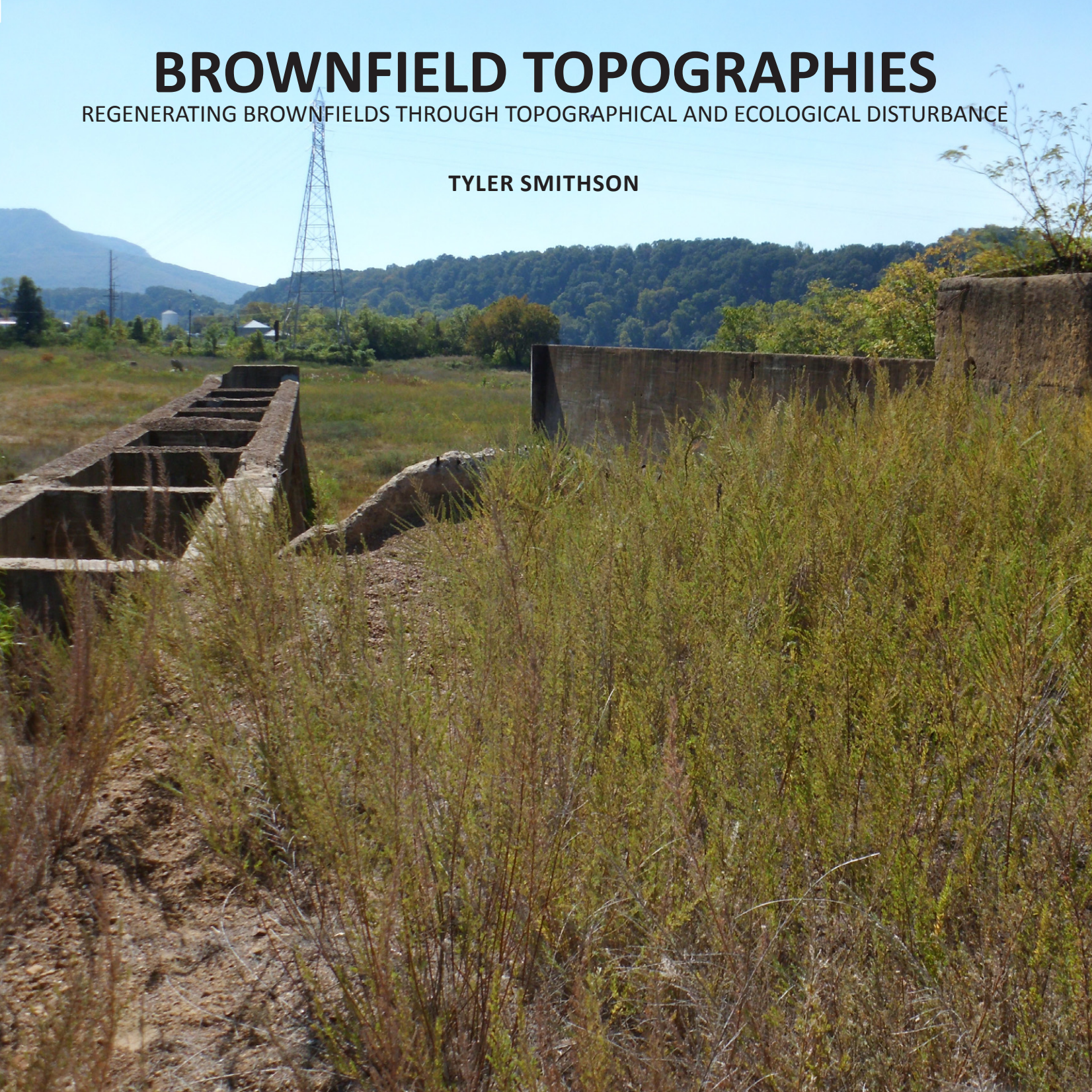


BROWNFIELD TOPOGRAPHIES

REGENERATING BROWNFIELDS THROUGH TOPOGRAPHICAL AND ECOLOGICAL DISTURBANCE

TYLER SMITHSON



BROWNFIELD TOPOGRAPHIES:

Regenerating brownfields through topographical and ecological disturbance

TYLER SMITHSON . MLA THESIS . 2011

AUBURN UNIVERSITY
College of Architecture, Design,
and Construction



Panorama of the entrance into the Vulcan site looking up towards Cameron Hill.



ACKNOWLEDGEMENTS

I would like to thank all those who have helped me to produce my thesis work over the past year. Specifically, Rod Barnett for having insight and input throughout the development of my research. I also thank those on my thesis committee; David Hill and Jocelyn Zanzot who were always there to give valuable feedback along the way. I would like to dedicate this book to my family, for without their constant support and encouragement, I would have not made it to where I am today.



RESEARCH QUESTION

How can topographical and ecological disturbance be used to regenerate the Vulcan Aggregate Facility landscape?



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ABSTRACT

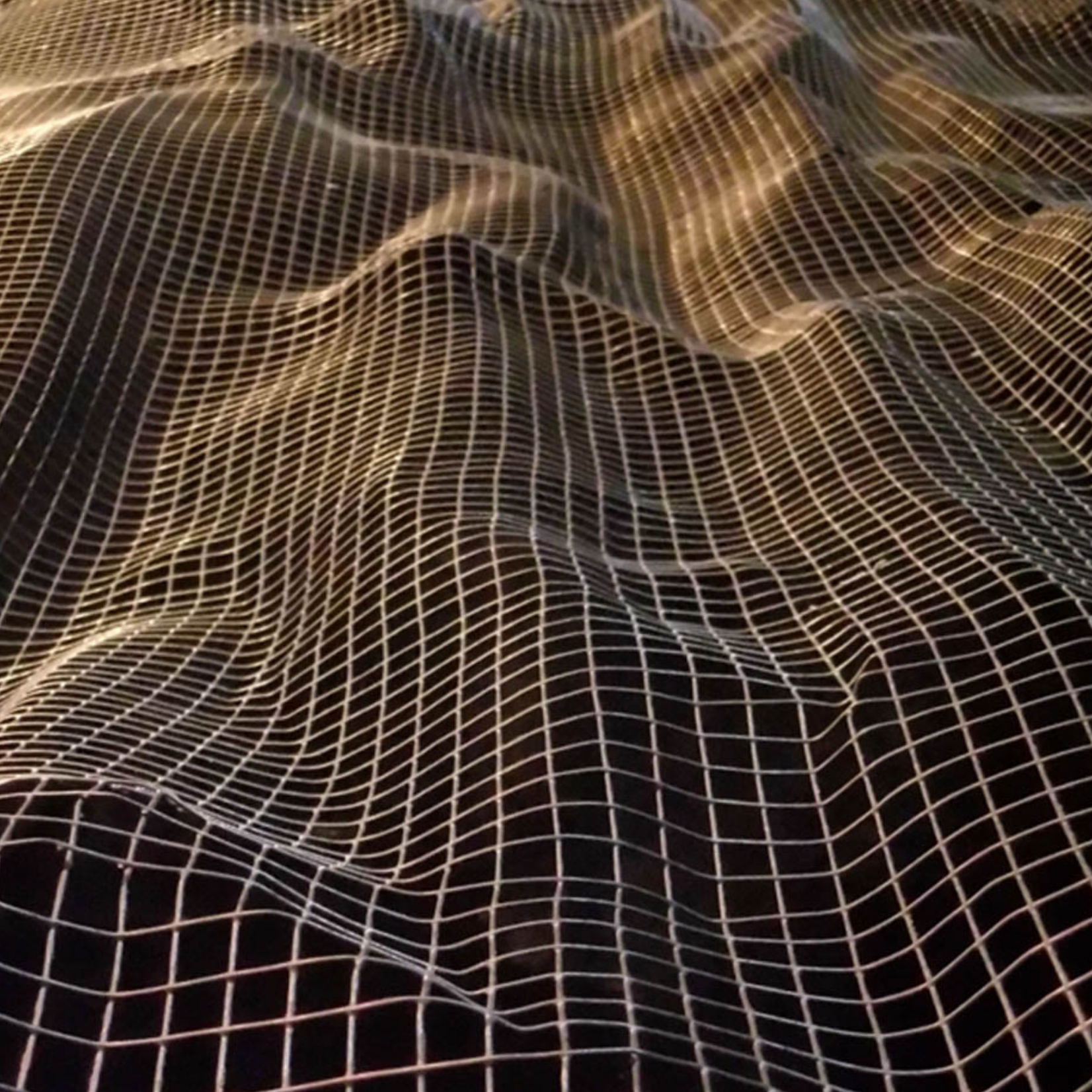
Brownfield topology is my term for the regeneration of urban brownfield sites through the disturbance of topography and site ecologies. This approach physically moves earth to generate unique arrangements of topography and disperses seeds to create microecologies. Once an initial disturbance is established, natural forces are allowed to resume in the colonization of the site. Elements that further redefine the spatial form of the site are natural forces such as erosion, sedimentation, and floral and faunal colonization. Human use of the site is also permitted to occur in unplanned ways, so that consequent uses and inhabitation will emerge over time. From this, an adaptive terrain emerges to regenerate the site.

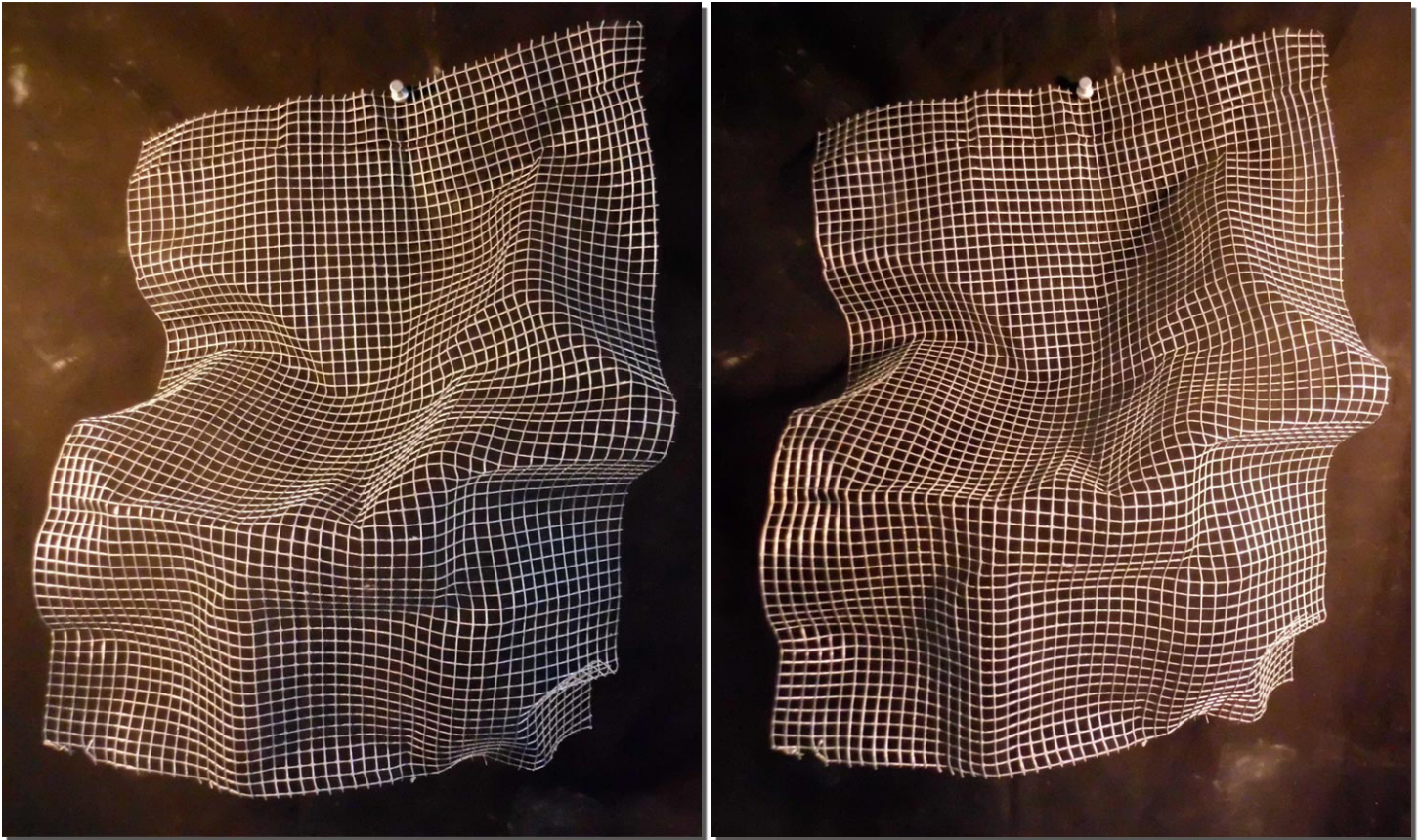
The methodology described above is an alternative approach towards the conventional methods of Brownfield regeneration. To test the theoretical ideas that have been put forward, I have chosen a Brownfield site along the Tennessee River in Chattanooga that was once home to Vulcan Materials Company. Unique components of the site are ruderal ecologies, the Vulcan structure and remnant industrial fragments. Changes in topography are intended not to erase the ruderal ecologies that have developed, but to enhance ecological conditions. Once the site has undergone the initial phases of regeneration, further elements of plantings, structures, and landscape features will be introduced to enrich the experience of the site and to reconnect it to the context.



KEYWORDS

Brownfield Regeneration, Disturbance, Ecological Restoration, Riverfront, Trail Network, Topography, Ruderal Ecology

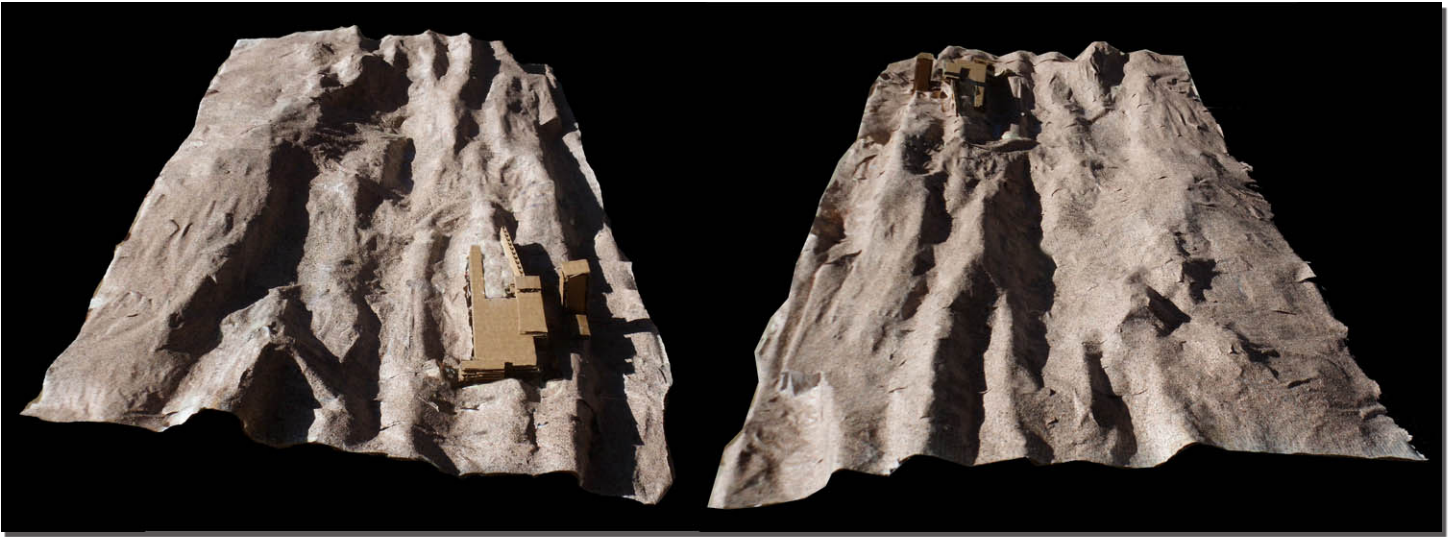




CHAPTER 1 / THEORETICAL FRAMEWORK

The genesis of disturbance theory is based upon the writings of the 1st century Roman poet Lucretius in his *De rerum natura* or *The Nature of Living Things*.¹ Lucretius describes an orderly world of equilibrium as being dramatically altered by introduction of chaos and disorder. In his analogy of the world as a “laminar flow of atoms raining in the void” he explains that through disturbance of this flow, the creation of living and chaotic systems is derived out of an orderly world. The natural systems on earth today have too emerged from chaos to produce self-sustaining and perpetuating systems. Because of this balance of forces, nature can continuously renew itself precisely from the dance of order and chaos.²

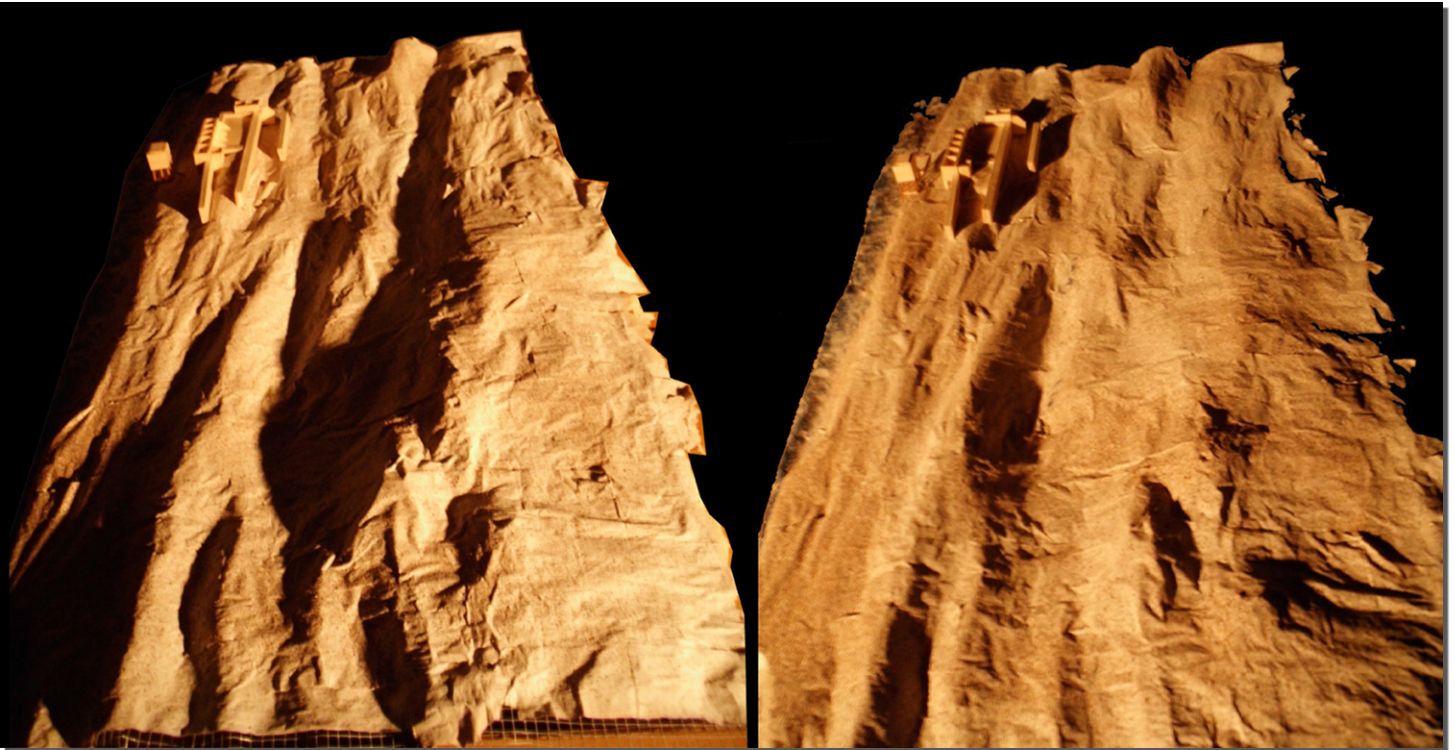




The emergence of new complex systems through methods of disturbance establishes the theoretical framework of this research. Integrating this understanding into the practice of Landscape Architecture can allow for an entirely new set of landscape transformations. This approach enables the designer to alter a set of initial conditions upon a particular site to allow for the emergence of a new, self-generating condition. Through this design methodology, the site itself will have its own unique “becoming” through the growth and succession of ruderal (naturally occurring) ecologies and various social activities occur throughout the years.

The process which guided the topographical manipulation and ecological dispersion was based upon a “formless” or “automatic” design methodology. In a formless design approach, no pre-decision in form drives the creation of an idea, just openness to undetermined results. In order for this to be successful, the design removes the designer from the process of consciously creating objects. This revealed the creation of unique and dynamic forms that dictated the final design. The paradox here, is that it is impossible for the designer to totally fulfill this methodology in the creation of formless objects from a thought process guided by rational (often times irrational) thinking. Thus, a more accurate description of the topographical design process is an “automatic” method which was used to generate highly sculpted horizontal surfaces upon the landscape. ³





In this process, various design experiments were conducted that deformed horizontal surfaces (wire mesh) through means of physical operations (crushing, stomping, bending and molding) to produce topographical study maquettes. Through the analysis of these models ideal dynamics such as aspect, slope and form began to emerge to the further the concept.

