Refection on Integrating Landscape Performance in 2nd Year BLA Studio – Design Process

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May 2015

Background

The course of Landscape Architecture Design Process, a 2nd year BLA design studio (4 credits), was offered in Spring 2015 at Texas Tech University. In addition to walking students through the typical landscape design process (programming, site inventory & analysis, conceptual design, design development, construction documentation, and implementation), this course integrated landscape performance measurement into the design process with the purpose of making it an essential step in design process. Introduced to landscape performance at the early stage of their landscape study, students are expected to have a seed planted in their minds. As time goes by, students' knowledge of landscape performance and quantification skills will keep growing and developing through continuous learning and practice in following education and practice. As a result, landscape performance quantification becomes a routine in the field of landscape architecture.

The course met twice a week for 16 weeks. Each class included a 1-hr lecture and a 3-hr studio. Totally, 17 undergraduate students registered for the course and all earned passing grades. According to the pre-test at the beginning of the semester, no student was familiar with landscape performance.

Goals

In addition to helping students develop an ability of implementing design process into design projects, this course also helps students

- understand the concept and demand for landscape performance
- understand the key steps of landscape performance quantification and how they can be integrated into the typical design process
- identify resources for landscape performance (Landscape Performance Series: CSI program, landscape performance case study and Benefits Toolkit)
- develop an ability of applying different tools and methods to estimate landscape performance of their designs

Process

Students were introduced to landscape performance through a mix of lectures and exercises. At the beginning of the semester (2nd week), Arianna Koudounas, the Landscape Architecture Foundation (LAF) program manager, conducted a webinar to present an overview of LAF, Landscape Performance Series (LPS), and the Case Study Investigation (CSI) program. Later on, I delivered a series of lectures covering the following topics:

- Evidence-based design & landscape performance
- Comparison of LEED-ND, SITES AND LPS
- Landscape performance (definition & framework)
- CSI & landscape performance case studies
- The process of landscape performance quantification, and
- The existing resources of the LAF website

To strengthen and test knowledge that students learned from the lectures, three exercises were assigned to them during the semester. The first assignment was "Landscape Performance Case Study Report". The purpose of this exercise was to familiarize students with the LPS website and help them learn the relationship and differences between sustainable features and performance benefits. The exercise required each student to study a published landscape performance case to identify sustainable features and performance benefits, and link performance benefits with related sustainable features.

The second exercise was "Benefits Toolkit Peer Teaching." The purpose of this exercise was to familiarize students with LAF'S Benefits Toolkit and enable them to use the tools to evaluate their term projects. It required every two students to select a tool from LAF Benefits Toolkit to study and later on, disseminate the knowledge they mastered to other students. Totally, nine tools were studied, including "Sub-surface Drip Irrigation Cost Calculator", "Recycling Landscape Waste Calculator", "National Stormwater Calculator", "Green roof energy", "i-Tree Streets", "The Value of Green Infrastructure", "Decking Cost Calculator", "Vegetable Garden Value Calculator", and "Resource Conserving Landscaping Cost Calculator".

The last exercise required students to use tools learned from the "Benefits Toolkit Peer Teaching" to estimate performance benefits of their term projects. The purpose of this exercise was to thoroughly test students' understanding of landscape performance and their ability of quantify performance benefits.

Results

Exercises & Exam

Students' learning outcomes were assessed by a term exam, the "Landscape Performance Case Study Report" and the term project benefit estimation. The results

showed that at the end of the semester, all students obtained a good comprehension of landscape performance concept and were acquainted with the LPS website and its resources. Most peer-teaching presentations were well organized and informative, while a few did not include examples to show how the tools can be used. In terms of using tools to estimate performance benefits, most students demonstrated an ability of using various tools to quantify performance benefits of their designs. However, about 1/3 of the students used only the "National Tree Benefit Calculator (NTBC)" or NTBC together with the tools they selected to study, indicating limited confidence in other quantification tools.

Student reflection

At the end of the semester, a voluntary anonymous questionnaire about the course was provided to every student. In the questionnaire, three questions were about landscape performance. 15 out of 17 students responded to the questionnaire. The result showed all 15 students agreed or strongly agreed that "landscape performance is important for the major of landscape architecture;" 11 students agreed or strongly agreed that "landscape performance should be included in BLA curriculum," while 4 students felt neutral about it; and 13 students expressed that "they are very likely to use LPS Benefits Toolkit to evaluate their designs in future study and career", while 2 students felt neutral about it.

Lessons Learned and Future Improvement

As mentioned above, in the term project, despite various tools taught in the peer-teaching presentations, 1/3 of the students used only the tools they studied. I believe several reasons might contribute to this result. First, some peer-teaching presentations did not include examples to help audience learn how to use the tools to evaluate design projects. Second, all peer-teaching presentations were before the spring break. Some students forgot how to use the tools at the end of the semester. Third, in the last week, students were very busy with renderings and final presentations. There was not enough time for them to quantify performance benefits.

In the future, I will require peer-teaching presentations to include an example to show how to use the tools to evaluate design projects. Also, I will work with each peer-teaching team to prepare an exercise for the class to practice the tools. Moreover, rescheduling peer-teaching presentations to the second half of the semester and moving up due date of all drawings to a week before the last week might also improve performance benefit quantification.

Another noticeable problem was that many students seemed still confused with SITES and LPS. In my future teaching of this course, I will try to further clarify the two concepts through lectures and exercise.

Department of Landscape Architecture
College of Agricultural Sciences & Natural Resources
Texas Tech University
Spring 2015

LARC 2402 : Design Process (4 credit hours)

Class Time	Lecture:	T& Th	9:00 – 9:50 am	FORL 112
	Studio:	T& Th	10:00am – 12:50 pm	Pavilion

Instructor

Yi Luo, PhD, PLA
Office Hours: 1:45-2:45 pm Tuesday
or by appointment
Office: PSS 153
Email: yi.luo@ttu.edu (Best)
Phone: 806.834.5873

I. COURSE DESCRIPTION

LARC 2402 is the second design course in the LARC sequence. It will reinforce the elements and principles of design while introducing how site data collection and analysis, and landscape performance evaluation fits into the overall design process. Understanding these elements and their relationship with the design process will help designers in understanding the environmental fit of the program to the site constraints and opportunities, promote evidence-based sustainable design practices, and help integrate baseline data collection and landscape performance evaluation a routine of design practices.

In this course we will have a series of small exercises together with one term design project which will deal with visual and physical connections among the various parts of a site. The specific theme for this semester is enhancing the measurable sustainability of the urban landscape.

II. COURSE OBJECTIVES

Upon completion of this course, each student with a passing grade will:

1. Demonstrate an ability to implement a design process into design projects.
2. Understand the concept of evidence-based design and the value of empirical evidence in informing future designs.
3. Demonstrate an ability to conduct evidence-based design.
4. Understand the concept and demand for landscape performance quantification
5. Understand the key steps of landscape performance quantification and how they can be integrated into the typical design process.
6. Be able to identify resources for landscape performance quantification tools and methods.

7. Demonstrate an ability to apply different tools and methods to estimate landscape performance of his/her designs.

III. COURSE CONDUCT

This course will involve a series of lectures, assignments, in-class exercises, exams, projects, and field trips. Projects will be handled as if it might be by a design firm. When possible, a Service Learning component or project will be incorporated into the class. Team work and independent work might be anticipated at different phases of a project.

A number of lectures will be given during the first hour of the class in FORL112 to cover different design issues at different project phases. Students are encouraged to ask questions or share information at any time during the lecture. The rest of the class will be devoted to applying knowledge learned from the lectures to in-class exercises or the term project.

Blackboard will be used for message, course materials, posting and submitting assignments, and grades. You are recommended to log onto Blackboard daily to follow instructions.

IV. POLICIES

A. Attendance:

Attendance at all class sessions is mandatory unless prior arrangements have been made with the instructor. Absences or late submission due to health-related problems, emergency situations, or mandatory participating activities approved by university policy (such as religious observance) may be excused if written verification is submitted to the instructor prior to the event if it is planned, or within in 1 week of absence if it is an emergency. Students are responsible for all work missed. Students are expected to arrive at each class on time, be prepared in advance by completing the assigned research and design tasks. Being late for three times is considered an absence. Absence records include both lecture and studios will be used in the determination of final grades.

2 absences:	no penalty
3-4 absences:	5 pts. off FINAL GRADE
5-6 absences:	10 pts. off FINAL GRADE
7-8 absences:	20 pts. off FINAL GRADE
9+ absences:	automatic failure in the course

Note: Missing both the lecture and studio time will count as 2 absences.

B. Due dates:

Due dates will be established by the instructor at the outset of each project. The landscape Architecture Program policy will be maintained.

Late work: 5 points per calendar day will be deducted from late projects (including weekends).

C. Studio Performance:
Students are expected to be fully engaged in course work during studio period. Each student is expected to review his/her process with the instructor at least twice weekly. However, studio hours alone will not be sufficient to complete the assigned work. You are expected to spend a minimum of one additional hour of work for each hour spent in the studio to complete assigned work satisfactorily.

D. Civility in the Classroom:
Students are expected to help maintain a classroom environment that is conducive to learning. In order to assure that all students have an opportunity to gain from time spent in class, unless otherwise approved by the instructor, students are prohibited from engaging in any other form of distraction, such as using cellular phones, text messaging devices, pagers or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a request to leave class. Additional information can be found in the TTU publication "Student Handbook, 2014/2015" and "Civility in the Classroom" posted on the TTU web site.

E. Academic Integrity:
It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. Any indication of possible cheating, plagiarism or other academic misconduct will be referred to the Committee on Academic Misconduct. Additional information can be found in the TTU publication "Integrity Matters" on the TTU website. " posted on the TTU web site.

F. Retention of Work:
All submitted work becomes the property of the Department of Landscape Architecture and may be retained for display, teaching resources, public display, and publication purpose.

G. Students with Disabilities:
Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office at 335 West Hall or 806-742-2405

VI. CRITERIA FOR EVALUATING STUDENT PERFORMANCE
Evaluation of student progress will be based on individual participation in the studio, interaction with counterparts on design teams, the active search for design information and design solutions, the quality of design solutions, and the quality of research reporting, design communication, and presentation drawings. All work will be weighted by the number of class days devoted to that activity with the final overall calculation of components as follows:

Exercises, assignments, quizzes, and exams	35%
Term design project and landscape performance benefit estimation	55%
Instructor assessment	10%
Total	**100%**

90-100	**A**	Outstanding/Excellent Performance
80-89	**B**	Above Average Performance
70-79	**C**	Average Performance
60-69	**D**	Marginal Performance
59 or less	**F**	Failing Performance

V. REQUIRED TEXTS

LaGro JA (2007). Site Analysis: A Contextual Approach to Sustainable Land Planning and Site Design. John Wiley & Sons, Inc.: Hoboken, N.J.

VI. RECOMMENDED TEXTS

Adams, Michelle (2011), High Performance Landscape Guidelines: 21st Century Parks for NY, Design Trust for Public Space.

ASLA Designing Our Future: Sustainable Landscapes. http://www.asla.org/sustainablelandscapes/index.html

Dramstad, W. E., Olson, J. D., and Forman, R. T. T. 1996. Landscape ecology principles in landscape architecture and land-use planning. Covela, CA.: Island Press.

Landscape Architecture Foundation Benefits Toolkit. https://lafoundation.org/research/landscape-performance-series/toolkit/

Landscape Architecture Foundation Landscape Performance Series. http://lafoundation.org/research/landscape-performance-series/

Li, M.-H., Dvorak, B., Luo, Y., & Baumgarten, M. (2013). Landscape Performance: Quantified Benefits and Lessons Learned from a Treatment Wetland System and Naturalized Landscapes. Landscape Architecture Frontiers, 1(4), 60-73.

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McHarg I (1992). Design with Nature. New York: John Wiley and Sons, Inc. 25th anniversary edition.

Reid, Grant (Sept. 2002), Landscape Graphics, Revised Edition, Watson-Guptill Publications.
Sustainable Sites Initiative. http://www.sustainablesites.org/

Whyte, W. H. 1980. Social life of small urban spaces. Washington, D. C.: The Conservation Foundation.

Benefits Toolkit Peer-Teaching Guideline and Schedule

For this assignment, you will work in team of two to select a tool from the Benefits Toolkit on the Landscape Performance Series website (http://landscapeperformance.org/benefits-toolkit) to study and prepare a 10 minutes presentation to teach your classmates about the tools.

The presentations should address at least the following questions:

1. Who designed the tool? When was it designed?
2. In what situation can we use the tool?
3. What are the requirements of the tool? (software, computer system, device, etc.)
4. How to use the tool? (You can consider using an on-campus example to show us how it works)
5. What are the limitations of the tool?

SCHEDULE

DATE	TOOL	PRESENTERS
2/10	Sub-surface Drip Irrigation Cost Calculator	
2/17	Recycling Landscape Waste Calculator	
2/19	National Stormwater Calculator	
2/24	Green roof energy	
2/26	i-Tree Streets	
3/3	The Value of Green Infrastructure	
3/5	Decking Cost Calculator	
3/10	Vegetable Garden Value Calculator	
3/12	Resource Conserving Landscaping Cost Calculator	

In Class Exercise: Landscape Performance Case Study

Due Jan. 29, 12:50pm

The purpose of this exercise is to familiarize you with the Landscape Performance Series website, and help you understand the relationship between sustainable features and performance benefits. Further you will learn some methods and tools the Case Study Investigation (CSI) research teams used to quantify landscape performance benefits.

Step

1. Explore the Landscape Performance Series website → Case Study Briefs, (http://landscapeperformance.org/case-study-briefs), and select a project you want to study.
2. Review the project and download "Method" (PDF)
3. Prepare a report:
    a. Basic info: name, location, acreage, designer, year of completion, budget.
    b. What are the challenges and solutions?
    c. What are the major lessons learned?
    d. What are the sustainable features?
    e. What performance benefits did the sustainable features create?
    f. What are the methods used to quantify each performance benefit?

Example for Questions (d-f)

- **Sustainable Feature:**
  A 50-ac constructed wetland to treat 5,000 household sewerage water
- **Performance benefit:**
    1. Reduced the use of potable water for irrigation by 121,671,400 gallons by using reclaimed water since 2009
       Method: second hand data from the designer
    2. Reduces concentration of nitrogen by 85%, phosphorous by 97%, potassium by 57%, calcium by 54%, magnesium by 52%, sodium by 85%, zinc by 7%, Copper by 93%, and manganese by 51%.
       Method: collecting water samples and sending them to water lab for quality analysis.

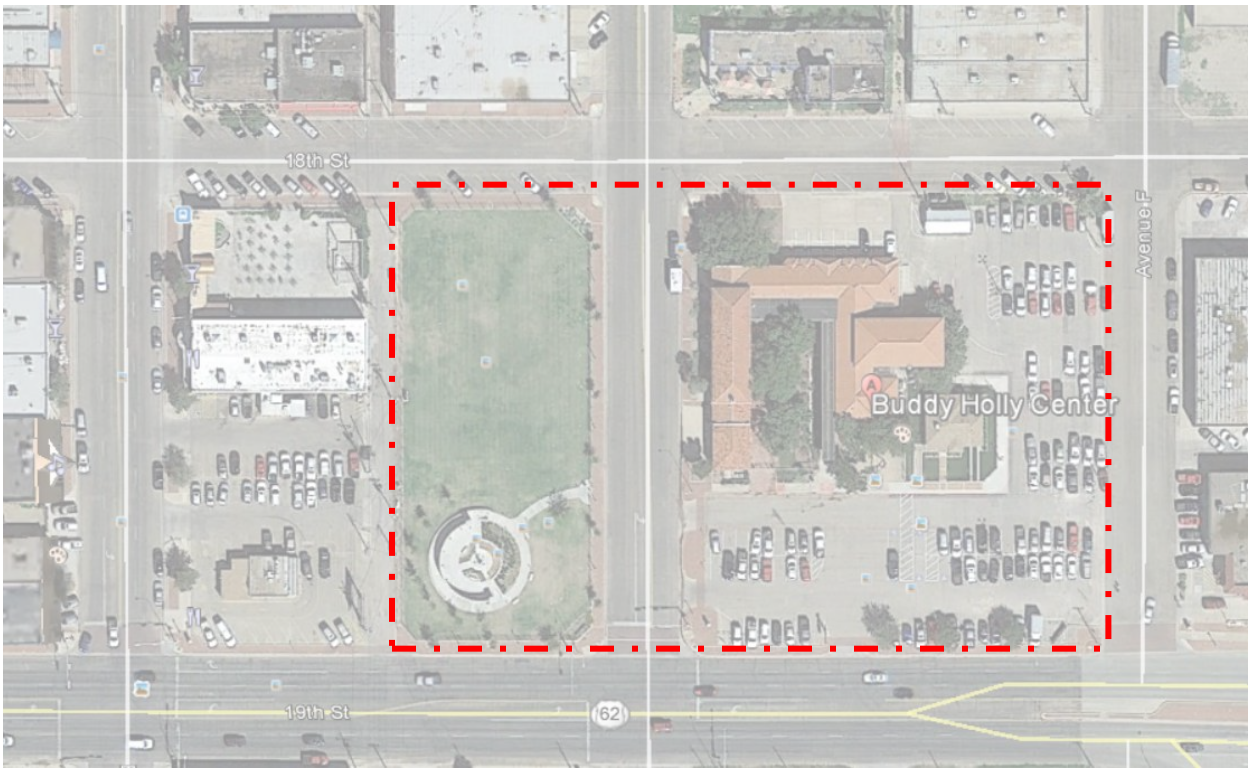
LARC 2402 S2015 Yi Luo
Department of Landscape Architecture, Texas Tech University

PROJECT MISSION STATEMENT
BUDDY HOLLY CENTER PLAZA, LUBBOCK, TX

Project Overview

The term project of this semester is to redesign the plaza and parking lot for the Buddy Holly Center in downtown Lubbock to a safe, vibrant, and sustainable public space. Buddy holly center is located between the 18th and 19th street on both sides of the Cricket Ave, as shown in the map below.

