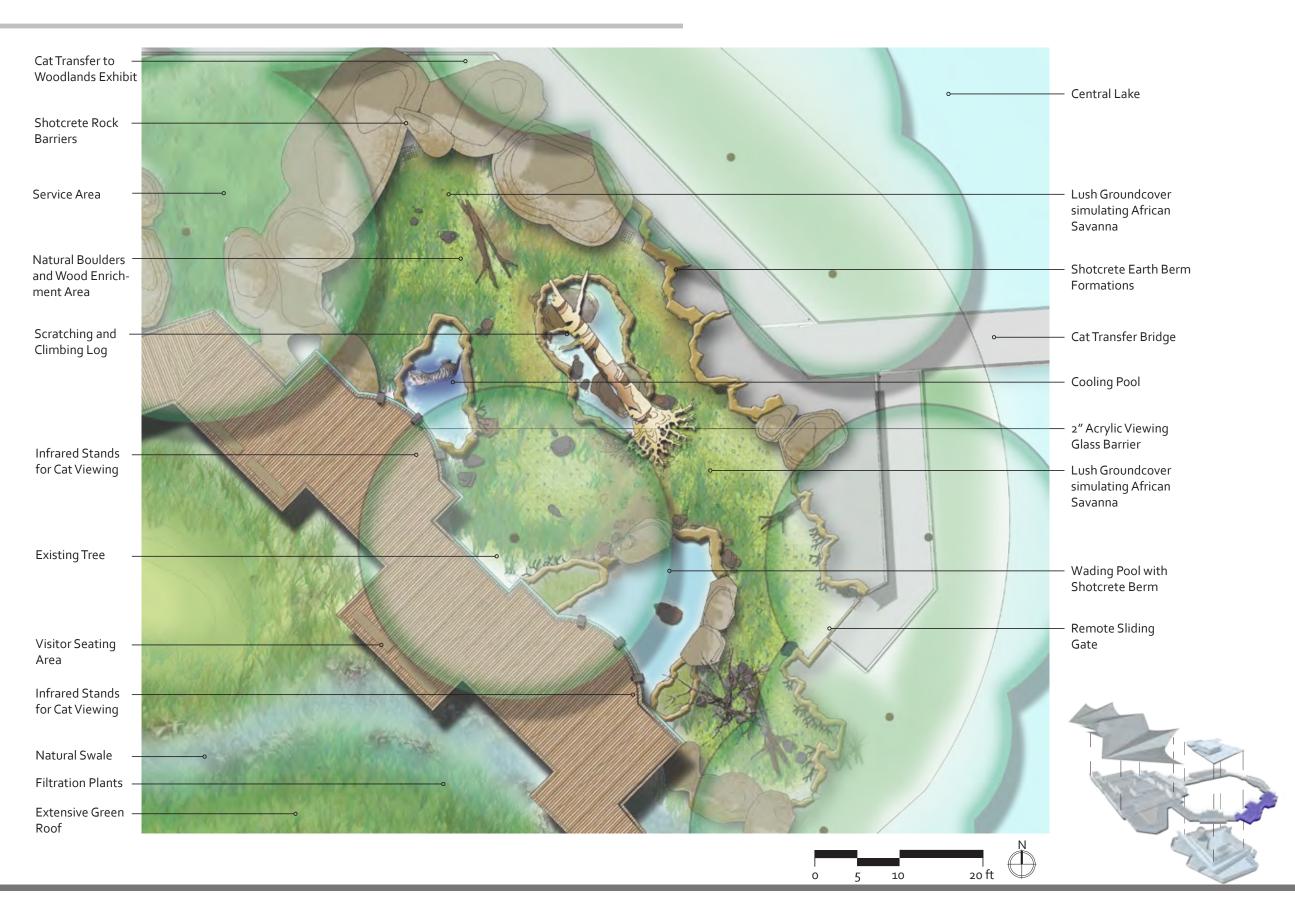
savannah exhibit enlarged plan

The Savanna exhibit will be the first of the big cat exhibits that visitors will encounter. By mimicking the physical appearance of a grassy savanna plain, this exhibit will allow the visitors to feel like they are viewing into the night of the African Savanna. Malaysian tigers, lions, and snow leopards will all be rotating through this exhibit.

This rotation of cats will allow for increased enrichment and greatly benefit the biological nature of the cats.

Visitors will be able to see the cats by either moonlight alone, or with the use of the six infrared camera stands set up on the designated viewing decks.

By witnessing how these animals act in their natural state and their ability to navigate and interact in pitch black, visitors will gain more of an appreciation for the importance of the world that comes alive at night.







woodlands exhibit enlarged plan

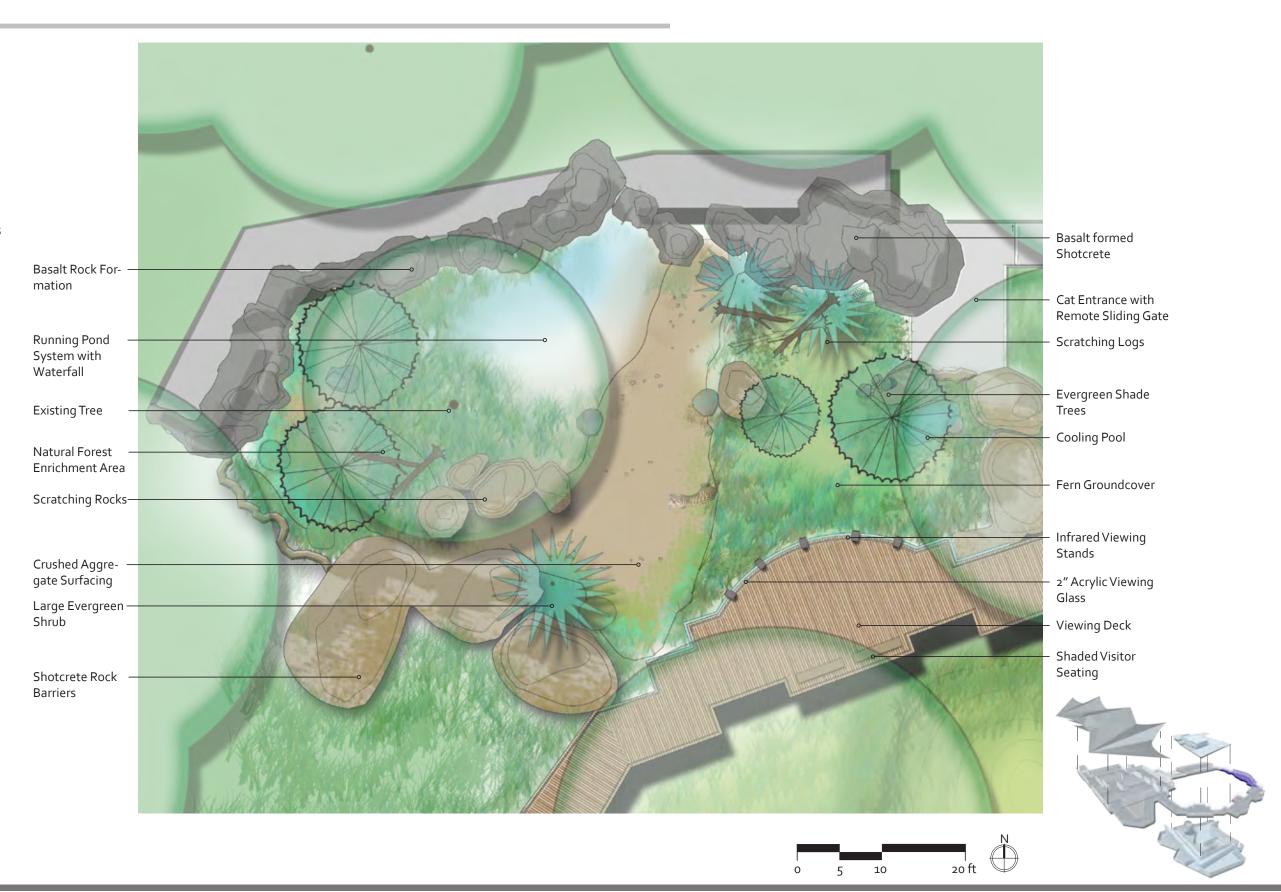
The woodlands exhibit is similar in function to the Savanna exhibit in terms of nocturnal benefits to the cats, however the aesthetic feel and enrichment techniques are varied.

Rather than the African Savanna, this exhibit represents the woodlands of Asia where tigers roam through the trees and shallow bodies of water.

A large shallow shotcrete pool with running miniature waterfalls allows for the cats to cool off in the summer's evening heat. The ground will be covered with a variation of ferns and tough grasses, along with natural logs for scratching.

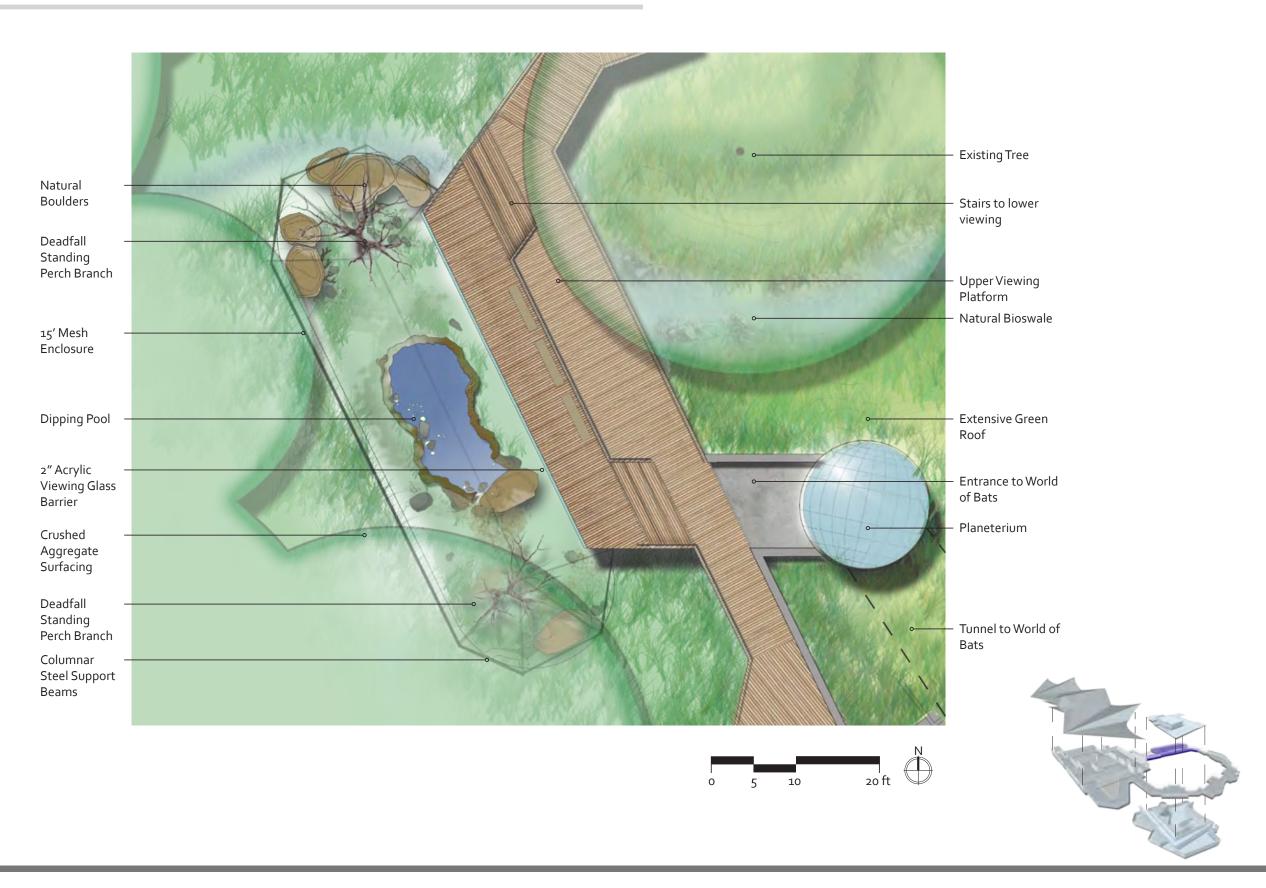
The evergreen tree groves will allow the cats to gain a bit of privacy and rummage through the vegetation.

This exhibit contains five infrared camera stands as well as a shaded area that overlooks the central berm and bioswale.



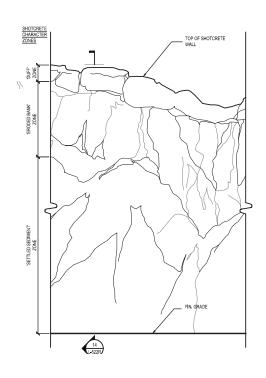
flying range enlarged plan

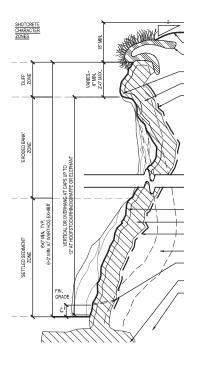
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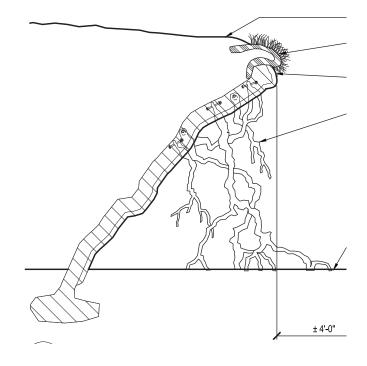


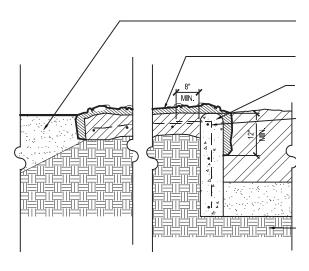
site details - shotcrete barriers and earth berms

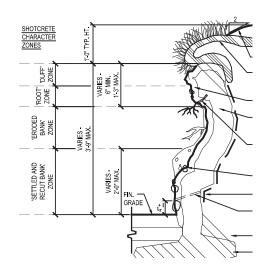
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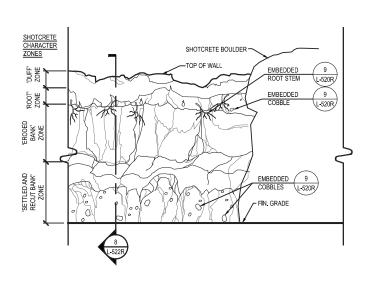




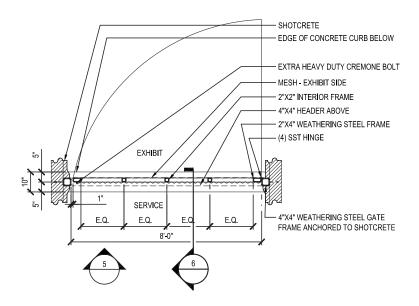


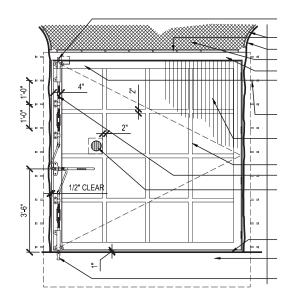


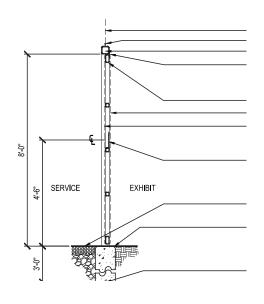


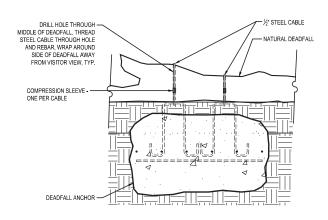


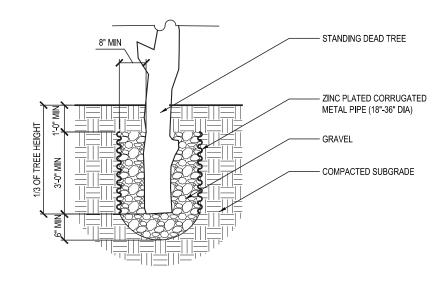
site details - cat service gate and enrichment items