The process of ruderal colonization upon brownfield landscapes is another element that influenced design methodology. Harnessing nature's ability to introduce disorder into ordered systems can be done through seeding and allowing succession to occur. This can allow for the ecological regeneration of brownfield sites towards greater complexity through increased ecological diversity over time. Utilizing natural operations of emerging ecosystems, the initial disturbance through seeding was an integral part in the design methodology that allows for new self-inventing landscapes to emerge.⁴

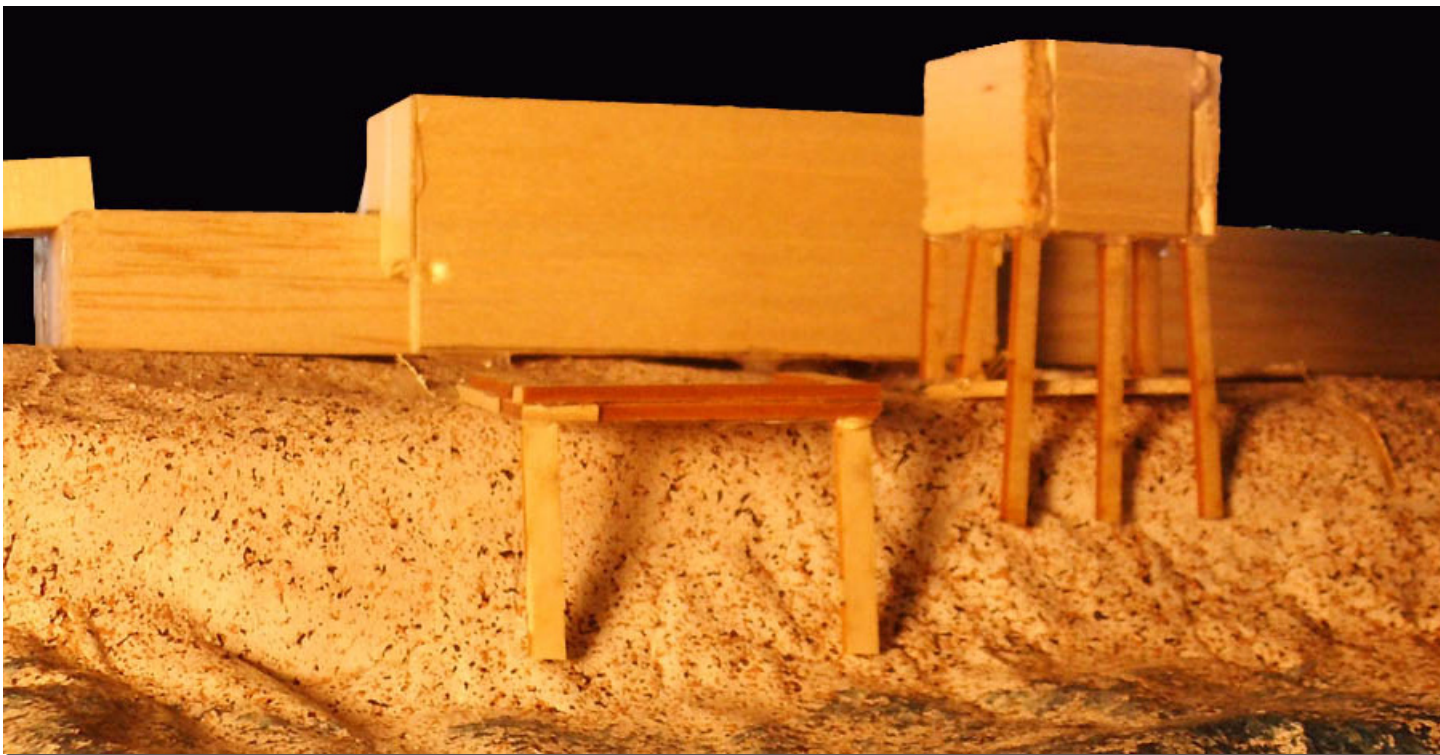
Notes

1. Lucretius, *Ed Rerum Natura*, trans. Cyril Bailey (Oxford: Clarendon Press, 1947)
2. Barnett, Rod, *A Ten Point Guide to Disturbance in Landscape Architecture*; 2010.
3. Waldheim, Charles, *Strategies of Indeterminacy in Recent Landscape Practice*. *Public Journal: Errata*, 2006.
4. Serres, Michael, *The Parasite* (Baltimore: The Johns Hopkins University Press, 1982), p99.



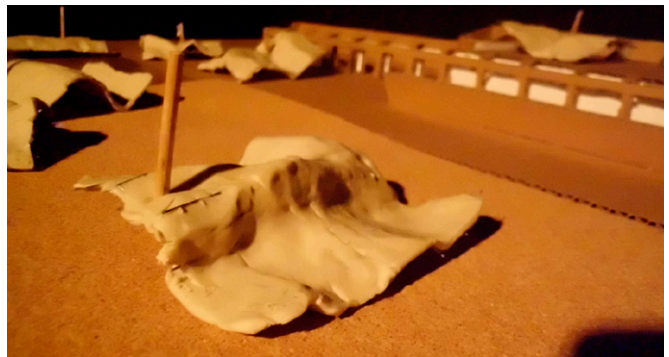


IN



TOPOGRAPHICAL STUDY MAQUETTES

Heliodon Light Study



ABOVE

Experimenting with topographical forms through molding clay onto wire mesh that was bended through “automatic” methods.



LEFT

Aerial photograph showing remediated condition upon site within Wellesley College.

CHAPTER 2 / BROWNFIELDS IN LANDSCAPE ARCHITECTURE

In Landscape Architecture, brownfield regeneration practices are utilizing these methodologies as well as introducing new ones. Methods such as bioswales and retention basins are common landscape themes. More ecologically restorative approaches can also be used, such as designed ecologies; including marshes, meadows, and forest lands.

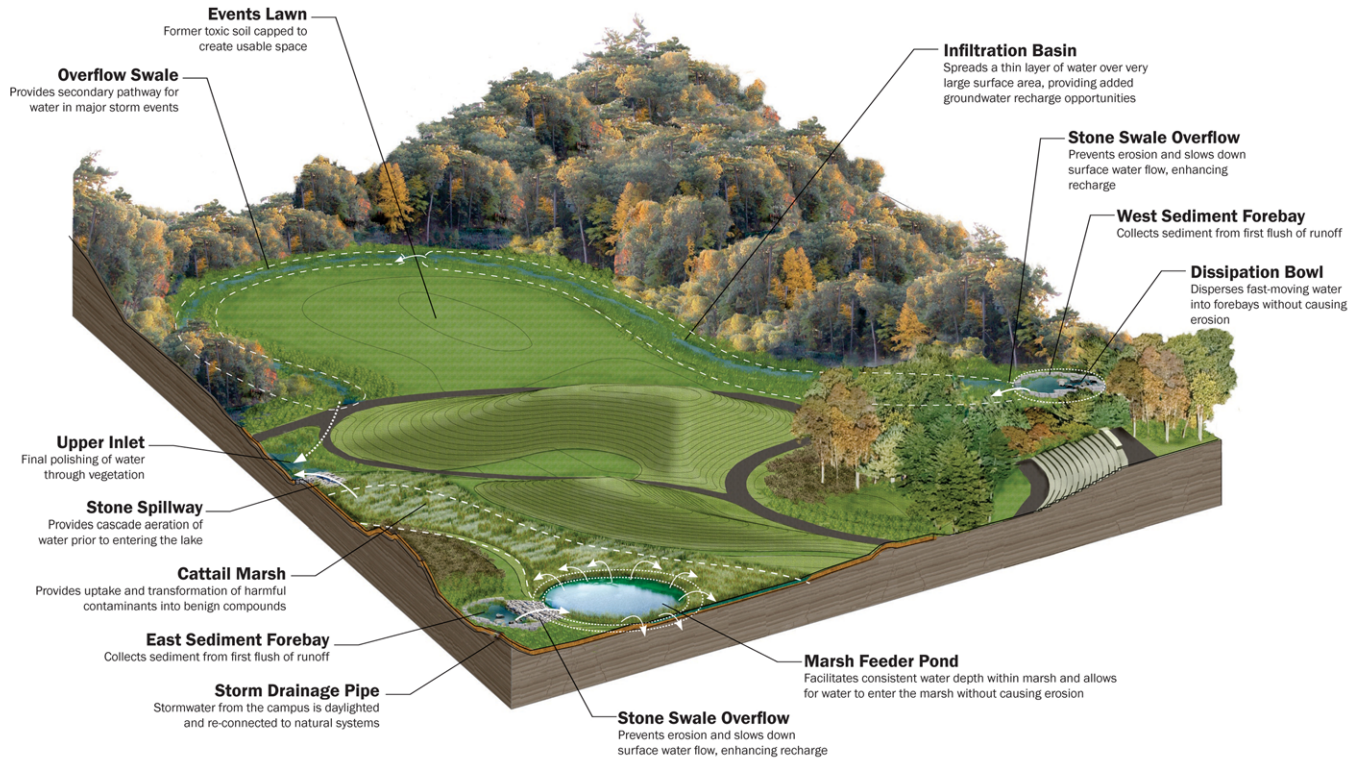
Michael Van Valkenburgh Associate's Alumnae Valley project at Wellesley College is a brownfield regeneration project located in Massachusetts. The 13.5 acre site that was formerly the site of gas manufacturing plant and later parking lot, is now ecologically productive and naturalized. Restoration began in 1999 and was completed in 2006 at a cost of \$4.5 million. The project has earned the highest award for design excellence from the American Society of Landscape Architects in 2006, who praised the way "science backs up an understated and sophisticated design." ⁴





The Alumnae Valley Project reclamation called for:

- 1. The physical and ecological renaturalization of the valley;** the reconnection of what had become a closed or filled-in valley system with the open valley system that organizes the rest of the campus landscape; the return of the valley to a walking area (removal of all cars); an informal multiuse student events and recreation area; low-maintenance plantings; an overall design to engage with the campus center.
- 2. Historical study revealed the sites morphology-** retracing glaciers deposition of eskers (lengthy winding narrow ridges of hills formed of glacial deposits), drumlins (smaller, smooth ridges in the direction of the movement of the ice in shapes like overturned tablespoons), and kettles (dell-like, often water filled depressions.)
- 3. A pastoral park** – forested hillsides, grassed meadows in the valleys, lakeside panoramas, exotic shrubbery, and irregular tree belts. Landscape to dominate architecture.
- 4. Remediation of contaminants** (dense nonaqueous phase liquid DNAPL, engine oils, gasoline, antifreeze) from gas manufacturing plant. Options – massive on-site soil treatment or encapsulate the valleys toxic hot spots by raising the ground surface. Solution – complex infrastructure of pipes and pumps, series of containment tanks where the residues are collected and disposed of over a 20 year period.



Alumnae Valley in context

The area highlighted shows the extent of this project in light green, in relation to the valley system of Wellesley's campus (in dark green)



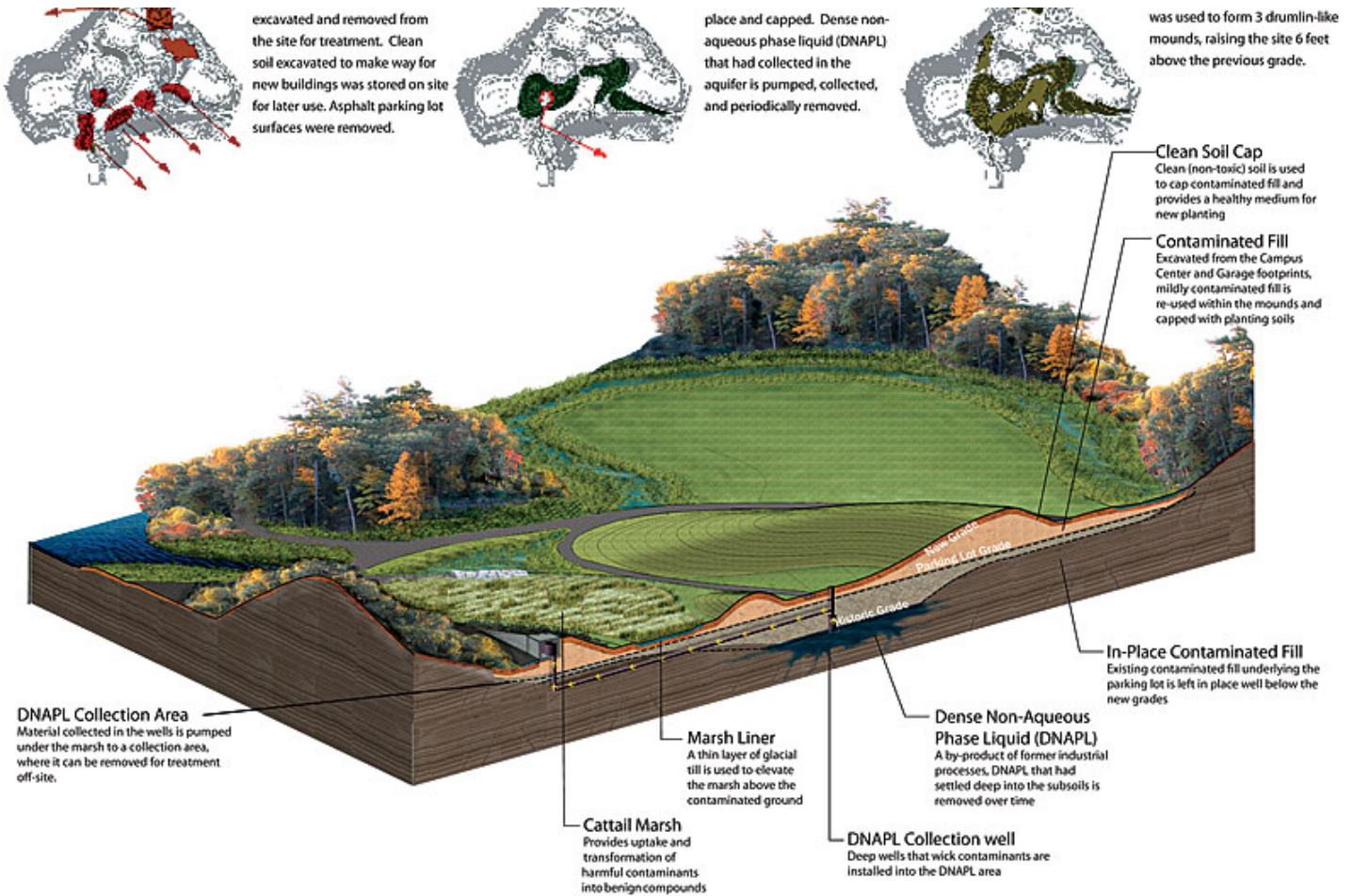
10

Reconnecting Systems - Using Topography and Hydrology to Treat Surface Water

Through ecological restoration techniques and hydrological design, Alumnae Valley is reinstated as part of the glacial topography and ecology that Olmsted cited as Wellesley's unique and valuable legacy.

5. Restoration of hydrology

Solution – channel water through underground pipes to two sedimentation basins. Bioregeneration of contaminants with cattails, sedges, forbs. Within marsh circular feeder pond with synthetic clay liner that simultaneously seals contaminated soils. Cattail → Marsh highlights environmental memory through its recall of a lost past, seasonal marker.



Brownfield Restoration - Efficiently Dealing With Toxicity

A variety of soil remediation techniques are used to treat the contaminated site and restore it as a living system.

6. Topographical manipulation – MVVA raised the valley floor by 6 feet; excavation of 55,000 cubic yards of sand and gravel from site of Campus Center to be used as fill. Solution – 3 drumlin-like mounds that are between 15 and 30 feet in height that measure between 150 and 250 feet in length. Massive forms do not replicate any known historical feature of the valley but serve as place-specific, historically grounded references not as imposed modernist shapes. Landforms are the result of countless experiments with pencil and paper, and of model building. The control of their scale, height, placement and crowning plantings derived from Van Valkenburgh's artistic intuition. The effect of these powerful sculpted forms is to break the formerly emptied valley into spatial segments, to choreograph their experience and to blur the site boundaries.



7. Pathways

Meandering more than walking with the intention to slow the walker, to offer indirect unfolding of nature, to open vistas, to engage curiosity in the rich biodiversity. Movement through is highlighted by the effect of spaces gradually opening up which requires the viewer a mental mapping to grasp orientation. Constructed and mown paths.

8. New ecologies to enhance “Wild beauty of the park”

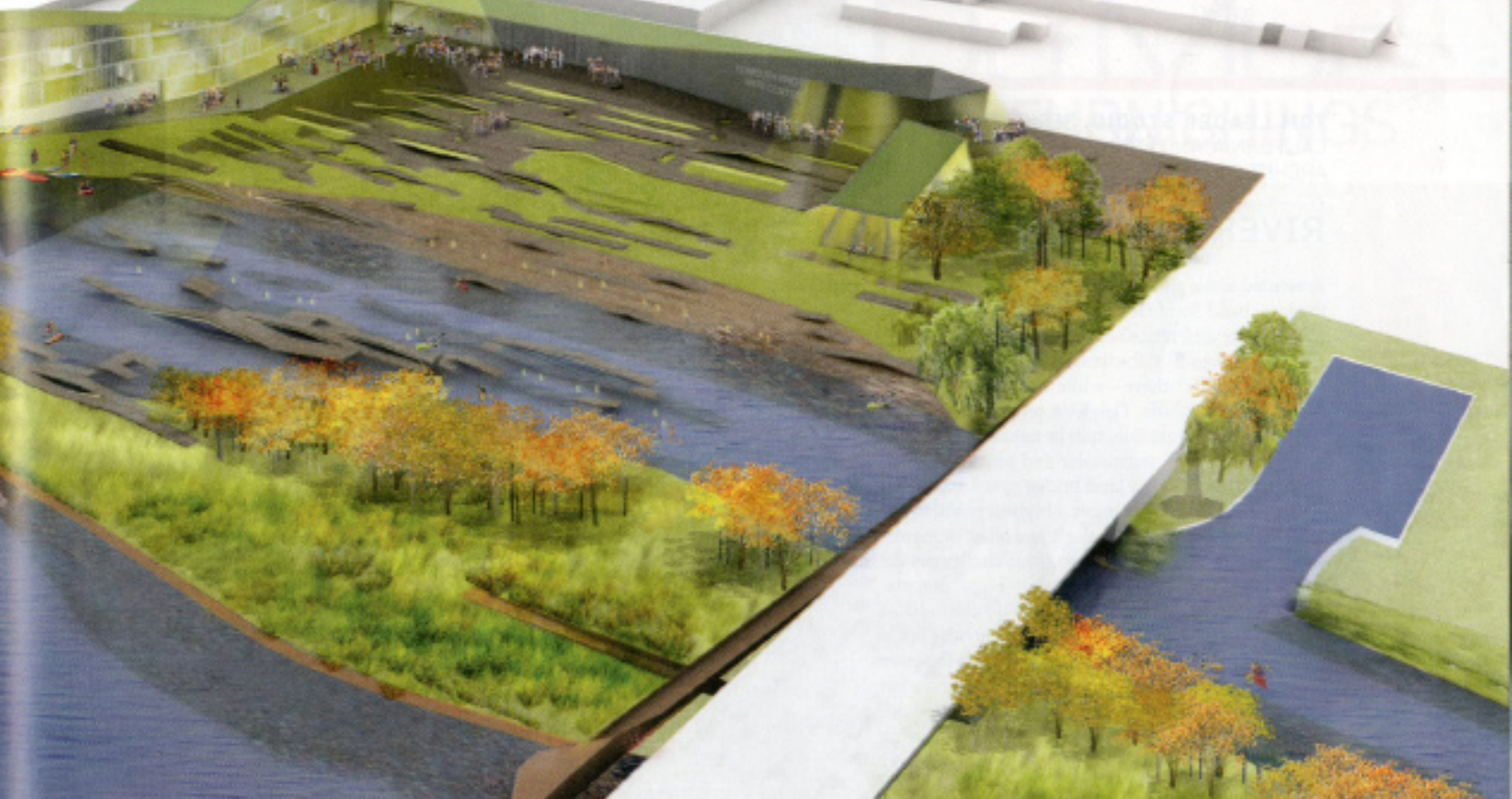
Native grasses intermixed with more than thirty kinds of native wildflowers (flowering cycles May to November). Contrast with the neated appearance of the older parts of campus (Chattanooga riverpark system). Demonstrate ecological restoration is necessary for its reconceptualization and elucidation. Achieved through ideology, machinery, ecology, money, and art.



Alumnae Valley accomplishes a far-reaching redefinition of the campus landscape. This important change may be best grasped when the new work is put in dialogue with the old. Shaped around contrasting irregular scales and forms, opened and canopied spaces, expansive pastoral panoramas, “minature forest” alternating with lawned areas, horticultural displays of exotic shrubbery, and areas designed for student recreation. Nature in the guise of a pastoral landscape. Making connections between hidden infrastructure, geological, topographic, hydrological and ecological past.

Parallels between this project and the current thesis

Both strive towards regenerating ecological, hydrological, topographical, and social conditions. However on a deeper more fundamental level the projects strive towards making the connection between the landscape and its inhabitants. Its our responsibility to leave the land better than what it was before so that generations in the future can have the opportunity to experience the land through remembrance of what was and what is to be. Regeneration so that we may build upon the foundation set today for a better future tomorrow. Reconnecting a social component back to the landscape is the most important aspect in both projects because our relationship with the land and the environment that we create is vital to making more robust complex systems that have feedback loops and long term benefits. Landscape performance and landscape infrastructure go hand in hand.



Minneapolis Riverfront Design Competition

In 2010, the City of Minneapolis held an international riverfront design competition that was to address 5.5 miles of the Upper Mississippi Riverfront. The top four teams that were selected as finalists included – Ken Smith Workshop | New York City, Stoss Landscape Urbanism | Boston, Tom Leader Studio | Berkeley, and Truenscape | Beijing. Each project was analyzed, debated and criticized by the jury and Tom Leader Studio's Riverfirst design emerged as the winner. This case study is aimed at comparing and contrasting the various design elements and methodologies used towards generating components of a successful riverfront design approach. And making the connectin to how various elements could be used in relationship to my research on brownfield regeneration.

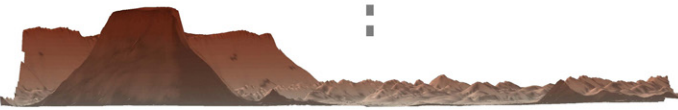
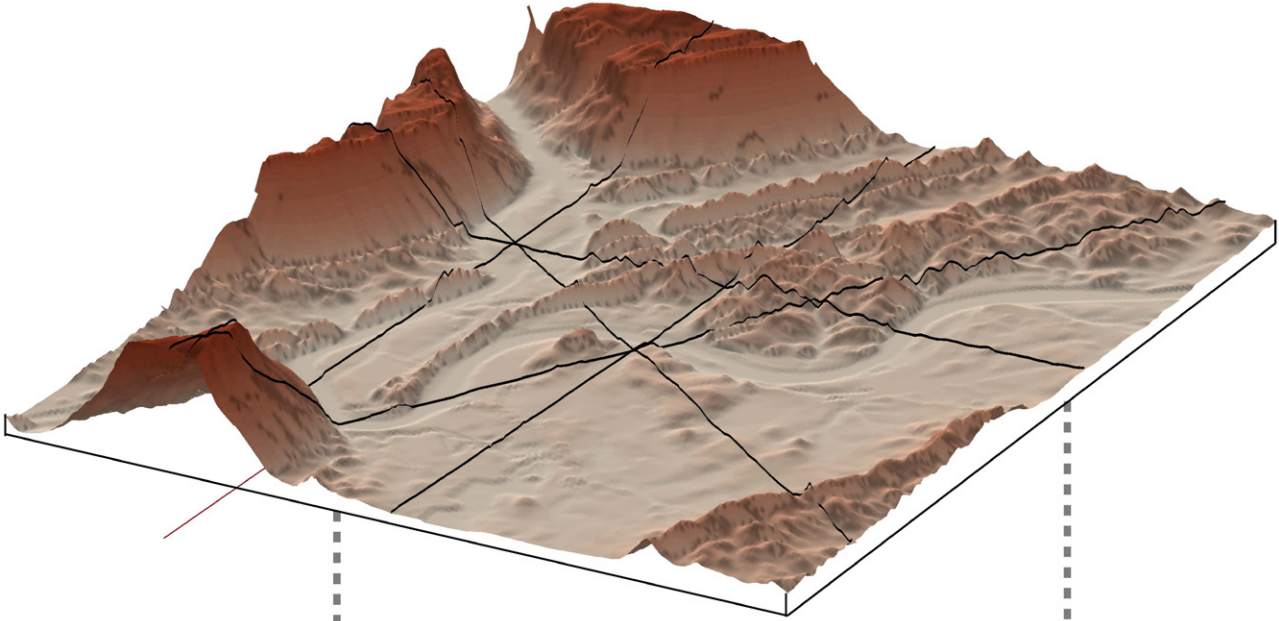
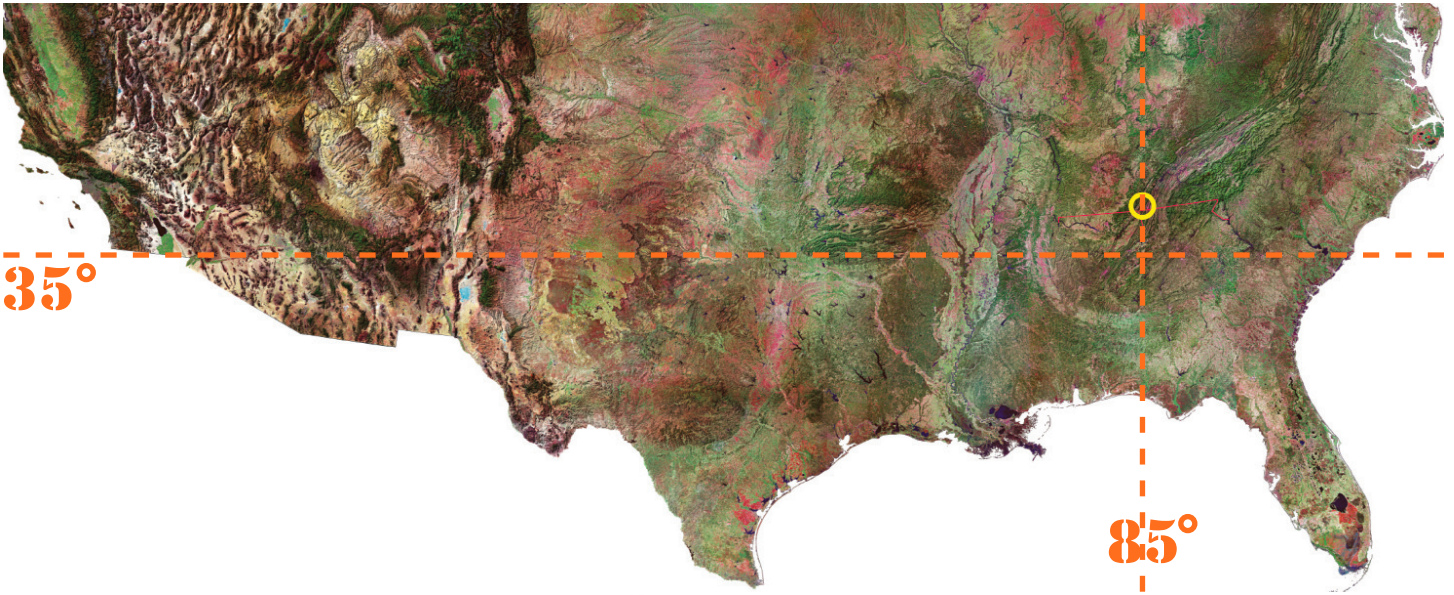
The TLS/KVA Riverfirst design team established a design framework to address 4 challenges: water, health, mobility, and green economy. These design initiatives function at multiple scales to link larger natural, social, civic and economic ecologies. Design elements include a continuous park trail system that allows for a diverse set of connections to the river as well as “soft” engineering. TLS's vision is for the riverpark system to serve as catalyst to accelerate the transition from smokestack industry to 21st century green economy based on logistical transportation, smart and clean technology innovation.