The design will follow the design process which includes programming, site inventory, site analysis, case study, conceptual design, design development and landscape performance benefit estimation. You are expected to understand various physical, ecological and cultural issues at various spatial scales. Your design decision are to be made based on evidence (through site inventory and analysis, topical research, case study, etc) and to enhance the sense of community and space.



Project Structure

This project will be carried out as both a team (6 teams) and an individual effort. The first third (February) of the project will be team work carrying out site inventory/analysis, research and case study. The second month (March) will be devoted to individual conceptual design and design developments. The last month of April will be devoted to producing final graphics, documentation and models. All members from each team should coordinate the entire process to produce a cohesive and professional final product.

General Project Goals

- Develop a design program of the space to support a variety of activities
- Improve thermal comfort
- Incorporate low impact development and sustainable development strategies
- Provide shade, seating for the plaza
- Enhance connection between the plaza and center
- Improve safety and security
- Universal accessibility
- Provide high aesthetic quality

Each team will develop its own program to include the above goals.

Site Inventory and Analysis

A comprehensive inventory and analysis of the existing site conditions are required to achieve these team-specific goals.

What to collect? (minimum requirement, you can add to it)

<u>Abiotic</u>

- Climate (temperature, wind direction/speed, precipitation, etc)
- Microclimate (sun angle, shadow, hours of sunlight, UHI, etc)
- Surface drainage
- Soil

<u>Biotic</u>

- Plant types
- Wildlife (birds, migrants, etc)

<u>Cultural</u>

- Existing building and structure on the site
- Land uses around the site (e.g. land uses within walking distance, driving distance, etc)
- Circulation system (road function, speed limit, bus, trolley, bike lane, sidewalks, crosswalks, traffic volume, parking spaces)
- History and culture (Buddy Holly, rock and roll, building, music of west Texas, etc)
- Local events (wedding, Buddy Holly's Birthday, summer concerts etc)

- Master plan of the Department of Park and Recreation
- Zoning map and code
- Noise level
- Visibility, visual quality
- Potential hazardous areas

Submission Requirements

Each Team [3-member design team] should prepare:

1. A single bound 11" x 17" report, containing all intermediate and final products for both the team and the individual work, such as inventory, analysis, case studies, design programs, design alternatives, etc. In addition to the final designs.
2. A single PPT file per team will be used for final oral presentation. This can be similar to the 11"x17" report but should be more concise to highlight most important information. Prepare a 25-minute oral presentation per team.

For the final 11" x 17" report:

The minimum team work submission requirements include:

- A location/context map
- A case study
- Design program narrative
- Multiple site inventory and analysis maps/photos/texts.

The individual site design submission requirements include:

- Design program narrative
- Conceptual design alternatives or function/spatial relationship diagram
- An illustrative site plan
- Two sections
- Two eye-level sketches
- One bird's eye view perspective
- Landscape performance benefit estimation (you will need to use tools/methods to estimate a minimum of 5 performance benefits and at least one from each type)

Make sure to include project title, class title, instructor's name, titles for individual drawings, graphic scales, north arrows, appropriate labels, your name, date, etc.

Project Evaluation

DESIGN – 60%

- Site analysis/Synthesis - site analysis thorough to address relevant factors (15%) [Team]
- Goals and objectives (5%) [Individual]
- Design (40%) [Individual]
    - Responding to the research and site analysis
    - Expression of the project identity and sense of place
    - Incorporate strategies to create a safe and vibrant urban spaces

  - Provision of social and recreational amenities
  - Responsive to ecological concerns and microclimate issues
  - Quality of planting design
  - Improvement of aesthetic quality of the site

COMMUNICATION – 30%

- Completeness of the presentation (10 %) [Individual]
- Hierarchy of information presented (5%) [Individual]
- Quality of individual drawings/maps (line weight, shade/shadow, label, etc) (5%) [Individual]
- Layout design (10 %) [Team]

PERFORMANCE EVALUATION – 10% [Individual]

- Estimate at least 5 performance benefits of your design using tools and methods from peer-teaching or LAF Benefits toolkit.

Landscape Performance Case Study

Underwood Family Sonoran Landscape Laboratory

Tucson, Arizona

Olivia Sievers Ross

LARC 2402

Dr. Yi Luo

January 29, 2015

Landscape Performance Case Study

Underwood Family Sonoran Landscape Laboratory

Tucson, Arizona

Project

Underwood Family Sonoran Landscape Laboratory
1040 N Olive Road, University of Arizona, Tucson, Arizona 85721

Project Type

Courtyard/Plaza
School/University

Climate Zone

Hot semi-arid

Budget

$1,050,000

Size

1.2 acres

Designer

Ten Eyck Landscape Architects, Inc.

Completion Date

2007

Former Land Use

Greyfield

Project Overview:

This project reclaimed and converted 1.2 acres of a parking lot into a usable plaza with interpretation, outdoor classroom space, and on-going monitoring by the university.

Challenges and solutions:

One of the challenges with this site was in converting a parking lot with runoff that drained into the new building entry area, into a fun, usable space for students and professors doubled as an interpretive area with a range of materials. The solution was to create an entry with a cleansing biosponge garden and interpretive space.

Cost comparison:

The cost of the project was relatively low-cost with a large volunteer-base to pull from. Materials, as well as, labor for planting, irrigation, and lighting were donated (estimated value: $650,000). The hardscape construction cost was $400,000.

Lessons learned:

- Appropriate plant selection reduces maintenance and long-term cost
- Despite the high traffic urban area, wildlife habitat can be created and utilized in an opportunistic way
- Integration of social and educational spaces increases learning opportunities

Sustainable features summary:

- Five Sonoran Desert biomes are represented
- Stormwater runoff is reduced with two desert arroyo micro-basins and the lower patio with a 5,500 gallon retention capacity total
- A sunken court, made of permeable stabilized decomposed granite and concrete, is multi-use and serves as an outdoor classroom, gathering space, and wet-weather retention pond
- The landscape is irrigated with the reused water consisting of roof runoff, HVAC condensate, and drinking fountain greywater
- Native vines help cover southern exposure reducing solar heat and building costs
- A bosque of native mesquite creates a shady entry plaza
- A high-efficiency drip irrigation system was used
- Terrestrial and aquatic wildlife habitat was created with the introduction of two threatened and endangered fish.
- Brick and concrete was reused from the on-site partial building demolition
- Extensive cooperative efforts among landscape architects, the university, and the Arizona green industry allowed for materials and labor to be donated

Performance benefits and methodology:

Sustainable feature:

- Reclaimed 1.2 acres of former university parking lot to create a viable Sonoran Desert landscape

Performance benefit:

- Created an outdoor usable space using rainwater harvesting, water reuse

Method:

- Based on scope of work and installation

Sustainable feature:

- Reduced potable water use for the initial planted establishment period (first 1-5 years)

Performance benefit:

- Potable water use was reduced by 87% (280,000 gallons) annually
- After the establishment period, irrigation with potable water should be eliminated

Method:

- Based on design estimates, calculated overall landscape water needs in comparison to potential capture and storage of non-potable water sources

Sustainable feature:

- Utilizes university well water backwash from sand filter well that was previously sent to stormwater drainage system

Performance benefit:

- Reduces potable water use by up to 250 gallons/day which helps maintain pond water levels that supports the wetland vegetation and fish habitat

Method:

- Based on university and design data

Sustainable feature:

- Sourced all materials and labor from within Arizona with few exceptions

Performance benefit:

- Kept materials more localized
- Reduced project cost

Method:

- Based on project and designer data and installation

Works Cited

"Landscape Performance Series: Underwood Family Sonoran Landscape Laboratory." *Http://landscapeperformance.org/case-study-briefs/underwood-sonoran-landscape-laboratory*. Landscape Architecture Foundation. 29 Jan. 2015. < http://landscapeperformance.org/case-study-briefs/underwood-sonoran-landscape-laboratory>.

Reading List

Required

LaGro JA (2007). Site Analysis: A Contextual Approach to Sustainable Land Planning and Site Design. John Wiley & Sons, Inc.: Hoboken, N.J.

Recommended

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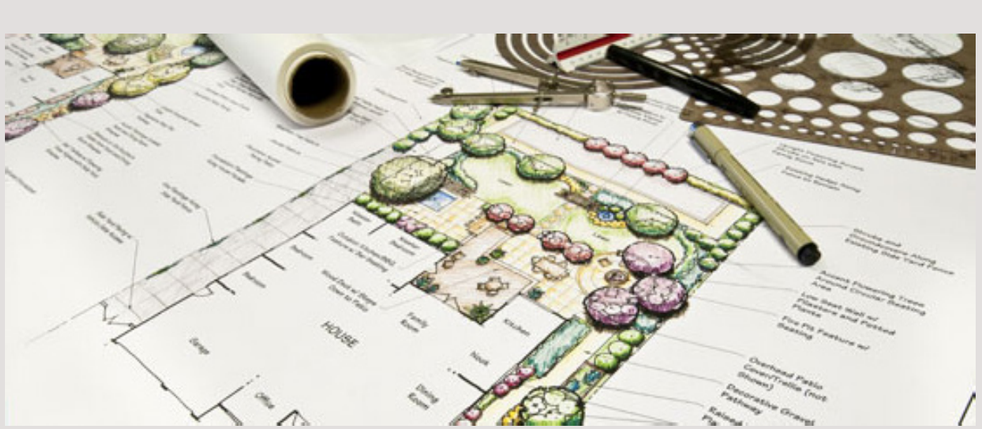
Buddy Holly Center Plaza

Heath Barfield Olivia Sievers Ross Surinder Aulakh

LARC 2402 Design Process Dr. Yi Luo

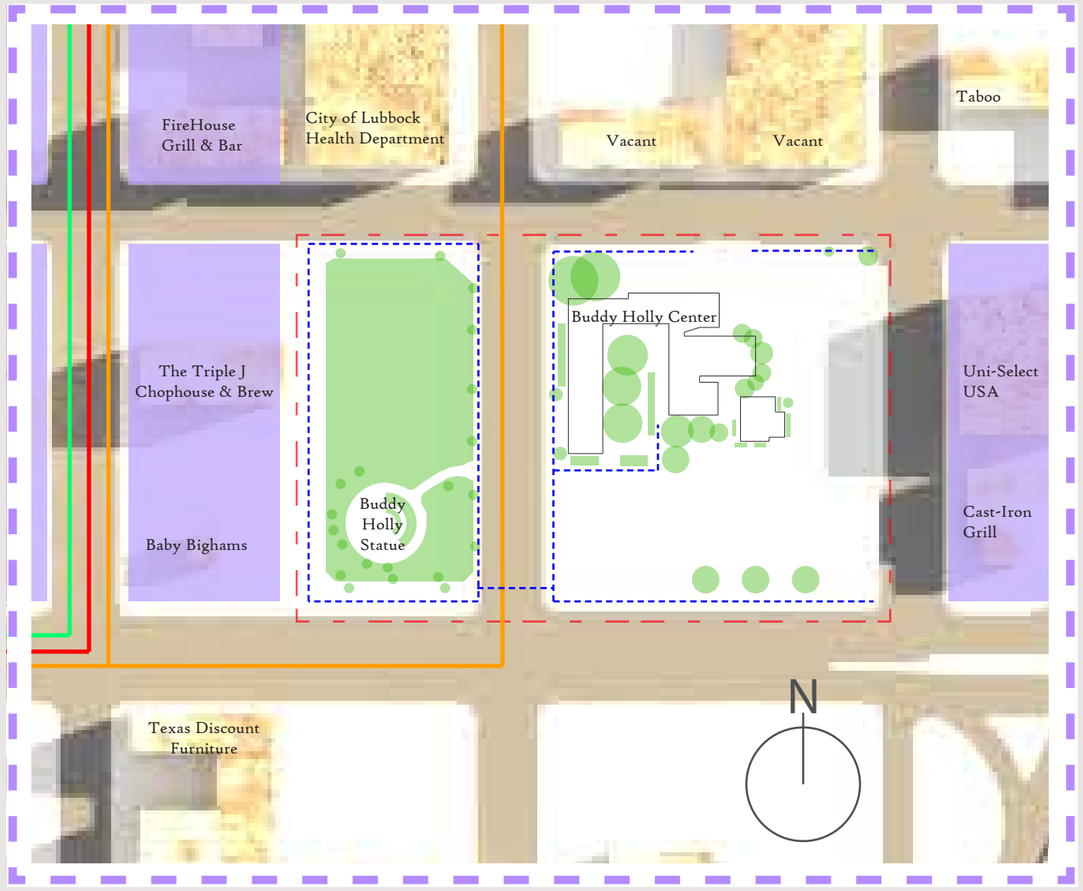
“I’m not trying to stump anybody... It’s the beauty of the language that I’m interested in.”

Comprehension of physical, cultural and ecological issues at diverse scales allow for a designer to enrich the built environment with communal and social spaces.
Enhancement and design decisions for the Buddy Holly Center are established with proprietary evidence.
Site Inventory is a process which the designer uses to assess the context and Site Analysis is the interpretation of the forces influencing a site. Conceptual design is an iterative process which entails the designer to test, make and repeat until a refined design emerges.
The methodologies implemented during the design development range from sketches, models, doodles, etc., thus, leading into finished documents.



Heath Barfield Olivia Sievers Ross Surinder Aulakh

"The Buddy Holly Center, a historical site, has dual missions; preserving, collecting and promoting the legacy of Buddy Holly and the music of Lubbock and West Texas, as well as providing exhibits on Contemporary Visual Arts and Music, for the purpose of educating and entertaining the public. The vision of the Buddy Holly Center is to discover art through music by celebrating legacy, culture and community."



Map Key

Bus Circulation
34
6
19

Pedestrian Circulation Path

Existing Vegetation

Commercial Land Use

Heath Barfield Olivia Sievers Ross Surinder Aulakh

Site Context

Cherry Creek North

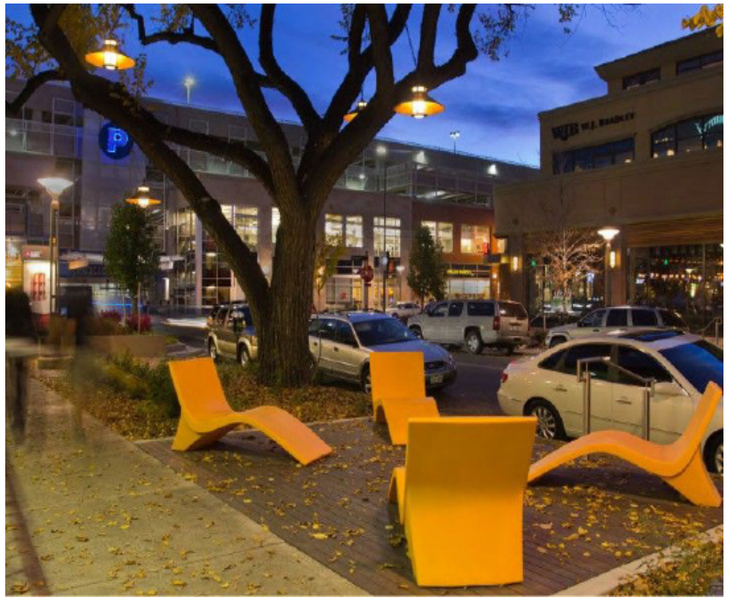
Designer: Design Workshope, Inc

Location: Filmore Plaza Denver, Colorado Size: 78 Acres (16 Blocks)

20 new “Art and Garden Spaces,” which contain signature art features, benches, tables and chairs, create distinct areas throughout the district, enrich the pedestrian experience, and encourage people to relax and linger.