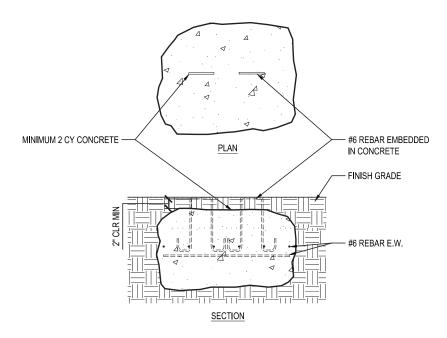










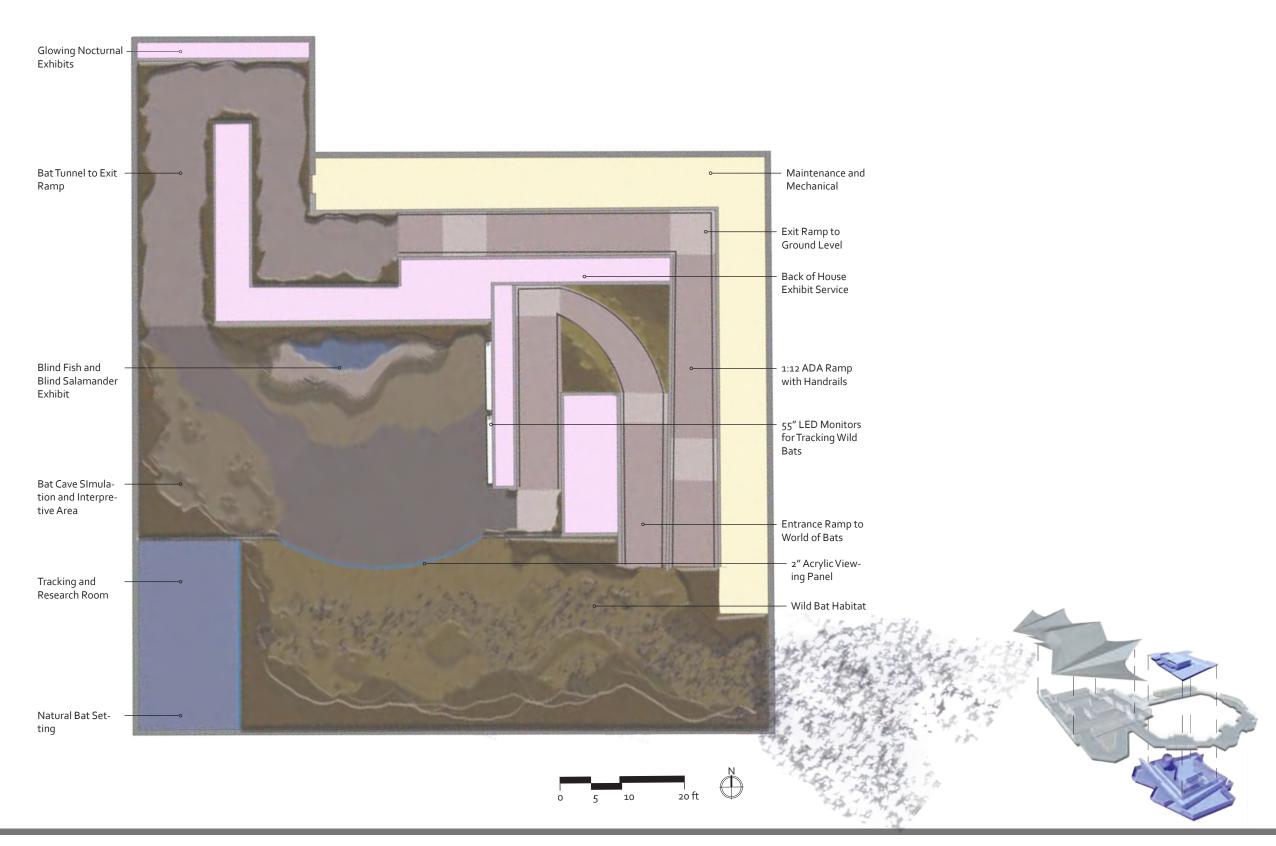


nocturnal world WORLD OF BATS

C.3

world of bats overall plan

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bat cave section

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Gray bat migration distribution: http://www.animalinfo.org/species/bat/myotgris.htm

Mexican free tailed distrubiuotn map

http://icwdm.org/handbook/mammals/Bats/BatBiology.aspx

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bat party

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sunset bat photo credit peter talke photography

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congress bat sculpture

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gray bat head

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Indiana myotis in flight black background

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World of Darkness – Images

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FRONT: http://www.lavidalocavore.org/diary/1587/the-animals-are-getting-the-pink-slip-a-bronx-zoo-photo-and-action-diary

http://www.lavidalocavore.org/diary/1587/the-animals-are-getting-the-pink-slip-a-bronx-zoo-photo-and-action-diary

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MALAYAN TIGER

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LION AT NIGHT

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tiger at night

http://images.nationalgeographic.com/wpf/media-live/photos/ooo/202/cache/tiger-reflected-pool-night_20247_990x742.jpg

SNOW LEOPARD AT NIGHT

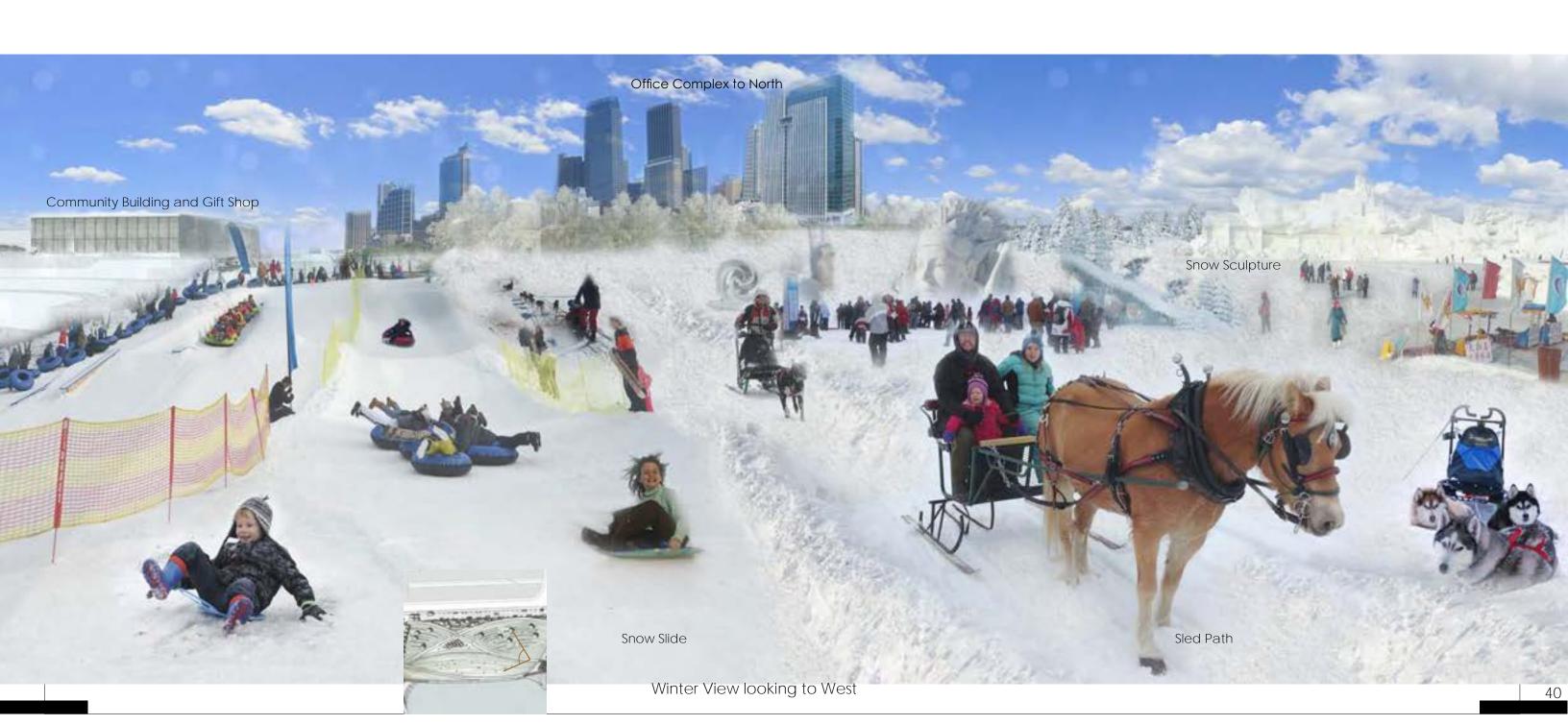
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Master Plan









Water

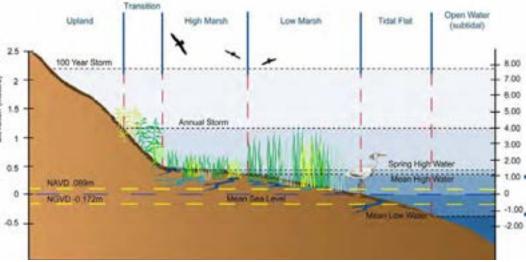




Gabion retaining wall Source: http://milkwood.net/2011/05/06/rock-science-building-ourgabion-wall/



Summer Rendering



Spring High Water, Map Elevations, and Tidal Wetlands From Titus and Wang (2008)

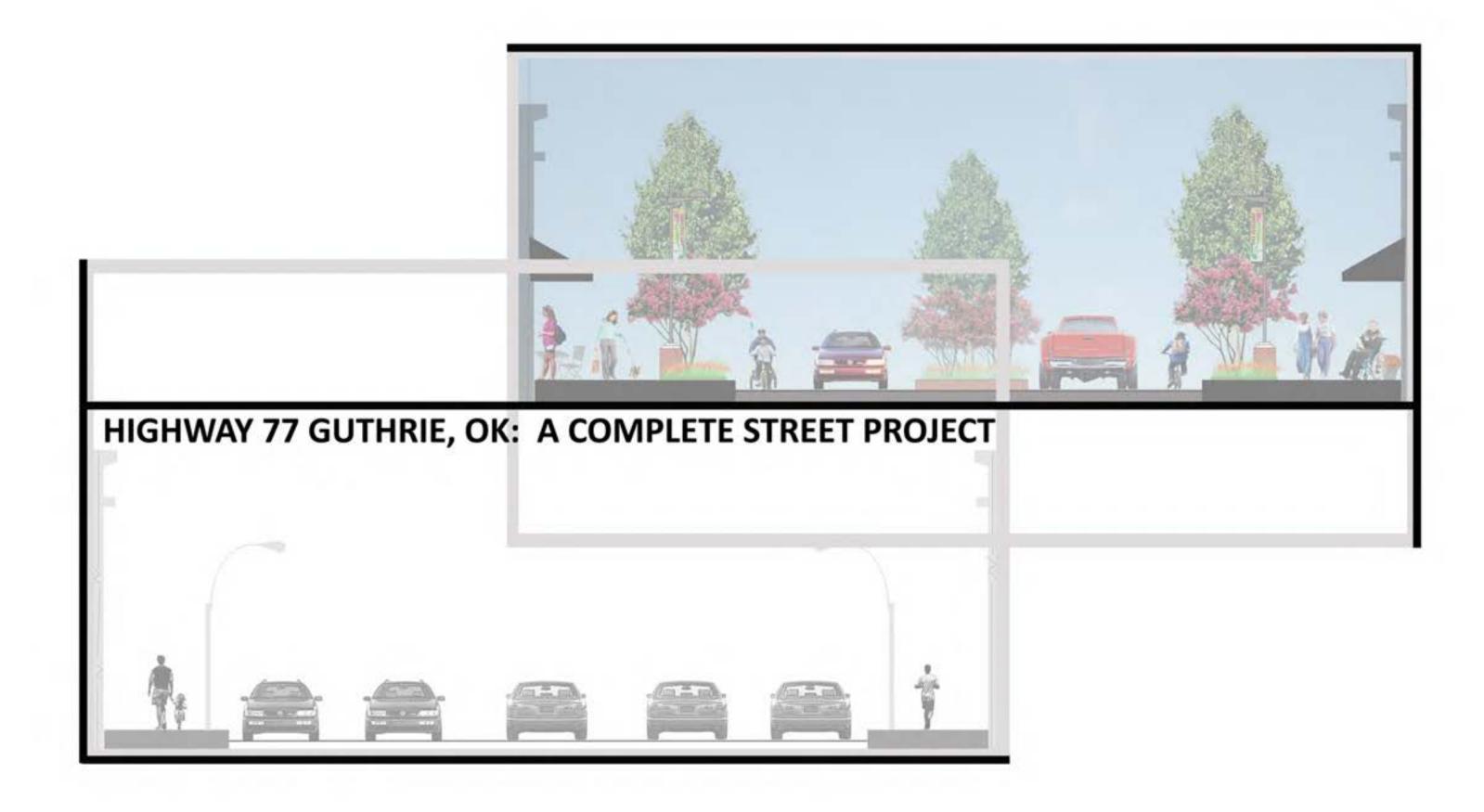


Winter Rendering

Inspiration

MRDC | Stoss Landscape Urbanism: STREAMLINES
The project re-imagines 5.5 miles of Mississippi Riverfront in
Minneapolis, from the cultural riverfront in downtown north
to the city limit.

Streamlines is also a project about working ecologies, ecological systems and dynamics put to work to clean, to re-constitute this working riverfront, and to guide a longer-term transformation of the city fabric.



11

HIGHWAY 77 GUTHRIE, OK: A COMPLETE STREET PROJECT

Leslie A. Novotny 17 April 2013

A graduate creative project submited to fulfill the requirements for the degree of Master of Landscape Achitecture

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A COMPLETE STREET IS AS COMPLICATED AS A SOCIETY ITSELF, YET AS SIMPLE AS THE BASIC NEED.

DESIGN INTRODUCTION HIGHWAY 77 GUTHRIE, OK	A COMPLETE STREET PROJECT	





National Complete Streets Coalition

RESOLUTION NO. 2011-02

A RESOLUTION SUPPORTING THE COMPLETE STREETS PHILOSOPHY TO EXPAND TRANSPORTATION CHOICES IN GUTHINE, OXILAHOMA.

WHEREAS, "A Componential Plan For the City of Gustive, Orisinana" (2002), expecially as singler will blocket. "A Balanced Tomographic System," the chapter emphasion "sinatops, barraportation system improvements and policies for anemphasing non-assumable makes of frantopolishins in the sity" (pp. 4), and

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WHEREAS, Companie Streets receive read competion by providing selectives officers, but economies dismensive transportation options, including the creating and capacity of the procountation reducels as well as dismessing consumer transportation costs; and

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APTHOLOGY STOLEGAL FORM

Range Street City Attorney

FIGURE 1-1: GUTHRIE, OKLAHOMA COMPLETE STREET RESOLUTION

INTRODUCTION AND OVERVIEW

The Request. An elderly Guthrie woman confined to a wheelchair approaches the city council to request access to her community. This is a sensible request made by many citizens who desire to create association, obtain necessities, satisfy wants, and function overall in a social environment. However, this woman finds difficulties accessing her community. Even though this woman can "throw a stone" to many different services the community has to offer her, her ability to safely and securely arrive at these destinations is hampered by a dangerous situation. This dangerous situation is her communities' streets, which are a direct effect of designing communities around the automobile. When venturing out of her home, she experiences firsthand how dangerous these design flaws are. She must navigate in her wheelchair through extended intersections, inadequate sidewalks, and threatening traffic. Despite the danger, the need to enjoy common experiences pushes her to venture past her front yard so that she may have a nice meal at Roma's Italian Restaurant or keep an appointment with her physician. These are all experiences that seem effortless to those of us with the ability to hop into our vehicles and drive to our destinations that stand as islands in a sea of parking lots, but to someone like this woman; it is much like playing Russian Roulette. So living with such circumstances, she brought her case in front of the city council to demand better access.

It is not only those with disabilities that long for a change in our street infrastructure and community development. An owner of Roma's Italian Restaurant expressed his desire to be able to navigate through his community by other means than a motor vehicle. He spoke of walkablity of past places that his new community lacked and the empathy he felt for the elderly woman in the wheel chair. Expanding beyond this smaller community, Americans nationally are also expressing desire for multi-user focused development. "The 2011 Community Preference Survey reveals that, ideally, most Americans would like to live in walkable communities where shops, restaurants, and local businesses are within an easy stroll from their homes and their jobs are a short commute away" (2011).

The City of Guthrie, Oklahoma has taken consideration of its citizens' mobility capabilities and has decided to incorporate Complete Streets standards, as outlined by the National Complete Streets Coalition. By signing a Complete Streets Resolution, Guthrie will promote "feasible" development that "provide safe and convenient transportation facilities for all modes of travel, including pedestrians, bicyclists, public transit riders, and motorists that are accessible for users of all ages and all ability levels" (Resolution No. 2011-02). With these principles, Guthrie will be able to create streets that incorporate all users and give their citizens the ability to choose their preferred mode of transportation.