Minnneapolis Riverfront / Tom Leader

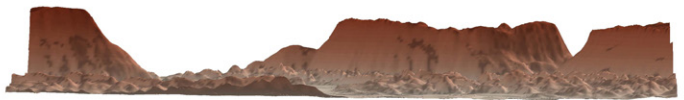


To achieve their intended impact, these design proposals reveal several commonalities including: innovative and convincing graphics, 3d models, and life-like renderings; however, with this they were designed to sell, not to actually perform. The designs were fairly comprehensive and well thought out, but, were lacking true spirit of place and seemed to smooth out the roughness of the existing site conditions. Were the project ever to be constructed, the actual cost would be so high that it would be hard to secure enough available funds in today's economy. One of the unique design proposals was the construction of "habitat islands" within the Mississippi built from sediment catchment and deposition. Utilizing some of the design elements within these projects, this thesis project can provide innovative and productive solutions that will help Chattanooga to achieve proactive growth and regeneration of its riverfront.





North Section



West Section

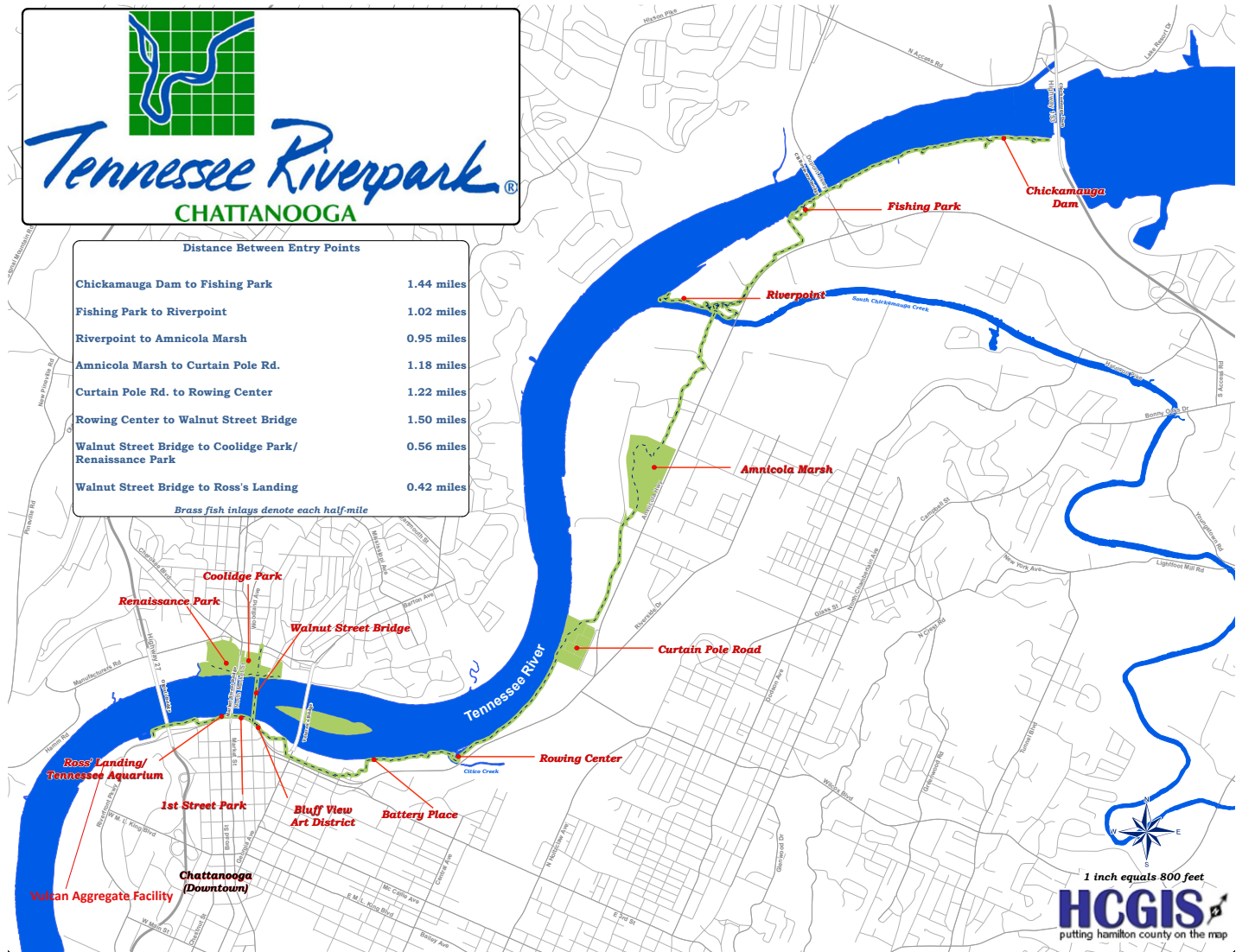
CHAPTER 3 / THE SITUATION



Located along the Tennessee River between the great Appalachian Mountains and the Cumberland Plateau, the Tennessee Valley is home to a city of nearly 170, 000 people known for its commitment to sustainable economic growth and quality of life. Entering the 21st century as one of the most progressive and livable mid-sized cities in the US, it has diverse economic advantages, abundant natural resources, a strong tourism industry, a trained labor force and a centralized location. Perhaps, nowhere in the country has a city undergone as dramatic an improvement as that experienced by Chattanooga, a city named America's most polluted city by the U.S. Department of Health, Education and Welfare in 1980. ¹ In response, Chattanooga initiated the Vision 2000 program in 1982 that aimed at revitalizing the city's riverfront and downtown. And change it did; by 2000, Chattanooga has become one of the cleanest U.S. cities, known especially for its natural attractions and cultural amenities.

From the Vision 2000 program, the 21st Century Waterfront Plan raised \$120 million to build a riverfront trail system connecting 129 acres on both sides of the river. This plan set the stage for the development of the Tennessee Aquarium, the Riverpark, the Walnut Street Bridge and Coolidge Park. Highlights of the remaining segments to be constructed include Cameron Harbor, anchoring the west end of the downtown riverwalk to Manufactures West, and an industrial area along the river, west of downtown.²

1. Chattanooga City Data. City-Data.com
2. Hargreaves Associates, "The 21st Century Waterfront: Executive Summary." May, 2002.
3. City of Chattanooga. Chattanooga.gov



ABOVE
HCGIS map of the Tennessee Riverpark shows 21st Century Riverfront extending from Ross' Landing (Downtown Chattanooga) 16 miles north east to the Chickamauga Dam.



ABOVE
Pictures show existing Tennessee Riverpark features that includes riverfront trails, pedestrian bridges, and a sculpture garden.



BELOW
Rail line crosses bridge 4 miles upstream from downtown.



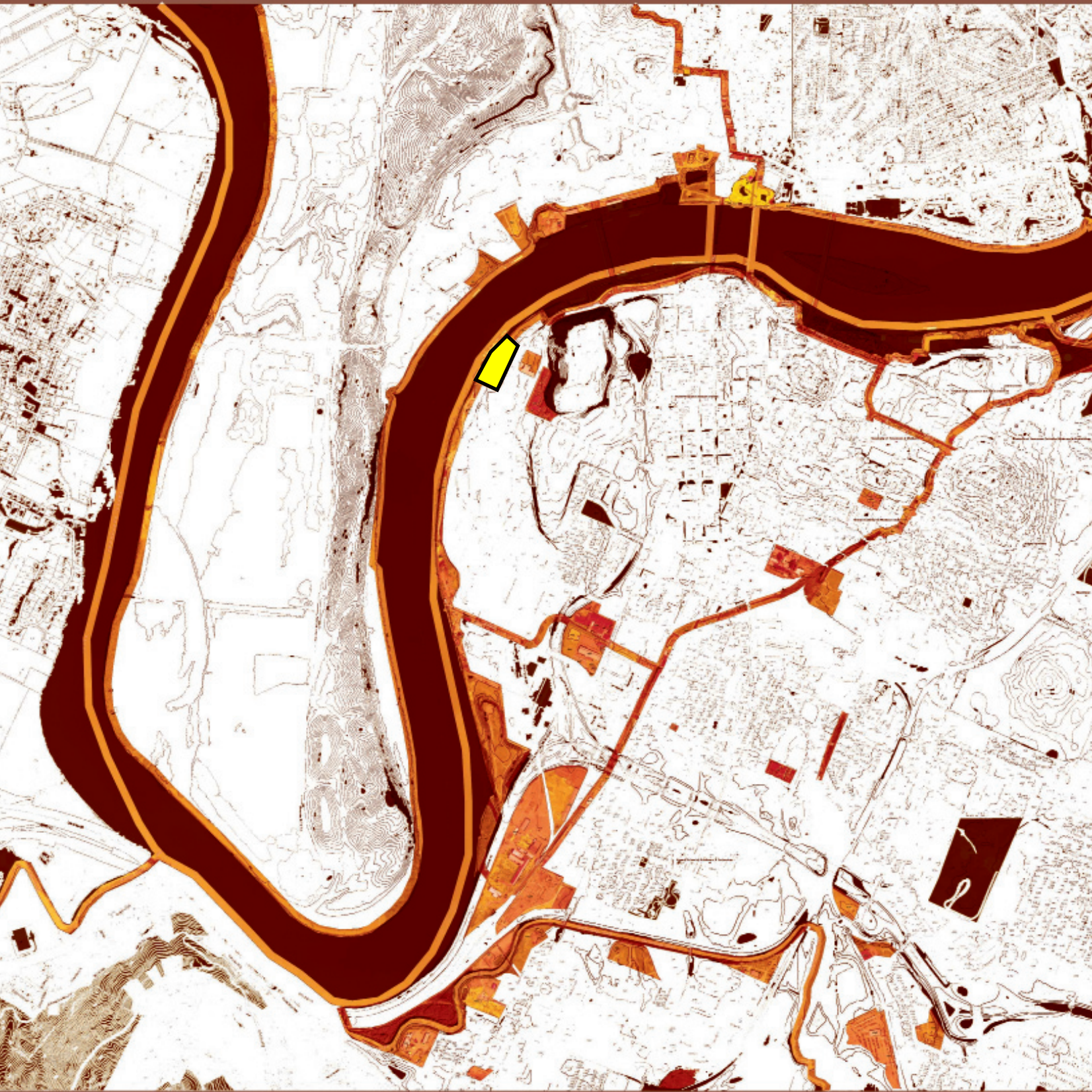


ABOVE
Downtown riverfront park perspective.



BELOW
Bridges along the Riverpark trail system.





LEFT

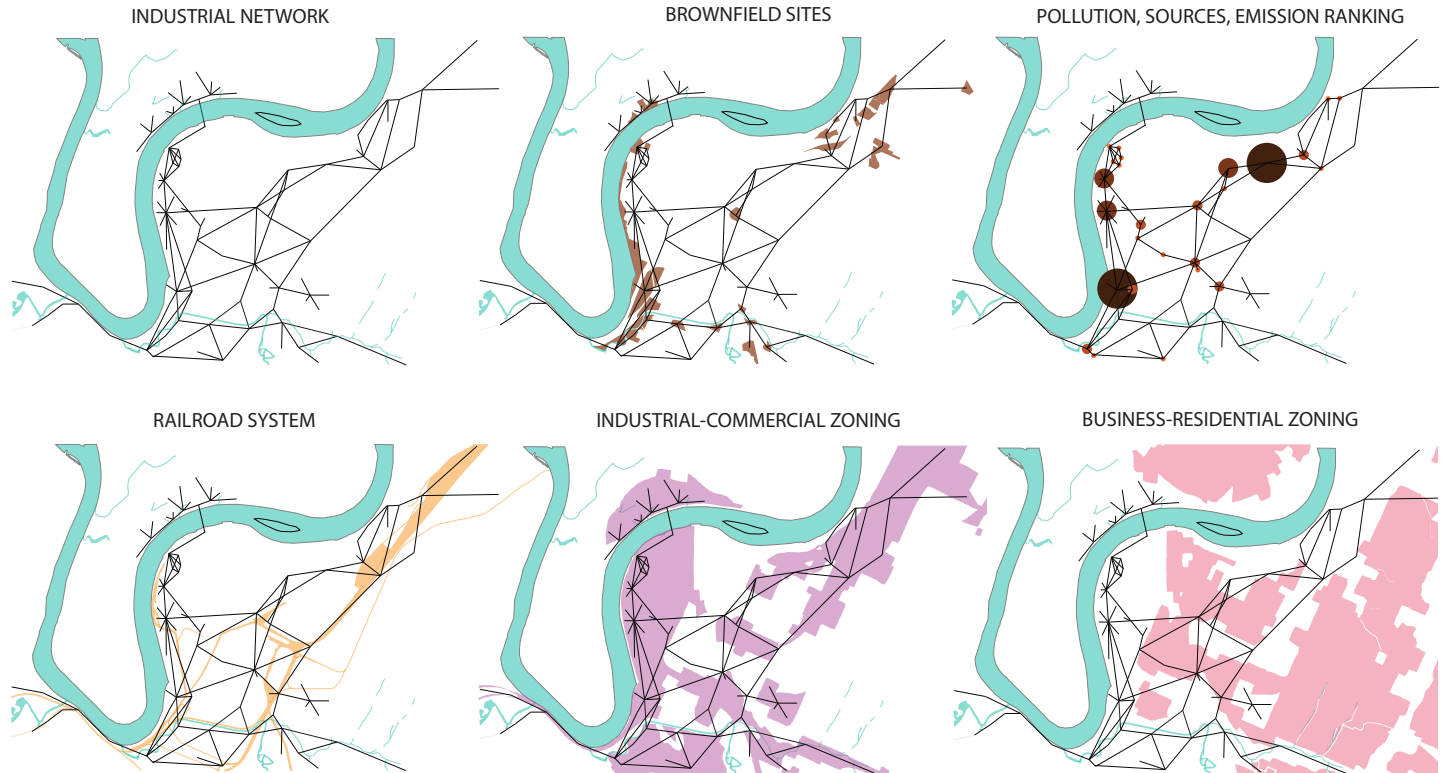
The underlying brownfield network within Chattanooga has the potential to be connected via trail network. This map can be seen as an abstraction upon viewing the urban field as a brownfield. The highlighted brownfield sites are contrasted against the constructed urban field.

CHAPTER 4 / INFRASTRUCTURE MAPPING

The mapping process led to a comprehensive understanding about the City of Chattanooga and the various infrastructures that compose it. Beginning at a regional scale: mapping of ecoregions, Tennessee River watershed, transportation networks, and proximity to nearby metropolises helped to understand the macro-context. Lying between the Appalachian Mountains and the Cumberland Plateau ecoregions, Chattanooga is ideally located along the Tennessee River Valley. Because of this topographical pinch point, trade was made possible due to the narrow river crossing. Utilizing its location along Tennessee River and 120 mile proximity to Nashville, Knoxville, Huntsville, Birmingham, and Atlanta; Chattanooga has strategic geographic location and has become transportation nexus for the surrounding region.

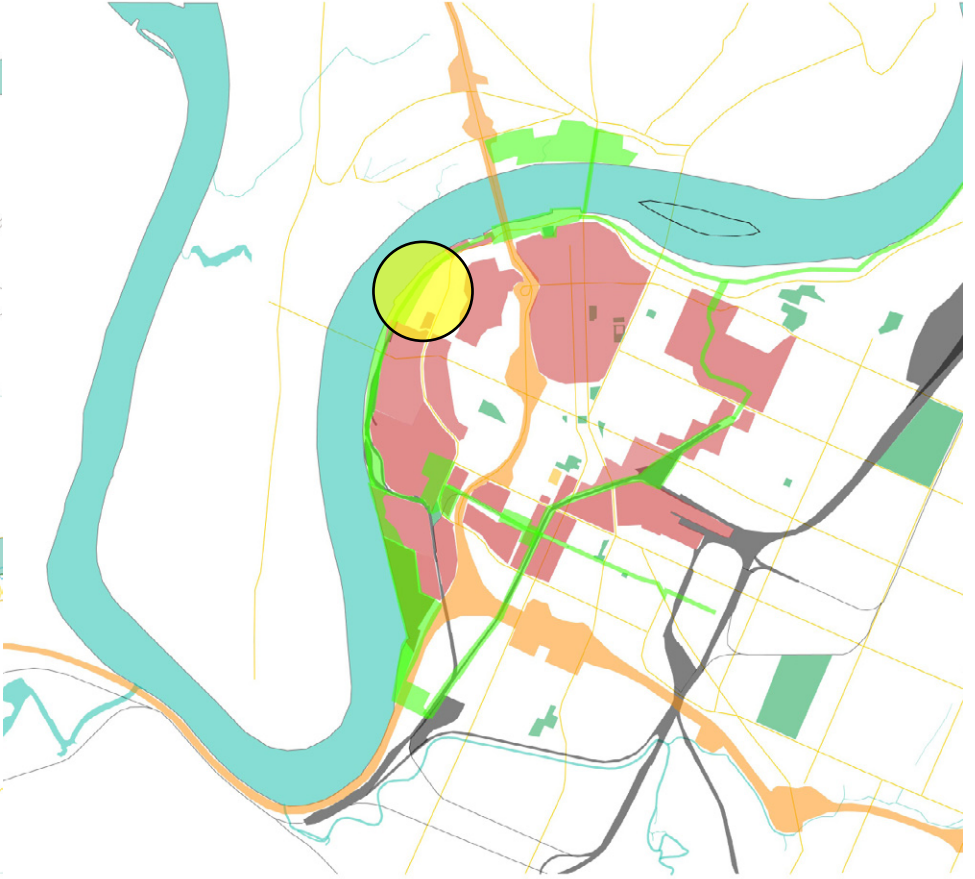
The cities roots lie in manufacturing industry that located predominately along the Tennessee River. Because of the alluvial sediment that has been deposited from the historic flooding of the river, the topography is relatively flat which made it easily accessible for railroad access. Due to the decline of manufacturing and industry in recent years, many of these sites have been abandoned and still contain many of the contaminants from operations. Mapping investigations led to the discovery of various brownfield sites, which had varied levels of contamination, size, and proximity to the river. The location of these sites has an important relationship to both the railroad network and the zoning of the city. Mapping of the development of infrastructure shows how these elements directly relate to the location of industry, businesses, and residences in Chattanooga.

Evolution of Infrastructure within Chattanooga



This mapping analysis, several low polluted sites began to emerge that had the ability to be ecologically regenerated. To further narrow the potential sites, selection criteria were established to incorporate elements of proximity to river, size of the site, defined yet porous boundaries, connection to context, and ability to be ecologically transformed.

Mapping investigations revealed that it was possible to integrate the brownfield network into the existing Tennessee Riverpark. This was done through revealing potential trail routes through the city that connect to various brownfields within the city via railroads and existing road infrastructure. Several sites have been identified along this proposed trail network that can be regenerated through similar methods as the Vulcan materials park. Once integrated into this trail system, these sites will become nodes along the trail system allowing for unique social and natural ecologies to develop.