160 pedestrian light poles, 12 benches, 10 trash receptacles, and 2,450 cubic yards of organic materials from the existing street were donated to local communities for reuse.

More than 53 new street signs, 37 street identification banners, 46 new marketing banners, 17 new parking directory signs, and 21 new free-standing directory map structures enhance navigation and walkability in the District.



Watch Factory Plaza

Designer: Richard Burck Associates

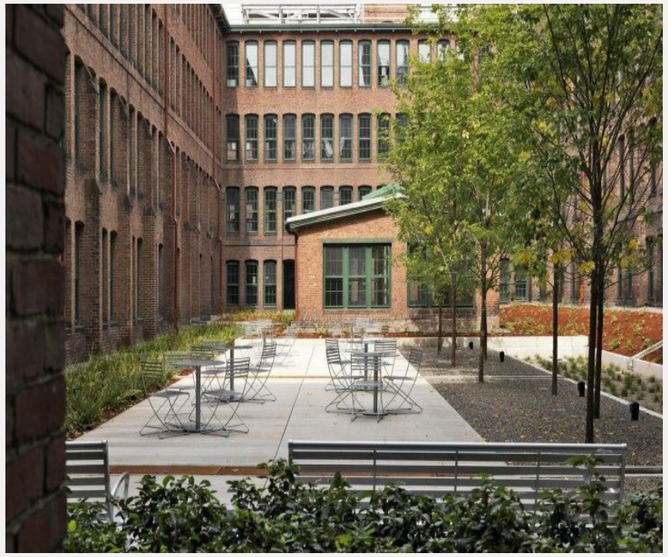
Location: 185 Crescent Street Waltham, Massachusetts

Size: 12 acres

Cobblestone runnels elegantly direct and runoff from roof gutters into rain gardens, offering a visual display of the storm water management process.

The rain gardens were planted with Pennsylvania Sedge; they include a rubber liner and pipe that discharges the cooled and filtered runoff into the Charles River.

Recreational equipment storage in the Robbins courtyard
provides residents with 8 racks for kayaks and 45 spots for bikes, available on a first-come, first-served basis.



Underwood Family Sonoran Landscape Laboratory

Designer: Ten Eyck Landscape Architects, Inc.

Location: 1040 N Olive Road, University of Arizona Tucson, Arizona

Size: 1.2 acres

An accessible, sunken court serves as outdoor classroom and gathering space and retains runoff during desert storm events.

The court is composed of permeable stabilized decomposed granite and framed by cast-in-place concrete seat walls of varying heights.

Storm water runoff is reduced by 2 desert arroyo 'micro-basins' and the lower patio with a 5,500-gallon retention capacity total. Native Mascagnia macroptera vines climb 50 feet up a scrim on the building's southern exposure reducing solar heat gain and blurring the lines between architecture and landscape. A bosque of native mesquite (Prosopis velutina) creates dappled shade in the entry plaza.

Site inventory is one of the beginning steps in the design process for landscap architecture.
This is a collection of data that is a major influence on the design and planning decisions
Site inventory includes abiotic, biotic, and cultural data.

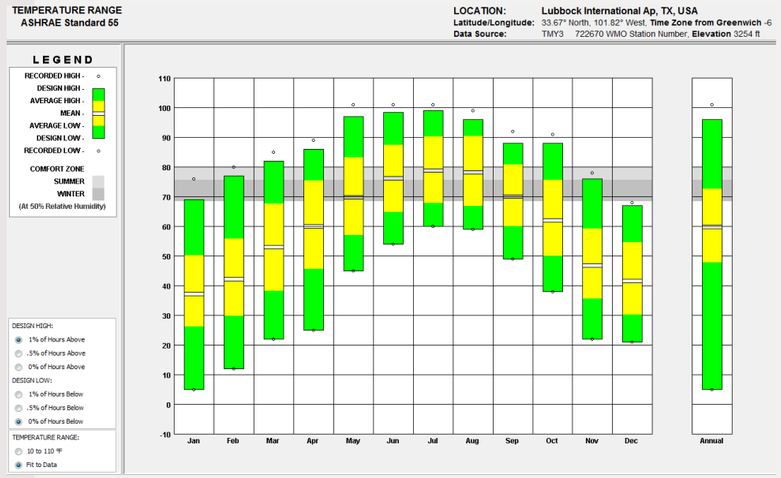
Soil (Abiotic)

The soil of the site is 100% urban soil and not prime farmland.

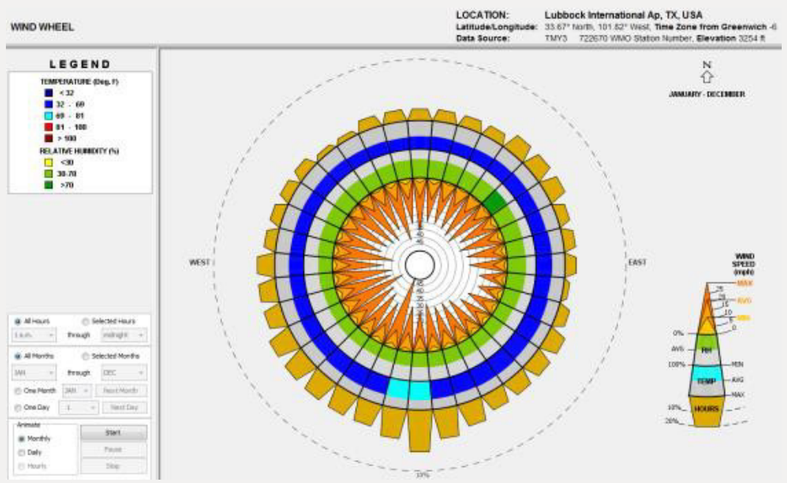
Topography (Abiotic)

The topography of the site lacks is mostly flat and lacks enough elevation change to mention.

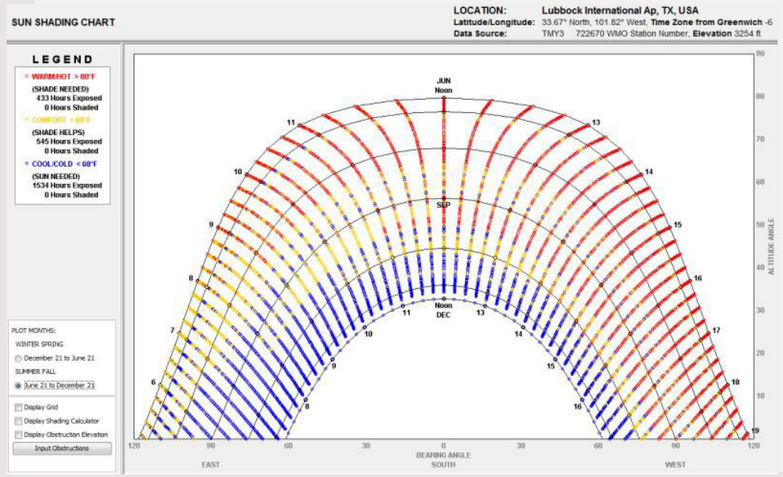
Climate (Abiotic)



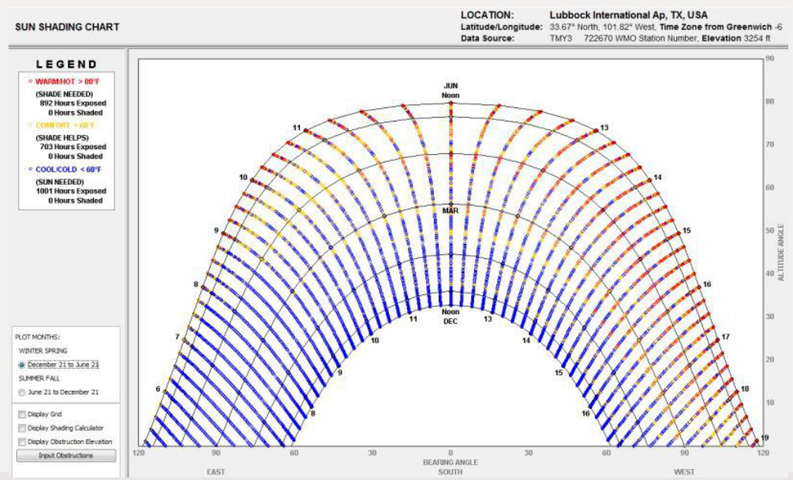
Temperature Range



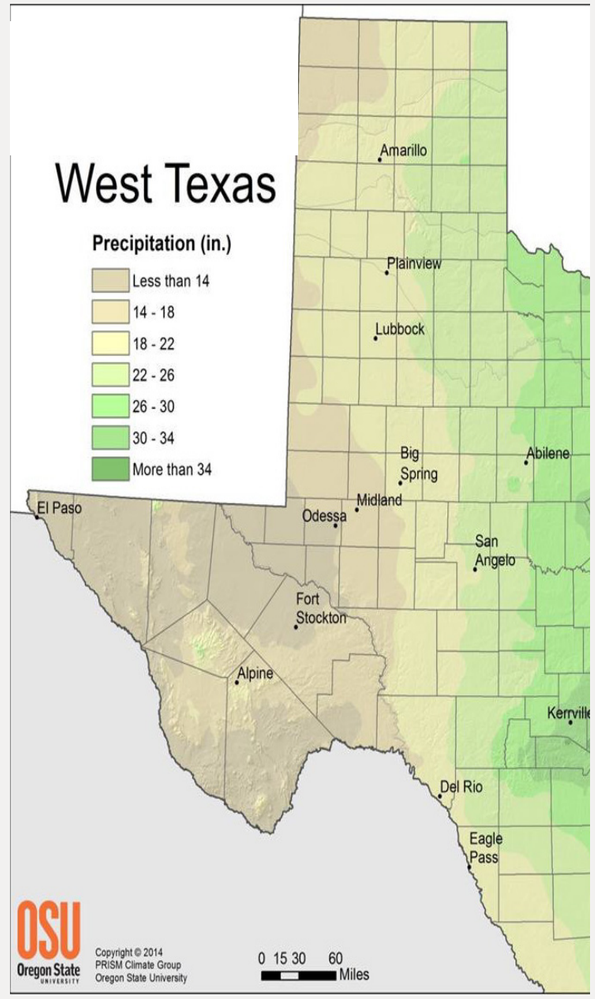
Wind Direction



Sun Shade Summer Solstice



Sun Shade Winter Solstice



2010 Annual Precipitation

Site Inventory

Heath Barfield Olivia Sievers Ross Surinder Aulakh

d

Wildlife (Biotic)

The vertebrates and invertebrates of Lubbock represent a typical urban assemblage. European pigeons, grackles, doves, song birds, raccoons, and domestic animals are some that are regularly found in the city limits. An assortment of migratory birds and waterfowl seasonally augment the year-round residents.

On-site Vegetation (Biotic)

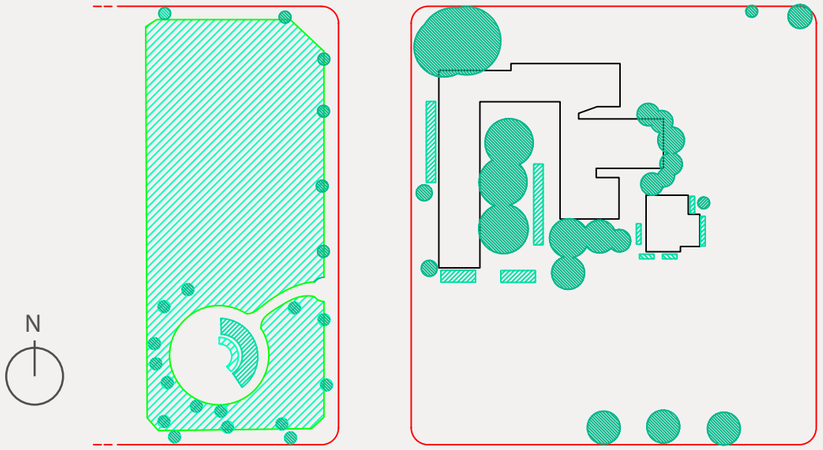
Trees
- Vitex agnus-castus
- Quercus sp.
- Ulmus sp.
- Pinus sp.

Grass

Assemblage - Small Plants

Assemblage - Trees with Small Plants

Small Plants
- Red/Yellow Yucca Hesperaloe parviflora
- Boxwood Buxus
- Santolina Grey Santolina chamsecyparissus
- Nandina domestica
- Indian hawthorn Rhaphiolepis indica
- Artemisia (powis castle)
- Creeping Juniper Juniperus horizontalis
- Elaeagnus
- Inland Sea Oats Chasmanthium latifolium



Historical Significance (Cultural)

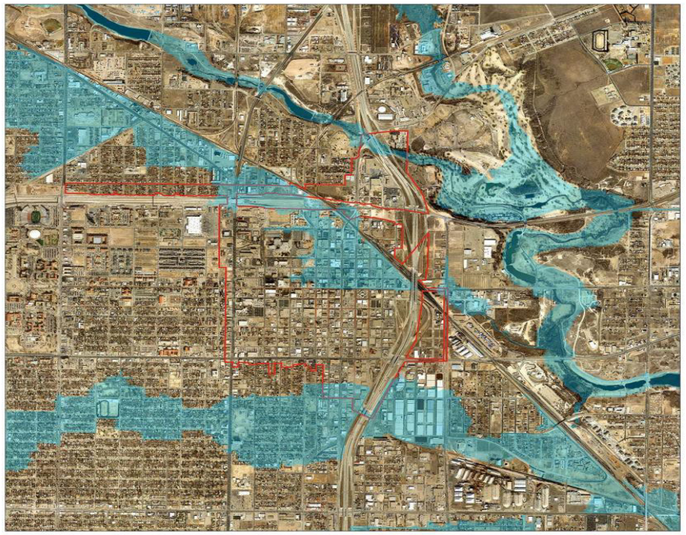
The eastern portion of the site served as the Lubbock stop on the Fort Worth and Denver South Plains Railway Depot. This station served as a stop for trainscarrying passengers and trains carrying freight. The building was designed in the Spanish Renaissance Revivial style as was much of Lubbock.

Water Restrictions (Cultural)

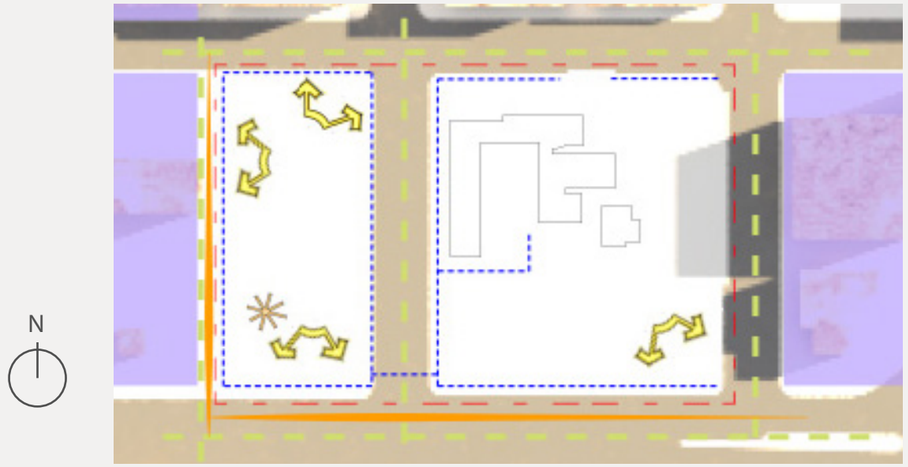
Stage 1 Water Restrictions
Can water on Tuesday & Friday only
Need a New Landscape Variance Request to establish new plants (good for 3 weeks)

Hydrology (Abiotic)

The site has massive surface drainage resulting in frequent ponding and flooding with torrential rains.