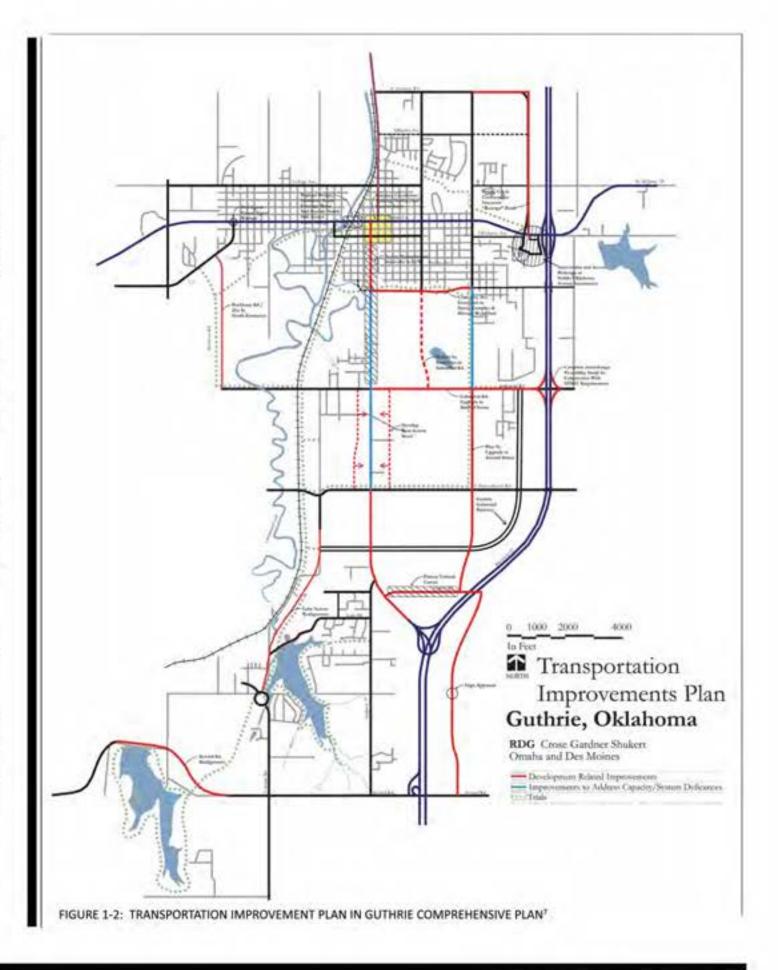
Project Intent. This project addresses the community's interest in developing its street by using complete street and smart growth development guidelines. The design will focus on a street infrastructure that is accommodating to every user with any physical abilities and will include elements that will allow pedestrians, bicyclists, and motorists equal opportunity to navigate safely through the city. Additionally, streetscape will perform for its aesthetic qualities along with functional qualities. Proposed streetscape will create an inviting atmosphere by developing street buffers, microclimates, and traffic calming systems. The project boundaries only cover a portion of the city's major north-south corridor, but the design will serve as a model for street development on the entire city's major throughways by addressing the three distinct character zones of the city.

Project Method. "A Comprehensive Plan for the City of Guthrie, Oklahoma" was completed in 2002. In the document, it was recommended that the city develop a "balanced transportation system" to increase usability, connection, capacity, and circulation (RDG, 77). A "Transportation Improvement Plan" seen in Figure 1-2 was outlined and rendered in Chapter 6 of this document illustrating proposed improvement needed for Guthrie's infrastructure. This plan covers the entire city and does not specify recommended phases of development. A part of this project's objective is to identify the first priority section of the city to reommend for phase one construction.

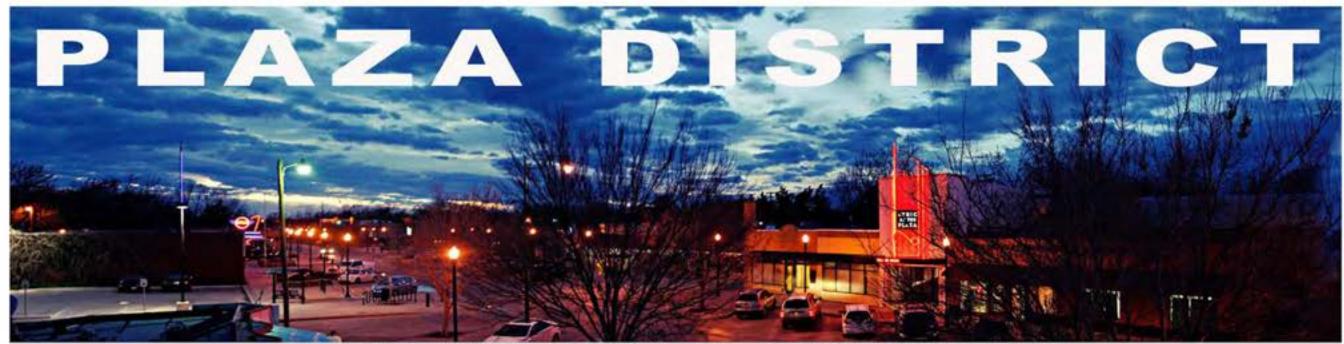
To begin the design process, an inventory and analysis of the entire city will identify the project boundaries. Information collected from official city documents and sources, Geographic Information System, and physical analysis will assist in defining boundaries. Research methods will define existing land use, existing transportation patterns, social behaviors, and urban context. The variety of sources will also allow an evaluation of population, significant locations, and other relevant data to access density, usage, and proximity. An analysis of this data will reveal which section of the city will benefit the most from smart growth development and will lead to an informative decision on what the project boundaries should be.

A comprehensive site analysis on both the city and the project boundary will reveal the physical and social environment. The findings will develop an understanding of deficiencies and advantages in the current infrastructure and assist in developing a comprehensive design for Guthrie's complete streets.

The complexity of this design will require meticulous planning and collaboration of different disciplines. Smart growth development is complex because of the many elements that must be considered to create a successful design. Social, economic, policy, and function all play a role in the direction of the design. To completely understand all these elements, it requires input from different groups and disciplines to propose a comprehensive plan. Direction given from regional and city planners, city leaders, landscape architects, and citizens will ensure an in-depth understanding on how a Complete Street design will work successfully in the City of Guthrie.



STATEMENT OF THE CREATIVE PROJECT



OKLAHOMA CITY, OKLAHOMA

LESLIE NOVOTNY. UNIVERSITY OF OKLAHOMA. COLLEGE OF ARCHITECTURE. DIVISION OF LANDSCAPE ARCHITECTURE. GRADUATE PROPOSAL CASE STUDY. PROFESSOR: DR. THOMAS WOODFIN. SPRING 2012.



PRECEDENT STUDY

COMPLETING A DISTRICT

The Plaza District is not classified as a "Complete Street", but the district has many elements to make a street complete.

VISION

Mission Statement "The Plaza District Association works to develop the Plaza District as a vibrant commercial district where arts, local business and neighborhood community thrives" (Plaza District).

SPECIFIES ALL USERS

Users of any age and ability can use the district. ADA specifications have been meet and street calming techniques create a safer environment for all users. All forms of mobility is encouraged in the district, allowing the user to choose their mode of transportation.

ALL PROJECTS

The entire boundries of the district has been included in the reconstruction by extending streetscape, street repair, and sidewalk considerations. Though some improvements could be made, like creating a bike lane to accommodate for the narrower sidewalks in the neighborhood district, the entire district has made vast improvements to "reconstruction, rehabilitation, and repair" the district. (Elements of an Ideal Complete Streets Policy).

CREATES A NETWORK

The Plaza District has successfully balanced the needs of all users. Pedestrians, cyclists, and motorists can all utilize the district. With the accommodation of the surrounding neighborhoods, the district has been able to handle the large amount of vehicular traffic during events. Though this approach may not be considered perfect, the lack of expansive parking lots and smaller sidewalks does "provide quality accessibility for everyone" (Elements of an Ideal Complete Streets Policy).

ALL AGENCIES AND ALL ROADS

The Plaza District Association had the difficult task of getting the participations of many groups, including residents, business owners, and city officials. Coordination of such magnitude takes careful preparation and compromise

CONTEXT-SENSITIVE

The design is "sensitive to the community context" (Elements of an Ideal Complete Streets Policy). Elements of the sidewalk complement the existing architecture and style. The street widths could function at a 11' to 12' widths, but are very functional as they are according to the current traffic volume. The sidewalks' size function well for the plaza's events and serves the local community on an daily basis. The off-street parking does not hinder traffic flow and efficiently performs in slowing traffic down inside the district.

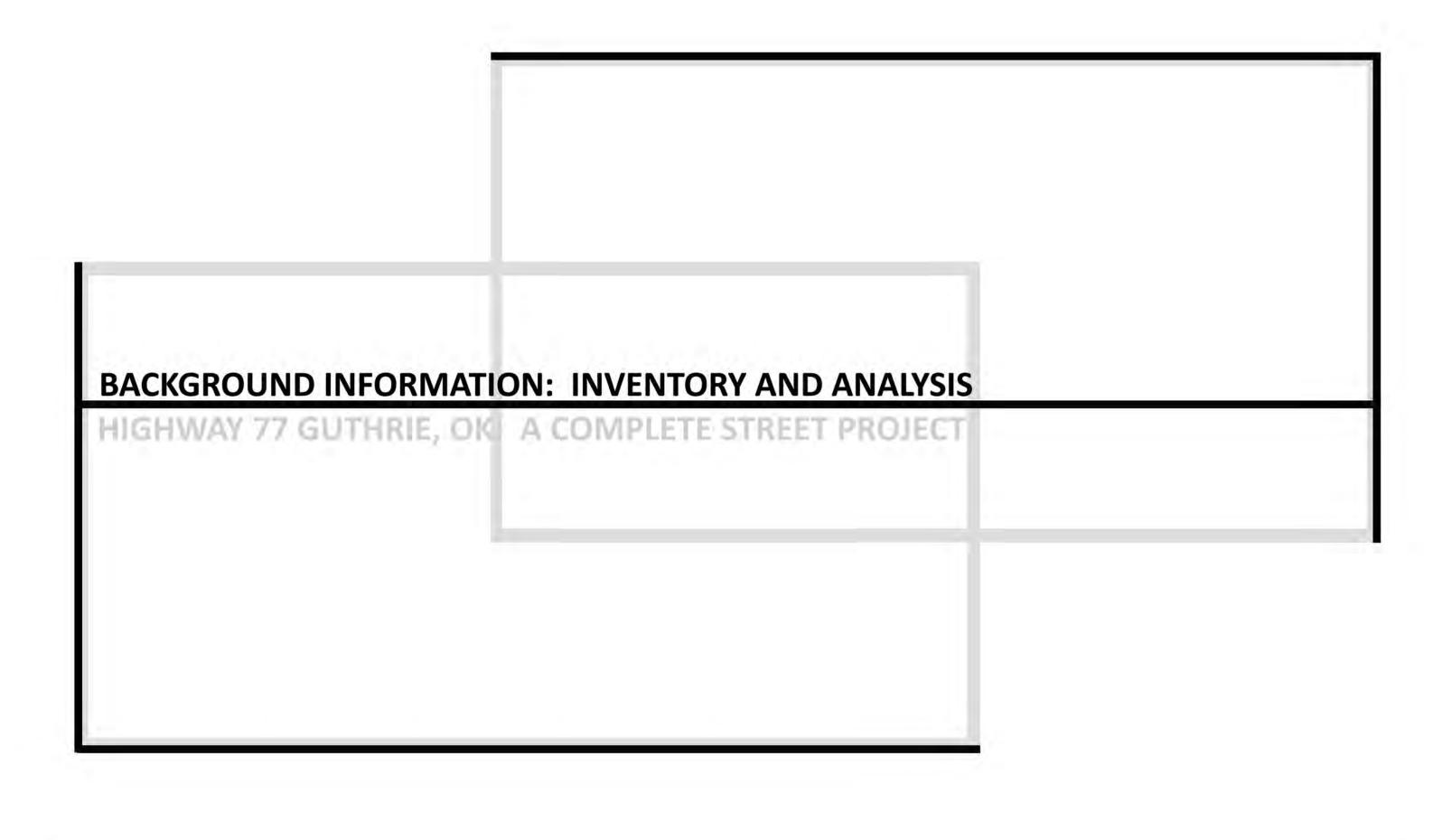
PERFORMANCE MEASURES

The sidewalks before the reconstruction were in poor conditions and were not clearly defined in the commercial district. The sidewalks now provide plenty a space for the user and are functional. A survey of the area could be conducted to determine linear feet added to have a comprehensive performance measures.

Factual data should be collected to officially determine the amount of usage from surrounding communities and the modes of transportation utilized. However; with observation, a hypothesis can be derived that foot traffic has increased within the district. With increase pedestrian use, the assumption can be made that vehicular traffic has decreased.

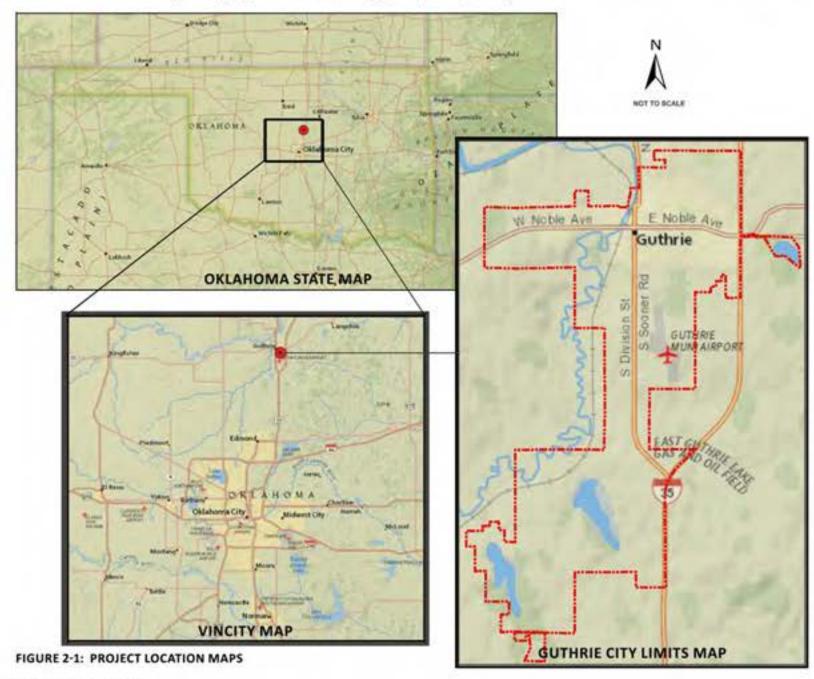
IMPLEMENTATION

With construction completed, others can take lessons from the development of this district. The district can serve as a visual example for others to experience and study how creating space for all users can benefit a community. The district can also serve to promote further development extending past the boundaries of the Plaza District. This could lead to interconnection between nearby communities, such as Oklahoma City University. The improvement of sidewalks and crosswalks, the installation of bike lanes, and the use of traffic calming techniques could create a connection between other areas in close proximity and broaden the user base.



Urban Character. Guthrie was established in 1887 as a Southern Kansas Railway station called Deer Creek in Oklahoma Indian Territory. At the time of the Land Run in 1889, the town of Guthrie was formed by the rush of non-Native American settlers staking claim to land in the open prairie. Guthrie later became the Oklahoma's territorial capitol and was named the state's capitol during Oklahoma's statehood in 1907. Guthrie remained the state's capitol until the governmental role was moved to Oklahoma City in 1910 based on majority vote. However, during this short time of organization to governmental relocation, a wealth of architectural and cultural attributes was created that is still evident today in Guthrie's well preserved historical downtown district.

Guthrie, Oklahoma is located in central Oklahoma approximately 30 miles north of Oklahoma City. It is the county seat of Logan County, Oklahoma and is steadily becoming more of a part of the Oklahoma City Metropolitan area. Guthrie's municipal city limits cover "over 17 square miles" which incorporates a treasure of urban history and open spaces as seen in the adjacent photos (RDG, 2). Despite the richness of this city, Guthrie has experienced a fluctuation of population throughout its lifetime mostly caused by economic factors. As of 2010, Guthrie's population was recorded to at 10,191. This number of residents is roughly what the population was during the Land Run establishment and indicates the struggles the city of Guthrie has experienced. However, population has increased 2.7 percent in the first decade of the 21st century and is projected to continually grow (Census, 2010).



GUTHRIE, OKLAHOMA

COUNTY SEAT OF LOGAN COUNTY, OKLAHOMA

POPULATION (CENSUS 2010): 10,191

HISTORY

1887-RAILROAD ESTABLISHED POST
1889-LAND RUN: POPULATION 10,000 TO 12,000
PEOPLE SETTLED OKLAHOMA FIRST CAPITAL
1910-STATE CAPITAL WAS MOVED TO OKLAHOMA CITY
1974-THE GUTHRIE HISTORIC DISTRICT WAS PLACED ON
THE NATIONAL HISTORIC PLACES

OPPORTUNITIES

HISTORICAL DISTRICT

1998-NATIONAL HISTORICAL LANDMARK

"CONTAINING THE LARGEST AND BEST PRESERVED

COLLECTION OF PRE-STATEHOOD COMMERICIAL,

RESIDENTIAL AND CULTURAL BUILDINGS IN THE

STATE" (SHUKERT, 6).