Above

Overlay of proposed trail system (green), Manufacturing zoning (red), and transportation infrastructure

INSEAM

Top

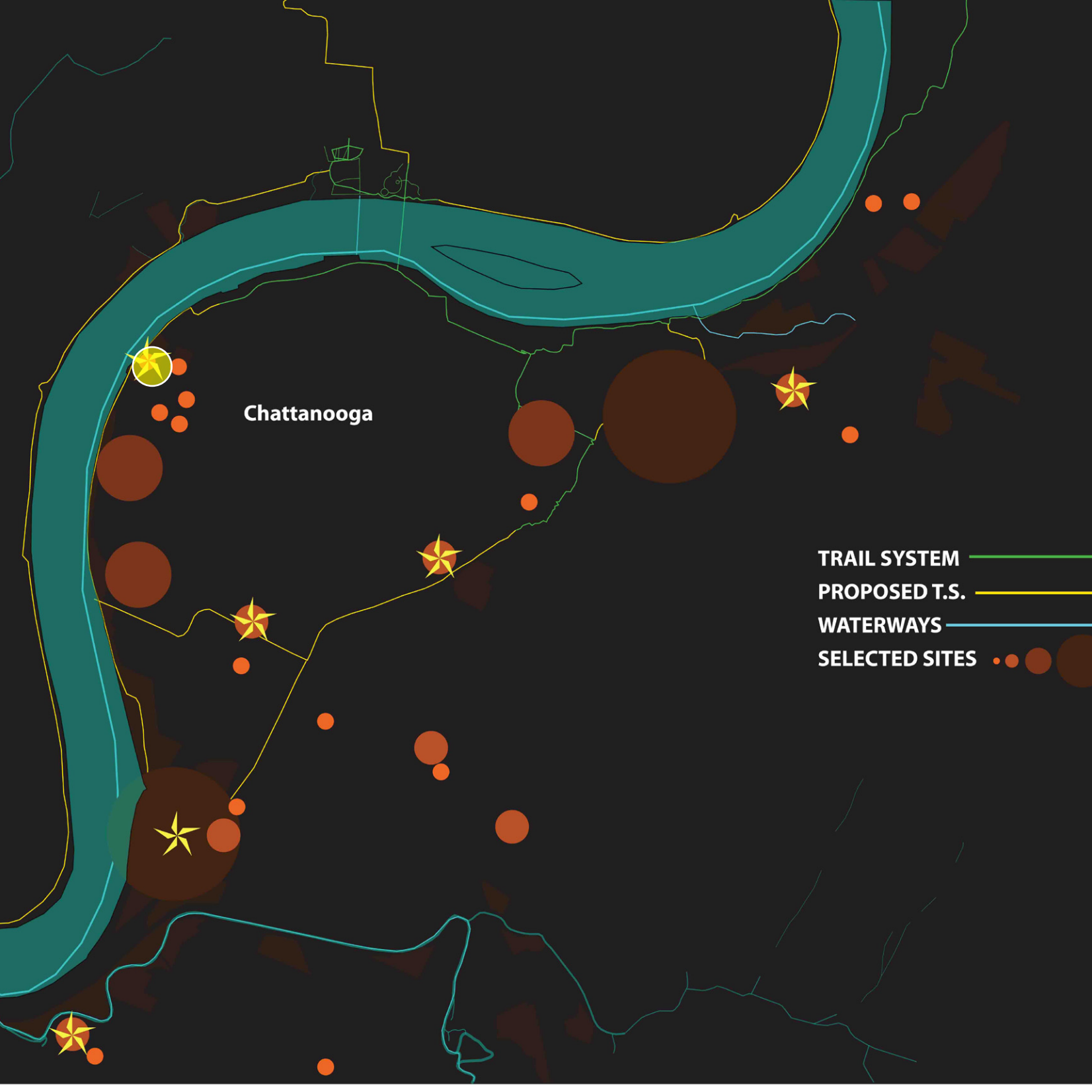
Brownfields and Rail Road Infrastructure

Middle

Brownfields, Tennessee Riverpark (Green), and proposed brownfield trail network (Yellow)

Bottom

Brownfields, Interstate, Primary Arterials

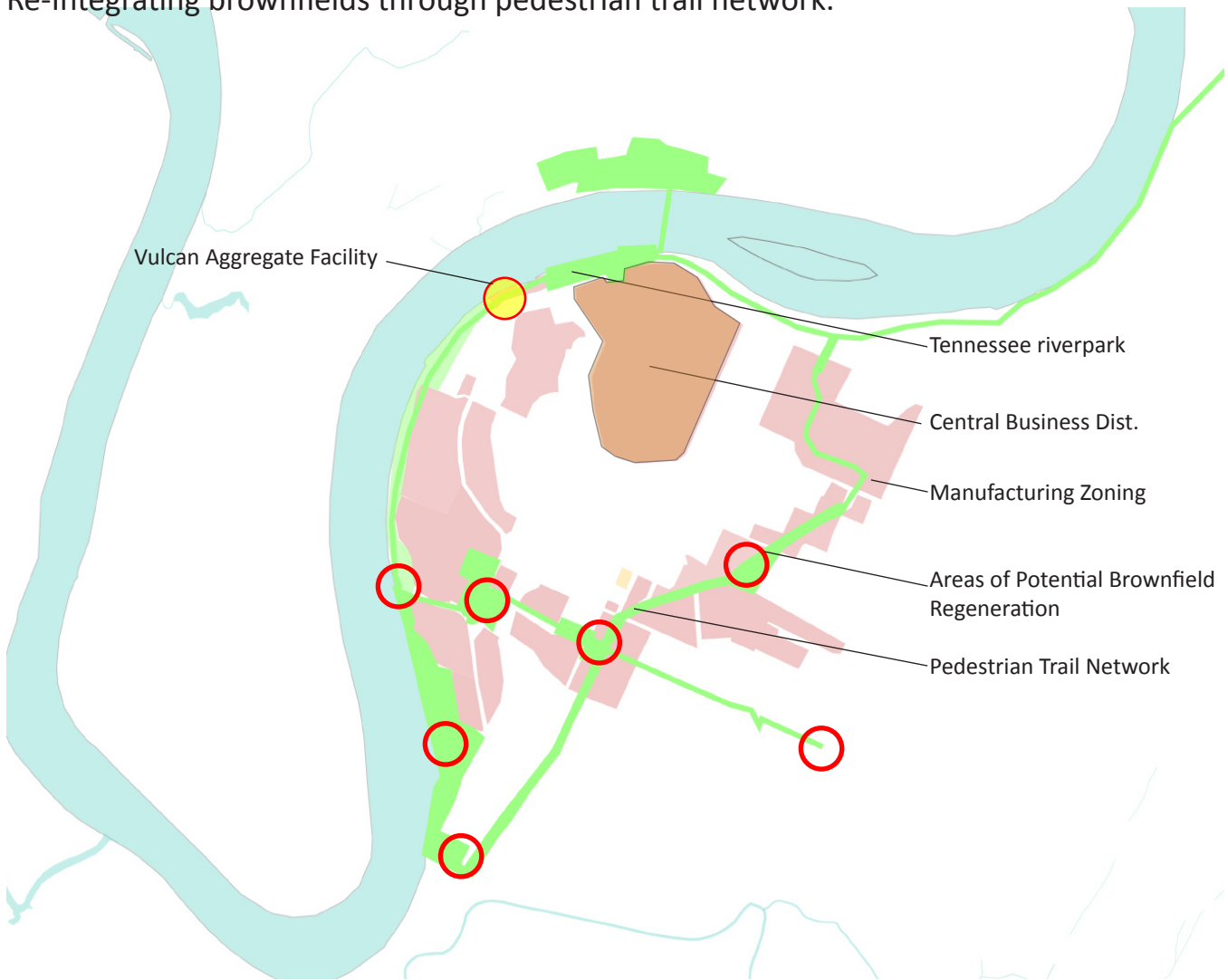


Chattanooga

- TRAIL SYSTEM 
- PROPOSED T.S. 
- WATERWAYS 
- SELECTED SITES   

TRAIL PROPOSAL

Re-Integrating brownfields through pedestrian trail network.



LEFT

Investigations of data on pollution, sources, and emissions locations within Chattanooga led to understanding the individual environmental impacts in relationship to each other. This analysis calculated three harmful environmental externalities to generate an environmental impact gradient, which exposed several sites that were highly detrimental and compared to other relatively moderately polluting sites.

FACTS

90% of all land adjacent to rail is Industrial or Manufacturing Zoning
40-60% of this have seeing economic decline over the past 30 years.
Green belt would follow existing industrial pathways.



CHAPTER 5 / TRAIL SYSTEM AND CONTEXT

Trail System

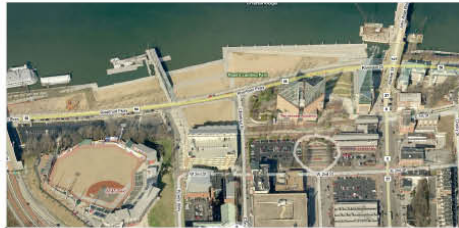
The investigation of brownfield infrastructure revealed a potential brownfield trail network that connects greater Chattanooga to the riverfront trail system, thus creating a more extensive trail network that fosters community interaction, livability, health and connection to place. The first phase of this trail network will be to connect the Vulcan facility to the downtown river front via a half mile trail along riverfront parkway. Once arriving at the site, visitors can be engaged in education, recreation, and discovery. Following the trail through the site they will encounter sculpted topographic form, changing site ecologies, and unique industrial remnants.

South of the Vulcan property, the trail will follow the river alongside Alstom Power Inc., which produces heavy wind turbine and other industrial components and U.S. Pipe brownfield which formerly made steel castings. The trail network will then tie inland connecting users to various sites including an old gas field, and a seldom used trail which runs through the city connecting UTC to Findley Stadium. The proposed trail will then complete the loop back downtown to the historic Bluff District.

BROWNFIELD SITES ALONG PROPOSED TRAIL SYSTEM



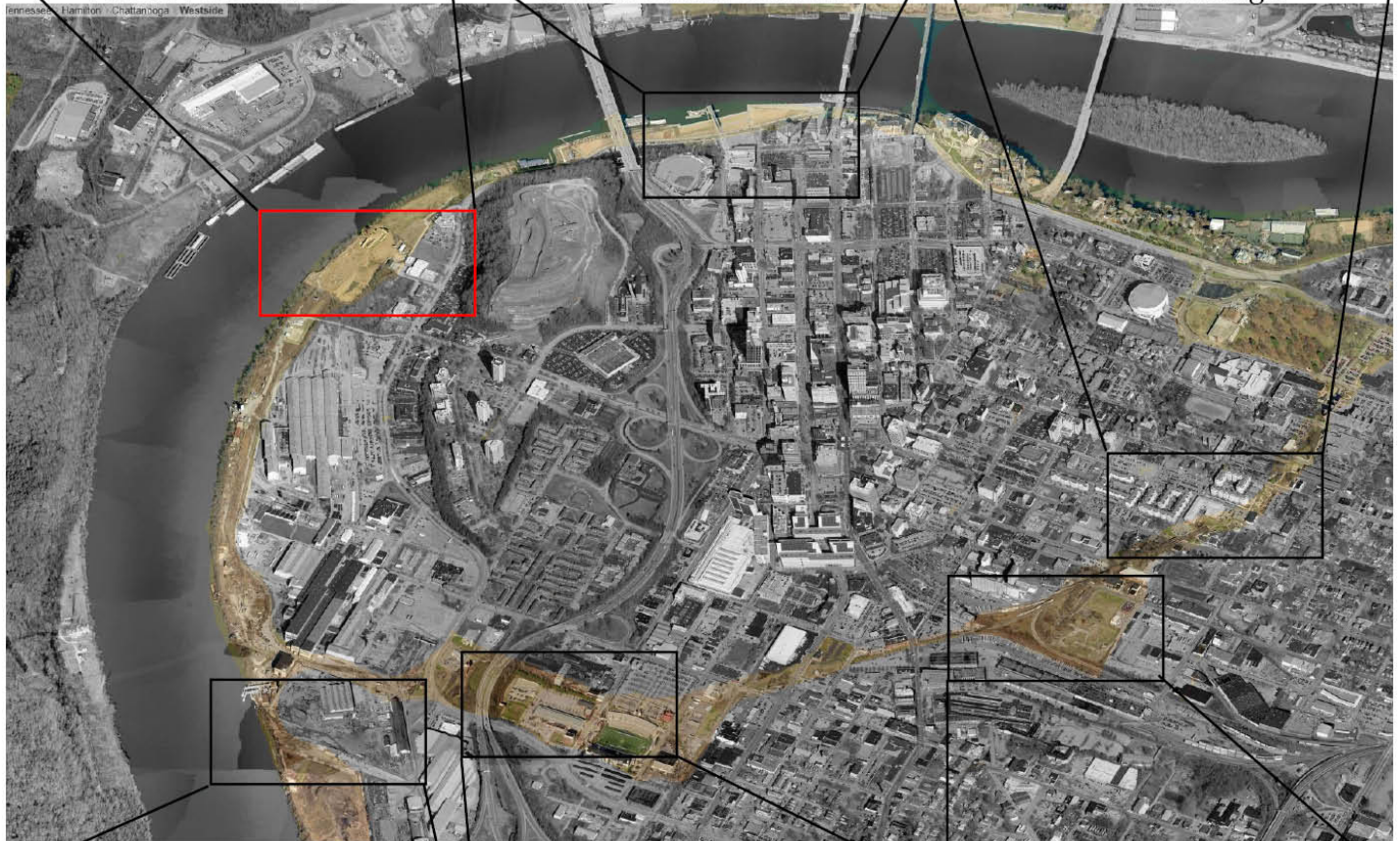
Vulcan Materials Co



Downtown Riverfront



UT Chattanooga



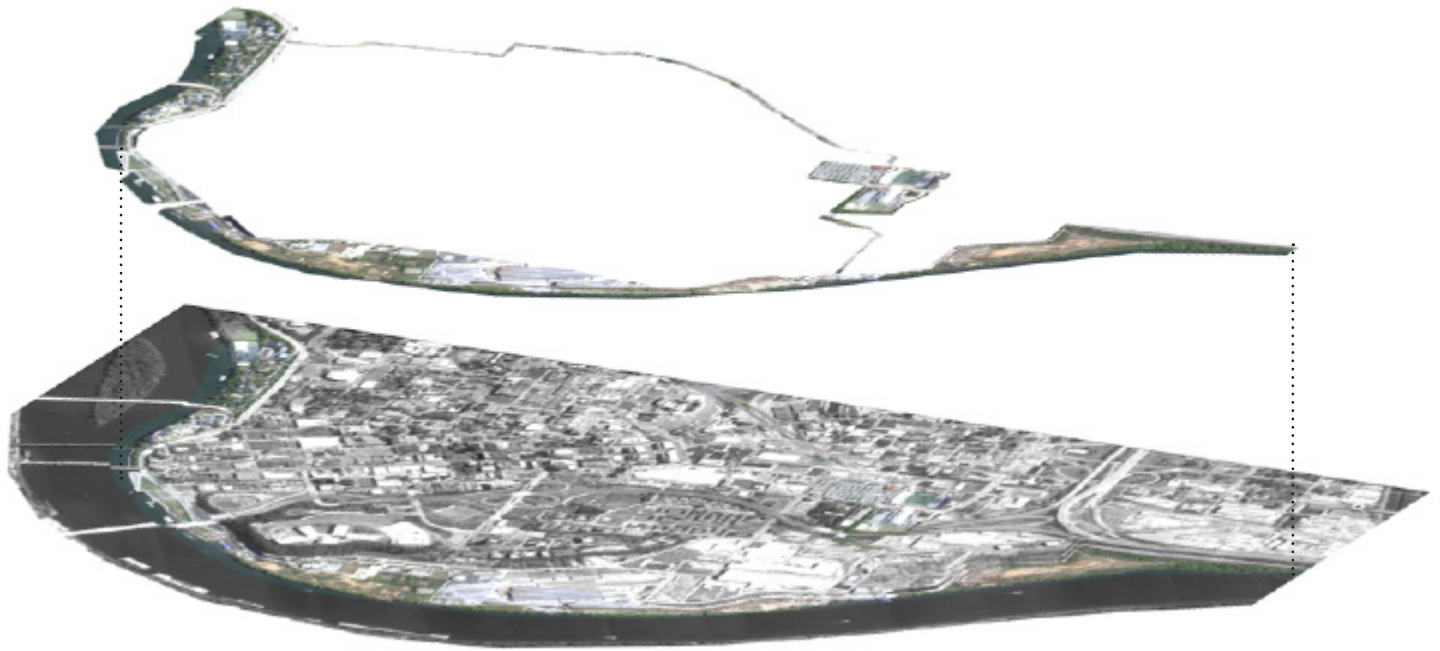
US Pipe Foundry



Eureka - Findley Stadium



Gas Street



ABOVE

Riverfront trail axonometric showing proposed brownfield trail connection through city. This allows for a more integrated and comprehensive trail network.

LEFT

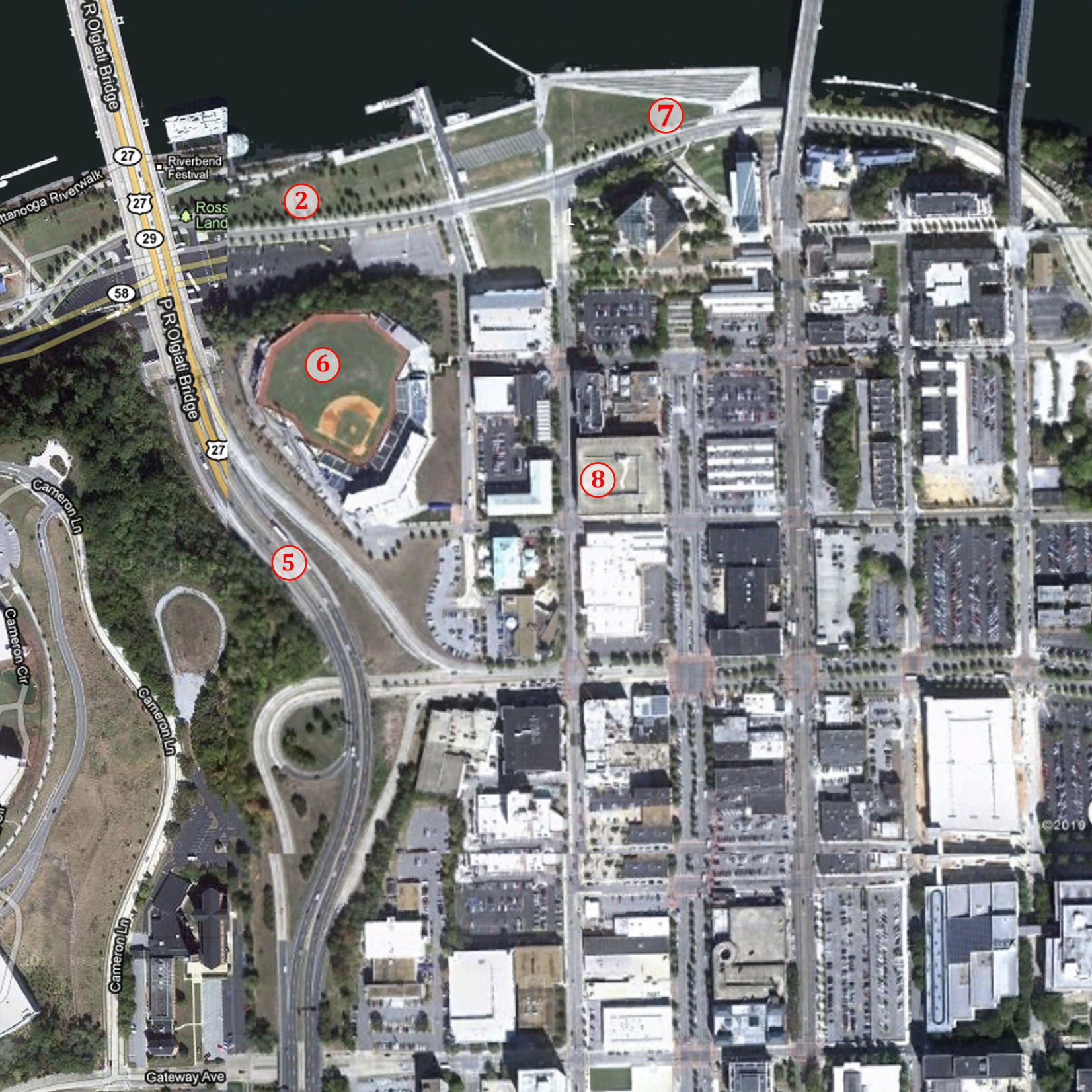
Diagram shows brownfield trail network and important brownfield sites along the trail network. These “nodes” will allow for recreational activity, urban public space, and ecological restoration. Lessons learned from the Vulcan regeneration will be applied to these areas.

Vulcan Park Context

KEY

1. Aquarium
2. Riverfront Park
3. Cameron Hill
4. Tennessee River
5. US 27
6. Lookout's Stadium
7. Chattanooga Riverwalk
8. Creative
Discovery Museum
9. Cameron Harbor
10. Alstom Power
11. Green Institute
12. Vulcan Park







CHAPTER 6 / VULCAN AGGREGATE FACILITY

Along the Tennessee River on the west bank of Chattanooga lies the post industrial remnant of an aggregate processing facility. Left behind is an amazing array of infrastructure that provides a unique opportunity for regeneration and growth within Chattanooga. Once an aggregate processing plant that used to unload dredged aggregate from upriver, the facility played an important role in the construction of various infrastructures within modern Chattanooga. Located only a half mile from the downtown riverfront of Chattanooga, the Vulcan facility is located just adjacent to the city's amenities and attractions. Because of its location, along with recent residential and business developmental pressure, it is critical that this important industrial remnant is preserved, both for the education of Chattanoogaans and our inherent connection to where we live.

The Situation

The Vulcan Aggregate Facility developed from the need for aggregate materials in the of construction Chattanooga's infrastructure. Located just half a mile from downtown, along the Tennessee River, the facility marks the transition between the central business district and the industrial-manufacturing zone that runs along the river. The location developed for two main reasons: first because of the power of the river to carry dredged aggregates from upstream locations; and second because of its proximity to where the material was most needed: downtown. During operation, the facility was in constant flux due to a continual flow of aggregate both in and out of the site. However, after the property was abandoned the combination of both natural and human processes have gradually transformed the site into a dynamic post-industrial landscape.



VULCAN / AERIALS

1990



Seeded by natural processes a rich and diverse ruderal (naturally occurring) ecology has developed upon the site. Where once massive aggregate mounds dominated the landscape, a stream now bisects the site and meadow ecologies have emerged. A sinkhole has formed from subsurface erosional forces, undermining a retaining wall along the river and creating habitat for aquatic species. A cattail marsh has developed from the ponding of stormwater runoff from a depression caused from the final grading of the site. A “natural” green roof has formed on the roof as well as meadow throughout the site, which marks the initial succession development of the resurgence of ecologies.

1999



Today, adverse economic conditions pose challenges to typical revitalization methodologies. Unlike other projects, the Vulcan design proposal utilizes a low-cost regenerative technique and time. The design uses nature’s processes of filtering water, extracting contamination and cleaning the air to regenerate the site.

2000



2010



The processes on the Vulcan aggregate are in transition from industrial histories and the ruderal colonization. Swiftly imposing an initial disturbance upon the facility can permit new designations that allow for increased biodiversity and social interaction. More flexible and efficient use of this site is attainable through self-generating and self-maintaining operations to achieve greater economies and ecologies of scale. At this precise moment when these landscape operations become essential in the regeneration of Chattanooga's brownfield network, they become infrastructural.¹

1. Belanger, Pierre, Landscape As Infrastructure. Landscape Journal 2009.
2. EPA: Office of Superfund Remediation and Technology Innovation. "Superfund Green Remediation Strategy," September 2010.
3. EPA: Green Remediation: Best Management Practices. Quick Reference Fact Sheets: Bioremediation; Excavation and Surface Restoration. March 2010; December 2008.
4. Michael Van Valkenburg Associates: Reconstructing Urban Landscapes. Alumnae Valley, Wellesley College. Redefining the Campus Landscape. By Anita Berrizbeitia, Paul Goldberger, Peter Fergusson, and Jane Amidon, 2009.

DESIGN EXPLORATION

Investigating potential microclimates through heliodon light study. Morning shade allows some relief, however, shade is only temporal until the sun rises above 10 am. The afternoon microecologies provide more relief for plant species and may be more habitable.