Existing Site Conditions



Map Key
- Noise corridor
- Pedestrian Circulation path
- Project Limit Line
- Vehicular Circulation
- Buddy Holly Statue
- View to adjacent businesses
- Commercial Land Use

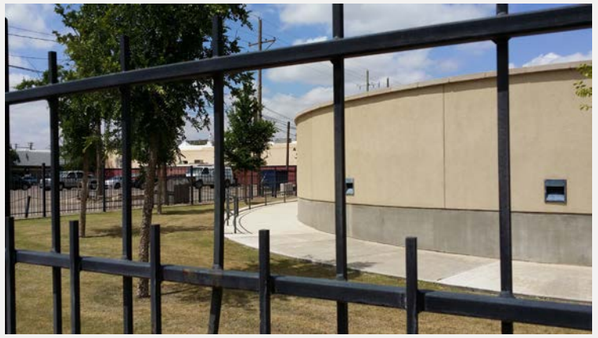
Heath Barfield Olivia Sievers Ross Surinder Aulakh

Inventory

Goals & Objectives

Programming is one of the initial steps in the design process for a project. The programming of a site defines the project's goals and objectives. It determines the proposed site usage and special features by describing values and desired outcomes, in addition to, the actions required to achieve those goals.

Parking lot is dangerous and lacks clear direction



Improved visual aesthetics from sidewalk and street will increase interest and visitation

Adding overhead planes will increase thermal

Use of drought-tolerant plants have social and economic benefits

Program: Goals and Objectives
Site: Buddy Holly Center Plaza
Address: 1801 Crickets Avenue, Lubbock, TX 79401
Group: Surinder Aulakh, Heath Barfield, Olivia Sievers Ross
Instructor: Dr. Yi Luo

Goal 1: Improve public appeal to the Center, thereby increasing visitation
Objective 1: Create additional well-designed, functional social areas
Objective 2: Improve existing social areas by improving functionality, flow, and design
Objective 3: Improve aesthetics of entire site
Objective 4: Create outdoor educational spaces

Goal 2: Provide noise reduction for the site
Objective 1: Add vertical planes in key locations

Goal 3: Improve existing pedestrian circulation and safety
Objective 1: Relocate pedestrian crosswalk connecting the two sections of the Center
Objective 2: Implement traffic-calming measures that will reduce traffic speeds

Goal 4: Improve sustainability of site
Objective 1: Reduce amount of lawn
Objective 2: Use only drought-tolerant plants focusing on natives and naturalized species
Objective 3: Use rainwater for irrigation

Goal 5: Address drainage and flooding
Objective 1: Design overhead structures with green roofs to delay rain runoff
Objective 2: Implement rainwater collection to reduce amount of rain runoff
Objective 3: Create elevation changes or swales to redirect flow of water

Goal 6: Improve thermal comfort
Objective 1: Add overhead structures in key areas
Objective 2: Plant additional trees
Objective 3: Create resting areas under shaded areas

Goal 7: Improve vehicular circulation
Objective 1: Reduce quantity of entrance driveways
Objective 2: Relocate main entrance driveway so as not to interfere with pedestrian circulation
Objective 3: Add directional signage effectively positioned

Program: Goals and Objectives
Site: Buddy Holly Center Plaza
Address: 1801 Crickets Avenue, Lubbock, TX 79401
Group: Heath Barfield
Instructor: Dr. Yi Luo

Goal 1: Improve public appeal to the Center, thereby increasing visitation
Objective 1: Create additional well-designed, functional social areas
Objective 2: Improve existing social areas by improving functionality, flow, and design
Objective 3: Improve aesthetics of entire site
Objective 4: Create outdoor educational spaces
Objective 5: Add children's interactive space
Objective 6: Repurpose existing interactive exhibit into memorial wall

Goal 2: Provide noise reduction for the site
Objective 1: Reorientate memorial site

Goal 3: Improve existing pedestrian circulation and safety
Objective 1: Redesign pedestrian crosswalk connecting the two sections of the Center
Objective 2: Implement traffic-calming measures that will reduce traffic speeds

Goal 4: Improve sustainability of site
Objective 1: Use only drought-tolerant plants focusing on natives and naturalized species

Goal 5: Address drainage and flooding
Objective 1: Implement rainwater collection to reduce amount of rain runoff
Objective 2: Create elevation changes or swales to redirect flow of water

Goal 6: Improve thermal comfort
Objective 1: Add overhead structures in key areas
Objective 2: Plant additional trees
Objective 3: Create resting areas under shaded areas

Goal 7: Improve vehicular circulation
Objective 1: Reduce quantity of entrance driveways
Objective 2: Relocate main entrance driveway so as not to interfere with pedestrian circulation
Objective 3: Add directional signage effectively positioned

Visual interest and direction between sections of the site can be improved upon

Improve exsisting pedestrian circulation between the museum and memorial

Improve thermal comfort by adding shade features as well as new planting design.

Manage storm water runoff to prevent flooding while achieving a visually pleasing space.

Program: Goals and Objectives
Site: Buddy Holly Center Plaza
Address: 1801 Crickets Avenue, Lubbock, TX 79401
Student: Olivia Sievers Ross
Instructor: Dr. Yi Luo

Goal 1: Improve public appeal to the Center, thereby increasing visitation
Objective 1: Create additional well-designed, functional social areas
Objective 2: Improve existing social areas by improving functionality, flow, and design
Objective 3: Improve aesthetics of entire site
Objective 4: Create outdoor educational spaces

Goal 2: Provide noise reduction for the site
Objective 1: Add vertical planes in key locations

Goal 3: Improve existing pedestrian circulation and safety
Objective 1: Implement traffic-calming measures that will reduce vehicle speeds
Objective 2: Clearly designate crosswalks, thus increasing drivers' awareness of pedestrians and creating a safer environment
Objective 3: In a safer location, create an additional pedestrian crosswalk as the primary connection between the two sections of the Center
Objective 4: Create clearly defined paths throughout site

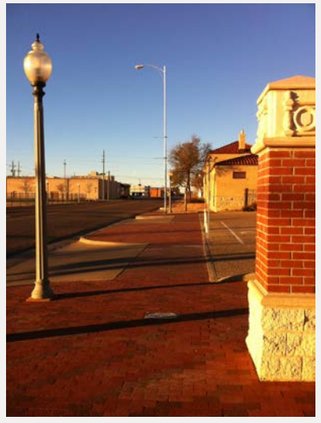
Goal 4: Improve sustainability of site
Objective 1: Reduce amount of lawn
Objective 2: Use only drought-tolerant plants focusing on natives and naturalized species
Objective 3: Use rainwater for irrigation

Goal 5: Address drainage and flooding
Objective 1: Design overhead structure(s) with green roof(s) to delay rain runoff
Objective 2: Implement rainwater capture measures to clean and reduce amount of rain runoff
Objective 3: Create elevation changes or swales to redirect flow of water

Goal 6: Improve thermal comfort
Objective 1: Add overhead structures in key areas
Objective 2: Plant additional trees
Objective 3: Create resting and social areas under shaded areas

Goal 7: Improve vehicular circulation
Objective 1: Relocate main entrance driveway so as not to interfere with pedestrian circulation
Objective 2: Add directional signage effectively positioned
Objective 3: Reduce quantity of entrance driveways

Unattractive on and off site views can be improved



8 driveways confuse visitors and creates a lack of direction

Over 30,000 feet square of lawn requires much maintenance, time, and cost.

Stormwater runoff creates flooding adjacent to buildings, in the parking lot, and on the streets. On site rain capture can help reduce runoff.

The site has many locations that can house aadditional social spaces

Program: Goals and Objectives
Site: Buddy Holly Center Plaza
Address: 1801 Crickets Avenue, Lubbock, TX 79401
Group: Surinder Aulakh
Instructor: Dr. Yi Luo

Goal 1: Improve public appeal to the Center, thereby increasing visitation
Objective 1: Create additional well-designed, functional social areas
Objective 2: Improve existing social areas by improving functionality, flow, and design
Objective 3: Improve aesthetics of entire site
Objective 4: Create outdoor educational spaces

Goal 2: Provide noise reduction for the site
Objective 1: Add vertical planes in key locations

Goal 3: Improve existing pedestrian circulation and safety
Objective 1: Redesign pedestrian crosswalk connecting the two sections of the Center
Objective 2: Implement traffic-calming measures that will reduce parking lot speeds

Goal 4: Improve sustainability of site
Objective 1: Reduce amount of lawn
Objective 2: Use only drought-tolerant plants focusing on natives and naturalized species
Objective 3: Use rainwater for irrigation
Objective 4: Reduce impervious surface and replace with permeable pavers

Goal 5: Address drainage and flooding
Objective 1: Implement rainwater collection to reduce amount of rain runoff
Objective 2: Create elevation changes or swales to redirect flow of water

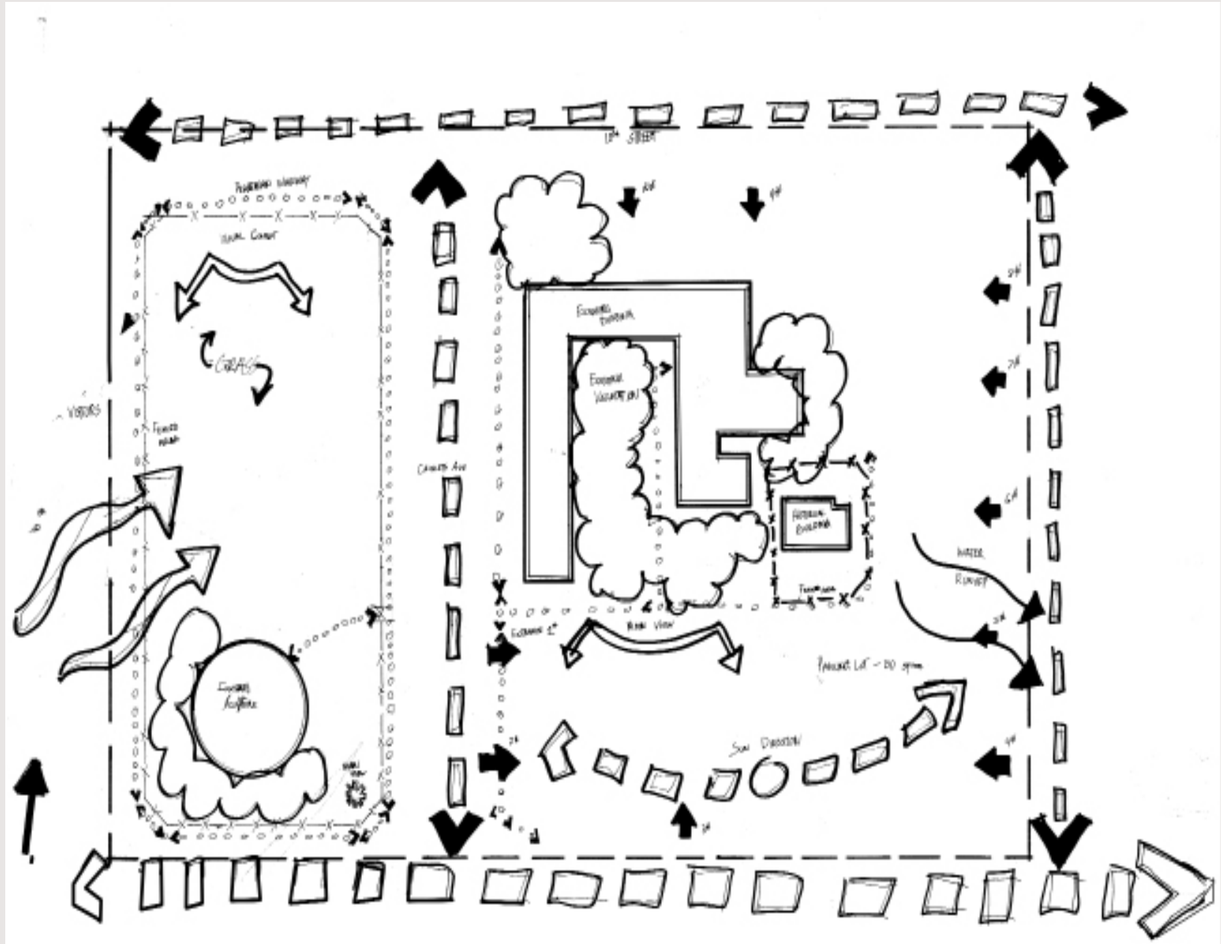
Goal 6: Improve thermal comfort
Objective 1: Add overhead structures in key areas
Objective 2: Plant additional trees
Objective 3: Create resting areas under shaded areas

Goal 7: Improve vehicular circulation
Objective 1: Reduce quantity of entrance driveways
Objective 2: Relocate main entrance driveway so as not to interfere with pedestrian circulation