HIGH DENSITY DEVELOPMENT

NOTABLE PARKS MINERAL WELLS PARK HIGHLAND PARK

ATTRACTIONS
DOWNTOWN HISTORICAL DISTRICT
BLUE GRASS FESTIVAL
UNIQUE RETAIL/SERVICE
HOTELS/BED AND BREAKFASTS

CONSTRAINTS

PROVERTY RATE\
FINANCIAL INVESTMENT

CONTEXTUAL BARRIERS
ENVIRONMENTAL BARRIERS
AUTOMOBILE ORIENTATED STREETS
LOW DENSITY DEVELOPMENT

CITY CONTEXT



HISTORICAL PHOTO PORVIDED ON CITY OF GUTHRIE OKLAHOMA OFFICIAL WEBSITE



HISTORICAL PHOTO PORVIDED ON CITY OF **GUTHRIE OKLAHOMA OFFICIAL WERSITE**



RESIDENTIAL HOME NEAR HISTORIC DOWNTOWN



HISTORIC DOWNTOWN BUILDINGS



HISTORICA DOWNTOWN PEDESTERIAN SIDEWALK HISTORIC DOWNTOWN BUILDINGS





HISTORIC WATER WORKS BUILDING NEAR MINERAL WELLS PARK



MINERAL WELLS PARK HISTORICAL MARKER



PAVILLION IN MINERAL WELLS PARK



HIGHLAND PARK FACILITIES.



HIGHLAND PARK WALKING TRAILS





OKLAHOMA INTERNATIONAL BILLIF GRASS. FESTIVAL HELD AT COTTONWOOD FLATS PHOTO CREDIT: EUROPEAN BLUEGRASS



JELSMA STADIUM OFF OF HARRISION AVENUE



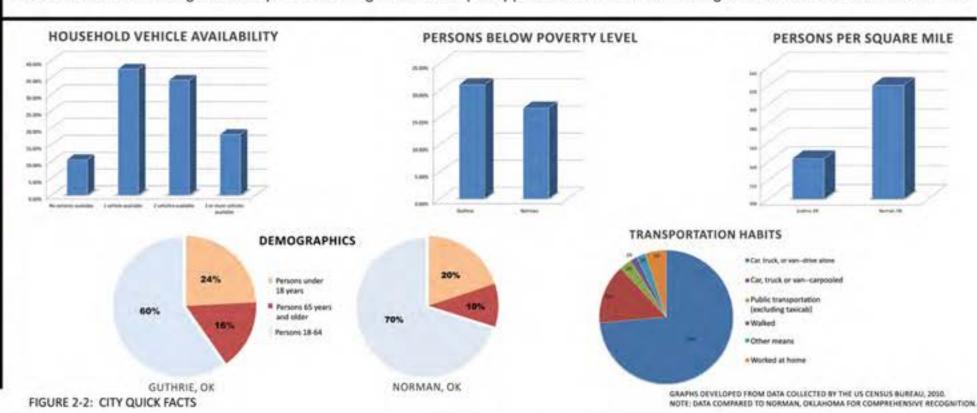
Factors of why Guthrie, Oklahoma would benefit from street infrastructure development by using Complete Street strategies and Smart Growth principles.

Economic opportunity and prosperity can be created through well-planned streets. Residents can reduce the amount spent on transportation by having the ability to choose alternative options. In 2006, the average amount of the household income spent on transportation was 20.2 percent (Lipman, 1). Considering past economic hardships of the city, the 21 percent of residents under the poverty level, and the country's recession, the ability for Guthrie's residents to increase their their probability of remaining stable in economic uncertainty only strengthens the city as a whole.

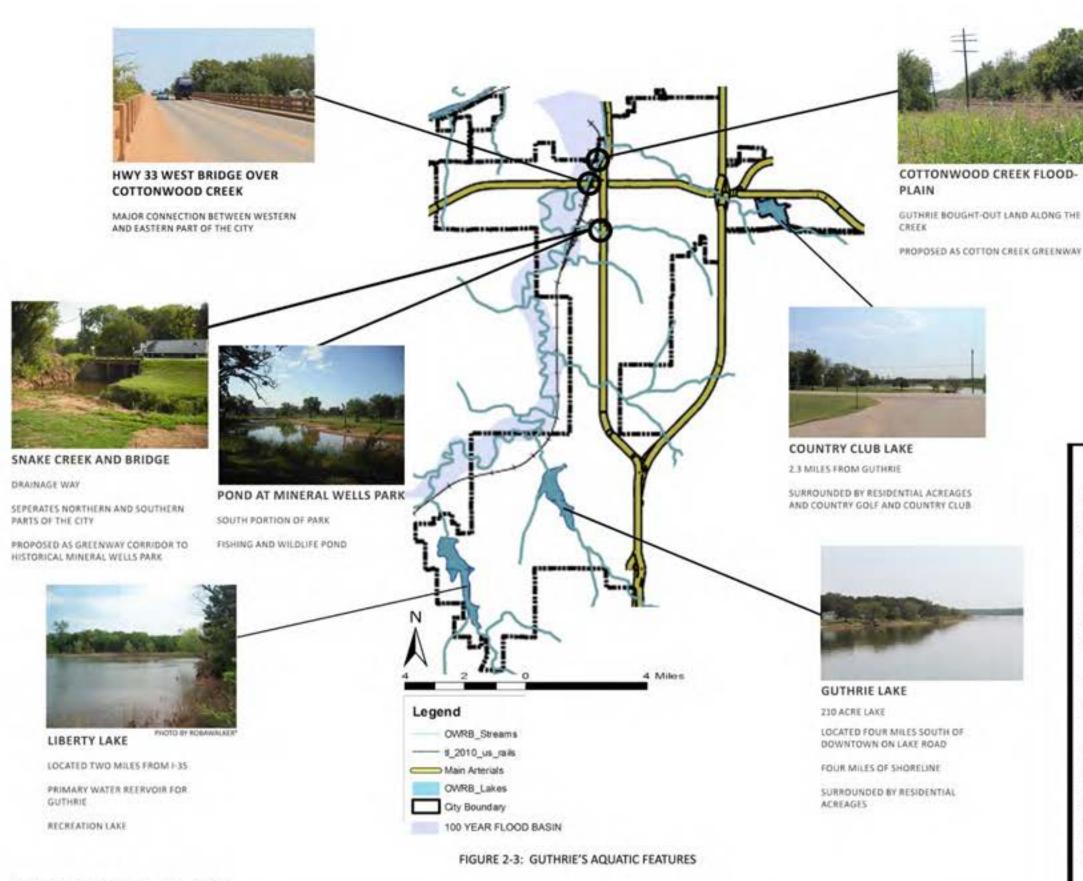
More transportation choices create more than just economic opportunity and prosperity. Having more choices has the potential to create more efficient and less congested roadways. According to 2010 US Census, 88 percent of Guthrie's residents rely on personal vehicles for transportation. With such large percentages, congestion can become a problem and will only increase if the population increases as projected. Those without vehicles will also benefit from having well-organized, less crowded streets. The 10.5 percent of residents that do not own personal vehicles and have no other choice than to walk, bike, or use transit will have the opportunity to travel more safely throughout their city.

Safer roads benefit all both motorists to pedestrians. The methods used in Complete Streets, such as traffic-calming techniques, decrease speeds and decreases the chances of injury for drivers and pedestrians in an accident alike. However, pedestrian have more of a chance to be injured or fatally injured in an automobile accident and out of these types of accidents, children and older adults have a high chance of suffering injury or death. The National Highway Traffic Safety Administration shows that "children 15 and under account for 7 percent of pedestrian fatalities and 23 percent of pedestrian injuries" and pedestrians 65 years or older account for the highest fatality rate in automobile accidents (Traffic Safety Facts, 2010). Since Guthrie's children and elderly account for 40 percent of its population, then creating Complete Streets in Guthrie will be creating a safer environment for a large portion of its citizens.

Investment in smart growth is promoted through Complete Street development and decreases the repercussions of low density development. Studies have shown a high correlation between automobile related development and deterioration of public health and "the highest per capita demands on natural systems and habitats" (Farr, 25). Low density development has been believed to be a main culprit of increase obesity, pollution, and habitat loss and threatens to decrease quality of life in general. Despite the density level of the historical district, Guthrie only has a density level of 542.8 persons per square mile. A comparison to Norman, Oklahoma, which has a density level of 620.5 persons per square mile, one can have a better understanding the development occurring in the contemporary part of Guthrie and how smart growth could benefit Guthrie's citizens.



CITY CONTEXT



OPPORTUNITIES

POTENTIAL GREENWAYS ALONG CREEKS TO CREATE CONNECTIVITY TO SEVERAL PARTS OF CITY

CREATE SAFER AND FASTER TRAILS FOR PEDESTRIANS

CREATE NATURAL SETTINGS AND OPPORTUNITIES FOR NEW PARKS

CREATE POTTENTIAL FUTURE ECONOMIC GROWTH

CHALLENGES

BRIDGES OVER CREEKS ARE NOT EASILY ASSESSIBLE FOR PEDESTRIANS

GUTHRIE MAY NEED TO PURCHASE ADDITIONAL LAND TO CREATE COMPLETE GREENWAYS

FLOODING CAN CREATE HIGH ESTABLISHMENT AND MAINTENANCE COSTS

Rural Character. Guthrie's naturalistic qualities distinctly come from the creeks, lakes, and ponds within the city limits and create an exceptional character to the city. "Images of a community that has a unique sense of place" is definitely created by the attractiveness of the winding Cottonwood Creek embraced by the rolling hills, the peacefulness the Guthrie and Country Club Lake bring to surrounding residential, and the sense of remoteness visitors feel near Lake Liberty (RDG, 14).

These features, both natural and man-made, create opportunity and challenges for the progression of the city. Greenways created by floodplains provide a place for potential pedestrian trails connecting the entire city. However, developing in floodplains can be costly and will need careful planning, designing, and maintaining to make these projects successful. A list of opportunities and challenges can be viewed above, but despite the risk, smart development in these areas can increase Guthrie's unique character and desirability.

HYDROLOGY

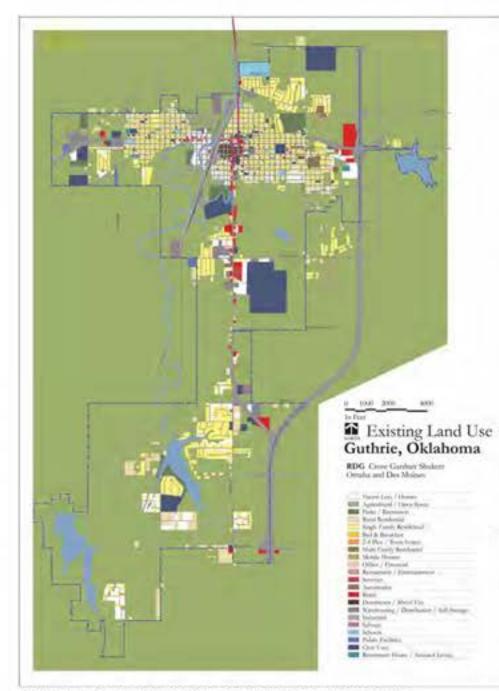


FIGURE 2-4: GUTHRIE'S EXISTING LAND USE PROVIDED IN THE GUTHRIE COMPREHENSIVE PLAN, 20027

Layout. Most of the development extending from the northern portion of Cottonwood Creek is characterized as the traditional urban form. Residential areas are based around the activity centers and urban core where downtown, community services, and housing are within reasonable distances from each other. This area of the city is why Guthrie has received a walkability score of 71 out of 100 from the private company Walk Score. According to the amenities' locations portion of the city, the company states that "most errands can be accomplished on foot" because they are within a mile radius.*

Development beyond the traditional development is more contemporary in nature, eventually becoming completely automobile oriented development. As seen in figure 2-4, as the city expands south from the downtown area, the distances between different land uses increase. This area has a completely different urban form and character that is included in "a composite of development patterns" that make up the entirety of the city (RDG, 37).

Complete Streets work best when there are destinations in a close proximity. Studies have shown the average person will walk about ¼ -½ miles to get somewhere and the average bicyclist will travel about 2 miles (Cerin, 2007). When amenities are over the distance most pedesterians are willing to travel, then sidewalks built will remain unused. In figure 2-5, the location of the services specified in the The 2011 Community Preference Survey as most desired to walk to are seen. The final comprehensive map shows where most of the locations are concentrated and a general idea where a Complete Street project would be most successful.

*Walk Score does not base score on the condition or availability of sidewalks, crosswalks, street widths, and other contributing factors to walkability. Score is only based on the proximity of services of certain criteria.

COMMERCIAL IS CONCENTRATED DOWNTOWN, NEAR INTERSTATE 35, AND SOUTHERN HIGHWAY 77.

HIGH DENSITY DEVELOPMENT OCCURS IN HISTORICAL DISTRICT.

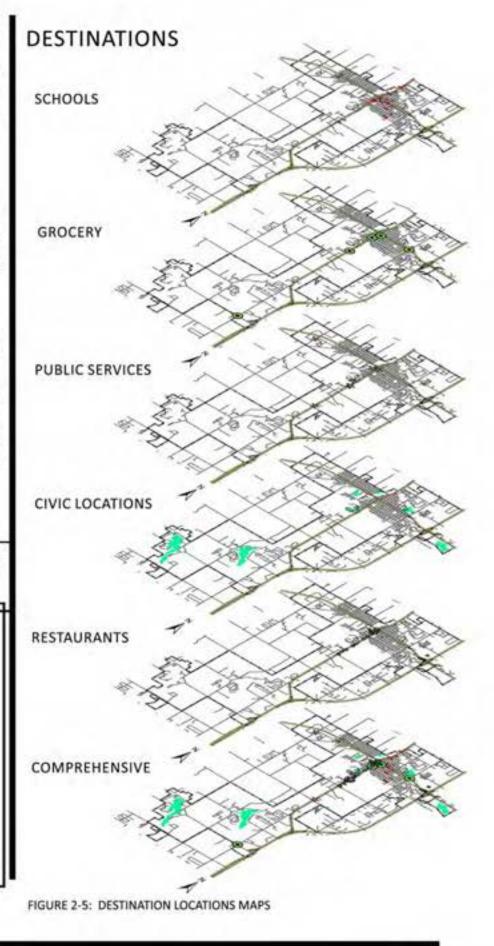
DENSITY DECREASES IN AS CITY SPREADS SOUTH OF THE DOWNTOWN DISTRICT.

OPEN SPACE, EMPTY BUILDINGS, AND EMPTY LOTS CREATE THE ABILITY FOR FURTHER GROWTH TO INCREASE MIX-USE.

LAND USE CLOSEST TO INTERSTATE 35 CATERS TO INTERSTATE TRAVELERS.

DOWNTOWN IS PROMOTED AS A TOURIST ATTRACTION.

SOUTHERN PORTION OF THE CITY IS DEVELOPED TO PROVIDE AUTOMOBILE ORIENTED RETAIL SERVICES.



LAND USE AND DESTINATIONS

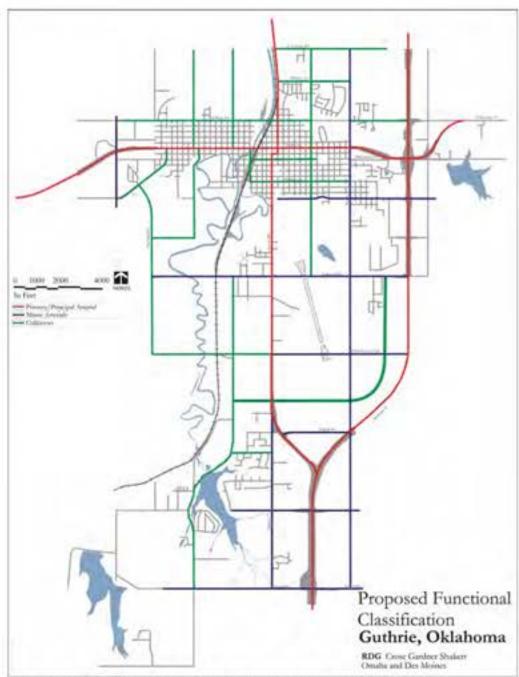


FIGURE 2-6: FUNCTIONAL CLASSIFICATION OF CURRENT STREET SYSTEM RECOMMENDED IN THE GUTHRIE COMPREHENSIVE PLAN, 20027



FIGURE 2-7: PROPOSED IMPROVEMENTS FOR GUTHRIE'S TRANSPORTATION SYSTEM RECOMMENDED IN THE GUTHRIE COMPREHENSIVE PLAN, 2002

a traditional grid. Highway 33 serves as the grid's major axis as it extends from east to west. Streets become irregular around the lakes, but for the most part, stay true to the grid unless their form is governed by topographical or natural elements. There are only two major arterials extending off of Interstate 35 into Guthrie that support most of the daily traffic throughout the city. These two arterials are US Highway 33 and US Highway 77, Also known as Noble Avenue and Division Street. The 2011 ODOT Traffic Count shows that within a 24 hour count, 11,728 vehicles travel on the east portion of US Highway 33 through Guthrie and 14,433 vehicles travel on the south portion of US Highway 77 through Guthrie. Traffic observed on these roads ranged from motorcycles to semi-trucks.