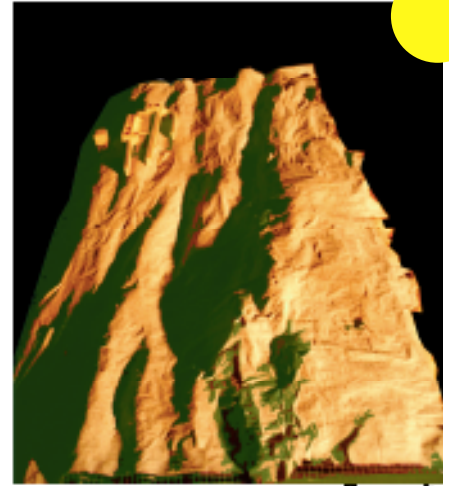
Morning



Ecological Tolerance Zones
Early to Mid Morning



West Facing Slopes



Composite

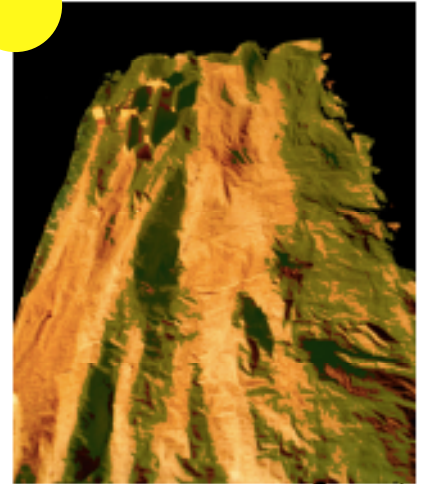
Afternoon



Ecological Tolerance Zones
Mid to Late Afternoon



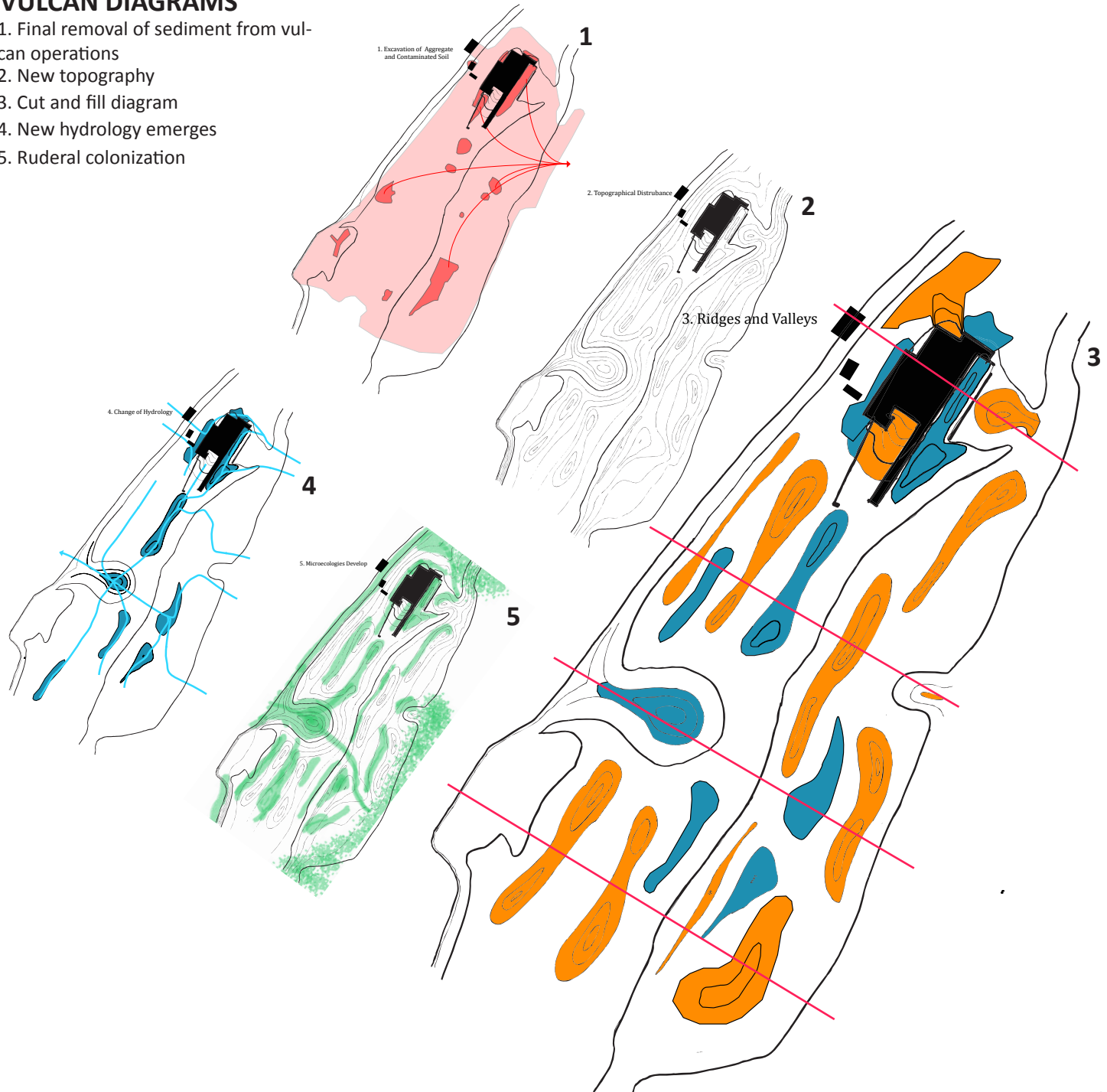
East Facing Slopes



Composite

VULCAN DIAGRAMS

1. Final removal of sediment from vulcan operations
2. New topography
3. Cut and fill diagram
4. New hydrology emerges
5. Ruderal colonization



HISTORICAL ANALYSIS

Operations conducted on Vulcan parcel.

Materials Processing Facility

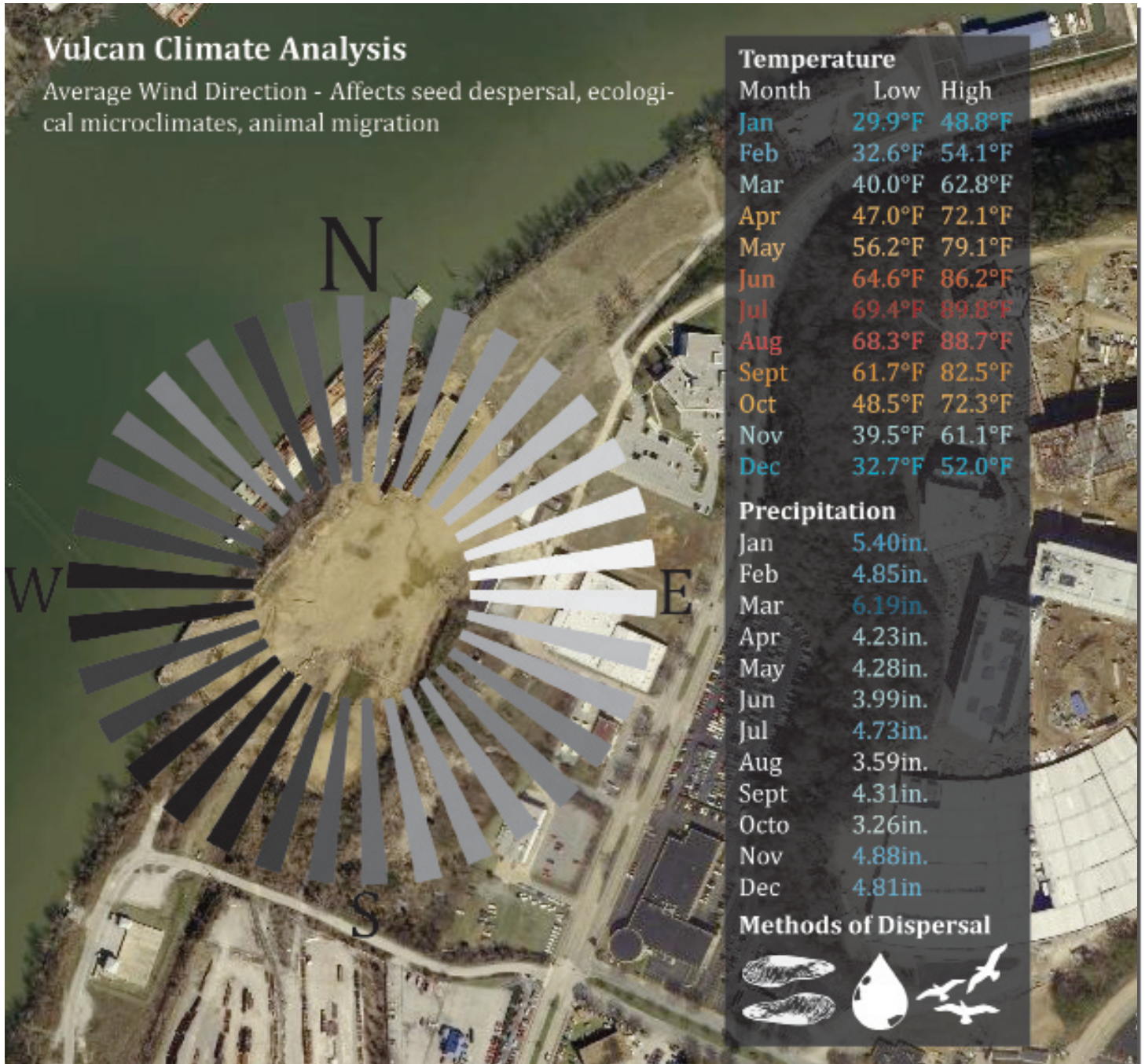
1. Dredged aggregate arrives at site
2. Crane extracts aggregate to conveyance
3. Pivot arm broadcast aggregate
4. Removal off-site
5. Storage



TOPOGRAPHICAL DISTURBANCE - BROWNFIELD TOPOLOGY

CLIMATE ANALYSIS

Wind, Temperature, Precipitation







Panoramas of the site show dynamic relationships between the facility, ruderal ecologies and the ephemerality of hydrologic conditions.



Images show various infrastructural elements leftover from Vulcan operations and the ruderal colonization that is reclaiming the site.

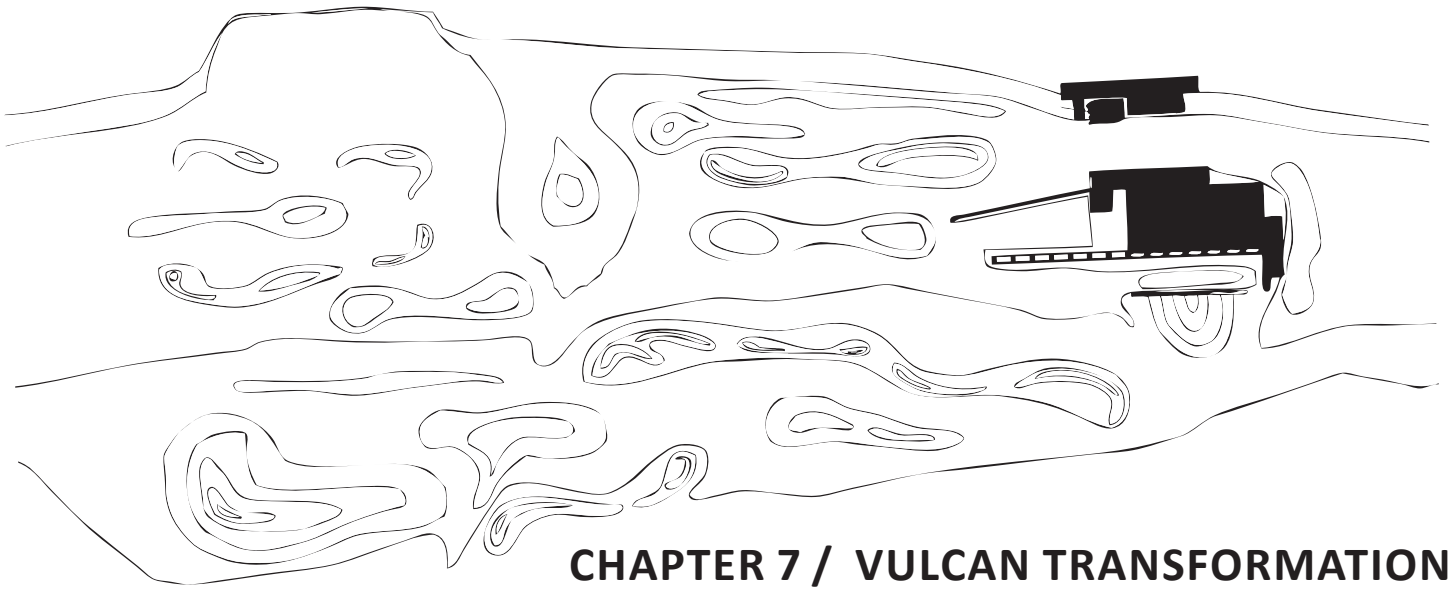




VULCAN SITE PLAN

1. Vulcan Facility
2. Boardwalk
3. Viewing Platform
4. Play Hill
5. Parking
6. Kids Play Pool
7. Dock
8. Cattail Marsh
9. Wildflowers
10. Meadow
11. Pond
12. Stream





CHAPTER 7 / VULCAN TRANSFORMATION

This chapter explains the design process and various components of the ongoing Vulcan transformation. Design investigations were based on understanding the role of disturbance in creating emergent landscapes. The diagram to the left is a glimpse 50 years into the future condition of the ecological succession on the site. A trail system has developed on site due to human habitation and use. The design vision of the Vulcan site is tested through topographical and ecological disturbances' ability to regenerate the site. The following pages are organized in a sequence that best explains the project. The overall design process is cyclical and addresses the site at multiple scales.

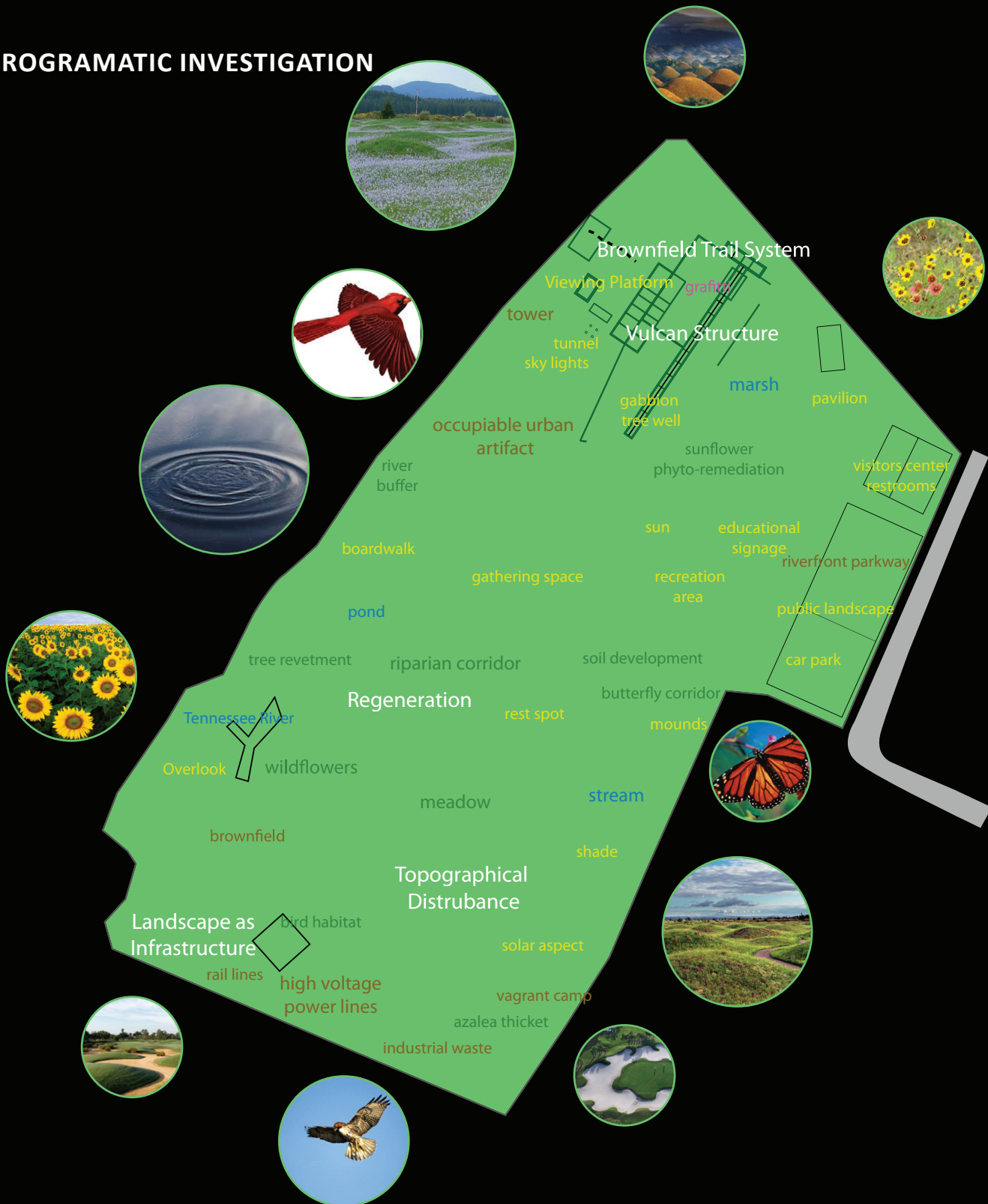
Design Intent

This thesis explores the potential for harnessing natural processes to develop the Vulcan brownfield from an initial topographic disturbance through experimental seeding to amplify the process of ecological succession throughout the site. On the areas of topographical manipulation, seeds from natural ecologies such as woodland, aquatic and meadow lands will be scattered and allowed to grow on their own. This process seeks to quickly regenerate the industrial condition of the site through ecological reestablishment.

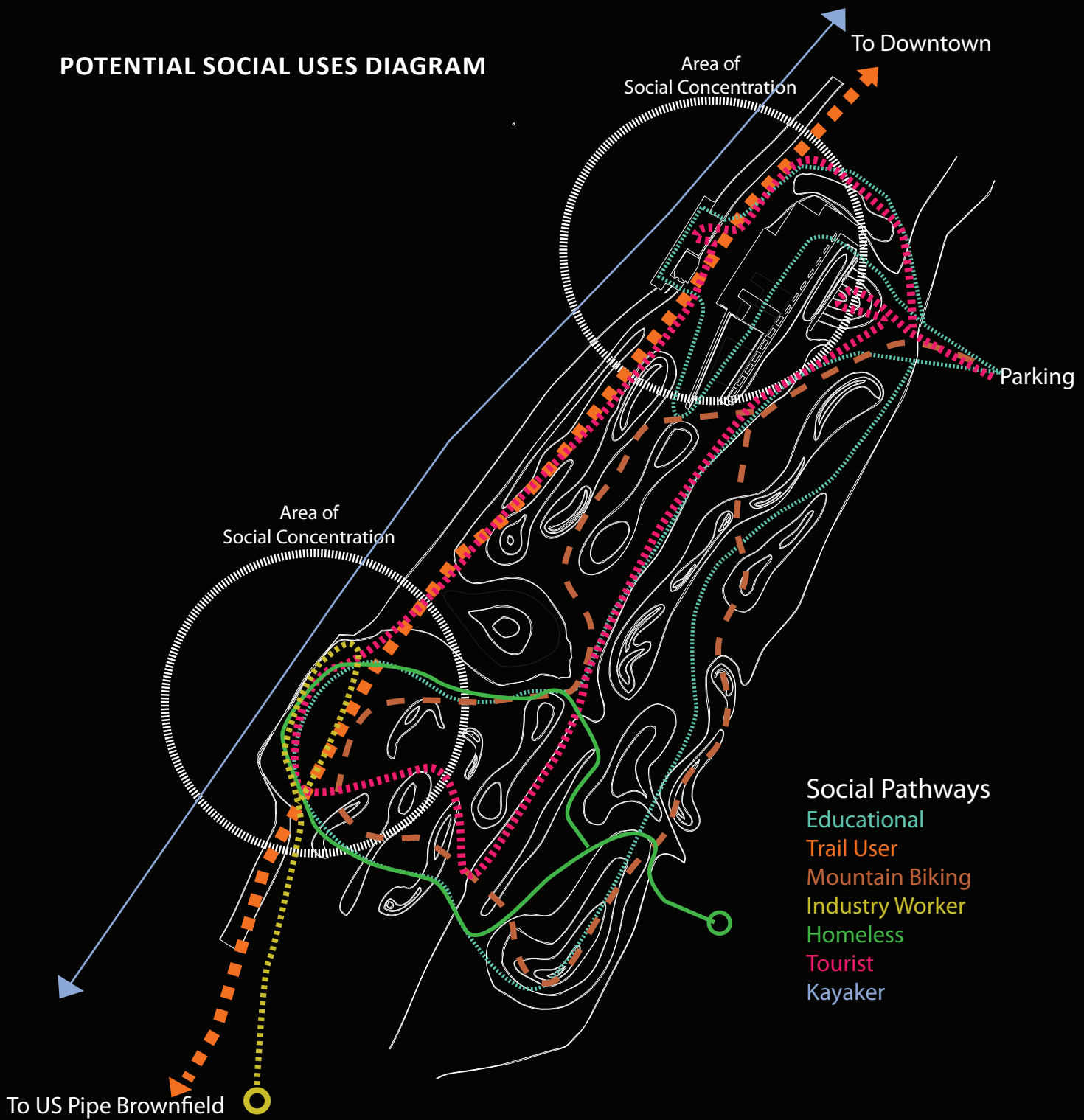
Design Process

The design seeks to recall the industrial past of the aggregate facility through reforming the topography by means of mechanical operations. The altered topography was derived from a modeling process that followed "automatic methods yielding highly sculpted horizontal surfaces" (Waldheim). After initial investigations, the selection of several topographic forms were chosen for their ability to foster unique microclimates and ecological diversity. Topographic forms will create zones of hot: cold, sunny : shady, wet : dry, which will influence the ecological establishment and human activity upon the site.