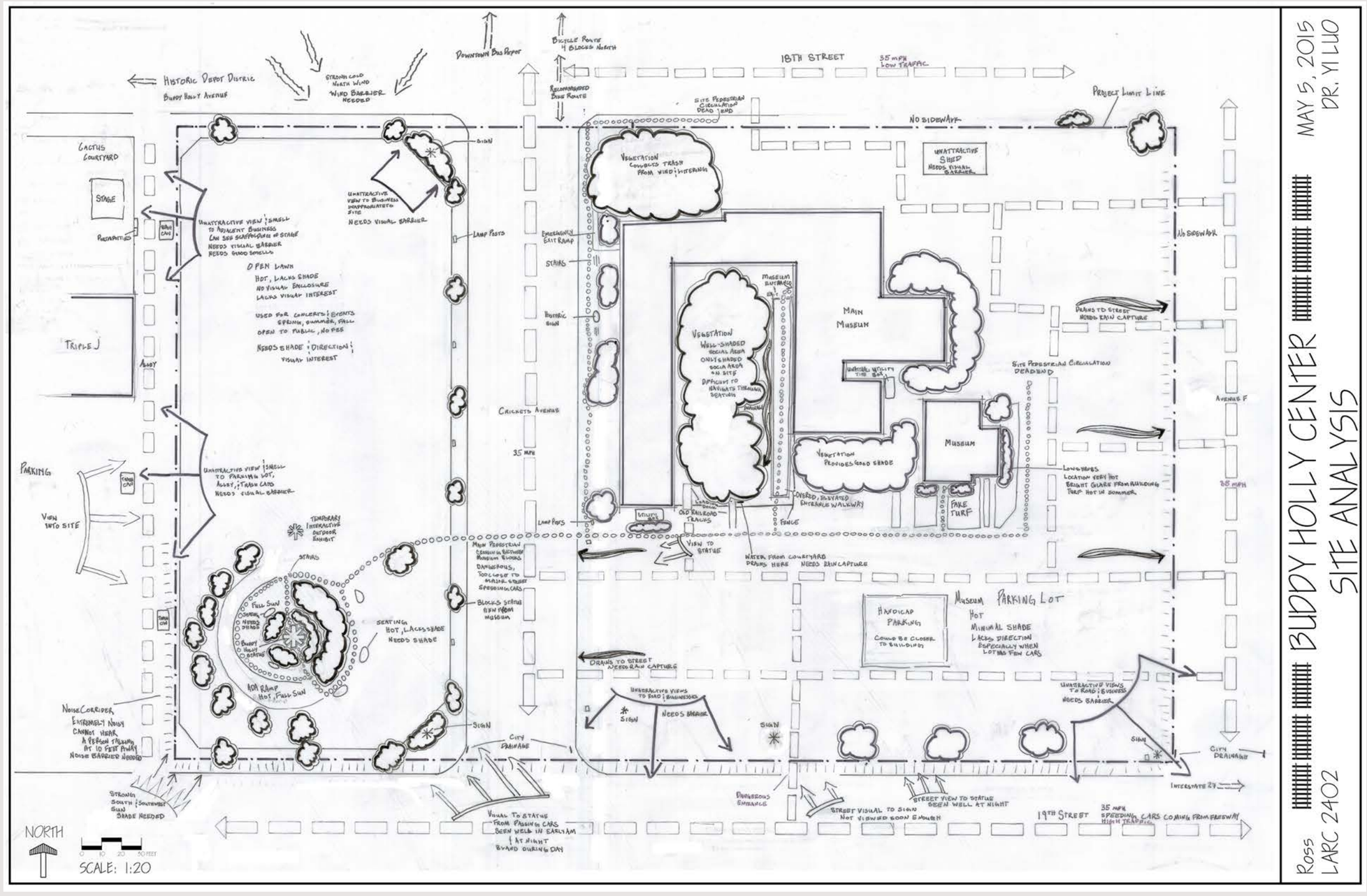

Address Pedestrian circulation and Safety

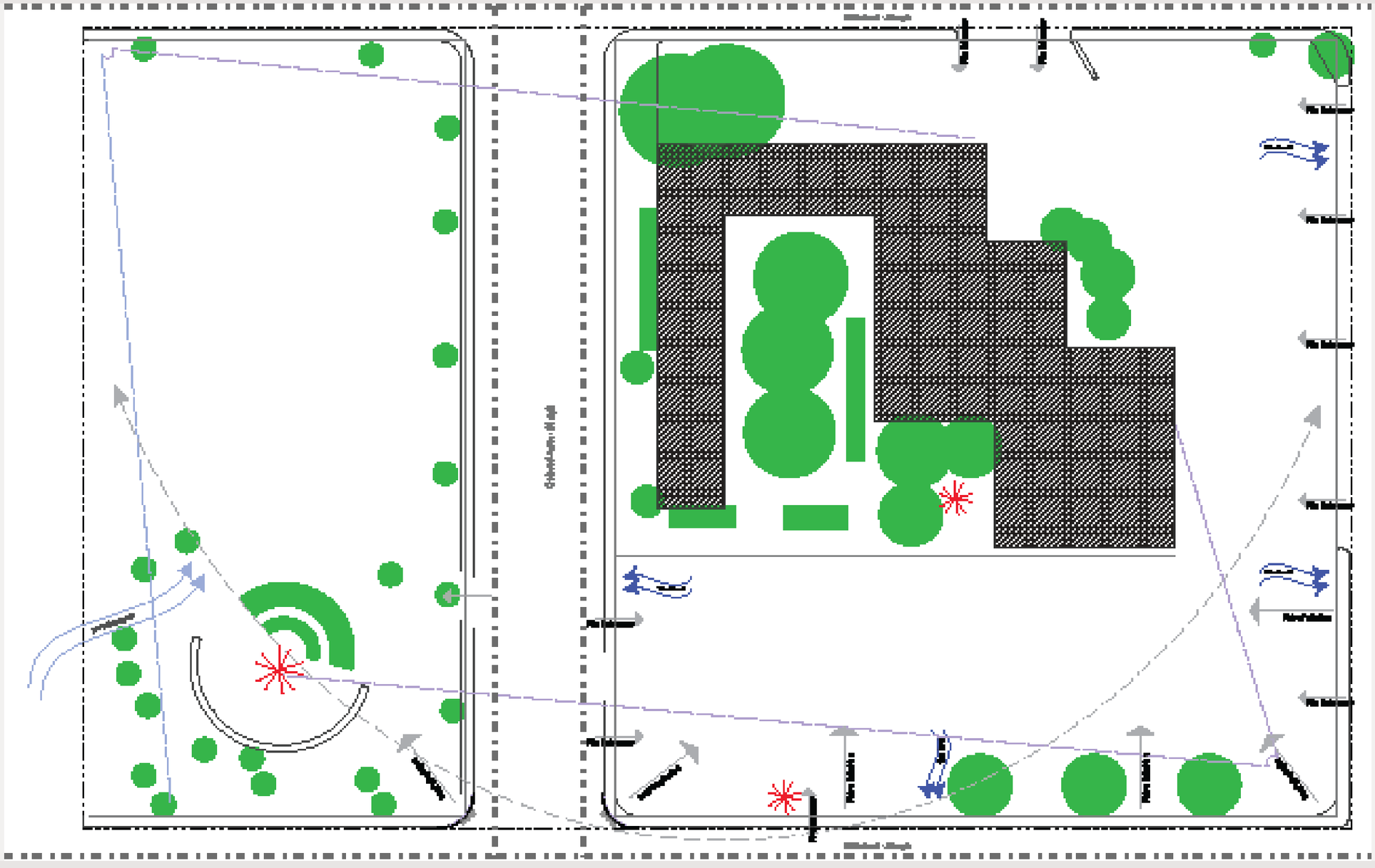

Improving Thermal Comfort of Park space

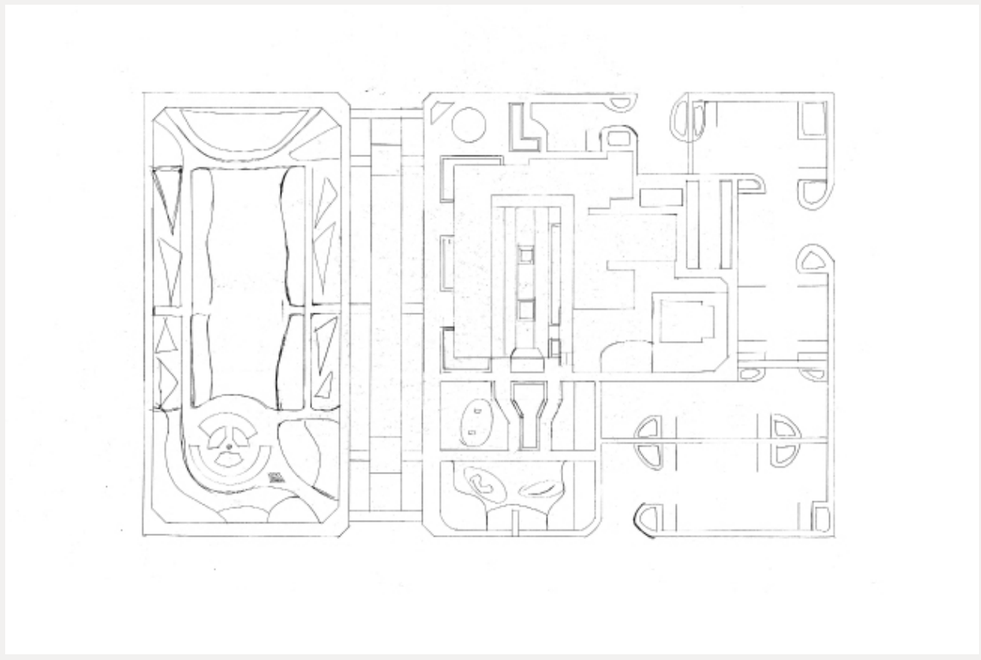

Noise reduction and designated driveway entries

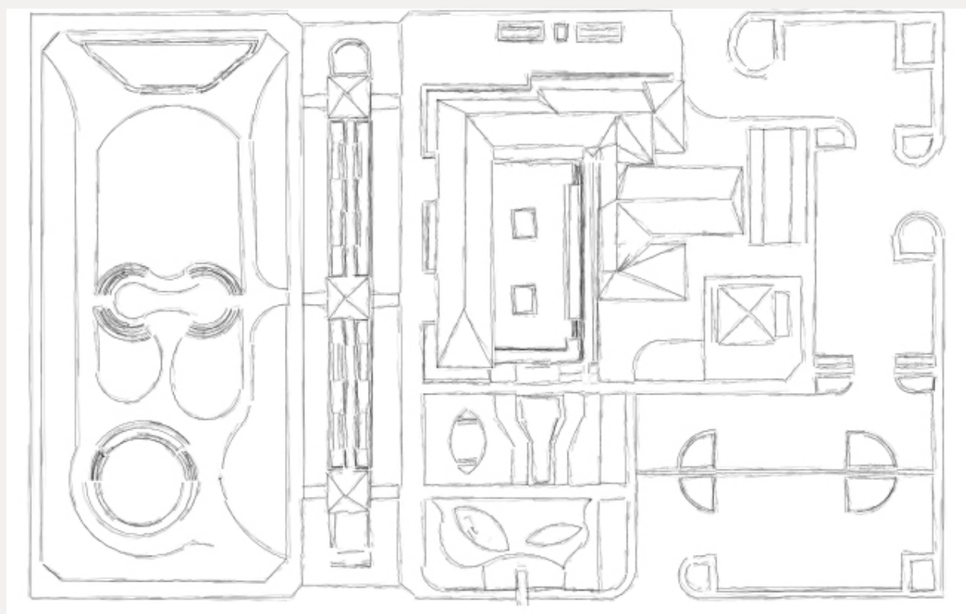

Fountain Walkway
Main Court
Fountain
VISITORS
Fountain
Entrance
Entrance
Entrance

The site analysis was a major influence on my design. The opportunities and constraints of the site were not only all important, but some ranked very high on the necesssity list. For example, safety of pedestrians is an issue on the site and was of high priority to be addressed in my design.

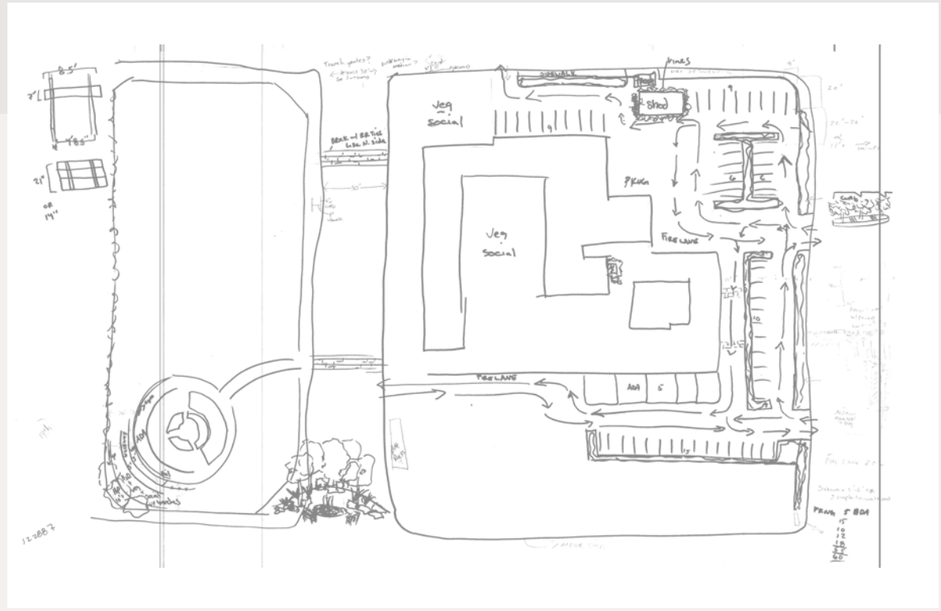






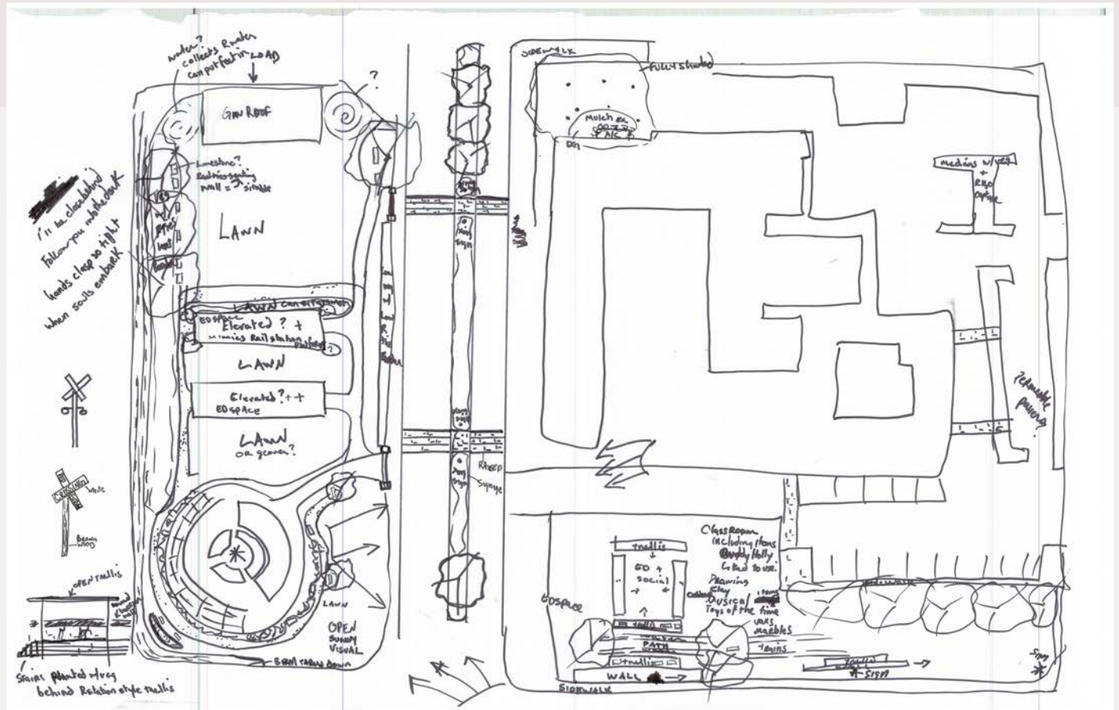


Concept Plan I



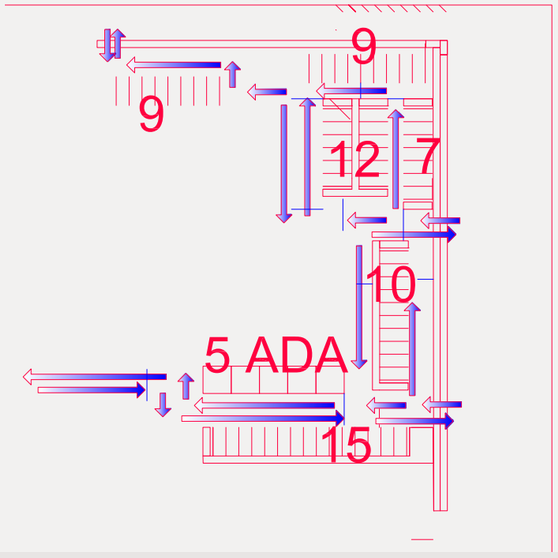
The first concept plan included teasing out parking flow, circulation, elevations of potential key areas, and object dimensions.

Concept Plan II



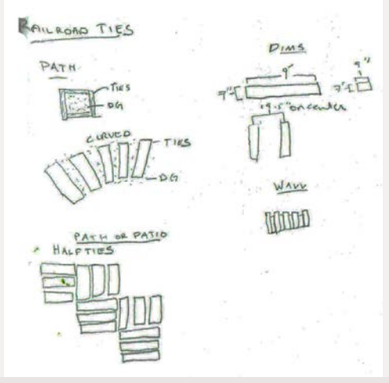
This concept plan incorporated some ideas I had about the historical aspect of the railway station. I found the old tracks onsite an inspiration, as well as, the architecture.

Parking Concept



This was the second iteration for parking. I used this method in order to make sure there were enough spaces and that traffic flowed well while adhering to parking code.

Materials Concept



In order to continue the historic feel of the existing site, I wanted to use railroad ties for planting borders, fences, and possibly walkways in the redesign.

Contextual Reference

Interstate 27 serves as a connecting factor for Southern and Northern Lubbock.