Network System. Most of Guthrie street network lies on

Guthrie's current transportation system is automobile oriented and the city does not have many alternative modes of transportation. The city has the First Capital Trolley System, but it is focused around tourist-related routes. There are sidewalk systems with the city's infrastructure, which is mostly concentrated along the original development and downtown area, but deficiencies and outlying system breakdowns limits usage of pedestrian paths. A photographic inventory in figure 2-8 illustrates circulation conditions and some of the conditions that discourage pedestrian use. With these limitations, the high concentration of automobile use, single directional primary arterial, potential use increase, capacity limitation and access issues have the potential to become a threat to the character of the streets and the city.

According to the Guthrie Comprehensive Plan, congestion occurs mostly in the a.m. and p.m. peak times and "supplemental transportation modes" would help relieve the current and potential "functional transportation problems" (RDG, 84). Strategies such as more public transportation with safe and convenient stops accompanied by accessible and safe pedestrian and bike paths can make transportation more efficient and the roadways less congested. With smart growth transportation system, more routes and options will be available to the traveler to lessen the burden on the two major routes currently available to citizens and visitors of Guthrie.

GUTHRIE COMPREHENSIVE PLAN TRANSPORTATION GOALS, 2002

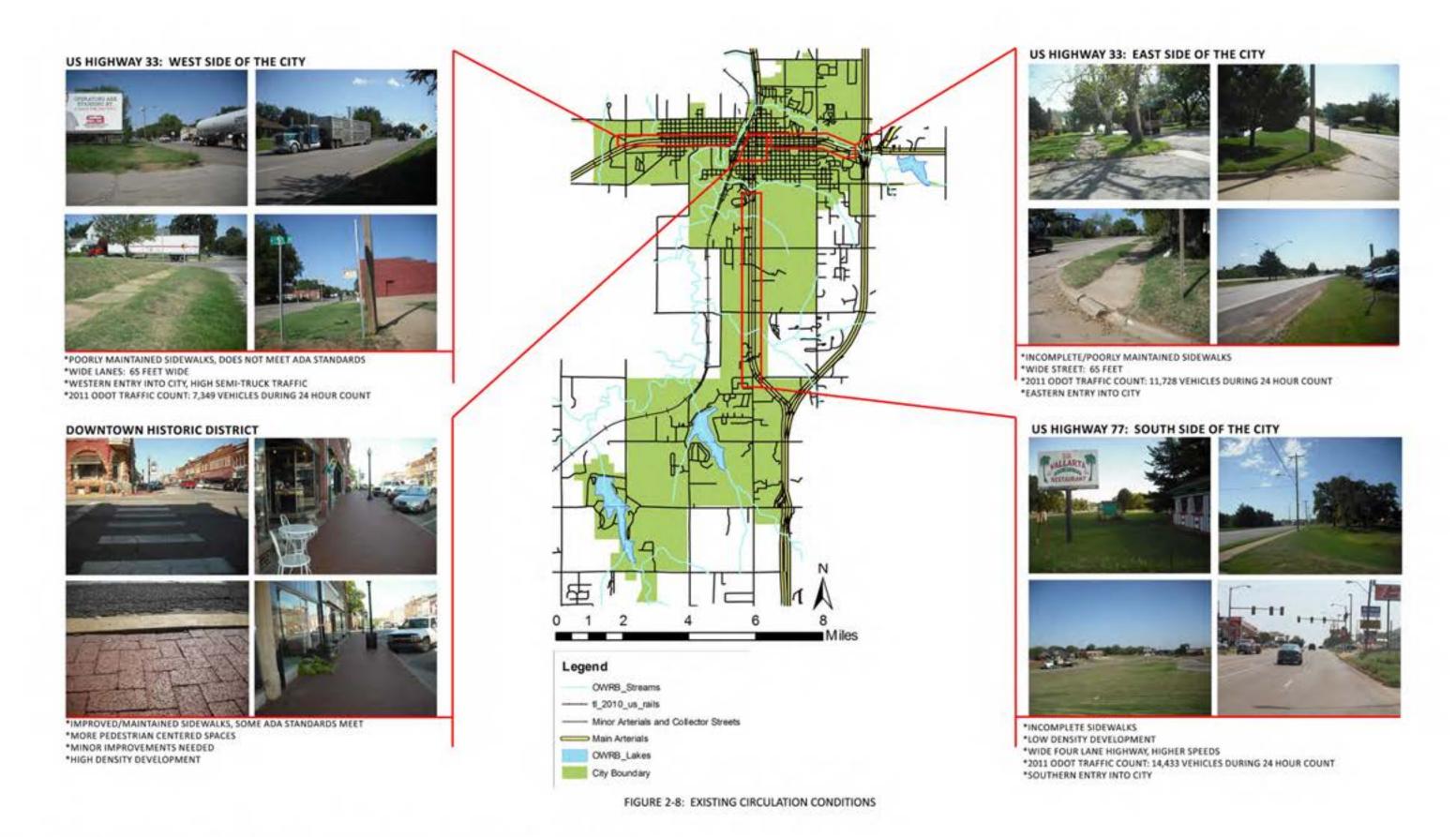
1. MAINTAIN A BALANCED TRANSPORTATION SYSTEM THAT PROVIDES ALL RESIDENTS WITH SAFE AND CONVENIENT MOBILITY.

2. ASSURE THAT THE TRANSPORTATION SYSTEM PROVIDES BOTH ADEQUATE ACCESS AND CAPACITY.

3. USE THE TRANSPORTATION NETWORK TO SUPPORT DESIRABLE PATTERNS OF COMMUNITY DEVELOPMENT.

4. DEVELOP A TRANSPORTATION SYSTEM THAT RESPECTS STREETS AS IMPORTANT FEATURES WITHIN THE PUBLIC ENVIRONMENT.

EXISTING CIRCULATION CONDITIONS



EXISTING CIRCULATION CONDITIONS

HIGHWAY 77 PROJECT BOUNDARY



PROJECT BOUNDARY DESCRIPTION

RUNS NORTH-SOUTH ON US HIGHWAY 77 (DIVISION STREET)

NORHTERN LIMITS: EAST OKLAHOMA AVENUE SOUTHERN LIMITS: ENTRY ROAD OF WALMART

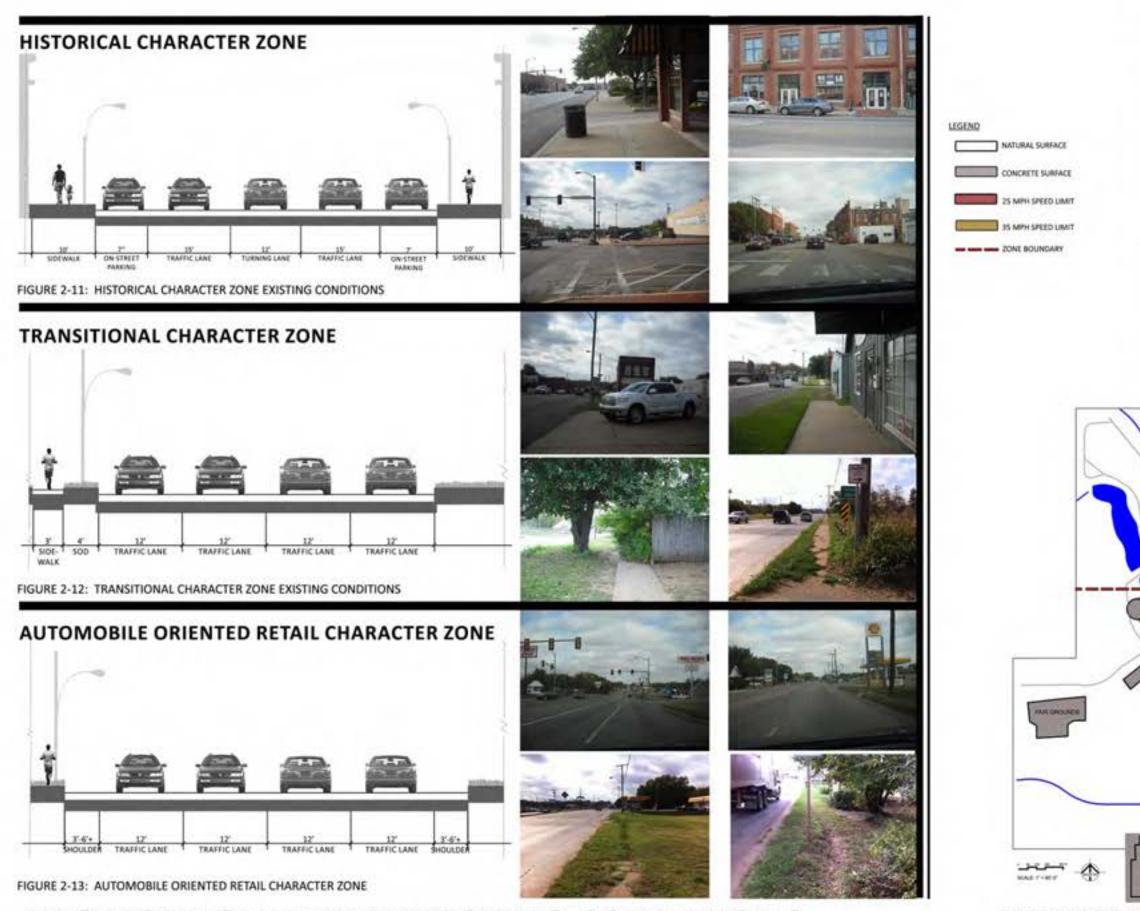
BOUNDARY LENGTH: ABOUT 1.25 MILES

BOUNDARY LINES ARE EXTENDED TO SHOW SURROUNDING CONTEXT

BOUNDARY IS DIVIDED INTO THREE CHARACTER ZONES

- 1. HISTORICAL CHARACTER ZONE
- 2. TRANSITIONAL CHARACTER ZONE
- AUTOMOBILE ORIENTED RETAIL CHARACTER ZONE

PROJECT BOUNDARY - HIGHWAY 77



CHARACTER ZONE 1 - HISTORICAL PROS: PEDESTERIAN FRIENDLY WIGE 39' SIDEWALKS, ADA STANDARDS, TEXTURE CHANGE ON CROSSWALKS, PEDESTRIAN LIGHTED CROSSWALKS, ON STREET PARALLEL PARKING SERVES HISTORICAL VALUE 足品 CONS: NO BIKE LANES, SS' CROSSWALK WITH NO CURB-0.00 -8 CHARACTER ZONE 2 - TRANSITIONAL PROS. PARK SPACE, PLENTY OF RIGHT OF WAY AND STREET WIDTH TO CREATE A COMPLETE STREET, VEGETRISON, SERVICES AND DINING DESTINATIONS, MIXTURE BETWEEN OLD AND NEW STRUCTURES CONS: NOT TO ADA STANDARDS, SOME WALKS ARE OVERGROWN OR IN POOR CONDITION, LITTLE TO NO-BUFFER ZONES, ACCESS CONTROL WITH MULTIPLE ENTRANCES INTO PARKING, AUTOMOBILE ORIENTED, TWO LANE ROAD CHARACTER ZONE 3 - AUTOMOBILE ORIENTED PROS: PLENTY OF RIGHT-OF-WAY AND STREET WIDTH TO CREATE A COMPLETE STREET IN MOST AREAS, AVAILABLE GREEN SPACE, SERVICES CREATE DESIRABLE DESTINATIONS CONS. MOSTRY NO SIDEWALKS, AVAILABLE SIDEWALKS ARE IN POOR CONDITION, NO BUFFER ZONE, MOST WALKS OR FOOT PATHS ARE EXTREMELY CLOSE TO CURB, NO LIGHTED CROSSWALKS AND CROSSING BUSY STREET IS DIFFICULT, ACCESS CONTROL WITH MULTIPLE ENTRANCES INTO PARKING LOTS, LOW-DENSITY, AUTOMOBILE ORIENTED, HIGH TRAFFIC NOISE FIGURE 2-14: PROJECT BOUNDARY ANALYSIS

PROJECT BOUNDARY EXISTING CONDITIONS

Inventory and Analysis. An inventory and analysis was conducted mostly on the character, circulation, roadway conditions, and existing conditions within the project boundary. A lot of information was discovered in the city's inventory and analysis, but further investigation into the project boundary gave a more detail description of the human scale experience. Overall, there were many conditions that created opportunities available to yield a successful complete street, such as adequate right-of-way and desirable destinations. Some of the disadvantages evident in the project boundaries were the lack of access control to surrounding amenities and inconsistency in sidewalk quality.

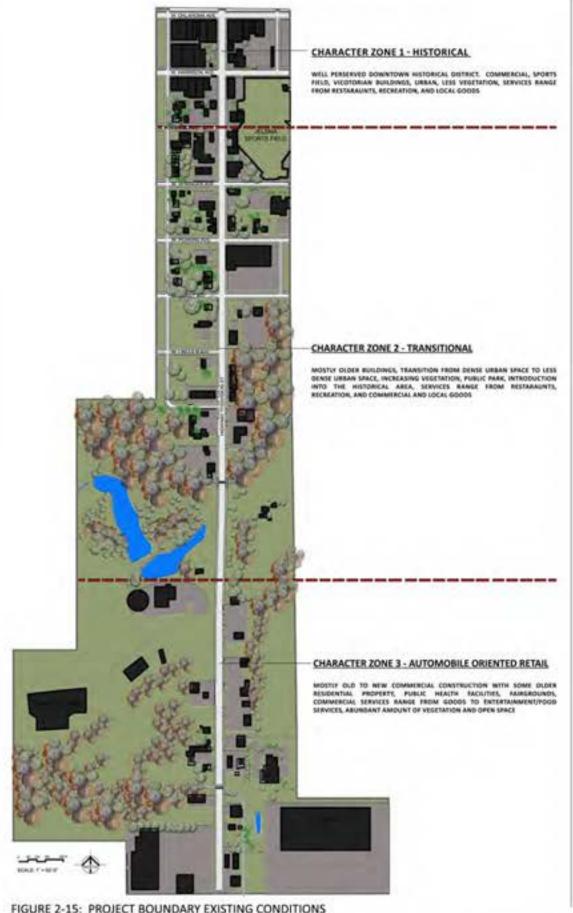
Character Zones. Within the 1.25 miles of the project boundary, there are three distinctive character zones. The zones can be identified according to the development Guthrie has experience during different time periods. Below is a description of each zone and what was discovered from the inventory and analysis.