PROGRAMATIC INVESTIGATION



POTENTIAL SOCIAL USES DIAGRAM



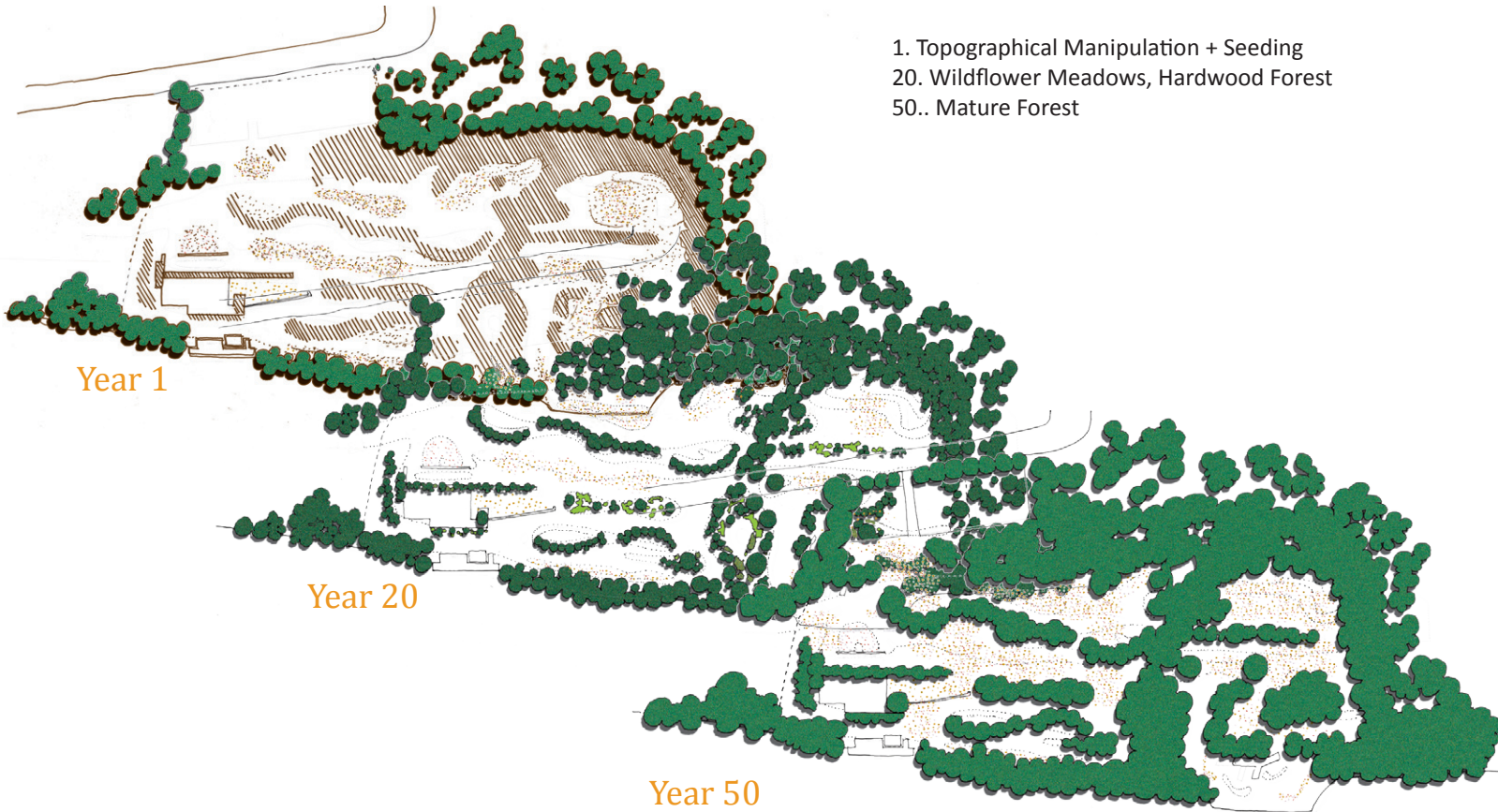
CUT & FILL DIAGRAM



SEEDING DIAGRAM



SITE DEVELOPMENT



Maintenance

Once this initial disturbance is conducted, the site will be left to develop through maintenance cycles of 10 years duration. These maintenance cycles will remove invasive or overly competitive species that dominate other species and manage the overall health of the systems. The ecologies will be allowed to succeed naturally, however will not be allowed to crowd out the other ecosystem types as to allow for more ecological diversity.

Site features include a large concrete structure that was once an aggregate crushing plant that contained various aggregate chambers, a truck loading zone, conveyor belt systems, a rock crusher, and storage areas. The overall structure is massive; constructed from reinforced concrete with rebar it was designed to support the large loads from the aggregate, machinery and equipment.



Structure

The reprogramming of the crushing plant will be the epicenter of social activity upon the site. A ramp that utilizes the natural form of the structure will run over 100 feet at a slope of 4 percent. This will allow for access to the “roof” of the facility at a gradual grade to permit new activities on the top of the structure. From biking to kids running down the slope the ramp provides for a diverse range of uses.

Atop the structure, a Green Institute will be constructed to teach the principles of green building design and

educate the public on brownfield regeneration projects and their ability to be reintegrated into the city as necessary public infrastructure.

Ecological colonization of the site will be allowed based upon initial ecological conditions and seeding of specific plants that will produce the forms called for by the design. For example, woodland species that provide ample shade, screening and size will be allowed to grow in the void where once aggregate filled the chambers.



Views of the site and the river will be possible from the roof of the structure and will allow visitors to orient themselves in the landscape and to decide where to explore next. Between the facility and a sediment retaining wall a cattail marsh is constructed to retain stormwater and allow it to infiltrate back into the water table. The side of the facility that faces the river has a unique tunnel that once allowed dump trucks to pull underneath the loading bay and fill their payloads. Several of these will be kept clean of debris to allow for skylights within this space.

ABOVE

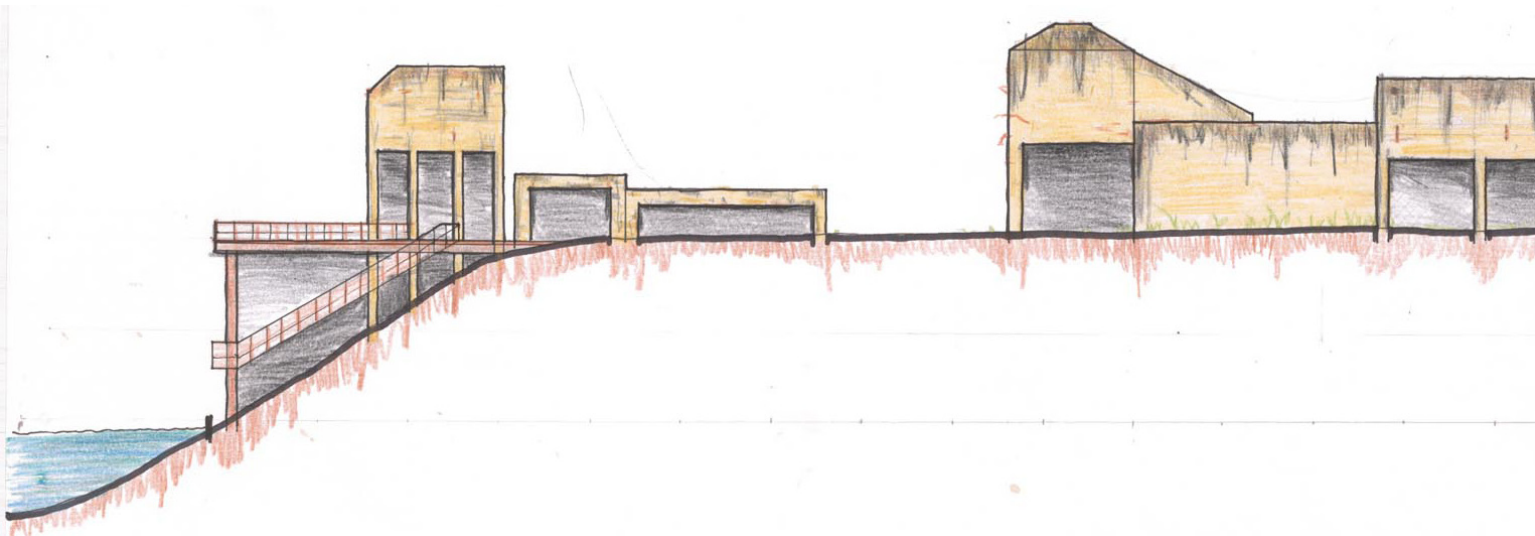
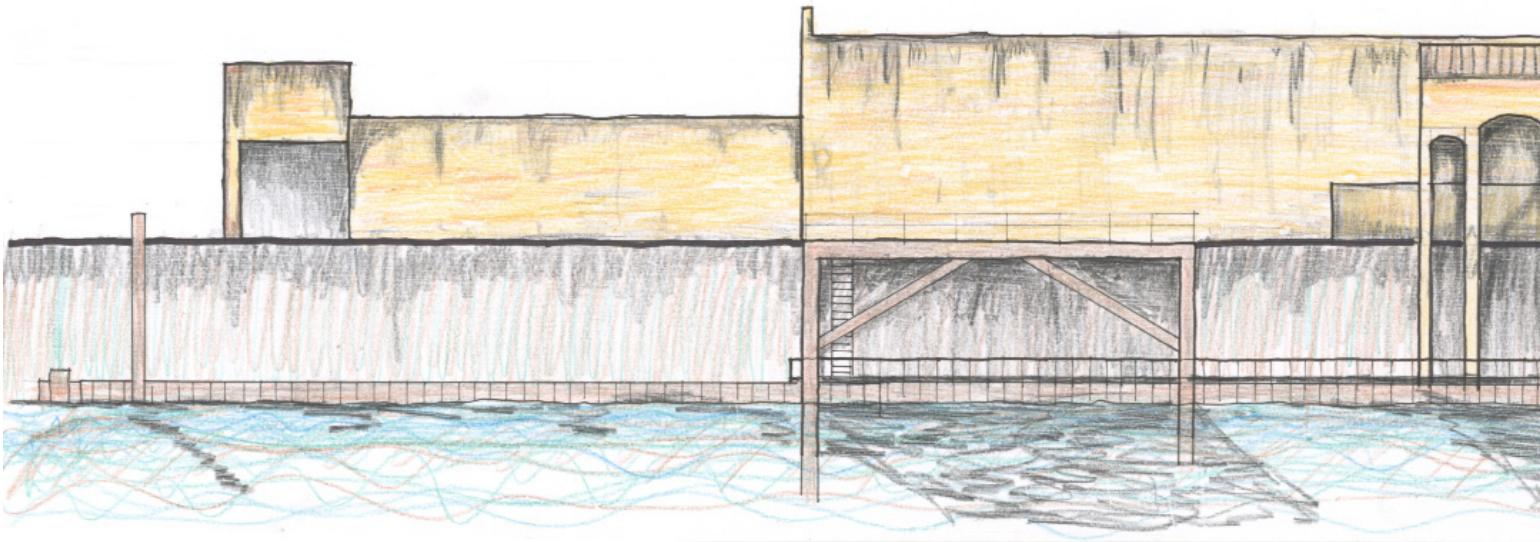
Perspective shows ecological colonization and human use on roof of Vulcan facility.

RIGHT

Google Earth screen shot with final Vulcan plan overlaid to show relationship to the Tennessee River, Manufactures West, and Look-out Mountain. The riverfront trail extends down river past Alstom Power and connects to additional brownfields in the city.

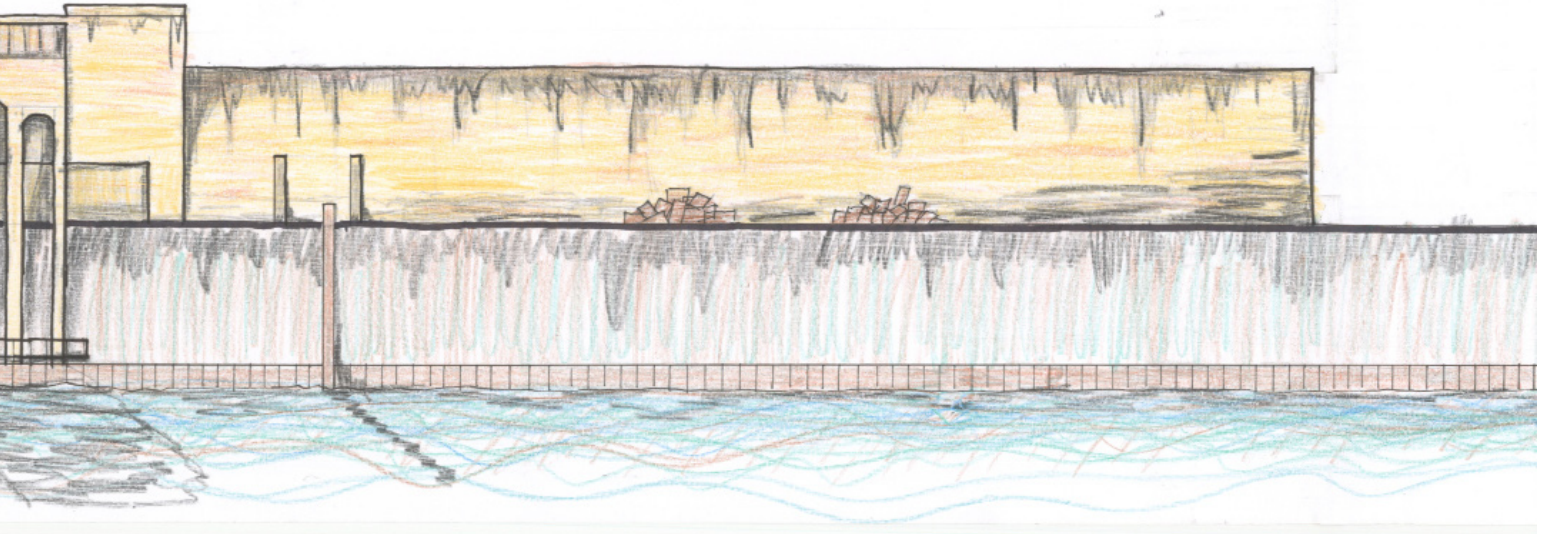


Vulcan materials facility 50 years after disturbance.



SECTION STUDIES

Initial topographic manipulation create various forms including: birms, swales and undulating surface features.



Section from Tennessee River looking at Vulcan facility



Section showing the relatively flat slope dropping off into the Tennessee River

**1 Year after
Initial Disturbance**

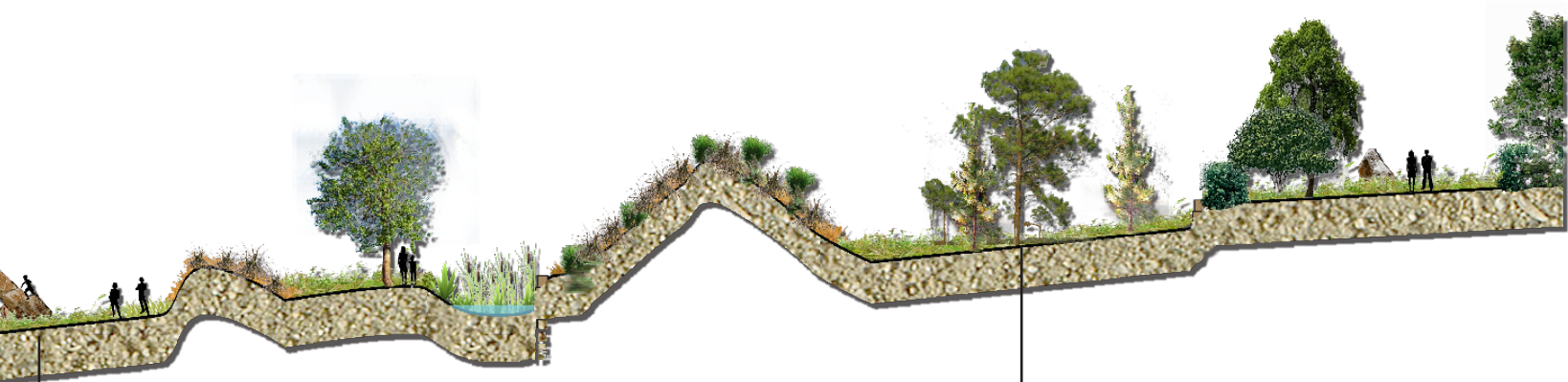
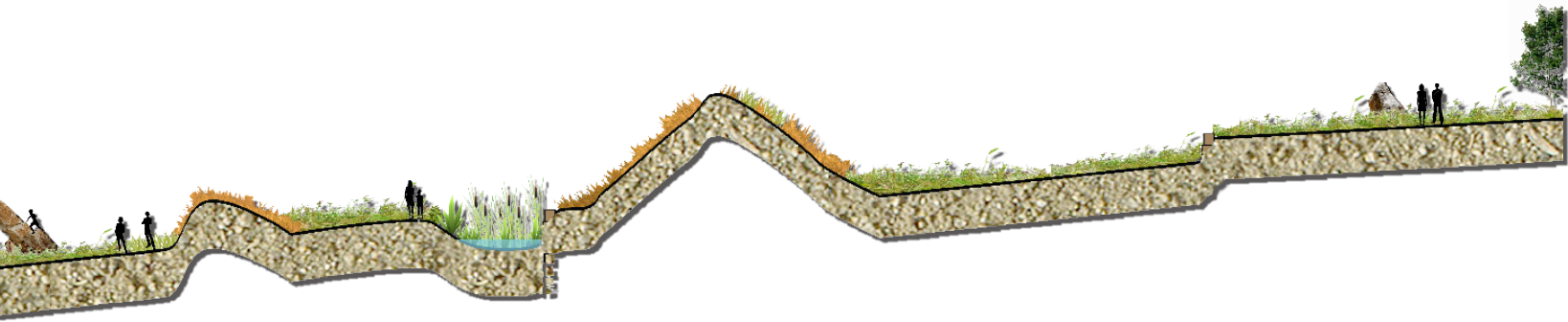


**10 Years after
Initial Disturbance**



Sectionions show **ecological succession** and how **microecologies** develop depending on the surface condition. As time progresses site ecologies begin to take hold and diversity increases. Human use of the site will be influenced by plant communities, topography and from climatic factors.

Sediment is cut from the lowest area of the site and moved to fill other areas to creat unique topography. The pond allows aquatic habitat for a diversity of plant and apmhibious species.

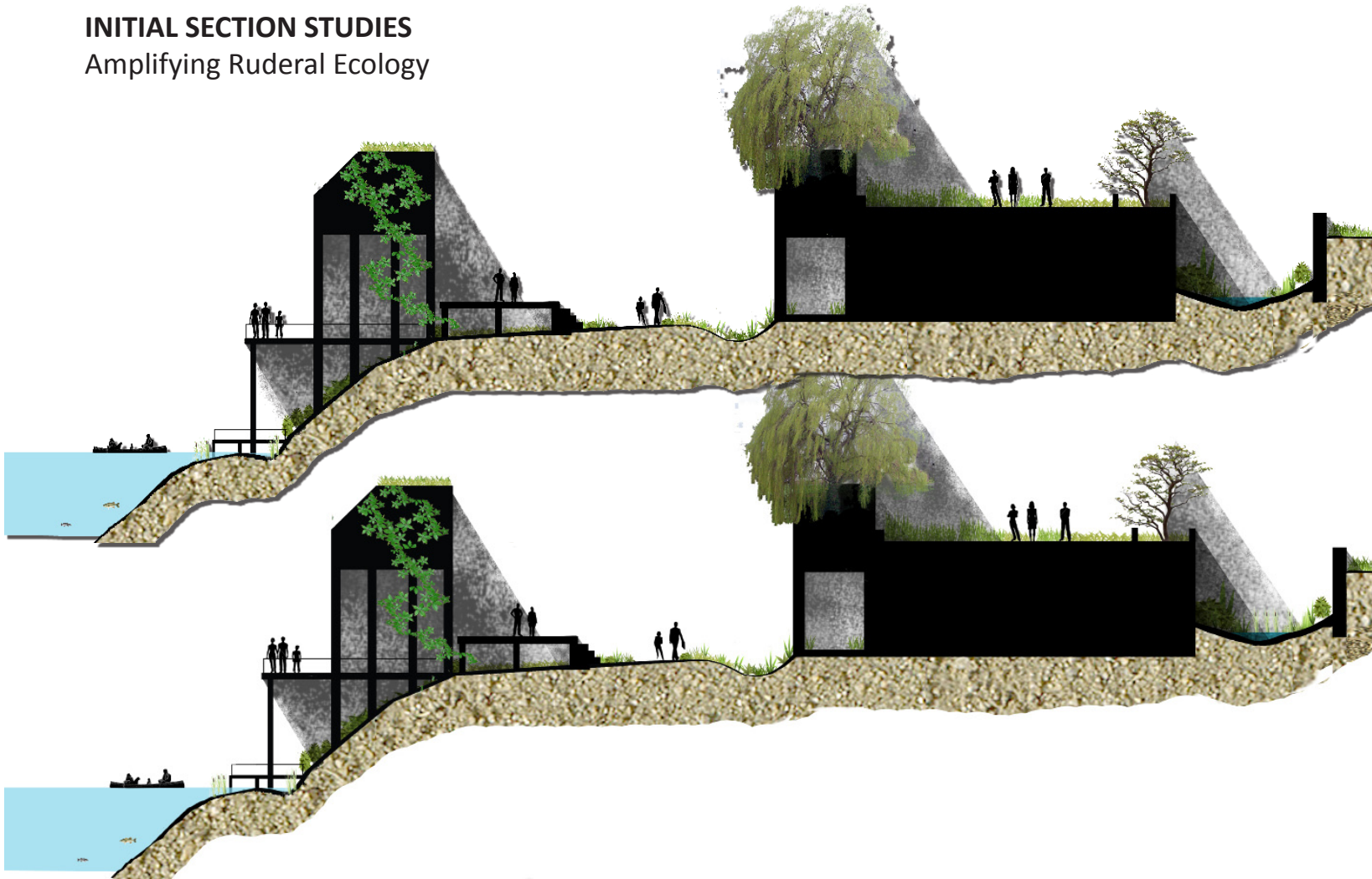


Remnant **sculptural fragments** left over from past uses include concrete blocks, roof tresses, railroad ties, amount various industrial remnants. These elements are to be integrated into the landscape and be used to act as retaining walls in select areas.

Duff (leaves, sticks, acorns) is applied along the current edge of the site thus allowing for **successional forest ecologies** to emerge. This helps to absorb stormwater, build soil, and provide habitat.

INITIAL SECTION STUDIES

Amplifying Ruderal Ecology



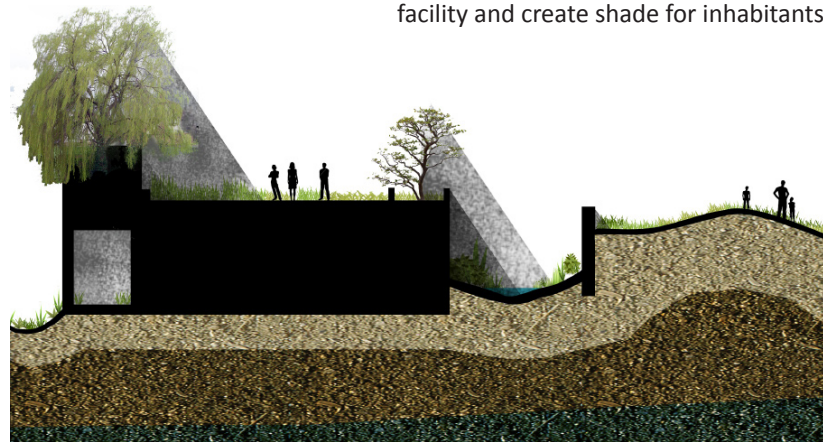
Human use and interaction of the site are enhanced through providing river access and observation areas. Before public inhabitation is permitted, hazards are removed and safety railings are installed. Through this, shoreline is protected through limited human access.





Ecologies are allowed to take control over Vulcan facility and create shade for inhabitants

Topographic decisions are derived from “automatic” modeling process of bending, shaping and manipulating various materials. Ridge like mounds reflect the historical use of the property from when it was Vulcan Aggregate Facility. Soil development is derived from plant community types and water saturation.