Abstract Diagram

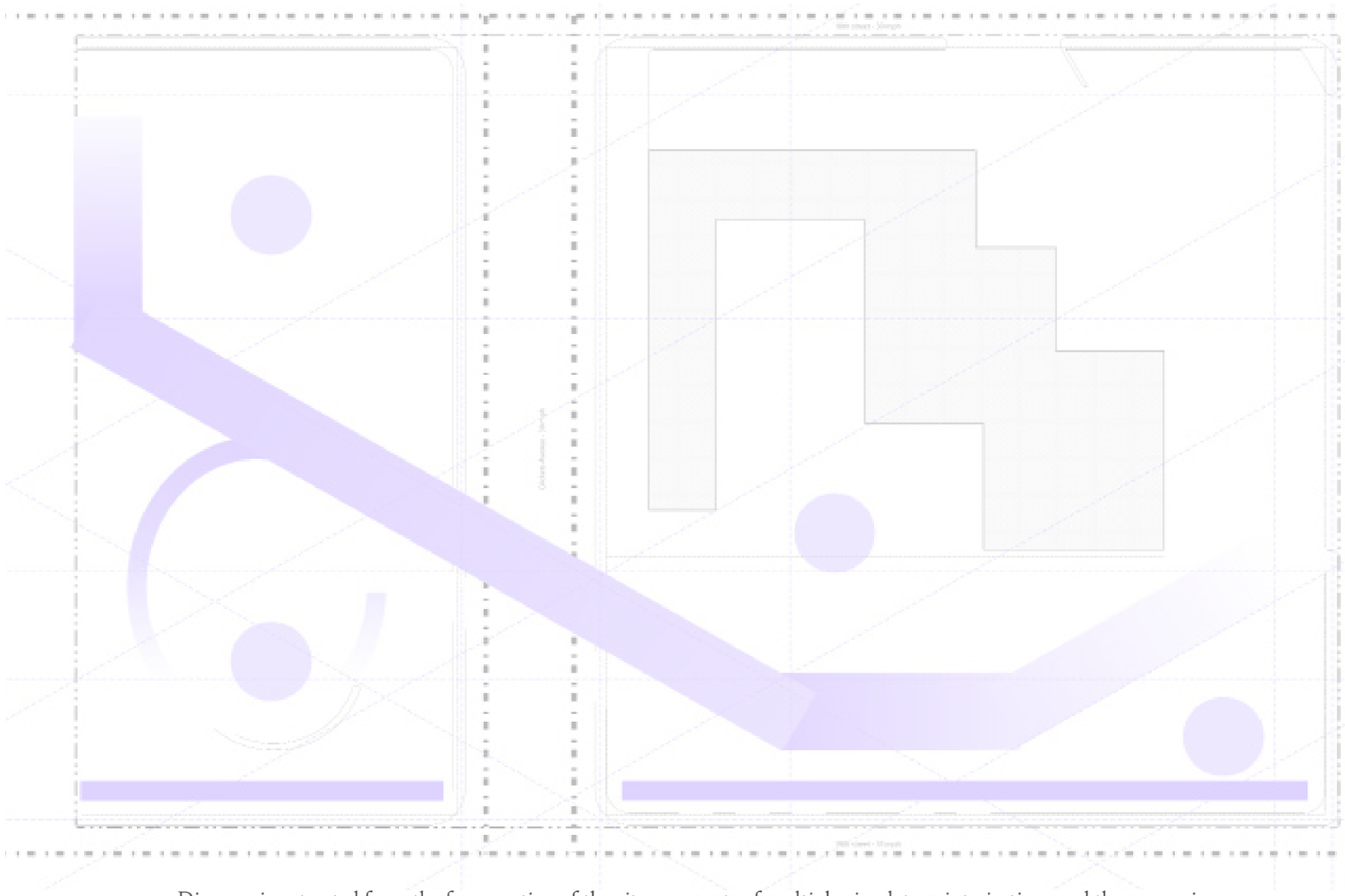
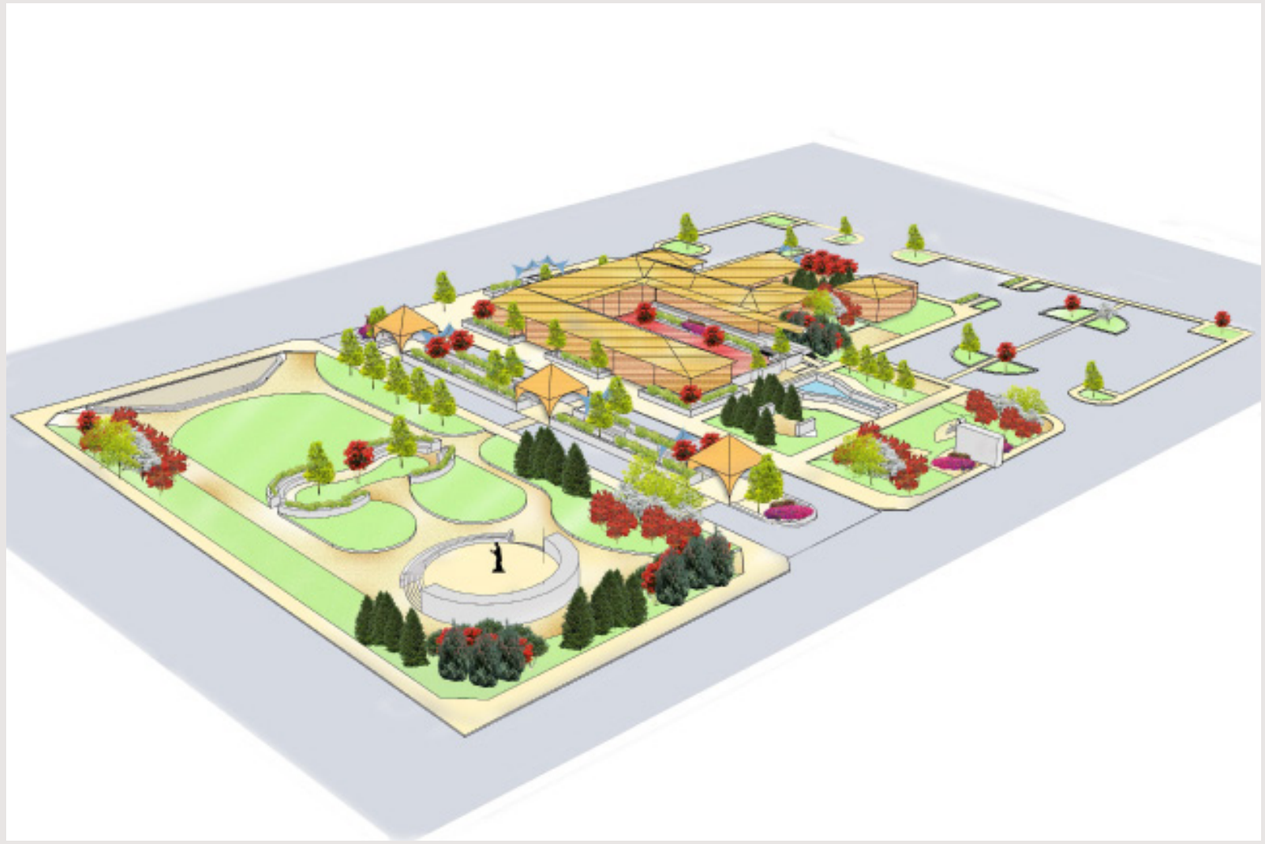


Diagram is extracted from the forces acting of the site, moments of multiple circulatory interjections and the procession through the site. The idea of the proposal is an extension of the West Texas Walk of Fame.

Site Design

The main focus of this design is to bring music back to the site by incorporating various sound features that allow people who visit the Buddy Holly center a truly unique experience. A xylophone, Whisper Wall, and an echo tube where placed at the entrance of the complex in order to bring in people by creating an interesting space. To achieve this design some of the parking lot had to be converted to open space for the new outdoor features. By doing so I was able to redirect the flow of traffic by eliminating the amount of entrances/exits to the site controlling vehicular circulation within the parking area. Adding a median to Crickets Ave would create a bridge to help gap pedestrian circulation to the memorial site in addition to providing a few outdoor seating areas shade by over head sails. Various plantings were added to the site in order to control the excess of storm water runoff while also creating an aesthetically pleasing garden scape. The green-space in front of the stage remained the same to accommodate for future concerts, outdoor classes, or any other activity that this site could facilitate.

Master Site Plan
Scale: n.t.s.



Bird's Eye View

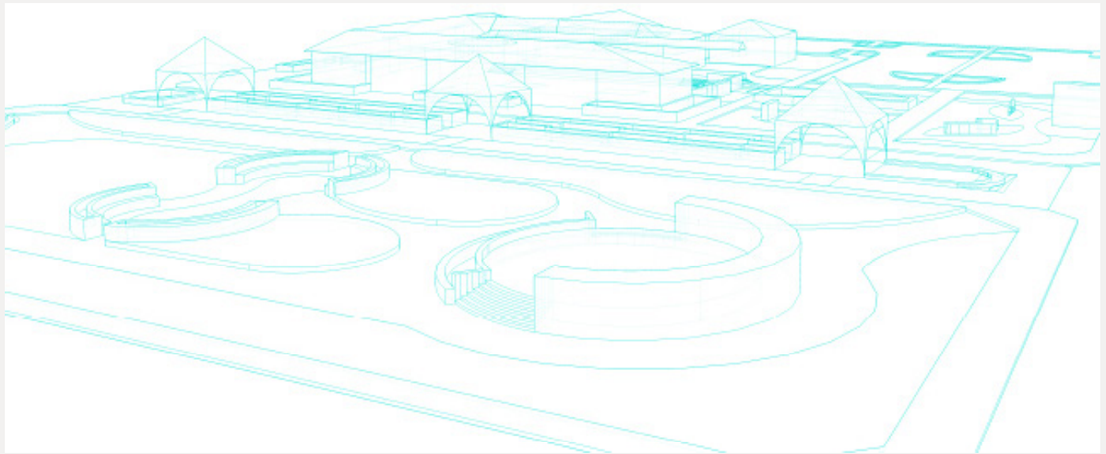
Eye Level View

Eye Level View

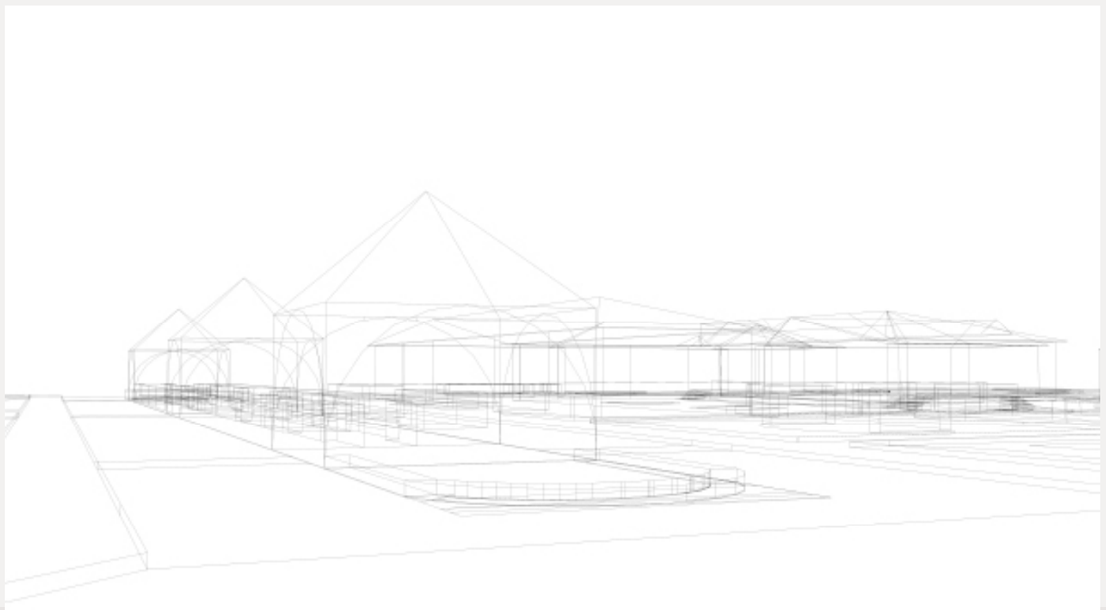
Section B-B'

Section A-A'

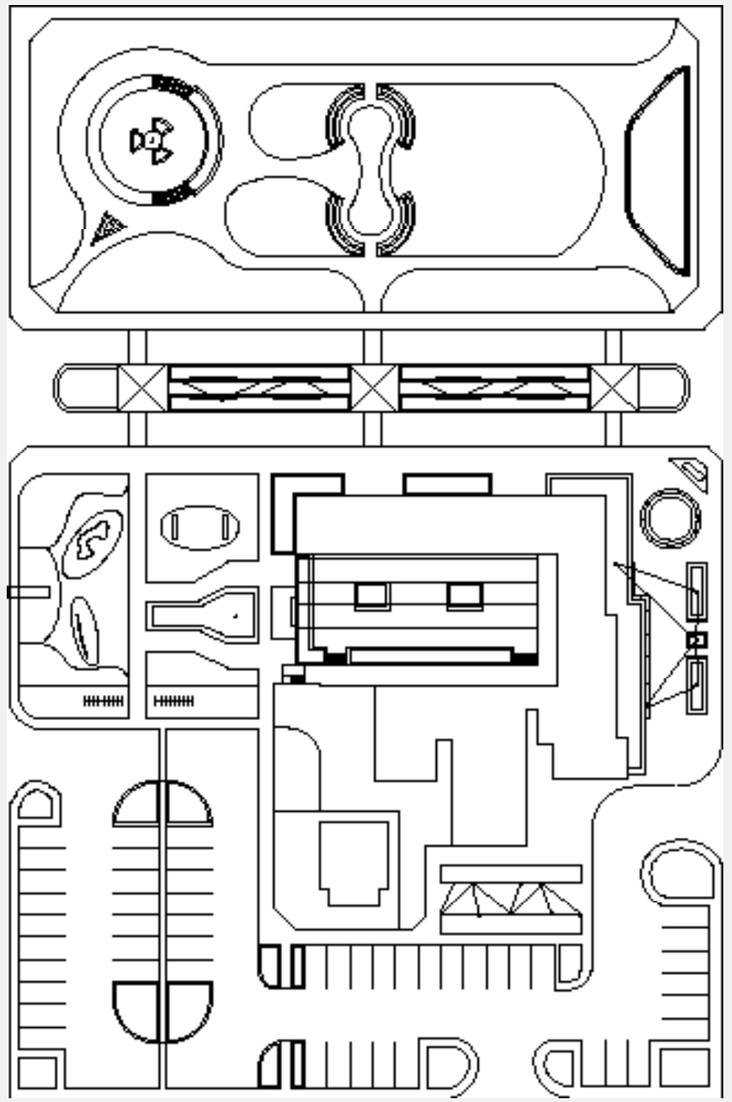
Concept Diagram 1



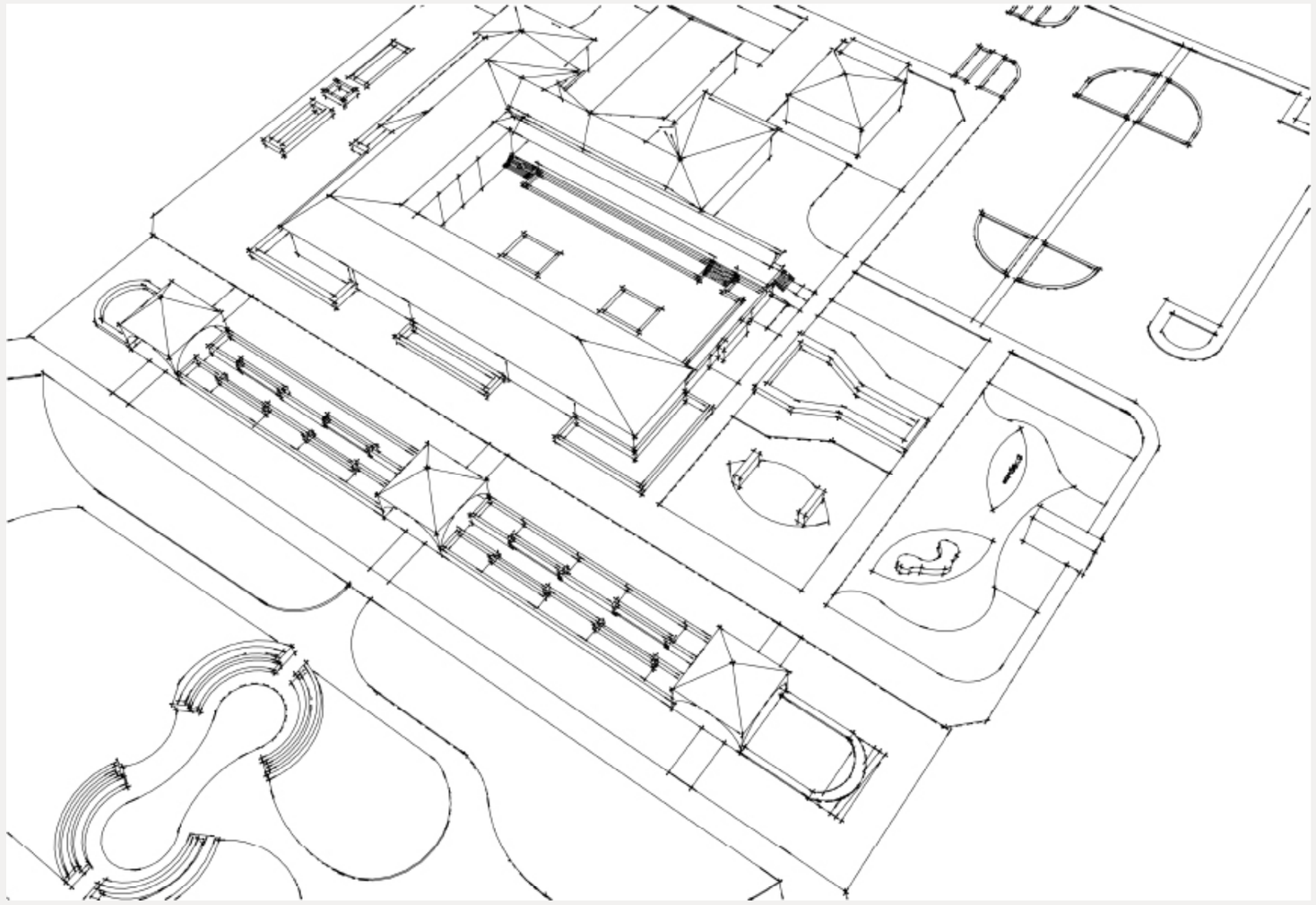
Concept Diagram 2



Concept Diagram 3



Concept Diagram 4



Concept Diagram 5

Design Narrative

My design process, utilized for the Buddy Holly Center Plaza redesign, began with a comprehensive look at programming which resulted in site-specific goals and objectives. Through careful analysis of collected site inventory I was able to explore and develop design objectives that utilized available opportunities and minimized or eliminated site constraints.