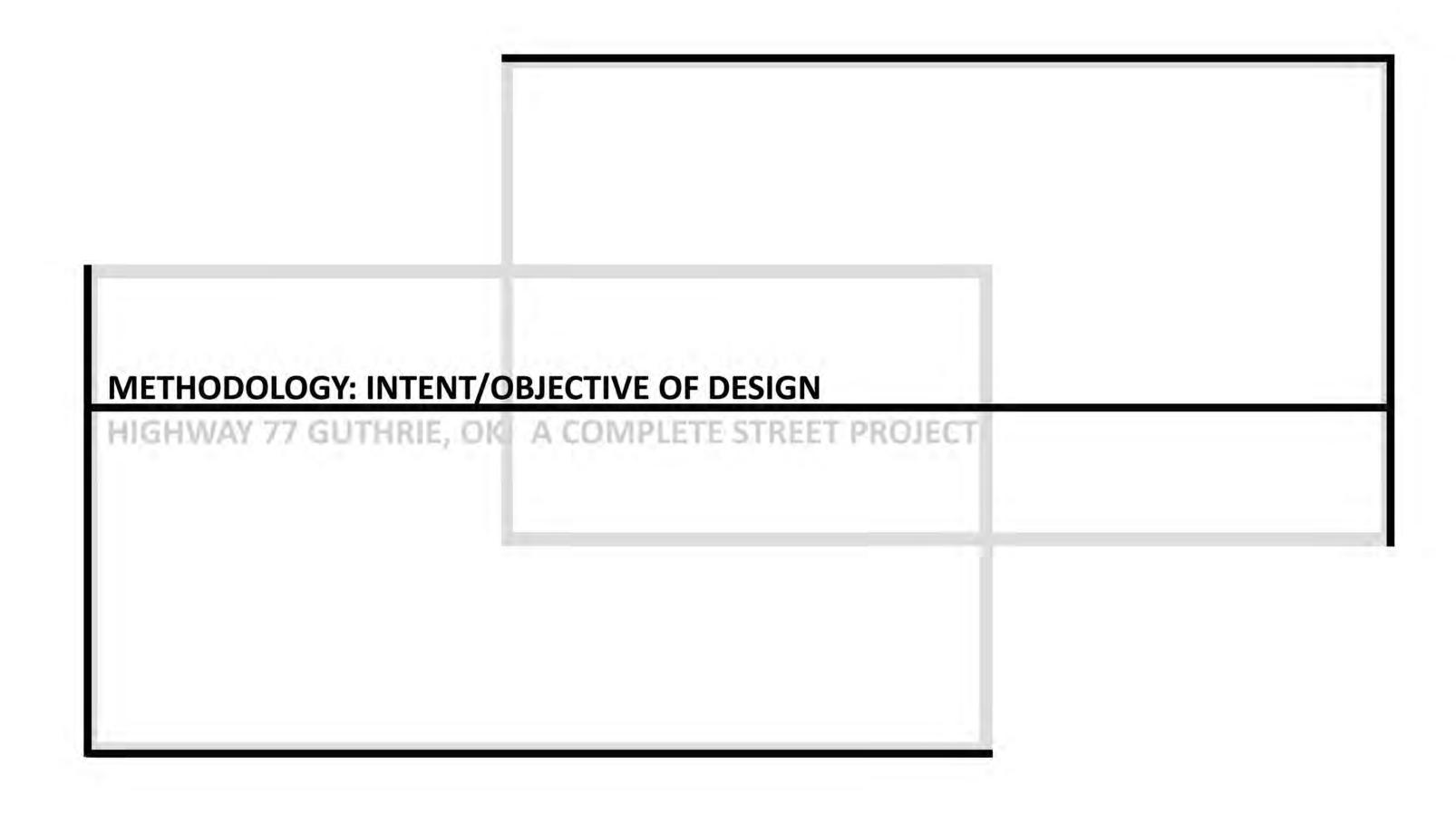
The Historical Character Zone is part of the original development in Guthrie and is high density development. The zone has the traditional focus on the pedestrian. The historic buildings are at human scale and the 10 foot sidewalks provide plenty of room for safe travel. Crosswalks are lighted, have curb-cuts, are marked, and have a slightly reasonable cross length of 55 feet. Modern infrastructure has been added to accommodate the automobile, such as parking lots have replaced a spot where a building once stood, but sometimes this infrastructure serves as a benefit to the pedestrian. Such a case is the on-street parking that also serves as a buffer for the sidewalks from the street. Speed limits are also posted at 25 miles per hour for the pedestrian's safety. This area is visually interesting as the user can enjoy the historic value, people watching, and entertainment and shopping venues. However, improvement could still be made in this zone for there are some ADA standards that need to be adhered to in the crosswalks and intersections of alleyways, there are no bike lanes, and there is a lack of access control to the parking lots and additional entrances of the downtown buildings.

The Transitional Zone is a mixture of development ranging from the traditional to contemporary. There is still history in this area as a collection of older buildings still grace this zone. Some of these buildings are in good condition and are occupied; others are abandoned and are in need of repair. Closer to the downtown area, the sidewalks are adequate for capable users, but they deteriorate as the path progresses south. There is still a mixture of residential tucked in between and around the businesses and most of the public structures are set closer to the roadway so to accommodate the pedestrian. Parking lots in this area have a tendency of being less defined, especially in the northern section of the zone. During one of the physical visits to the site, a vehicle was parked in the sidewalk's path most likely because the boundary for the walk and lot was clearly undefined. Despite this, this zone has a lot to offer. There are desirable destinations, such as restaurants, specialized grocery, and historic park. The increase amount of vegetation develops the rural atmosphere in an urban setting, and there are plenty of room to accommodate wider walks, buffers, and other elements of a complete street.

The Automobile Oriented Retail Zone is entirely contemporary development. There are a many sought-after destinations and services provided in this area. However, the distance between these facilities have increased to make room for the surrounding parking lots. The land use is more specialized and consists of mostly restaurants, goods distribution, and other public services. On the other hand, this does leave room for improvement as empty space could be revamped to include mix-use facilities and trails and other smart growth development. Speeds have increased 10 miles per hour in the transitional zone and remain at 35 miles per hour in this zone. However, the major difference in this zone is the structures and lots are setback further from the street. This creates the illusion that the street is wider and more dominant in this zone than in the other zones. Along with the lack of sidewalks, buffers, access control, and high traffic noise, this zone can be very intimidating for a pedestrian. This zone also does not have any lighted or marked cross walk, which makes crossing Division Street very dangerous.

PROJECT BOUNDARY EXISTING CONDITIONS





Guidelines. The use of external guidelines will assist in the design of the streets for Guthrie, Oklahoma. These resources will include the National Complete Street Coalition, the American Public Transportation Association, American Association of Retired Person (AARP), Urban Street Design Guidelines (USDG), and The Alliance for Biking and Walking. From these resources, guidance will be taken into consideration of how to create streets that are available to multi-users. Some of the concepts from these resources that will be implemented into the completed design will be bike lanes, street buffers, traffic calming measures, and safer pedestrian crossings. Both qualitative and quantitative methods will be used in accordance to how they correlate with existing or expected conditions.

The National Complete Street Coalition has created the "Elements of an Ideal Complete Streets Policy" from which a check list is created to ensure a successful design. The following list is elements most relevant to Guthrie's complete street design:

- Includes a vision for how and why the community wants to complete its streets.
- · Specifies that 'all users' includes pedestrians, bicyclists and transit passengers of all ages and abilities, as well as trucks, buses, emergency vehicles, and automobiles.
- Encourages street connectivity and aims to create a comprehensive, integrated, connected network for all modes.
- Applies to both new and retrofit projects, including design, planning, maintenance, and operations, for the entire right of way.
- Makes any exceptions specific and sets a clear procedure that requires high-level approval of exceptions.
- Directs the use of the latest and best design criteria and guidelines while recognizing the need for flexibility in balancing user needs.
- Directs that Complete Streets solutions will complement the context of the community.
- Establishes performance standards with measurable outcomes.

One of the most important aspects of the final design will be a connection for the people to their community. This design must be receptive to the needs and wants of the community. Some methods that work well in another city may not be appropriate for the community of Guthrie. Another connective quality will be the link the citizens will have with every aspect the community. This plan should be able to give the user options and continuity throughout the whole section allowing each user the ability to maintain their navigation throughout the community unhampered. The last element that will be considered is the ability to connect to surrounding areas. Since only one section of the city will be concentrated on, it is important to relate to the adjacent context.

GUTHRIE'S COMPRHRENSIVE PLAN VISION: "MAINTAIN A BALANCED TRANSPORTATION SYSTEM THAT PROVIDES ALL RESIDENTS WITH SAFE AND CONVENIENT MOBILITY" (RDG, 78)

WAYS TO ACCOMPLISH A COMPLETE STREET

CONNECTION: LINK LAND USE WITH TRANSPORTATION OPTIONS SAFE PEDESTRIAN CONNECTIONS

- COMPREHENSIVE TRAIL AND LANE SYSTEM
- ACCESSIBLE/SAFE/CONVENIENT TRANSIT STOPS

SAFETY: INCREASE SAFETY AND AWARENESS BY DESIGN OF INFRASTRUCTURE

- TRAFFIC CALMING TECHNIQUES
- SAFE AND VISIBLE CROSSINGS

COMPLETE STREET EXAMPLES



TRAFFIC CALMING TECHNIQUES¹





COMPLETE STREET EXAMPLE



CHARLOTTE, NORTH CAROLINA



LAWRENCE, KANSAS³



HOLIDAY DRIVE IN NEW ORLEANS⁴



COMPLETE STREETS EXAMPLE



PORTLAND, OREGON®

PROJECT MASTER PLAN

PROJECT GOALS

- CREATE A DESIGN TO CONSTRUCT STREETS FOR ALL USERS, INCLUDING SAFE ROUTES FOR EVEN THE MOST VULNERABLE – CHILDREN, OLDER ADULTS, AND THOSE WITH DISABILITIES.
- CREATE A DESIGN THAT ALLOWS CONTINUITY BETWEEN THE THREE DISTINCT CHARACTER ZONES TO PROVIDE EACH ZONE THE SENSE OF BELONGING TO AN UNINTERRUPTED CITY.
- CREATE A DESIGN THAT WILL SERVE AS A MODEL FOR STREET DEVELOPMENT ON THE ENTIRE CITY'S MAJOR THROUGHWAYS.

The Design. With information discovered through a site inventory and analysis, research, and external guidelines, a propose design will incorporate Complete Street principles by using the suggested implications that will benefit the city and its citizens the most. Elements, such as sidewalk widths, bicycle lanes, shared-used paths, and pedestrian safe crossings, will be included and reflective of the context of the city. The main objective of the design will be to include a "common denominator" by "balancing safety and convenience for everyone using the road" (Smith, 2010).

Overall, the Complete Street design will address transportation context, urban and rural context, objectives, and most importantly, the desire for streets that satisfy the citizens' and officials' desires to have means of multiple mobility possibilities. The City of Guthrie is considered a small town, with a population of 10,191 (U.S. Census Bureau). The design will complement the trends of a smaller town's traffic density and patterns. Even though the traffic can be heavier than most rural roads, the guidelines of designing a Complete Street for rural areas will be used in certain conditions. To the addition of the city's context, the design will address objectives of the city council members and citizens. This will consist of economic stimulus, mobility advantages, and street aesthetics.

The project master plan in figure 3-1 illustrates Guthrie's complete street design. The different modes of transportation are shown to be continuous throughout the entire project boundaries. Included in this layout are proposed trolley stops. These trolley stops are space accordingly so that a pedestrian on foot does not have to travel past the ideal distance of ½ to ½ of a mile. The stops are also placed so that the passenger is dropped off at or near ideal destinations and where there is available space so to minimize cost. In addition to the trolley stops, a proposed lighted cross walk is placed in the vicinity of the stops so there are safe crossing points for pedestrians at a reasonable walking distance.

Two other design features of the plan are the proposed Water Works Building renovation and relocation of the lane transition relocation. Transportation enhancement funds could be utilized to renovate the historic Water Works Building located south of Mineral Wells Park to accommodate tourists and citizens alike. The building could contain a café with indoor/outdoor seating, a bike rental service, and a tourist center. This building would provide refreshments, mobility options, information, and a place of rest for those entering the city or for those utilizing the trails or neighboring park. Just south of the Water Works building on Division Street is where the transition between a four lanes to two lanes street should occur. This is also the boundary line between the automobile oriented character zone and the transitional character zone. In the automobile oriented character zone, the streetscape and pedestrian trails are an introduction of the city's new character. As the motorists passes into the transitional character zone, raised center medians are introduced to further enhance the traffic calming techniques to slow down the driver and to entice them to become more aware of the surroundings. By having the lane transition at the character zone boundary, it will reinforce the traffic calming methods and the intent of the design.

PROJECT MASTER PLAN

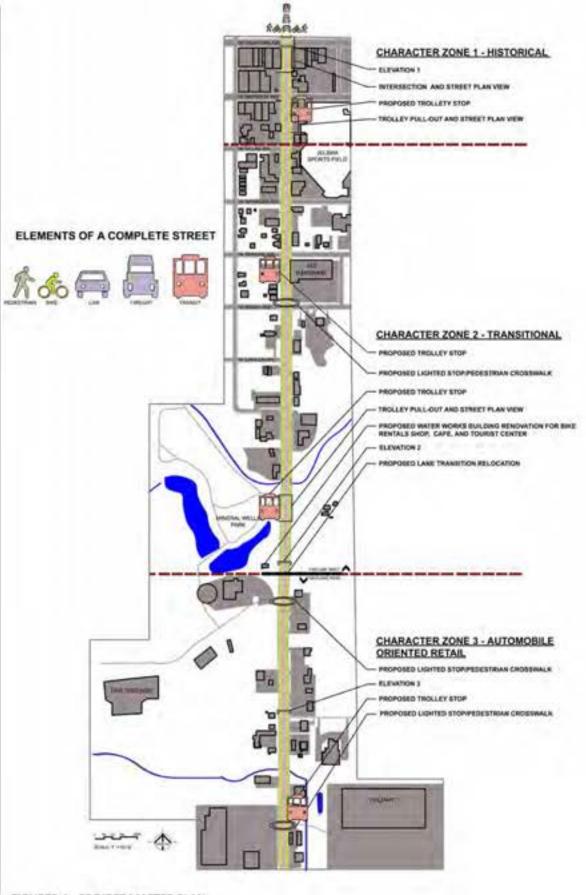
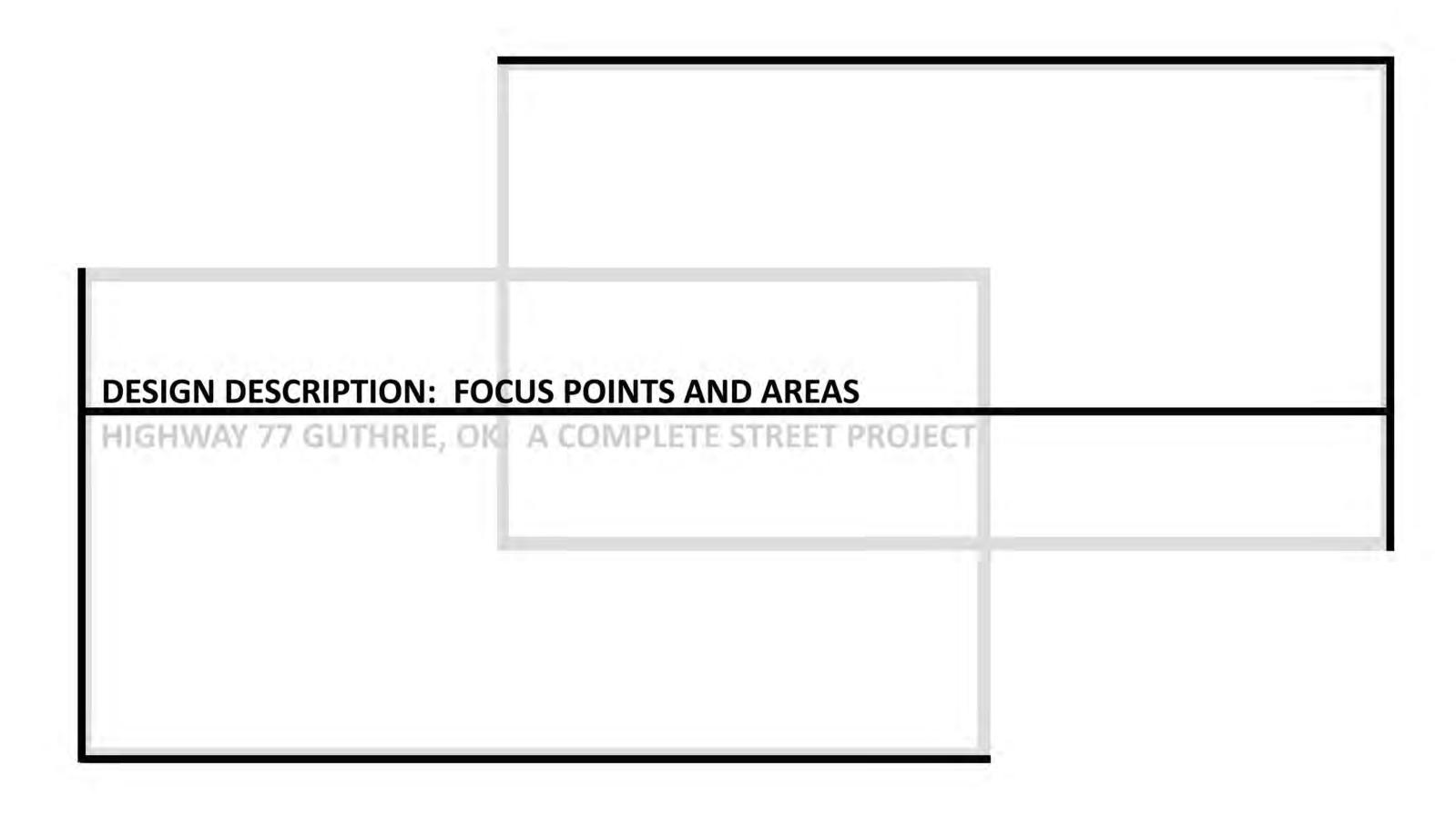
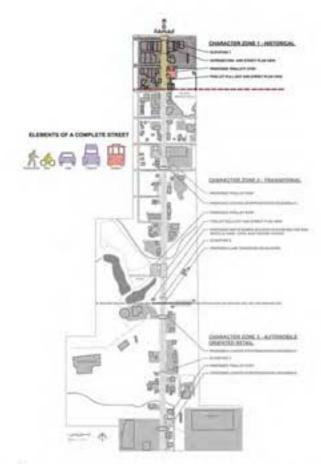


FIGURE3-1: PROJECT MASTER PLAN





Sidewalks and Intersections. The sidewalks along Oklahoma Avenue currently are made of brick pavers. This material is not continued on the sidewalks aligning Division Street. To include this historical section with the rest of the district and to notify the user they have reached the downtown area, the sidewalks in this zone will receive the same treatment. This treatment will continue throughout the crosswalks to indicate the pedestrian's right-of-way and develop the access characteristics of the intersections. To further call attention to the intersection and to make the motorists more aware of its importance, a marker will be stamped and colored into the concrete. This intersection marker will include a shape resembling the dentils found on the Victorian architecture of the downtown buildings. This will make the intersection inclusive to its surrounding context. Other features of this intersection will be the landscaped curb-bump outs. Along with creating aesthetic attributes, the bump-outs will decrease the distance of the crosswalk to forty feet. The intersections of sidewalk and alleyways will also be designed according to the pedestrian's right-of-way. To decrease the hazard of the limited view created by the buildings' and alleyway's close proximity, a raised crosswalk will be constructed to slow the motorist approaching the intersection. A sidewalk and street illuminating light will also be placed near this intersection to properly light the path for safety.