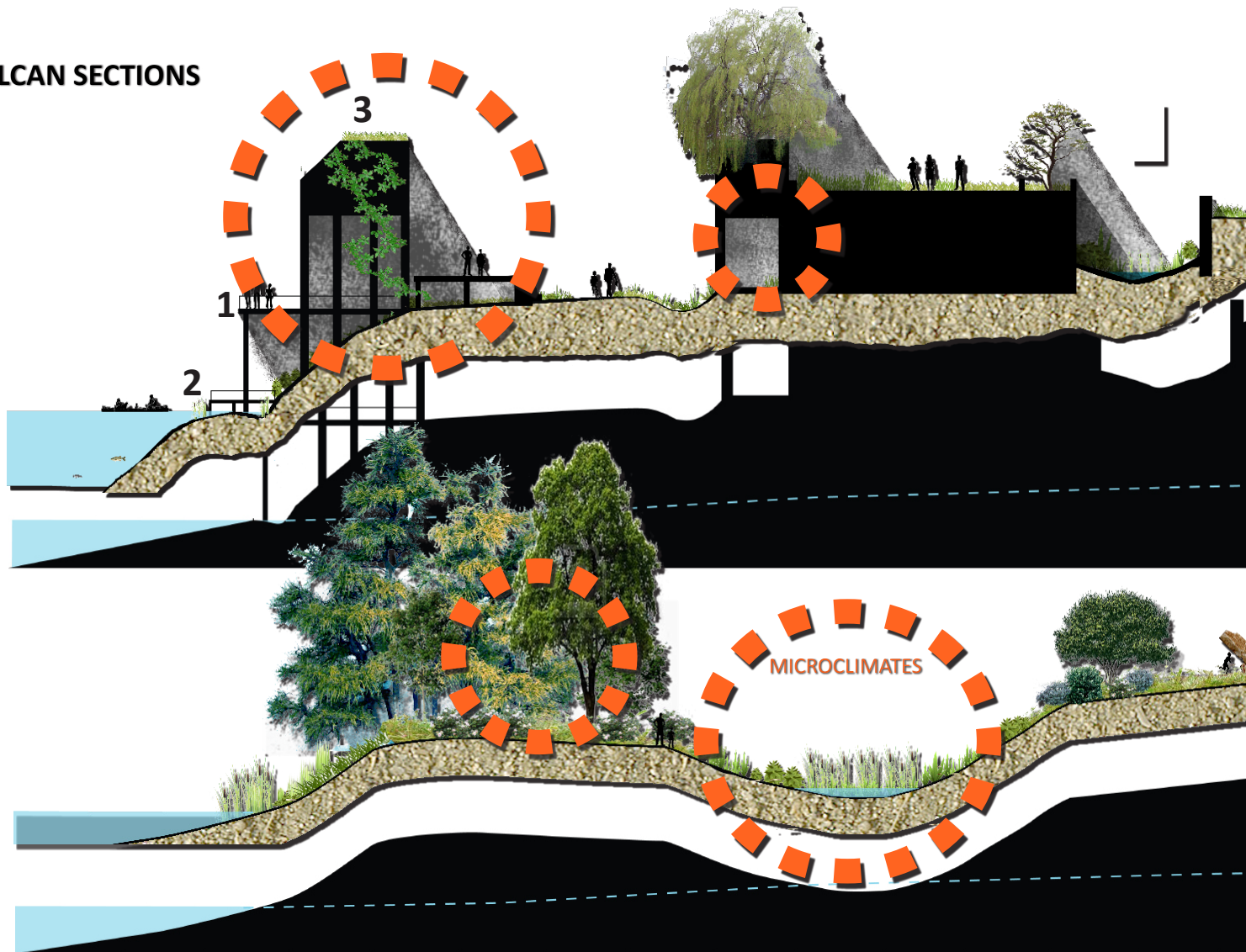
Tunnel

Vulcan Facility

Cattail Marsh

Mound

VULCAN SECTIONS

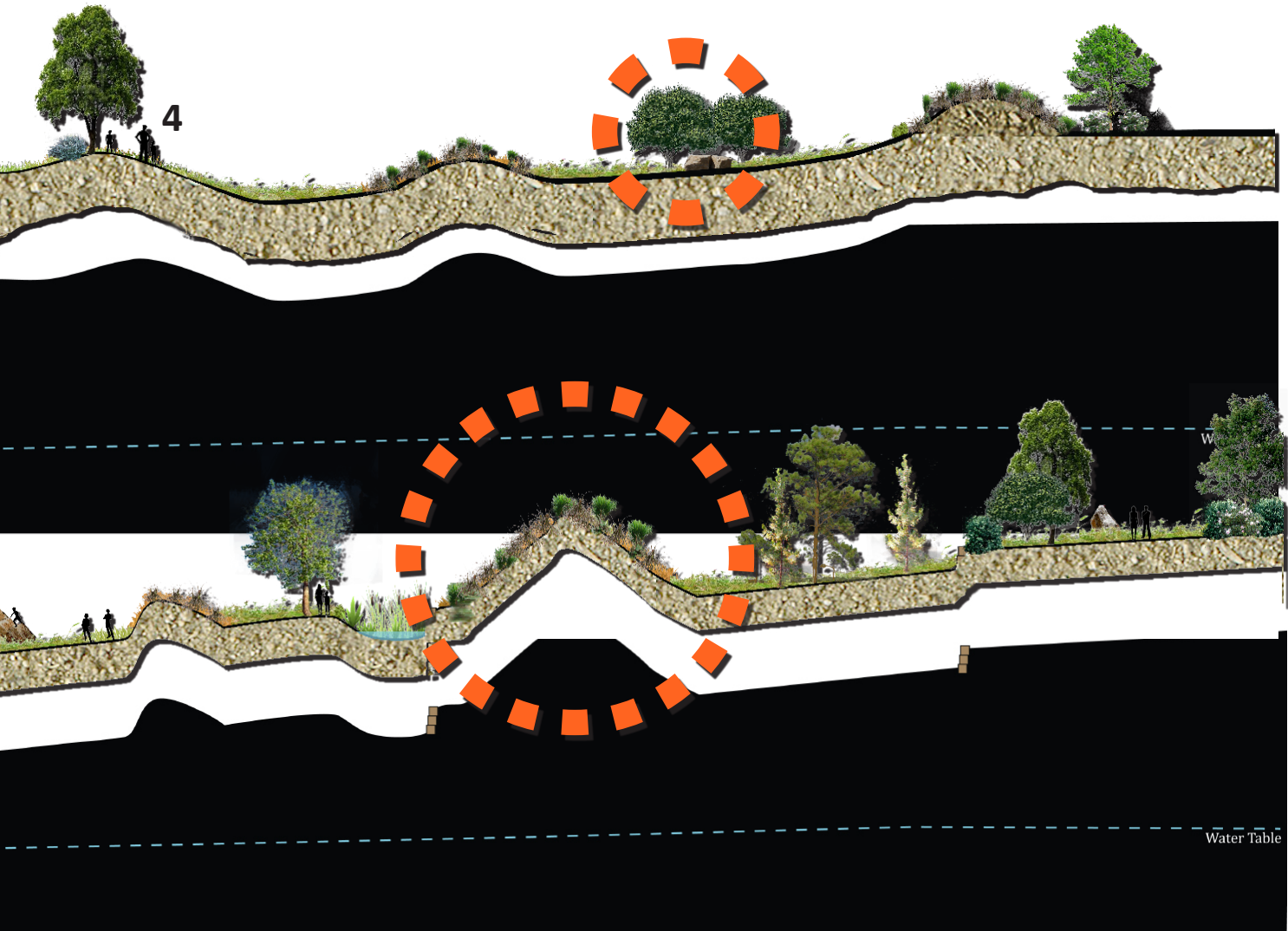


1. Loading Deck

This is one of the most ephemeral locations on the Vulcan site. Currently when it rains, the metal deck holds water until evaporation eventually dries it up. This area is a prime location for views of the river and the landscape beyond. Running along one side of this structure are stairs that will provide access to a boardwalk, constructed running along the rivers edge.

2. Boardwalk

This boardwalk spans from the loading deck past the tower to another set of stairs over 250 feet away. Construction of this will be in the form of a simple dock structure made of recycled wood, railroad ties for support and telephone poles for a foundation. The boardwalk will be constructed 1 foot over the water level (which rarely changes because of dams both upstream and downstream of Chattanooga). The boardwalk will allow users to freely interact with the water as well as serve as river access for watersports.



3. Tower

Because of the liability issues involved in providing access to the top of the tower, public access will be kept to the ground level. Clearing of dangerous machinery and overhead obstructions will make the area safe for users of the site. The construction of a deck system that utilizes the existing metal platform at ground level inside the tower will allow users to have views of the river as well as interesting space in which the columns are a vertical component that connects the ground to the ceiling.

4. Play Mound

Play mound provides enjoyment for all ages and serves as a vantage point.

VULCAN FACILITY SECTION

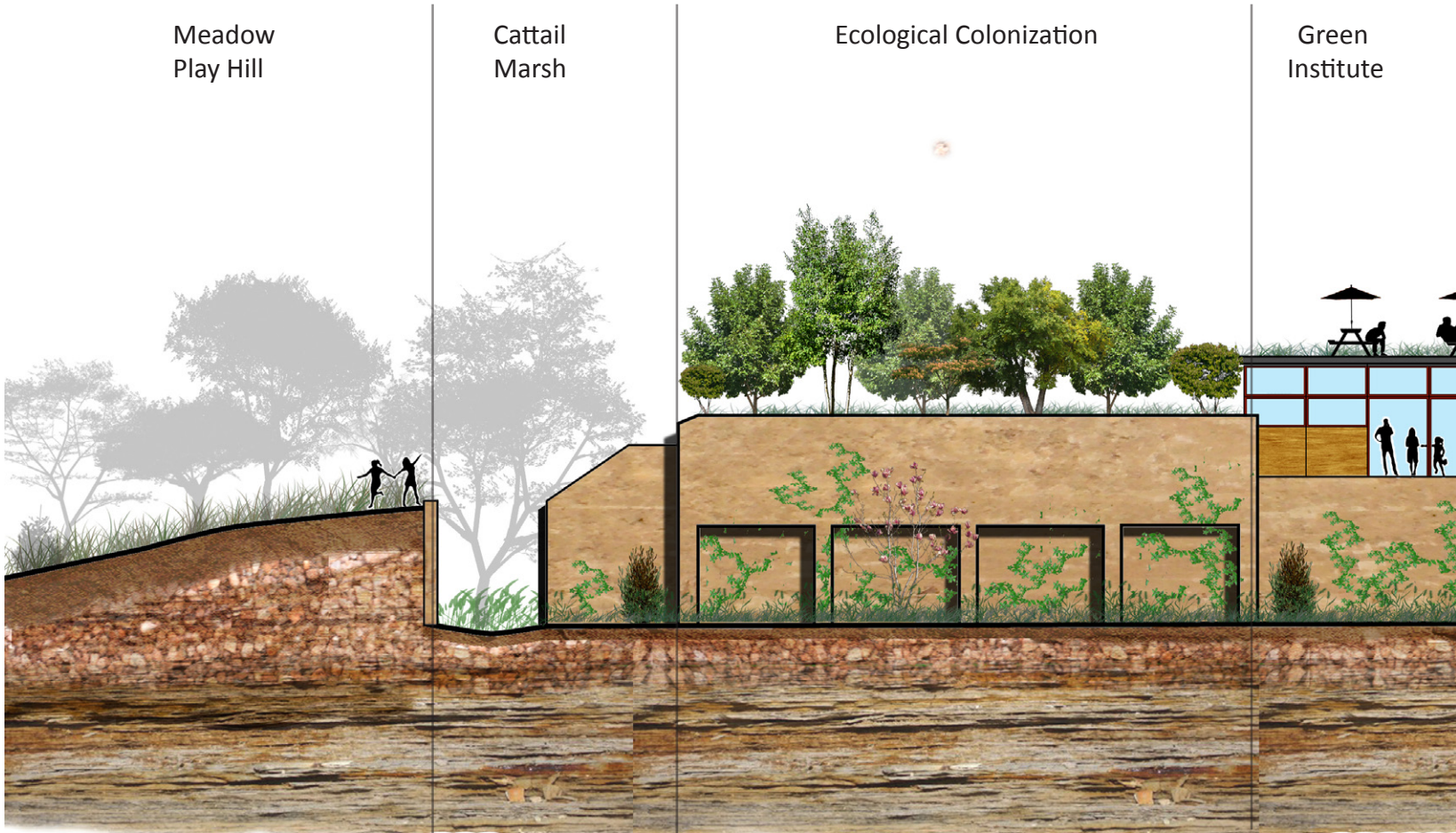
50 Years After Initial Disturbance - Ecological Colonization of Facility

Meadow
Play Hill

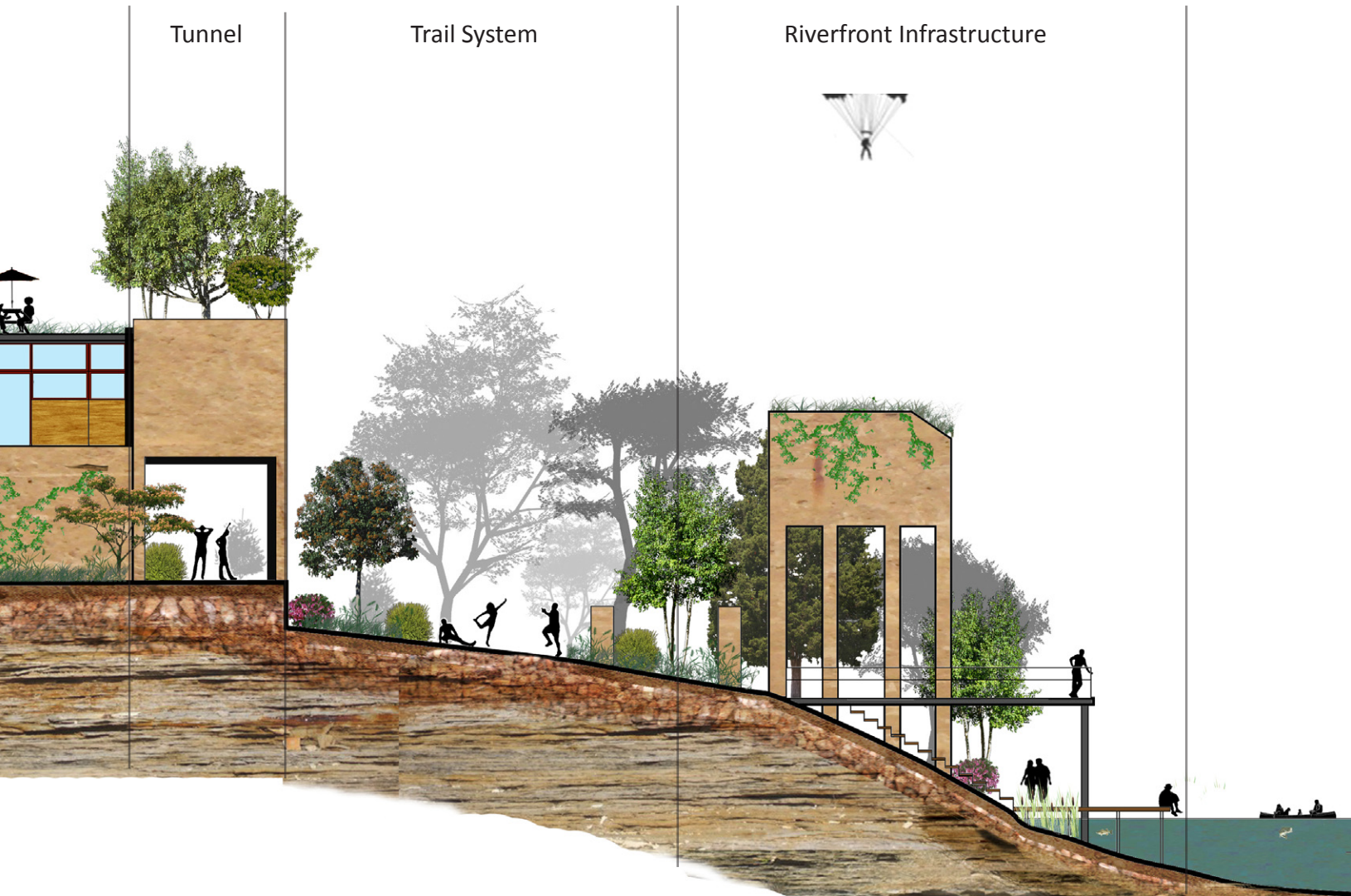
Cattail
Marsh

Ecological Colonization

Green
Institute



Soil development is one of the critical components of the Vulcan Regeneration. The section above shows development of soil on top of aggregate and sublayers. Ecological colonization of the site is allowed to happen naturally.



Access to the riverfront is an important aspect of the design. A boardwalk runs approximately 100 feet and allows participatory human interaction with water. Repurposing the loading platform above the boardwalk allows for social gathering and views.

BIOFILTRATION POND SECTION

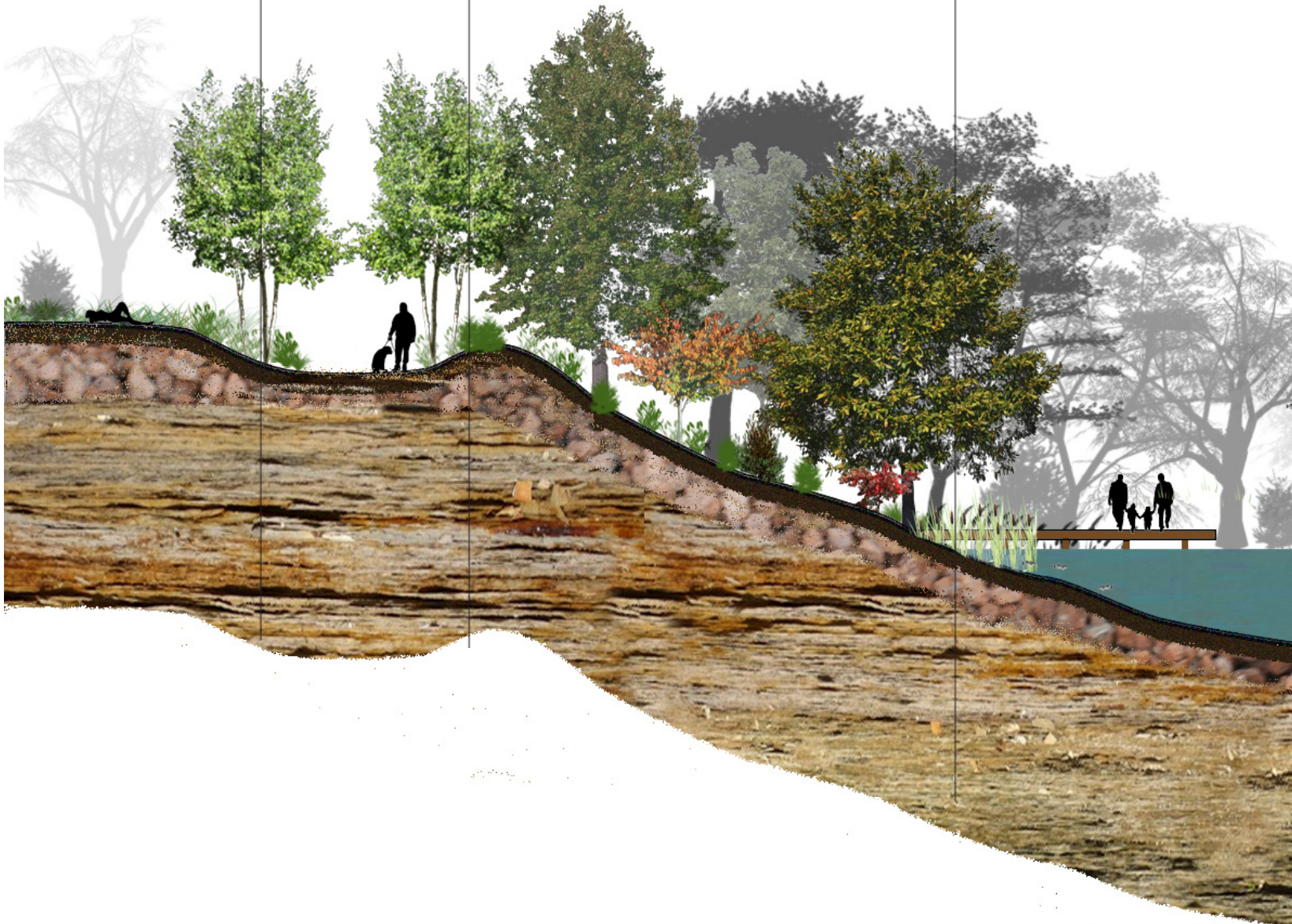
50 Years After Initial Disturbance

Meadow

Pathway

Woodland Ecology

Dock



Pond

Woodland Ecology



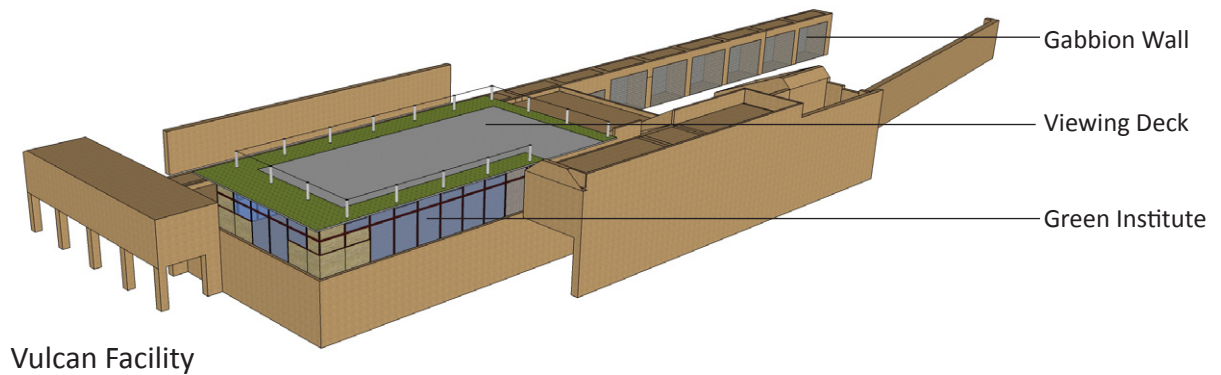
People can access the pond via a viewing platform constructed over the water. Ecological succession derives from initial seeding of the site that includes native hardwood and aquatic species.