This diligent use of analysis drove my entire process. It was evident from several site visits that there was a lack of linkage between the Center and the Buddy Holly statue. Informal interviews with Center visitors confirmed this. Many were unaware that the two entities were indeed part of a whole. I was also concerned about safety. I felt that there were dangerous conditions exacerbated by poorly defined automobile and pedestrian circulation on the site. In addition, it was apparent that microclimate modification in the form of shade plantings and structures were needed to make the site more comfortable and appealing to visitors. I addressed all of these inventory and analysis issues in my design.

Further, I was particularly interested in the context of the site. To honor the historic railroad station aspect of the Buddy Holly Center, I chose to bring the appropriate contextual clues to the railroad past into the design by utilizing railroad ties as edging for landscape and walkways. I brought architectural elements from the center across to the statue area and repeated forms in order to bring unity to the design. I wanted to address noise and smell concerns on the site, so I utilized plantings, land form modification, and architecture to mitigate these issues. In addition, I wanted to deal with storm water runoff while addressing circulation. I utilized planted medians that function as small bio-retention zones that clean and slow down storm water runoff from the site.

Bird's Eye View

Site Plan


SECTION B
NORTH
EXISTING VEGETATION
EXISTING FENCE
EVERGREEN WINDBREAK
STAGE WITH GREENROOF
18TH STREET
EX. SIDEWALK
EX. VEGETATION
VINE
EX. SOCIAL AREA
EX. DRIVEWAY
EX. DUMPSTER WITH FENCE
VINE
EX. SHED
EVERGREEN WINDBREAK
SHADE TREE
FLOWERING TREE
DECIDUOUS SHRUB
FLOWERING PLANT
BERM 1'
PERGOLA
PATH
RAILROAD TIE BORDER
ALLEY
EYE LEVEL VIEW 2
CRICKETS AVENUE
AVENUE F
RAILROAD TIE WALL
EX. VEGETATION
PATH
PERGOLA
WATER PLANTS
WATER FEATURE
FLOWERING TREE
BUDDY HOLLY CENTER SIGN
SECTION A
BUDDY HOLLY STATUE
SEATING
EX. SEATING
LAWN
EYE LEVEL VIEW 1
LIGHTED CROSS-WALK
EYE LEVEL VIEW 3
OUTDOOR CLASSROOM & PLAY AREA
ACCESSIBLE PARKING
PARKING LOT
DRIVEWAY
RAIN COLLECTING MEDIAN
SIDEWALK
CURB
SECTION A'
19TH STREET
GRASS
EXISTING SIDEWALK
RAILROAD TIE WALL
EVERGREEN SHRUB
EX. VEGETATION
EX. BUDDY HOLLY CENTER SIGN
EX. FENCE
SECTION B'
BUDDY HOLLY CENTER SIGN
GROUNDCOVER
RAIN COLLECTING MEDIAN
EX. CROSSWALK
CROSSWALK
EX. VEGETATION
FLOWERING PLANT
EX. SIDEWALK
BUDDY HOLLY CENTER SIGN
DECIDUOUS SHRUB
0
20
60
120
240 FEET

Section Views

Section A-A'

Section B-B'

Eye-level Views

View 1
Looking south-west towards the water feature in a shady, semi-private social area

View 2
Looking north from under the shade of a pergola serving dual purpose as a social area and for watching music

View 3
Looking north-west from the outdoor educational center

View 4
Looking west from the Center toward the Buddy Holly statue

Site Plan

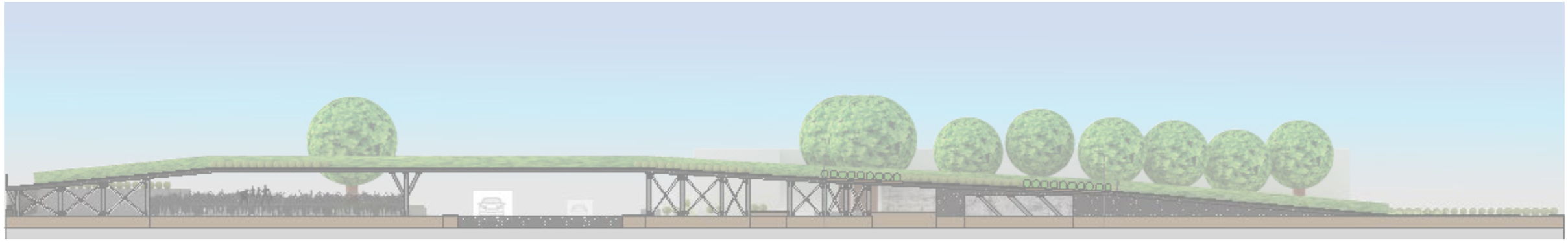
N

Scale | 1’ = 1/32”

Project Narrative

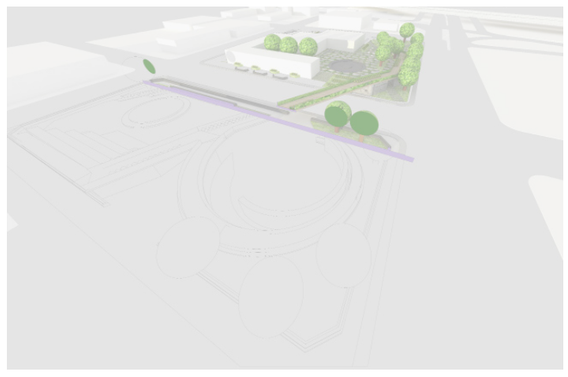
Contextually derived elements are composed to create experiential moments. These moments are expressions of the Legacy of Buddy Holly and extrapolations of Lubbock’s urban development.

Section



Transverse Sectional Perspectives

Cut 1 of 4



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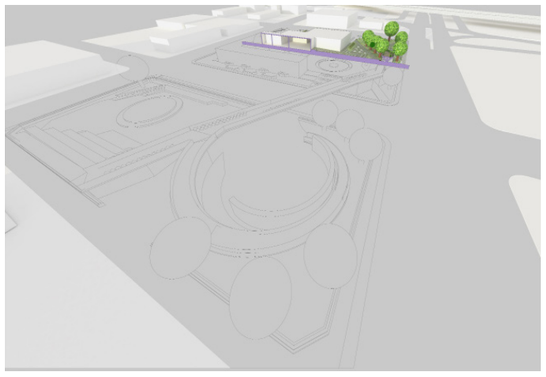
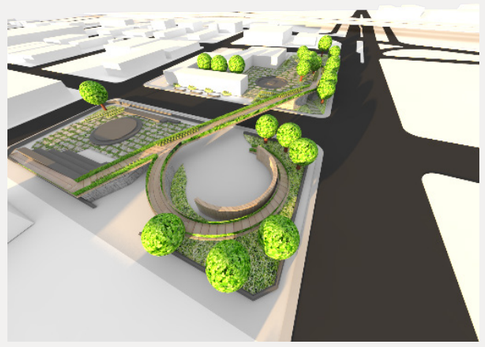
Cut 3 of 4

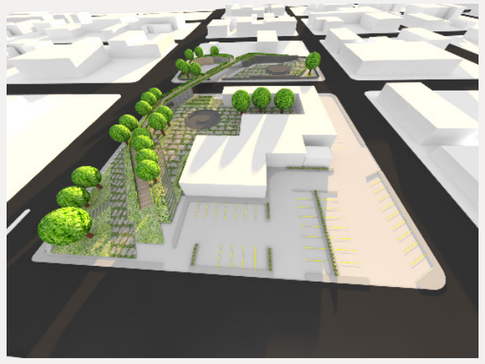
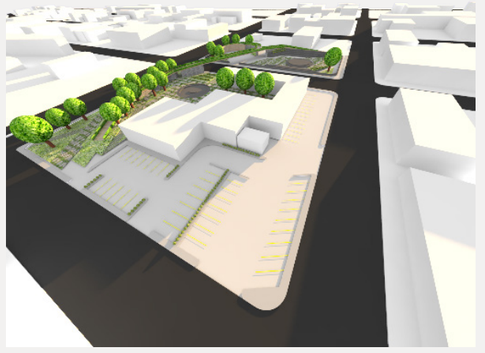


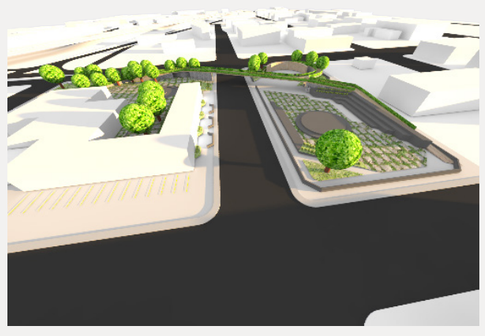
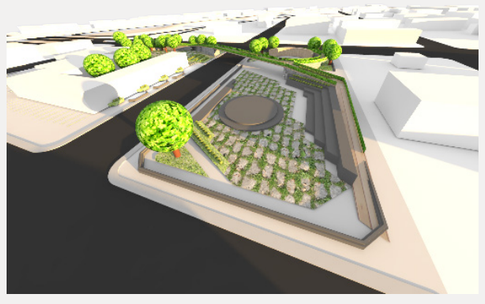
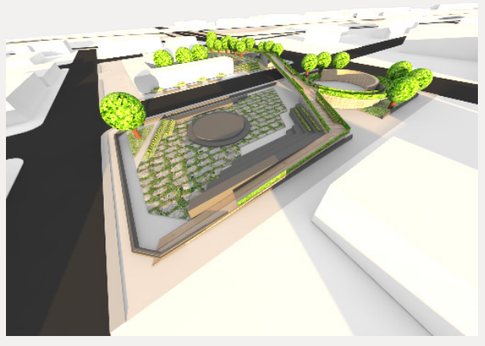
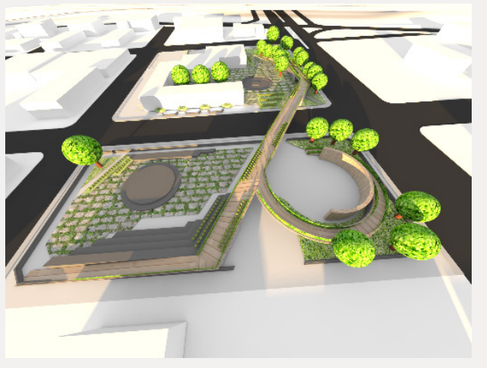
Cut 4 of 4

Bird's Eye Series

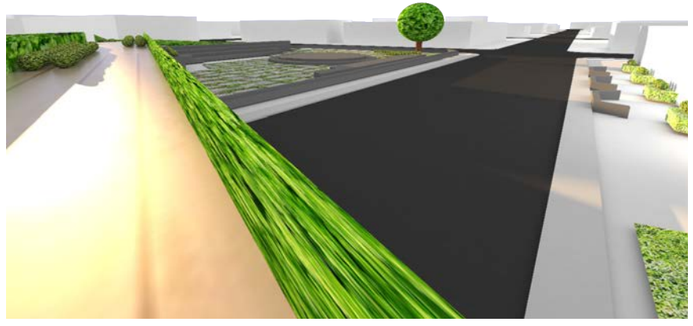




Bird's Eye and Eye Level Renderings



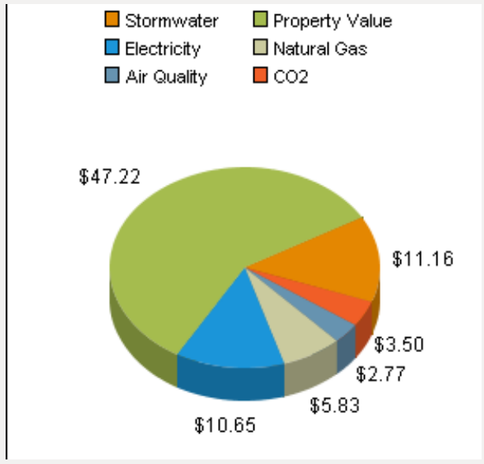
Landscape Performance Benefits

The following information is based off the benefits of the proposed Buddy Holly design and uses the landscape performance benefits calculators in order to determine the environmental, economic, and social benefits that were implemented to the site. According to the National Tree Benefit calculator I was able to determine that based off the planting design of my site plan that the yearly overall benefits will be $46,833 according to the 231 trees added to the site. According to the storm water calculation the amount of storm water runoff that will be intercepted is 295,948 gallons of runoff and will remove 107,698 pounds of carbon from the atmosphere. The design will also conserve up to 24,377 kilowatt/hours of electricity by reducing the amount of heat absorb onto the site, slowing down windings reducing the amount of heat lost, and by cooling the air due to evapotranspiration which cools the air by using solar energy. The calculator did not have all the plants that I choose to place on my site as part of my design so I had to use generic broadleaf deciduous trees and broadleaf deciduous evergreen trees. This could change the amount of money, energy, storm water management, and carbon removal that would typically be removed by certain tree species. Here is one example of the cost break down per tree:

Breakdown of your tree's benefits

This 20 inch Broadleaf Evergreen Large Other
provides overall benefits of: $81 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult.
Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.



The social benefits of the site are calculated based off the amount of social space added to the site according to the square footage. By adding almost 2812.67 additional square feet to the site for purely social interactive areas increase the amount of social interaction taking place on site. These will allow a larger variety of activities and area for people to gather. It will also establish the site as a prominent cultural feature for the Lubbock area which will increase site visitation which was one of the goals I wished to achieve.

The economic value of the site I feel is clearly established using the National Tree Calculator by addressing the cost benefits gained by adding more vegetation to the site and by reducing the amount of heat/electricity used by the site. Based on these calculations of my design I can conclude that the main goals for increasing site visitation, reducing environmental impact, and generating revenue to the site was achieved.

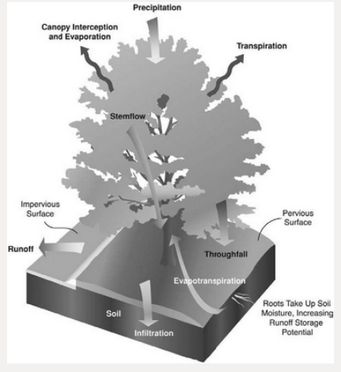
Benefits of trees do not account for the costs associated with trees' long-term care and maintenance. If this tree is cared for and grows to 25 inches, it will provide $95 in annual benefits.
Broadleaf Evergreen Large Other
Broadleaf Evergreen Large Other

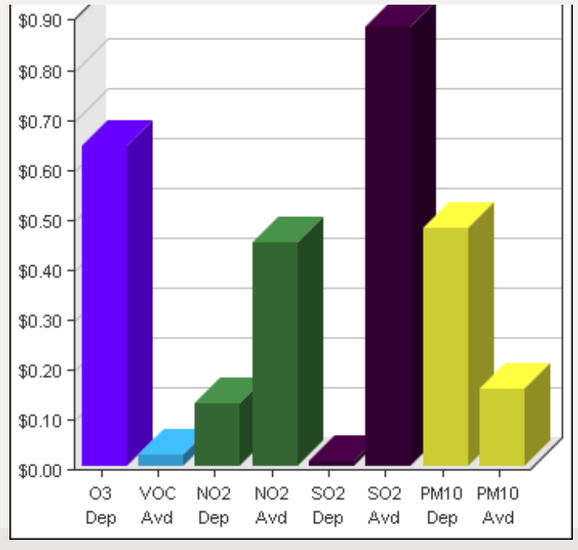
"Dep" stands for deposition. This is your tree absorbing or intercepting pollutants. "Avd" stands for avoided. This is your tree lessening the need for creation of these pollutants in the first place by reducing energy production needs.
Air quality benefits of your 20 inch Broadleaf Evergreen Large Other shown in the graph at left.

Air pollution is a serious health threat that causes asthma, coughing, headaches, respiratory and heart disease, and cancer. Over 150 million people live in areas where ozone levels violate federal air quality standards; more than 100 million people are impacted when dust and other particulate levels are considered "unhealthy." We now know that the urban forest can mitigate the health effects of pollution by:

- Absorbing pollutants like ozone, nitrogen dioxide and sulfur dioxide through leaves
- Intercepting particulate matter like dust, ash and smoke
- Releasing oxygen through photosynthesis
- Lowering air temperatures which reduces the production of ozone
- Reducing energy use and subsequent pollutant emissions from power plants

It should be noted that trees themselves emit biogenic volatile organic compounds (BVOCs) which can contribute to ground-level ozone production. This may negate the positive impact the tree has on ozone mitigation for some high emitting species (e.g. Willow Oak or Sweetgum). However, the sum total of the tree's environmental benefits always trumps this negative





Landscape Performance Benefits

Social, Economic, and Environmental Benefit Calculations

Social, economic, and environmental benefits can be reaped by a retrofit design for the Buddy Holly Center. The Landscape Performance Series Benefits Toolkits, at http://landscapeperformance.org/benefits-toolkit, help translate intangible benefits into tangible benefits.