The streetscape planted in the sidewalks and curb bump-outs will enclose the street to create a sense of place, to buffer pedestrians from traffic, and to produce a more pleasing atmosphere. The streetscape will be a common dominator throughout all zones to create a connection and to define the limits of the roadway. The definition of the roadway will also create a sense of safety for pedestrians because they will not feel exposed to the oncoming traffic. Beyond the characteristics, the streetscape will create shade in the hot summer months and soften the hard lines of the structures.

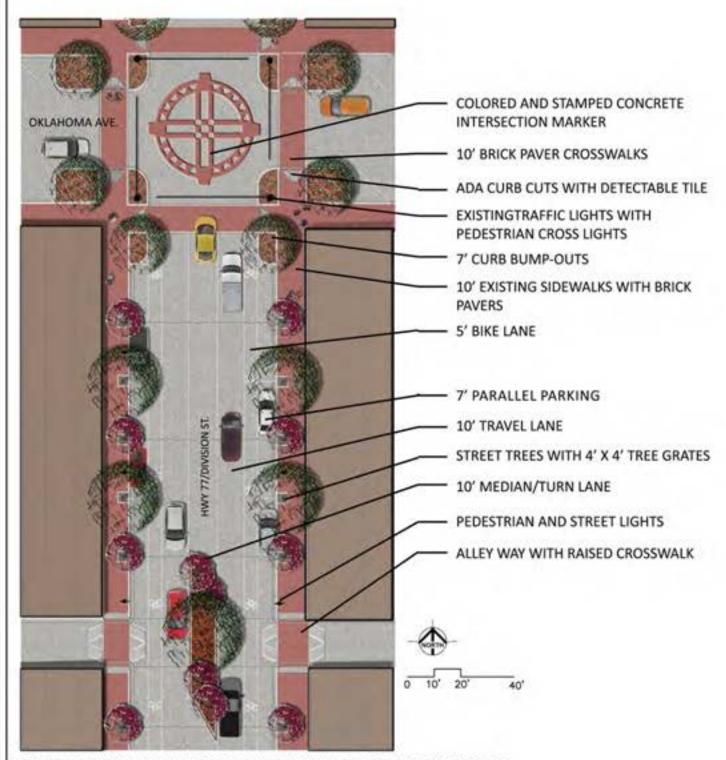
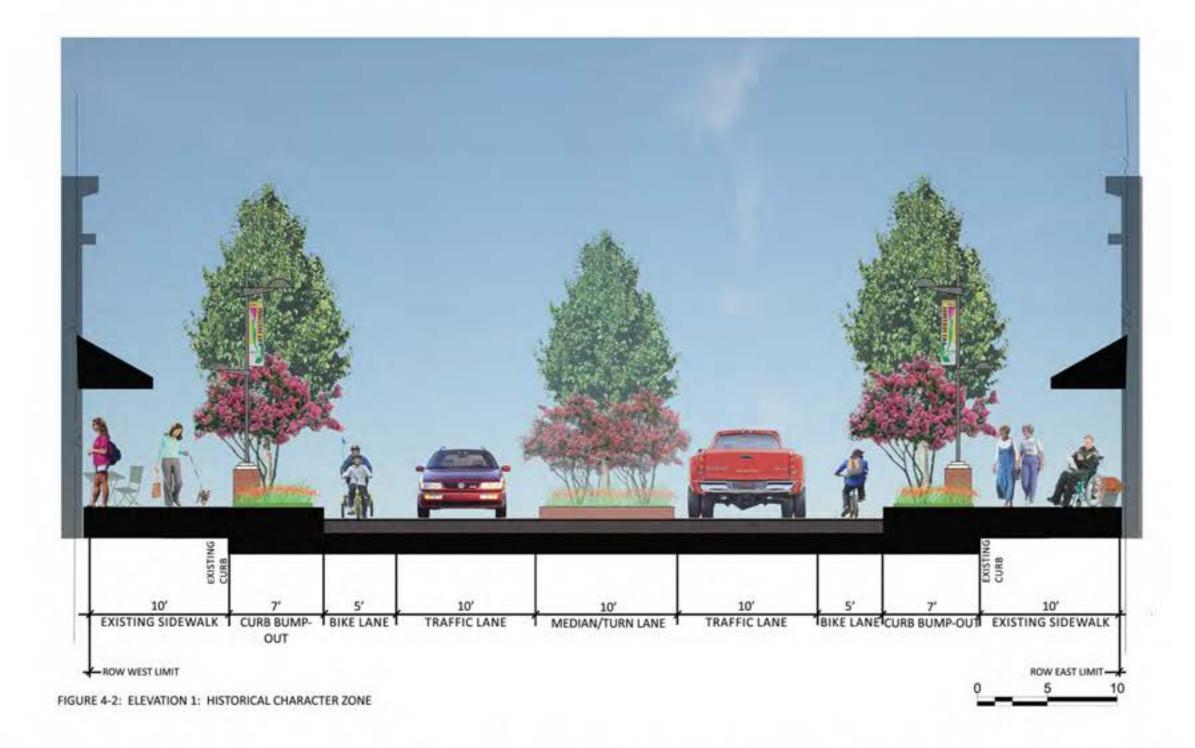


FIGURE 4-1: HISTORICAL CHARACTER ZONE PLAN VIEW: STREET AND INTERSECTION

HISTORICAL CHARACTER ZONE DESIGN



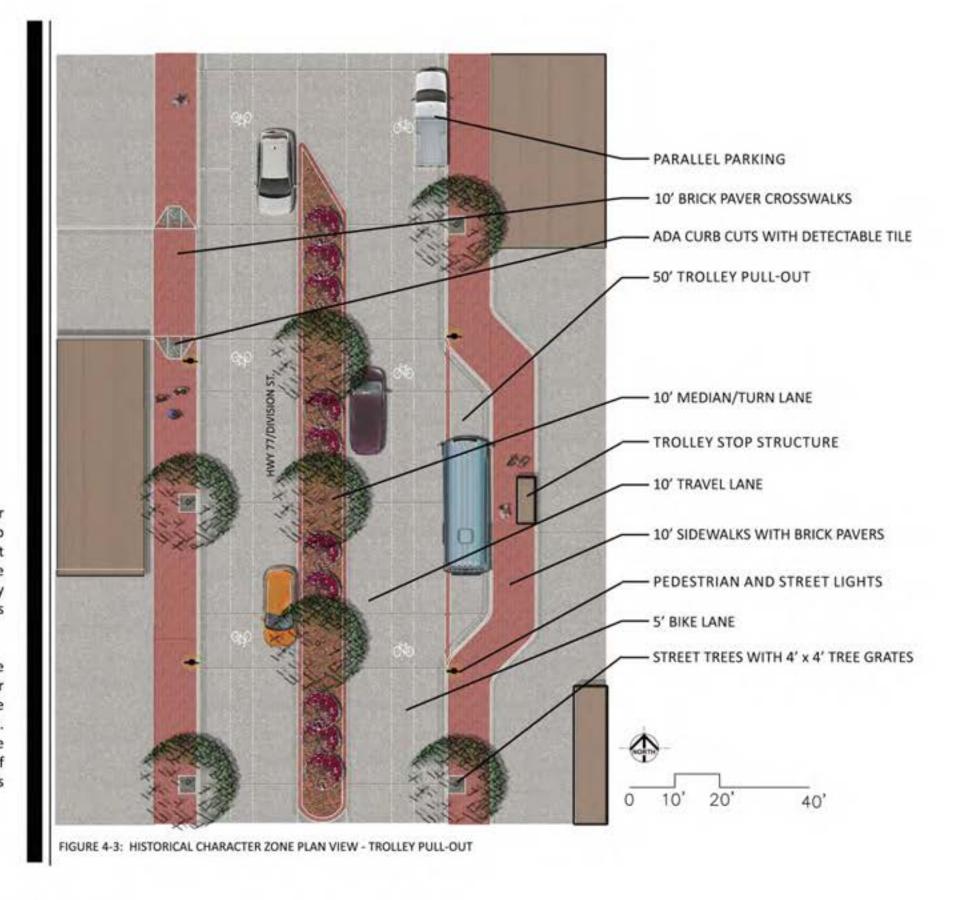
Street. The traffic lanes in this zone will be reduced from the varying width up to fifteen feet to be a constant width of ten feet. The remaining five feet will become a bike lane. Since the traffic speeds are slower in this zone and the sidewalks should remain a path for those on foot to enjoy outdoor seating, window shopping, or other downtown activities, the bike lanes would function more properly in the roadway. The turning lanes will also remain, but will also be reduce to ten feet. The empty space in between the turning lanes will be converted into raised center medians to perform as traffic calming mechanisms to ensure slower speeds are adhered to. The center medians will contain planted beds to increase the character of the zone and define the limits of the street. Along with the limited lane widths, the motorists will not feel the option to drive beyond the speed limits to make this zone a safer place for all that use the road.

HISTORICAL CHARACTER ZONE DESIGN



Trolley Pull-out. Trolley pull-outs are designed to create a safe zone for passenger loading and to "minimize impacts on traffic flows" caused by trolley stops (Bus Stop Specification Guidelines). The space allotted for on-street parking around the pull-out will be designated for adequate exiting and reentering space for the trolley to increase safety and flow. A "minimum fifty foot clear zone" around the stop will increase visibility and a transparent bus shelter placed on the far side of sidewalk will increase awareness and safety of the transit riders (Bus Stop Specification Guidelines).

The historic trolley pull-out will be near Jelsma Sports Field. The space required for the pull-out will be taken from a large undefined parking area that has no access control or definition. Along with the sidewalk, the adjacent parking lot boundaries will become more defined and decrease the possibility of strayed parked vehicles blocking sidewalk. The pull-out is placed on the eastern side of Division Street so that it is on the far side of the alleyway intersection. With the center median preventing left hand turns out of the alleyway onto Division Street, these design elements will eliminate possible conflicts and increase the efficiency of the trolley system.



HISTORICAL CHARACTER ZONE DESIGN



Trolley Pull-out. The transitional trolley pull-out will adhered to the same design guidelines explained in the historic pull-out on page 26. The differences occuring at the pull-out shown in figure 4-4 will be the characteristic of the streetscape and landscape around the trolley stop and structure. This stop will be adjacent to Mineral Wells Park, so the landscape will develop the park-like atmosphere of the surrounding context. The vegetation around the fifty foot pull-out should be placed so not to obscure the view of incoming and outgoing trolley, especially since this stop does not have space created by on-street parking. Also, passengers have a larger landing pad because the trolley structure can be placed off the pedestrian and bike trail. This will allow enough room for passage of bicyclists and pedestrians along with the loading and unloading passengers of the trolley. The shared trail in this zone will be lined with a brick paver to create a transition from the walks that are brick paver in the historical character zone.

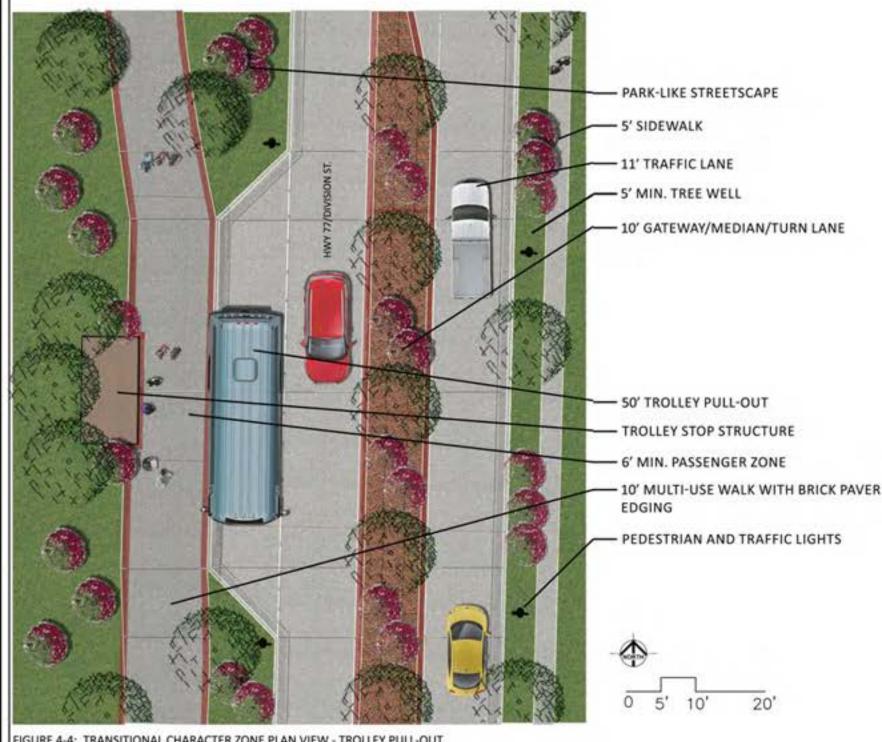
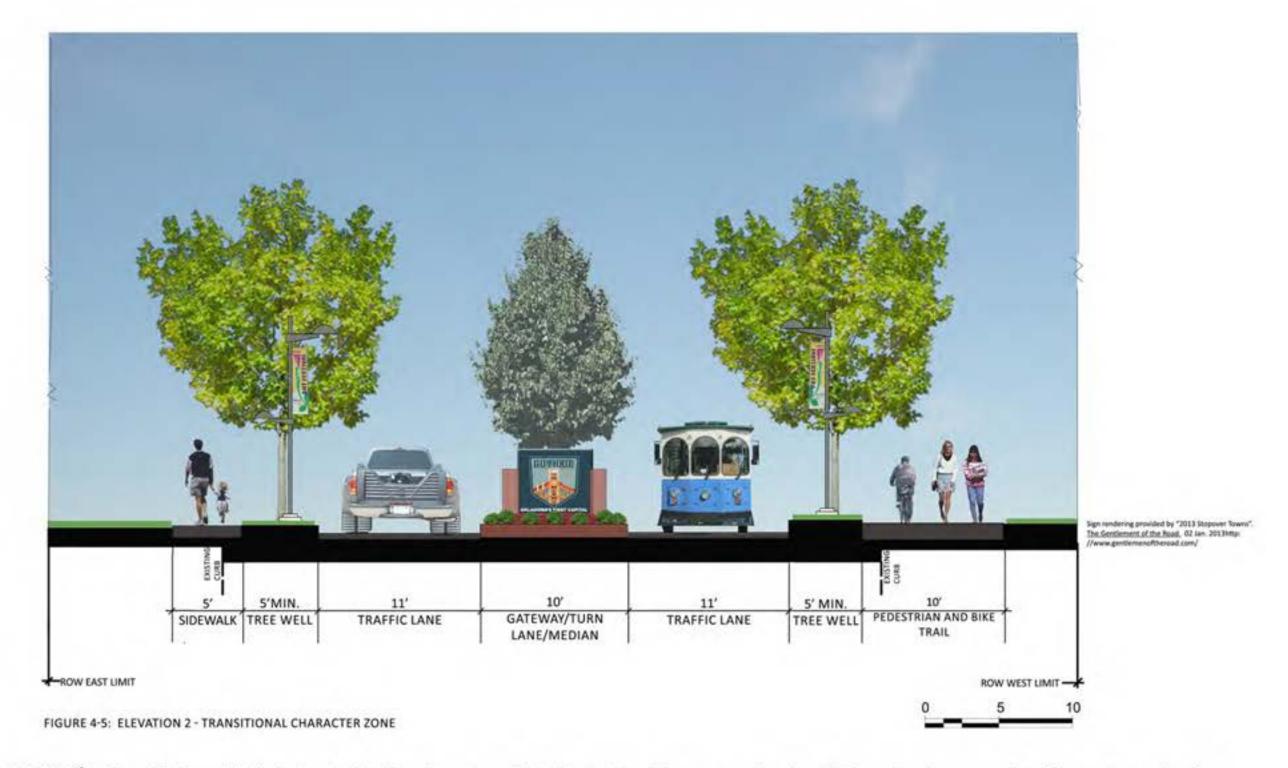