3D DESIGN EXPLORATIONS

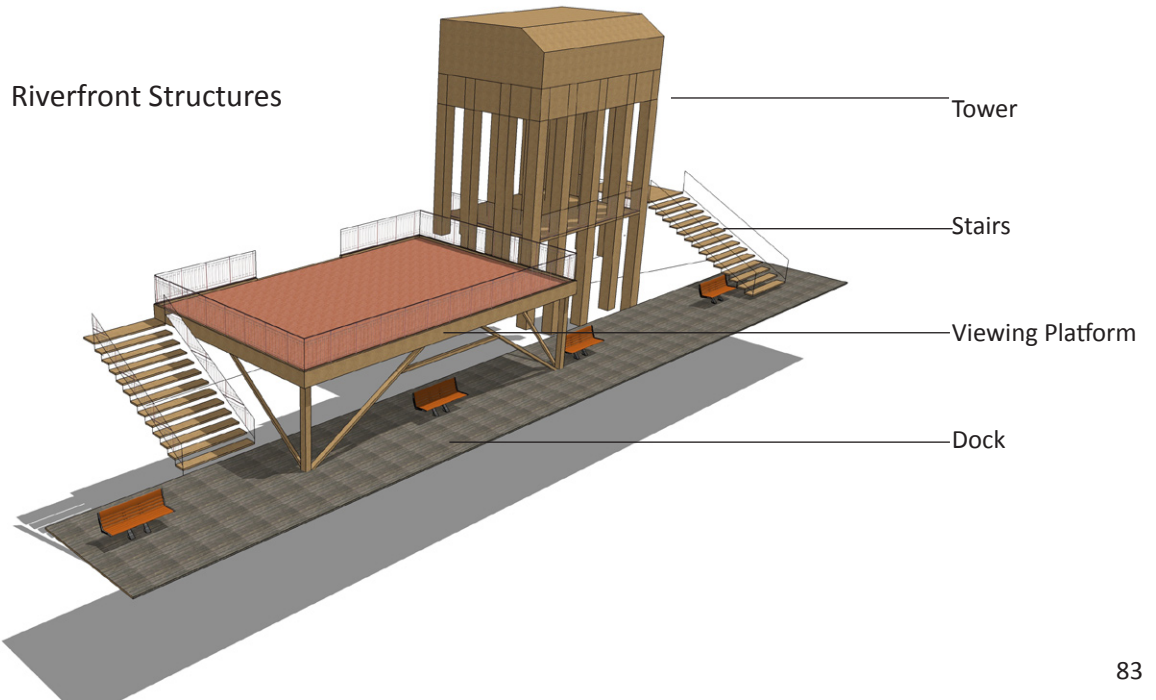
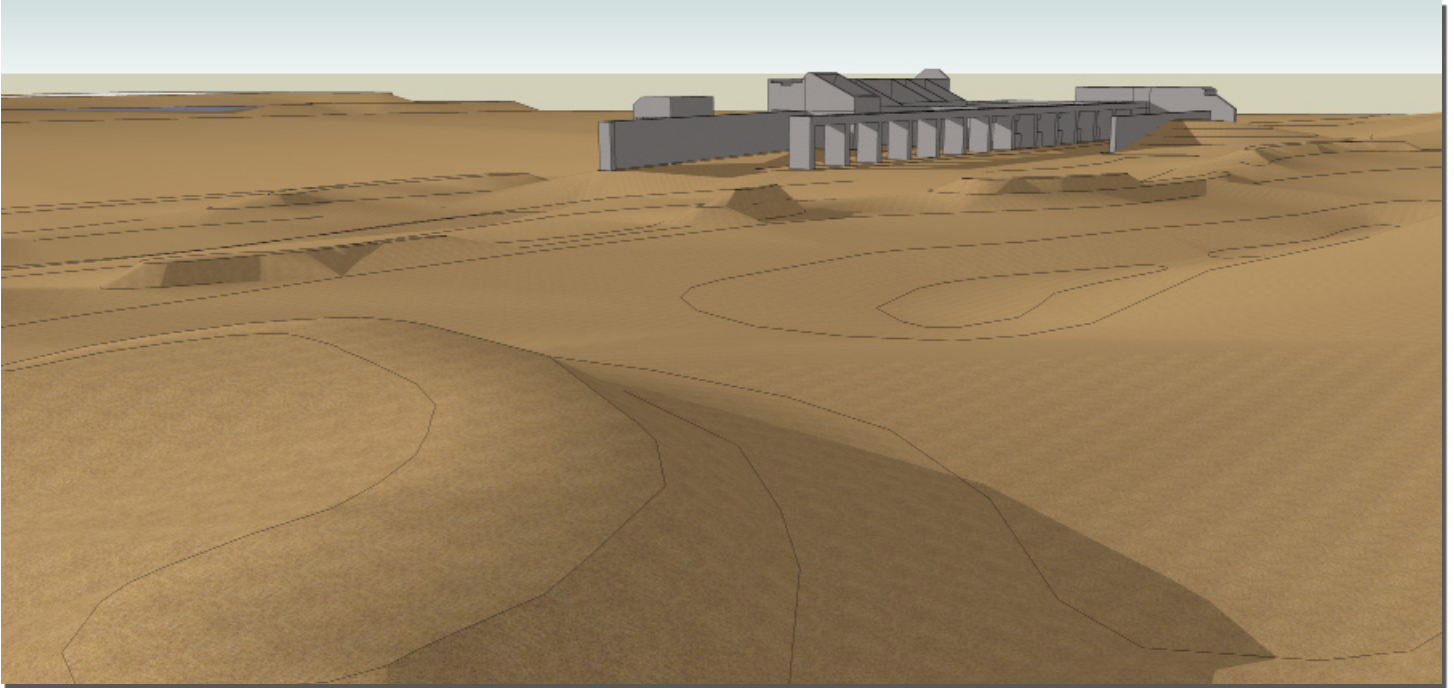
STAGE 1 - CUT/FILL



Diagrams show the repurposing of existing Vulcan infrastructure as well as new design implementations. This design exercise explored the process of creating 3D forms on SketchUp software.



STAGE 2 - SCULPTING



Vulcan Perspective

Initial concept of reusing the facility for botanical garden



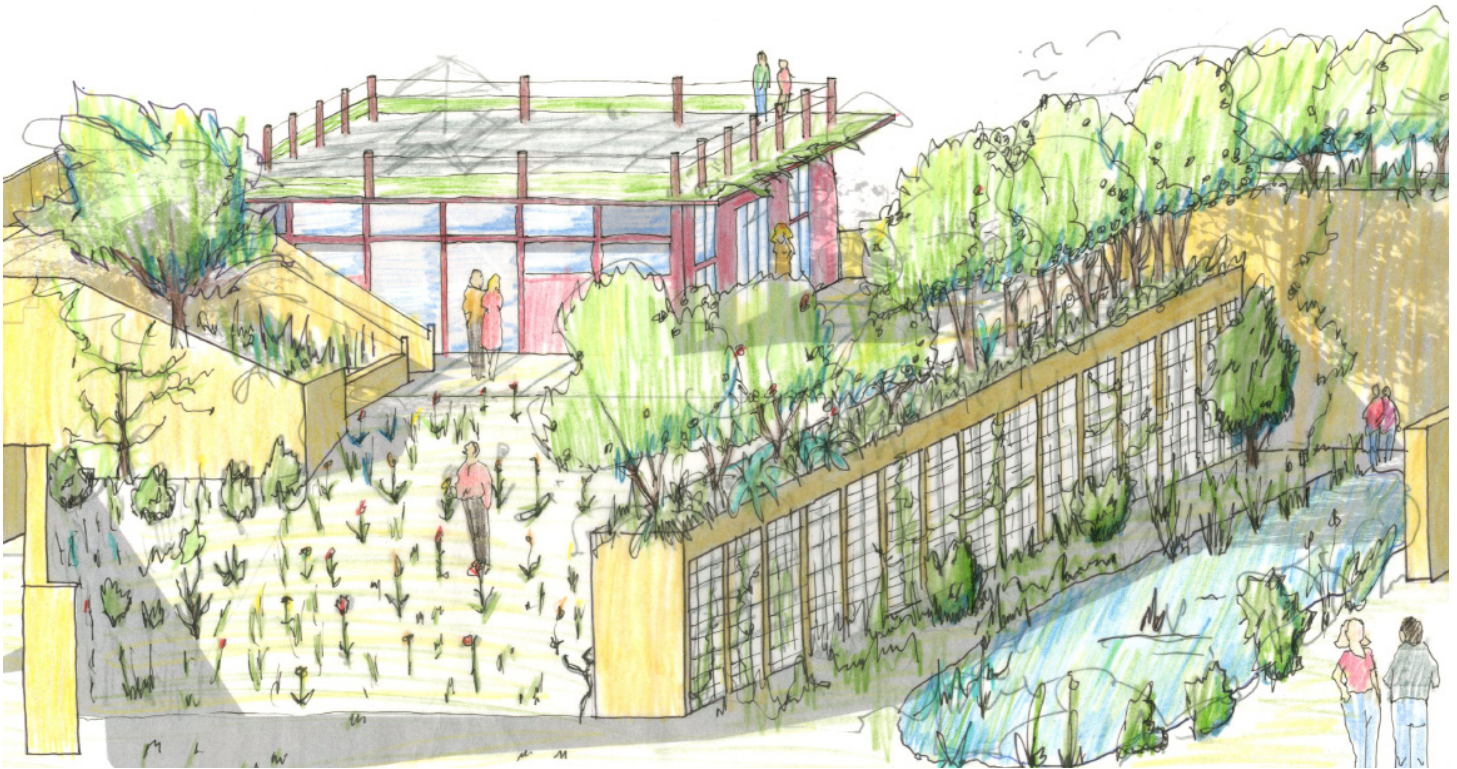
Initial design exploration using botanic garden idea of planting specimen trees in concrete cells and providing access to the roof via stairs.

River Walk Perspective



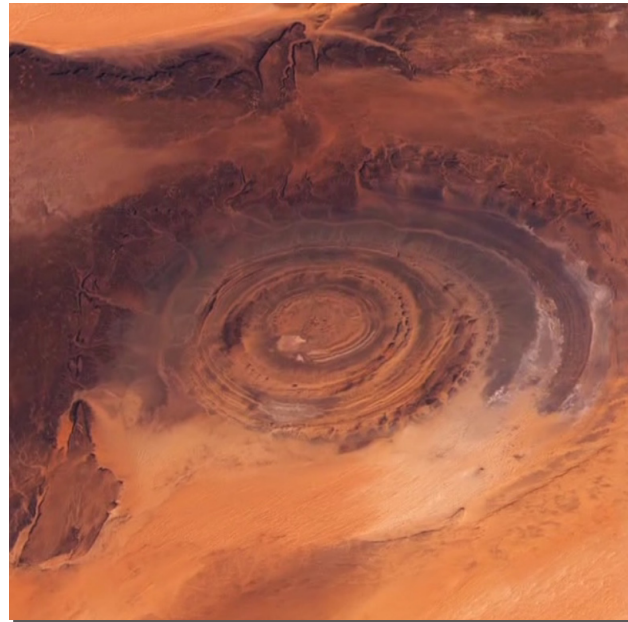
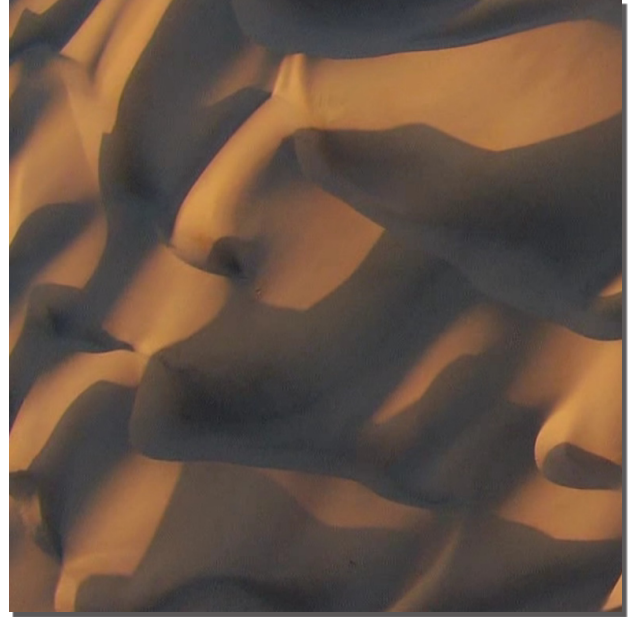
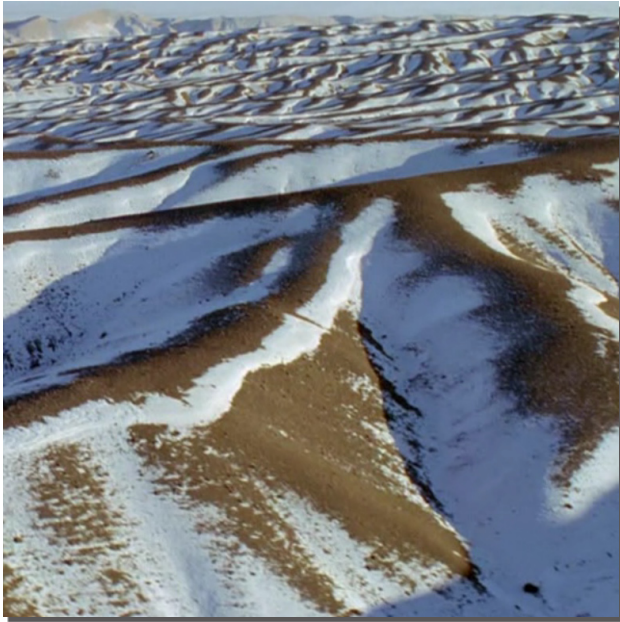
Recycled concrete blocks from site protect the shore line from erosion and provide access to the river.

Ecological Amplification



Quick hand rendering of vulcan facility with green institute building fully constructed. Design features include 100 foot earthen ramp leading up to the roof to the structure, gabion walls containing soil for tree wells, cattail marsh to retain occasional stormwater, viewing platform.

DESIGN INSPIRATION / SAND DUNES





REFLECTION

Measures of success in terms of outcomes

Successful ecological regeneration of the Vulcan site can be measured through species diversity and development of soil structure. Ecological succession over time will naturally increase the biodiversity as well as soil development. This can be measured by observing increases in overall biomass of both floral and faunal species and their overall productivity.

This project differs from other brownfield regeneration projects through both the process and the outcome. Regeneration judged on topography's ability to change initial conditions such as hydrology, can be done through measuring the amount of stormwater containment and infiltration. Variety of human activities upon various slopes and mounds is another indicator of the projects success. Finally, a diversity of conditions such as dry or wet, sun or shade, steep or flat, support the development of various microecologies, which are important indicators of successful regeneration.

Urban outcomes of the Vulcan site are measured through connections such as transportation, economic, cultural, and social. These are essential to the success of the project because without these wider contextual relationships the park would fail. The trail connection from downtown to the site is the first step in establishing this. The green institute building constructed on the Vulcan structure is pivotal towards making these urbanistic objectives possible. This building would provide for education on green construction practices, ecological restoration of brownfields, and of the history of the site and its relationship to the river. Additional functions would include bringing together various interest groups to the site through education, work days, and provide a gathering space for events. The overall site attends to social use through providing a unique experience in an "ecological garden" with singular forms in topography and native plant colonization. The abundance of industrial relics on the site will aid in the unconstructed use of the site, which allows for personal freedom and exploration.

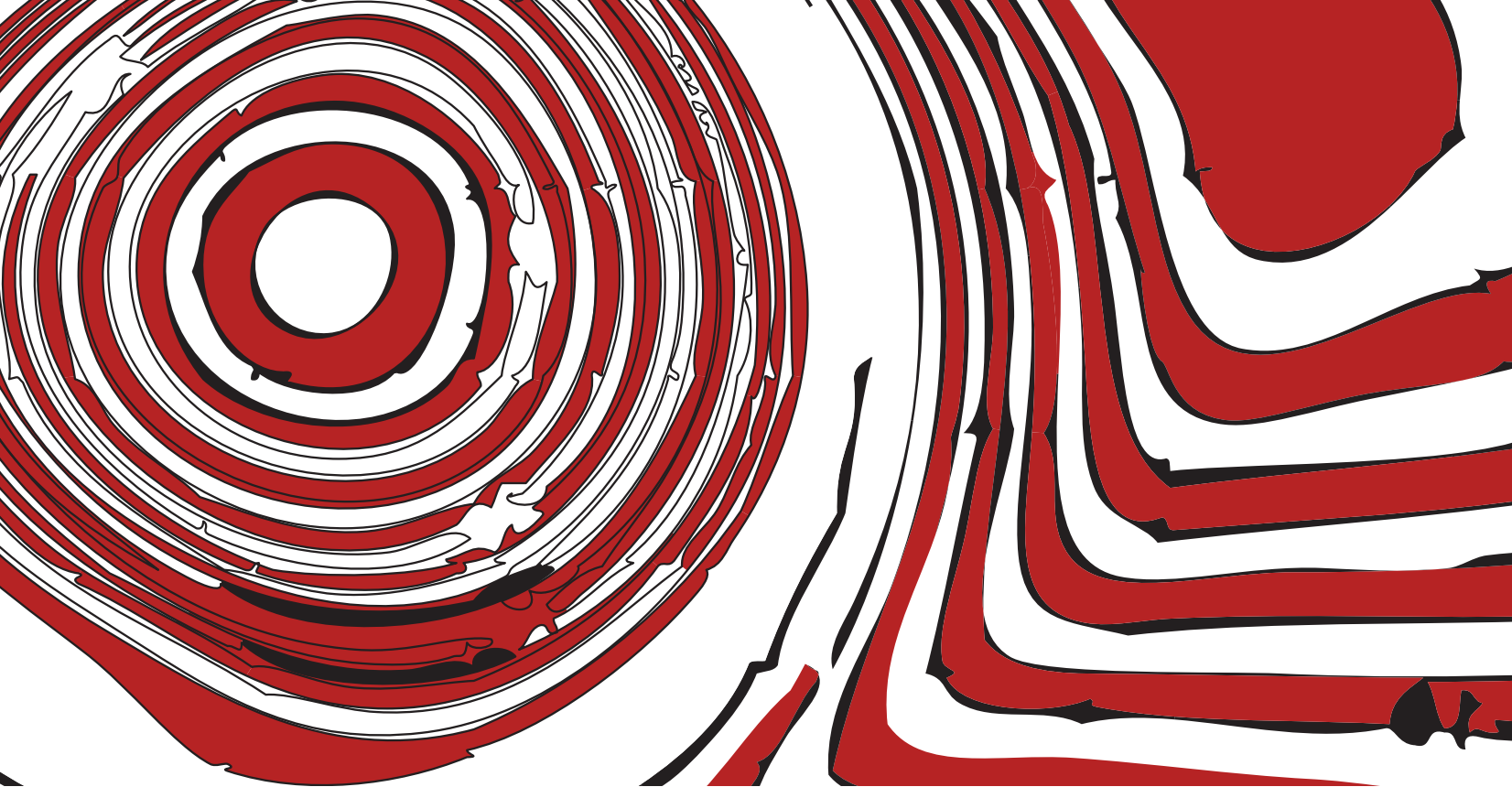


Weaknesses

The overall project has various weak points in terms of analysis, design process, and design. Investigation on how ecological colonization is affected by the soil development would have helped to better understand succession. Soil formation and development are very important factors that were largely left out of this thesis. Initial investigations were made towards understanding development of soil horizons through section studies and experimental modeling, however, were not pursued. Understanding the marriage between the inorganic and organic elements that make a complete soil would have better guided ecological seeding on the site. Integrating symbiotic alliances between organisms, to develop organic soil and increase fertility. Soil regeneration techniques could be induced through composting, aeration, and adding high nitrogen starter to help establish site ecologies.

Mapping of Chattanooga's context and brownfield network developed an under developed, generic look. This was due to the challenges with Adobe Illustrator's inability to quantify spatial information and project data. Integrating GIS to this process would have been helpful towards quickly compiling the data and analyzing the results in a more efficient manner. The lack of readily available data also posed limitations on the analysis that was conducted. Much of the mapping was done through tracing aerial pictography and on-foot surveys.

The overall design of the Vulcan facility could have achieved a more in-depth in connection to the Tennessee River. Elements such as riverfront views, accessibility, and reuse of existing infrastructure should have had more influence on the overall design. This would have helped to establish a more intimate connection between the river's scenic beauty, its ecological systems and the industrial remnants.



Main Innovations

The main innovation of this Vulcan regeneration project is that it is derived from automatic design methods that expose the richness of the site through unique topographic forms. These forms pay close attention to existing site features while implementing new dynamics to the site. Finally, the design is not intended to remove the remnants of past inhabitation or the “dirtiness” of the site, but to adapt it towards productive use for tomorrow.

What would I do differently?

If I were to redo the design process, I would first try to understand developmental relationships between ecological succession and social use of site. This would help to establish appropriate initial conditions to facilitate diverse interactions and increased connection to the context. Incorporation of various recreation components such as Bocce ball, disc golf, workout stations, and play areas would add to social use. An economic consideration of how this would influence the adjacent land uses and Chattanooga as a whole, would help to explain the project implications to interested stakeholders and developing grant proposals. Finally, developing an overall planning synthesis would help to fully develop the trail network and to understand externalities associated with its implementation.



Strengths

I believe that the overall process that went into the development of this project was fairly sound. The “automatic” study models that I made were critical to the design of topography that was highly instrumental in the hydrology and the creation of microclimates. This experimentation focused on the integrity of the operation itself, not the end outcome, thus allowing a design to best capture the spirit of historical uses of the site and the existing conditions. Integration of topography and Vulcan infrastructure allows for evolving and unplanned relationships to the brownfield trail system.

The overall concept of a brownfield trail network beginning with the regeneration of the Vulcan site is the strongest component of this thesis. I believe that this has real potential towards creating a more livable and walkable city. This is important for the future development of cities so that more viable transportation alternatives may be established to build resilience. Additionally, providing parks for growing communities adds to overall health and happiness of Chattanooga.

“Commitment to not knowing what the end goal is how novelty occurs”

Rod Barnett



DrummondPhlox



Narrowed Leaf
Sunflower



Goldenwave Coreopsis



ShowyPrimrose



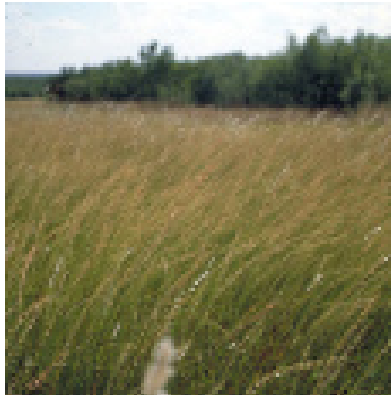
Poppie



MEADOW ECOLOGY



Lindheimer's Muhly



Lindheimer's Muhly



Prairie Dropseed



Buffalo Grass



Andropogon Gerardii



Blue Flag Iris



Carex vesicaria



Blue Joint Grass



Meadowsweet



Sensitive Fern



WOODLAND ECOLOGY



Overcup Oak



Rhododendron



Hickory



Tulip Poplar



Southern Waxmyrtle

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City of Chattanooga. Chattanooga.gov

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Hamilton County Geographic Information Systems. www.gis.hamiltontn.gov

National Center for Neighborhoods and Brownfield Redevelopment. www.policy.rutgers.edu/brownfields/

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STUDIO



ABOUT THE AUTHOR



Tyler Smithson is completing his final year of the first professional Master of Landscape Architecture program at Auburn University. Tyler has worked as a graduate research assistant for the past two years where he has assisted with water quality and stream restoration initiatives in Alabama communities. He has been recognized for his leadership capabilities as an elected officer in the Student Chapter of ASLA for the past two years and as an Eagle Scout. Tyler's interest in landscape architecture has been reinforced through internships with the Georgia Avenue Community Development Task Force and the Landscape Architecture Foundation in Washington, D.C. His thesis on brownfield regeneration focuses upon the transformation of landscapes by manipulating the initial conditions to establish diverse social and ecological conditions that foster the emergence of self-organizing systems. After graduation, Tyler plans on working in a landscape architecture firm that engages social and environmental concerns.