One of the social benefits for the Buddy Holly Center is an addition of well-designated social areas. These social spaces benefit not only to the visitors of the Center, but the public and city as well. The space allows for family, individual, and classroom usage. A total of 35,709 ft^2 was specifically designated as social space. The area can be used for recreation, entertainment, or education.

The economic benefits associated with the redesign are very beneficial. According to the National Tree Benefit Calculator at http://www.treebenefits.com/calculator, there is an annual cost benefit of $2,791 for the addition of 55 trees. There are three major tree species used in the redesign. 31 Desert Willows (*Chilopsis linearis)* will be added with an 18" trunk. Each Desert Willow provides $14 overall benefits per year. Each of the 14 Shumard Oaks (*Quercus shumardii) with* 20" trunks yield an annual $144 cost benefit. The 11 Junipers (*Juniperus* species) with 15" trunks provide $31 overall benefits per year.

According to the National Stormwater Management Calculator there will be an 82% increase in construction and maintenance total life-cycle. Site impermeable area is reduced by 56.5%, a green roof and vegetation filter strips are implemented thus drastically decreasing stormwater runoff and increasing cost benefits. With this, annual green benefits are $6,996 and annual life cycle benefits are $221,678 NPV.

Benefits

	Annual Benefits ($)	Life Cycle Benefits ($, NPV)
	Green Benefits	Green Benefits
Reduced Air Pollutants	5	143
Carbon Dioxide Sequestration	3	95
Compensatory Value of Trees	6,875	217,852
Groundwater Replenishment	45	1,435
Reduced Energy Use	43	1,357
Reduced Treatment benefits	25	795
Total	**6,996**	**221,678**

A major benefit of the redesigned site is the positive environmental impact of the area. The environmental benefits include a decrease of stormwater runoff and carbon footprint, in addition to, conservation of electricity and reduction of oil and natural gas usage.

The National Tree Benefit Calculator determined that 41,702 gallons of stormwater runoff will be intercepted with the addition of 55 trees. Each Desert Willow intercepts 288 gallons of stormwater runoff annually. Each Shumard Oak intercepts 1,835 gallons and each Juniper intercepts 664 gallons of stormwater runoff annually. The National Stormwater Management Calculator at http://greenvalues.cnt.org/national/calculator.php reflects a 430.2% decrease in stormwater runoff. According to the calculator at http://greenvalues.cnt.org/national/calculator.php, overall benefits, and pre-retrofit versus post-retrofit comparisons are listed below:

Coefficients and Runoff

	Predevelopment	Conventional	Green	Predevelopment to Conventional Difference (%)	Conventional to Green Difference (%)
Average Annual Rainfall					
Total Runoff (in)	13.21	12.92	9.98	-2%	-23%
Total Runoff Volume (ft^3)	164,509	160,828	124,314	-2%	-23%
Cumulative Abstractions (in)		1.22	3.48		185.83
90% Storm					
Total Runoff (in)	0.39	0.3	0	-22%	-99%
Total Runoff Volume (ft^3)	4,822	3,767	45	-22%	-99%
Cumulative Abstractions (in)		0.5	0.13		-74.36
CN	91	88	68		
Initial Abstractions (in)		0.27	0.94		252.21

According to the Green Roof Calculator at http://greenbuilding.pdx.edu/GR_CALC_v2/grcalc_v2.php#retain, a 7.2" increase in evapotranspiration and a 60% decrease in rain runoff was determined with a 35' x 17' (595 ft2) stage that will be constructed. Below shows the results for usage of a 100% new green roof versus a dark roof, no irrigation, conditions are similar to El Paso, Tx, growing media depth of 2 inches, and leaf area index of 1:

Average Sensible Heat Flux to the Urban Environment (W/m^2)

	Dark Roof	100% Green Roof System
Annual Average:	61.6	58.8
Summer Average:	54.1	58.1
Summer Daily Peak Avg.:	-120.2	128.1

Annual Roof Water Balance (in)

	Conventional Roof	100% Green Roof System
Precipitation:	6.0	6.0
Evapotranspiration:	–	7.2
Net Runoff (2):	6.0	0.1

According to the National Tree Benefit Calculator, there will be an atmospheric carbon reduction of 41,003 pounds. Using the Construction Carbon Calculator at http://buildcarbonneutral.org, a net embodied CO2 of 305 metric tons was approximated as shown below:

Total Square Feet	11,896
Stories Above Grade	1
Stories Below Grade	0
System Type	mixed
Ecoregion	Great Plains
Existing Vegetation Type	Previously Developed
Installed Vegetation Type	Shrubland
Landscape Disturbed (SF)	7,000
Landscape Installed (SF)	15,000

According to the National Tree Benefit Calculator each Desert Willow conserves 63 Kilowatt/hour of electricity and reduces oil or natural gas consumption by 3 therms.
Each Shumard Oak conserves 227 Kilowatt/hour of electricity and reduces oil or natural gas consumption by 7 therms. Each Juniper conserves 69 Kilowatt/hour of electricity and reduces oil or natural gas consumption by 3 therms.

With the redesign of the Buddy Holly Center, there are many social, economic, and environmental benefits including cost savings, a decrease of stormwater runoff and carbon footprint, as well as, conservation of electricity and reduction of oil and natural gas usage.

Olivia Sievers Ross

Surinder Aulakh
Dr. Yi Lou
LARC 2402

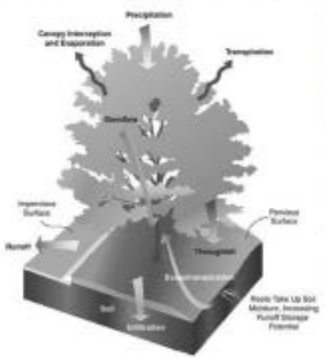
Landscape Performance Benefits

1|The benefactor of utilizing Shumard Oak trees in this proposal provides the developer a monetary benefit. This design implements 21 Shumard Oaks to maximize the opportunity of producing saving.

This 24 inch Shumard oak provides overall benefits of: $206 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations—a general accounting of the benefits produced by urban street-side plantings.

2| Implementation of an imbedded Storm water harvesting system, beneath a vegetative walkway, accompanied by with Shumard Oaks allows the proposal to create a natural readapted used for rain water.



Your 24 inch Shumard oak will intercept 2,718 gallons of storm water runoff this year.

Urban storm water runoff (or "non-point source pollution") washes chemicals (oil, gasoline, salts, etc.) and litter from surfaces such as roadways and parking lots into streams, wetlands, rivers and oceans. The more impervious the surface (e.g., concrete, asphalt, rooftops), the more quickly pollutants are washed into our community waterways. Drinking water, aquatic life and the health of our entire ecosystem can be adversely effected by this process.
Trees act as mini-reservoirs, controlling runoff at the source.

Trees reduce runoff by:

Tree, C., & Tree Experts, D. (2014, February 12). National Tree Benefit Calculator. Retrieved May 4, 2015, from http://www.treebenefits.com/calculator/ReturnValues.cfm?climatezone=Interior West

Surinder Aulakh
Dr. Yi Lou
LARC 2402

- Intercepting and holding rain on leaves, branches and bark
- Increasing infiltration and storage of rainwater through the tree's root system
- Reducing soil erosion by slowing rainfall before it strikes the soil

3| An economic benefit produced from the use of Shumard Oaks is the incline in property value over time. The Buddy Holly Center is perceived as a historical remnant and the property is priceless but through the proposal it is enhanced slightly.

Located in front of a small commercial business, this 24 inch Shumard oak will raise the property value by $148 this year.

Trees in front of single family homes have a greater property value benefit than those in front of multi-family homes, parks or commercial properties. Real estate agents have long known that trees can increase the "curb appeal" of properties thereby increasing sale prices. Research has verified this by showing that home buyers are willing to pay more for properties with ample versus few or no trees.

The 24 inch Shumard oak you selected will add 628 square feet of LSA this year.

In subsequent years it will add more, and the property value will increase accordingly

4| Calculations of readapting the under-utilized open spaces into designated social spaces increases opportunity of the social encounters in the boundaries of the site. The creation of spaces along the edge condition increases the interaction of a pedestrian with the site.

Entire Site Area| 15000

Designated Area to Social Spaces| 2500 Sq. Ft.

16 Percent Incline in spaces with socially interactive characteristics

Tree, C., & Tree Experts, D. (2014, February 12). National Tree Benefit Calculator. Retrieved May 4, 2015, from http://www.treebenefits.com/calculator/ReturnValues.cfm?climatezone=Interior West

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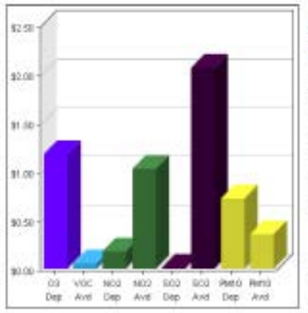
5|Shumard Oaks increase the quality of air in the surrounding area and creates a micro-climate on the site. The acclimatized spaces naturally attract users from the city to benefit the reduction or toxins and pollutants.



Air quality benefits of your 24 inch Shumard oak shown in the graph at left.

Air pollution is a serious health threat that causes asthma, coughing, headaches, respiratory and heart disease, and cancer. Over 150 million people live in areas where ozone levels violate federal air quality standards; more than 100 million people are impacted when dust and other particulate levels are considered "unhealthy." We now know that the urban forest can mitigate the health effects of pollution by:

- Absorbing pollutants like ozone, nitrogen dioxide and sulfur dioxide through leaves
- Intercepting particulate matter like dust, ash and smoke
- Releasing oxygen through photosynthesis
- Lowering air temperatures which reduces the production of ozone
- Reducing energy use and subsequent pollutant emissions from power plants

Tree, C., & Tree Experts, D. (2014, February 12). National Tree Benefit Calculator. Retrieved May 4, 2015, from http://www.treebenefits.com/calculator/ReturnValues.cfm?climatezone=Interior West

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Works Cited

Green Roof Energy

Olivia Ross & Idalia Vera

5 Benefits of a Green Roof

Who designed this tool?

- Researchers and Staff
  - Portland State University
  - University of Toronto
  - Green Roofs for Healthy Cities
- Funded by
  - US Green Building Council
  - Those stated above
  - Environment Canada

When was it designed?

- 2004-2006 Dr. Sailor & colleagues at Portland
- In April 2007 module became part of standard release of the US Department of Energy’s EnergyPlus model

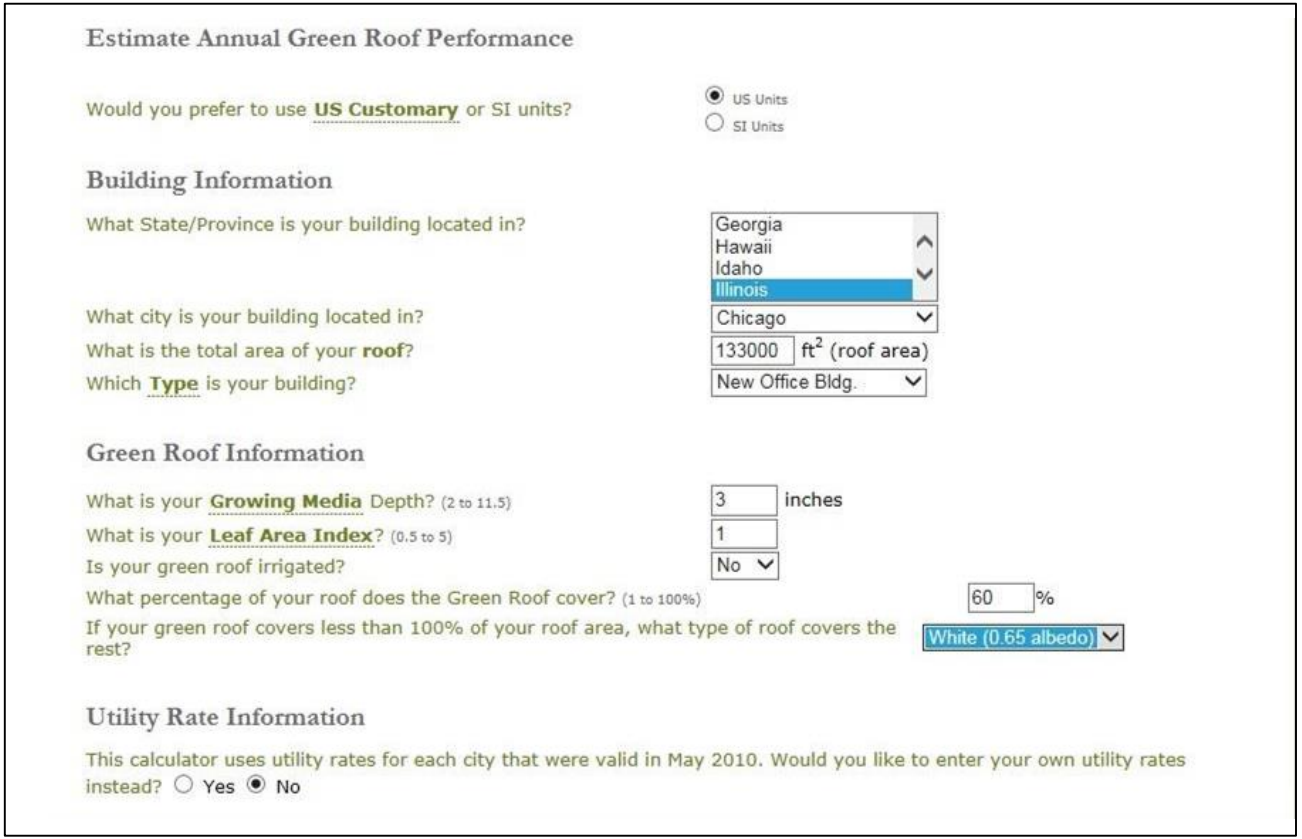
In what situation can we use this tool?

To compare annual ***energy performance*** and ***cost benefit*** of a building with green roofing to the same building with either dark roof or white roof

What are the requirements to use this tool?

Access Online

Minimal Site Data



How to use this tool?

Impact of a Green Roof

You specified **a New Office Building** in **Chicago, IL** with a total roof area of 133000 ft^2. The Green Roof you specified for this building has a **Growing Media Depth** of 3 inches, a **Leaf Area Index** of 1, covers approximately 60% of the total roof area (the rest being a white roof), and is **not irrigated.** For reference, the annual whole building electricity consumption for the specified green roof was 5608378 kWh and the annual gas consumption of this green roof was 16329 Therms

Annual Energy Savings compared to a Dark Roof (albedo = 0.15)

Electrical Savings:	28615.4 kWh
Gas Savings:	-111.3 Therms
Total Energy Cost Savings(1):	$2774.09

Annual Energy Savings compared to a White Roof (albedo = 0.65)

Electrical Savings:	7774.7 kWh
Gas Savings:	747.6 Therms
Total Energy Cost Savings(1):	$1680.75

Average Sensible Heat Flux to the Urban Environment (W/m^2)

	Dark Roof	White Roof	60% Green Roof System
Annual Average:	55.3	6.5	26.1
Summer Average:	82.1	20.4	37.4
Summer Daily Peak Avg.:	305.1	109.7	112.0

Average Latent Heat Flux to the Urban Environment (W/m^2)

	Conventional Roof	60% Green Roof System
Annual Average:	-	28.2
Summer Average:	-	35.8
Summer Daily Peak Avg.:	-	105.6

Annual Roof Water Balance (in)

	Conventional Roof	60% Green Roof System
Precipitation:	31.8	31.8
Evapotranspiration:	-	14.9
Irrigation:	-	0.0
Net Runoff (2):	31.8	17.0

What does it tell us?

New Walmart Store #5402
Chicago, Illinois

- Site Data
  - 133,000 sq ft.
  - 60% covered green roof, 40% white
  - Growth Media 3 inches
  - Leaf Area Index 1
  - No irrigation
- Results
  - Calculator [1 year] → $1,756
  - Walmart [2006-2009] → $6,650
  - Difference→ 4,894 (66% difference)

Disadvantages

- Doesn’t include every city [Lubbock not included]
- Version differences between “Old” and “New”
  - Conduction Finite Difference [CFD] scheme to transfer solution
  - Precipitation schedule data
- “Old”--> doesn’t use Canadian precipitation schedules
  - Similar US Cities precipitation adjusted and used instead
- No irrigation = Potential for dead Vegetation
  - By including irrigation schedule cost benefit will decrease [due to maintenance cost]

Advantages

- Generally accurate +/- 20%
- Commercial or Residential Buildings
- “NEW” or“OLD” Buildings
- Compared with conventional white and black roofs
- Predict energy and cost savings based on input

Works Cited

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