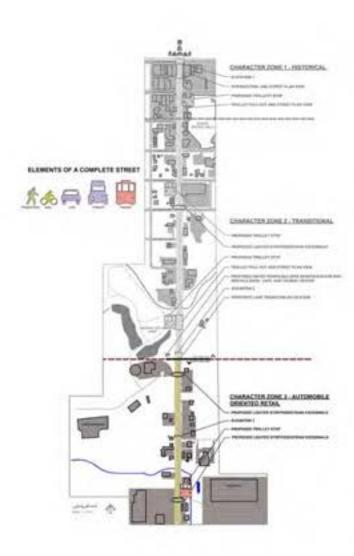
FIGURE 4-4: TRANSITIONAL CHARACTER ZONE PLAN VIEW - TROLLEY PULL-OUT

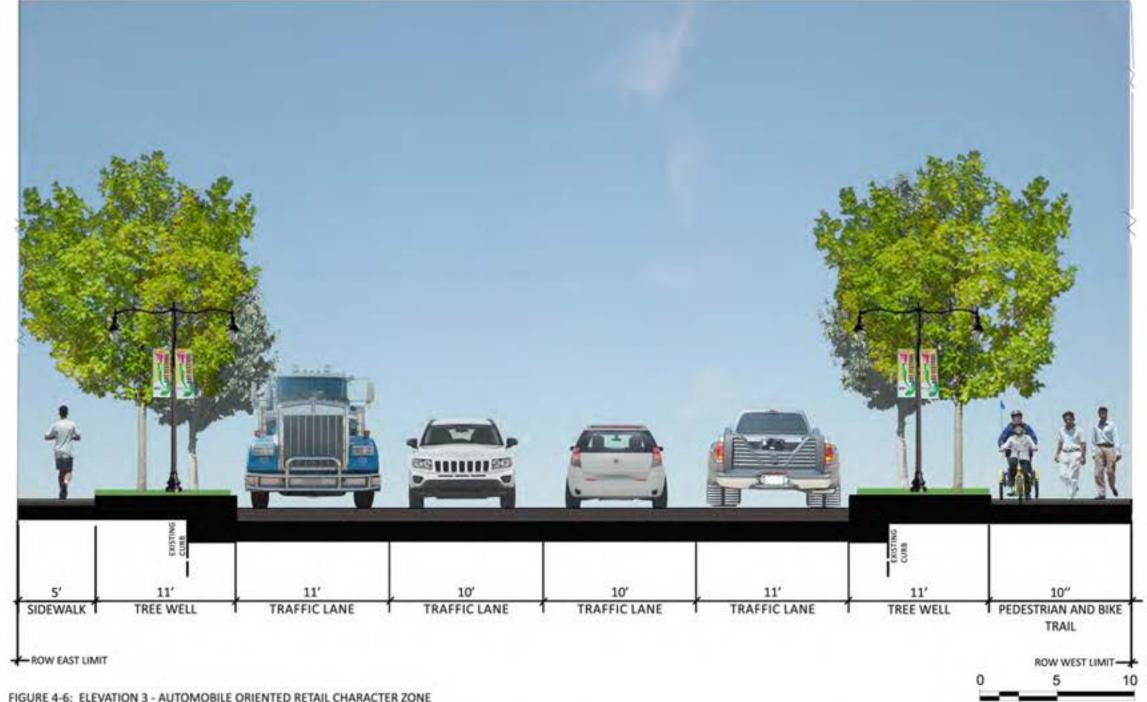
TRANSITIONAL CHARACTER ZONE DESCRIPTION



Street and Mix-Use Trails. The traffic lanes still include directional traffic and a turning traffic in the transitional character zone, but the traffic lanes have increase to eleven feet to accommodate for the increase speed limit. There will still be a raised center median to include landscape to define the street. A welcome sign will be placed within the median to make it more visible to passing traffic. Oklahoma Department of Transportation approval will dictate the sign design and placing, which may differ the sign's appearance greatly from what is seen in figure 4-5. The streetscape in this zone will remain the defining boundaries of the street, create a buffer zone between pedestrian and vehicle, and create a more acceptable atmosphere along the trail. The pedestrian trails will differ on each side of the street. On the west side of the street, cyclists and pedestrians will share a ten foot trail. Since speeds have increased and the surrounding context is becoming more open, the bicyclists would be safer off the road and would not have to compete with traffic. On the east side of the street, a five foot sidewalk would accommodate the pedestrian so they could reach desired destinations that fall between crosswalks.

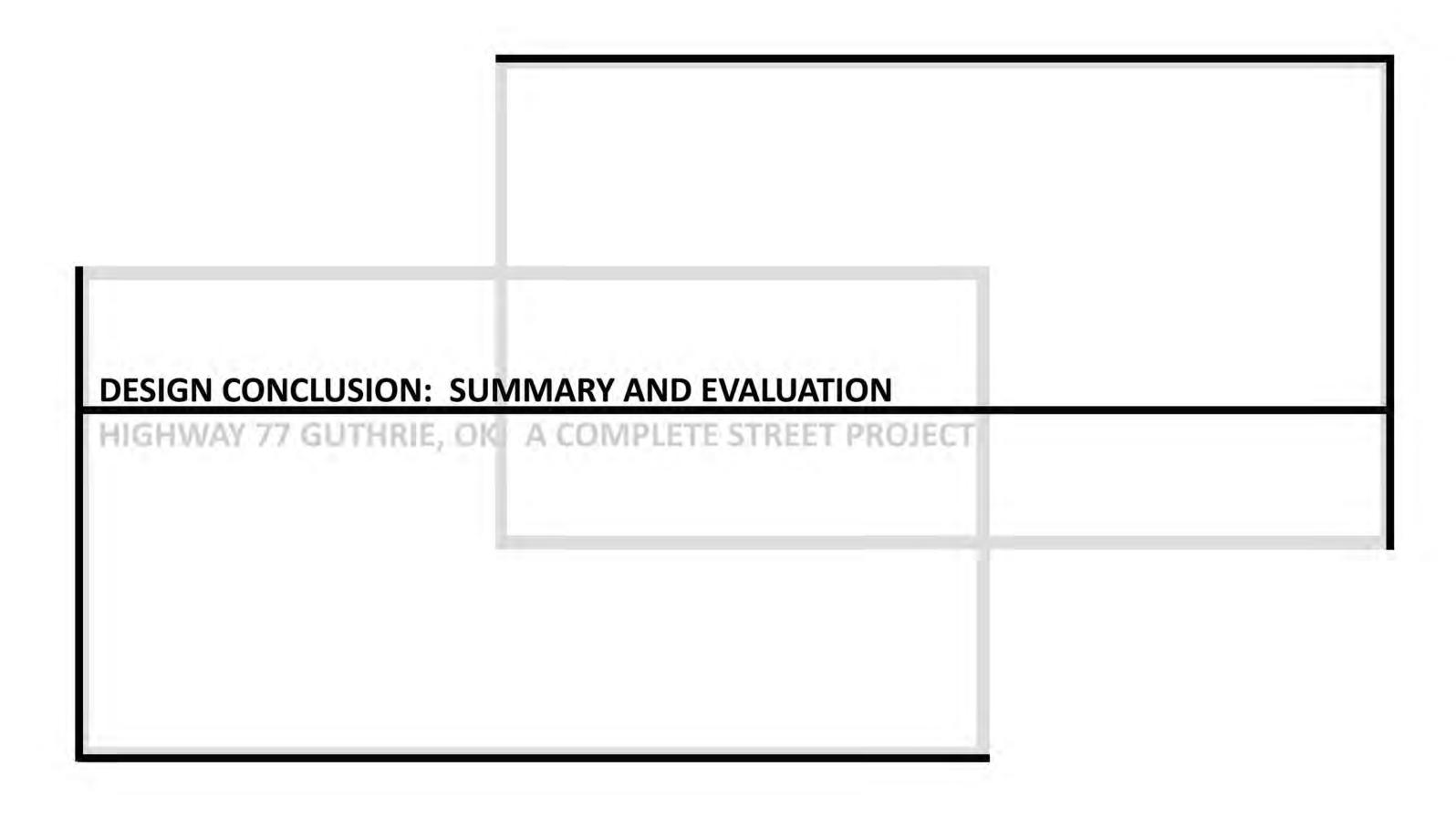
TRANSITIONAL CHARACTER ZONE DESIGN





Street and Mix-Use Trails. The automobile oriented retail character zone is an introduction into what the city has to offer. The streetscape lining the street will be more formal than in the transitional character zone but will still be the common element that runs throughout the entire project. The vegetation will serve as boundaries to the street and give the pedestrian a sense of protection. The street has four lanes and only the outer lanes will be at eleven feet to accommodate for the higher speeds. The inner lanes will be at ten feet to entice the motorists to not exceed the speed limits. The trail along the west side of the street will remain the shared pedestrian and bike trail and the sidewalk along the east side of the street will be kept at five feet to accommodate the destinations on this side.

AUTOMOBILE ORIENTED RETAIL CHARACTER ZONE DESCRIPTION



Project Goals. To understand if the design is successful, an evaluation of the project goals will reveal measurable outcomes.

1. Create a design to construct streets for all users, including safe routes for even the most vulnerable – children, older adults, and those with disabilities.

The elements of a complete street seen in figure 5-1 illustrate the continuous nature of access for each user; pedestrian, bicyclists, and motorists. Their unhampered navigation is determined by complete and uninterrupted corridors throughout the entire site. Detail was placed on the throughways' design to ensure that each user has a designated and adequate route to travel. Bike lanes, sidewalks, and shared trails were designed at a proper width and logical placement to ensure accommodation with traffic lanes. Transit riders were also included in this thought process by ensuring transits stops were safe and efficient by designing pull-outs and reasonable stop spacing

This design also set out to create safe routes for the most vulnerable. ADA standards were met at every sidewalks and crosswalk. Sidewalk widths are more than accommodating to handle any user and curb cuts with detectable tile ensure that any pedestrians' safety is priority. Also, measures such as traffic calming techniques and decrease traffic lanes increase the motorists' awareness and to stabilize the speeds of traffic. These measures have been revealed in studies conducted by the Department of Transportation to decrease injuries and fatalities of those most susceptible to automobile and pedestrian accidents, therefore, creating a safer atmosphere for these users (Traffic Safety Facts, 2010).

2. Create a design that allows continuity between the three distinct character zones to provide each zone the sense of belonging to uninterrupted city.

The streetscape vegetation is one of the constant themes throughout the entire design. The repetition of street trees lining the edges of the street defines street's boundaries and character. Beforehand, the structures and their urban form were the major defining features of the character zones. With the addition of a common dominator, the differences between the character zones can be tied together by an element of consistency.

The sidewalks and shared trails will also be a constant element throughout the design. Even though the user may adjust throughout the character zones, the reliability of a ten foot wide path along the street establishes the usability of each zone. The character of the paths created by design features such as material and accessibility also continues a common atmosphere through the changing context.

3. Create a design that will serve as a model for street development on the entire city's major throughways.

Since the project boundaries include three different character zones that are commonly found through Guthrie, the possibility of incorporating the design guidelines throughout the entire city is more likely. The other major arterial in Guthrie is US Highway 33 and this route also includes both traditional and contemporary development. However, further analysis of this roadway would determine if all standards could be met according to right-a-ways, surrounding context and other existing conditions.

Improvement of Mobility and Community. One of complete street agenda's is to improve mobility and the community for all users. With the inclusion of continuous user routes for pedestrians, bicyclists, and transit riders would complete improvement for the existing infrastructure. Existing sidewalks within the project boundary are for the most part in need of improvement. There are no noticeable bike routes and the transit system is not accommodating to all users. However what is currently evident within the boundary is the street is mostly accommodating only to the automobile. With this plan, all users can now be inclusive to the community and the project boundary's context.

Economic Feasibility. The major downfall of this design is the economic feasibility of all of the design elements. Ten foot wide sidewalks lined with a brick pavers or raised crosswalks can become very expensive and appropriate funds may not be available to smaller communities such as Guthrie. Despite this, the basic principles of the design can still be achieved through budget evaluation and design specification. An example could be discovered in the historic character zone. The width of the street currently has ample room to accommodate proposed traffic lanes and bike lanes. A technique as simple as repainting of lane markers to the design's placement would create a shared transportation system in this district.

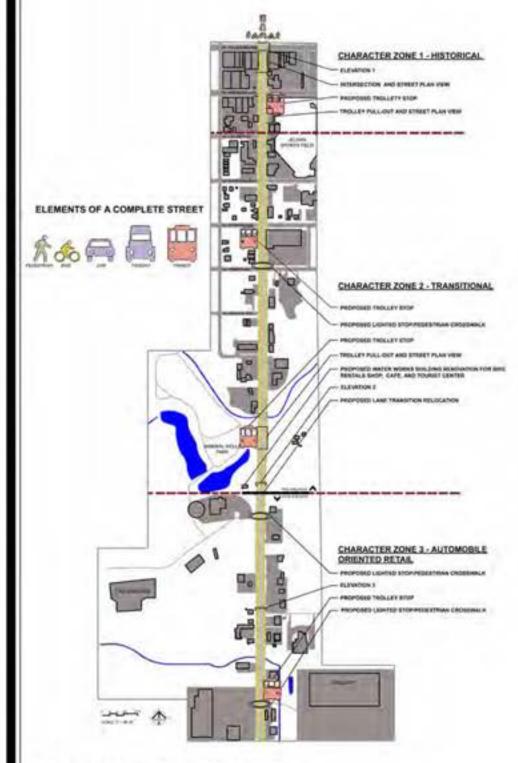
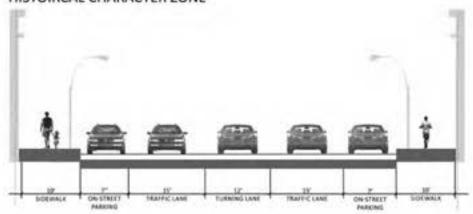


FIGURE 5-1: PROJECT MASTER PLAN REVISTED

EVALUATION

HISTOIRCAL CHARACTER ZONE



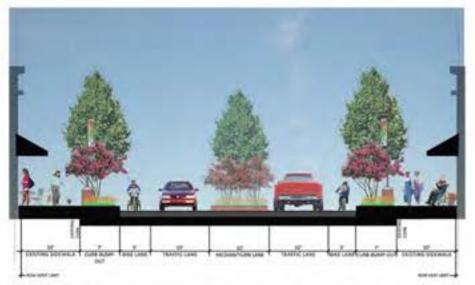
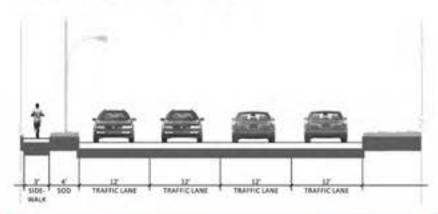


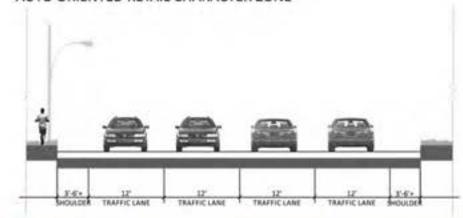
FIGURE 5-2: STREET CHARACTER AND CONDITIONS COMPARISON

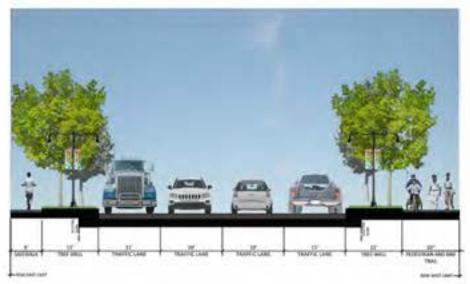
TRANSITIONAL CHARACTER ZONE





AUTO ORIENTED RETAIL CHARACTER ZONE





Values Derived From Design. The figure 5-2 above depicts the change the street will experience through the design and the value derived from the design. Instead of a street dominated by the automobile, the streets will be an inclusive setting that accommodates a variety of users with the ability to choose their desired mode of transportation. This also creates a level of increased visibility as users are able to be seen outside of their encompassing vehicles. The harshness of the existing environment will similarly be softened by the surrounding streetscape by breaking the hard lines of the urban form and will create a more desirable climate underneath its canopy. With all these elements, a character develops for the city that cannot be found in an automobile oriented system. A street that includes the many elements of a complete street is more visibly defining than a street full of vehicles. With this design, a street can be defined as an inclusive, community oriented element that is a part of the city and its context.

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